**Special Publication No. 06-07**

# Run Forecasts and Harvest Projections for 2006 Alaska Salmon Fisheries and Review of the 2005 Season

2/21/2006
CORRECTION:
This report has been corrected from the original publication, to update data presented in the Executive Summary and in Table 1. Updated text is outlined, and shown in this errata.

**by**

**Doug Eggers**

**February 2006**

**Alaska Department of Fish and Game** **Divisions of Sport Fish and Commercial Fisheries**

## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

**Weights and measures (metric)**

| | |
|---|---|
| centimeter | cm |
| deciliter | dL |
| gram | g |
| hectare | ha |
| kilogram | kg |
| kilometer | km |
| liter | L |
| meter | m |
| milliliter | mL |
| millimeter | mm |

**Weights and measures (English)**

| | |
|---|---|
| cubic feet per second | $ft^3/s$ |
| foot | ft |
| gallon | gal |
| inch | in |
| mile | mi |
| nautical mile | nmi |
| ounce | oz |
| pound | lb |
| quart | qt |
| yard | yd |

**Time and temperature**

| | |
|---|---|
| day | d |
| degrees Celsius | °C |
| degrees Fahrenheit | °F |
| degrees kelvin | K |
| hour | h |
| minute | min |
| second | s |

**Physics and chemistry**

| | |
|---|---|
| all atomic symbols | |
| alternating current | AC |
| ampere | A |
| calorie | cal |
| direct current | DC |
| hertz | Hz |
| horsepower | hp |
| hydrogen ion activity (negative log of) | pH |
| parts per million | ppm |
| parts per thousand | ppt, ‰ |
| volts | V |
| watts | W |

**General**

| | |
|---|---|
| Alaska Administrative Code | AAC |
| all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. |
| all commonly accepted professional titles | e.g., Dr., Ph.D., R.N., etc. |
| at | @ |
| compass directions: | |
| east | E |
| north | N |
| south | S |
| west | W |
| copyright | © |
| corporate suffixes: | |
| Company | Co. |
| Corporation | Corp. |
| Incorporated | Inc. |
| Limited | Ltd. |
| District of Columbia | D.C. |
| et alii (and others) | et al. |
| et cetera (and so forth) | etc. |
| exempli gratia (for example) | e.g. |
| Federal Information Code | FIC |
| id est (that is) | i.e. |
| latitude or longitude | lat. or long. |
| monetary symbols (U.S.) | $, ¢ |
| months (tables and figures): first three letters | Jan,...,Dec |
| registered trademark | ® |
| trademark | ™ |
| United States (adjective) | U.S. |
| United States of America (noun) | USA |
| U.S.C. | United States Code |
| U.S. state | use two-letter abbreviations (e.g., AK, WA) |

**Measures (fisheries)**

| | |
|---|---|
| fork length | FL |
| mideye-to-fork | MEF |
| mideye-to-tail-fork | METF |
| standard length | SL |
| total length | TL |

**Mathematics, statistics**

| | |
|---|---|
| *all standard mathematical signs, symbols and abbreviations* | |
| alternate hypothesis | $H_A$ |
| base of natural logarithm | *e* |
| catch per unit effort | CPUE |
| coefficient of variation | CV |
| common test statistics | (F, t, $\chi^2$, etc.) |
| confidence interval | CI |
| correlation coefficient (multiple) | R |
| correlation coefficient (simple) | r |
| covariance | cov |
| degree (angular ) | ° |
| degrees of freedom | df |
| expected value | *E* |
| greater than | > |
| greater than or equal to | ≥ |
| harvest per unit effort | HPUE |
| less than | < |
| less than or equal to | ≤ |
| logarithm (natural) | ln |
| logarithm (base 10) | log |
| logarithm (specify base) | $\log_2$, etc. |
| minute (angular) | ' |
| not significant | NS |
| null hypothesis | $H_O$ |
| percent | % |
| probability | P |
| probability of a type I error (rejection of the null hypothesis when true) | α |
| probability of a type II error (acceptance of the null hypothesis when false) | β |
| second (angular) | " |
| standard deviation | SD |
| standard error | SE |
| variance | |
| population | Var |
| sample | var |

*SPECIAL PUBLICATION NO. 06-07*

# RUN FORECASTS AND HARVEST PROJECTIONS FOR 2006 ALASKA SALMON FISHERIES AND REVIEW OF THE 2005 SEASON

by

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February 2006
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2/21/2006
CORRECTION:
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# EXECUTIVE SUMMARY

The Alaska Department of Fish and Game is expecting a significant decrease in commercial salmon catches in 2006. The pink salmon (*Oncorhynchus gorbuscha*) harvest is expected to be lower than in 2005, the expected sockeye salmon (*O. nerka*) is expected to be lower than 2005, and chum salmon (*O. keta*) harvests are expected to be slightly higher than 2005. The higher chum salmon catches are increasing runs of chum salmon to western Alaska. The 2006 commercial catch all-species projection of 167 million is distributed as 780,000 Chinook salmon (*O. tshawytscha*), 35.6 million sockeye salmon, 5.0 million coho salmon (*O. kisutch*), 108 million pink salmon, and 17.6 million chum salmon. Table 1 shows specific projection numbers by species and fishing area. Catch projections generally reflect potential harvests for most of the major sockeye salmon fisheries as well as for large hatchery runs including pink, sockeye, and chum salmon to the Southeast Alaska, Kodiak, and Prince William Sound areas. These projections are based on quantitative projections of next year's salmon run, using information on previous spawning levels, smolt outmigrations, returns of sibling age classes, and recent survival rates observed for hatchery releases. However, for other fisheries, including the wild pink salmon fisheries in Southeast Alaska, Prince William Sound, Kodiak, and the South Alaska Peninsula areas, the catch projections are based on averages of recent catch levels that are affected, to some extent, by recent levels of fishing effort. Recent levels of catch have been constrained in many areas by low fishing effort, thus catch levels are affected by both market conditions and size of salmon runs. Harvest projections for these fisheries may not be indicative of potential harvest levels. With the exception of the Southeast Alaska Chinook salmon fisheries, 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 181 million for the 2005 season. As it turned out, the all-species catch reached 221 million. The 2005 catch was a record harvest exceeding the previous record of 218 million recorded in 1995. In 2005, the overall catch of pink salmon was 161 million compared to the preseason projection of 114 million. The overall chum salmon catch was 11.4 million compared to the preseason projection of 17.6 million. Table 2 shows 2005 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 2005 exvessel value of the commercial harvest showed a marked increase over the value of the catch for the previous three years. The preliminary estimate for the total value of Alaska's 2005 harvest is $305 million and above the $257 million for 2004, $195 million for 2003, $275 million in 2000; but down from the $370 million for 1999.

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/.

**Table 1.–**Projections of 2006 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total |
| Southeast Alaska | | | | | | |
| *Natural Production* | | 1,603[a] | 3,023[a] | 52,000 | 2,500 | 59,126 |
| *Hatchery Production* | | | | | 8,039[b] | 8,039 |
| Southeast Region Total | 446[c] | 1,603 | 3,023 | 52,000 | 10,539 | 67,611 |
| Prince William Sound | | | | | | |
| *Natural Production* | 47[a] | 1,008 | 311[d] | 2,660 | 331 | 4,357 |
| *Hatchery Production* | | 818[e] | 254[f] | 26,877[f] | 2,350[f] | 30,299 |
| Upper Cook Inlet | 19[a] | 2,100 | 194[a] | 349[g] | 131[a] | 2,793 |
| Lower Cook Inlet | 1[a] | 302[a] | 10[a] | 800 | 95[a] | 1,208 |
| Bristol Bay | 141 | 23,700 | 41[g] | 1[g] | 819[a] | 24,702 |
| Central Region Total | 208 | 27,929 | 810 | 30,686 | 3,726 | 63,359 |
| Kodiak | | | | | | |
| *Natural Production* | 21[a] | 1,731 | 430[a] | 12,000 | 891[a] | 15,073 |
| *Hatchery Production* | | | | 6,700 | | 6,700 |
| Chignik | 3[a] | 887 | 58[a] | 293[g] | 65[a] | 1,306 |
| South Alaska Peninsula | 5[a] | 1,450[a] | 186[a] | 5,311[a] | 785[a] | 7,737 |
| North Alaska Peninsula | 6[a] | 1,921[a] | 41[a] | 14[a] | 65[a] | 2,048 |
| Westward Region Total | 35 | 5,989 | 716 | 24,318 | 1,806 | 32,864 |
| AYK Region Total | 92 | 115 | 410 | 1,001 | 1,480 | 3,098 |
| Statewide Total | 780 | 35,636 | 4,959 | 108,005 | 17,552 | 166,931 |

Note: Columns and rows may not total exactly due to rounding.

[a] Average harvest for the five-year, 2001–2005 period.

[b] Projection of southeast Alaska hatchery chum salmon return of 8.5 million less broodstock (500,000). Hatchery projections made by SRAA, NSRAA, and DIPAC.

[c] Average harvest for three-year, 2003–2005 period.

[d] Average harvest for the 10-year, 1996–2005 period.

[e] Includes the harvest of Gulkana sockeye and preliminary forecasted return of Main Bay hatchery sockeye less broodstock requirements. Forecasts made by PWSAC.

[f] Preliminary forecasted returns to PWSAC and VFDA hatcheries less broodstock requirements. Forecasts made by PWSAC and VFDA.

[g] Five-year average of even-year harvests.

**Table 2.–**Preliminary 2005 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total |
| Southeast Region Total | 448 | 1,608 | 2,993 | 59,040 | 6,437 | 70,526 |
| Prince William Sound | 35 | 1,987 | 536 | 59,897 | 1,987 | 64,442 |
| Upper Cook Inlet | 29 | 5,191 | 199 | 47 | 68 | 5,534 |
| Lower Cook Inlet | 1 | 233 | 9 | 2,307 | 99 | 2,648 |
| Bristol Bay | 75 | 24,502 | 75 | 3 | 1,131 | 25,786 |
| Central Region Total | 140 | 31,913 | 840 | 62,255 | 3,287 | 98,435 |
| Kodiak Area | 14 | 3,047 | 396 | 30,139 | 477 | 34,073 |
| Chignik | 3 | 1,145 | 7 | 194 | 9 | 1,358 |
| South Peninsula & Aleutians | 4 | 2,337 | 144 | 9,416 | 739 | 12,641 |
| North Peninsula | 9 | 3,116 | 69 | 4 | 43 | 3,240 |
| Westward Region Total | 31 | 9,644 | 615 | 39,753 | 1,268 | 51,313 |
| AYK Region Total | 63 | 121 | 349 | 0 | 386 | 892 |
| Total Alaska | 682 | 43,286 | 4,797 | 161,048 | 11,378 | 221,166 |

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

**Table 3.–**Preliminary 2005 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total |
| Southeast Region Total | 6,496 | 9,069 | 18,368 | 207,103 | 57,087 | 298,123 |
| Prince William Sound | 763 | 11,726 | 3,966 | 206,403 | 15,630 | 238,488 |
| Upper Cook Inlet | 685 | 30,857 | 1,256 | 156 | 497 | 33,451 |
| Lower Cook Inlet | 9 | 992 | 61 | 7,858 | 845 | 9,764 |
| Bristol Bay | 1,209 | 152,162 | 475 | 9 | 8,898 | 162,753 |
| Central Region Total | 2,666 | 195,737 | 5,758 | 214,426 | 25,870 | 444,456 |
| Kodiak Area | 168 | 16,705 | 2,982 | 102,792 | 3,732 | 126,379 |
| Chignik | 62 | 7,477 | 47 | 612 | 64 | 8,262 |
| South Peninsula & Aleutians | 62 | 14,314 | 886 | 30,244 | 4,874 | 50,380 |
| North Peninsula | 123 | 18,850 | 578 | 12 | 316 | 19,879 |
| Westward Region Total | 415 | 57,346 | 4,493 | 133,660 | 8,986 | 204,900 |
| AYK Region Total | 1,050 | 808 | 2,600 | 0 | 2,589 | 7,048 |
| Total Alaska | 10,600 | 263,000 | 31,200 | 555,200 | 94,500 | 954,500 |

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

# 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.

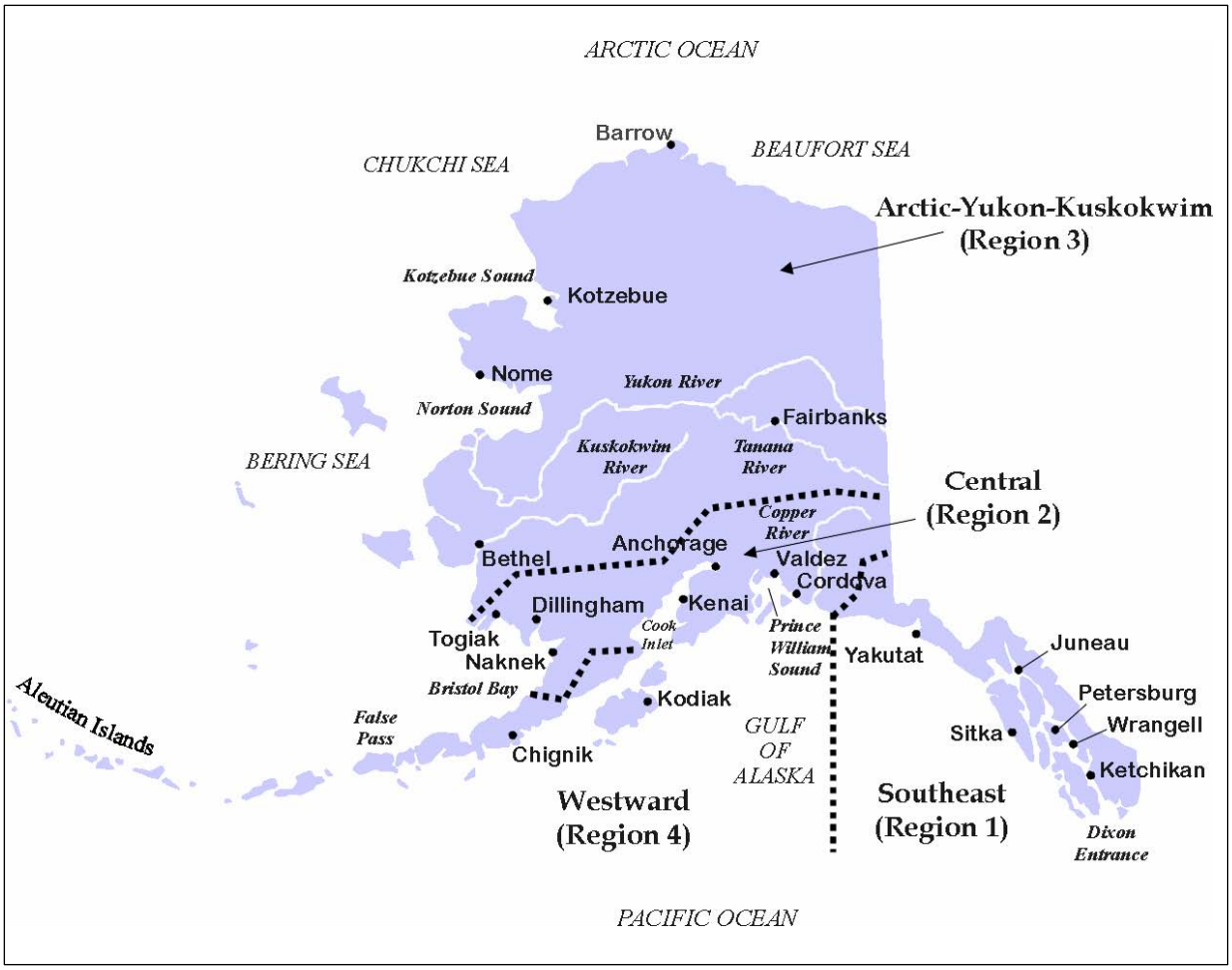


**Figure 1.–**The four fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Alaska Department of Fish and Game, Division of Commercial Fisheries.

Forecasts of runs (catch+escapement) for major salmon fisheries and projections of the statewide commercial salmon harvest have been published every year by ADF&G since 1969 (ADF&G 1969–1973, 1975–1983; Eggers 1985, 1986; Eggers and Dean 1987, 1988; Geiger and Savikko, 1989–1993; Geiger and Simpson 1994, 1995; and Geiger and Frenette 1996–1997; Geiger et. al. 1997; Hart et. al. 1998; Geiger and Hart 1999; Scott and Geiger 2000; Geiger and McNair 2001, Eggers 2002, Eggers 2003, Plotnick and Eggers 2004, Eggers 2005). 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 2006 Alaska commercial salmon harvest, by species and area, are found in

Table 1. Harvest outlooks for the Arctic-Yukon-Kuskokwim Region are developed as ranges; these ranges are listed in Appendix A9. Trends in total statewide salmon harvests and catch projections in numbers of fish, by species, are found in Figures 2–6 (pages 42–46). Tables 2–7 provide detailed information on the 2005 harvest.

This report contains a detailed review of Alaska's 2005 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Board of Fisheries (BOF), the fishing industry, and the public.

Predominant ages and brood years for 2005 salmon runs, by species, are as follows:

| | Age of Returning Salmon in Years | | | | |
|---|---|---|---|---|---|
| Species | 2 | 3 | 4 | 5 | 6 |
| Pink | 2004 | | | | |
| Chum | | 2003 | 2002 | 2001 | |
| Coho | | 2003 | 2002 | | |
| Sockeye | | | 2002 | 2001 | 2000 |
| Chinook | | | 2002 | 2001 | 2000 |

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

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

# DEFINITIONS OF TERMS

| | |
|---|---|
| *Biological escapement goal* | The number of salmon in a particular stock that ADF&G has determined should be allowed to escape the fishery to spawn to achieve the maximum yield (human use). This determination is based on biological information about the fish stock in question. (Also see *optimum escapement goal*.) |
| *Commercial harvest* | Harvests of fish that are used for commercial purposes. This includes fish caught by the commercial common property fishery (see below) and by hatchery operators for cost recovery; it excludes sport, subsistence, and personal use harvests. |
| *Commercial common property harvest* | Harvests taken by traditional, competitive commercial fisheries (gillnet, purse seine, and troll), as opposed to commercial harvests resulting from hatchery cost recovery, fishing derbies, and sale of confiscated fish. |
| *Common property harvest* | Harvests taken by the commercial common property fisheries (see above), as well as the sport, subsistence, and personal use fisheries. This category excludes hatchery cost recovery harvests. |
| *Cost recovery harvest* | Harvests of salmon by hatchery operators in specially designated areas to fund the operation of hatcheries and other enhancement activities. |
| *Enhancement of runs* | Hatcheries and other means of artificial propagation to create salmon runs or make existing salmon runs larger. Enhancement includes remote fish stocking, fertilization of lakes, and other techniques. |
| *Escapement, spawning population, or 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. |

# PRELIMINARY REVIEW OF THE 2005 ALASKA COMMERCIAL SALMON FISHERIES

## SOUTHEAST ALASKA AND YAKUTAT

All five Pacific salmon species are harvested in the Region I fisheries. Approximately 70.5 million salmon were commercially harvested in Region I in 2005. The total exvessel value of the commercial salmon harvest was approximately $65.9 million. For 2005, 1,779 permit holders participated in salmon season, a slight increase over 2004. With 66% of the Region I subsistence/personal use permits returned thus far, 33,000 fish were harvested, of which 80% were sockeye salmon.

The Region I cumulative commercial salmon harvest by all gear types, including hatchery cost recovery, totaled approximately 70.5 million fish in 2005 (Tables 2 and 4). The 2005 harvest compared to 2004 was as follows: Chinook 93%, sockeye 79%, coho 97%, pink 130%, and chum salmon 57%. The Region I total commercial salmon harvest proportion consisted of Chinook (1%), sockeye (2%), coho (4%), pink (84%), and chum salmon (9%). The 2005-combined Chinook harvest of 448,000 fish is the second highest Chinook salmon harvest on record since statehood, and almost twice the 10-year average. The 1.6 million sockeye salmon harvest is slightly below the 10-year average. The coho salmon harvest of almost 3.0 million fish is slightly above the 10-year average. The pink salmon harvest of 59 million fish ranks fourth in the past 10-years and sixth since statehood. The chum salmon harvest of 6.4 million fish is half of the 10-year average.

The exvessel value (wholesale fish ticket value) of the 2005 Region I commercial salmon harvest was estimated at $65.9 million, an 11% decrease from 2004. The exvessel estimate is considered conservative because it is based on the price reported on fish tickets and does not include subsequent price adjustments. The actual exvessel value, possibly 10% to 20% higher, will not be known until final processor reports are received and analyzed by the Commercial Fisheries Entry Commission (CFEC). The exvessel value by gear was highest for purse seine ($29.7 million), followed by troll ($17.9 million), drift gillnet ($9.2 million), hatchery cost recovery ($7.0 million), Annette Island/Miscellaneous ($1.0 million), and set gillnet gear ($1.0 million). The total regional harvest of salmon was valued at approximately: Chinook $13.9 million, sockeye $8.8 million, coho $9.6 million, pink $19.2 million, and chum salmon $14.5 million.

Salmon landed by purse seiners accounted for 83% of the total salmon harvest, followed by hatchery cost recovery (7%), drift gillnetters (5%) and trollers (4%). Trollers (hand and power) accounted for 77% of the regional landings of Chinook and 68% of the coho salmon harvest. Of the total harvest, purse seiners harvested 56% of the sockeye, 94% of the pink, and 44% of the chum salmon in Region I. Drift gillnetters accounted for 29% of the sockeye and 23% of the chum salmon harvested. The set gillnet harvest of 5% of the sockeye and 3% of the coho salmon regional harvest. Approximately 6% of the Chinook and 29% of the chum salmon harvest was taken in the hatchery cost recovery fisheries.

