Run Forecasts and Harvest Projections for 2003 Alaska Salmon Fisheries and Review of the 2002 Season

Edited by

Douglas M. Eggers

REGIONAL INFORMATION REPORT NO.[1] 5J03-01

Alaska Department of Fish & Game
Division of Commercial Fisheries
P.O. Box 25526
Juneau, Alaska 99802-5526

February 2003

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

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This report is based on information contributed by Division of Commercial Fisheries biologists located in field offices throughout the state. Hal Geiger, Brian Bue, Linda Brannian, and Patricia Nelson assembled the forecasts and season summaries for their respective regions. Individual credit for forecast material is contained in area forecast discussions in the Appendix. Area biologists throughout the state supplied reviews of the 2002 fishing season.

The editor would also like to acknowledge Amy Carroll for her editorial advice and assistance with the report figures, tables and layout.

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EXECUTIVE SUMMARY

The Alaska Department of Fish and Game is expecting an increase in commercial salmon catches in 2003. The pink salmon *Oncorhynchus gorbuscha* harvest is expected to be slightly higher than 2002, while the expected sockeye salmon *O. nerka* and chum salmon *O. keta* harvests are expected to be higher than 2002. The 2003 commercial catch all-species projection of 151 million is distributed as 457 thousand chinook salmon *O. tshawytscha*, 30.4 million sockeye salmon, 5 million coho salmon *O. kisutch*, 92 million pink salmon, and 23 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 levels, 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 Alaska Chinook salmon troll fishery and the 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 128 million for the 2002 season. As it turned out, the all-species catch reached 131 million. In 2002, the overall catch of pink salmon was as expected with the actual catch of 87.2 million compared to the preseason projection of 87.3 million. Table 2 shows 2002 harvest numbers by salmon 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 continued its long downward trend. The preliminary estimate for the total value of Alaska's 2002 harvest is $144 million, down further from the low estimate of $229 million for 2001, and significantly down from the $275 million in 2000, and the $370 million for 1999, $261 million for 1998, $297 million for 1997, $378 million for 1996, $487 million for 1995, and $489 million for 1994.

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/.

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; Geiger and Frenette 1996–1997; Geiger et. al. 1997; Hart et. al. 1998; Geiger and Hart 1999; Scott and Geiger 2000; Geiger and McNair 2001), and Eggers (2002). 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 2003 Alaska commercial salmon harvest, by species and area, are found in Table 1, Figures 2–6, and Appendix A. Harvest outlooks for the Arctic-Yukon-Kuskokwim Region are developed as ranges; these ranges are listed in Appendix B. Trends in total statewide salmon harvests and catch projections in numbers of fish, by species, are found in Figures 2–6. Tables 2–7 provide detailed information on the 2002 harvest.

This report contains a detailed review of Alaska's 2002 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Alaska Board of Fisheries (BOF), the fishing industry, and the public.

Predominant ages and brood years for 2003 salmon runs, by species, are as follows:

	Age of Returning Salmon in Years				
Species	2	3	4	5	6
Pink salmon	2001				
Chum salmon		2000	1999	1998	
Coho salmon		2000	1999		
Sockeye salmon			1999	1998	1997
Chinook salmon			1999	1998	1997

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

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

DEFINITIONS OF TERMS

Biological escapement goal	The number of salmon in a particular stock that ADF&G has determined should be allowed to escape the fishery to spawn to achieve maximum sustainable yield (human use). This determination is based on biological information about the fish stock in question. (Also see *optimum escapement goal and sustainable escapement goal*.)
Commercial harvest	Harvests of fish that are used for commercial purposes. This includes fish caught by the commercial common property fishery (see below) and by hatchery operators for cost recovery; it excludes sport, subsistence, and personal use harvests.
Commercial common property harvest	Harvests taken by traditional, competitive commercial fisheries (gillnet, purse seine, and troll), as opposed to commercial harvests resulting from hatchery cost recovery, fishing derbies, and sale of confiscated fish.
Common property harvest	Harvests taken by the commercial common property fisheries (see above), as well as the sport, subsistence, and personal use fisheries. This category excludes hatchery cost recovery harvests.
Cost recovery harvest	Harvests of salmon by hatchery operators in specially designated areas to fund the operation of hatcheries and other enhancement activities.
Enhancement of runs	Hatcheries and other means of artificial propagation to create salmon runs or make existing salmon runs larger. Enhancement includes remote fish stocking, fertilization of lakes, and other techniques.
Escapement, spawning population, or brood stock	The portion of a salmon run that is not harvested and survives to reach the spawning grounds or hatchery.
Harvest projections or harvest outlooks	Harvest outlooks are the best available estimates of upcoming harvest levels. Prepared by local biologists, outlooks are based on formal run forecasts, when available. At other times outlooks are based on historical average catches, subjectively adjusted based on recent trends and local knowledge.

Optimum escapement goal	The number of salmon in a particular stock that should be allowed to spawn to achieve sustainable runs based on biological needs of the stock, as well as 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.
Sustainable escapement goal	The number of salmon in a particular stock that ADF&G has determined should be allowed to escape the fishery to spawn to achieve sustainable yield (human use). This determination is based on escapements that are known to provide for sustained yields over a 5- to 10-year period, used in situations where a biological escapement goal cannot be estimated due to the absence of stock-specific catch information.

PRELIMINARY REVIEW OF THE 2002 ALASKA COMMERCIAL SALMON FISHERIES

Southeast Alaska and Yakutat

The 2002 Southeast Alaska commercial salmon harvest, including hatchery cost recovery, totaled 57.1 million fish (Tables 2 and 4). The exvessel value totaled $42.6 million. The exvessel values by species were $6.1 million for chinook salmon, $3.5 million for sockeye salmon, $11.0 million for coho salmon, $9.0 million for pink salmon, and $12.6 million for chum salmon.

The Southeast Alaska preliminary total chinook salmon harvest in the troll fishery was 326,000 fish, the fourth highest since Statehood. The preliminary total coho salmon harvest in the troll fishery was approximately 1.3 million fish, which is well below the recent 10-year average of about 1.9 million fish. The reduced coho salmon harvest was due in significant part to reduced effort because coho salmon escapements throughout Southeast Alaska were good to "near highest on record" levels.

The total Southeast Alaska purse seine pink salmon harvest was approximately 43 million fish and was within the department's preseason harvest forecast range of 30 to 52 million fish. The total Southeast Alaska purse seine chum salmon harvest was approximately 5.8 million fish (includes hatchery cost recovery harvests), which was significantly below the recent 10-year average of 9.3 million fish. The total Southeast Alaska purse seine sockeye salmon harvest was approximately 173,000 fish, which was significantly below the recent 10-year average of 1.1 million fish.

The total Southeast Alaska drift gillnet sockeye salmon harvest was approximately 463,000 fish, which was well below the recent 10-year average of 770,000 fish. The total Southeast Alaska drift gillnet chum salmon harvest was approximately 1.4 million fish, which was significantly below the recent 10-year average of 2.0 million fish. The total Southeast Alaska drift gillnet coho salmon harvest was approximately 414,000 fish, which was below the recent 10-year average of 430,000 fish. The total Southeast Alaska drift gillnet pink salmon harvest was approximately 0.8 million fish, which was below the recent 10-year average of 1.5 million fish.

The total Yakutat set gillnet sockeye salmon harvest was approximately 113,000 fish, which was well below the recent 10-year average of 178,000 fish. The total Yakutat set gillnet coho salmon harvest was approximately 201,000 fish, which was below the recent 10-year average of 248,000 fish. The coho salmon harvest in the Situk River will probably be the third highest on record.

Southeast Alaska chinook salmon escapements were within or above desired goals in all but one of the monitored systems. Sockeye salmon spawning goals were met for early and late run fish at Chilkat and Chilkoot Lakes, for the Taku River, and were within a few hundred fish of the lower end of the escapement goal for Tahltan Lake. For the Situk River in Yakutat the sockeye salmon escapement was near the upper end of the escapement goal range as was the sockeye salmon escapement in the Kluckshu River in Canada. Coho salmon escapements throughout Southeast Alaska were all well above average, and while the data are not final, they appear to be well above goals for those systems with established goals. The coho salmon escapement at the Situk River is well above the upper end of the escapement goals range and over 16,000 fish above the previous highest count. It is likely that the exploitation rate on coho salmon stocks throughout Region 1 will be well below average. Overall, pink salmon escapements in Southeast Alaska were mixed in some specific areas but were overall good to excellent. Chum salmon escapements in Southeast Alaska were below average for summer chum salmon in most

systems and continued to be well below average in the Chilkat and Taku rivers. Fall chum salmon escapements to the Excursion River and systems in Cholmondeley Sound were average.

Prince William Sound

The 2002 Prince William Sound Area commercial salmon harvest of 28.28 (Table 2) million fish is the twelfth highest on record. The harvest was comprised of 18.95 million pink, 2.26 million sockeye, 6.37 million chum, 650 thousand coho, and 40 thousand chinook salmon (Table 5). Just over half of the catch, 14.81 million, was common property harvest and 13.46 million were sold for hatchery cost recovery. (exclusive of post egg-take roe sales).

The estimated value of the combined commercial salmon harvest is $37.8 million, including hatchery sales. During the 2002 season, 534 drift gillnet permit holders reported at least one landing. The drift gillnet catch is valued at $21.9 million, setting the average earnings at $41,039. The set gillnet catch is valued at $1.7 million, setting the average earnings of the 28 participating permit holders at $62 thousand. The purse seine fishery was worth $5.0 million for an average exvessel value of $41 thousand for the 120 permit holders that participated this year. Revenue generated for hatchery operations (exclusive of post egg-take roe sales) was approximately $9.2 million.

The Copper River sockeye salmon harvest of 1.25 million ranked as the tenth largest on record since 1889 and was below the recent 10-year average harvest of 1.53 million sockeye salmon. The harvest of 39 thousand chinook salmon was below the projected harvest and ranked as the seventeenth largest chinook salmon harvest on record. The coho salmon harvest of 504 thousand ranked as the sixth largest commercial harvest. The 2002 inriver goal for salmon passing the Miles Lake sonar site was set at 651,500 salmon, which included 99 thousand hatchery surplus salmon. Approximately 820 thousand fish were counted past the Miles Lake sonar. While not finalized, it appears the estimated chinook salmon escapement into upper Copper River drainages will be below the minimum escapement objective. A final chinook salmon spawning escapement estimate will be made once all upriver harvests have been quantified. The sockeye salmon escapement index in the lower Copper River in 2002 was above the lower end of the escapement range. The actual escapement index of 76 thousand fish was 16% below the midpoint index goal of 90 thousand. Lower river coho salmon escapement in 2002 was above the goal of 50 thousand with a peak index count of 90 thousand fish.

The 2002 harvest of only 235 sockeye salmon from the Bering River District was well below the recent 10-year average of 18 thousand fish. However, the coho salmon harvest of 109 thousand fish fell near the recent 10-year average of 95 thousand fish. Sockeye salmon escapement into Bering River District streams was below the goal of 32 thousand with an index estimate of 25 thousand sockeye salmon. The coho salmon escapement goal was achieved for the Bering River District with a peak spawning count of 34 thousand versus the goal of 24.7 thousand.

Gillnet fisheries in Prince William Sound primarily targeted enhanced and wild sockeye and chum salmon. In the Coghill District, the gillnet harvest was 1.7 million chum and 60 thousand sockeye salmon. A total of 831 thousand sockeye salmon were harvested by the drift and set gillnet fleets in the Eshamy District. Escapements of sockeye salmon to Coghill and Eshamy Lakes were above escapement goals.

The pink salmon return of 21.3 million to Prince William Sound was less than the 30.9 million fish forecast and resulted in the sixteenth largest single season harvest of 18.95 million fish and the lowest harvest since 1995 when 16.2 million pink salmon were harvested. The ratio of enhanced pink salmon to

wild pink salmon in the 2002 total commercial common property harvest is estimated to have been 33:1. An estimated 943 thousand pink salmon escaped into Prince William Sound index streams to spawn which ranks as the sixth lowest escapement since 1965. Only the Southeastern and Montague Districts met their escapement goals.

The wild and enhanced chum salmon returns to Prince William Sound were mixed with an areawide chum salmon purse seine harvest for 2002 of 1.97 million fish. Purse seiners were unable to target wild chum salmon in the Eastern and Southeastern Districts while enhanced chum salmon returns to the Montague and Coghill Districts were well above forecast. The Port Chalmers remote release site in the Montague District had a harvest of approximately 1.1 million chum salmon, which was approximately four times greater than the preseason catch projection. Overall, wild stock chum salmon escapement was near or above the midpoint escapement goals in the Eastern, Northern, Southwestern, and Southeastern Districts. The purse seine fleet harvested 32.7 thousand coho salmon in 2002, the majority of which came from the Solomon Gulch Hatchery.

Cook Inlet

Upper Cook Inlet

The commercial harvest of 3.7 million salmon (Tables 2 and 5) in Upper Cook Inlet in 2002 was approximately equal to the average harvest for the last 49 years. This was also the highest total salmon harvest since 1997. The exvessel value of $12.5 million is poor by recent exvessel standards, which have ranged as high as $120 million. As is the case statewide, prices paid for all salmon, and sockeye salmon in particular, has plummeted recently, thereby depressing exvessel values even in moderate sized salmon returns as experienced in 2002. Sockeye salmon escapements to most systems were at or above desired levels, with the exception of the Yentna River where the final escapement was 12,000 fish below the lower end of the escapement goal.

The preseason forecast in 2002 was for a total return of 3.7 million sockeye salmon and a commercial harvest of approximately 2.2 million sockeye salmon from all systems. The actual Upper Cook Inlet harvest of approximately 2.8 million sockeye salmon was 27% more than the preseason projection. Most of this increased harvest was attributable to the Kenai River where the actual total return was approximately 1.2 million fish more than forecast. The Upper Cook Inlet sockeye salmon harvest was approximately 13% of the total statewide sockeye salmon harvest in 2002.

The forecasted return to the Kenai River of 1.7 million sockeye salmon resulted initially in an escapement goal target for the Kenai River of 600,000 to 850,000 (past the sonar counter at river-mile nineteen). Because the actual total return to the Kenai River was projected to exceed 2 million sockeye, the inriver sonar goal changed inseason to 750,000 to 950,000 sockeye salmon as directed in the management plan. This was the fourth year the abundance-based escapement goal was in effect, and the fourth time the goal shifted due to actual returns not being what was forecast. The commercial fisheries harvesting Kenai River stocks i.e., drift gillnet and Upper Subdistrict set gillnets, were fished to the maximum extent allowed by management plan. The final Kenai River escapement of 958,000 sockeye salmon was slightly over the upper end of the escapement goal. The only other system to return more fish than forecast was Fish Creek where the actual return was nearly double the forecasted return. The Final Fish Creek escapement was also over the upper end of the escapement goal range.

The remaining monitored systems were all below forecast. The Susitna River sockeye salmon return was below forecast by approximately 38%. This poorer than expected return resulted in prolonged

closures in the commercial fishery. The Northern District was closed or restricted for three regular fishing periods and the drift gillnet fleet was restricted for four regular fishing periods, the most restrictions that have ever been necessary or implemented. Even with the actions taken in these fisheries, the escapement goal was not achieved in the Yentna River. In addition to what was likely an overall poor Susitna River sockeye salmon return, several other causative factors likely contributed to the reduced sockeye salmon escapement. The first was what appears to be a very poor return to Chelatna Lake, a major producer of Yentna River sockeye salmon. The second factor that could have resulted in reduced sockeye escapement counts was a very healthy pink salmon return to the Yentna River. The total salmon return in 2002 was the largest since the flood of 1986, with 595,000 salmon counted in 2002 as compared to the average of approximately 300,000 since 1986. At this level of return, even minor errors in species apportionment become problematic. A second sonar counter was deployed in the Yentna River in 2002 when this potential problem was recognized. The target strength data from this sonar counter has not been analyzed yet, but it should indicate if this was indeed a problem. The only other system to return a significant percentage below forecast was the Crescent River, however, due to significantly reduced set gillnet activity in the Western Subdistrict, the upper escapement goal was exceeded even with this poorer return and much additional fishing time.

Sockeye salmon prices at the beginning of the season were $0.55 to $0.65 per pound. Typically this price would have risen by the end of the season, but this did not occur in 2002. The total exvessel value in Upper Cook Inlet for sockeye salmon was $11.6 million, which was 92% of the total Upper Cook Inlet exvessel value for salmon.

The 2002 coho harvest of 245 thousand was about equal to the recent 10-year average harvest of 270 thousand fish and was the highest harvest since 1995. 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 also due to strong sockeye salmon returns to Upper Cook Inlet, which resulted in more fishing time in the Central District. Since 1996, BOF regulations have reduced the fishing time of the drift gillnet fleet in the Central District and eliminated additional fishing time directed at coho salmon surpluses in the Northern District and in the Kalgin Island and Upper Subdistricts of the Central District, which has resulted in marked reductions in the commercial exploitation rate. For systems with escapement goals, the escapement objectives were exceeded by wide margins and most were the highest counts recorded to date. The exvessel value of coho salmon to the commercial fishery was approximately $351 thousand or 2.8 % of the total exvessel value.

The 2002 harvest of 445 thousand pink salmon is approximately equal to the even-year average harvest for the last ten years. It is much lower than the long-term average harvest due to restrictions to fisheries to protect other stocks and also due to avoidance in the fishery due to low prices. Pink salmon escapements are not monitored in Upper Cook Inlet to an appreciable degree; however, it appears that escapements to most river systems were very good. Prices paid for pink salmon were $0.03 to $0.07 per pound, resulting in an exvessel value for this species of $85 thousand, or less than 1% of the total exvessel value..

The 2002 harvest of 237 thousand chum salmon was above the recent 10-year average harvest. The 2002 chum salmon return was much improved from returns seen during the 1990s. Since the flood of 1986, chum salmon production in much of Southcentral Alaska has been poor, with recent harvests well below the long-term average harvest of 543 thousand. Since 1995–1996, small improvements have occurred each year, and returns to most of Cook Inlet in 2002 were very good. Fishermen were paid $0.10 to $0.15 per pound for chum salmon, producing an exvessel value of $222 thousand, which is just 1.8% of the overall fishery value.

The 2002 harvest of 13 thousand chinook salmon is about half of the long-term average harvest, but only slightly less than the recent 10-year harvest. The two fisheries wherein chinook salmon are harvested in appreciable numbers in Upper Cook Inlet are the Northern District and the Upper Subdistrict of the Central District. After experiencing a significant downturn in the early to mid-1990s, Northern District chinook salmon stocks continue to trend sharply upward, and no generalized conservation issues are currently applicable. Late run Kenai River chinook salmon returns have been relatively stable and escapement objectives have been consistently achieved or exceeded. In 2002, the exvessel value for chinook salmon was valued at $299 thousand, which is approximately 2.4% of the total exvessel value.

Lower Cook Inlet

The preliminary 2002 Lower Cook Inlet all-species salmon harvest of 2.31 (Tables 2 and 5) million fish was the third highest during the past decade, exceeding both the most recent 10- and 20-year averages. However, the overall harvest totaled less than two-thirds of the preseason forecast, yielding an estimated exvessel value of about $1.36 million, which was slightly greater than that for the 2001 season but still the third lowest over the past 10 years.