In general, Chinook escapements were excellent in Southern Southeast, with all index areas from the Stikine on Southward, meeting or exceeding their escapement goal ranges. Behm Canal systems were a bright spot this year with the Unuk and Chickamin continuing to have strong escapements and the Blossom and Keta River counts the highest since I started surveying in 1990. North of the Stikine was a different story, with the Chilkat and Situk rivers declining from

2004, but still well within their escapement goal range, the Alsek River declining to slightly below the escapement goal range, and the Taku Index counts below the lower end of escapement goal range. The preliminary mark–recapture estimate for the Taku River indicates a better escapement, but still below average. The region-wide estimate of escapement declined about 30%, primarily due to declines in the three big transboundary rivers.

**Table 4.–**Preliminary 2005 Southeast Region commercial salmon harvests, by fishing area and species, in thousands of fish.

| Fishery | Chinook | Sockeye | Coho | Pink | Chum | Total |
|---|---|---|---|---|---|---|
| Southern Seine[a] Total | 15.6 | 735.5 | 208.1 | 27,121.8 | 981.8 | 29,063 |
| Northern Seine[b] Total | 4.8 | 163.0 | 133.2 | 28,605.1 | 1,832.7 | 30,739 |
| Drift Gillnet | 55.8 | 462.2 | 272.9 | 1,530.2 | 1,511.6 | 3,833 |
| Tree Point | 1.5 | 79.7 | 51.2 | 556.4 | 234.2 | 923 |
| Prince of Wales | 1.6 | 110.2 | 114.4 | 461.2 | 198.6 | 886 |
| Stikine | 27.0 | 99.5 | 42.2 | 106.4 | 150.1 | 425 |
| Taku-Snettisham | 23.3 | 87.3 | 20.7 | 181.5 | 93.2 | 406 |
| Lynn Canal | 0.7 | 62.8 | 27.9 | 172.9 | 232.6 | 497 |
| Hatchery Terminal | 1.8 | 22.7 | 16.5 | 51.8 | 602.9 | 696 |
| Set Gillnet | 0.8 | 79.2 | 82.9 | 60.4 | 0.5 | 224 |
| Hand Troll [c] | 16.8 | 0.3 | 143.3 | 6.2 | 0.4 | 167 |
| Traditional | 11.0 | 0.3 | 142.5 | 6.0 | 0.3 | 160 |
| Hatchery Terminal | 0.3 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Experimental | 4.9 | 0.0 | 0.8 | 0.2 | 0.1 | 6 |
| Power Troll [c] | 321.2 | 12.9 | 1,891.6 | 103.4 | 174.2 | 2,503 |
| Traditional | 266.3 | 12.9 | 1,883.8 | 95.7 | 134.1 | 2,393 |
| Hatchery Terminal | 1.3 | 1.4 | 0.0 | 2.2 | 0.0 | 9.2 |
| Experimental | 53.5 | 0.0 | 5.6 | 7.6 | 30.9 | 98 |
| Total Annette Isl. Res. | 1.7 | 13.3 | 35.2 | 598.1 | 58.5 | 707 |
| Seine | 0.2 | 6.9 | 6.8 | 489.5 | 13.6 | 517 |
| Drift Gillnet | 1.1 | 6.4 | 25.0 | 108.5 | 44.9 | 186 |
| Total Annette Is. Troll [c] | 0.4 | 0.0 | 3.4 | 0.1 | 0.0 | 4 |
| Hand Troll | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| Power Troll | 0.4 | 0.0 | 3.4 | 0.1 | 0.0 | 4 |
| Trap | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| Hatchery Cost Recovery | 29.6 | 140.3 | 221.9 | 881.2 | 1,870.9 | 3,144 |
| Miscellaneous [d] | 1.9 | 1.1 | 4.3 | 133.1 | 6.5 | 147 |
| Southeast Region Total | 448 | 1,608 | 2,993 | 59,040 | 6,437 | 70,526 |

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

Note: Columns may not total exactly due to rounding error.

[a] Districts 101-108.

[b] Districts 109-114.

[c] Catch accounting period for the 2004 Chinook salmon season goes from October 1, 2003 through September 30, 2004.

[d] Includes salmon that were confiscated, caught in sportfish derbies, or commercial test fisheries, and sold.

Sockeye salmon escapements across the region were normal, but higher than last year's values for many areas (e.g., Hugh Smith Lake, Taku River, East Alsek River, and Situk River). The Hugh Smith Lake adult sockeye salmon escapement was just under 24,000, and exceeded the upper end of the recently established biological escapement goal (BEG) range of 8,000–18,000 adults. This stock was formally adopted as a stock of concern at the 2003 BOF meetings.

Coho salmon escapements in monitored systems were good throughout Southeast Alaska in 2005 and escapement objectives were met for escapement indicator streams except for one Juneau roadside system (Montana Creek) and two Yakutat systems (Situk and Lost Rivers). Coho escapement indicators for the Sitka area were mixed; however, the overall escapement index was above historical average. The overall escapement index for 15 streams in the Ketchikan area was the largest on record.

Pink salmon escapement was excellent throughout Southeast Alaska and escapement objectives were met or exceeded in all districts. Pink salmon management targets were met or exceeded for 42 of 44 pink salmon stock groups with management targets. The 2005 pink salmon escapement index of 20.3 million was ranked fourth highest and slightly above the recent 10-year average.

Nearly all escapement measures available for chum salmon indicated the 2005 runs were below average for most of the region. The chum salmon harvest in the region was the lowest since 1992. Escapement survey information for chum salmon index streams was generally below average for all districts, and the 2005 weighted rank escapement index over 82 streams thought the region was the lowest since 1991.

## PRINCE WILLIAM SOUND

The 2005 Prince William Sound (PWS) Area commercial salmon harvest of 64.4 million fish is the largest on record (Tables 2 and 5). The harvest was comprised of 59.9 million pink, 2.0 million sockeye, 2.0 million chum, 536,000 coho, and 35,000 Chinook salmon. Approximately 80% of the harvest, 51.1 million fish, was common property harvest and 13.3 million were sold for hatchery cost recovery (exclusive of post egg-take roe sales). Personal use, educational permits, and donated fish accounted for less than 1%. Despite larger-than-forecast hatchery returns, Prince William Sound Aquaculture Association (PWSAC) failed to achieve their cost–recovery goal. This was the second consecutive year of PWSAC cost–recovery shortfalls.

The estimated value of the combined commercial salmon harvest is $50.5 million, including hatchery sales. This estimate is based on the price reported on fish tickets and does not include post-season price adjustments. Therefore, the final exvessel value, possibly 10% to 20% higher than the current estimate, will not be known until final processor reports are received and analyzed by the CFEC.

## COPPER RIVER DISTRICT

The 2005 harvest forecast for the Copper River District was 49,900 Chinook, 1.4 million sockeye, and 294,000 coho salmon. The Gulkana Hatchery, located north of Paxson Lake, was expected to contribute 153,000 sockeye salmon to the commercial harvest. The actual 2005 sockeye salmon harvest of 1.3 million ranked as the seventh largest since 1974 and was below the recent 10-year average harvest of 1.5 million sockeye salmon. The harvest of 35,000 Chinook salmon ranked as the 19th largest since 1974 and was below the 10-year average harvest of 50,000 Chinook salmon. The coho salmon harvest of 263,000 ranked as the 15th largest commercial harvest since 1974 and was below the 10-year average harvest of 291,000

coho salmon. The 2005 inriver goal for salmon passing the Miles Lake sonar site was set at 579,000–779,000 salmon, which included 48,000 hatchery surplus salmon. The 2005 sonar escapement estimate was 854,000 salmon. The upper Copper River Chinook salmon escapement was estimated to be 21,000 salmon, 12% below the minimum escapement objective of 24,000 Chinook salmon. The 2005 Copper River delta sockeye salmon escapement was above the lower end of the sustainable escapement goal (SEG) range of 55,000 fish with an index value of 59,000 fish. Lower Copper River coho salmon escapement in 2005 was above the midpoint of the SEG range of 50,000 fish, with a peak index count of 56,000 fish.

Opening in early June, the Bering River District is managed concurrently with the Copper River District. The 2005 harvest of 77,000 sockeye salmon from the Bering River District was above the recent 10-year average of 13,000. The coho salmon harvest of 43,000 fell below the 10-year average of 72,000 coho salmon. Sockeye salmon escapement into Bering River District streams was above the lower end of the SEG escapement range of 26,000 with an index estimate of 31,000 sockeye salmon. The coho salmon escapement goal was achieved with a peak spawning count of 45,000 versus an anticipated SEG range midpoint of 23,000.

Gillnet fisheries in PWS primarily targeted enhanced and wild sockeye and chum salmon. In the Coghill District, the common property harvest totaled 1.2 million chum salmon with 881,000 and 276,000 chum salmon harvested by drift gillnet and purse seine gear, respectively. PWSAC harvested 601,000 chum salmon for cost recovery and 273,000 for broodstock. The Coghill Lake sockeye salmon escapement of 30,000 fish was within the BEG range of 20,000–40,000 sockeye salmon. The total sockeye salmon harvest by the common property fishery was 105,000 sockeye salmon with 95,000 harvested by the drift gillnet fleet and the balance by the seine fleet. Sockeye salmon run entry at the Coghill River weir allowed a regular schedule of fishing periods for the drift gillnet fleet in the Coghill District. Later in the season the drift gillnet fleet harvested 52,000 coho salmon of a PWSAC projected return of 54,000 enhanced coho salmon.

The department's preseason forecast for the Eshamy District indicated a run of 77,000 wild stock sockeye salmon to Eshamy Lake and PWSAC forecast a run of 1.2 million enhanced sockeye salmon to Main Bay Hatchery. The Main Bay Hatchery experienced a sockeye salmon run shortfall in 2005 and did not achieve the cost recovery goal. PWSAC forecast a return of 1.1 million enhanced sockeye salmon of which 450,000 fish were required for cost recovery and brood stock. PWSAC harvested only 178,000 sockeye salmon (40%) of the 443,000 fish required for cost recovery. Of those enhanced fish approximately 105,000 were of Coghill stock and 73,000 were from Eshamy stock. The PWSAC run shortfall resulted in restricted area for the commercial common property fishery in the Eshamy District. The set gillnet fleet harvested 110,000 sockeye salmon and the drift gillnet fleet harvested 79,000 sockeye salmon. The BEG range of 20,000–40,000 fish at Eshamy Lake was met with 24,000 sockeye salmon passing through the weir by August 27 when the weir was removed. It is likely that some additional escapement occurred after the removal of the weir because water levels increased after the weir was removed. Eshamy stock sockeye salmon have a protracted run timing (mid-July into September).

The department's preseason forecast for the Unakwik District predicted a commercial harvest of 6,000 sockeye salmon. The total commercial harvest from Unakwik Inlet was 23,000 sockeye salmon; with 80 fish harvested by purse seiners and the balance by the drift gillnet fleet. The 2005 sockeye salmon harvest was over four times the 10-year average harvest and was double the average since 1974 (10,000 sockeye salmon). Additionally, this years harvest was

approximately half of the Unakwik Inlet record harvest of 49,000 sockeye salmon that occurred in 1982.

The 2005 chum salmon run forecast for PWS was 2.6 million fish. The majority (75%) was anticipated to be from PWSAC hatchery production. Approximately 468,000 enhanced chum salmon were expected to return to Port Chalmers, 1.47 million to the Wally Noerenberg Hatchery (WNH) facility, with an additional 18,500 chum returning to the Armin F. Korenig Hatchery (AFK). PWSAC's initial intent was to harvest 753,000 chum salmon for cost recovery and broodstock with the remaining 717,000 chum salmon available for the common property fisheries. As the result of higher market prices, PWSAC was able to meet the 2005 WNH chum salmon cost recovery goal with a harvest of 573,000 fish.

The combined common property and cost recovery harvest of 2.0 million enhanced chum salmon was approximately 5% greater than PWSAC's forecast of 1.9 million chum salmon. The purse seine and drift gillnet fleets harvested 276,000 and 881,000 chum salmon respectively in the Coghill District. The Port Chalmers chum salmon remote release failed to meet PWSAC's projections in 2005. The Montague District total common property chum harvest was 239,000 chum salmon, only 53% of PWSAC's projected Port Chalmers return. A fishing schedule of seven consecutive 156-hour periods was initiated in the Montague District on May 30 and continued through July 24 to harvest Port Chalmers enhanced chum salmon. Wild stock chum salmon escapement was within or above the escapement goal range in all districts: 70,000 wild stock chum salmon were harvested in PWS with 30,000 harvested in the Eastern District, 4,000 in the Southeastern District, and 15,000 harvested in the Coghill District.

The 2005 pink salmon forecast for PWS was 33.3 million fish. This estimate includes 6.2 million wild stock fish, 11.6 million Valdez Fisheries Development Association (VFDA) enhanced fish, and 15.5 million PWSAC enhanced fish. PWSAC required approximately 10.7 million (70%) of the projected 15.5 million enhanced pink salmon for cost recovery. VFDA anticipated requiring 4.2 million (36%) of the projected 11.6 million pink salmon harvest for cost recovery. The projected remaining 12.2 million enhanced fish would be available for commercial common property harvest. About 4.3 million wild stock pink salmon were projected to be available for harvest, leaving 2.0 million fish in the spawning escapement. The total PWS spawning escapement index was 4.7 million pink salmon. This is the largest spawning escapement index since consistent aerial surveys began in the early 1960s. All districts with SEG ranges exceeded the upper bound of their range in 2005.

A record 59.9 million pink salmon were harvested in PWS in 2005, composed of 47.4 million commercial common property fish and 12.5 million cost recovery fish (Table 1). A preliminary estimate of 12.3 million wild stock pink salmon contributed to the commercial common property fishery, primarily harvested in the Eastern District. The ratio of enhanced pink salmon to wild pink salmon in the 2005 total commercial common property harvest is estimated to be 3:1.

In 2005 PWSAC achieved their pink salmon cost recovery goals. Enhanced pink salmon returns for the WNH, AFK and Cannery Creek Hatchery (CCH) were significantly greater than PWSAC's preseason projections. PWSAC harvested approximately 2.9 million fish at AFK, 2.5 million fish at CCH, and 3.6 million fish at WNH. In early July, it was apparent that the enhanced pink salmon return was early and much larger than PWSAC projections.

VFDA's anticipated 2005 adult return of pink salmon to the Solomon Gulch Hatchery was 11.6 million fish. To meet egg take objectives at the hatchery, 323,000 salmon were anticipated to be

needed. The 2005 sales harvest revenue goal is $2.3 million as outlined in the VFDA FY 2005 Income and Expense Statement. VFDA achieved the cost recovery goal with a harvest of 3.5 million pink salmon. In the Eastern District common property fishery 20.5 million pink salmon were harvested, with a hatchery contribution estimated at 65%.

The unexpectedly large run of hatchery pink salmon outpaced harvest and processor capacity and resulted in a build up of poor quality fish in Port Valdez. As of July 15, an estimated 3.0 million fish in the port had deteriorated to the point that their flesh had become unmarketable. If left unharvested, a significant number of the hatchery salmon could be expected to stray into 39 nearby pink salmon streams and interfere with natural stocks. To prevent further waste, hatchery salmon straying, and accumulations of dying salmon, the Commissioner of ADF&G allowed roe stripping. Even with roe fishery regulations implemented, large numbers of rotting carcasses were reported in the harbor, at the boat ramp, stream mouths, and throughout the port. Approximately 2.5 million fish were harvested in the common property roe fishery. Additionally, a smaller scale build-up of poor quality pink salmon occurred at all of PWSAC's hatcheries. The smaller scale build-up of fish (~500,000 fish per hatchery) did not warrant a commercial common property fishery roe fishery. PWSAC harvested approximately 1.5 million fish for roe during egg take activities.

The 2005 adult return of coho salmon to the VFDA hatchery was anticipated to be 132,000 fish. The broodstock goal of 1,000 coho salmon was anticipated in order to meet VFDA egg take objectives. The purse seine fleet harvested approximately 148,000 coho salmon in 2005, the majority of which came from the Solomon Gulch Hatchery. The waters of Port Valdez north of the latitude of Rocky Point were opened on September 7 to harvest coho salmon returning to Solomon Gulch Hatchery. VFDA expressed concern that allowing the fleet into Port Valdez near the hatchery could jeopardize coho salmon broodstock collection. The sport fish harvest of coho salmon in Port Valdez was considered good.

**Table 5.–**Preliminary 2005 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total |
| Purse Seine | | | | | | |
| Eastern | 0 | 7 | 136 | 20,516 | 32 | 20,691 |
| Northern | 0 | 4 | 1 | 10,176 | 6 | 10,187 |
| Coghill | 0 | 11 | 2 | 3,247 | 276 | 3,536 |
| Southwestern | 0 | 39 | 9 | 11,377 | 4 | 11,429 |
| Montague | 0 | 2 | 0 | 845 | 239 | 1,086 |
| Southeastern | 0 | 1 | 0 | 771 | 4 | 776 |
| Unakwik | 0 | 0 | 0 | 82 | 0 | 82 |
| Drift Gillnet | | | | | | |
| Bering River | 0 | 77 | 43 | 9 | 0 | 129 |
| Copper River | 35 | 1,331 | 263 | 35 | 4 | 1,668 |
| Unakwik | 0 | 23 | 0 | 2 | 1 | 26 |
| Coghill | 0 | 95 | 52 | 72 | 881 | 1,100 |
| Eshamy | 0 | 79 | 2 | 110 | 3 | 194 |
| Set Gillnet | | | | | | |
| Eshamy | 0 | 110 | 1 | 126 | 3 | 240 |
| Hatchery [a] | 0 | 208 | 27 | 12,529 | 534 | 13,298 |
| Misc. PWS [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| Prince William Sound Total [c] | 35 | 1,987 | 536 | 59,897 | 1,987 | 64,442 |
| Southern District | 1 | 111 | 3 | 2,175 | 2 | 2,291 |
| Kamishak District | 0 | 65 | 0 | 8 | 84 | 157 |
| Outer District | 0 | 0 | 0 | 110 | 13 | 123 |
| Eastern District | 0 | 57 | 6 | 14 | 0 | 77 |
| Lower Cook Inlet Total | 1 | 233 | 9 | 2,307 | 99 | 2,648 |
| Central District | 25 | 5,167 | 191 | 47 | 69 | 5,500 |
| Northern District | 3 | 24 | 28 | 1 | 1 | 57 |
| Upper Cook Inlet Total | 29 | 5,191 | 220 | 48 | 70 | 5,557 |
| Naknek-Kvichak District | 1 | 6,701 | 3 | 0 | 80 | 6,785 |
| Nushagak District | 62 | 7,132 | 43 | 1 | 874 | 8,112 |
| Egegik District | 0 | 8,004 | 21 | 0 | 28 | 8,053 |
| Ugashik District | 2 | 2,202 | 8 | 0 | 24 | 2,236 |
| Togiak District | 10 | 463 | 0 | 2 | 125 | 600 |
| Bristol Bay Total | 75 | 24,502 | 75 | 3 | 1,131 | 25,786 |
| Central Region Total | 140 | 31,913 | 840 | 62,255 | 3,287 | 98,435 |

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

Note: Columns may not total exactly due to rounding

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

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

[c] Some of these fish were donations.

## COOK INLET

### Upper Cook Inlet

The 2005 Upper Cook Inlet (UCI) commercial harvest of 5.6 million (Tables 2 and 5) salmon represents the second highest harvest in UCI for the past 10 years and was also approximately 47% greater than the average annual harvest from 1954 to 2004. The estimated exvessel value of $31.4 million is 52% more than the value in 2004 and the highest exvessel value since 1997. While all five species of Pacific salmon are present in UCI, the primary focus of the commercial fishery is sockeye salmon. Sockeye salmon escapement goals to the five monitored systems in UCI were not within the goal range in any system. The Kenai, Kasilof and Crescent Rivers were all above the upper end of the escapement goal range and the Yentna River and Fish Creek escapements were both below the lower end of the escapement goal range.

The preseason forecast for the 2005 season projected a run of 5.6 million sockeye salmon, with a harvest estimate (sport, personal use and commercial) of 4.1 million fish. The total run to the Kenai River was forecasted to be 3.3 million sockeye salmon, the actual return to the Kenai River was estimated at 5.5 million, resulting in an in-river sonar goal range of 850,000 to 1.1 million fish. The actual in-river sonar count in the Kenai River was 1.4 million sockeye salmon. The UCI commercial harvest of 5.2 million sockeye salmon was 25% above the preseason forecast, while the total run of sockeye salmon to UCI was 44% more than the preseason forecast. Returns to all systems in UCI, with the exception of the Susitna River and Fish Creek, were stronger than expected in 2005, with the Kenai River sockeye salmon run approximately 66% greater than the preseason forecast. The Kasilof River sockeye salmon run was approximately 27% greater than the preseason forecast. The total run to the Susitna River was 66% lower than the forecast. Roughly, half of this Susitna River run is bound for the Yentna River where the escapement is monitored. The escapement to the Yentna River was significantly below the escapement goal with a final sonar count of 37,000. Sockeye salmon prices at the beginning of the season averaged $0.90–$0.95 per pound. Typically, this price is adjusted upwards by the end of the season, but for the past few years prices have not changed dramatically from the beginning of the year to the end of the season. The total exvessel value in UCI for sockeye salmon was $29.9 million, which was 95% of the total UCI exvessel value for salmon.

The 2005 coho salmon harvest of 220,000 was about equal to the recent 10-year average harvest and approximately 30% less than the 50-year long term average coho harvest. The coho salmon run in 2005 was judged to be well above average. Commercial coho salmon harvests in UCI during the 1980s and early 1990s were much higher than the long-term average due to good coho salmon production and strong sockeye salmon returns to Upper Cook Inlet, which resulted in more fishing time in the Central District. Since 1996, BOF regulations have reduced the fishing time of the drift 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, escapement objectives were met or exceeded. The exvessel value of coho salmon to the commercial fishery was approximately $692,000 or 2% of the total exvessel value in Upper Cook Inlet.

The 2005 harvest of 48,000 pink salmon is about 20% below the recent 10-year average odd-year pink salmon harvest and about half of the long-term average odd-year harvest since 1956. It is

lower than the average harvests due to poorer pink returns in recent years, restrictions to fisheries to protect other stocks, and lower prices paid for pink salmon. The low prices have resulted in commercial fishers avoiding pink salmon, especially when sockeye salmon are present in large numbers. Pink salmon escapements are not monitored in UCI to an appreciable degree; however, it appears that escapements to most river systems were good. Prices paid for pink salmon were approximately $.08 per pound, resulting in an exvessel value for this species of $12,700, or less than 1% of the total exvessel value.

The 2005 harvest of 70,000 chum salmon was well below the long-term average harvest of approximately 527,000 chum salmon. The 2005 chum salmon harvest was approximately 59% less than the recent 10-year average harvest. Much of this reduction in harvest has been the result of reduced fishing time, primarily by the drift fleet, in traditional areas. 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. Between 1995 and 1996, small improvements have occurred most years, and chum salmon runs to most of Cook Inlet in 2005 were reasonably good by recent standards. The exvessel value of chum salmon to the commercial fishery was approximately $101,000, less than 1% of the total.

The 2005 harvest of 29,000 Chinook salmon is well above the long term average harvest by approximately 11,000 Chinook salmon. The two fisheries where Chinook salmon are harvested in appreciable numbers in UCI are in the Northern District and in 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 most escapement goals are being met or exceeded. Harvests in the Northern District Chinook salmon fishery remain well below the harvest cap of 12,500 Chinook, due to reduced participation and regulatory closures of the highest producing sites north of the Theodore River. Changes made by the BOF in the 2005 regulations—lengthening the fishing periods to 12 hours instead of six hours each Monday—likely increased harvests in 2005. The 2005 harvest of 3,500 Chinook salmon is approximately 1,200 fish above the recent 10-year average harvest of 2,200 Chinook. Late-run Kenai River Chinook salmon runs have been relatively stable and escapement objectives have been consistently achieved or exceeded. In 2005 the commercial harvest in the Upper Subdistrict set gillnet fishery of 21,000 Chinook salmon was the third highest harvest since 1966 when harvest records specific to fishery are available. In 1999, one 24-hour closed period per week was mandated for the set gillnet fishery in the Upper Subdistrict. Since that time, longer closed periods of 48-hours or two shorter closed periods, a 24- and a 36-hour period, have also been put into regulation. The purpose of these closed periods was to pass fish into the inriver recreational fishery for the weekend. The overall impact of these closed periods, however, may be an increase from what would have occurred in commercial Chinook harvests without these closed periods. In essence, large numbers of sockeye salmon escape inriver during these expanded closed periods resulting in more than normal amounts of fishing time to compensate for these longer closures. In 2005, the ex-vessel value for Chinook salmon was $692,000, which is approximately 2% of the total exvessel value.

## Lower Cook Inlet

The preliminary 2005 Lower Cook Inlet (LCI) all-species commercial salmon harvest of 2.6 million fish (Tables 2 and 5) was the fourth highest during the past decade, exceeding the most recent 10- and 20-year averages. The overall harvest totaled just over two thirds of the preseason

forecast, yielding an estimated exvessel value of about $1.6 million, which exceeded that for the poor 2004 season but was still the fourth lowest over the past 10 years.

As has been the case for many years, LCI commercial salmon harvests in 2005 relied heavily on the success of hatchery and enhanced fish production. An estimated 72% 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. Pink salmon production from Tutka Hatchery, operated by CIAA, exceeded the preseason forecast of just over 1.0 million fish by over 700,000. The harvest of this species returning to the facility, at nearly 1.6 million fish, comprised about 60% of the all-species catch, which is substantially higher than the anticipated percentage. The overall return of pinks to Tutka Hatchery, estimated at over 1.7 million fish, was the fourth highest on record for the facility. At nearby Port Graham Hatchery, the cost recovery harvest this season totaled approximately 467,000 pinks, falling short of a preseason outlook calling for a harvest of 675,000. As is usually the case, since hatchery programs were taken over by private non-profit agencies in LCI, a significant portion of the salmon harvest was taken and utilized for hatchery cost recovery. An estimated 84% of the total salmon catch was taken by CIAA and Port Graham Hatchery Corporation (PGHC) as hatchery cost recovery to support the sockeye lake stocking programs and Tutka/Port Graham Hatchery operations, equating to approximately 45% of the exvessel value of the 2005 LCI salmon fishery.

Returns of naturally produced sockeye salmon were reasonably good, with SEGs attained at four of five systems in the management area. Additionally, returns to the two sockeye systems with a combination of natural and enhanced production also achieved their established goals. Natural returns of pink salmon in LCI were considered good for a fourth consecutive season, with several systems (Port Dick/Rocky River/Windy Bay-Outer District, Rocky/Ursus Coves–Kamishak Bay District) experiencing relatively strong runs this season. All of the major monitored pink salmon systems in the management area met or exceeded their SEGs. Another bright spot in the management area was the continuation of relatively strong chum salmon returns. Nearly all systems achieved their chum salmon SEGs while still allowing a harvest totaling almost 99,000 fish, the second highest total for this species in LCI since 1988. The LCI chum salmon harvest in 2005 represented the sixth consecutive year of good catches. Additionally, escapement of chum salmon into McNeil River in the Kamishak Bay District achieved the established SEG for only the fourth time since 1990.

The 2005 commercial sockeye salmon harvest of 233,000 fish represents the third lowest catch for the LCI management area over the past decade, equaling less than three fourths of the recent 10-year average. As usual, sockeyes accounted for a relatively low percentage (<10%) of the landings in numbers of fish this season, but due to the price differential, they comprised over half of the exvessel value of the fishery. With a combined preseason forecast of 114,000 sockeye salmon returning to Leisure and Hazel Lakes in the Southern District, actual harvests of these enhanced runs were less than expected, with a catch estimated at 95,000 fish, which represents about 40% of the entire LCI sockeye total. At Bear Lake in Resurrection Bay of the Eastern District, the actual catch of nearly 57,000 sockeyes fell short of the forecasted harvest of 73,000 fish. Additionally, despite management efforts to equalize harvest between hatchery cost recovery and common property as required by regulation, migration patterns of the fish in waters of Resurrection Bay this season skewed the harvest in favor of CIAA, with estimated percentages of 66% for hatchery harvest versus 34% for seiners. In the Kamishak Bay District,

the enhanced return to Kirschner Lake produced a harvest of only around 14,000 sockeyes—failing to achieve the preseason forecast of 24,000 fish.

The 2005 commercial set gillnet harvest of about 16,000 sockeyes represented the second consecutive year of poor catches for that gear group in LCI and was lowest total since 1994. The closure of the Port Graham Subdistrict set gillnet fishery for the entire 2005 season, to protect sockeyes returning to English Bay Lakes for escapement purposes, contributed to the low set gillnet catches. The closure, however, aided in attaining the SEG for English Bay Lakes, with a final escapement into the lake system estimated at about 8,000 sockeye. Unfortunately, the weak sockeye return forced a closure of the local subsistence fishery for a majority of that return's duration. The success of an ongoing sockeye salmon enhancement/rehabilitation project at English Bay Lakes, originally initiated by ADF&G in the late 1980s and presently being conducted by Chugach Regional Resources Commission (CRRC) in conjunction with the village of Nanwalek, is expected have a significant effect on future harvest levels in Port Graham Subdistrict subsistence and commercial fisheries.

Natural returns of sockeye salmon were considered fair to good, with four of five systems achieving their respective SEGs. In the Outer District, Delight Lake slightly exceeded its SEG with a combined weir/aerial count of 15,000 sockeyes, while escapement at Desire Lake fell short of the SEG with an aerial estimate of 5,000 sockeyes; marine waters near both lakes remained closed to commercial fishing for the entire season to protect fish for escapement. The sockeye return to Mikfik Lake in the Kamishak Bay District once again experienced no directed effort in 2005 and therefore achieved the SEG of 6,000 to 12,000 fish, with a final aerial estimate of 6,000 fish into the lake. Also in the Kamishak Bay District, the sockeye return to Chenik Lake was strong for a third straight season, achieving the SEG with a total of around 13,000 fish into the lake, while additionally providing seiners with an estimated harvest totaling 47,000 sockeyes. At Aialik Lake in the Eastern District, nearby waters were opened to seining in mid-July, but by then the run had already peaked and only minimal effort and harvest resulted. With an estimate of 5,000 sockeyes, the final escapement at Aialik Lake fell within the SEG range of 4,000 to 8,000 fish.

Harvest of pink salmon, the dominant species in numbers of fish in LCI, fell well short of preseason expectations in 2005, with an overall catch of approximately 2.3 million fish. However, this statistic is considered misleadingly low because natural returns of pinks were relatively strong and fishery openings targeting this species were liberal, but fishermen failed to capitalize on these circumstances because of poor market conditions (lack of tenders and markets). Nonetheless, the overall catch exceeded the most recent 10-year average by over 40%, representing the fourth highest total during that time period. Approximately 2.1 million pinks, or about 94% of the management area total, were taken in the Southern District and were comprised primarily of Tutka and Port Graham Hatchery production. However, nearly all (99%) of these fish were utilized in an unsuccessful effort to attain the cost recovery revenue goals established for the two hatchery facilities. The estimated hatchery return to Tutka, including escapement and commercially harvested fish, was about 1.7 million pinks, or about 67% greater than the preseason projection of 1.0 million fish. Since this was the final adult pink salmon return to Tutka Hatchery due to the closure of the hatchery, no broodstock were collected. At Port Graham, the hatchery return was estimated at 641,000 pinks, approximately 75% of the preseason projection of 866,000. Of the total return, an estimated 174,000 pinks were collected at

Port Graham Hatchery for broodstock purposes, with the remainder harvested for hatchery cost recovery.

Naturally produced pinks contributed less than 10% of the area-wide harvest for that species this season, a common theme in LCI since the early 1990s because of hatchery production. The majority of natural harvests in 2005 came from Port Dick and Windy Bay in the Outer District, with a total catch of 110,000 fish. Overall, natural pink salmon returns were relatively strong, and all of the major monitored pink systems in the management area achieved their SEGs this season. The good pink salmon returns were somewhat surprising coming on the heels of similar, though stronger, area-wide returns last season.

The 2005 LCI commercial chum salmon harvest was the second highest since 1988, totaling nearly 99,000 fish and easily exceeding the recent 10- and 20-year averages of 49,000 and 58,000 chums, respectively. This marked the sixth consecutive season of relatively strong chum returns coupled with good catches. Nearly all of the chum salmon catch this season came from Kamishak Bay, with the majority of effort and targeted harvest occurring in the northern end of the district at Cottonwood Creek, a system that has dominated chum catches in recent seasons. Reasonable chum salmon returns elsewhere in the management area resulted in attainment of SEGs into a majority of streams. At McNeil River in the Kamishak Bay District, the chum escapement achieved the SEG for only the fourth time since 1990.

Coho salmon resources in LCI are limited, and therefore little or no directed effort traditionally occurs on this species. The commercial harvest to date of about 9,000 coho salmon in 2005 was the third lowest total for this species in LCI since 1990, representing only about 64% of the 20-year average. The majority of the LCI harvest (63%) came from the Eastern District, primarily for the Seward Silver Salmon Derby, followed by the Southern District (36%), where set gillnetters and seiners accounted for about 70% and 30% of that district's coho harvest, respectively. The coho salmon catch total is expected to increase marginally due to anticipated hatchery cost recovery at Bear Lake in Resurrection Bay of the Eastern District.

Although coho run assessment in LCI is limited, commercial, sport, and personal use harvests usually provide the best indicators of run strength. Returns during 2005 were considered average based on these indicators. One aerial survey was conducted for coho salmon on a major index stream at the head of Kachemak Bay, indicating good escapement into Clearwater Slough.

Chinook salmon are not normally a commercially important species in LCI. The 2005 LCI harvest of Chinook salmon totaled just over 600 fish, falling well short of the recent 10- and 20-year averages. All of the catch came from the Southern District, with the majority attributed to enhanced production at Halibut Cove Lagoon. Set gillnetters accounted for 85% of the Southern District Chinook catch, with purse seiners taking the remaining 15%.

## BRISTOL BAY

The inshore Bristol Bay sockeye salmon run of approximately 39.3 million fish (Tables 2 and 5) was the 15th largest inshore run since 1952 and the 14th largest harvest on record. The 2005 total inshore run was 13% above the 1985–2004 average of 35.1 million. It was approximately 20% above the preseason forecast of 32.8 million fish. The Nushagak, Togiak, and Naknek-Kvichak Districts all had sockeye runs that were larger than forecasted. The Naknek-Kvichak District sockeye salmon run was 45% above, the Togiak District was 57% above and the Nushagak District was 36% above the preseason forecast; the Egegik sockeye run was 7% below the

preseason forecast, the Ugashik run was 17% below the forecast. The commercial harvest of 25.0 million sockeye salmon was 96% of the 26 million forecast. A total escapement of approximately 14.8 million sockeye salmon was achieved.

The commercial harvest of approximately 75,000 Chinook salmon was the ninth largest catch in the last 20 years and 9% above the 20-year average of 69,000. The chum salmon harvest of approximately 1.2 million fish was the sixth largest harvest in the last 20 years. The coho salmon harvest of approximately 75,000 fish was well below the 20-year average of 108,000.

The 2005 harvest of all salmon species in Bristol Bay totaled approximately 25.0 million fish. The calculated exvessel value of the 2005 Bristol Bay salmon fisheries totaled approximately $93.0 million. Although $93.0 million is only 80% of the 20-year average value for Bristol Bay, the value of the 2005 fishery is the highest since 1999 and more than three times that of the 2002 harvest, the lowest exvessel value in the last 20 years.

The 2005 inshore sockeye salmon run of 39.3 million fish was 6.5 million more than the forecast of 32.8 million fish. Escapements to the Ugashik, Wood, and Togiak Rivers fell within their BEG ranges. Although other escapements exceeded the upper ends of escapement goal ranges, the lack of available processing capacity resulted in widespread limits and suspensions imposed by processors and made harvesting of fish surplus to escapement needs impossible. The Alagnak River had another very strong escapement, with a tower count of 4.2 million sockeye salmon, despite an inriver setnet fishery that harvested over 225,000 sockeye salmon. This year's salmon season in Bristol Bay was characterized by large catches, more normal run timing, and the use of eastside special harvest areas. The combination of these factors resulted in a somewhat slow start to the season followed by very intense fishing that overwhelmed virtually every processor in the Bay. A prime example of this was the 950,000 harvest in Egegik in a 4-hour drift opening on June 26. As the season progressed and harvest increased in other Districts, daily harvests started exceeding capacity. On July 6, many major processing companies were forced to suspend buying or limit harvest by their fleets. This continued through July 9. Despite processing issues, the total harvest in Bristol Bay was just short of the forecasted harvest of 24.5 million sockeye. Every system in Bristol Bay in which sockeye salmon are counted achieved or exceeded the BEG, including the Kvichak River. The initial price of $0.60 per pound paid by processors is the highest price since 2000 and $0.14 more than the initial price last year.

The Chinook salmon harvests in Bristol Bay districts were below average in every district except the Nushagak. There were seven directed Chinook fishing periods in the Nushagak District, resulting in approximately 30,000 Chinook salmon landed. The Nushagak harvest of 62,000 Chinook salmon was well above its 1985–2004 average catch of 5,000. Other Chinook catches were incidental to targeting sockeye salmon. The Portage Creek sonar count of 181,000 Chinook salmon was 141% above the 75,000 fish Nushagak goal.

The total Bristol Bay chum salmon harvest of approximately 1.1 million fish was the sixth largest harvest in the last 20 years. The Nushagak and Naknek/Kvichak produced harvests above their 1985–2004 average catches; the other three Districts had smaller harvests than the 20-year averages. The Nushagak harvest of 874,000 chum salmon was the highest in 20 years and 128% above its 20-year average of 384,000.

Pink salmon do not occur in significant numbers in odd years in Bristol Bay.

The total Bay-wide coho salmon harvest of approximately 75,000 fish was 30% below the recent 20-year average of 107,000, but higher than the recent 10-year average of 64,000. All of the districts, except Nushagak, produced catches below their 1985–2004 average harvests. The Nushagak District harvest of 43,000 fish was 54% above its 20-year average of 28,000. It is important to note that in some districts coho harvest was limited by market availability rather than fish abundance.

## KUSKOKWIM AREA

The 2005 Kuskokwim Area Chinook, sockeye, and chum salmon runs returned in greater strength than anticipated while coho salmon run strength was weaker than anticipated. Kuskokwim River salmon fisheries were managed according to the Kuskokwim River Salmon Management Plan with Chinook and chum salmon stocks identified as stocks of yield concern. Amounts of salmon necessary for subsistence use were achieved throughout the Area.

There were four chum and sockeye salmon directed commercial openings in the Kuskokwim River in late June and early July. A directed commercial coho fishery was implemented in the Kuskokwim River in August. Kuskokwim Bay commercial salmon fisheries were managed according to their associated management plans and regulations. The Kuskokwim Area (Table 6) salmon harvest was 442,000 salmon. A total of 484 permit holders participated in the Area fishery with the exvessel value estimated at $1.2 million. Limited processor capacity, low prices, and low fishing effort dominated the season; however, a modest increase in effort was observed in comparison to the previous two years.

District 1 commercial harvest in 2005 was 5,000 Chinook, 28,000 sockeye, 69,000 chum, and 142,000 coho, and 19 pink salmon from 15 periods. With the exception of sockeye salmon, the 2005 salmon harvest by species was below the recent 10-year average. The harvest of sockeye salmon was 14% greater than the recent 10-year average. A total of 403 individual permit holders recorded landings during the 2005 season. This level of fishing effort was 20% below the recent 10-year average of 507 fishers. The total exvessel value of the fishery was $449,000, 50% of the recent 10-year average value.

Kuskokwim River Chinook escapements ranged from above average to record highs at nearly all monitored locations, with the exception of George River where the escapement was near average. Kogrukluk River Chinook salmon escapement exceeded the escapement goal range with a record escapement of 22,000 fish. The improved escapements in 2005 were consistent with the general trend of increasing Chinook salmon abundance in the Kuskokwim River since the low abundance years of 1998, 1999, and 2000.

Kuskokwim River Sockeye escapements are monitored with weir projects at all six of the rivers; however, sockeye are not a prominent species in many of these systems. Among these locations, Kogrukluk and Kwethluk Rivers receive the largest sockeye escapements. Kogrukluk River sockeye salmon passage in 2005 was a record high. The Kwethluk River weir was not operational in 2005 and no escapement information is available. A pilot sockeye salmon radio telemetry project was implemented in 2005 at the mainstem tagging site near Upper Kalskag.

Kuskokwim River chum salmon escapements achieved record highs at nearly all monitoring projects with the exception of George River where escapement was near average. Escapements were well above the Kogrukluk and Aniak River escapement goal ranges. The Kogrukluk escapement was more than triple the previous high and Aniak sonar escapement was among the

highest on record. Chum escapements were exceptionally low in 1999 and 2000, and nearly all chum salmon escapements observed since have been above those years.

Kuskokwim River coho salmon escapements were average to below average at all monitored locations in 2005. Escapement at Kogrukluk River was within the escapement goal range; however, escapements at several other locations were near the lower end of their historic range. Coho escapement at the Takotna River was the lowest in six years of monitoring. Coho abundance in the Kuskokwim River was extremely low in the late 1990s, but has generally improved since that time with record highs occurring at all monitored locations in 2003.

In Kuskokwim Bay, the District 4 harvest in 2005 was 24,000 Chinook, 69,000 sockeye, 14,000 chum, and 51,708 coho salmon (Table 6). Chinook and sockeye salmon harvest was 11% and 32% above the recent 10-year average respectively, coho salmon harvest was similar to the recent 10-year average, and chum salmon harvest was below the recent 10-year average. A total of 145 individual permit holders recorded landings in District 4 during the 2005 season. Although and increase over recent years, this level of fishing effort was 30% below the recent 10-year average of 207 fishers. The total exvessel value of the District 4 fishery was $570,000, which is 23% above the recent 10-year average value. Limited processing capacity and weaker than expected coho salmon run strength limited the District 4 fishery in 2005.

Salmon escapement estimates at the Kanektok River weir were 14,000 Chinook, 242,000 sockeye, 26,000 coho, and 54,000 chum salmon. Chinook salmon escapements were above average, sockeye and chum salmon counts were the highest on record, and coho salmon counts were below average. Aerial surveys for Chinook and sockeye salmon were flown over the Kanektok River drainage on July 31 and August 1. A total of 14,000 Chinook and 111,000 sockeye salmon were observed. The Chinook and sockeye salmon aerial survey escapement goal ranges were exceeded.