As has been the case for many years, Lower Cook Inlet commercial salmon harvests in 2002 relied heavily on the success of hatchery and enhanced fish production. Nearly 70% of the sockeye salmon catch was attributed to Cook Inlet Aquaculture Association (CIAA) lake stocking and fertilization projects at Leisure and Hazel Lakes in the Southern District, Kirschner Lake in the Kamishak Bay District, and Bear Lake in the Eastern District. Another enhancement/rehabilitation project, undertaken by Chugach Regional Resources Commission (CRRC) and Port Graham Hatchery Corporation (PGHC) at English Bay Lakes in the Southern District, provided a significant harvestable surplus of sockeye salmon for both subsistence and commercial set gillnet fishermen in Port Graham Subdistrict, while also generating considerable cost recovery revenues for the hatchery. Pink salmon production from Tutka Hatchery, operated by CIAA, fell far short of the preseason forecast of 2.2 million fish. The overall return of pink salmon to the hatchery, estimated at around 882 thousand fish, was the third lowest for the facility during the past decade. The harvest of this species returning to the facility comprised less than one-third of the all-species catch, which is substantially lower than the traditional contribution. And, as is usually the case since hatchery programs were taken over by private nonprofit agencies in Lower Cook Inlet, a significant portion of the salmon harvest was taken and utilized for hatchery cost recovery. An estimated 45% of the total salmon catch was taken by CIAA and PGHC as hatchery cost recovery to support the sockeye salmon lake stocking programs and Tutka and Port Graham Hatchery operations, equating to approximately 29% of the exvessel value of the 2002 Lower Cook Inlet salmon fishery.

The 2002 sockeye salmon harvest of nearly 291 thousand fish was the third highest for Lower Cook Inlet in the past decade and was about 35% greater than the preseason forecast. Sockeyes accounted for less than 13% of the landings in numbers of fish, but due to the price differential, comprised about 60% of the exvessel value of the fishery in 2002. Natural returns of sockeye salmon were considered excellent, with all four systems achieving their respective sustainable escapement goals (SEGs), while the two systems with both natural and enhanced production also attained their escapement goals.

Returns of pink salmon, the dominant species in numbers of fish in Lower Cook Inlet, fell short of preseason expectations in 2002, with an overall harvest of just under 2.0 million fish. Still, the catch was nearly 80% greater than the most recent 20-year average, representing the third highest catch during that time period. Approximately 954 thousand pink salmon, or about 48% of the total, were taken in the Southern District and were comprised primarily of Tutka and Port Graham Hatchery production. However, virtually all (99%) of these fish were utilized in an unsuccessful effort to attain the cost recovery revenue goals established for each hatchery. The estimated hatchery return to Tutka, including

escapement, brood stock, and commercially harvested fish, was about 882 thousand pink salmon, less than half of the preseason projection of 2.2 million fish. At Port Graham, the hatchery return was estimated at about 364 thousand pink salmon, far short of the preseason projection of around 800 thousand fish.

Naturally produced pink salmon contributed over one-half of the areawide harvest for that species this season, a noticeable increase over recent seasons traditionally dominated by hatchery returns. The majority of this production came from Port Dick in the Outer District, with a total harvest of 454 thousand fish, and Bruin Bay in the Kamishak Bay District, where 322 thousand pink salmon were harvested. East Nuka Bay in the Outer District and Rocky Cove in the Kamishak Bay District provided an additional cumulative harvest of 202 thousand pink salmon. Overall, natural pink salmon returns were strong, and all of the major monitored pink salmon systems in the management area achieved their SEGs this season.

The 2002 Lower Cook Inlet commercial chum salmon harvest was the third highest since 1988, totaling over 43 thousand fish, which easily exceeded the recent 10-year average of 23 thousand but was considerably short of the 20-year average harvest of 68 thousand fish. Prior to the season, the chum salmon outlook was questionable since the management area had experienced strong back-to-back returns in 2000 and 2001, yet a number of fishermen expressed confidence that the trend would continue. Nearly all of the chum salmon harvest this season came from Kamishak Bay, with effort and harvest spread rather evenly between the southern end of the district, targeting returns to the Big and Little Kamishak River systems, and the northern end, directed at returns to Cottonwood Creek and Iniskin River. Reasonable chum returns elsewhere in the management area, especially at Koyuktolik (Dogfish) Bay and Port Dick in the Outer District, resulted in good escapements into a majority of streams. At McNeil River in the Kamishak Bay District, the escapement failed to attain the SEG despite a complete closure of the McNeil River Subdistrict for the duration of the return.

The commercial harvest of about eight thousand coho salmon in 2002 was the sixth lowest total for this species in Lower Cook Inlet during the past 20 years, representing just under 60% of the average for that time period. The majority of the harvest was split between the Eastern District (53%), primarily for the Seward Silver Salmon Derby and CIAA cost recovery at Bear Lake, and the Southern District (45%), where set gillnets accounted for the bulk of the harvest. Although coho salmon run assessment in Lower Cook Inlet is limited, commercial, sport, and personal use harvests usually provide the best indicators of run strength. Returns during 2002 were considered strong, yet no directed commercial effort resulted. Two aerial surveys were conducted for coho salmon at the head of Kachemak Bay, indicating excellent escapement into Clearwater Slough, the major index stream.

Bristol Bay

The inshore run of sockeye salmon of approximately 17.20 million fish was the smallest inshore run in over 20 years, and it was 53% below the 20-year average of 36.34 million. It was approximately 2% above the preseason forecast of 16.76 million fish. The Egegik, Ugashik, and Togiak Districts all had sockeye salmon runs that were higher than preseason forecasts, while the Naknek/Kvichak sockeye salmon run was 5% below the preseason forecast and the Nushagak District was 13% below the forecast. The Naknek River run was approximately 30% higher than its preseason forecast. The commercial harvest of 10.6 million sockeye salmon was 10% above the 9.66 million preseason forecast. A total escapement of approximately 6.56 million sockeye salmon was achieved.

The commercial harvest of approximately 44 thousand chinook salmon was the seventh smallest catch in the last 20 years and it was half the 20-year average of 88 thousand. It was, however the second largest harvest in five years. The chum salmon harvest totaled approximately 461 thousand fish, which is about half the 20-year average of 1.03 million. The pink salmon harvest of less than one thousand fish was the smallest recorded catch for even-year returns in over 20 years. The coho salmon harvest of approximately nine thousand fish was 95% below the 20-year average of 168 thousand.

The 2002 harvest of all salmon species in Bristol Bay totaled approximately 11.14 million fish (Tables 2 and 5). The calculated exvessel value of the 2002 Bristol Bay salmon fisheries totaled $29.75 million, which is the lowest exvessel value in over 20 years. It was 77% below the 20-year average exvessel value of $128 million.

The 2002 season was the fifth year of managing for a sockeye salmon harvest allocation between drift and set gillnet gear groups in four of the five districts in Bristol Bay. Togiak District is excluded from the allocation plan. While in the Naknek River Special Harvest Area, there is no provision in regulation for meeting an allocation percentage between the gear types in that fishery. The BOF's direction to the department is to rotate periods between the gear types and not fish the gear types together.

Sockeye salmon runs to the Naknek/Kvichak and Nushagak Districts were less than forecast; Egegik, Ugashik and Togiak Districts all exceeded forecasted returns. Escapements in the Naknek, Egegik, Ugashik, Wood, and Togiak Rivers fell within their escapement goal ranges. The Kvichak, Nushagak, and Igushik River escapements did not reach the lower end of their biological escapement goal (BEG) ranges.

The Naknek-Kvichak sockeye salmon harvest of approximately 1.41 million fish was the second smallest harvest for this system since 1982 and well below the average of 9.4 million fish. The Egegik District sockeye salmon harvest of 4.60 million fish was the fourth smallest in the last 20 years and 45% below the 20-year average of 8.31 million fish. The Ugashik District harvest of approximately 1.58 million sockeye salmon was the seventh smallest since 1982 and was 45% below its 20-year average. The Nushagak District harvest of 2.82 million sockeye salmon was the eighth smallest harvest since 1982, and was 27% below the 20-year average. The Togiak District sockeye salmon harvest of approximately 248 thousand fish was the sixth smallest in 20 years and was 45% below the 20-year average of 454 thousand fish.

The 2002 Kvichak River drainage forecast of 1.8 million sockeye salmon was the smallest since the 1968 forecast of 0.9 million fish. This was the first preseason forecast that was less than the escapement goal since 1987. Because of Kvichak River's low forecast, a conservative approach was taken in all eastside districts by pulling in the outside boundaries and further reducing the fishing areas of these terminal districts. The Naknek/Kvichak and Egegik Districts stayed at their reduced fishing areas for the entire season. The Ugashik District's fishing area was reduced through June 28.

Escapement into the Igushik River and commercial catch in the set gillnet fishery was lower than expected from the beginning of the season; consequently, commercial fishing was closed in the Igushik Section on June 29. Permit holders were asked to monitor subsistence nets to determine if there was a push of fish into the Igushik River. Based on moderate subsistence catches there was another 12-hour set gillnet period on July 2. With continued poor escapement and commercial catches, the Igushik Section closed after the July 2 opening and was not reopened to commercial fishing in 2002.

On July 4, ADF&G management and research staff reevaluated the Nushagak sockeye salmon run strength. Based on this reevaluation, the sockeye salmon return to the Nushagak River was forecasted to

be greater than one million. Pursuant to 5 AAC 06.358 Wood River Sockeye Salmon Special Harvest Area Management Plan, managers now needed to manage for the BEG range of 340 thousand to 760 thousand sockeye salmon in the Nushagak River, up from the 235 thousand optimum escapement goal (OEG) minimum required by the preseason forecast of less than 1 million fish. Although escapement on July 4 was several days ahead of the 340 thousand fish curve, daily escapement was far below expected levels and managers were concerned about reaching the 340 thousand fish escapement target. The Wood River Special Harvest Area (WRSHA) was implemented on July 5. Commercial fishing continued in the WRSHA until July 21 when it closed for the season.

The Naknek and Egegik Special Harvest Areas were utilized for the entire season while the Ugashik District's fishing area was reduced through June 28. The Kvichak River run was approximately 62% below its forecast while Naknek River was approximately 30% above its forecast. Egegik River was approximately 24% above its forecast, and Ugashik River was 6% above its forecast.

The chinook salmon harvests in all Bristol Bay districts were below average. There were four directed chinook salmon fishing periods in the Nushagak District resulting in approximately 32 thousand chinook salmon landed, but other chinook salmon catches were primarily incidental to targeting sockeye salmon. Aerial surveys indicated the 10 thousand fish escapement goal was almost achieved in the Togiak River with a count of 9.5 thousand. The Portage Creek sonar count of 87.5 thousand chinook salmon was 17% above the 75 thousand fish Nushagak River escapement goal.

The total Bristol Bay chum salmon harvest of 461 thousand fish was well below the recent 20-year average of 1.03 million. All of the districts produced harvests below their 1982–2001 averages. Escapements counts ranged from above average in the Nushagak and Alagnak Rivers, to below average in the Kvichak, Egegik and Ugashik Rivers.

The 2002 run produced a reported commercial harvest of only 500 pink salmon. Though pink salmon usually return in strength to Bristol Bay during even-numbered years, the 2002 catch was the lowest even-year catch on record. Pink salmon escapement counts were above average in the Alagnak River but below average in the Nushagak River.

Coho salmon runs to all Bristol Bay districts were weak in 2002. The bay-wide coho salmon harvest of approximately 8,760 fish was 95% below the 1982–2001 average of 167 thousand fish. The Egegik District had the largest harvest with approximately 7.5 thousand coho salmon landed. Coho salmon escapement data are still being compiled.

Kuskokwim Area

The total 2002 commercial salmon harvest for the Kuskokwim Area was 185 thousand fish (Tables 2 and 6) the lowest since 1972. This poor harvest was primarily a result of low salmon prices; below average effort; limited fishing time; limited processor capacity; low abundance for some species; and, for Kuskokwim River chum salmon, no processor interest.

The Kuskokwim Area chinook salmon harvest of 13 thousand fish was 67% below the recent 10-year (1992–2001) average of 37 thousand fish. A poor sockeye salmon harvest of 24 thousand fish was recorded, which was 82% below the recent 10-year average of 137 thousand fish. Fishers harvested 35 thousand chum salmon, 85% below the recent 10-year average of 238 thousand fish. The coho salmon harvest was 113 thousand, 77% below the recent 10-year average of 501 thousand fish.

In September 2000, the BOF classified Kuskokwim River chinook and chum salmon stocks as yield concerns based on guidelines established in the Policy for the Management of Sustainable Salmon Fisheries. However, by the last week of June in 2002, inseason indicators were so positive for chinook and chum salmon that the commercial chum season was opened, and subsistence salmon fishing reverted to seven days per week (from four days per week). Unfortunately, there were no processors interested in purchasing chum salmon, so no chum salmon commercial fishing periods were announced.

Chinook, chum, and sockeye salmon harvests were incidental to the coho salmon commercial fishery in August. The chinook salmon harvest of 72 fish was the lowest on record. The chum salmon harvest of two thousand fish was 89% below the recent 10-year average and the second lowest since 1970. The sockeye salmon harvest of 84 fish is the lowest sockeye salmon harvest since 1975. The coho salmon harvest of 83 thousand fish was 80% below the recent 10-year average. During the coho salmon fishery, there were 5 half-district openings and 1 full district opening in District 1 and no openings in District 2.

Overall, within the Kuskokwim drainage, the chinook salmon escapement was about 70% of the drainage-wide goal while chum salmon escapement goals were achieved. The lone Kuskokwim River coho salmon escapement goal at Kogrukluk River weir was not achieved.

Quinhagak, District 4 within Kuskokwim Bay, opened to commercial salmon fishing on June 14. The chinook salmon harvest of 11 thousand fish was 44% below the recent 10-year average; the sockeye salmon harvest of 18 thousand fish was 70% below the recent 10-year average; the incidental chum salmon harvest of 29 thousand fish was 38% below the recent 10-year average; and the coho salmon harvest of 27 thousand fish was 54% below the recent 10-year average. Approximately 25 thousand coho salmon were counted through the Kanektok River weir. Chinook, sockeye, and chum salmon aerial surveys within the Kanektok River drainage were inconclusive.

Goodnews Bay, District 5 within Kuskokwim Bay, opened on June 27 to provide for a directed harvest of sockeye salmon. Commercial salmon fishing was closed during most of June to protect chinook salmon. The chinook salmon harvest of one thousand fish was 72% below the recent 10-year average. Chinook salmon escapement, as monitored through the Middle Fork Goodnews River weir, was 3,151, which was 10% below the escapement goal of 3,500 salmon. The sockeye salmon harvest of six thousand fish was 74% below the recent 10-year average. The Middle Fork Goodnews River escapement was 22,608, which was 10% below the goal of 25 thousand sockeye salmon. The incidental chum harvest of four thousand fish was 73% below the recent 10-year average, but the chum salmon count through the Middle Fork Goodnews River weir was twice the escapement objective. The coho salmon harvest of three thousand fish was 85% below the recent 10-year average. Coho salmon escapement at the Middle Fork Goodnews River weir was better than the historical average for comparable years. An escapement goal for coho salmon has not been established for the Middle Fork Goodnews River.

Only 407 of the 832 Kuskokwim Area permit holders participated in the commercial salmon fishery in 2002. The exvessel value of the harvest was $0.32 million, 88% below the recent 10-year average exvessel value of $2.7 million. The average exvessel earning per permit holder was $0.8 thousand, well below the most recent 10-year average value of $3.5 thousand.

Yukon Area

The 2002 Yukon River commercial salmon harvest of 38 thousand fish (Table 6) was the third lowest harvest since statehood (1960). The harvest was comprised of 24.4 thousand chinook salmon and 13.6

thousand summer chum salmon. No commercial fishing for fall chum or coho salmon was allowed due to low run abundance of fall chum salmon.

The total estimated commercial chinook salmon harvest, including the estimated harvest to produce roe sold, was 24.4 thousand fish for the Alaskan portion of the Yukon River drainage. The total harvest was comprised of 24.2 chinook salmon in the round, and 896 pounds of chinook salmon roe. The chinook salmon harvest was 73% below the recent 10-year average harvest of 90 thousand fish and 60% below the recent 5-year average harvest of 60 thousand fish.

Due to the lack of market, the summer chum salmon harvest was taken incidentally to fishing directed at chinook salmon, except for two directed chum salmon commercial fishing periods in District 6. The total estimated commercial harvest, including the estimated harvest to produce roe sold, was 13.65 thousand summer chum salmon for the Yukon River drainage. The total harvest was comprised of 13.5 summer chum salmon in the round, and 16 pounds of roe. The summer chum salmon harvest was 96% below the recent 10-year average harvest of 342 thousand fish and 83% below the recent 5-year average of 75 thousand fish.

No commercial fishing for fall chum salmon was allowed in 2002 due to low run abundance. Severe subsistence fishing restrictions occurred. Commercial fishing for fall chum salmon has become sporadic with commercial fisheries occurring in only five out of the past ten years and with a significantly reduced harvest in each of those years. The historical commercial harvest from 1961 to 1990 averaged 178,000 fall chum salmon. However, the recent 5-year average (1997–2001) is 16,000 fall chum salmon; no were harvests allowed in the years 1998, 2000, and 2001.

A record low total of 560 permit holders participated in the chinook and summer chum salmon fishery, which was 24% below the recent 10-year average of 737 permit holders. The Lower Yukon Area (Districts 1-3) and Upper Yukon Area (Districts 4-6) are separate Commercial Fishery Entry Commission (CFEC) permit areas. A total of 540 permit holders fished in the Lower Yukon Area in 2002, which was 16% below the recent 10-year average of 646 permit holders. In the Upper Yukon Area, 20 permit holders fished, which was 80% below the recent 10-year average of 101 permit holders. These comparisons exclude the 2001 season because of the extreme restrictions and closures making that year misleading in this context.

Yukon River fishers in Alaska received an estimated $1.7 million for their chinook and summer chum salmon harvest in 2002, approximately 69% below the recent 10-year average of $5.5 million. The decrease in exvessel value was due to the poor chinook and summer chum salmon runs resulting in a low commercial harvest. Four buyer-processors operated in the Lower Yukon Area. Lower Yukon River fishers received an estimated average price per pound of $3.37 for chinook and $0.06 for summer chum salmon. The average price paid for chinook salmon in the Lower Yukon Area was well above the recent 10-year average of $3.00 per pound. Prices paid for summer chum salmon (in the round) continued to be low as observed since 1995. The exvessel value of the Lower Yukon Area fishery of $1.7 million is 66% below the recent 10-year average of $5.0 million. The average income for Lower Yukon Area fishers that participated in the 2002 fishery was $3,131.

Upper Yukon Area fishers received an estimated average price per pound of $0.75 for chinook and $0.32 for summer chum salmon. The average price paid for chinook salmon in the Upper Yukon Area was slightly below the recent 10-year average of $0.90 per pound. The exvessel value of the Upper Yukon Area fishery of $26.9 thousand is 95% below the recent 10-year average of $533 thousand. The average income for Upper Yukon Area fishers that participated in the 2002 fishery was $1,346.

In 2002, the total chinook salmon run was similar to 2001 and near preseason expectations, however it remains a yield concern based on the inability of the stock to maintain expected yields, or harvestable surpluses, above the stock's escapement needs. Chinook salmon escapement appeared adequate throughout most of the drainage, although the Koyukuk River escapement was slightly lower than desired levels. Chinook salmon escapement goals were achieved in the two streams with biological escapement goals, the Chena and Salcha Rivers.

The 2002 summer chum salmon run was better than 2001 and above preseason expectations. Chum salmon escapement appeared to be adequate in four of seven streams where chum salmon escapement was monitored. Chum salmon escapement goals were achieved in one of the two streams with goals. The Anvik River (believed to contribute approximately 50% of the summer chum salmon run) escapement was above the low end of the escapement goal range. The estimated total run size was slightly more than one million summer chum salmon, the minimum amount necessary to allow a commercial fishery.

The abundance of fall chum salmon returning to the Yukon River drainage was low in 2002. As with the last few seasons the low abundance of chum salmon was unexpected based on the good to fair parent-year escapements documented throughout the drainage in 1997 and 1998. However, the department was prepared for a poor run in 2002 based on recent trends in productivity. Fall chum salmon escapement goals were met in three of five monitored systems. Additionally, the BEG for the upper Tanana River was met as the stocks returned the strongest in this portion of the drainage.

The coho salmon run appeared to be average in 2002, however subsistence harvests of coho salmon were affected by fishery restrictions aimed at protecting the weaker fall chum salmon run. The Delta-Clearwater River was well above the minimum escapement goal of nine thousand fish with an estimated return of 38.6 thousand coho salmon.