District 5 commercial harvests in 2005 were 2,000 Chinook, 24,000 sockeye, 3,000 chum, and 12,000 coho salmon. Harvests for all of these species were below recent 10-year averages. Twenty-nine individual permit holders recorded landings in District 5 during the 2005 season. This level of fishing effort was 44% below the recent 10-year average of 52 fishers. The total exvessel value of the District 5 fishery was $135,000, which is 12% below the recent 10-year average value. Limited processing capacity and weaker than expected coho salmon run strength limited the District 5 fishery in 2005.

Salmon escapement estimates at the Middle Fork Goodnews River weir were 5,000 Chinook, 111,000 sockeye, 14,000 coho, and 26,000 chum salmon. Sockeye salmon counts were the highest on record since 1981 and were nearly double the previous high escapement. Chinook and sockeye salmon escapements achieved the upper end of their respective SEG ranges. Chum and coho salmon escapements exceeded their SEG thresholds. Aerial surveys for Chinook and sockeye salmon were not flown over the Goodnews River drainage in 2005 because no pilots or aircraft were available during the survey period.

## YUKON AREA

The 2005 Yukon River total commercial harvest was 32,000 Chinook, 41,000 summer chum, 180,000 fall chum, and 58,000 coho salmon for the Alaskan portion of the drainage (Table 2). A total of 30,000 Chinook, 32,000 summer chum, 131,000 fall chum, and 37,000 coho salmon were harvested in the Lower Yukon River and 2,000 Chinook, 9,000 summer chum, 50,000 fall

chum, and 22,000 coho salmon were harvested in the Upper Yukon River (Table 6). All salmon were sold in the round with no salmon roe sold separately.

The 2005 Chinook salmon run was anticipated to be lower or similar to the run experienced in 2004 based on the lower proportion of five-year-old fish in 2004. The 2005 Chinook salmon harvest was the third lowest commercial harvest since statehood and 57% below the 10-year average (1995–2004) harvest of 75,000 fish. No commercial fishing occurred in 2001. The summer chum salmon harvest was the ninth lowest since 1967 and 82% below the 10-year average (1995–2004) harvest of 232,000 fish. Due to the lack of markets, the summer chum salmon harvest was taken incidental to fishing directed at Chinook salmon, except in District 6 where a limited chum salmon directed commercial fishery occurred.

A total of 598 permit holders participated in the Chinook and summer chum salmon fishery during 2005, which was 10% below the 10-year average (1995–2004) of 665 permit holders. The Lower Yukon Area (Districts 1–3) and Upper Yukon Area (Districts 4–6) are separate CFEC permit areas. A total of 578 permit holders fished the summer season in the Lower Yukon Area in 2005, which was 5% below the 10-year average (1995–2004) of 607 permit holders. In the Upper Yukon Area, 20 permit holders fished, which was 69% below the 1994–2004 average of 64 permit holders.

Yukon River fishers in Alaska received an estimated $2.0 million for their Chinook and summer chum salmon harvest in 2005, approximately 48% below the 10-year (1995–2004) summer season average of $3.8 million.

Lower Yukon River fishers received an estimated average price per pound of $3.43 for Chinook and $0.05 for summer chum salmon. The average price paid for Chinook salmon in the Lower Yukon Area was 26% above the 10-year average (1995–2004) of $2.72 per pound. The average income for Lower Yukon Area fishers that participated in the 2005 fishery was $3,372.

Upper Yukon Area fishers received an estimated average price per pound of $0.87 for Chinook and $0.25 for summer chum salmon. The average price paid for Chinook salmon in the Upper Yukon Area was 1% below the 10-year average (1995–2004) of $0.88 per pound. The average price per pound for summer chum salmon of $0.25 was 35% above the 10-year average (1995–2004) of $0.19 per pound. The exvessel value of the Upper Yukon Area summer season fishery of $38,000 was 88% below the 10-year average (1995–2004) of $323,000. The average income for Upper Yukon Area fishers that participated in the 2005 fishery was $1,800.

The 2005 Chinook salmon run was better than expected. Inseason run assessment was conservative in early June, because two of our main assessment projects underestimated the run strength due to high water conditions lowering efficiency of test gillnets at the mouth, and Pilot Station sonar project missing fish on the left bank due to erosion. A DIDSON sonar was deployed on the left bank to correct the problem. Chinook salmon escapement goals throughout the drainage were either met or exceeded. BEGs have been established for the Chena and Salcha rivers located in the Tanana River drainage. A minimum of 1,600 Chinook salmon observed during an aerial escapement survey, which rates as fair to poor. An estimated 564 Chinook salmon were counted by the Chena River tower project (BEG 2,800–5,700), which was operated for only a few days because of high turbid water conditions. The Salcha River tower project estimated an escapement of 6,000 fish (BEG 3,300–6,500). An estimated 5,000 Chinook salmon were observed during an aerial survey, which rates as excellent in the Salcha River. The

Canadian Yukon River mainstem escapement objective of 28,000 was exceeded with an estimated escapement of 34,000 fish.

The 2005 summer chum salmon escapement levels were above average in most tributaries. Escapement goals have been established for the East Fork Andreafsky and Anvik Rivers. There is also a drainage-wide minimum optimum escapement objective for the Yukon River, based on the Pilot Station sonar project of 600,000 summer chum salmon.

The Pilot Station passage estimate was 2.4 million summer chum salmon, which was well above the 1995, 1997–2004 average of 1.4 million fish.

The Anvik River sonar-based escapement count of 525,000 summer chum salmon was within the BEG range of 350,000–700,000. The estimated escapement of 20,000 summer chum salmon for the East Fork Andreafsky River was below the low end of the BEG of 65,000–135,000. Spawning escapements were well above average in the Koyukuk and Tanana River drainages. The Salcha River escapement of approximately 200,000 fish was the largest on record. It appears that production was lower for spawning areas closer to the ocean such as the Andreafsky and Anvik rivers, whereas production was much higher for spawning areas upriver of the Anvik River.

Commercial fishing for fall chum and coho salmon has become sporadic because of very poor runs from 1998 to 2002 with commercial fishing occurring in six of the past 10 years. The 2005 commercial season was managed to maximize efficiency and opportunity to utilize the unanticipated large surplus of fall chum salmon.

The 2005 Alaskan commercial harvest of fall chum salmon was the largest landing since 1995 and the commercial harvest of coho salmon was the largest landing since 1991. The Yukon Area fall chum commercial harvest was approximately 275% above the 10-year average (1995–2004) of 48,000 fish and 215% above the 10-year average of 19,000 coho salmon. However, weak market conditions and limited buying capacity limited the commercial harvest throughout the drainage.

The preliminary 2005 commercial fall chum and coho salmon season value for the Yukon Area was $469,000 ($400,000 for the Lower Yukon Area, $69,000 for the upper Yukon Area). The previous 10-year average value for the Yukon Area was $90,000 ($64,000 for the Lower Yukon Area, $26,000 for the Upper Yukon Area).

Yukon River fishers received an average price of $0.32 per pound for fall chum salmon in the Lower Yukon Area and $0.14 per pound in the Upper Yukon Area in 2005. This compares to the 1995–2004 average of $0.19 per pound and $0.13 per pound, respectively. For coho salmon, fishers received an average price of $0.32 per pound and $0.13 per pound in the Lower and Upper Yukon Areas compared to the recent 10-year average price of $0.29 and $0.11 per pound, respectively.

An average of 136 permit holders fished the fall chum and coho salmon fishery (126 for the Lower Yukon Area, 10 for the Upper Yukon Area) during the previous 10 fall seasons as compared to 120 fishers who participated in 2005 (115 for the Lower Yukon Area, 7 for the Upper Yukon Area).

The preseason outlook for the 2005 fall commercial fishery did anticipate some harvest opportunity because there were indications that the Yukon River fall chum salmon stocks were recovering from low returns in 1997–2002. However, the magnitude of the 2005 fall chum salmon run was much larger than expected. The primary parent year escapements were among

the lowest on record, yet they produced the largest run in 30 years. The 2005 commercial harvest is primarily a reflection of what the market could support this year because allowable fishing time was well above normal levels and a large surplus remained unharvested.

Fall chum salmon BEG ranges have been established for the Yukon River drainage-wide as well as several major tributary stocks. All escapement goals including interim Canadian goals were exceeded. Using the Pilot Station Sonar project passage estimate of 1.8 million chum as an index of salmon returning to the Yukon River, it is likely the post-season run reconstruction will estimate the 2005 total run to be approximately 2.0 million fall chum salmon.

There is only one established escapement goal for coho salmon in the Yukon River drainage, which is a SEG for the Delta Clearwater River of 5,200–17,000. The 2005 boat count survey of the Delta Clearwater River estimated an above average escapement of 31,000 coho salmon. The 2005 Pilot Station Sonar passage index of 175,000 fish was the third highest since 1995, behind 2003 and 2004, indicating coho salmon stocks are continuing their trend of above average returns.

## NORTON SOUND AREA

The 2005 Norton Sound commercial salmon harvest was one of the best in the last decade. A near record coho salmon run allowed for the normal commercial fishing schedule of two 48-hour periods per week from late July until early September in the Shaktoolik and Unalakleet Subdistricts, and the commercial coho harvest for those subdistricts was the third highest on record. However, the Chinook salmon run was poor again this year and has been consistently weak for several years. The were two commercial Chinook salmon fishing periods in the Shaktoolik and Unalakleet Subdistricts in late June with catches of under 100 Chinook salmon in each Subdistrict during the first period and lower catches in the second period. The chum run in the Shaktoolik and Unalakleet Subdistricts was above average, but there has been little buyer interest in commercial chum salmon fishing. The pink salmon run was a well above average for an odd-numbered year, but there has been no buyer interest in pink salmon the last five seasons.

The first 24-hour commercial opening occurred in the Shaktoolik and Unalakleet Subdistricts for Chinook salmon in late June, but catches were weak. Another 24-hour period occurred a day later, but fishers reported weak catches and were hampered by wood fouling their nets. No further Chinook openings were allowed as there was concern about the run after the catch results from the two periods and decreasing catches at the Unalakleet River test net and decreasing counts at North River tower. The commercial coho season opened the week of July 24 after the Unalakleet River test net had the best catches for July in the 21-year project history. Record catch per unit of effort (CPUE) in the commercial fishery, record catches at the test net and record passage of coho salmon at North River tower allowed for commercial fishing to continue on the normal schedule until September. The combined commercial harvest of all salmon species ranked fourth in the last 10 seasons in Norton Sound and ranked first with pink salmon harvest excluded.

The 2005 commercial catch was 151 Chinook, 280 sockeye, 4,000 chum and 85,000 coho salmon (Table 6). The coho salmon harvest was over 300% above the recent five-year average, and over 200% above the recent 10-year average. There were no chum salmon directed periods and harvest of chum salmon was incidental during the Chinook and coho fishery. Only 40 permit holders participated in the commercial fishery and only the three previous years have had a lower participation. The previous five-year average was 42 permits fished and the previous 10-year average was 64 permits fished.

The 2005 fishery value to the fishers of $296,000 was above the five-year average of $78,000 and the 10-year average of $180,000. This was 375% above the recent five-year average, and 160% above the 10-year average. The average value per permit holder was a record $7,000 without adjusting for inflation. The average price paid for Chinook salmon was $1.22 per pound, $0.45 per pound for sockeye salmon, $0.44 per pound for coho salmon, and $0.14 per pound for chum salmon.

## KOTZEBUE AREA

The Kotzebue Sound commercial salmon fishery opened on July 11 and the fishery closed by regulation after August 31. The last fish were sold on August 22 when the major buyer ceased operations.

In 2005 the department opened the fishery continuously beginning on July 11 and let the buyer determine the fishing time for their fleet. Because fish were not immediately shipped in the round, as in years prior to 2002, the buyer was limited in the amount of salmon that could be purchased. There were 41 permit holders who sold fish to the buyer, and there was one catcher-seller in Kotzebue who sold fish to the buyer and also sold some of his catch from his boat to area residents. The commercial harvest consisted of 76,000 chum salmon (Table 6), 7 Chinook salmon, and 181 Dolly Varden. The chum salmon harvest was 17% below the recent five-year average and 35% below the recent 10-year average. The overall chum salmon run to Kotzebue Sound in 2005 was estimated to be average based on the commercial harvest rates, subsistence fishers reporting average to above average catches, and the Kobuk test fish index being average.

A total of 622,000 pounds of chum salmon (average weight 8.2 pounds) were sold at an average of $0.20 per pound. A total of 100 pounds of Chinook salmon (average weight 14.3 pounds) were sold at an average of $0.50 per pound. A total of 1,000 pounds of Dolly Varden (average weight 6.4 pounds) were sold at an average of $0.30 per pound. The total exvessel value was $125,000 to Kotzebue Sound fishers with the chum salmon value at $124,000. The average value for each participating permit holder was $3,000. The total exvessel value represents 20% of the $617,000 historical average.

**Table 6.–**Preliminary 2005 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total [a b] |
| Kuskokwim River | 5 | 28 | 142 | 0 | 69 | 244 |
| Kuskokwim Bay | 26 | 93 | 64 | 0 | 16 | 199 |
| Kuskokwim Area Total | 31 | 121 | 206 | 0 | 85 | 443 |
| Lower Yukon River | 30 | 0 | 37 | 0 | 163 | 229 |
| Upper Yukon River | 2 | 0 | 22 | 0 | 59 | 82 |
| Yukon River Total | 32 | 0 | 58 | 0 | 221 | 312 |
| Norton Sound | 0 | 0 | 85 | 0 | 4 | 90 |
| Kotzebue Area | 0 | 0 | 0 | 0 | 76 | 76 |
| AYK Region Total | 87 | 66 | 602 | 0 | 140 | 895 |

[a] Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
[b] Columns and rows may not total exactly due to rounding error.

## KODIAK MANAGEMENT AREA

The 2005 Kodiak management Area (KMA) commercial salmon fishery began on June 1, 2005 and the last commercial landing occurred on September 29, 2005. Commercial fishing effort was once again low for the 2005 commercial salmon season. Of the 608 eligible Kodiak commercial salmon permits, only 301 made commercial landings. Fifty seven permits were not renewed for the 2005 season. By gear type, 165 set gillnet and 136 purse seine permit holders fished; there was no participation by beach seiners again in 2005. The number of permits actually fished varied during the season, with the highest participation in any single week at 113 purse seine and 129 gillnet permit holders fishing (week four of the season, June 21–27).

Approximately 34.1 million salmon were commercially harvested in the KMA (Table 7), which is above the previous 10-year average (1995–2004) of 22.3 million salmon. Of the total salmon harvested in 2005, ADF&G commercial test fisheries took under 1,000 salmon (628 fish), and about 10,000 salmon were retained from commercial catches for the permit holder's own use (taken but not sold). Subsistence and sport fishery salmon harvests will not be known until late spring of 2006, after permits and questionnaires are returned to the department.

The estimated total exvessel value of the 2005 fishery was approximately $25.0 million, below the 1995–2004 average exvessel value of $27.0 million. The estimated exvessel value is based on inseason price estimates and will increase as final processor reports become available. The inseason values may not reflect additional payments made to fishermen for dock deliveries, refrigerated sea water, iced fish, or other settlements.

Purse seine fishermen accounted for 90% of the total number of salmon harvested and averaged approximately $136,000 per fished permit. This is an increase from the 2004 season, and is more than the previous 10-year average earnings for purse seine permit holders of $89,000. Set gillnet fishermen accounted for 10% of the total number of salmon harvested and earnings averaged approximately $40,000 per fished permit. This was an increase from last year, but still less than the previous 10-year average set gillnet permit holder average earnings of $43,000.

Fish-counting weirs were operated on nine systems this year. In addition, four different observers flew 23 aerial surveys, and seven observers made foot and skiff survey escapement estimates.

The total Chinook salmon escapement was substantially lower than the previous 10-year average (1995–2004) but was within the KMA aggregate escapement goal. The total sockeye salmon escapement met escapement goals and was similar to the 10-year average and approached the upper end of the aggregated escapement goal. The coho salmon escapement was well below the previous 10- year average and the escapement was above the goal. Overall, the pink salmon escapement was nearly 2.0 million more than the 1995–2003 odd-year average. The overall chum salmon escapement was below the 10-year average and below the goal.

The Ayakulik and Karluk river systems support the largest Chinook salmon populations in the KMA. Commercial harvest occurs during targeted sockeye salmon fisheries; there are no directed Chinook salmon commercial fisheries in the KMA. The 2005 KMA Chinook salmon harvest (14,000 fish) was below the previous 10-year average (19,000 fish) and below forecast (20,000 fish). The average weight of commercially harvested Chinook salmon was 11.7 pounds.

The total Chinook salmon escapement (13,000 fish) was within the escapement goals (8,400–16,900 fish), but below the previous 10-year average (26,000). Escapement goals for Chinook salmon have been developed for the Ayakulik and Karluk rivers and the escapements are

estimated using fish counting weirs. Chinook salmon escapement through the Ayakulik weir (8,000 fish) was within the established range of the escapement goal (4,800–9,600 fish). The Chinook salmon escapement through the Karluk weir (4,800 fish) also was within the range of the established goal (3,600–7,300 fish). Early in the 2005 commercial salmon season, it appeared the Chinook salmon escapement into the Karluk River was weak; the department implemented the non-retention of Chinook salmon for the Inner and Outer Karluk Sections in order to increase escapement numbers of Chinook salmon into the Karluk River.

The KMA sockeye salmon commercial harvest was below the 10-year average (3.0 million fish) but above the point forecast (2.6 million fish). The average sockeye salmon weight for the commercial harvest was 5.5 pounds. The overall sockeye salmon escapement (1.5 million fish) was below average (1.8 million fish) but within the aggregated escapement goals (747,000 to 1.7 million fish).

The Karluk early-run (through July 15) was again strong and came in early. Earlier migration timing has occurred for the past five years. To slow the early escapement the initial commercial fishing period was June 1, eight days earlier than the "traditional" opening date (June 9), and four days earlier than the 2004 opening of June 5. Sockeye salmon escapement met and exceeded the low end of the early-run escapement goal (100,000–210,000 fish) on June 5. The upper escapement goal was exceeded by June 23. Continuous fishing was allowed along the westside of Kodiak in the Central, North Cape, and Outer Karluk Sections through early July, when the management focus turned to pink salmon. The Karluk early-run sockeye salmon escapement was 268,000 fish. Approximately 674,000 sockeye salmon were harvested in early-season westside fisheries; well above the early-run sockeye salmon point forecast (454,000 fish).

The Karluk late-run sockeye salmon escapement was approximately 434,000 fish. Approximately 782,000 sockeye salmon were harvested in late-season westside fishery, well above the late-run sockeye salmon point forecast (581,000 fish).

The Ayakulik was expected to have a small surplus of sockeye salmon available to commercial fishing in 2005. Escapements began weak with the lower interim escapement objective not met until July 31. There were no fishing periods targeting Ayakulik sockeye salmon. However, both the Inner and Outer Ayakulik Section were opened to commercial salmon fishing on September 2 in order to provide the opportunity to harvest coho salmon. The Ayakulik sockeye salmon escapement was 251,000, near the lower end of the escapement objective range (200,000–500,000 fish). Approximately 1,400 sockeye salmon were harvested incidentally in the Ayakulik Sections when coho salmon were the targeted species during September fisheries. The total harvest was below the 2005 point forecast (42,000 fish).

The department tentatively scheduled a commercial salmon fishing period for June 5 in the Alitak Bay District if certain criteria were met prior to June 3. Generally, the Upper Station early-run sockeye salmon have an earlier run timing than the Frazer system. The intent of the early opening was to allow an opportunity to harvest Upper Station early-run sockeye salmon prior to the Frazer system sockeye salmon peak run timing. Sockeye salmon escapement to Upper Station began earlier than average with well above average escapement counts by June 3. The Upper Station sustainable objective (25,000 fish) was certain to be exceeded before June 5 and it was evident that the minimum escapement objective (30,000 fish) would be met. Test fish results also indicated a good push of sockeye salmon traveling into Olga Bay. Criteria being met, the department prosecuted a 33-hour test fishery on June 5. By June 6, the minimum escapement

objective for Upper Station was met and Frazer sockeye salmon escapement (36,000 fish) was well ahead of interim escapements objectives. Following a brief closure, the department then prosecuted a commercial salmon fishing period following the Alitak Bay District Management Plan (ABDMP). The Alitak District early-run sockeye salmon commercial harvest was approximately 460,000, which was above the point forecast (375,000 fish).

The 2005 forecast for the Frazer system estimated a run of 384,000 sockeye salmon (range 178,000–622,000 fish), with a harvestable surplus of approximately 294,000 sockeye salmon. The forecast for the early run to the Upper Station system was 170,000 sockeye salmon (range 113,000–231,000 fish), with a harvestable surplus of approximately 140,000 sockeye salmon. Early Upper Station sockeye salmon are taken incidentally during fisheries primarily targeting Frazer system sockeye salmon or in directed fisheries in upper Olga Bay.

Late-run Upper Station sockeye salmon were expected to be strong. With the strong late escapement into Frazer Lake and a strong pink salmon return, fishing time was allowed for the Alitak Bay District beginning July 16. The Upper Station sockeye salmon escapement counts proved to be weaker than expected, with lower interim objectives not met until the end of August. The late-run Upper Station escapement was 156,000 sockeye salmon, meeting the established objective (150,000–200,000 fish). Harvests from late Alitak fisheries include about 317,000 sockeye salmon which falls below 2005 projection (456,000 fish).

The Afognak Lake (Litnik) sockeye salmon run was weak for the fifth consecutive year. No commercial salmon fishery targeting sockeye salmon was allowed. However, sufficient sockeye salmon escapement occurred and subsistence fishing was not restricted. The sockeye salmon escapement (21,000 fish) into Afognak Lake, was within established escapement goals (20,000–50,000 fish).

Malina Lake sockeye salmon escapement was monitored by weir counts and aerial surveys in 2005. Escapements were weaker than expected with only 3,000 sockeye salmon counted through the weir. Commercial salmon fishing was not allowed in the Malina Creek Special Harvest Area (THA). The remainder of the Southwest Afognak Section opened June 9 for a 33-hour test fishery. While there was no directed sockeye salmon commercial fishery in the Malina Creek THA, there were likely some Malina-bound sockeye salmon harvested in adjacent areas (catches from adjacent areas cannot be separated from other Kodiak stocks moving through those areas).

The Saltery Lake weir was not operated for the 2005 season. Budget constraints forced KMA management staff to prioritize existing funds and the Saltery Lake weir project was cut in 2004. However, aerial surveys were conducted and the Saltery Lake sockeye salmon run proved again to be strong. The sockeye salmon escapement (28,500 fish) was within the established objective (15,000–30,000 fish) with liberal fishing opportunities. This system has a mid- to late-season timing. Fishing was allowed June 14–15, and continuous fishing was allowed beginning June 21 with closed waters reduced to the stream terminus for much of the time. The commercial harvest from the Inner Ugak Bay Section included approximately 6,000 sockeye salmon. No forecast was made for the Saltery sockeye salmon run or harvest.

The Cape Igvak Salmon Management Plan (5 AAC 18.360) allocates up to 15% of the total Chignik-bound sockeye salmon harvest to KMA fishermen in the Cape Igvak Section, and by regulations, 90% of all sockeye salmon caught prior to July 25 in the Cape Igvak Section are considered to be Chignik-bound.

Allocative and biological criteria of the management plan were met in 2005 and commercial fisheries were allowed in the Cape Igvak Section with 12 days of fishing allowed in June during the early run to Chignik. However, the late-run Chignik sockeye salmon run was below forecast. The criteria were not met for additional fishing opportunities and fishing did not reopen until after July 25 in the Cape Igvak Section.

Through July 25, the Cape Igvak harvest of sockeye salmon considered Chignik bound (90%) was approximately 274,000 fish. This Cape Igvak sockeye salmon harvest represents 18% of the total Chignik sockeye salmon harvest (15% allocation). Overall, the total sockeye salmon harvest in the Cape Igvak Section through July 25 was 305,000 fish, which is above the point forecast (286,000 fish).

The North Shelikof Sockeye Salmon Management Plan (5 AAC 18.363) applies from July 6– 25, and places harvest limits on two areas of the KMA bordering northern Shelikof Strait to limit interception of sockeye salmon that are considered Cook Inlet-bound. When this management plan is in effect, KMA fisheries are targeting local pink salmon runs and the fishing periods are based on the projected pink salmon run strength. If it appears that the sockeye salmon harvest will meet or exceed limits set by the BOF, then fisheries are to be restricted to inshore waters only, and offshore "Seaward Zones" are closed (Figure 2). In 2005, a department biologist was present on the grounds, to determine the sockeye salmon catch and facilitate orderly, short-notice closures if the harvest limits were met.

A Seaward Zone closure was required in the North Shelikof Unit (mid to north Mainland and northwest Afognak/Shuyak Islands). Soon after the July 12 commercial fishing period, the department biologists estimated that the harvest would meet the North Shelikof sockeye salmon harvest cap (15,000 fish). The Seaward Zone of North Shelikof Unit was closed at 12:01 AM July 13. At the closure, the harvest in this area was estimated to include approximately 18,000 sockeye salmon. The total July 6–25 harvest in the North Shelikof Unit included about 96,000 sockeye salmon, which includes the Shoreward Zone harvests during the normal fishing periods and the Seaward Zone harvests prior to the closure. There was no closure to the Seaward Zone in the Southwest Afognak Unit. The harvest cap of 50,000 sockeye salmon was not met. The July 6–25 harvest in the Southwest Afognak Unit was approximately 30,000 sockeye salmon.

Terminal and special harvest areas are located in restricted areas where salmon enhancement projects create surplus production. Sockeye salmon harvests occurred as follows:

**Settler Cove THA (Crescent Lake):** There was no reported commercial harvest of sockeye salmon in the Settler Cove THA. Sockeye salmon returning to this system are taken in commercial fisheries in adjacent sections however no stock separation studies are available. Additionally, a local subsistence fishery harvests a significant portion of this enhanced run. While no estimate of the subsistence harvest is currently available, personal communications with Port Lions subsistence fishermen indicate that this run was below average.

**Waterfall SHA (Little Waterfall Lake**): Approximately 23,000 sockeye salmon (forecast 23,000; range 14,000–40,000 fish) were harvested.

**Foul Bay SHA (Hidden Lake):** Approximately 20,000 sockeye salmon (forecast 14,000; range 5,000–29,000 fish) were harvested.

**Spiridon SHA (Telrod Cove):** The harvest was 56,000 sockeye salmon. The Spiridon SHA represents about 41% of the total harvest of Spiridon enhancement fish; the other 59% are

harvested in traditional net fisheries along the westside of the KMA. If expanded the total Spiridon sockeye salmon commercial harvest is estimated at approximately 137,000 (forecast 104,000; range 61,000–145,000 fish). In 2005, there was reduced commercial fishing effort in the KMA, including the westside fisheries, so the relationship between THA catch (41%) and outside catches (59%) may not be the same as in prior years.

**Kitoi Bay Hatchery:** The commercial harvest was 45,000 sockeye salmon (point forecast 9,000; range 6,000–12,000 fish) from the Inner and Outer Kitoi Bay, Duck Bay and Izhut Bay Sections. Additional sockeye salmon may have been harvested in adjacent sections, but stock separation studies are not available.

The commercial coho salmon harvest (396,000 fish) was below forecast (526,000 fish) but very near the 1995–2004 average (368,000 fish). The average weight was 7.9 pounds.

The Kitoi Bay Hatchery coho salmon commercial harvest was approximately 152,000 fish, which was close to the forecast (152,000 fish). The hatchery coho salmon average weight was 6.4 pounds.

The only established coho salmon escapement objectives (5,800–13,600 fish) occur in the Northeast Kodiak District and include the American (400–900 fish), Olds (1,000–2,200 fish), and Buskin (3,200–7,200 fish) rivers and the Pasagshak River (1,200–3,300 fish) in the Eastside Kodiak District. Escapement goals were met for the Olds (2,500 fish), Buskin (17,000 fish) and Pasagshak (3,800 fish) rivers but were below the escapement goal for the American River (339 fish). For the entire KMA, the estimated coho salmon escapement (108,000 fish) was below the previous 10-year average (175,000 fish). Coho salmon escapement estimates are a minimum number; more coho salmon entered KMA systems after the removal of the weirs and aerial survey projects. Many weirs were not operated as late as in past years. Aerial surveys were not conducted past September 8, while it is known that fresh coho salmon were still migrating into area streams into late October.

Overall, the pink salmon harvest (30.1 million fish) was well over the harvest forecast (13.9 million–21.9 million fish) and above the past five odd-year (1995–2003) average harvest (19.9 million fish). The average weight was 3.4 pounds.

Wild stock pink salmon harvests were excellent. Over 16.5 million wild stock pink salmon were harvested (forecast 6.0 million–10.0 million fish). Westside fisheries (Southwest Afognak to Ayakulik), accounted for 5.3 million pink salmon (forecast 2.4 million–4.0 million fish) and the Eastside Kodiak District harvested 5.6 million pink salmon.

The Kitoi Bay Hatchery pink salmon return was stronger than expected. In those sections near the hatchery about 13.6 million pink salmon were harvested (forecast 7.9 million –11.9 million fish). The average weight of hatchery pink salmon was 3.5 pounds. Additional Kitoi-bound pink salmon were likely harvested along the west side and eastside of Kodiak and Afognak Islands. However, the department does not have a stock separation program for pink salmon and is unable to differentiate stocks. There was a cost recovery fishery near the hatchery, with Kitoi pink salmon harvested and sold by the Kodiak Regional Aquaculture Association.

Overall, pink salmon escapement (3.9 million fish) was below the 1995–2003 odd-year average (5.3 million fish). Pink salmon escapement goals have been established for the entire Kodiak Archipelago and the Mainland District. The escapement goal (2.0 million–5.0 million fish) was

met for the combined Kodiak Archipelago. The Mainland District pink salmon escapement (226,000 fish) was slightly below the established escapement goal (250,000–750,000 fish).

The chum salmon harvest (477,000 fish) was below the forecast (1.2 million fish) and below the 1995–2005 average (899,000 fish). The average weight was 7.7 pounds. The commercial catch from all districts were less than forecast.

Kitoi Bay Hatchery chum salmon production was also weaker than expected. The Kitoi Bay Hatchery chum salmon harvest (92,000 fish) was well below the hatchery forecast (248,000 fish).

The overall chum salmon escapement (244,000 fish) was below the aggregated escapement goal (300,000 fish) and below the recent 10-year average (549,000 fish). Escapement goals have been established in all Districts of the KMA except the Afognak District. The Northwest Kodiak District, Southwest Kodiak District, Northeast Kodiak District, and the Mainland District did not meet current escapement goals. The Alitak and Eastside Kodiak Districts were above established escapement goals.

## CHIGNIK MANAGEMENT AREA

The Chinook salmon harvest of 3,000 (Table 7) was the largest under the cooperative management plan but less than the prior 10- and 20-year averages. The 2005 Chignik Management Area (CMA) harvest of sockeye was 1.1 million and more than the 2002–2004 average (the cooperative management plan years), but less than the prior 10- and 20-year averages. The 2005 early-run sockeye salmon harvest (prior to July 5) was larger than the 2002–2004 and 1992–2001 average early-run harvests. The 2005 late-run harvest was slightly more than the 2002–2004 average harvest but below the prior 10- and 20-year averages. The 2005 coho salmon harvest was small because there was no commercial salmon fishing effort after early August. The pink salmon harvest of 194,000 was slightly above the recent 2002–2004 average. The chum salmon harvest of 9,000 was well below recent averages, likely because of the lack of commercial fishing effort outside of Chignik Lagoon.

The Chignik River watershed supports two distinct sockeye salmon runs and a Chinook salmon run which provide the majority of the salmon harvest within the CMA. There are several streams within the CMA that support healthy runs of pink, chum, and coho salmon; however, in recent years the commercial effort directed at these species has been minimal. In 2005, the sockeye salmon early run was above both the average early run from 2002–2004 (the cooperative years) and the prior 10-year average. The late run was approximately equal to the average late-run from 2002–2004 and about 490,000 fewer than the prior 10-year average. The total for both runs combined was approximately 370,000 sockeye salmon above the average combined runs from 2002–2004 and about 600,000 sockeye salmon below the prior 10-year average.

The Chignik cooperative salmon fishery management plan has been under constant legal scrutiny since its adoption by the Alaska BOF in January 2002. In March of 2005, the Alaska Supreme Court ruled that the original regulation contradicted the intent of the Limited Entry Act. On May 4, 2005, the BOF adopted an emergency regulation (5 AAC 15.358) that reestablished the Chignik cooperative and defined active participation by requiring a cooperative member to make a minimum of 10 deliveries in order to receive economic benefit from the fishery. The emergency regulation was challenged in Anchorage Superior Court, where the trial court judge ruled that, while the Board's finding of emergency was valid, the emergency regulation still violated the spirit and purposes of the Limited Entry Act, as set out in the Supreme Court decision.

The state appealed the superior court decision to the Alaska Supreme Court and moved for stay of the decision until after the 2005 season. The Supreme Court granted the motion, so the emergency regulation remained in effect for 2005.

In 2005, the cooperative fleet was allocated 68% and the competitive fleet was allocated 32% of the commercial sockeye salmon harvest within the CMA. Commercial harvest numbers are defined as fish caught and sold as well as fish retained for a person's own use (homepack). The cooperative fleet harvested 782,000 sockeye salmon, or 68% of the CMA commercial sockeye salmon harvest. The competitive fleet harvested 363,000 sockeye salmon, or 32% of the CMA commercial sockeye salmon harvest.

Chignik bound sockeye salmon are allocated to the Cape Igvak fishery in the Kodiak Management Area (Area K) and to the Southeastern District Mainland (SEDM) fishery in the Alaska Peninsula Management Area (Area M). Through July 25, Cape Igvak fishermen harvested approximately 18% of the total sockeye salmon considered Chignik bound, which was about 3% above their allocation of 15%. SEDM area fishermen harvested about 11% of the total sockeye salmon considered Chignik bound, which was approximately double their allocation of 6%.

The exvessel value of the 2005 CMA salmon harvest was about $6.2 million (approximately $64,000 per permit holder). The vast majority of the value was from the sale of sockeye salmon, with pink salmon being the second most valuable species. The harvest of Chinook salmon provided about $338 per permit holder, while coho and chum salmon provided about $114 per permit holder).

The Chignik River watershed total early-run of 1.5 million sockeye salmon was above the average total early-run from 2002–2004 (the cooperative years) and about equal to the prior 10-year average. The total late-run of 710,000 sockeye salmon was approximately equal to the sockeye salmon average total late-run from 2002–2004 and about 537,000 sockeye salmon fewer than the prior 10-year average run. The total for both runs combined was 2.1 million sockeye salmon, which was approximately 370,000 sockeye salmon more than the average combined runs from 2002–2004 and about 600,000 sockeye salmon less than the prior 10-year average combined run. The early-run materialized 21% under the pre-season forecast and the late-run exceeded the pre-season forecast by 29%. The actual Chignik River sockeye salmon run for 2005 returned 10% under forecast. Escapement through the Chignik River weir is monitored utilizing underwater video equipment. There are two gates in the weir, which are generally always open. Fish passage is recorded 24 hours a day and the recordings are archived. The numbers of fish passing the weir are counted by species for the first 10 minutes of each hour, and then the counts are expanded to obtain hourly escapement estimates. These hourly estimates are summed to provide an estimate of daily fish passage. The first count of the 2005 season occurred when weir installation was complete on June 1. The last count of the season took place on September 3, after which the weir was removed.

For sockeye salmon, the early-run SEG of 350,000–400,000 sockeye salmon through July 4 was achieved with an estimated escapement of 355,000. The late-run (post-July 4) SEG of 200,000–250,000 sockeye salmon was met with an estimated escapement of 225,000 sockeye salmon. A post-weir sockeye salmon escapement estimate was produced for the September 4–15 and the September 16–30 period. Sockeye salmon escapements into other CMA streams were relatively minor.

For Chinook salmon, the BEG in the Chignik River watershed is 1,300–2,700 fish. The 2005 Chignik River Chinook salmon escapement of 6,500 was the second largest on record and substantially exceeding the BEG.

For coho salmon, the 2005 Chignik River escapement estimate through September 3 was 18,000 (Table 2). Coho salmon begin to enter CMA drainages in mid-August and continue through November. The coho salmon run is generally building when the weir is removed; therefore coho salmon escapement estimates are considered incomplete. No coho salmon escapement goals have been established for the CMA.

For pink salmon, the 2005 Chignik River escapement estimate was 14,000. Pink salmon escapement to other CMA streams were estimated via aerial survey and summarized by district. All of the districts management objectives for pink salmon were exceeded in 2005. The upper end of the BEG of all districts combined (1.2 million) was exceeded with an estimated overall peak escapement of 1.6 million pink salmon.

For chum salmon, the 2005 Chignik River chum salmon escapement was 408. Chum salmon escapements to other CMA streams were estimated via aerial survey and summarized by district. All of the districts management objectives for chum salmon were exceeded in 2005. The SEG of all districts combined (50,000) was exceeded with an estimated overall peak escapement of 339,000 chum salmon.

## ALASKA PENINSULA-ALEUTIAN ISLANDS

### South Alaska Peninsula Area

The 2005 total commercial harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amilia Islands Management Areas was 14,000 Chinook, 5.5 million sockeye, 212,000 coho, 9.4 million pink, and 782,000 chum salmon (Table 7). The harvests of Chinook, sockeye, and pink salmon were above the most recent 10-year average (1995–2004) and above the 2005 harvest projection. The harvest of coho and chum salmon was below the 2005 harvest projection, largely due to market conditions. The number of permit holders participating in the fishery was well below average. The total exvessel value of the harvest of $22.5 million was 3% above the 1995–2004 average value of $21.9 million.

#### South Alaska Peninsula June Fishery

In February 2004, the Alaska BOF made three changes to the South Unimak and Shumagin Islands June Salmon Management Plan.

(1) The season opened on June 7 (previously June 10).

(2) Fishing periods were established that start at 6:00 AM and run for 88 hours until 10:00 PM three days later. The fishing periods are separated by 32-hour closures with the fishery ending at 10:00 PM June 29.

(3) The South Unimak fishery was expanded to include the entire Southwestern District and the West Pavlof Bay and East Pavlof Bay Sections of the South Central District.

Because of a relatively large harvest of chum salmon, most of the 21 Shumagin Island seiners voluntarily suspended fishing by the afternoon of June 7. Only four seine deliveries were made from the Shumagin Islands during the period June 8–10. When the purse seine permit holders

resumed fishing in the Shumagin Islands on June 12, the chum salmon harvest rates had decreased significantly.

The harvest from the expanded area of the South Unimak fishery (Poperechnoi Island, north side of Dolgoi Island, West Pavlof Bay Section, and East Pavlof Bay Section) was 129 Chinook, 161,000 sockeye, 25 coho, 54,000 pink, and 2,000 chum salmon (Table 7). In the South Unimak fishery, this represented 16% of the Chinook salmon harvest, 37% of the sockeye salmon harvest, 45% of the coho salmon harvest, 14% of the pink salmon harvest, and 1% of the chum salmon harvest. The expanded area of the South Unimak fishery is only open to seine and set gillnet gear and accounted for 72% of the purse seine (69,000 fish) and 80% of the set gillnet (97,000 fish) South Unimak sockeye salmon harvest.

The South Peninsula June fisheries sockeye salmon harvest was 118,000 fish below the 1995–2004 average (1.1 million fish) and 482,000 fish above the 2002–2003 average (522,000 fish). The total exvessel value ($4.1 million) was below the 1995–2004 average of $6.0 million but almost three times the 2002–2003 average of $1.4 million. During 2002 and 2003, fishing time was limited to between 134 and 192 hours (depending on gear type and location) in June, well below the 416 hours fishing time in 2004 and 2005. Fishing effort by all gear types was well below average largely because of low prices. The number of purse seine permit holders participating in the 2005 South Unimak and Shumagin Islands June fisheries was 40 as compared to 38 in 2004. The number of drift gillnet permit holders was 94 in 2005 as compared to 95 in 2004, while the number set gillnet permit holders was 56 in 2005 as compared to 57 in 2004.

**Southeastern District Mainland Fishery**

Based on the CMA sockeye salmon harvest, the SEDM opened to commercial salmon fishing starting at 6:00 AM on June 15. Between June 15–30, there was one 160-hour and one 18-hour period in the entire SEDM and, on July 22–23, one 24-hour period outside the Northwest Stepovak Section (NWSS). The estimated SEDM sockeye salmon harvest, considered Chignik-bound through July 25, was 171,000 fish. This constituted 12% (6% allocation) of the total Chignik-bound sockeye salmon harvest through July 25.

Beginning July 1, the NWSS of the SEDM was managed based on the Orzinski Lake sockeye salmon run and a sockeye salmon harvest in the CMA of at least 600,000 fish. Four fishing days were allowed in the NWSS through July 25. Orzinski Bay was open continuously July 22–25. The sockeye salmon harvest in the NWSS from July 1–25 was 22,000 fish. The Orzinski Lake sockeye salmon escapement was below interim escapement objectives through July 21. Beginning July 19, sockeye salmon escapement increased substantially into Orzinski Lake; 39,000 adult sockeye salmon passed the weir prior to August 1, surpassing the 15,000–20,000 adult salmon season escapement goal.

The July 26–August 18 harvest in the SEDM was 56 Chinook, 300,000 sockeye, 28,000 coho, 1.2 million pink, and 70,000 chum salmon. Landings were reported during 22 days during this period for the entire SEDM. Because of lack of processor interest for pink salmon, and to achieve early coho salmon escapements, the commercial salmon fishery was closed during August 19–31.

The fall fishery opened on September 1 with landings reported by set gillnets during 12 days through September 21. Purse seine fishing effort consisted of only two deliveries. Coho salmon catch per vessel-day, although highly variable, was mostly above average. Effort was well below

average because of low prices. The cumulative fall fishery harvest (September 1–21) of 0 Chinook, 3,600 sockeye, 5,900 coho, 0 pink, and 260 chum salmon, was below the 1995–2004 average for all species.