Norton Sound Area

Because just one buyer operated in the Norton Sound Area in 2002, the actual harvest numbers are confidential. The 2002 commercial harvest in the Norton Sound Area was the lowest on record. There were no chinook or chum salmon directed periods in 2002 because the chinook and chum runs to eastern Norton Sound were weak. Chinook and chum salmon were caught incidentally to the coho salmon harvest. The chinook salmon harvest was 99% below the recent 5-year and 10-year averages. The chum salmon harvest was 95% below the recent 5-year and 10-year averages. The coho harvest was 93% below the recent 5-year average and 96% below the recent 10-year average. There was no buyer for pink salmon in 2002.

The commercial season opened in eastern Norton Sound on July 25 to target coho salmon with a test period reduced to 24 hours duration compared to the normal 48 hours duration for coho salmon. A series of fishing periods were announced, each one separately, with reduced fishing time. Commercial fishing effort and catches continued to be low and even with the reduced effort, the catch per unit of effort (CPUE) continued to be below average. Only the August 8 fishing period had an above average CPUE, but the catches and the CPUE decreased in fishing periods thereafter. There was a final 24-hour period on August 19 with a below average catch and CPUE, and the commercial season was closed.

The Norton Sound Salmon District has 185 active CFEC salmon permits and 101 permit holders renewed their permits for the 2002 season, however only 12 actually fished during the 2002 season. The

previous record low participation was last year when 51 permit holders fished. The recent 5-year average was 75 permits fished and the recent 10-year average was 95 permits fished. The exvessel value of the fishery was a record low, and was 98% below the recent 5-year and 10-year averages.

Kotzebue Area

Because just two buyers operated in the Kotzebue Area in 2002, the actual harvest numbers are confidential. The fishery was capacity limited because of weak salmon marketing conditions and lack of buyers. Because of the limited fishing effort the season was open continuously until it closed by regulation on August 31. The 2002 chum salmon harvest was 94% below the recent 5-year average. The exvessel value of the fishery was 96% below the recent 5-year average. The total permits fished were 95% below the recent 5-year average effort. There are 186 active permits for the Kotzebue Area.

The overall chum salmon run to Kotzebue Sound was estimated to be below average based on the lower CPUE and the Kobuk test fish index being below average. Age composition from the test net catches showed a weak return of 4-year-old fish.

Kodiak Management Area

Commercial fishing effort was down for the fifth consecutive year. Of the 604 Kodiak commercial salmon permits, only 242 were fished. Ninety-six permits were not renewed for the 2002 season. By gear type, a total of 93 set gillnet and 149 purse seine permit holders fished; there was no participation by beach seiners in 2002. Approximately 21.3 million salmon (86.9 million pounds) were harvested in the Kodiak Management Area commercial fisheries (Tables 2 and 7), which is below the previous 10-year (1992–2001) average (21.5 million salmon).

The chinook salmon harvest (19,300) was below forecast (20,000) and below the 1992–2001 average (21,100). The sockeye salmon harvest (1.83 million) was below forecast (2.20 million) and below the 1992–2001 average catch (3.72 million). Overall, the pink salmon harvest (18.3 million) was well over the harvest forecast (8.7 to 16.1 million) and above the past five even-year (1992–2000) average harvest (9.4 million). The chum salmon harvest (650,100) was below forecast (778,000) and below the 1992–2001 average (807,200). The coho salmon harvest (496,000) was well above forecast (367,000) and the 1992–2001 average (324,300).

The total chinook salmon escapement of 20,100 was above established goals (11,000 to 18,000), but below the 1992–2001 average (24,500). The overall sockeye salmon escapement (1.59 million) was within established goals (1.28 million to 1.89 million), but was below the 1992–2001 average (1.82 million). The overall pink salmon escapement (7.8 million) was above established goals (2.4 million to 6.0 million), and above the 1992–2000 even-year average (4.5 million). Coho salmon escapement (164,800) exceeded established goals (54,600 to 93,600) but was below the previous 10-year (1992–2001) average (203,900).

The estimated total exvessel value of the 2002 fishery was approximately $12.3 million, well below the 1992 to 2001 average exvessel value of $32.3 million. The estimated 2002 exvessel value is based on inseason price estimates and will increase as final processor reports are submitted. The inseason values may not reflect additional payments made to fishers for dock deliveries, iced fish, or other settlements. Additional postseason payments could add over $3 million to the Kodiak Management Area exvessel

value. The reported average prices per pound for sockeye ($0.56), pink ($0.07), chum ($0.14), and coho ($0.19) salmon were the lowest since 1975.

Commercial harvests for all species were reduced by a price dispute between fishers and processors that delayed the onset of fishing for the majority of the fleet, and harvest restrictions imposed on fishers by salmon processors, due to production limitations
Fish counting weirs were operated on 15 systems this year, with projects operated by the ADF&G management and research staff, and by the U.S. Fish and Wildlife Service. In addition, five different observers flew 26 aerial surveys, and eight observers made foot survey escapement estimates. Aggregated by district, chinook salmon escapements met or exceeded established goals; sockeye salmon escapement goals were met in two districts, exceeded in two districts, but were below desired goals in two districts; pink salmon escapements met or exceeded established goals in all seven districts; chum salmon escapements met all district goals; and coho salmon escapements met or exceeded all district goals.

Chignik Management Area

The 2002 Chignik Management Area salmon fishing season was characterized by a below average early run of sockeye salmon to the Black Lake system as well as a below average late run to the Chignik Lake system. The first commercial salmon fishery opened on June 3 (first delivery occurred on June 5); the last reported landing was on September 5. This was the first season of the Chignik Management Area purse seine cooperative fishery management plan. A cooperative fleet of 77 Chignik Management Area permit holders formed to harvest salmon during the 2002 salmon season. Twenty-four Chignik Management Area permit holders who chose not to join the cooperative fleet were identified as the competitive fleet; two of these permit holders chose not to join the cooperative and did not participate. A total of 41 CFEC seine permits were fished in 2002 (19 cooperative fleet and 22 competitive fleet).

Due to deteriorating market conditions and the weak strength of the second run, local processors stopped purchasing salmon during the last week of August. One floating processor purchased salmon until September 5, when the cooperative fleet ceased all commercial fishing activities. Although salmon surplus to the September 1-15 escapement objective was available for harvest, neither fleet fished after September 5. Overall, the 2002 season provided 72.5 days of fishing opportunity for the cooperative fleet and 16.8 days for the competitive fleet to target sockeye salmon. An additional seven days of fishing opportunity was available during the June 3-9 commercial test fishery in Chignik Lagoon. Eight days of fishing opportunity for both fleets was provided to target pink and chum salmon in the Western and Perryville Districts. The Chignik Management Area was open to commercial fishing for 98 days and fishing activity occurred on 90 of those days. Fifty percent of the sockeye salmon harvest within the Chignik Management Area occurred from June 9 through July 7.

The 2002 total chinook salmon harvest was 1.4 thousand fish (Tables 2 and 7), which was the lowest harvest since 1979. This was below the forecast (3,600) and substantially less than the 10-year (1992–2001) average of 5.9 thousand chinook salmon.

The 2002 total sockeye salmon harvest was 1.04 million fish (Tables 2 and 7), which was the lowest harvest since 1997. This was below the forecast (1.21 million) and below the 10-year (1992–2001) average of 1.65 million salmon. The cooperative fleet harvested 721 thousand (69.27%; allocation 69.3%) sockeye salmon and the competitive fleet harvested 320 thousand (30.73%; allocation 30.7%) sockeye salmon.

The 2002 total coho salmon harvest was 49 thousand fish (Tables 2 and 7), which was less than the forecast (182 thousand) and the 10-year average (1992–2001) average of 182 thousand salmon and was the lowest harvest since 1978.

The 2002 total pink salmon harvest was 66 thousand fish (Tables 2 and 7), which was a fraction of both the forecast (1.09 million) and the 10-year (1992–2001) average of 1.09 million salmon, and was the lowest harvest since 1973 (excluding 1989 when fishing was restricted because of the *Exxon Valdez* oil spill).

The 2002 total chum salmon harvest was 55 thousand fish (Tables 2 and 7), which was well below the forecast of 178 thousand salmon and the 10-year (1992–2001) average of 180 thousand salmon and was the lowest harvest since 1985 (excluding the 1989 harvest).

The exvessel value of the 2002 fishery was $4.65 million, which is the lowest value since 1975 and 61% below the 1992–2001 10-year average of $12.1 million. The total value of the harvested salmon was worth $47 thousand per active Chignik Management Area permit holder.

The Chignik weir was operational from June 2 until September 4. High water conditions at the end of May delayed the installation of the weir. Escapements were estimated by video weir counts on the Chignik River and by aerial surveys for all other streams. Management for specific sockeye salmon escapement goals, and interim inseason objectives, was more accurately attained in 2002 than in previous years, largely due to the ability to control daily harvests of the cooperative fleet.

The 2002 chinook salmon escapement to the Chignik River system was 3,541 salmon, which was above the minimum goal of 1,450 salmon and the 10-year (1992–2001) average escapement of 3,443 salmon.

Sockeye salmon escapement to the Chignik Lakes system from June 2 through August 31 was 654,695 salmon with postseason analysis apportioning 381 thousand to the Black Lake run (goal = 350 thousand to 400 thousand through August 31) and 274,008 to the Chignik Lake run (goal = 225 thousand to 250 thousand through August 31). The total September 1–30 estimated sockeye salmon escapement was 70.5 thousand salmon, thus the total escapement including the postweir estimate, was 725.2 thousand salmon. Other species enumerated through the Chignik River weir included 3,541 chinook, 9,487 coho, 3,417 pink, and 67 chum salmon.

The 2002 Chignik Management Area pink and chum salmon escapement goals were not met in many of the districts. The pink salmon district escapement goals were met in the Chignik Bay, Eastern, and Western Districts and chum salmon district-wide escapement goals were met in the Eastern and Western Districts. Aerial stream surveys of the Chignik Management Area indicated that the chum and pink salmon escapements were below average through late August. The timing of the 2002 pink and chum salmon runs appeared to be similar to historical averages. As a result of the lack of rain, most streams experienced low water conditions in August and into September. The low water conditions significantly reduced salmon spawning habitat in many streams. All species were adequately surveyed except for coho salmon.

Alaska Peninsula-Aleutian Islands

South Alaska Peninsula Area

The 2002 commercial salmon fishery began on June 10, when a fishing period for all gear types was announced. The last landing occurred on October 1. A total of 199 permit holders participated during

the 2002 season, down from 241 permit holders in 2001. The total South Peninsula harvest of approximately 6.4 thousand chinook salmon in 2002 was 1.4 thousand more than the forecast of 5 thousand fish. The sockeye salmon catch of 1.04 million was about 0.5 million less than the forecast of 1.5 million fish. The coho salmon catch of about 203 thousand was 47 thousand less than the forecast of 250 thousand fish. The pink salmon harvest of approximately 2.17 million was less than half the forecast of 6 million fish. The total South Peninsula chum salmon catch was 819 thousand, 281 thousand less than the forecast of 1.1 million fish. The total exvessel value of the South Peninsula fishery, including the $1.8 million derived from the June fishery, was $3.9 million, which is slightly less than the exvessel value in 2001 of $4.1 million. In 2002, sockeye salmon contributed $2.67 million, pink salmon $0.56 million, chum salmon $0.49 million, coho salmon $0.13 million, and chinook salmon $0.02 million.

South Alaska Peninsula June Fishery

The total June salmon harvests in numbers of fish for the South Unimak and Shumagin Islands fisheries were approximately 2.4 thousand chinook, 591 thousand sockeye, 76 thousand pink, and 379 thousand chum salmon. The South Unimak harvest was approximately 0.43 thousand chinook, 356 thousand sockeye, 34 thousand pink, and 201 thousand chum salmon. The Shumagin Islands harvest was approximately two thousand chinook, 235 thousand sockeye, 42 thousand pink, and 178 thousand chum salmon.

Southeastern District Mainland Fishery

Based on the Chignik Management Area sockeye salmon harvest, the Southeastern District Mainland opened to commercial salmon fishing for 106 hours at 2:00 PM on June 21. Between June 26 and July 25, the fleet fished outside the Northwest Stepovak Section during two 48-hour periods. The estimated Southeastern District Mainland sockeye salmon harvest, considered Chignik bound through July 25, was 63 thousand fish. This constituted 6.0% (6.0% allocation) of the total Chignik bound sockeye salmon harvest through July 25.

Beginning July 1, the Northwest Stepovak Section of the Southeastern District Mainland was managed on the basis of a strong Orzinski Lake sockeye salmon run and a sockeye salmon harvest in the Southeastern District Mainland of at least 600 thousand fish. Thirteen fishing days (four days per week) were allowed in the Northwest Stepovak Section through July 25. Orzinski Bay was extended for an additional eleven days through July 25. The sockeye salmon harvest in the Northwest Stepovak Section from July 1-25 was 75 thousand fish. Orzinski Lake sockeye salmon escapement reached interim escapement goals throughout the season. The weir enumerated 34 thousand adult sockeye salmon prior to August 1, surpassing the 20 thousand adult salmon escapement goal.

South Peninsula Post-June Fishery.

Prior to the South Peninsula post-June fishery, the ADF&G conducted a test fishery for immature salmon in the Shumagin Islands. Test fishery results on July 3 and 4 indicated that the number of immature salmon was below the regulatory threshold (100 per set), at 94 and 37 immatures per set, respectively. The Shumagin Islands fishery was opened to seine and gillnet gear on July 6. Inseason monitoring of the seine fishery showed that the harvest of immature salmon was below the threshold for the entire fishery.

Fishing effort continued to be well below normal during the post-June fishery. Fishermen did not generally fish for pink and chum salmon aggressively because of low prices. The South Peninsula

(excluding Southeastern District Mainland) post-June chinook salmon harvest of 3.4 thousand was above the 1992–2001 average of 2.2 thousand fish. The sockeye salmon harvest of 291 thousand was 83% of the 1992–2001 average of 349 thousand fish. The coho salmon harvest of 197 thousand was 94% of the 1992–2001 average of 208 thousand fish. During the period of July 22–31, a total of 49 thousand coho salmon were harvested in nonterminal areas and applied to the 60 thousand fish cap. The pink salmon harvest of 2.0 million was 53% of the 1992–2001 average of 3.8 million fish. The chum salmon harvest of 421 thousand was 54% of the 1992–2001 average of 776 thousand fish.

The South Peninsula reopened to commercial fishing on September 1. Only one purse seine permit holder fished in September. The majority of the harvest was from set gillnet operators in the Southeastern District. Fishing time in the Southeastern District was based on coho salmon harvest rates. Although highly variable, coho salmon harvest rates were above average in early September and generally declined as the season progressed. Effort was well below average because of low prices. The cumulative fall fishery harvest (September 1–October 1) of 19 thousand sockeye, eight thousand coho, and 7.8 thousand chum salmon, was below the 1992–2001 average for all species. There was little interest by the industry in South Peninsula coho salmon. The last delivery of the season was made on October 1.

South Peninsula Escapements

The South Peninsula estimated total escapement of 191 thousand sockeye salmon was above the escapement goal range of 67 thousand to 124 thousand fish and was the highest on record. The South Peninsula indexed total pink salmon escapement of 3.76 million was above the upper end of the even-year goal range (1.9 million to 3.7 million fish). The South Peninsula indexed total chum salmon escapement of 602 thousand fish was near the upper end of the goal range (347 thousand to 693 thousand fish). A total of 100 thousand coho salmon were documented in 55 South Peninsula streams. Some of the major coho salmon systems were not surveyed or surveyed during off-peak times due to inclement fall weather.

North Alaska Peninsula

In 2002, 138 permit holders (2 of which were Area T permit holders) participated in commercial salmon fisheries along the North Peninsula which began on June 10. In comparison, during 2001, 167 Area M and 5 Area T permit holders participated. The last landing during 2002 was made on September 16. The North Peninsula fishery is predominantly a sockeye salmon fishery, although depending on market conditions directed chinook, chum, and coho salmon fisheries occur in some locations. During even-numbered years, pink salmon are targeted in select locations if abundance is high and market conditions are favorable.

The chinook salmon harvest of about 3.9 thousand fish was less than half of the 10 thousand fish projection. The sockeye salmon harvest of 1.4 million fish was slightly below the harvest projection of 1.5 million fish. The pink salmon harvest of 21.5 thousand fish was far below the projection of 100 thousand fish. Due to poor market conditions, the coho harvest was only 28.8 thousand fish, which was well below the 100 thousand fish projection. Due to low prices, there was little fishing effort directed toward North Peninsula chum salmon, resulting in a harvest of 51 thousand fish, which was about half of the 100 thousand fish harvest projection.
The 2002 chinook salmon harvest was slightly below the 2001 harvest, but was well below the previous 10-year average of 9.7 thousand fish. The sockeye salmon harvest was higher than in 2001, but was only 59% of the 1992–2001 average. The coho salmon harvest was the second lowest since 1977. The pink salmon harvest was well below the 1992–2000 even-numbered year average of 109,000 fish.

The total exvessel value of the 2002 North Peninsula fishery was $3.6 million. This was about the same as the exvessel value in 2001.

North Alaska Peninsula Escapement

The total North Peninsula indexed chinook salmon escapement was 18.9 thousand fish, which exceeded the upper end of the escapement goal range (12.4 thousand fish). The North Peninsula sockeye salmon escapement was estimated to be 895 thousand fish. River systems with weirs (Bear, Nelson, Sandy and Ilnik) accounted for 76% of North Peninsula sockeye salmon escapement. The total North Peninsula escapement goal range is approximately 631 thousand to 872 thousand sockeye salmon. All sockeye salmon system escapement goals were met or exceeded. The North Peninsula coho salmon run was at least moderately strong. The bulk of the run escaped due to low prices and a lack of processor interest in purchasing coho salmon. Approximately 289 thousand coho salmon were documented in 37 North Peninsula streams during 2002. This escapement figure is lower than the actual total because some streams were not surveyed. The North Peninsula pink salmon escapement was at least 24.3 thousand fish. The North Peninsula is normally a minor pink salmon producer. The North Peninsula indexed total chum salmon escapement was 680 thousand fish, which was near the upper end of the 343 thousand to 686 thousand fish goal.

Aleutian Islands and Atka-Amlia Islands Areas

In 2002, no commercial salmon harvests were reported from the Aleutian Islands and Atka-Amlia Islands Areas. Pink salmon runs on Unalaska Island were apparently not strong enough and the price too low to attract any fishing effort. However, analysis of the limited data available indicates that escapements were good.

An unusually strong sockeye salmon run occurred at McLees Lake. A total of 97.8 thousand sockeye salmon were counted through a U.S. Fish and Wildlife Service weir that operated from June 1 through July 29.

PRELIMINARY FORECASTS OF 2003 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 2003 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. Projections of 2003 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [d]
Southeast Region Total	259 [a]	1,320 [a]	3,020 [a]	43,500	14,903 [b]	63,002
Prince William Sound						
Common Property	49	2,035	622	17,130	3,586	23,422
Cost Recovery		326	0	9,740	1,356	11,422
Upper Cook Inlet	10 [a]	2,400	170 [a]	80 [a]	140 [a]	2,800
Lower Cook Inlet	1 [a]	307	14 [a]	1,528	23 [a]	1,872
Bristol Bay	73	16,800	16 [c]	300 [c]	417	17,606
Central Region Total	133	21,868	822	28,778	5,522	57,122
Kodiak Area	20	2,150	514	16,300	1,230	20,214
Chignik	5	1,770	155	942	178	3,050
South Peninsula	5	1,600	200	2,500	850	5,155
North Peninsula	8	1,600	50	10	80	1,748
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	38	7,120	919	19,752	2,338	30,167
AYK Region Total	27	63	242	4	277	612
Statewide Total	457	30,370	5,003	92,034	23,039	150,903

[a] Average harvest for the five-year, 1998-2002, period.

[b] Projection of Southeast Alaska hatchery chum salmon return of 12.121 million less broodstock (0.418 million) plus projected wild stock catch of 3.2 million.

[c] 5-year average of even-year harvests.

[d] Columns and rows may not total exactly due to rounding error.

Table 2. Preliminary 2002 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [b c]
Southeast Region Total	387 [a]	786	3,241	45,258	7,443	57,117
Prince William Sound	40	2,262	650	18,951	6,373	28,277
Upper Cook Inlet	13	2,770	245	445	237	3,710
Lower Cook Inlet	2	291	8	1,970	43	2,313
Bristol Bay	44	10,651	9	1	461	11,165
Central Region Total	98	15,974	912	21,366	7,114	45,464
Kodiak Area	19	1,830	496	18,300	650	21,295
Chignik	1	1,040	49	66	55	1,211
South Peninsula & Aleutian	6	1,040	203	2,170	819	4,238
North Peninsula	4	1,420	29	21	51	1,525
Westward Region Total	31	5,330	777	20,557	1,575	28,270
AYK Region Total [d]	37	24	113	0	49	223
Total Alaska	553	22,113	5,043	87,182	16,181	131,074

[a] Total commercial harvest of chinook salmon for the October 1, 2001 to September 30, 2002 catch accounting period.

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

[c] Columns may not total exactly due to rounding error.

[d] AYK Region totals do not include Norton Sound and Kotzebue Area harvests; these data are confidential.

Table 3. Preliminary 2002 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [a b]
Southeast Region Total	6,236	5,039	24,380	150,574	69,790	256,020
Prince William Sound	830	14,453	6,096	65,795	52,583	139,758
Upper Cook Inlet	287	18,061	1,674	1,776	1,900	23,698
Lower Cook Inlet	22	1,497	65	6,575	214	8,374
Bristol Bay	803	66,530	59	2	1,556	68,950
Central Region Total	1,940	100,540	7,890	74,150	56,250	240,780
Kodiak Area	193	10,347	3,883	67,510	5,062	86,996
Chignik	14	7,245	361	207	407	8,233
South Peninsula & Aleutians	79	5,943	1,328	7,914	5,976	21,239
North Peninsula	59	7,634	258	66	373	8,390
Westward Region Total	344	31,170	5,830	75,700	11,820	124,858
AYK Region Total	658	161	908	0	449	2,176
Total Alaska	9,180	136,900	39,000	300,400	138,300	623,780

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

[b] Columns may not total exactly due to rounding error.

Table 4. Preliminary 2002 Southeast Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [b c]
Tree Point Gillnet	1	120	34	513	145	812
Prince of Wales Island Gillnet	0	56	226	83	112	478
Stikine River Gillnet	0	0	21	5	2	28
Seine - Southern Districts	4	99	207	21,329	984	22,622
Southern S.E. Alaska Total	5	276	487	21,928	1,243	23,940
Taku-Snettisham Gillnet	2	178	39	76	230	525
Lynn Canal Gillnet	1	74	77	69	507	728
Yakutat Setnet	2	113	201	16	0	332
Seine - Northern Districts	2	51	207	20,365	714	21,339
Northern S.E. Alaska Total	6	416	525	20,500	1,450	22,897
Winter Troll [a]	29	0	0	0	0	29
Experimental Troll	38	0	0	3	3	44
Hatchery Terminal Area Troll	7	0	10	2	6	25
Summer Troll	252	1	1,310	83	110	1,756
Troll Fishery Harvest Total	326	1	1,320	88	119	1,854
Hatchery Terminal Area Gillnet	6	35	38	56	414	550
Hatchery Terminal Area Seine	13	4	56	444	1,413	1,930
Hatchery Cost Recovery	29	19	750	853	2,720	4,370
Annette Island	2	35	65	1,363	83	1,550
S.E. Alaska - Other Total	50	93	909	2,700	4,600	8,352
Southeast Region Total	387	786	3,241	45,258	7,443	57,117

[a] Includes salmon caught by troll gear from October 11, 2001 through April 14, 2002.

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

[c] Columns may not total exactly due to rounding error.

Table 5. Preliminary 2002 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [e f]
Purse Seine						
Eastern	0	0	25	356	10	391
Northern	0	1	0	594	9	604
Coghill	0	2	2	1,271	795	2,070
Southwestern [b]	0	13	5	5,711	55	5,783
Montague [a]	0	2	0	33	1,071	1,106
Southeastern	0	0	0	1	33	34
Unakwik	0	1	0	0	0	1
Drift Gillnet						
Bering River [b]	0	0	109	0	0	109
Copper River [a, b]	39	1,249	504	4	32	1,827
Unakwik	0	10	0	0	1	11
Coghill	0	60	1	6	1,660	1,728
Eshamy	0	589	4	122	104	820
Set Gillnet						
Eshamy	0	242	1	64	23	330
Hatchery [c]	0	94	0	10,788	2,581	13,462
Misc. PWS [d]	0	0	0	0	0	0
Prince William Sound Total	40	2,262	650	18,951	6,373	28,277
Southern District	2	218	4	954	5	1,182
Kamishak District	0	34	0	446	35	515
Outer District	0	21	0	570	4	595
Eastern District	0	17	4	0	0	22
Lower Cook Inlet Total	2	291	8	1,970	43	2,313
Central District	11	2,735	196	439	232	3,613
Northern District	2	33	49	6	5	95
Upper Cook Inlet Total	13	2,770	245	445	237	3,710
Naknek-Kvichak District	1	1,408	0	0	12	1,421
Nushagak District	39	2,816	0	0	270	3,126
Egegik District	0	4,603	8	0	23	4,633
Ugashik District	1	1,576	1	0	37	1,614
Togiak District	3	248	1	0	119	371
Bristol Bay Total	44	10,651	9	1	461	11,165
Central Region Total	98	15,974	912	21,366	7,114	45,464

[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.

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

[f] Columns may not total exactly due to rounding error.

Table 6. Preliminary 2002 Artcic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [c d]
Kuskokwim River	0	0	83	0	2	85
Kuskokwim Bay	13	24	30	0	33	100
Kuskokwim Area Total	13	24	113	0	35	185
Lower Yukon River	23	0	0	0	10	33
Upper Yukon River [a]	2	0	0	0	3	5
Yukon River Total	24	0	0	0	14	38
Norton Sound	[b]	[b]	[b]	[b]	[b]	[b]
Kotzebue Area	[b]	[b]	[b]	[b]	[b]	[b]
AYK Region Total [b]	37	24	113	0	49	223

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

[b] Totals do not include Norton Sound and Kotzebue Area harvests; these data are confidential.

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

[d] Columns and rows may not total exactly due to rounding error.

Table 7. Preliminary 2002 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [b c]
Kodiak	19	1,830	496	18,300	650	21,295
Chignik	1	1,040	49	66	55	1,211
South Peninsula and Aleutian Islands	6	1,040	203	2,170	819	4,238
North Peninsula	4	1,420	29	21	51	1,525
Alaska Peninsula Total	10	2,460	232	2,191	870	5,763
Aleutian Islands [a]						
Westward Region Total	31	5,330	777	20,557	1,575	28,270

[a] Harvest data are presently confidential.

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

[c] Columns may not total exactly due to rounding error.

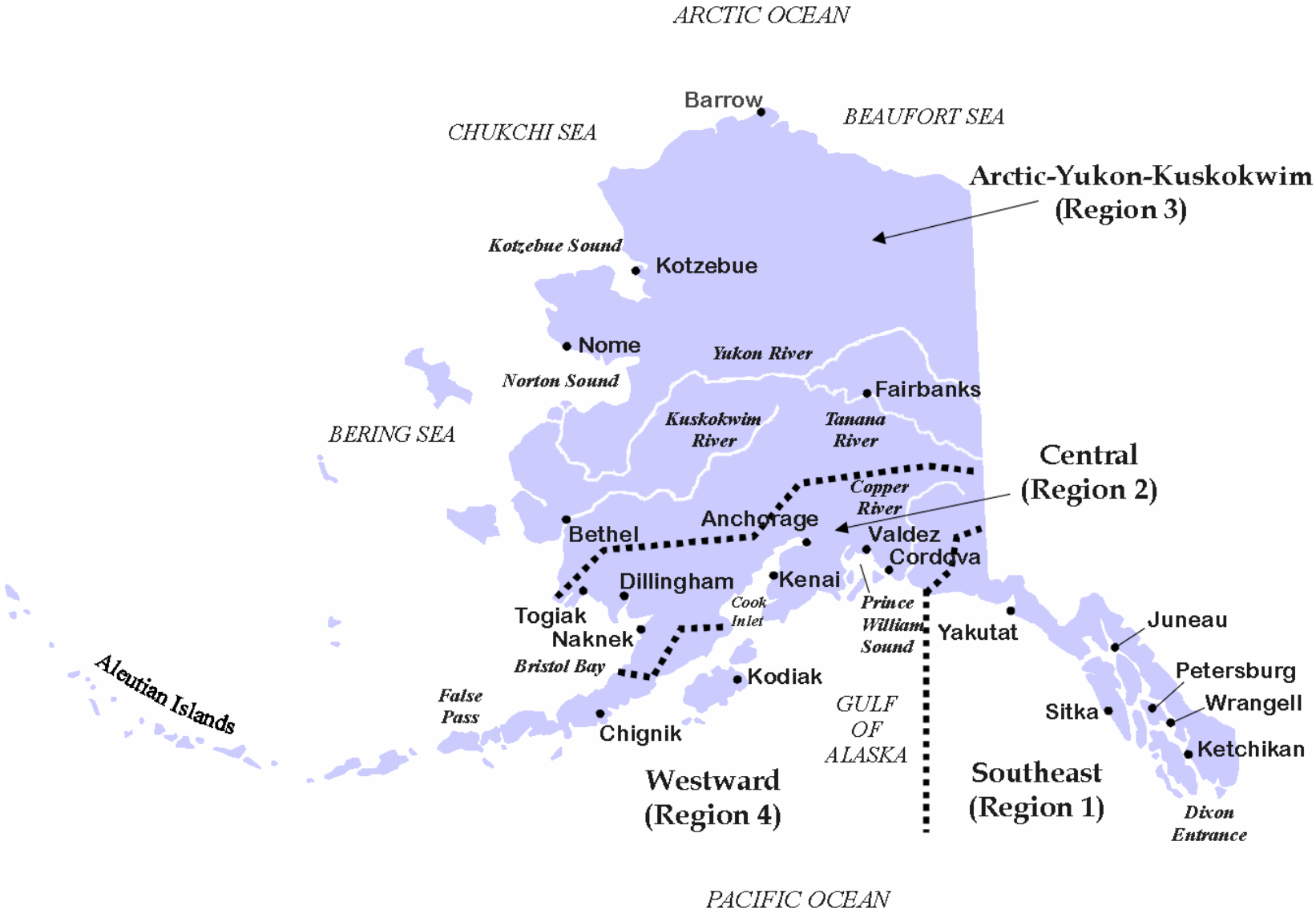

Figure 1. The four fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Alaska Department of Fish and Game, Division of Commercial Fisheries.

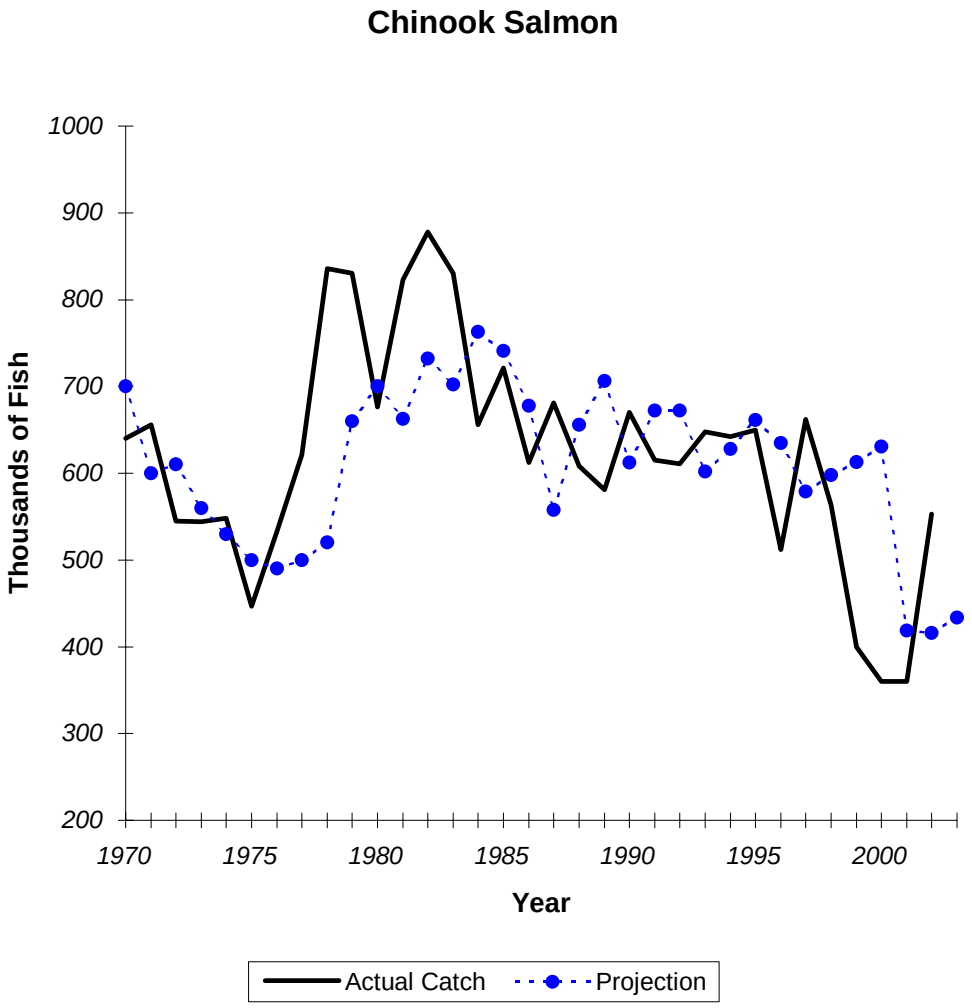

Figure 2. Relationship between actual catch and projected catch in thousands, for Alaskan chinook salmon fisheries from 1970-2002, with the 2003 projection.

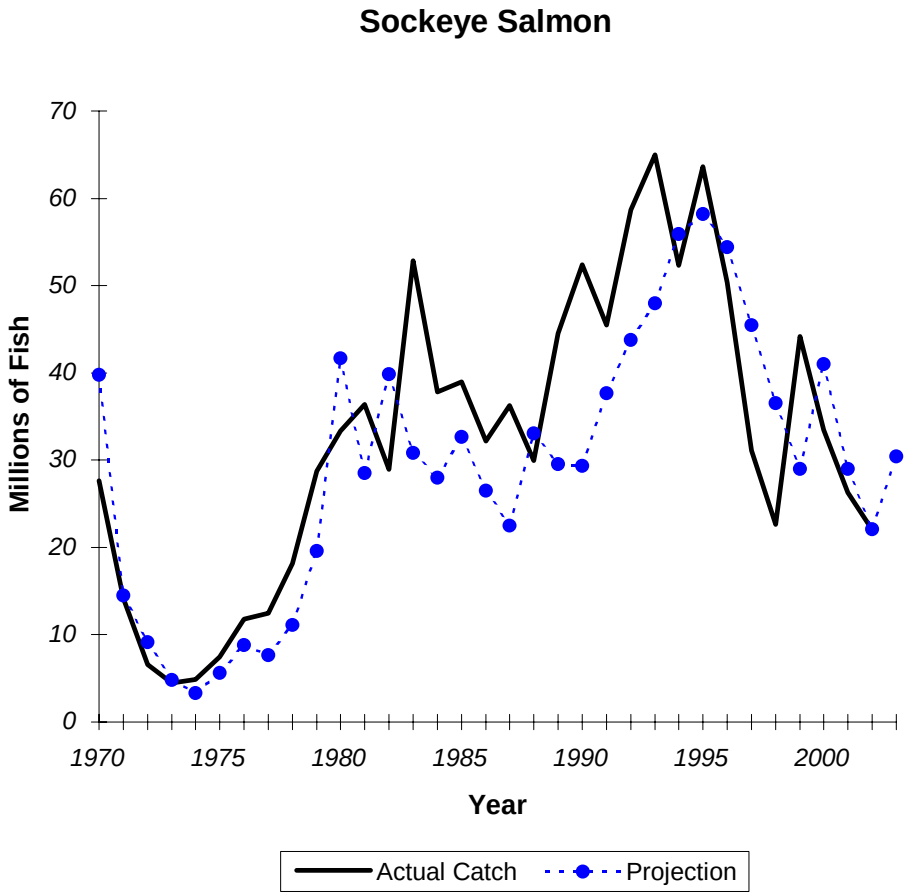

Figure 3. Relationship between actual catch (millions) and projected catch (millions) for Alaskan sockeye salmon fisheries from 1970-2002, with the 2003 projection.

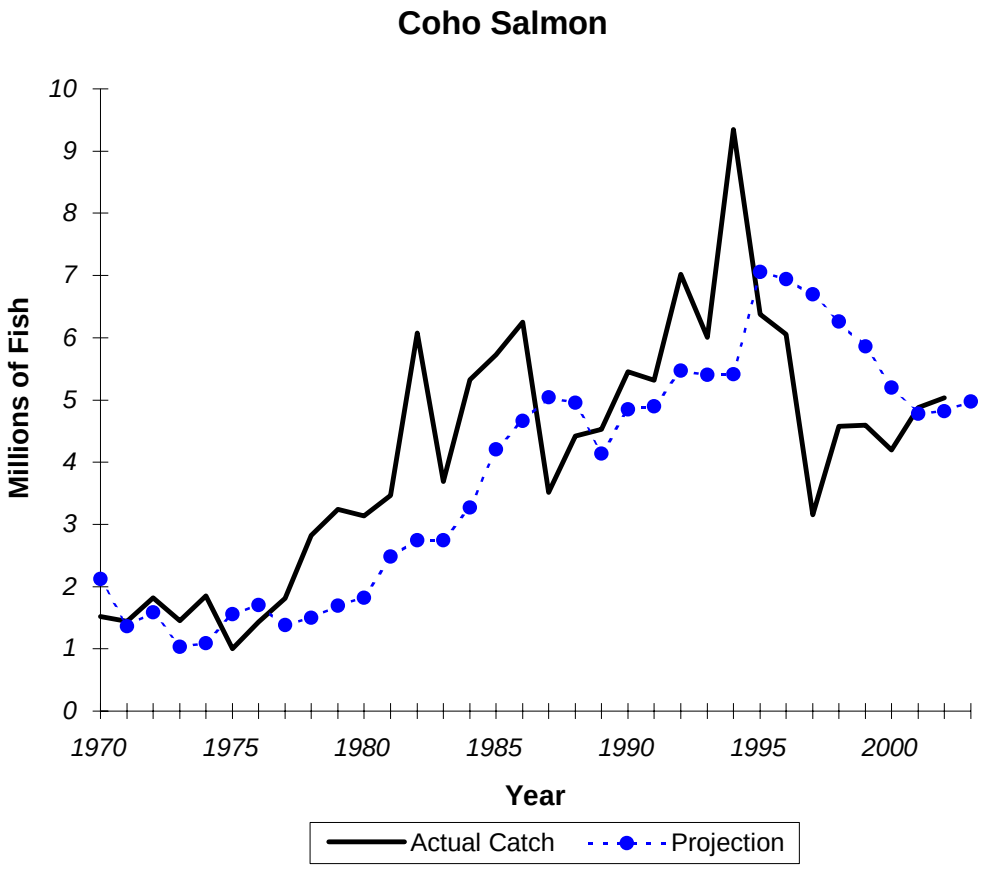

Figure 4. Relationship between actual catch (millions) and projected catch (millions) for Alaskan coho salmon fisheries from 1970-2002 with the 2003 projection.