**South Peninsula Post-June Fishery**

Prior to the South Peninsula Post-June fishery, the ADF&G conducted a test fishery to determine immature salmon abundance in the Shumagin Islands. Test fishery results on July 5 indicated that the number of immature salmon was below the regulatory threshold (100 per set) at 37 immatures per set. 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 was at levels similar to the 2004 season during the Post-June fishery. Fishermen did not generally fish for pink and chum salmon aggressively because of low prices. Because of adequate salmon run strength, low effort levels, and limited processing capacity for pink salmon, fishing time in non-terminal areas through July 21 was the maximum allowed under the management plan.

During July 11–21, continuous fishing time was allowed in Canoe Bay and Upper Pavlof Bay in response to an exceptionally strong and early pink salmon run. Chum salmon runs into Canoe Bay also appeared to be moderately strong.

During July 22–31, extensions of fishing time in northern Pavlof Bay and the Canoe Bay, Mino Creek-Little Coal Bay, Belkofski Bay, and Deer Island Sections between the general South Peninsula openings (5 AAC 09.366) provided uninterrupted harvest opportunity. Additional fishing area was also allowed at Thin Point Cove to provide opportunity to harvest sockeye salmon in excess of escapement needs.

In an attempt to preserve a quality product, beginning July 22, one processing company began to limit the fishing time of seiners targeting pink salmon in order to slow the harvest rate to stay within their processing capacity. Another processor put daily limits on the pounds of pink salmon their seiners could deliver.

All of the South Peninsula September harvest was from set gillnet permit holders in the Southeastern District. Fishing time in the Southeastern District was based on coho salmon harvest. Coho harvest rates were above average.

The South Peninsula Post-June harvests of sockeye, and pink salmon were above the most recent 10-year average (1995–2004). The chum salmon harvest was 55% of the 1995–2004 average of 569,000 fish.

The South Peninsula preliminary indexed sockeye salmon escapement of 124,000 fish was above the escapement objective of 62,000–115,000 fish. The South Peninsula indexed total pink salmon escapement of 6.2 million fish was the third largest on record. The South Peninsula indexed total chum salmon escapement of 970,000 fish was well above the escapement goal of 330,400–660,800 fish; 75,000 coho salmon were documented in 20 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 2005, 155 Area M permit holders and 11 Area T permit holders participated in commercial salmon fisheries along the North Alaska Peninsula. This was above the 2004 level when 144 Area M and 1 Area T permits fished, but far below effort levels during the 1990s. The North Alaska Peninsula fishery is predominantly a sockeye salmon fishery, although depending on market conditions, directed Chinook, chum, and coho fisheries occur in some locations. During odd-numbered years, pink salmon catch tends to be incidental to the targeting of other salmon species.

The Chinook salmon harvest of 9,000 fish was more than the 7,500 fish harvest projection. The sockeye salmon harvest of 3.1 million fish was approximately 60% above the 1.9 million fish harvest projection. The coho harvest of 69,000 fish was above the 2005 projection of 50,000 fish, mostly due to market interest by processors and fishermen. The pink salmon harvest of 4,000 fish was the lowest odd-year harvest since 1987 and was far below the 20,000 fish harvest projection. Market conditions limited the harvest of pink salmon on the North Alaska Peninsula during 2005. The chum salmon harvest of only 43,000 fish was far below the projected level of 75,000 fish and was limited by market conditions and run strength.

The Chinook, coho, and pink salmon harvests would have been substantially larger had market conditions been strong, while the low chum salmon harvests were caused by a combination of mediocre runs and a lack of interest by the industry.

The North Alaska Peninsula indexed total Chinook salmon escapement was 31,000 fish. The Nelson (Sapsuk) River escapement (mostly a weir count) was 5,000 fish, which exceeded the goal (2,400–4,400 fish). The respective Black Hills Creek and Steelhead Creek Chinook salmon escapements were 1,200 and 700 fish respectively. The indexed total escapement objectives for both Black Hills and Steelhead Creeks is 600–1,200 Chinook salmon. King Salmon River had a Chinook salmon escapement of 900 fish. The Bear River had an escapement of 1,200 Chinook salmon that migrated mainly up Ridgerunner Creek, which is a tributary of the Bear River. Sandy River had a good Chinook escapement of approximately 3,500 fish. The Meshik River had a strong Chinook salmon escapement of 10,000 fish and the Cinder River had an escapement of 4,400 fish.

The North Alaska Peninsula sockeye salmon escapement was an estimated 1.6 million fish. All sockeye salmon system escapement goals were met or exceeded. The weired systems (Bear, Sandy, Nelson, and Ilnik rivers) accounted for 71% of North Alaska Peninsula sockeye salmon escapement. The total North Alaska Peninsula escapement objective range is 523,000–934,000 sockeye salmon. At the peak of the run, sockeye salmon escapements in most of the North Alaska Peninsula systems were affected by harvest limits imposed by the processors. In the Port Moller Bight to Strogonof Point reach, fish surplus to escapement needs were not harvested due to processor capacity being exceeded, and the fleet was put on daily catch limits by the processors for 18 days.

The North Alaska Peninsula coho salmon escapements were good at major coho salmon producing systems. However, intensive aerial surveys were not flown for coho salmon during 2005 and estimates should be considered minimum. The Nelson (Sapsuk) River escapement was at least 24,000 fish compared to the escapement goal of 18,000 fish. Other major streams surveyed were: Meshik River 10,000 fish, Mud Creek, 9,000 fish, Cinder River 14,000 fish, and the Ilnik Lagoon system 50,000 fish. In all, approximately 137,000 coho salmon were

documented in 29 North Alaska Peninsula streams during 2005. This escapement estimate is conservative because some streams were not surveyed or surveyed prior to the peak of the run.

The North Alaska Peninsula pink salmon escapement was at least 53,000 fish, which is well above the 1995–2003 odd-year average of 21,000 fish. The North Alaska Peninsula is normally a minor pink salmon producer. The Bechevin Bay Section's pink salmon escapement was 8,700 fish as compared to the escapement goal of 1,600 fish.

The North Alaska Peninsula indexed total chum salmon escapement was 297,000 fish, which was within the 220,000–454,000 goal. Due to low prices, there was little fishing effort directed toward North Alaska Peninsula chum salmon. The locations with the largest chum salmon indexed total escapements were: Izembek-Moffet Bay (131,000 fish), Bechevin Bay (55,000 fish), Meshik River (22,000 fish), and Herendeen-Moller Bay (27,000 fish).

## ALEUTIAN ISLANDS AND ATKA-AMLIA ISLANDS AREAS

In 2005, no commercial harvests were reported from the Aleutian Islands and the Atka-Amlia Islands Management Areas. No buyers were available for pink salmon on Unalaska Island and South Alaska Peninsula pink salmon runs were so strong that there was no need for the permit holders to travel to Unalaska. However, analysis of the limited data available indicates that escapements were good.

The U.S. Fish and Wildlife Service operated a weir at McLees Lake on Unalaska Island. During 2005, the weir passed 12,000 sockeye salmon through July 26. This was the lowest sockeye escapement since the project began operations in 2001.

**Table 7.–**Preliminary 2005 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Fishing Area | Chinook | Sockeye | Coho | Pink | Chum | Total |
| Kodiak | 14 | 3,047 | 396 | 30,139 | 477 | 34,073 |
| Chignik | 3 | 1,145 | 7 | 194 | 9 | 1,358 |
| South Peninsula and Aleutian Islands | 4 | 2,337 | 144 | 9,416 | 739 | 12,641 |
| North Peninsula | 9 | 3,116 | 69 | 4 | 43 | 3,240 |
| Alaska Peninsula Total | 14 | 5,453 | 212 | 9,420 | 782 | 15,881 |
| Aleutian Islands | 0 | 0 | 0 | 0 | 0 | 0 |
| Westward Region Total | 31 | 9,644 | 615 | 39,753 | 1,268 | 51,313 |

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

# PRELIMINARY FORECASTS OF 2006 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 2006 fishing year, forecast fisheries are as follows:

| | | |
|---|---|---|
| Southeast | — | pink salmon |
| Prince William Sound | — | pink, chum, and sockeye salmon |
| Copper River/ Copper River Delta | — | sockeye salmon |
| Upper Cook Inlet | — | sockeye salmon |
| Lower Cook Inlet | — | pink salmon |
| Kodiak | — | pink salmon |
| Upper Station (early and late) | — | sockeye salmon |
| Frazer Lake | — | sockeye salmon |
| Ayakulik River | — | 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 (late run) | — | 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, smolt outmigration levels, returns to date from sibling age classes of the projected return, and environmental conditions. 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.

Catch projections based on quantitative forecasts of salmon runs generally reflect potential harvests, and are made for most of major sockeye salmon fisheries as well as for large hatchery runs including pink, sockeye, and chum salmon hatchery runs to the Southeast Alaska, Kodiak, and Prince William Sound areas. However, for other fisheries, including the wild pink salmon fisheries in Southeast Alaska, Prince William Sound, Kodiak, and the South Alaska Peninsula areas, the catch projections are made based on recent catch levels and are reflective of recent levels of fishing effort. Recent harvest levels have been constrained in many areas by historically low fishing effort, thus recent catch levels are reflective of both market conditions and recent levels of salmon runs. Harvest projections for these fisheries may not be indicative of potential harvest levels.

## ACKNOWLEDGMENTS

This report is based on information contributed by Division of Commercial Fisheries biologists located in field offices throughout the state. Hal Geiger, Jim Edmundson, 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 2004 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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# SALMON PROJECTION FIGURES

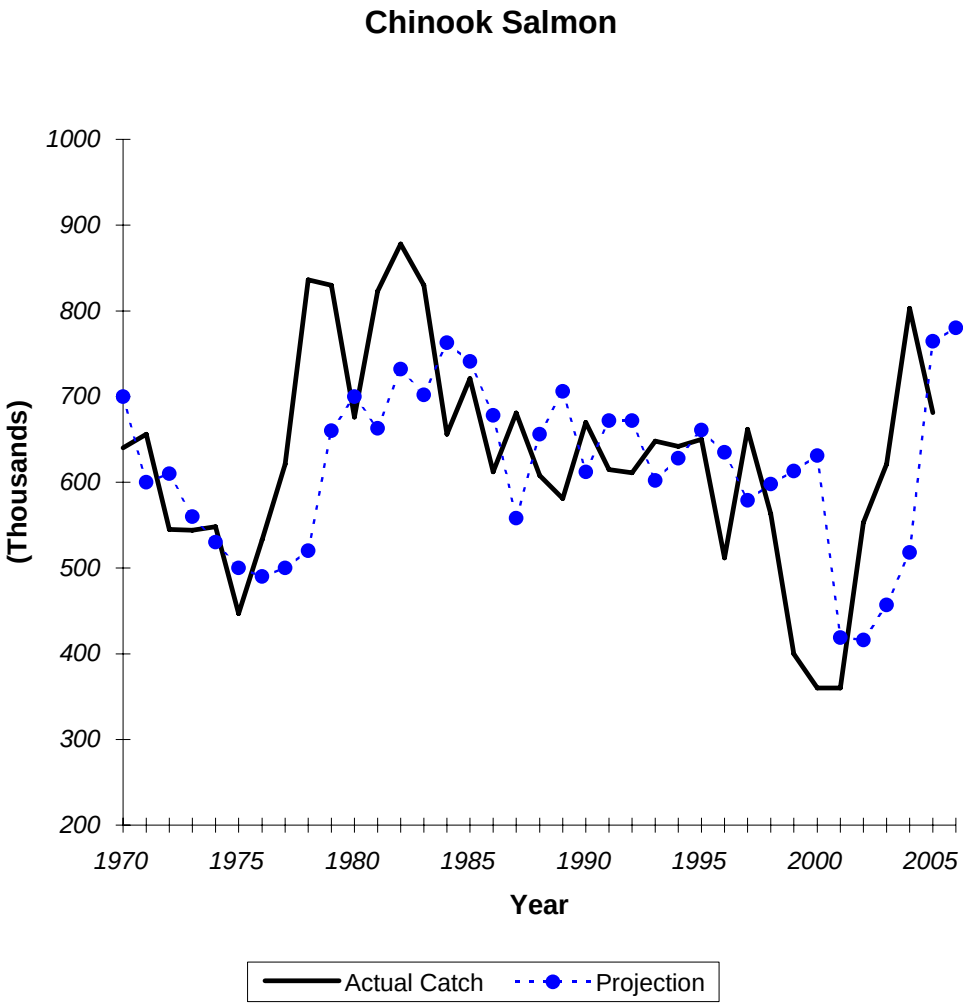


**Figure 2.–**Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970–2005, with the 2006 projection.

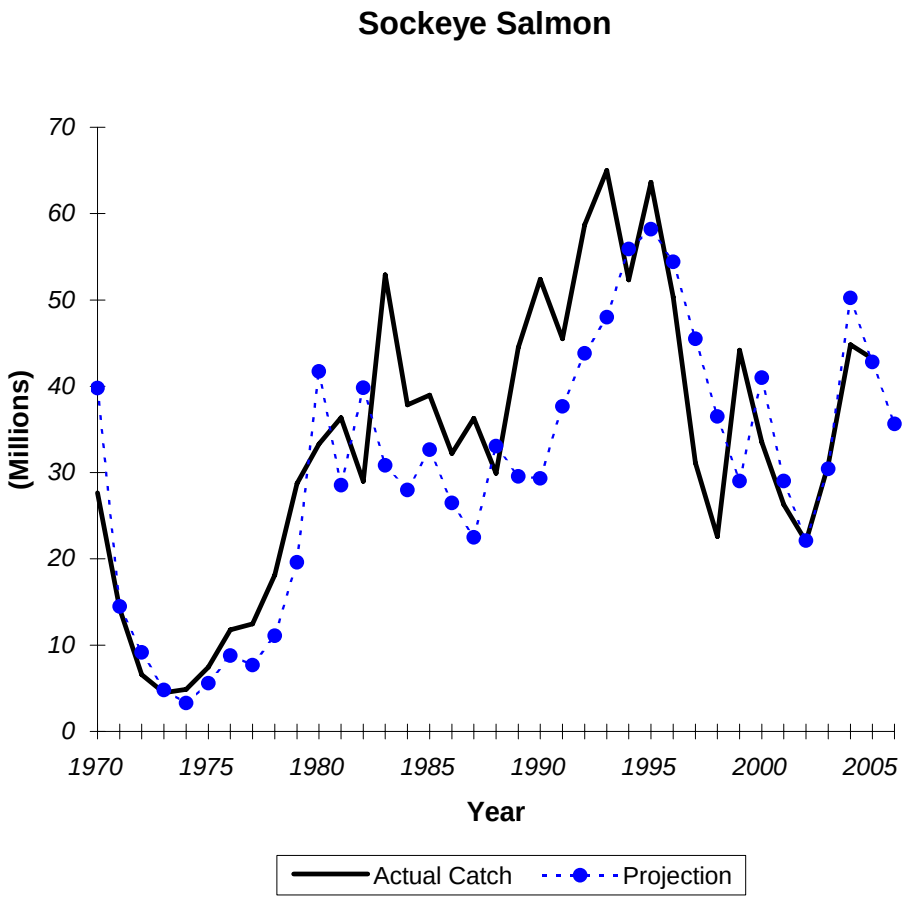


**Figure 3.–**Relationship between actual catch (millions) and projected catch (millions) for Alaskan sockeye salmon fisheries from 1970–2005, with the 2006 projection.

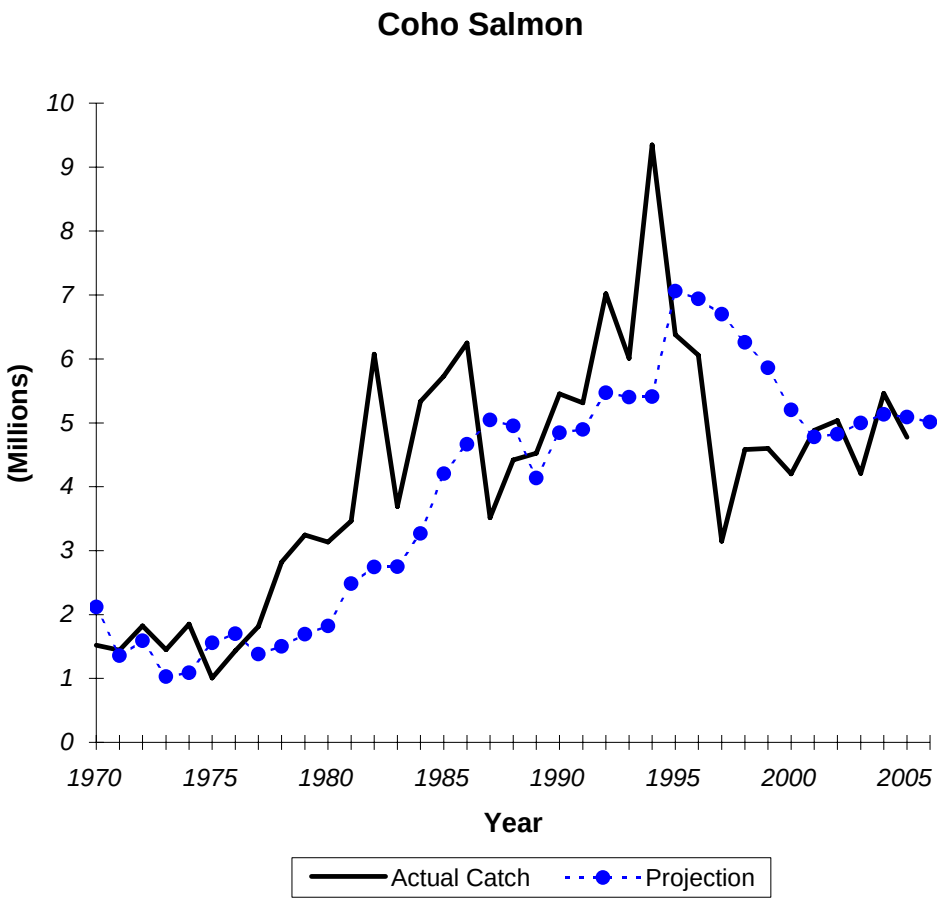


**Figure 4.**–Relationship between actual catch (millions) and projected catch (millions) for Alaskan coho salmon fisheries from 1970–2005, with the 2006 projection.

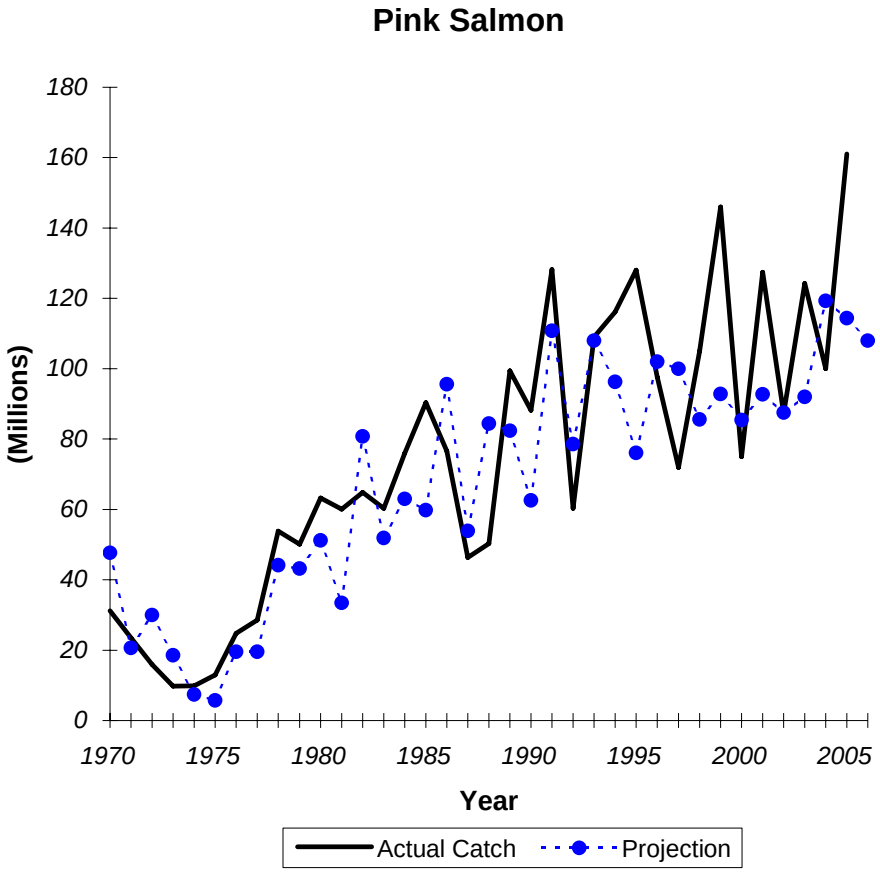


**Figure 5.–**Relationship between actual catch (millions) and projected catch (millions) for Alaskan pink salmon fisheries from 1970–2005, with the 2006 projection.

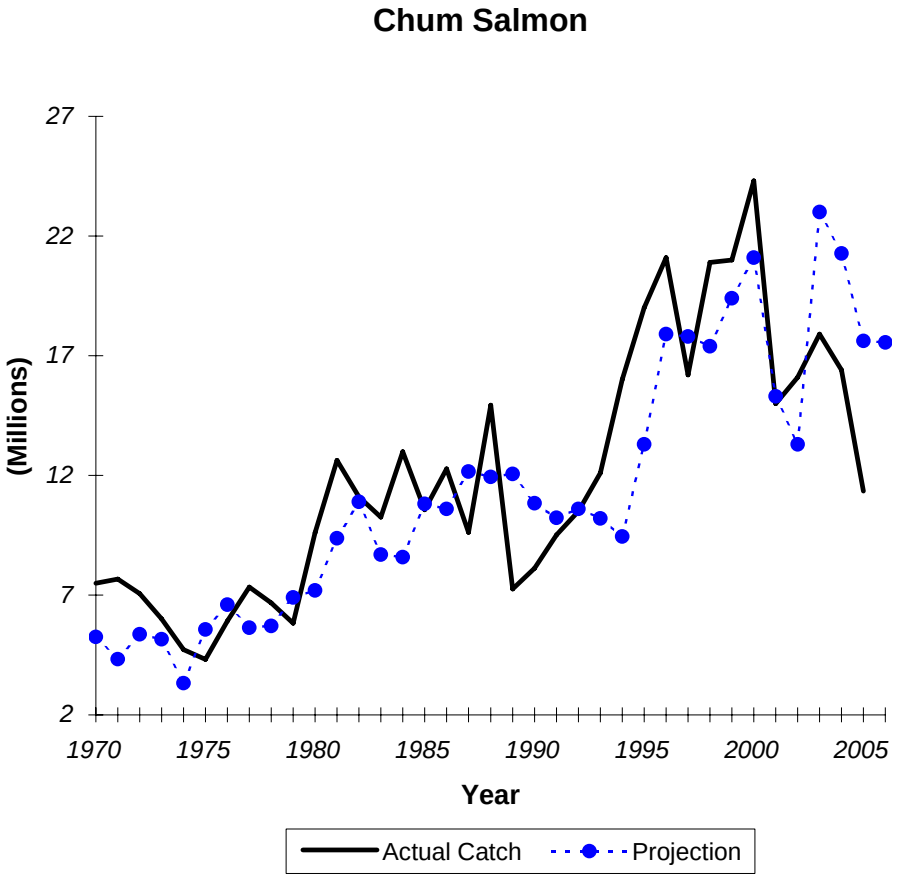


**Figure 6.**–Relationship between actual catch and projected catch in millions, for Alaskan chum salmon fisheries from 1970–2005, with the 2006 projection.

# APPENDIX A

**Appendix A1.–**Southeast Alaska.

**Forecast Area: Southeast Alaska**

**Species: Pink Salmon**

The following categories of pink salmon harvest in Southeast Alaska were obtained by calculating the 20th, 40th, 60th, and 80th percentiles of historical harvest during the 40-year period 1962 to 2001:

| Category | Range (millions) | Percentile |
|---|---|---|
| Disaster | Less than 11 | Less than 20th |
| Weak | 11 to 19 | 21st to 40th |
| Average | 19 to 29 | 41st to 60th |
| Strong | 30 to 52 | 61st to 80th |
| Excellent | Greater than 52 | Greater than 80th |

The pink salmon return in 2006 is predicted to be *Strong* to *Excellent*, with a potential total Southeast Alaska harvest of 52 million fish, with a range of 29 million to 74 million fish. The Strong category represents harvests between the 61st and 80th percentiles of the historical Southeast Alaska pink salmon harvest from 1960 to 2005.

**Forecast Methods**

The forecast of the potential pink salmon harvest in Southeast Alaska in 2006 was based on a time-series technique called *exponential smoothing.* This technique is similar to a running average, except that all harvests since 1960 were used in the analysis (Figure 1). Recent harvest observations were given more weight in the analysis, while past harvest observations were increasingly down-weighted with time; i.e., the older the data, the less influence it has on the forecast. If $x_t$, $x_{t-1}$, ... denotes the observed harvests in year $t$, $t$-1, and so on, then the forecast in year $t$+1 is given by,

$$\hat{x}_{t+1} = cx_t + (1-c)\hat{x}_t \ .$$

The forecast for year $t$, that is $\hat{x}_t$, is also a weighted average of the observed catch in year $t$-1, and the forecast in year $t$-2. This is a kind of recursive equation that contains all of the data in the series. In this case, we choose a value of $c$ to be approximately 0.27, based on minimizing the sum of past squared errors. The forecast range is an 80% confidence interval, calculated by estimating the forecast error in the exponential smoothing technique over the recent 16-year period of high production since 1990 (Figure 1).

**Forecast Discussion**

The parent year escapement appears to have been ample to provide a strong total return in 2006. Brood year escapement indices in 2004 were the 8th highest on record for the region (15.8 million), and were at the upper end or above the recently established sub-regional BEGs. Only 4 of 44 pink salmon stock groups had escapement indices below the management target ranges, while escapement indices in the remaining stock groups were within (16), or above (24) the desired management target ranges.

ADF&G programs designed specifically for collecting data useful for predicting returns of pink salmon in Southeast Alaska were eliminated in 1992. Our ability to forecast the pink salmon harvest is further complicated by recent large-scale changes in the fishing industry. Researchers cannot predict future management actions, fishing conditions, processing capacity, or product demand that drives the harvest each year. These factors have affected recent harvest levels, and in some recent years, our escapement measures indicated that there could have been considerable additional harvest had there been demand for the product.

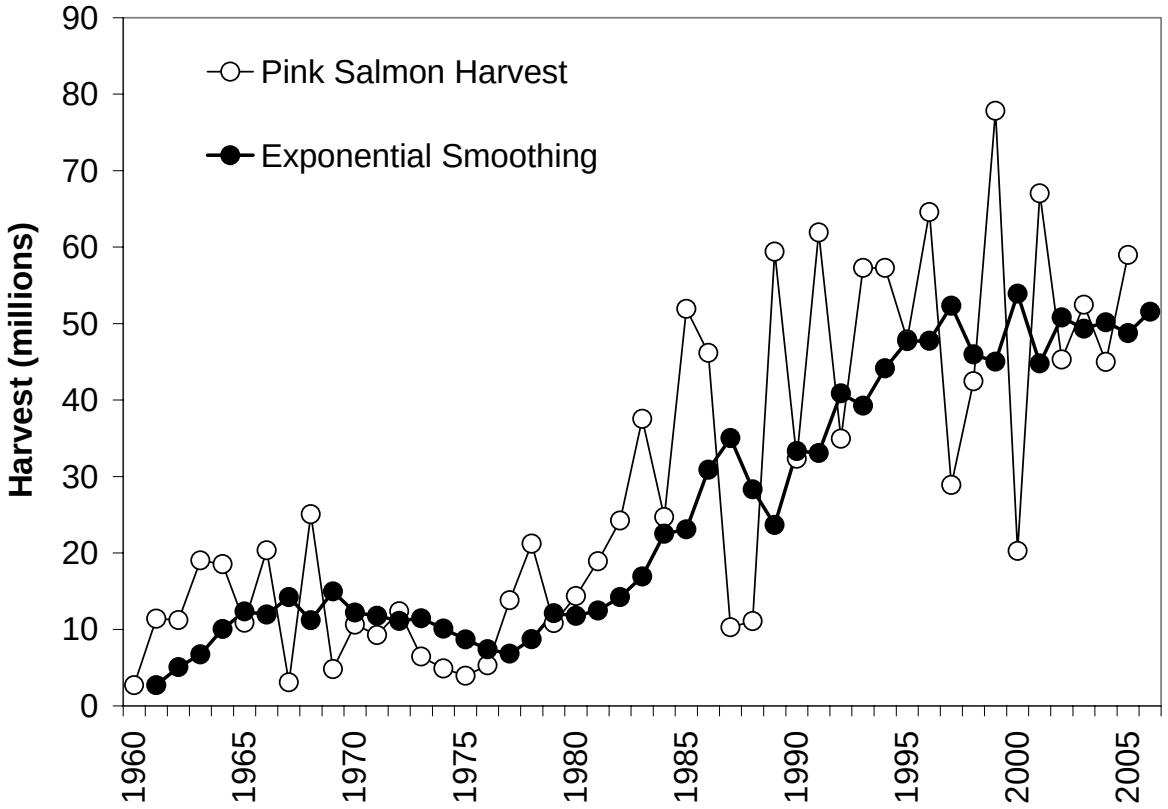


**Figure 7.–** Comparison of annual harvest of pink salmon in Southeast Alaska, and smoothed values of the harvest used in the 2005 forecast model.

Given these facts, we believe a simple, easily explained procedure that tracks the overall trend in harvest will produce a better forecast than complicated analyses based on questionable assumptions or based on spurious correlations. The current forecast does not rely on estimates of total escapement or total run size, as did prior forecasts, because accurate measures of these variables are not currently available. Because it is strictly based on historical harvests, this new method of forecasting does not directly forecast the amount of fish that might be available for harvest. This is the third year we have used exponential smoothing to forecast the harvest. The last two forecasts have been accurate to within 5 million fish and 10 million fish; or about 10%–20% of the forecast.

The department will manage fisheries inseason based on the strength of salmon runs. Aerial escapement surveys and fishery performance data will continue, as always, to be essential in making inseason management decisions.

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Xinxian Zhang, Biometrician, Douglas
Hal Geiger, Fishery Biologist, Douglas

**Appendix A2.–**Prince William Sound.

**Forecast Area: Prince William Sound**

**Species: Pink Salmon**

| Preliminary Forecast of the 2006 Run: | Forecast Estimate (Thousands) | Forecast Range (Thousands) |
|---|---|---|
| **Natural Production:** | | |
| *Prince William Sound General Districts* | | |
| Total Run | 4,660 | 1,300–8,030 |
| Escapement Goal[a] | 2,000 | |
| Harvest Estimate | 2,660 | 0–6,030 |

[a] The escapement goal of 2.0 million pink salmon is the midpoint of the sustainable escapement goal range (1.25-2.75 million).

**Forecast Methods**

The predicted natural run of pink salmon is the average total run for the even years 1996–2004. The total run by year was estimated as the total natural contribution to commercial harvests combined with the escapement index calculated as the area under the curve of weekly aerial escapement surveys adjusted for an estimate of stream life. The natural pink salmon contributions to the Commercial Common Property Fishery were estimated by subtraction of hatchery stock estimates based on thermal marked otolith recoveries (1997–2005), coded wire tag recoveries (1985–1996), or average fry-to-adult survival estimates times fry releases numbers and an estimate of exploitation rate. The prediction procedure differs from the 1997–1999 method that used linear regressions of adult production versus brood year escapement index. Prior to 1997, forecast methods employed surveys of preemergent fry; however, surveys of preemergent fry have not been conducted since 1995. The forecast range is the 80% prediction interval about the mean total brood year return. The prediction interval was calculated as the average total run (even years 1996–2004) plus or minus the standard deviation times the *t*-value.

**Forecast Discussion**

Beginning in 2004, the department stopped producing hatchery pink salmon forecasts because the hatchery operators were already producing forecasts for their releases. Forecast methods examined for the 2006 natural run included 1) using the previous even-brood-year total run to predict the 2006 total run (most naïve forecast method), 2) using total run averages with 2–20 years of data, and 3) using the linear regression of log-transformed total PWS escapement versus log-transformed total PWS return by brood line. These methods were only moderately successful when tested against the estimated actual total runs. The forecast was generated from the 1996–2004 even-brood year average run because it had the lowest mean absolute percentage error.

The brood year 2004 escapement index (1,996,223) was the fourth largest observed even brood year escapement since 1964. If the total run forecast is realized, it will be the 11th largest among the 23 even brood years, 1960–2004.

With assistance from the Exxon Valdez Oil Spill Trustee Council and PWS Fisheries Research Application and Planning group, future enhancements to forecasting accuracy may come from examining early marine survival; zooplankton abundance and distribution; and juvenile pink salmon migration corridors. Other research examining pristine levels in blue mussels and juvenile pink salmon size and abundance during their early marine life stage may provide a more accurate preseason total run forecast in the future.

In 2005, the Department conducted a feasibility study examining the use of passive integrated transponder tags. If this technology is used on a large scale it may provide much more robust estimates of early marine survival of pink salmon migrating into the Gulf of Alaska.

Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

**Appendix A2.–**Page 2 of 4.

**Forecast Area: Prince William Sound**

**Species: Chum Salmon**

| Preliminary Forecast of the 2006 Run: | Forecast Estimate (Thousands) | Forecast Range (Thousands) |
|---|---|---|
| **Natural Production:** | | |
| *Prince William Sound General Districts* | | |
| Total Run | 531 | 380-680 |
| Escapement Goal[a] | 200 | |
| Harvest Estimate | 331 | 180-480 |

[a] The escapement goal of 91,000 chum salmon is the minimum threshold for the sustainable escapement goal range. It is the intention of ADF&G to manage for the long-term escapement mean of 200,000 chum salmon among all Districts with an existing Sustainable Escapement Goal (SEG).

**Forecast Methods**

The forecast of the total natural chum salmon run was calculated as the 2001–2005 average. The total natural run by year was estimated as the total commercial harvest contribution combined with the escapement index calculated as the area under the curve of weekly aerial escapement surveys adjusted for an estimate of stream life. The Commercial Common Property Fishery harvest contributions of natural stock chum salmon were estimated using prehatchery average wild runs (2001 and 2002) or thermally marked otolith estimates (2003–2005) for the Coghill, Eshamy, and Montague Districts. The forecast range is the 80% prediction interval about the five-year mean run size. The prediction interval was calculated as the average total run (even years 1996–2004) plus or minus the standard deviation times the *t*-value.

**Forecast Discussion**

Beginning in 2004, the department stopped producing hatchery chum salmon forecasts because the hatchery operators were already producing forecasts for their releases. Our ability to accurately forecast natural chum salmon stocks is limited by the small amount of data available. Estimates of natural stock contributions to the commercial common property fishery were unavailable prior to 2003. In 2003, 2004, and 2005, natural chum salmon contribution, estimates based on thermally marked otoliths were available for the Coghill and Montague Districts and for the Eshamy District in 2004 and 2005. Historical age data from escapements and the commercial common property fishery harvests are unavailable for most districts of PWS. If this total run is realized it will be the 19th largest since 1970.

Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

**Appendix A2.–**Page 3 of 4.

**Forecast Area: Prince William Sound**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run: | Forecast Estimate (Thousands) | Forecast Range (Thousands) |
|---|---|---|
| **Natural Production:** | | |
| *Prince William Sound-Coghill Lake* | | |
| Total Run | 54 | 0–170 |
| Escapement Goal[a] | 30 | |
| Harvest Estimate | 24 | 0–140 |
| *Prince William Sound-Eshamy Lake* | | |
| Total Run | 45 | 9–82 |
| Escapement Goal[a] | 30 | |
| Harvest Estimate | 15 | 0–52 |
| **Total Production:** | | |
| Run Estimate | 99 | 9-189 |
| Escapement Goal | 60 | |
| Common Property Harvest | 39 | 0-129 |

[a] The escapement goal of 30,000 sockeye salmon for both Coghill and Eshamy Lakes is the midpoint of the escapement goal range. The escapement goal range for both systems is 20,000-40,000 sockeye salmon.

**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 with log-transformed data were used to predict returns of age-1.2 and age-1.3 sockeye salmon. The return 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 to predict the run of age-1.2 fish in 2006 used the run of age-1.1 fish in 2005 as the input parameter. The predicted returns of age-1.1, age-2.2, and age-2.3 sockeye salmon were calculated as the 1974–2005 mean return of that age class. Although harvest 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 80% prediction intervals were calculated using the mean square error of the past five years of preseason forecasts.

For an off-cycle year such as 2006, the forecast of the natural run to Eshamy Lake is the mean of the runs from the year after the peak year in the four-year cycle. Eshamy Lake escapements have been enumerated at a weir since 1950, except for years 1987 and 1998. Commercial harvest data are available for the same period, but age composition data are available for only some years since 1962.

Data collected since 1970, excluding 1987 and 1998, were used to calculate the forecast and the 80% prediction interval.

The PWS total run and common property harvest forecasts were calculated as the sum of the Coghill and Eshamy Lakes midpoint forecasts. The 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for Coghill and Eshamy Lakes.

**Forecast Discussion**

Beginning in 2004, the department stopped forecasting hatchery runs of sockeye salmon to the Main Bay Hatchery (MBH) because the hatchery operators were already producing forecasts for these releases. Coghill Lake has very dynamic limnological characteristics that can significantly impact the sockeye salmon population. Studies conducted in the mid 1980s and early 1990s found the lake may be zooplankton limited. As a result, the BEG was lowered in 1992 (40,000–25,000) 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 2005, current data were reviewed and the midpoint escapement goal remained unchanged; although the goal type was changed from a BEG to a SEG. Also, in 2002 the department began collecting limnological data to monitor the basic lake characteristics. The Coghill Lake natural run escapement has been within or above the BEG range every year since 1995.

The Eshamy Lake natural stock appears to exhibit a four-year cycle. The 2006 run should be one year after the peak year in the cycle. The spawning escapement goal was met in 2005 with 23,523 sockeye salmon enumerated past the Eshamy River weir.

The Eshamy Lake natural stock is the largest natural stock contributor to the commercial common property fishery harvests of sockeye salmon in PWS 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, only periodic collection of age, sex, and size data has occurred for the Eshamy and Southwestern District the commercial common property fishery sockeye salmon harvests. Contributions to the commercial common property fishery harvests in western PWS of sockeye salmon produced by the MBH have been estimated by recovery of coded wire tags and thermally marked otoliths. However, not all harvests can be adequately sampled, increasing the uncertainty of total run estimates for all natural and enhanced sockeye salmon stocks in western PWS. Age composition data and weir counts were not collected in 1987 and 1998 because of budget reductions. The on-going Eshamy River weir operation and thermal otolith marking of MBH sockeye salmon should allow more accurate estimates of total Eshamy Lake natural runs.

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Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

**Appendix A3.–**Copper River.

**Forecast Area: Copper River/Copper River Delta**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run: | Forecast Estimate (Thousands) | Forecast Range (Thousands) |
|---|---|---|
| **Natural Production:** | | |
| Total Run | 1,489 | 817–2,161 |
| Escapement Goal[a] | 530 | |
| Common Property Harvest[b] | 959 | 516–1,403 |
| **Hatchery and Supplemental Production:** | | |
| *Prince William Sound Aquaculture Corp.–Gulkana Hatchery* | | |
| Hatchery Run | 379 | 208–550 |
| Broodstock Needs | 20 | |
| Supplemental Escapement[c] | 106 | |
| Common Property Harvest[b] | 253 | 136–370 |
| **Total Production:** | | |
| Run Estimate | 1,868 | 1,025–2,711 |
| Natural Escapement Goal | 530 | |
| Broodstock Needs | 20 | |
| Supplemental Escapement[c] | 106 | |
| Common Property Harvest[d] | 1,212 | 588–1,837 |

[a] The escapement goal of 530,000 sockeye salmon is the historical average spawning escapement (361,000) of the upper Copper River (spawning escapement range: 300,000–500,000) combined with the historical average Copper River delta aerial survey peak count ×2 (spawning escapement range 55,000–130,000). The average Copper River delta peak count of 84,500 is multiplied by 2 to adjust for surveyor efficiency, i.e. we assume surveyors count 50% of total fish. No adjustment is made for freshwater residence time.

[b] Includes the harvests from commercial, subsistence, personal use, and sport fisheries.

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

[d] Includes the harvests from commercial, subsistence, personal use, and sport fisheries. The commercial common property harvest is estimated to be ~ 1,007,000 sockeye salmon.

## Forecast Methods

The forecast of natural run sockeye salmon to the Copper River is the total of estimates for six age classes. Linear regression models with log-transformed data were used to predict returns for age-1.2, age-1.3, and age-2.2 sockeye salmon. The return 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 to predict the return of age-1.3 fish in 2006 used the return of age-1.2 fish in 2005 as the input parameter. Finally, predicted return 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 run and harvest forecasts were calculated using the mean square error of the 1984–2005 total run or harvest forecasts.

Forecast methods for 2006 are similar to forecast methods since 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. 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 age specific smolt-to-adult survival estimates from brood years 1995–1998. The survival estimates were calculated using coded wire tag recoveries in harvests and enumerated adult escapements. The forecast of supplemental production from Gulkana I and Gulkana II Hatcheries was estimated from the total fry release and a fry to adult survival of 0.8%. The return was apportioned to return year using a maturity schedule of 13% age-4 and 87% age-5. The average estimated exploitation rate (67%) for 2000–2004 was used to project the total harvest of Gulkana Hatchery stocks in 2006. 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 the dominant age class (age-5) of the forecast year. Because average return-per-spawner values do not reflect recent production trends, and because returns are still incomplete from the most recent brood years, linear regressions of brood-year sibling returns were used to produce forecasts beginning in 1998. Additionally, more precise estimates of survival and contributions from supplemental production for individual brood years and release locations were available through coded wire tag recoveries in harvest and escapements for brood years 1995–1998.

Historical estimates of Gulkana Hatchery production are considered imprecise. Improved contribution estimates for brood years 1995–1998 indicate large contributions from supplemental production and smolt-to-adult survival estimates for Crosswind Lake releases that averaged ~ 20%. Returns from fish marked with strontium chloride (Sr) began in 2003 (age-4 fish) and the majority of the adult run (age-4 and age-5 fish) was marked beginning in 2004. Fish from all release locations (Gulkana I and Gulkana II sites; Crosswind and Summit Lakes) are now marked, but all fish now have the same mark. We can now estimate the total contribution of enhanced fish to all Gulkana Hatchery releases, but unless different marks for individual releases can be developed, future forecasts will be limited to using fry-to-adult survival estimates and estimated maturity schedules to forecast total enhanced production.