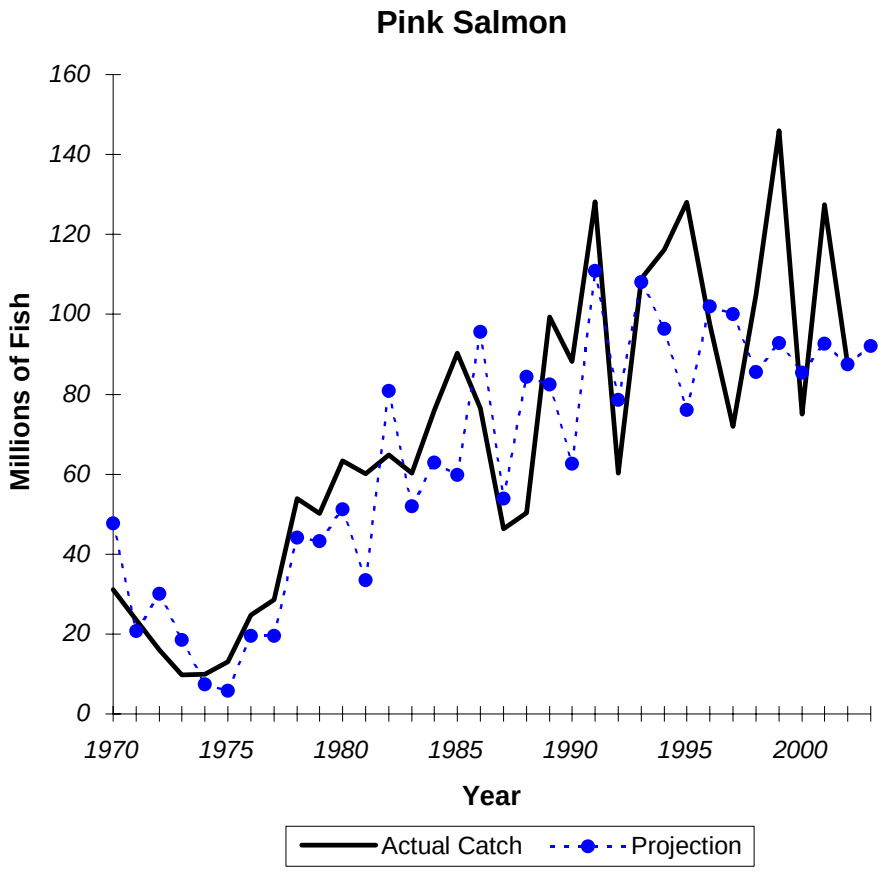

Figure 5. Relationship between actual catch (millions) and projected catch (millions) for Alaskan pink salmon fisheries from 1970-2002, with the 2003 projection.

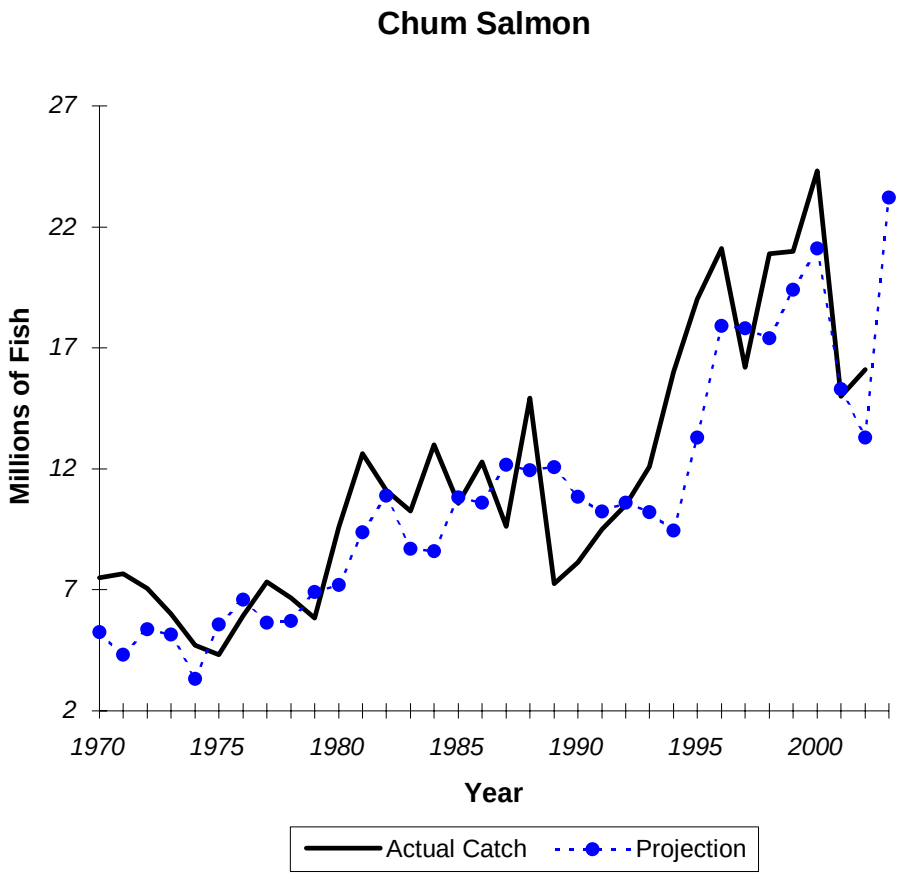

Figure 6. Relationship between actual catch and projected catch in millions, for Alaskan chum salmon fisheries from 1970-2002, with the 2003 projection.

APPENDIX

APPENDIX A. ALASKA SALMON FORECASTS BY AREA AND SPECIES

Appendix A.1. Southeast Alaska Forecast

Pink Salmon

Forecast Methods

This year's preliminary prediction of the 2003 harvest of pink salmon in Southeast Alaska is based on selecting one of five different return magnitude categories. These categories were obtained by calculating the 20th, 40th, 60th, and 80th percentile of Southeast Alaska's pink salmon harvest during the 1962 through 2001 period. These categories are:

Category	Range	Percentile
Disaster	Less than 10 million	Less than 20th
Weak	10 to 17 million	21st to 40th
Average	17 to 30 million	41st to 60th
Strong	30 to 52 million	61st to 80th
Excellent	More than 52 million	Greater than 80th

The pink salmon harvest in 2003 is predicted to be very **STRONG to EXCELLENT** with a potential TOTAL SOUTHEAST ALASKA HARVEST of 32 million –55 million fish.

Southeast Alaska is divided into three sub-regions:

Southern (SSE) Districts 1–8
Northern Inside (NSEI) Districts 9–15, except the majority of District 13
Northern Outside (NSEO) Only District 13 except Hoonah Sound and Peril Strait.

Estimated distributions of the total Southeast Alaska harvest by the three areas in 2003 are:

SSE	61%
NSEI	28%
NSEO	11%

Past results have shown that it is very difficult to predict harvest rates, especially on strong return years (Appendix Table A.1). Researchers cannot predict future management actions, fishing conditions, harvest and processing capacity, or product demand that drives the harvest each year or what any of these factors have on the subsequent escapement influencing future run strengths. In 2002, these issues were evident because escapement levels indicated there could possibly have been more pink salmon harvested had there been more demand for the product. We note that there is substantial uncertainty in the forecasting procedures we have relied upon. Actual harvests could be substantially higher than those we have forecasted. Indeed, we understand that an independent forecast of 67 million pink salmon was generated for the 2003 harvest of pink salmon by Dr. Milo Adkison of the University of Alaska.

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 Index) from 1962 to 2001. These total return categories are:

Category	Range	Percentile
Disaster	Less than 18 million	Less than 20th
Weak	18 to 35 million	21st to 40th
Average	35 to 57 million	41st to 60th
Strong	57 to 87 million	61st to 80th
Excellent	More than 87 million	Greater than 80th

The total pink salmon return in 2003 is predicted to be very **STRONG** with total returns somewhere in the 57 to 87 million fish range. The peak aerial escapement index goals for all Southeast Alaska streams range between 9.9 and 14.7 million fish; this equates to expanded escapement indices between 24 and 37 million (using the traditional 2.5 times index expansion).

This preliminary prediction is based on the following considerations:

1) Two statistical models (Ricker spawner-recruit relationship and a "generalized Ricker" fit) were used.
2) Brood year escapements in 2001 were 3rd highest on record for the region: the 4th highest in SSE; the 5th highest in NSEI; and the 4th highest in NSEO for years 1960-2002.
3) Winter incubation temperatures throughout Southeast Alaska during November 2001 through February 2002 were at or above the 40-year average and should not produce any unexpected significant causes for mortality for the 2003 return.
4) No early marine fry surveys were conducted in Southeast Alaska in 2002 to indicate fry abundance. However, anecdotal observations throughout Southeast indicated fry abundance was very high in relation to other years.
5) Regardless of modeling, the results demonstrate that as we venture into the range of high escapements seen in recent years, the range of returns actually increase on a magnitudinal scale. Any detrimental effect that happens during the life span can cause catastrophic declines in the adult return similar to 1987 and 1988. Alternatively, if all life stages experience excellent survival conditions, we could see very large returns similar to 1996 and 1999. Preseason forecasting since 1994 has erred on the conservative side in most cases except for 2001 (Appendix Table A.1). Even with this conservative approach, the preseason forecast has provided a general indication of either high or low abundance.

The bottom line: our analysis of the available data predicts a very **STRONG** total return in 2003.

Inseason forecasting for SSE is used to aid in fisheries management. Preseason forecasting gives us an indication of what to expect, but inseason forecasting attempts to produce a truer picture of what to expect within the season. For the inseason forecast, the department uses the 1980-2001 seine harvest database of catch, catch per unit effort (CPUE), and available pink sex ratios (PSR) by week by district in comparison with the current year's catch statistics. The department starts with area management biologist harvest estimates and proceed to fish ticket information two weeks post opening closure. We use the first two weeks (28 and 29) of fishery information to build a better forecast in the next 2-3 weeks. As the season progresses and more harvest information is tabulated, the inseason forecast becomes more reliable. The 2002 season started out with good PSR's but low harvest and CPUE information. Normal PSR trends are to start high (> 70% males) and decline (to < 40% males) towards the end of the return.

However, poor catch and effort in District 104 indicated that the run was coming in weaker than predicted. At the same time, inside Districts 101 and 102 were showing signs of a strong return. In addition, low sockeye salmon catches in District 104 with high sockeye catches in the Northern British Columbia fisheries indicated that fish were migrating further offshore before landfall in Dixon Entrance or further south. Thus, in the 2002 inseason forecast, week 29 was predicting a dismal harvest because of the District 104 information. As additional data from District 101 and 102 was added to the model, the inseason forecast demonstrated that a lot more pink salmon were coming.

Another early indicator of run strength for NSEI pink and chum salmon returns is the Cross Sound Experimental Troll Fishery. The CPUE for each species is examined each year during weeks 25 and 26. However, in 2002 this troll fishery CPUE was not useful because the fishery changed, apparently due to fish values and changes in other species abundance (i.e., increased chinook salmon abundance).

Regardless of the actual returns of pink salmon to Southeast Alaska in 2003 the department will continue to manage fisheries inseason based on the strength of salmon runs. Data from aerial escapement surveys and fishery performance data will continue to be essential in making inseason management decisions.

Appendix Table A.1. Pink salmon preseason forecast versus actual harvests for Southeast Alaska, 1994-2002 (millions of fish).

Year	Preseason Estimate			Postseason		
	Category	Harvest	Total Return	Harvest	Total Return	Category
1994	Strong	47	78.0	57.6	91.0	Excellent
1995	Average	21.2	52.4	47.9	83.4	Strong
1996	Excellent	62	93.2	64.6	124.8	Excellent
1997	Strong	37	68.2	28.9	65.2	Strong
1998	Strong	31-51	55-84	42.4	82.3	Strong
1999	Strong	31-51	55-84	74.6	150.6	Excellent
2000	Strong	31-51	55-84	20.3	50.4	Average
2001	Strong	31-50	55-85	67.0	115.0	Excellent
2002	Strong	30-52	57-87	45.3	88.8	Excellent
2003	Strong	32-55	57-87	?	?	?

Total Return = (harvest + (escapement index × 2.5)

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Appendix A.2. Prince William Sound Forecasts

Pink Salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Prince William Sound General Districts		
Total Run	5.13	0.37–9.89
Escapement Goal[a]	2.00	
Harvest Estimate	3.13	0.00–7.89
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Valdez Fisheries Development Association–Solomon Gulch Hatchery		
Hatchery Run	10.45	7.64–13.26
Broodstock Needs	0.5	
Cost Recovery Needs[b]	4.76	3.97–5.95
Limited Entry Harvest	5.19	2.38–8.00
Historical Survival for Odd Years: Range = 1.3%–9.7%, Mean = 5.2%		
Prince William Sound Aquaculture Corporation–Cannery Creek Hatchery		
Hatchery Run	2.19	0.00–4.39
Broodstock Needs	0.3	
Cost Recovery Needs[c]	0.58	0.00–1.46
Limited Entry Harvest	1.31	0.00–3.51
Historical Survival for Odd Years: Range = 0.5%–8.3%, Mean = 4.5%		
Prince William Sound Aquaculture Corporation–A. F. Koernig Hatchery		
Hatchery Run	7.58	5.99–9.17
Broodstock Needs	0.3	
Cost Recovery Needs[c]	2.73	2.10–3.37
Limited Entry Harvest	4.55	2.96–6.14
Historical Survival for Odd Years: Range = 0.9%–10.5%, Mean = 5.0%		
Prince William Sound Aquaculture Corporation–Wally Noerenberg Hatchery		
Hatchery Run	4.92	3.06–6.78
Broodstock Needs	0.3	
Cost Recovery Needs[c]	1.67	0.92–2.41
Limited Entry Harvest	2.95	1.09–4.81
Historical Survival for Odd Years: Range = 0.9%–8.7%, Mean = 4.6%		
TOTAL PRODUCTION:		
Run Estimate	30.27	17.06–43.49
Natural Escapement Goal	2.00	
Broodstock Needs	1.4	
Cost Recovery Needs[c]	9.74	6.99–13.19
Limited Entry Harvest	17.13	3.9–30.4

[a] The escapement goal of 2.0 million pink salmon is the midpoint of the sustainable escapement goal range (1.25 – 2.75 million).
[b] Pink salmon cost recovery was estimated using a revenue goal of $2.5 million, an average price of $0.15/pound with 3.5 lb fish.
[c] Pink salmon cost recovery and broodstock was estimated as 40% of the total hatchery return.

Forecast Methods

The predicted natural run of pink salmon is the average total run of natural production for the odd years 1993–2001. This differs markedly from predictions through 1999 that used linear regressions of adult production on brood year escapement for indicator spawning streams. The forecast range is the 80% prediction interval about the mean.

The forecast for the total hatchery run is the sum of individual hatchery forecasts. The forecasts for Armin F. Koernig (AFK), Wally Noerenberg (WNH), and Solomon Gulch (SG) Hatcheries are the product of the number of fry released and historical mean marine survival at each hatchery. The 80% prediction interval around the forecast is derived from the prediction interval around the mean of the marine survival data. A linear regression model using logarithm-transformed data was used to forecast the Cannery Creek Hatchery (CCH) return. The forecast is the product of juvenile survival and total pink salmon release. Juvenile survival was calculated from a regression of ln mean juvenile weight versus ln adult survival. The 80% prediction interval was calculated using the mean accuracy of preseason forecasts versus actual return for the previous five years.

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 from each female and the expected percentage of females in the broodstock.

All cost recovery harvest estimates are preliminary. Cost recovery and broodstock harvests for Prince William Sound Aquaculture Corporation (PWSAC) are based on 40% of the total return at each facility. Actual PWSAC cost recovery harvests will depend on the run to each facility and a revenue goal to be determined. The Valdez Fisheries Development Association (VFDA) projected cost recovery harvest is based on a revenue goal of $2.5 million. The VFDA cost recovery estimate was calculated using a pink salmon weight of 3.5 pounds and a base price of $0.15/lb. The range was calculated using $0.12/lb as the lower bound and $0.18/lb as the upper price bound.

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. This method was discontinued because the linear regressions were not significant and produced estimates no better than the average harvest. The 1993–2001 odd year average return was chosen because reliable estimates of natural and hatchery contributions are available for that period.

The total 2002 release from Prince William Sound hatcheries was 603 million pink salmon. Marine survival estimates for AFK, WNH, and SG were calculated using coded wire tag recoveries (1987–1997) and otolith samples (1998–2002). The coded wire tag survival estimates have probably underestimated hatchery production. Mean hatchery specific odd-year survival was used to calculate the estimated run size. All of the fry released at PWSAC and VFDA hatcheries were relatively large (0.4g–0.7g). However, the average weight of juveniles collected in the Southwestern District from CCH were the second lowest in the time series (1997–2002). This indicates that survival may be below average.

The department has collected samples of juvenile pink salmon each summer as they migrate through Prince William Sound in the Southwestern District. These samples allow the department to examine juvenile weight by hatchery. CCH has consistently had the lowest average juvenile weight since samples were first collected in 1997. As a result of lower juvenile weight, the forecast for CCH was calculated using a linear regression with logarithm-transformed data. Comparing mean juvenile weight versus return year adult survival allowed the department to estimate a total return for CCH pink salmon.

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. Future enhancements to forecasting accuracy may come from work being done examining pristine and zooplankton abundance and distribution during times of peak juvenile pink salmon emigration from Prince William Sound. Data collected by the Prince William Sound Science Center suggests environmental conditions for pink salmon survival in 2002 were closer to 2001 than 2000. Zooplankton abundance on average was much lower than in 2000. However, these data were not collected in conjunction with PWS hatchery fry releases and may not accurately reflect the exact environmental conditions that pink salmon experienced in the spring and early summer of 2002.

The common property harvest range was calculated by subtracting the broodstock and cost recovery midpoint estimate from the lower and upper bounds of the total run for that stock. The midpoint forecast for a 2003 hatchery return of 25.1 million pink salmon to Prince William Sound would be the eighth largest hatchery run achieved.

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Chum salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Prince William Sound General Districts		
Total Run	525.4	444.4–606.3
Escapement Goal[a]	174.5	
Harvest Estimate	350.9	269.9–431.8
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Prince William Sound Aquaculture Corporation –Wally Noerenberg Hatchery (Onsite Returns)		
Hatchery Run	3,739.0	2,622.3–4,855.6
Broodstock Needs	140.0	
Cost Recovery Needs[b]	1,355.6	908.9–1,802.2
Limited Entry Harvest	2,243.4	1,126.7–3,360.1
Prince William Sound Aquaculture Corporation –Wally Noerenberg Hatchery (Port Chalmers Remote Returns)		
Hatchery Run	989.5	624.4 –1,354.6
Broodstock Needs	0.0	
Cost Recovery Needs[b]	0.0	
Limited Entry Harvest	989.5	624.4–1,354.6
Prince William Sound Aquaculture Corporation –A. F. Koernig Hatchery (Onsite Returns)		
Hatchery Run	2.4	0.0–4.5
Broodstock Needs	0.0	
Cost Recovery Needs[b]	0.00	
Limited Entry Harvest	2.4	0.0–4.5
TOTAL PRODUCTION:		
Run Estimate	5,256.3	3,691.1– 6,821.0
Escapement Goal	174.5	
Broodstock Needs	140.0	
Cost Recovery Needs[b]	1,355.6	908.9– 1,802.2
Limited Entry Harvest	3,586.2	2,021.0– 5,151.0

[a] The escapement goal of 174.5 thousand is the midpoint of all PWS District specific chum salmon sustainable escapement goal ranges

[b] Chum salmon cost recovery was estimated as 40% of the total run for cost recovery and brood.

Forecast Methods

The forecast of the total natural chum salmon run was calculated as the average of all natural runs from 1993–2002. Estimated wild contributions to the Coghill and Eshamy Districts were calculated using the average of all natural chum salmon runs to those districts from 1970–1986. The forecast range is the 80% prediction interval about the mean run size.

The forecast of the total hatchery chum salmon run is the sum of individual hatchery forecasts. Hatchery runs for all age classes were calculated from fry releases made during 1998–2001 multiplied by the mean age-specific marine survival for that facility.

WNH mean age-specific marine survival for all released fry was based on three years of fry release and adult return data (0.2% for age-3, 3.9% for age-4, 0.8% for age-5, and 0.02% for age-6). Age compositions collected from samples of WNH chum salmon cost recovery were used in the calculation. The 80% prediction interval was calculated using the mean accuracy of the forecast versus actual run for the previous seventeen years. A record four-year-old component returned to WNH in 2002 from fry that were released at over twice the average size of historical releases. Large size at release appears to be shifting the majority of adult returns to age-6 chum salmon, as well as significantly increasing overall survival.

The AFK return is expected to be composed of only age-6 chum salmon from a release in 1998. No historical survival data are available for releases at this site. Average chum salmon age compositions were used from samples collected from the Southwestern District commercial harvest from 1980–2001. Only the 1997 release at AFK has yielded age-6 return data making it difficult to calculate a prediction interval around the point forecast. Therefore, the 80% prediction interval was calculated using the variance among thirteen years of age-6 chum salmon returns to WNH.

The Port Chalmers chum salmon run will be composed of all adult age classes in 2003. Mean age specific marine survival was calculated from historical chum salmon returns to Port Chalmers from 1994–2002. Age data samples from the Port Chalmers return were used. The 80% prediction interval was calculated using the mean accuracy of the forecast versus actual run for the previous seven years.

Projected broodstock needs for WNH were based on the expected number of eggs produced from each female and expected proportion of females in the broodstock. All cost recovery harvest estimates are preliminary. PWSAC cost recovery needs for chum salmon are based on taking 40% of the total run for broodstock and cost recovery.

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 the commercial harvest are not available for recent years due to elimination of the coded wire tag recovery program for this species. Age data from escapements and commercial harvests are unavailable for most areas of PWS.

Our ability to accurately forecast hatchery chum salmon runs is also limited as a result of changes in the hatchery rearing practices. In 1995, PWSAC began releasing fry that were on average 2.5 times larger than those released prior to 1995. These changes are probably the cause of larger hatchery returns, higher marine survival, and possibly younger age at maturity. The WNH forecasted onsite return of age-3 chum (brood year 2000) are expected to contribute near the long-term average of four percent of the overall run. The return of age-4 chum salmon in 2002 was the largest on record. Therefore, based on the strength of the 1999 brood year, and the recent strength of age-4 WNH chum salmon, a large proportion (80%) of the forecasted total run are age-4 fish. The strong returns from this brood year were probably due to releases of larger fry and favorable environmental conditions. Age-5 chum salmon have historically contributed approximately 40% of the run; however, since 1995 age-5 fish have contributed less. The age-5 year class is expected to contribute approximately 16% to the total WNH run. Age 6 chum salmon typically contribute a very small proportion to the overall hatchery run.

Chum salmon released at Port Chalmers have been released at a larger size since 1995. Similar to the WNH onsite return, the Port Chalmers hatchery run is also experiencing higher marine survival and younger age at maturity. If the 2003 Port Chalmers chum salmon run is near forecast, it will be the second largest run on record.

Chum salmon released at AFK Hatchery in 1997 and 1998 were reared to a large size. In 2003, only age-6 chum salmon will return from a release in 1998. The 2003 AFK chum salmon run will be harvested by the commercial common property fleet inside the special harvest area.

The common property harvest range was calculated by subtracting the broodstock and cost recovery midpoint estimate from the lower and upper bounds of the total run for that stock. Together, the WNH, and AFK onsite, and Port Chalmers remote returns are expected to produce over 4.7 million adult chum salmon.

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Sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Prince William Sound–Coghill Lake		
Total Run	142.22	54.93–379.71
Escapement Goal[a]	30.00	
Harvest Estimate	112.22	24.93–349.71
Prince William Sound–Eshamy Lake		
Total Run	32.25	2.16–62.34
Escapement Goal[a]	27.50	
Harvest Estimate	4.75	0.00–34.84
Prince William Sound–Unakwik District		
Harvest Estimate	10.15	7.88–12.41
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Prince William Sound Aquaculture Corporation –Main Bay Hatchery (Coghill Stock Onsite Returns)		
Hatchery Run	835.84	677.74–993.93
Broodstock Needs	8.0	
Cost Recovery Needs[b]	326.34	263.10–389.57
Limited Entry Harvest	501.50	343.40–659.59
Historical Survival: Range = 3.2%–19.5%, Mean = 11.0%		
TOTAL PRODUCTION:		
Run Estimate	1,020.46	742.7 – 1,448.4
Natural Escapement Goal	57.50	
Broodstock Needs	8.0	
Cost Recovery Needs[b]	326.34	263.10–389.57
Limited Entry Harvest	628.62	378.71–1,056.55

[a]. The escapement goal for Coghill and Eshamy Lakes is the midpoint of the biological escapement goal range for each lake (20.0–40.0 thousand and 20.0–35.0 thousand, respectively).
[b] The Main Bay Hatchery cost recovery was estimated as 40% of the total run for cost recovery and brood stock combined.

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 age-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 2003 used the run of age-1.1 sockeye salmon in 2002 as the input parameter. The predicted runs of age-1.1, age-2.2, and age-2.3 sockeye salmon were calculated as the mean return of that age class in past years. Although catch and escapement numbers, as well as age composition data, are available for Coghill Lake 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 80% prediction intervals. The predicted total run to Coghill Lake was the sum of predictions for individual ages.

The forecast of the natural run to Eshamy Lake is the mean of the runs from the fourth year after the peak in the four-year cycle. Eshamy Lake escapements have been enumerated at a weir since 1950 except 1987 and 1998. Commercial harvest data are available for the same period, but age composition data are available only for some years since 1962. Only data collected since 1970, excluding 1987 and 1998, were used to calculate the forecast and the 80% prediction interval.

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

Main Bay Hatchery (MBH), operated by PWSAC, is the only facility producing sockeye salmon in Prince William Sound. In 2003, only Coghill Lake stock will be returning.

The forecast for the Coghill stock onsite run is based on mean age-specific return rates for releases from 1986 through 1996 brood years (0.53% for three-year-old, 6.57% for four-year-old, and 2.93% for five-year-old sockeye salmon). The return rates are based on fry releases, harvest contribution estimates from coded wire tag recoveries, and broodstock data. The 2003 run will consist of three, four, and five-year-old sockeye salmon from releases of smolt in 2000, 2001, and 2002.

Approximately 12,000 sockeye salmon are expected to return to Solf Lake in 2003 from fry releases in 1999, 2000, and 2001. PWSAC discontinued this stocking program in 2001.

Projected broodstock needs 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. PWSAC cost recovery needs for sockeye salmon are based on taking 40% of the total run for broodstock and cost recovery. All cost recovery harvest estimates are preliminary.

Forecast Discussion

Coghill Lake has very dynamic limnological characteristics that can significantly impact the sockeye salmon population in the lake. Studies conducted in the mid-1980s and early 1990s found that the lake may be a zooplankton limited system. As a result, the biological escapement goal for this system was lowered in 1992 to allow zooplankton populations to recover. Fertilizers were added to the lake (1993-1996) in a cooperative project with the U.S. Forest Service to improve the forage base for rearing sockeye salmon juveniles. In 2002, the department has again started collecting limnological data in an attempt to begin monitoring the basic characteristics of the lake. The BEG for Coghill Lake natural run was met in 2002, and has been met every year since 1995.

The Eshamy Lake natural stock appears to exhibit a four-year cycle, and the 2003 run should be the fourth year after the peak in the cycle. The spawning escapement goal was met in 2002 with 40,785 sockeye salmon past the Eshamy weir. Mean run size for this point in the cycle for 1971–1999 is 32 thousand sockeye salmon.

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 Eshamy District directed harvest, and the Southwestern District incidental harvest. These data were used to construct brood tables for this run. Contributions to commercial harvests in western PWS of sockeye salmon produced by the MBH have been estimated by recovery of coded wire tags. However, not all harvests can be adequately estimated,

increasing the uncertainty of total run estimates for all wild and enhanced sockeye salmon stocks in western PWS. Age composition data and weir counts were not collected in 1987 and 1998 due to budget reductions. The return of the Eshamy weir and the start of thermal otolith marking of MBH sockeye salmon should allow much better estimates of Eshamy wild runs in the future.

The common property harvest range was calculated by subtracting the broodstock and cost recovery midpoint estimate from the lower and upper bounds of the total run for that stock. The onsite hatchery run of Coghill stock in 2003 is expected to be slightly larger than the 2002 Coghill stock run. The run will be composed of three, four, and five-year old sockeye salmon from smolt releases in 2000, 2001, and 2002. No Coghill Lake stock smolts were released from MBH in 1998 and 1999. This stock has been reintroduced to the MBH and has replaced all other stocks currently at that facility.

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Coho salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Valdez Fisheries Development Association–Solomon Gulch Hatchery (Onsite Releases)		
Hatchery Run	185.76	153.06–218.47
Broodstock Needs	1.5	
Cost Recovery Needs	0.0	
Common Property Harvest	184.26	151.56–216.97
Historic Survival: Range = 0.9%–23.7%, Mean = 10.0%		
Valdez Fisheries Development Association–Solomon Gulch Hatchery (Remote Releases)[a]		
Hatchery Run	2.04	1.68– 2.40
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Common Property Harvest	2.04	1.68– 2.40
Prince William Sound Aquaculture Corporation–Wally Noerenberg Hatchery (Onsite Releases)		
Hatchery Run	17.77	14.12–21.42
Broodstock Needs	1.0	
Cost Recovery Needs	0.0	
Common Property Harvest	16.77	13.12–20.42
Historic Survival: Range = 0.1%–14.3%, Mean = 7.4%		
Prince William Sound Aquaculture Corporation–Wally Noerenberg Hatchery (Remote Releases)[b]		
Hatchery Run	17.97	14.28–21.66
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Common Property Harvest	17.97	14.28–21.66
TOTAL HATCHERY PRODUCTION:		
Run Estimate	223.54	183.14–263.95
Broodstock Needs	2.5	
Cost Recovery Needs	0.00	
Common Property Harvest	221.04	180.64 –261.45

[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 historical annual harvests. In recent years, commercial harvests have targeted primarily hatchery runs, and no stock contribution estimates are available to assess natural production. Estimates of sport harvests, which do target natural coho salmon runs, are not available until the following winter. Therefore, no projection is estimated for natural production of this species for 2003.

The forecast for each hatchery run is the product of the number of smolt released in 2002 and mean marine survival for each facility (10.0% for SG and 7.4% for WNH). Forecast ranges are the 80% prediction intervals about mean survivals.

Projected broodstock needs were based on the expected number of eggs produced from each female and the expected percentage of females in the broodstock. All broodstock estimates are preliminary.

Forecast Discussion

Coho smolt releases (486,000 from WNH, and 1,841,000 from SG) in 2002 were near the long-term average. Marine survival estimates for coho salmon hatchery stocks assume that all harvest taken near each hatchery is composed of production from that hatchery. Survival estimates could be overly optimistic if hatchery and natural runs mix in harvest areas. Run estimates to remote stocking locations are based on hatchery survival estimates since little information is available on actual sport harvest of these stockings. The common property harvest range was calculated by subtracting the broodstock estimate from the lower and upper bounds of the total run for that stock. No direct cost recovery harvest is anticipated at either WNH or SG hatcheries. However, some revenue could be generated from coho salmon incidentally captured during the pink salmon cost recovery harvest.

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Appendix A.3. Copper and Bering Rivers Forecasts

Copper River sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Natural Run	1.67	1.01– 2.80
Escapement Goal	0.53	
Common Property Harvest[a]	1.14	0.48–2.27
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Prince William Sound Aquaculture Corporation–Gulkana Hatchery		
Hatchery Run	0.35	0.13– 0.56
Broodstock Needs	0.02	
Supplemental Escapement[a]	0.08	
Common Property Harvest[a]	0.25	0.03– 0.46
TOTAL PRODUCTION:		
Run Estimate	2.02	0.84–2.59
Natural Escapement Goal	0.53	
Broodstock Needs	0.02	
Supplemental Escapement[a]	0.08	
Common Property Harvest[b]	1.39	0.51– 2.73

[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, age-1.3, and age-2.2 sockeye salmon. The run for 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-1.3 sockeye salmon in 2003 used the run of age-1.2 sockeye salmon in 2002 as the input parameter. Finally, predicted runs of age-1.1, age-0.3, and age-2.3 sockeye salmon were calculated as the mean return of those age classes since 1961. The 80% prediction bounds for the total forecast of natural production is the sum of 80% prediction bounds for each age class. The 80% prediction intervals were estimated using either a cross validation technique for predictions based on regression models or the prediction interval around the mean. Forecast methods for 2003 are similar to forecast methods used after 1998, 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 mean age specific return rates observed for the 1995–1998 brood years. The return rates were calculated using coded wire tag recoveries in harvests and enumerated adult escapements. Survival of juveniles released into Paxson Lake was assumed to lie between values estimated for Crosswind and

Summit Lake. The average of the estimated wild exploitation rates (72%) for 1996–2001 was used to estimate the total harvest of Gulkana Hatchery stocks in 2002. The 80% prediction interval for the forecast of supplemental production was calculated using mean square error estimates calculated for total runs.

Forecast Discussion

Forecasts prior to 1998 relied on the relationship between number of spawners and subsequent returns, using return-per-spawner values for parent year abundance similar to that of the dominant age class (age 5) of the forecast year. 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 1998–2002 forecasts. Linear regressions of sibling returns were not used prior to these years 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. Historical estimates of Gulkana Hatchery production are considered imprecise. Improved contribution estimates for brood years 1995–1997 indicate large contributions from supplemental production and smolt-to-adult survival estimates for Crosswind Lake releases that exceeded 20%. The 2003 contribution of age-4 fish from Gulkana Hatchery will probably be weak due to poor fry-smolt survival of both Crosswind and Summit Lake remote releases.

The 2003 run will be composed primarily of 1998 and 1999 brood year returns. Five-year-old sockeye salmon (1998 brood year) are expected to predominate Copper River delta and Upper Copper River runs. The total production common property harvest range was calculated by subtracting the broodstock and escapement goal from the lower and upper bounds of the total run. The forecast for the 2003 total run is well above the 1967–2002 average. If realized, the 2003 forecast total run would rank as the eighth largest since 1967, just below the 2001 and 2002 runs. The 1.67 million natural run would be above average for runs documented prior to substantial supplemental production, and a 0.35 million Gulkana Hatchery run would be about 13% below the 1997–2002 average.

Steve Moffitt
Fisheries Biologist III
PWS Research Project Leader
Cordova

Bering River sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HARVEST PROJECTION FOR NATURAL RUN:		
Bering River District	16.00	5.49–26.50

Forecast Methods

The harvest projection for the 2003 sockeye salmon run to the Bering River drainage is the average limited entry commercial harvest for 1993–2002. The range is the 80% prediction interval about the mean harvest.

Forecast Discussion

Prior to 1986 Kayak Island was included in the Bering River District. Total commercial harvest data prior to 1986 reflect a much larger total harvest for the Bering River District than is currently observed. The 2002 limited entry commercial harvest of sockeye salmon in the Bering River District was well below the 1988-2001 average of 41,423 sockeye salmon. Estimating total Bering River sockeye salmon run strength based on commercial harvest is difficult due to little effort in recent years or improper reporting of harvest location on fish tickets.

Rick Merizon
Fisheries Biologist II
PWS Research Project Leader
Cordova

Copper River chinook salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HARVEST PROJECTION FOR NATURAL RUN:		
Copper River District	49.00	29.54–68.48

Forecast Methods

The harvest projection for the 2003 chinook salmon run to the Copper River is the average limited entry commercial harvest for 1993–2002. The range is the 80% prediction interval about the mean harvest.

Forecast Discussion

During the past 20 years, Copper River chinook salmon harvests have been above the 1966–1980 average of 18,900 chinook salmon, and several harvest records have been set since 1981. Total harvests in all Copper River fisheries (commercial, subsistence, and sport) between 1995 and 1999 exceeded all documented annual harvests since 1890. Mark-recapture estimates of total chinook salmon spawning escapement in 1999, 2000, and 2001 provided reason for concern about recent escapement levels. 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 salmon 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 estimated actual runs.

Rick Merizon
Fisheries Biologist II
PWS Research Project Leader
Cordova

Copper and Bering Rivers coho salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HARVEST PROJECTION FOR NATURAL RUN:		
Copper River District	306.95	11.95–601.94
Bering River District	94.04	0.00–236.58

Forecast Methods

The harvest projection for the 2003 run of coho salmon to the Copper and Bering River areas is the average limited entry commercial harvest for 1993–2002. The forecast range is the 80% prediction interval about the mean harvest.

Forecast Discussion

The 2002 Copper River commercial harvest was the sixth largest since 1889. The 2002 Bering River commercial harvest of 108,522 was also much larger than the 1997–2001 average. The winter of 2000–2001 was extremely warm with high rainfall totals on the Copper and Bering River deltas. These environmental factors may have played an important role in over-winter survival of fry that returned in 2002. The occurrence of extremely high and low brood year returns since 1990 may help identify environmental factors affecting freshwater survival of coho salmon juveniles, which may be used to improve forecast accuracy.

Rick Merizon
Fisheries Biologist II
Prince William Sound Research Biologist
Cordova

Appendix A.4. Cook Inlet Forecasts

Upper Cook Inlet sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Total Run:	3.9	0.5–7.2
Escapement Goal:	1.5	
Harvest Estimate:	2.4	

Forecast Methods

Four models were used to forecast the return of sockeye salmon to the Kenai, Kasilof, Susitna and Crescent Rivers, and Fish Creek in 2003: (1) the relationship between adult returns and spawners, (2) the relationship between adult returns and fry, (3) the relationship between adult returns and smolts, and (4) the relationship between adult returns and siblings. While sibling relationships were used to forecast returns to most river systems, the return of age-1.3 sockeye salmon to the Kenai River was forecast using a model based on the abundance of sockeye salmon fry rearing in Skilak and Kenai lakes in the fall of 1999. The abundance of smolts emigrating from Tustemena Lake was used to forecast returns of age-1.2, age-1.3, and age-2.2 sockeye salmon to the Kasilof River in 2003. This is the second time this model has been used. An approximate eighty percent confidence 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

A run of 3.9 million sockeye salmon is forecasted to return to Upper Cook Inlet in 2003 with a harvest by all user groups of 2.4 million sockeye salmon. The forecasted harvest is about 1.6 million fish below the 20-year average harvest. There is a level of uncertainty with the forecasted return to the Kenai River. The fry model used to forecast the return of age-1.3 sockeye salmon to the Kenai River has provided more accurate forecasts than the sibling model in 5 of the past 6 years. But the difference between the forecast return of age-1.3 sockeye salmon using the fry model (957 thousand) and the sibling model (2.6 million) is large. The forecasted return to the Kenai River is about one half of the 20-year average return for this age class. The return to the Kasilof River is forecasted to be slightly below the 20-year average return of 890 thousand. The smolt models used to forecast the returns of age-1.2, age-1.3, and age-2.2 sockeye salmon to Kasilof River have provided more accurate forecasts than other models over the past 10 years. The smolt populations that will produce the returns of these three age classes in 2003 were slightly below average.

Forecast runs to individual freshwater systems of Upper Cook Inlet are as follows:

System	Run	Inriver Goal
Crescent River	115,000	25,000–50,000
Fish Creek	125,000	20,000–70,000
Kasilof River	677,000	150,000–250,000
Kenai River	2,044,000	750,000–950,000
Susitna River	397,000	90,000–160,000
Minor System	504,000	N/A

Mark Willette
Research Project Leader
Upper Cook Inlet

Lower Cook Inlet pink salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate[a] (thousands)	Forecast Range[a] (thousands)
NATURAL PRODUCTION:		
Total Run	882	254–3,256
Escapement[b]	314	104–604
Commercial Harvest[c]	568	150–2,652
SUPPLEMENTAL PRODUCTION:		
Total Run	1,361	745–1,987
Broodstock and Escapement[b d]	401	396–406
Commercial Harvest[c e]	960	416–1,515
TOTAL AREA PRODUCTION:		
Total Run	2,243	1,000–5,243
Broodstock and Escapement[b d]	715	500–1,011
Commercial Harvest[c f]	1,528	565–4,166

[a]All values are rounded to the nearest thousand fish.

[b]Escapement values include an escapement goal shortfall of 56 thousand fish for systems with a forecast in 2003.

[c]Commercial Harvest = Total Run - Escapement/Broodstock.

[d]Broodstock included escapement goal for Tutka Creek.

[e]Commercial harvests of supplemental production include both common property and cost recovery harvests.

[f]Additional harvests may be expected from systems not included in 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 log-log regression of total return on escapement from 34 to 42 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 the escapement goal from the forecasted run for each of our 11 index areas and then summing the resulting values. Forecasts of supplemental production by the Tutka and Port Graham hatcheries was based on marine survival rates of 1.2% and 3.2%, respectively. 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 41 changes in direction of annual run size. Accordingly, we have some confidence that the 2003 total return will continue the recent trend of fewer fish returning in odd-numbered years. In 2001, the last odd numbered year, 10 of the 11 systems for which a forecast was made had runs within the forecast range. The 2003 forecast for natural production of 882 thousand pink salmon has an 80 percent confidence interval of 254 thousand to 3.26 million fish. Given the lower than expected parent-year escapement in many of the 11 index areas and the recent trend towards lower return-per-spawner ratios, the lower end of this range appears more probable than the point estimate. If realized, a natural run of 882 thousand pink salmon would be nearly two times the median run size of 458 thousand fish for odd-year returns between 1961 and 2001. The pink salmon escapement goal is 370 thousand fish for systems with a forecast, but a

combined escapement shortfall of 56 thousand fish is expected for Humpy Creek and Seldovia and Bruin Bay rivers. The resulting escapement forecast is 314 thousand pink salmon.

The harvestable surplus of naturally produced pink salmon in the Southern District is projected to be 8.2 thousand fish, all of which is expected to come from Port Graham Bay. No harvest is projected for Humpy Creek or Seldovia Bay, where escapement shortfalls of 5 and 10 thousand fish, respectively, are expected. 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 99.4 million fry in 2002. Given the recent trend in reduced ocean survival rates (1.2%), about 1.15 million pink salmon are expected to return to Tutka Bay and Lagoon in 2003 (pers. comm. with G. Fandrei, Cook Inlet Aquaculture Association). The Port Graham Hatchery released 6.6 million fry in 2002. They are optimistically assuming a marine survival rate of 3.2%, and expect about 211 thousand pink salmon to return to Port Graham Bay in 2003 (pers. comm. with P. McCollum, Port Graham Hatchery). The 2003 brood stock goals for the Tutka and Port Graham hatcheries are 178 thousand and 211 thousand fish, respectively. Because cost recovery requirements are dependent upon inseason fish prices, the allocation of Tutka Hatchery's supplemental production salmon returns between common property and cost recovery fisheries cannot be determined at this time.

In the Outer District, the number of naturally produced pink salmon available for harvest is projected to be 517 thousand fish, with almost 67% of the harvest expected to occur in the Port Dick subdistrict. If realized, the Port Dick harvest would be the highest in an odd year since 1981. Harvests ranging from 13 to 76 thousand fish are anticipated from Nuka Island, Windy Bay, Rocky Bay, and Port Chatham.

In the Eastern District, a harvestable surplus of only two thousand pink salmon is projected for Resurrection Bay. However, commercial fishing specifically directed at pink salmon has not been allowed in that area in recent years due to a combination of erratic production and potential conflicts with the Resurrection Bay Salmon Management Plan, which limits commercial interference with the sport coho salmon fishery.

In the Kamishak Bay District, an escapement shortfall of 47 thousand pink salmon is forecasted for Bruin Bay, and a harvestable surplus of 40 thousand fish is projected for Ursus and Rocky Coves. If realized, it would be the largest pink salmon harvest from this index area since 1995. Low market value and generally low returns have limited the incentive to harvest pink salmon in the Kamishak District in recent years.

Edward O. Otis
LCI Research Biologist
Homer

Lee F. Hammarstrom
Area Finfish Management Biologist
Homer

Appendix A.5. Kodiak Forecasts

Kodiak pink salmon

Preliminary Forecast of the 2003 Run:	**Harvest Forecast (millions)**
Wild Stock Production: **AVERAGE**	6.0–10.0
Kitoi Bay Hatchery Production:	5.2– 9.9
2003 Total KMA Pink Salmon Harvest	11.2–19.9
Wild Stock Production by District:	
AFOGNAK	0.5–0.9
WESTSIDE	2.4–4.0
ALITAK	1.5–2.5
EASTSIDE	1.2–2.0
MAINLAND	0.4–0.6

Forecast Methods

The 2003 Kodiak Management Area wild stock pink salmon forecast was prepared by evaluating Ricker spawner-recruit models, and comparing the 2001 brood-year escapement indices for the entire Kodiak Management Area and for individual fishing districts to past escapements, subsequent returns, and escapement and harvest averages. Climatological data, from the fall of 2001 (spawning period) through the spring and summer of 2002 (emigration and nearshore residence periods), plus miscellaneous observations of fry survival, were also considered. An anticipated harvest range for the 2003 wild stock pink salmon return was determined by selecting one of five different harvest magnitude categories.

Harvest categories were delimited by melding harvest quintiles with the forecast categories previously used by management biologists to determine the length of initial fishing periods. This forecasting method has been used since 1999. Categories are shown on the right:

Harvest Category	**Range (millions)**
Very Weak	Less than 3
Weak	3 to 6
Average	6 to 10
Strong	10 to 14
Excellent	Greater than 14

The Kitoi Bay Hatchery pink salmon forecast was developed by applying the survival rates of "40-day" reared fry (over 0.5 grams on release) from the past 5 years (1998 through 2002 returns) to the estimated number of fry released in 2002. The low range estimate used the lowest of the 1998–2002 survival rates, and the high range estimate used the average survival rate of the past two odd-year returns (1999 and 2001).

Forecast Discussion

Several Ricker spawner-recruit models examined the relationship of 1979 to 2001 odd-year escapements to total return or harvest. Kodiak Management Area pink salmon exhibit odd-numbered or even-numbered year dominance; currently even-year runs tend to be larger than odd-year runs. All spawner-recruit models produced similar estimates and harvest yield projections were within the upper bounds of the AVERAGE (6 million to 10 million) category. Models were also developed for each district and the sum of the district estimates was similar to the area-wide prediction.

The effect of climatic conditions on pink salmon spawning, egg-to-fry survival, emigration, and nearshore survival is unquantified. However, no conditions were experienced that would suggest that the

estimate produced from Ricker spawner-recruit models should be modified. During the spawning period in the fall of 2001, Kodiak weather was warm with slightly above average rainfall (based on National Weather Service records; www.wrcc.dri.edu/cgi-bin/). From November through March, mean monthly temperatures were near or just below average. Nearshore ocean temperatures, as noted by fishers and ADF&G during the April 2002 Kodiak herring fishery, were colder than normal and herring aggregation and spawning was later than in recent years. The Kitoi Bay Hatchery manager reported that plankton production near the hatchery was fairly poor and occurred later than normal. Fishermen reported that ocean temperature rose from June through September 2002, though not to the extremes noted during the previous two years. Large numbers of pink salmon fry were noted in several bays during the summer of 2002.

Recent odd-year pink salmon returns have declined from record numbers produced in 1993 and 1995. The 2001 (brood year) pink salmon escapement (3.4 million) was above established goals (1.0 million to 3.0 million), but below the 1991–1999 odd-year average (4.5 million). Escapement goals were met for each district in the Kodiak Management Area in 2001.

The 2003 pink salmon wild production harvest will likely be AVERAGE (6 million to 10 million), with the statistical modeling suggesting that the high end of the range may be achieved. This forecast level will allow an initial weekly fishing period length of 81 hours.

For the Kitoi Bay Hatchery pink salmon return, approximately 149 million fry were fed and released into Kitoi Bay on May 24, 2002 (nearly the same date as in recent years). An additional four million fry were not fed, but were released directly into the bay. Cold spring temperatures slowed pink fry growth and the average fry size upon release was smaller than in the past several years, which may negatively affect survival.

Nicholas H. Sagalkin	Jeff Wadle	Kevin Brennan	Drew Aro
Finfish Research Biologist	Assistant Area Management Biologist,	Area Management Biologist	Kitoi Bay Hatchery Manager
Kodiak	Kodiak	Kodiak	Kodiak

Kodiak, Upper Station (Early Run) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	125	48 –216
Escapement Goal	25	25–75
Harvest Estimate	100	

Forecast Methods

The 2003 Upper Station early-run forecast was prepared primarily by investigating simple linear regression models using recent brood year sibling relationships for five major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Age classes 1.2, 1.3, 2.2, and 2.3 were predicted from age-1.1, age-1.2, age-2.1, and age-2.2 siblings respectively. In previous years, age-0.3 fish were forecasted from the median; however, in 2001 and 2002 returns were far below the estimates. Therefore, the 2003 forecast estimate for age-0.3 fish was based on the lowest previously observed return. The variance of this estimate was estimated around the minimum value instead of the average. Minor age classes (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 10 individual returning age class estimates by run year and using the 10-year median value (1993–2002). The prediction interval for the median forecast was calculated using the 10^{th} and 90^{th} percentiles of the data. 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 age classes were summed to calculate 80 percent prediction intervals. The overall prediction interval was calculated as the sum of the 80 percent prediction interval and the prediction interval of the minor age classes.

Forecast Discussion

The 2003 forecast is approximately 36 thousand fish greater than the 2002 forecast (89 thousand) and about 88 thousand fish higher than the actual 2002 run of 37 thousand fish. In addition to investigating sibling relationships, year class relationships were also evaluated (e.g., predicting four-year-old fish from three-year-old fish). This method (total age) resulted in a similar, but slightly lower, point estimate. The 2002 run (37 thousand) fell below the 80 percent prediction intervals of the forecast (43 thousand–135 thousand). Individual age class predictions were fair; specifically, the age 2.2 return was weaker than expected. In 2002, returning age 2.2 fish were weaker then expected in many systems indicating possible poor marine conditions. The 2003 early Upper Station run is expected to be composed of about 50 percent age 2.2 fish. If similar age class failures occur in 2003, as were seen in 2002, the run could be much weaker than forecasted. The 2003 run should be composed of approximately 27 percent four-year-old fish and 55 percent five-year-old fish. If this run is realized, it will be four thousand fish greater than the recent 10-year average run of 121 thousand fish.

The Upper Station early run sustainable escapement goal (SEG) range is 50 thousand–75 thousand; however, the Alaska Board of Fisheries has adopted a 25 thousand optimum escapement goal (OEG) in the Alitak Bay District Salmon Management Plan. The projected harvest of 100 thousand fish is based on the achievement of the OEG. Similar to the 2000 and 2001 runs, the predominant age class in the 2003 run should be age 2.2 (53 percent).

Nicholas H. Sagalkin
Finfish Research Biologist, Kodiak

Kodiak, Upper Station (Late Run) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	236	0–879
Escapement Goal	175	150–200
Harvest Estimate	61	

Forecast Methods

The 2003 Upper Station late-run forecast was prepared primarily by investigating simple linear regression models using recent brood year sibling relationships for two major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. A standard sibling regression model was used to estimate the age-1.3 component of the run from returns of age-1.2 fish. An alternate sibling regression relationship was used to estimate the age 2.2 component of the run from returns of age-1.2 fish. In previous years, age-0. fish were predicted from sibling relationships; however, in 2001 and 2002 all age-0. fish returned at levels far below estimates. Similarly, the number of age-1.2 fish has been decreasing. Therefore, the 2003 forecast estimates for age-1.2, age-0.2, and age-0.3 fish were based on the lowest previously observed return for each age class. The variances of these estimates were estimated around the minimum value instead of the average. Minor age classes (0.1, 1.1, 2.1, 3.1, 0.4, 1.4, 3.2, 3.3, and 2.4) were estimated by summing nine individual returning age class estimates by run year and using the 10-year median value (1993–2002). The prediction interval for the minor age class forecasts were calculated using the 10th and 90th percentiles of the data. The variances associated with individual age classes were summed to calculate 80 percent prediction intervals. The total run prediction interval was calculated as the sum of the 80 percent prediction interval and the prediction interval of the minor age classes.

Forecast Discussion

The 2003 forecast is about 116 thousand fish less than the 2002 forecast (352 thousand) and about 76 thousand fish greater than the actual 2002 run of 160 thousand fish. The majority (81 percent) of the run in 2003 will be composed of age 2.2 fish. The age 2.2 returns in 2002 were very poor, possibly due to poor marine conditions. If similar age class failures occur in 2003, as were seen in 2002, the run could be much weaker than forecasted. The breadth of the prediction interval reflects the uncertainty in the estimate. The 2003 run should be composed of approximately 89 percent five-year-old fish. If this run is realized it will be approximately half of the 10-year average run of 444 thousand fish.

The projected harvest of 61 thousand fish is based on the achievement of the middle (175 thousand) of the escapement goal range of 150 thousand to 200 thousand.

Nicholas H. Sagalkin
Finfish Research Biologist
Kodiak

Kodiak, Frazer Lake (Dog Salmon River) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	183	0–594
Escapement Goal	140	140–200
Harvest Estimate	43	

Forecast Methods

The 2003 Frazer Lake (Dog Salmon River) forecast was prepared primarily by investigating simple linear regression models using recent brood year sibling relationships for three major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Ages 1.3, 2.3, and 3.2 were predicted from age-1.2, age-2.2, and age-3.1 siblings respectively. Age-1.2 and age-2.2 fish were predicted by using estimated survival of the corresponding estimated smolt emigration. Minor age classes (0.2, 1.1, 0.3, 2.1, 3.1, 1.4, 2.4, and 3.3) were estimated by summing eight individual age class estimates by run year and using the 10-year median value. The prediction interval for the minor age class forecast was calculated using the 10th and 90th percentiles of the data. 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 age classes were summed to calculate 80 percent prediction intervals. The total run prediction interval was calculated as the sum of the 80 percent prediction interval and the prediction interval of the minor age classes.

Forecast Discussion

The 2003 forecast is about 339 thousand fish less than the 2002 forecast (522 thousand) and about 73 thousand fish greater than the actual 2002 run of 110 thousand fish. The 2002 run did not fall within the 80 percent prediction interval (125 thousand–919 thousand) of the forecast. Age 2.2 fish generally contribute the most to the overall Frazer Lake production (38 percent; 10-year average). Smolt data were very important in our assessment of this run. Smolt emigration estimates in 2001 were the lowest on record and where composed of 96% age 2. fish. In addition, age 2. smolt emigrating in 2001 were substantially smaller in size and their overall condition was poor. Zooplankton biomass in Frazer Lake was at a historical low when these fish reared prior to emigration. These pieces of information suggest poor age 2.2 adult returns in 2003. The 2003 run should be composed of approximately 35 percent five-year-old fish and 46 percent six-year-old fish. If this run is realized, it will be 351 thousand fish less than the recent 10-year (1993–2002) average run of 534 thousand fish. Despite the weak Frazer Lake run anticipated in 2003, recent limnology and smolt data suggest that freshwater production has improved.

The projected harvest of 43 thousand fish is based on the achievement of the lower bound of the escapement goal range of 140 thousand to 200 thousand. The major age classes in the run should be 2.2 (32 percent) and 2.3 (46 percent).

Nicholas H. Sagalkin
Finfish Research Biologist
Kodiak

Kodiak, Ayakulik (Red River) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	226	0 –569
Escapement Goal	200	200–300
Harvest Estimate	26	

Forecast Methods

The 2003 Ayakulik sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1967–2000) ocean age-class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Estimates from regression models were only used in cases where the slope of the regression was significant ($P < 0.25$). Ocean age two (2-ocean) sockeye salmon were predicted from prior year 1-ocean returns ($P = 4.5x10\text{-}6$), while 3-ocean sockeye were predicted from prior year 2-ocean returns ($P = 2.5x10\text{-}13$). Estimates of variance were calculated from the regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return and confidence intervals were calculated using the 10th and 90th percentiles of the returns. The regression estimates (2-ocean and 3-ocean) were summed and the collective regression variance was used to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Ayakulik sockeye salmon run for 2003; 80 percent prediction intervals for the total run were calculated by combining the regression and median intervals.

Forecast Discussion

The 2003 forecast is substantially less than the 2002 forecast (604 thousand) and about 10 thousand fish less than the actual 2002 run estimate of 236 thousand fish. The 2003 run should be composed of approximately 73 percent 2-ocean and 19 percent 3-ocean sockeye. If realized, this run will be 506 thousand fish less than the recent 10-year average (1993–2002) run of 732 thousand fish. The projected harvest of 26 thousand fish is based on the achievement of the lower bound of the escapement goal range (200 thousand fish).

The 2002 run was the lowest since 1983. Due to the low run level, and subsequent extreme values of the predictor age classes, the confidence in this forecast is fair. In addition, an alternate analysis of ocean age-class relationships, using only recent years (1993–2002), produced an estimate of 125 thousand fish. This suggests that the run may fall in the lower half of the range.

M. B. Foster
Finfish Research Biologist
Kodiak

Kodiak, Spiridon Lake sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	426	284–568
Escapement Goal	0	0
Harvest Estimate	426	284–568

Forecast Methods

The 2003 Spiridon Lake forecast estimate was based on: 1) 2000–2002 smolt estimates, 2) average survival from smolt to adult, and 3) adult age of returns to Telrod Cove from the 1995 stocking year of Saltery Lake broodstock.

Smolt estimates have been determined annually at the outlet to Spiridon Lake. Smolt were sampled daily throughout the migration to determine smolt ages. The 2000 smolt emigration was composed of approximately 792 thousand age-1. and 494 thousand age-2. smolt. Approximately 1.09 million age-1. smolt and 443 thousand age-2. smolt emigrated in 2001, and 442 thousand age-1. and 92 thousand age-2. smolt emigrated in 2002.

The 2003 Spiridon Lake forecast was based on a smolt to adult survival of 30 percent (with a lower range of 20 percent and upper range of 40 percent). These survival estimates were determined from the complete data sets (Upper Station and Saltery stocks combined) from Spiridon Lake stockings and adult returns to Telrod Cove for fry stocking years 1991–1997.

The final step in estimating the 2003 run was based on the estimated age composition of the Saltery Lake broodstock from 1995. Adult returns to Telrod Cove from this stocking year were composed of 2% 1-ocean, 59.6% 2-ocean, and 38.4% 3-ocean fish. These proportions were applied to the total return estimates from the 2000–2002 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 2003.

Forecast Discussion

The barrier falls at Telrod Creek prevent adult sockeye salmon from returning to Spiridon Lake. Therefore, all of the returning adults will be available for harvest in the traditional fishing areas and the Spiridon Bay Terminal Harvest Area in Telrod Cove. The forecast for 2003 is based on the same premise as the 2002 forecast, which is that the marine age-at-returns are predominantly 2-ocean fish and to a lesser extent 3-ocean fish. The 2003 run is predicted to be 157 thousand fish greater than the 1994–2002 average of 269 thousand sockeye salmon, but about 66 thousand fish less than what is estimated to have returned in 2002 (492 thousand). The predominant age classes in the run are expected to be 1.2 (46%), 1.3 (21%), 2.2 (19%), and 2.3 (13%). The remaining age classes (1.1 and 2.1) should contribute less than one percent to the run. The last of the Upper Station sockeye salmon stocked into Spiridon Lake returned in 2002. Thus, the 2003 run should be entirely composed of Saltery Lake stock returning in late June to early July, peaking in mid to late July and ending by mid August.

Steve Schrof
Finfish Research Biologist

Kodiak, Karluk Lake (Early Run) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	579	442–778
Escapement Goal	150	150–250
Harvest Estimate	429	

Forecast Methods

The 2003 Karluk Lake early-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979–1998) 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, 2.3, 3.2, and 3.3 were predicted from age 1.2, 2.1, 2.2, 3.1, and 3.2 siblings, respectively. Following non-significant regression results, the median brood year return was used to estimate the age 1.2 component of the run. All "other" age classes were estimated by summing 13 minor age class run estimates (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 year (1993–2002) 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 80 percent prediction intervals were estimated by calculating the 10th and 90th percentiles of the data. The variances associated with individual regression age class estimates were summed to calculate 80 percent prediction intervals. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2003 forecast is about 106 thousand fish greater than the 2002 forecast (473 thousand) and about 45 thousand fish less than the actual 2002 run estimate of 624 thousand fish. Our confidence in this forecast is fair. The 2003 run should be composed of approximately 52% five-year-old fish and 36% six-year-old fish. If realized, this run will be 33 thousand fish greater than the recent 10-year average (1993–2002) run of 546 thousand fish.

The projected harvest of 429 thousand fish is based on the achievement of the lower bound of the escapement goal range (150 thousand fish). The predominant age classes in the run should be age-2.2 (51%) and age-2.3 (26%). Age 2.2 fish have been the dominant age class in each of the past five seasons. Smolt outmigration estimates indicate that a higher number of age-2. smolt outmigrated in 2001 than in the 2000 season. This suggests that a higher number of age 2.2 sockeye will return in 2003 than in 2002 which corroborates the estimate generated using sibling relationships.

Mark Witteveen
Finfish Research Biologist
Kodiak

Kodiak, Karluk Lake (Late Run) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:		
Total Run Estimate	799	468–1,205
Escapement Goal	400	400–550
Harvest Estimate	399	

Forecast Methods

The 2003 Karluk Lake late-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979–1998) 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 ($P < 0.25$). A significant standard sibling regression model was employed to estimate the age-1.3, age-2.3, and age-3.3 components of the run from returns of age-1.2, age-2.2, and age-3.2 sockeye salmon, respectively. A significant alternate sibling relationship was used to estimate the age-2.2 and age-3.2 components of the run from age-1.2 and age-2.2 sockeye salmon, respectively. Following nonsignificant regression results, the median brood year return was used to estimate the age-1.2 component of the run. All "other" age classes were estimated by summing 12 minor age class run estimates (0.1, 0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 2.4, 4.2, 3.4, and 4.3) by year (1993–2002) 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 10th and 90th percentiles of the data were used to describe the range of the data. The variances associated with individual regression age class estimates were summed to calculate 80% prediction intervals. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2003 forecast is about 164 thousand fish greater than the 2002 forecast (635 thousand) and about 67 thousand fish less than the actual 2002 run estimate of 866 thousand fish. Regression estimates from sibling relationships were used for most age classes despite a relatively poor predictive value. Therefore, our confidence in this forecast is poor to fair. The 2003 run should be composed of approximately 39% five-year-old fish and 54% six-year-old fish. If realized, this run will be 76 thousand fish greater than the recent 10-year average (1993–2002) of 723 thousand fish.

The projected harvest of 399 thousand fish is based on the achievement of the lower bound of the escapement goal range (400 thousand fish). The predominant age classes in the run should be age-2.2 (38%), age-3.2 (29%), and age-2.3 (25%). Age-2.2 fish have been the dominant age class in four of the past five seasons. Smolt outmigration estimates indicate that a higher number of age-2. smolt outmigrated in 2001 than in the 2000 season. While the alternate sibling relationship estimates a lower age-2.2 return in 2003 when compared with 2002, the smolt outmigration information suggests that the return of age-2.2 sockeye salmon may be higher than the forecast indicates.

Mark Witteveen
Finfish Research Biologist
Kodiak

Appendix A.6. Chignik Forecast

Sockeye salmon

Preliminary Forecast of the 2003 Run:		Forecast Estimate (thousands)	Forecast Range (thousands)
Total Production:			
Early Run (Black Lake)	Total Run Estimate	1,640	1,070–2,820
	Escapement Goal	400	350– 400
	Harvest Estimate	1,240	
Late Run (Chignik Lake)	Total Run Estimate	1,190	765–2,200
	Escapement Goal	250	200– 250
	Harvest Estimate	940	
Total Chignik System	Total Run Estimate	2,830	1,840–5,020
	Escapement Goal	650	550– 650
	Harvest Estimate	2,180	

These figures include harvests of Chignik-bound sockeye salmon by the Southeastern District Mainland and the Cape Igvak fisheries; approximately 1,770 thousand sockeye salmon are projected to be harvested in the Chignik Management Area.

Forecast Methods

The forecasts for the 2003 early and late Chignik sockeye salmon runs were based on simple linear regressions using sibling relationships, escapements and subsequent year-class returns, or median estimators of age class returns from brood years since 1977. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The early-run age-1.3 and age-2.3 returns were estimated based on the abundance of their sibling returns (age-1.2 and age-2.2) in 2002. The late-run age-1.3 and age-2.3 returns were estimated using regression relationships based on the abundance of spawners in their parent years. Following nonsignificant regression results, the median brood year return by total age was used to estimate all other age class components of the run. When regression relationships were used, the variance of the estimate was calculated from the error structure of the regression. When the median returns by age class were used, the 10th and 90th percentiles of the data were used to describe the range of the data. The variances associated with individual estimates were summed to estimate 80% prediction intervals, which were then added to the percentile estimates to calculate the forecast ranges.

Forecast Discussion

The 2003 sockeye salmon run to the Chignik River is expected to be 2.83 million fish, which is approximately 850 thousand fish greater than the run of 2002 (1.98 million). The early run is expected to be approximately 570 thousand fish greater than the estimated early run in 2002 of 1.07 million fish. The late run is expected to be approximately 281 thousand fish greater than the estimated 2002 late run of 909 thousand. The 2003 sockeye salmon run to Chignik is expected to be approximately 60 thousand fish less than the recent 10-year average run (2.89 million).

Approximately 86% of the 2003 early run was forecasted using sibling relationships. Using similar methods,

the 2002 early-run forecast of 1,025 thousand was 39 thousand fish less than the actual 2002 early run of 1,064 thousand sockeye salmon. The majority of the 2003 late run (85%) was forecasted using relationships between parent escapement and returns for the two major age classes (age-1.3 and age-2.3). Using similar methods, the 2002 late run forecast of 1,088 thousand was 178 thousand fish greater than the actual 2002 late run of 910 thousand sockeye salmon.

Available smolt data were analyzed and significant regression relationships were found between the total number of emigrating smolt and subsequent 3-ocean (usually about 80% of the run) returns. This estimate was then expanded to account for other ocean ages. In 2002, this method over-estimated the total run by about 87 thousand sockeye salmon. The smolt-based forecast of sockeye salmon returns in 2003 to Chignik is 1,820 thousand sockeye salmon which is substantially (about 1 million fish) lower than that predicted from sibling relationships.

Both runs were also forecasted together as one run as an alternative method, and the resultant 2003 forecast was approximately 140 thousand sockeye salmon higher than when both runs were forecasted separately. Historically, this method has been at least as accurate as forecasting the runs separately. It was not used to officially forecast the 2003 run, however, because of the loss of information of the relative magnitude of the two runs.

The disparity between the smolt forecast and the sibling forecast suggest the actual return may fall between the point estimate and the lower 80 percent confidence interval. Given this ancillary data, our confidence in this forecast is fair.

Kenneth A. Bouwens
Finfish Research Biologist
Kodiak

Appendix A.7. Bristol Bay Forecasts

Bristol Bay sockeye salmon

Forecast of the 2003 Return:	Forecast Estimate (millions)	Forecast Range (millions)
TOTAL PRODUCTION:		
Total Run	24.1	11–37
Escapement Goal	7.3	
Commercial Common Property Harvest)[a]	16.8	

[a] The Escapement Goal and Harvest summed do not equal 16.8 million because the Kvichak return is projected to be 0.2 million less than the escapement goal.

Forecasted sockeye harvests for inshore Bristol Bay fishing districts are as follows:	
Naknek-Kvichak	4.0 million
Egegik	5.4 million
Ugashik	2.3 million
Nushagak	4.9 million
Togiak	0.3 million

Forecast Methods and Results

The forecast for the sockeye salmon return to Bristol Bay in 2003 is the sum of individual predictions for nine river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak-Mulchatna, and Togiak) and four age classes (ages 1.2, 1.3, 2.2, and 2.3, plus ages 0.3 and 1.4 for Nushagak). Adult escapement and return data from brood years 1973-1999 were used in the analyses.

Predictions for each age class returning to a river system were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. Also, models based on the relationship between returns and smolt were examined for Ugashik River. Tested models included simple linear regression, multiple regression, and 5-year averages. In addition, univariate and multivariate time series analysis models were examined. The models chosen were those with statistically significant parameters having the greatest past reliability (accuracy and precision) based on mean absolute deviation, mean absolute percent error, and mean percent error between forecasts and actual returns for the years 2000 through 2002.

The forecast range was the upper and lower values of the 80% confidence bounds for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published run predictions for the 1993 through 2002 returns. Run predictions for the period 1993 to 2002 were based on slightly different methodology, but nevertheless, should sufficiently approximate forecast error for 2003.

A total of 24.1 million sockeye salmon are expected to return to Bristol Bay in 2003. This prediction is 36 percent and 28 percent lower than the previous 10- and 20-year mean (37 million and 33 million) of returns. All systems are expected to exceed their spawning escapement goals. A return of 24.1 million sockeye salmon can be expected to produce a total harvest of 16.8 million fish if all escapement goals are

met. A harvest of this size would be about 31% smaller than the previous 10- and 20-year mean harvests of approximately 24 million (range is 10 million to 44 million).

Forecast Discussion

We excluded some historical escapement and return data to prepare the 2003 forecast. Beginning with the 1973 brood year (>1979 return year), the number of returning adults produced from each spawner in Bristol Bay showed a dramatic increase across most 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 1992–94) suggested we might be entering a period of productivity more similar to the pre-1978 period. However, the fish from the 1996–1998 return years reared in the ocean when 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. Recent ocean temperature data and the returns to Bristol Bay in 1999 to 2002 suggest that returns in 2003 may be more characteristic of the period 1978–1995. Hence, we used these data to prepare our forecast.

The greatest source of uncertainty in the 2003 forecast is in predicting the returns of 2-ocean fish (ages 1.2 and 2.2). The near absence of jacks in the 2002 return (1-ocean fish, the siblings of the 1.2s and 2.2s returning in 2003) caused the sibling models to be less reliable for predicting returns of 2-ocean fish, and may therefore require the use of typically less reliable models that incorporate escapement or smolt data. The greatest sources of potential error in actual numbers of fish are the forecasts of 1.2s for Kvichak and Wood Rivers.

In general, the source of the larger forecast in 2003 as compared to 2002 is the greater than expected returns of 2-ocean fish in 2002, suggesting an improved 3-ocean return for 2003. We do not know why the Bristol Bay sockeye salmon returns in 1996–1998 were poor or whether decreased production will persist. The 1999 and 2000 returns to Bristol Bay (41 and 30 million) suggest the poor returns in 1996–1998 were anomalies. However, we still have insufficient evidence to conclude that the high production of 1978–1995 will continue. We are actively working with scientists inside and outside the department to better understand the reasons for these population trends and develop better techniques for forecasting sockeye salmon returns to Bristol Bay.

Lowell Fair
Research Project Leader
Anchorage

Nushagak District chinook salmon

Forecast of the 2003 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run	148	101–195
Inriver Run Goal[a]	75	
Harvest	73	

[a] The Nushagak inriver goal is 75 thousand chinook salmon, which provides for a biological escapement goal of 65 thousand spawners and a harvest of 10 thousand chinook salmon by upriver subsistence and sport fisheries

Forecast Methods

The 2003 Nushagak District chinook salmon forecast is the sum of individual predictions of five age classes (age-1.1, -1.2, -1.3, -1.4, and -1.5). For each age class, up to 10 models were evaluated for use in forecasting abundance. Predictions for each age class were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. Tested models included simple linear regression, multiple regression, and 5-year averages. In addition, univariate and multivariate time series analysis models were examined. The models chosen were those with statistically significant parameters having the greatest past reliability (accuracy and precision) based on mean absolute deviation, mean absolute percent error, and mean percent error between forecasts and actual returns for the years 2000 through 2002. Data sets in the analyses included adult escapement and return data from brood years 1978–1999.

A simplistic stock-recruitment model (log of recruitment against log of spawning escapement) was used to predict age-1.1 returns. A Ricker stock-recruitment model using spawning escapements and total returns was used to forecast age-1.2 abundance. The best age-1.3 and age-1.5 models were based on the relationship between sibling returns in succeeding years (e.g., age-1.3 returns for 2003 based on age-1.2 returns in 2002). The top model for age-1.4 abundance used age-1.3 returns and spawning escapements as predictors.

The forecast range is the upper and lower values of the 80% confidence bounds for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published run predictions for the 1993 through 2002 returns. Run predictions for the period 1993 to 2001 were based on slightly different methodology, but nevertheless, should sufficiently approximate forecast error for 2003.

Forecast Discussion

Age composition of the forecasted total run is <1% (<1 thousand) age-1.1, 18% (27 thousand) age-1.2, 43% (63 thousand) age-1.3, 37% (55 thousand) age-1.4, and 2% (3 thousand) age-1.5. The 2003 forecasted total run of 148 thousand chinook salmon is 99% of the previous 20-year mean total run of 149 thousand and 97% of the most recent 10-year mean total run of 152 thousand. The projected harvest of 73 thousand chinook salmon is 103% of the previous 20-year mean harvest of 71 thousand and 94% of the most recent 10-year mean harvest of 78 thousand.

Lowell Fair
Research Project Leader
Anchorage

Appendix A.8. Alaska Peninsula Forecasts

Bear Lake (Late Run) sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	553	314–997
Escapement Goal	100	75–125
Harvest Estimate	453	

Forecast Methods

The 2003 Bear River late-run sockeye salmon forecast was prepared primarily by using simple linear regression models utilizing available brood year (1980–1999) sibling relationships where significant regression relationships existed. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Regression models were 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-2.1 in 2002 and the abundance of age-2.3 fish were predicted from their age-2.2 siblings. All "other" age classes were estimated by summing 15 minor age class run estimates (ages 0.1, 0.2, 1.1, 0.3, 1.2, 2.1, 0.4, 1.3, 3.1, 1.4, 3.2, 1.5, 2.4, 3.3, and 3.4) by year (1997–2002) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When a regression relationship was used to predict an individual age class, the variance of the estimate was calculated from the error structure of the regression. When the median returns by total age were used, the 10th and 90th percentiles of the data were used to describe the variance. The variances associated with individual estimates were summed to estimate 80 percent prediction intervals, which were then added to the percentile estimates to calculate the forecast range.

Forecast Discussion

The 2003 forecast for the Bear Lake late run is about 150 thousand fish less than the 2002 forecast (703 thousand), and about 158 thousand fish greater than the actual 2002 run of 395 thousand fish. This equates to a run in 2003 that, if achieved, would be 159 thousand fish less than the recent (1993–2002) 10-year average (711 thousand) and 14 thousand fish less than the most recent (1998–2002) 5-year average of 567 thousand. The projected harvest of 453 thousand fish is based on the achievement of the midpoint of the escapement goal range (100 thousand fish).

The dominant age classes of the Bear Lake late run have historically been ages 2.2 and 2.3; these ages, on average (brood years 1983–1995), have composed approximately 58% and 29% of the run. In 2002, the actual number of age-2.2 sockeye salmon that returned was less than half of the number estimated. This phenomenon was noted in various Kodiak and Bristol Bay sockeye salmon systems in 2002. It is not known if there was higher than expected mortality of age-2.2 sockeye salmon or if a large portion of these fish held over in the marine environment and will return in 2003 as age-2.3 fish. Because the abundance of age-2.2 sockeye salmon in 2002 was used to predict the abundance of age-2.3 sockeye salmon in 2003, our confidence in this forecast is poor to fair.

Kenneth A. Bouwens
Finfish Research Biologist
Kodiak

Nelson River sockeye salmon

Preliminary Forecast of the 2003 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	518	359–832
Escapement Goal	150	100–200
Harvest Estimate	368	

Forecast Methods

The 2003 Nelson River sockeye salmon forecast was constructed using simple linear regression models of recent brood year sibling relationships, ocean age relationships, 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 ($P < 0.25$). Regression estimates were used for age classes 2.2 (predicted from age 2.1), and for 3-ocean returns (predicted from 2-ocean returns), using data from the last 10 years. All "other" age classes were estimated by summing 11 minor age class run estimates (ages 0.1, 0.2, 1.1, 1.2, 2.1, 0.4, 3.1, 1.4, 3.2, 1.5, and 2.4) by year (1985–2002) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When a regression relationship was used to predict an individual age class, the variance of the estimate was calculated from the error structure of the regression. When the median returns by total age were used, the 10th and 90th percentiles of the data were used to describe the variance. The variances associated with individual estimates were summed to estimate 80 percent prediction intervals, which were then added to the percentile estimates to calculate the forecast range.

Forecast Discussion

The 2003 forecast for Nelson River is 518 thousand sockeye, which is 122 thousand less fish than the actual 2002 run of 640 thousand sockeye salmon. The 2003 forecast is 104 thousand fish greater than the recent 5-year average (1998–2002) and 10 thousand fish less than the recent 10-year average (1993–-2002) of 507 thousand sockeye salmon. The projected harvest of 368 thousand fish is based on the achievement of the midpoint of the escapement goal range (150 thousand fish).

Approximately 86% of the 2003 run was forecasted using regression relationships. Historically, age-2.2 sockeye salmon composed about 50% and 3-ocean sockeye salmon composed about 35% of the Nelson River run. Similar proportions, by age, are expected in 2003. Our confidence in this forecast is fair because although a large portion of the 2003 forecast was based on returns in 2002, the relationships have been highly variable in the past.

Kenneth A. Bouwens
Finfish Research Biologist
Kodiak

APPENDIX B. ARCTIC–YUKON–KUSKOKWIM ALL SALMON SPECIES

The Alaska Department of Fish and Game does not produce formal run forecasts for any salmon runs in the Arctic-Yukon-Kuskokwim Region. Salmon run outlooks in the AYK Region are qualitative in nature because of the lack of adequate information with which to develop more rigorous forecasts. Consequently, the commercial harvest outlooks for the AYK region are typically based upon available parent year spawning escapement indicators, age composition information, recent year trends and the likely level of commercial harvest that can be expected to be available from such indicators, given the fishery management plans in place. While the commercial harvest outlooks provide for a general level of expectation, the fisheries are managed based upon inseason assessments of the actual runs.

In the AYK region, as in some other areas of the state, salmon production has notably decreased for many stocks. Chinook salmon stocks in the Yukon and Kuskokwim Rivers have been classified as stocks of concerns under the guidelines established in the Sustainable Salmon Fisheries Policy for the State of Alaska. Similarly, chum salmon from the Kuskokwim and Yukon (summer and fall) Areas, and the Nome Subdistrict of the Norton Sound Area have also been classified as stocks of concern. Causes for the loss of productivity have been the subject of much interest and concern, but to date it is unknown whether the decline in productivity can be expected to continue or not.

The commercial harvest outlooks for the year 2003 try to qualitatively take recent decreased abundance trends into account. Additionally, declining salmon markets, particularly for chum salmon flesh since 1994 and salmon roe in 1997, have had a major impact on the commercial fisheries in the AYK Region. A continuation of these market trends in the year 2003 could further reduce harvests in some areas, or lower exvessel value. In most cases, market conditions have not been accounted for in the harvest outlooks.

The commercial harvest outlook for the year 2003 can be found in the following Table.

Commercial salmon harvest outlook for the AYK Region, year 2003, in thousands of fish:

Management Area	SPECIES					
	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim	0–1	0–15	50–250	0–1	0–150	
Kuskokwim Bay	9–23	20–90	17–65	0–2	18–55	
Kuskokwim Total	9–24	20–105	67–315	0–3	18–205	
Yukon	0–20		0–50		0–150	0–150
Norton Sound	0–1		10–20	0–5	10–20	0–1
Kotzebue Sound					50–100	