The 2006 run will be composed primarily of returns from brood years 2001 and 2002. Miles Lake sonar counts were significantly higher than anticipated for most of 2001; however, the 2002 escapements were generally slightly below the minimum objective until early July. Five-year-old fish (brood year 2001) are expected to predominate Copper River delta and upper Copper River runs. The total common property harvest range was calculated by subtracting the broodstock and escapement goal from the lower and upper bounds of the total run. The 2006 total run forecast is about 210,000 fish below the 20-year average (1985–2004 = 2.08 million). If realized, the 2006 forecast total run would be the 13th largest since 1978 and just above the 2004 total run. The 1.49 million natural run would be below the recent 20-year average (1985–2004 = 1.85 million), and a 380,000 Gulkana Hatchery run would equal the 1995–2004 average.

Steve Moffitt, Fisheries Biologist III, PWS Research Project Leader, Cordova

**Appendix A4.–**Upper and Lower Cook Inlet.

**Forecast Area: Upper Cook Inlet**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (millions) | Forecast Range (millions) |
|---|---|---|
| **Natural Production** | | |
| Total Run | 3.6 | 0.3–7.0 |
| Escapement Goal | 1.5 | |
| Harvest Estimate | 2.1 | |

**Forecast Methods**

The major sockeye salmon systems in Upper Cook Inlet (UCI) are the Kenai, Kasilof, Susitna and Crescent Rivers, and Fish Creek. Spawner, sibling, fry, and smolt data, if available, were examined for each system. Four models were used to forecast the return of sockeye salmon to UCI in 2006: 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. In most cases, sibling relationships were used. The return of age-1.3 sockeye salmon to the Kenai River in 2006 was forecast using the fry model. The fry-model prediction was based on the abundance of sockeye salmon fry rearing in Skilak and Kenai lakes in the fall of 2002. The abundance of smolts emigrating from Tustemena Lake (estimated by the Cook Inlet Aquaculture Association) was used to forecast returns of sockeye salmon to the Kasilof River in 2006. This is the fifth time this model has been used. The aggregate escapement goal is the sum of the upper end of the escapement goal ranges for each of the major sockeye salmon producing systems in UCI. An approximate 80% 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**

In 2005, the commercial harvest of sockeye salmon in UCI was 5.1 million, while the preseason forecast was 4.1 million. The higher than expected commercial harvest in 2005 was largely due to a stronger than expected return of five-year-old sockeye salmon to the Kenai and Kasilof rivers. In 2005, the total return of sockeye salmon was 5.5 million to the Kenai River, 1.2 million to the Kasilof River, 143,000 to the Susitna River, 173,000 to the Crescent River, and 22,000 to Fish Creek. The forecast return of sockeye salmon in 2005 was 3.3 million to the Kenai River, 911,000 to the Kasilof River, 432,000 to the Susitna River, 160,000 to the Crescent River, and 27,000 to Fish Creek.

A run of 3.6 million sockeye salmon is forecasted to return to Upper Cook Inlet in 2006 with a harvest by all user groups of 2.1 million sockeye salmon. The forecasted harvest in 2006 is about 2.5 million fish below the 20-year average harvest. A fry model was used to forecast the return of age-1.3 sockeye salmon to the Kenai River. The fry model predicted a return of 1.1 million age-1.3 sockeye salmon to the Kenai River, which is less than half of the 20-year average return for this age class. The fry model has provided more accurate forecasts of age-1.3 sockeye salmon runs to the Kenai River than the sibling model in five of the past nine years, but this year the sibling model forecast of 900,000 fish was similar to the fry model forecast. The forecast return to the Kasilof River is slightly below the 20-year average return of 957,000. Smolt models were used to forecast the returns of sockeye salmon to Kasilof River in 2006. Smolt models for Kasilof River salmon have provided more accurate forecasts than other models over the past 10 years. Age-1.2 and age-1.3 sockeye salmon typically comprise about 69% of the run to the Kasilof River. These fish emigrated from Tustemena Lake as smolts in 2003 and 2004. The smolt population estimate in 2003 was the third highest since 1981, while the smolt population estimate in 2004 was near the long-term average. The forecast return to Susitna River is much lower than the 20-year average return of 468,000. Age-1.3 and age-2.3 sockeye salmon typically comprise 68% of the run to this system. The below average

forecast is due to the poor runs of age-1.2 and age-2.2 sockeye salmon in 2005, which were used to forecast the runs of age-1.3 and age-2.3 sockeye salmon in 2006 using sibling models. The forecast return to Fish Creek is only 27% of the 20-year average return of 164,000. Age-1.2 sockeye salmon typically comprise 58% of the run to this system. Only 32,300 age-1.2 sockeye salmon are forecast to return to Fish Creek in 2006. This forecast is based upon a count of only 256,000 sockeye salmon smolts emigrating in 2004, which is 40% of the 20-year average smolt abundance in this system.

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

| System | Run | In River Goal |
|---|---|---|
| Crescent River | 125,000 | 30,000–70,000 |
| Fish Creek | 44,000 | 20,000–70,000 |
| Kasilof River | 937,000 | 150,000–250,000 |
| Kenai River | 1,849,000 | 650,000–850,000 |
| Susitna River[a] | 190,000 | 175,000–312,000 |
| Minor System | 727,000 | N/A |

[a] The in-river goal listed for Susitna River sockeye salmon is based upon the escapement goal range for Yentna River sockeye salmon expanded (× 1.95) to the entire watershed.

Mark Willette, Research Project Leader, Upper Cook Inlet

**Forecast Area: Lower Cook Inlet**

**Species: Pink Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Natural Production** | | |
| Total Run | 644 | 189–2,651 |
| Escapement[a] | 335 | 114–604 |
| Commercial Harvest[b] | 309 | 76–2,047 |
| **Supplemental Production**[c] | | |
| Total Run | 691 | 531–903 |
| Broodstock and Escapement | 200 | 200 |
| Commercial Harvest | 491 | 331–703 |
| **Total Area Production**[d] | | |
| Total Run | 1,335 | 721–3,554 |
| Broodstock and Escapement | 535 | 314–804 |
| Commercial Harvest | 800 | 407–2,750 |

Note: Columns may not total exactly due to rounding to the nearest thousand fish.

[a] Escapement values include an escapement goal shortfall of 35,000 fish for systems with a forecast in 2006.

[b] Commercial Harvest = Total Run–Escapement/Broodstock.

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

[d] 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 29–40 years of observations. An 80% 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. The supplemental production forecast for the Port Graham Hatchery was based on a marine survival rate of 2.6%. 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 has correctly predicted 37 out of 44 changes in direction of annual run size. In 2004, the last even-numbered year, 11 of 11 systems forecasted had runs within the forecast range. The 2006 forecast for natural production of 644,000 pink salmon has an 80% confidence interval of 189,000 to 2.65 million fish. Relatively strong parent-year escapement and fairly good marine survival in 2004–2005, as indicated by hatchery returns, suggests there is a strong likelihood of reaching at least the mid-point estimate of this forecast. If realized, a natural run of 644,000 pink salmon would be about 16% higher than the median run size of 553,000 fish for even-year returns between 1960 and 2004. The pink salmon escapement goal is 370,000 fish (range 136,000–604,000) for systems with a forecast. If the run comes in as forecast, the mid-point of the escapement goal range should be met for eight of our 11 index streams. If the lower end of the forecast range is realized, a combined escapement shortfall of 21,900 fish is expected, primarily from Humpy Creek and Bruin Bay. The resulting escapement forecast would then be 114,000 pink salmon.

The harvestable surplus of naturally produced pink salmon in the Southern District is projected to be 71,000 fish, relatively evenly split between the Seldovia and Port Graham rivers. Humpy Creek is expected to have a 9,000 fish escapement goal shortfall if the mid-point of the 2006 forecast is realized. Supplemental production of pink salmon in the Southern District has contributed from 24%–90% of the total Lower Cook Inlet commercial harvest in recent years. However, the Tutka Hatchery, which historically generated the majority of the supplemental production of pink salmon in Lower Cook Inlet, ceased egg-take operations in 2004 and realized its final adult return in 2005. Similar to 2003–2004, the winter of 2004–2005 produced fairly good ocean survival rates for Tutka Bay and Port Graham Hatchery pink salmon. The Port Graham Hatchery released 26.6 million fry in 2005. That facility is assuming a marine survival rate of 2.6% and is expecting nearly 691,000 pink salmon to return to Port Graham Bay in 2006 (P. McCollum, Sound Fisheries, personal communication). The 2006 brood stock goal for the Port Graham Hatchery is 200,000 fish. Because cost recovery requirements are dependent upon inseason fish prices, the allocation of hatchery-produced 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 208,000 fish, with over 57% (119,000 fish) of the harvest expected to occur in the Port Dick subdistrict. If realized, the Port Dick harvest would be about 65% of the mean even-year catch since 1960. Harvests ranging from 4,000–29,000 fish are anticipated from Port Chatham, Nuka Island, Windy Bay, and Rocky Bay.

In the Eastern District, an escapement goal shortfall of fewer than 1,000 pink salmon is projected for Resurrection Bay. 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 (RBSMP), which limits commercial interference with the sport coho salmon fishery.

In the Kamishak Bay District, the number of naturally produced pink salmon available for harvest is projected to be 30,000 fish, all of which is expected to occur in the Ursus/Rocky Cove subdistrict. An escapement goal shortfall of 25,000 fish is forecasted for Bruin Bay. If realized, the Ursus/Rocky Cove harvest of 30,000 fish would be over two times the mean even-year catch since 1960 for this index area. However, low market value and lack of tender service and available buyers have limited the incentive to harvest pink salmon in the Kamishak District in recent years.

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Edward O. Otis, LCI Research Biologist, Homer
Lee F. Hammarstrom, Area Finfish Management Biologist, Homer

**Appendix A5.**–Kodiak.

## Forecast Area: Kodiak

## Species: Pink Salmon

| Preliminary Forecast of the 2006 Harvest | Harvest Forecast (millions) |
|---|---|
| Wild Stock Production: Strong | 10.0–14.0 |
| Kitoi Bay Hatchery Production | 5.5–7.9 |
| 2006 Total KMA Pink Salmon Harvest | 15.5–21.9 |
| **Wild Stock Production by District:** | |
| Afognak | 0.9–1.3 |
| Westside | 6.9–9.7 |
| Alitak | 1.1–1.5 |
| Eastside | 1.1–1.5 |

### Forecast Methods

The Kodiak Management Area (KMA) wild stock pink salmon harvest forecast is derived from a total run forecast minus the KMA escapement goal (2.0 million–5.0 million). Return is forecasted based on escapement estimates from weirs on two large indicator systems and total run estimates. The total run estimates were derived from a combination of several weir estimates, from aerial surveys and from harvest data. For the 2006 KMA forecast, Ricker spawner-recruit models were fit to the combined even-year Ayakulik and Karluk Rivers' escapement and subsequent KMA pink salmon returns from 1978–2002 (not including the Mainland District). Both an additive and multiplicative model were employed and estimates compared. Because of the uncertainty associated with an estimate that is modeled from a large return of multiple stocks, the harvest forecast is given as a category rather than a point estimate.

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 below.

| 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 2006 Kitoi Bay Hatchery (KBH) pink salmon forecast was prepared by evaluating pink salmon survivals from brood years 1990–2003, when releases from the facility were in excess of 100 million fry and average marine survival was 4.02%. Brood years 1996–2003 were particularly important to the forecasting model because all pink fry were released (1997–2004) on the same day in order to saturate the release area with fry. The average marine survival was 5.79% during this period. In 2005, there were 136,287,250 pink fry released, averaging 0.62 g, or slightly smaller than the five-year average release size of 0.69 g. Another forecasting consideration relates to cyclical returns that have held fairly consistent over the last twelve years. Every other even-year return has been consistently strong and marine survival has averaged 4.07%. The return in 2006 is expected to be one of these historically higher-than-average even-year returns. The midpoint of the forecast range was calculated using a marine survival estimate of 4.93%, which is the average of two values; the average survival of the four-year cycle return (4.07%) and the average survival of brood years 1996–2003 (5.79%).

The forecast range was calculated using the two individual survival values (low = 4.07%; high = 5.79%).

**Forecast Discussion**

Two Ricker spawner-recruit models were used to examine the relationship of the 1978 to 2002 even-year Ayakulik and Karluk River escapements to the total KMA return. When escapement goals (2.0 million–5.0 million) are applied, harvest projections for wild pink salmon stocks in the KMA are in the *strong* category.

For the KBH pink salmon, the broodstock requirement is 335,000, so the midpoint projected harvest is 6.38 million pink salmon. The 6.38 million harvest includes a KBH cost recovery harvest. Cost recovery levels have previously been between 1.58 million and 2.64 million fish and the cost recovery is expected to fall into this range again in 2006. The expected return of 6.72 million fish would be the second largest even-year return to KBH.

Combining the 2006 pink salmon wild and hatchery production suggests that the total KMA pink harvest will likely be *excellent* (greater than 14 million). This forecast level will allow an initial weekly fishing period length of 105 hours (4½ days) for most of the KMA during the initial general pink salmon fisheries (beginning July 6, 2006). By the fourth week of July, fishing time may be extended or restricted, by section or district, as true run strengths become known.

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Ivan Vining, Biometrician, Kodiak
Jeff Wadle, Assistant Area Management Biologist, Kodiak
Kevin Brennan, Area Management Biologist, Kodiak
Drew Aro, Kitoi Bay Hatchery Manager, Kodiak

## Forecast Area: Kodiak, Spiridon Lake

### Species: Sockeye Salmon

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 161 | 143–183 |
| Escapement Goal | 0 | |
| Harvest Estimate | 161 | 143–183 |

### Forecast Methods

The Spiridon Lake enhancement project requires annual releases of juvenile sockeye salmon into the lake to produce adult returns for harvest in the commercial fishery. Late-run Upper Station sockeye salmon was the initial brood source selected for this project. However, as the project evolved, Saltery Lake sockeye salmon replaced Upper Station sockeye salmon as the brood source in 1998 because the run timing of the stock was more appropriate for management purposes. An experimental release of Saltery Lake sockeye salmon into Spiridon Lake was conducted earlier in 1995. In an attempt to more precisely forecast the adult returns to Telrod Cove, only the estimated age composition of the adult returns from the Saltery Lake brood stock were used (1995, 1998–2000).

The 2006 Spiridon Lake forecast estimate was based on the 2003–2005 smolt outmigration estimates, average smolt-to-adult survival rates, and the average age compositions of adult returns to the Spiridon Bay Special Harvest Area (SBSHA) from the 1995 and 1998–2000 juvenile stocking years.

Sockeye salmon smolt outmigrating in the spring (May–June) from Spiridon Lake were trapped, counted, and a portion of the outmigration was sampled for age (scales) and size data. Age composition estimates were used to assign ages to the seasonal outmigration. The 2003 smolt outmigration was composed of approximately 229,000 age-1. smolt and 35,000 age-2. smolt. In 2004, approximately 541,000 age-1. smolt and 37,000 age-2. smolt outmigrated from Spiridon Lake, and approximately 1.4 million age-1. and 48,000 age-2. smolt outmigrated in 2005.

Dividing the total adult return by the number of smolt that outmigrated from Spiridon Lake resulted in an average smolt-to-adult survival of 36.4% from stocking years, 1995 and 1998–2000. The 2003–2005 annual smolt outmigration estimates by age were multiplied by 36.4% to calculate adult sockeye salmon returns by freshwater age.

The estimated returns for age-1. and age-2. smolt were multiplied by the average age-at-return (1.1, 1.2, 1.3, 2.1, 2.2, and 2.3) percentages to generate an estimate of returning fish by ocean age (and year). The results for each age class were summed to calculate a forecast estimate for the 2006 run. The range was generated by using the lowest (32.3%) and highest (41.5%) smolt-to-adult survival rates observed for these stocking years.

### Forecast Discussion

Adult sockeye salmon are prevented from returning to Spiridon Lake due to a series of impassable falls in the outlet creek (Telrod Creek). Therefore, all returning adult sockeye salmon are available for harvest in the traditional fishing areas and in the SBSHA, which is located at Telrod Cove. The 2006 forecast is greater than the 2005 forecast (104,000) by 57,000 and also greater than the actual 2005 run estimate (137,000) by about 24,000. The 2006 run should be composed of approximately 74% ocean-age-2 and 24% ocean-age-3 fish. If realized, this run will be 121,000 fish less than the recent 12-year average (1994–2005) run of 282,000. Spiridon Lake sockeye salmon are expected to return in late June with the run ending by mid August.

Steve Schrof, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Ayakulik River**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 294 | 53–536 |
| Escapement Goal | 200 | 200–500 |
| Harvest Estimate | 94 | |

**Forecast Methods**

The 2006 Ayakulik River sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year 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 significantly different from zero ($P<0.25$). Ocean-age-2 sockeye salmon were predicted from prior year ocean-age-1 returns ($P = 3.8 \times 10^{-5}$) using only recent outmigration years (1989–2004). Ocean-age-3 sockeye were predicted from prior year ocean-age-2 returns ($P = 5.2 \times 10^{-8}$) using outmigration years from 1967–2003. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. Both ocean-age-1 and ocean-age-4 sockeye salmon were predicted by calculating the median return (outmigration year 1989 to present) and prediction intervals were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns. Regression and median estimates were summed to estimate the total Ayakulik sockeye salmon run for 2006. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each ocean age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast is 98,000 fish less than the 2005 forecast (39,000) and about 12,000 fish less than the actual 2005 run estimate of 306,000 fish. The 2006 run should be composed of roughly equal portions of ocean-age-2 and ocean-aged-3 sockeye and account for 94% of the run. If realized, this run will be 340,000 fish less than the recent 10-year average (1996–2005) run of 634,000 fish. Overall, the confidence in the 2006 Ayakulik forecast is good, due to the relatively strong relationships in the regressions. The projected harvest of 94,000 fish is based on achievement of the lower end (200,000) of the escapement goal range.

M. B. Foster, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Karluk Lake (Early Run)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 464 | 310–619 |
| Escapement Goal | 150 | 100–210 |
| Harvest Estimate | 314 | |

**Forecast Methods**

The 2006 Karluk Lake early-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979–2001) sibling relationships for three age classes. Linear regression models were also used to investigate the relationship between ocean-age-1 (1-ocean) and 2-ocean sockeye salmon. 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 ($P < 0.25$). Age-1.3, age-2.3, and age-3.3 were predicted from age-1.2, age-2.2, and age-3.2 siblings respectively. Two-ocean fish (age-1.2, age-2.2, age-3.2, and age-4.2) were predicted from 1-ocean fish (age-1.1, age-2.1, and age-3.1). All "other" age classes were estimated by summing 12 minor age class run estimates (age-0.2, age-1.1, age-0.3, age-2.1, age-0.4, age-3.1, age-1.4, age-4.1, age-2.4, age-3.4, age-4.3 and age-4.4) by year (1996-2005) 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% prediction intervals were estimated by calculating the $10^{th}$ and $90^{th}$ percentiles of the data. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast is about 90,000 fish less than the 2005 forecast (554,000) and about 66,000 fish less than the actual 2005 run estimate of 530,000 fish. The 2006 run should be composed of approximately 58% 2-ocean fish and 38% 3-ocean fish. If realized, this run will be 142,000 fish less than the recent 10-year average (1996–2005) run of 606,000 fish.

The projected harvest of 314,000 fish is based on achievement of the midpoint of the escapement goal range (150,000). Age 2.2 has been the predominant age class in each of the past eight seasons. The 2004 age-2. smolt outmigration estimate was smaller than the 2003 estimate and the age-2.1 siblings that returned in 2005 were well below average. The smolt outmigration information corroborates the sibling relationship, with both suggesting a below average run. Our confidence in this forecast is good.

Mark Witteveen, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Karluk Lake (Late Run)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 1,150 | 772–1,540 |
| Escapement Goal | 270 | 170–380 |
| Harvest Estimate | 876 | |

**Forecast Methods**

The 2006 Karluk Lake late-run sockeye salmon forecast was prepared by investigating simple linear regression models utilizing recent brood year (1980–2000) alternative sibling relationships for one age class, an ocean temperature relationship for one age class and estimating median returns for four individual 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 alternative sibling regression relationship was employed to estimate the age-3.2 component of the run from 2005 returns of age-2.2 sockeye salmon. A significant regression relationship was employed to estimate the age-2.2 component of the run from sea surface temperatures (excluding 1981 and 1987 for which data were not available) that occurred in the summer of the first year of ocean residence. Predicting the return using sea surface temperatures was used successfully for the first time last year. Following non-significant regression results, the median return by age class was used to estimate the age-1.2, age-1.3, age-2.3, and age-3.3 components of the run. All "other" age classes were estimated by summing 12 minor age class run estimates (age-0.1, age-0.2, age-1.1, age-0.3, age-2.1, age-0.4, age-3.1, age-1.4, age-2.4, age-4.2, age-3.4, and age-4.3) by year (1996–2005) 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, 80% prediction intervals were estimated by calculating the $10^{th}$ and $90^{th}$ percentiles of the data. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast is about 291,000 fish more than the 2005 forecast (856,000) and about 225,000 fish more than the actual 2005 run estimate of 922,000 fish. Median estimates were used for most age classes due to relatively poor sibling relationships. The 2006 run should be composed of approximately 63% five-year-old fish and 33% 6-year-old fish. If realized, this run will be 325,000 fish more than the recent 10-year average (1996–2005) of 821,000 fish.

The projected harvest of 876,000 fish is based on achievement of the mid point of the escapement goal range (270,000 fish). The predominant age classes in the run should be age-2.2 (63%), age-3.2 (19%), and age-2.3 (13%). Age-2.2 has been the predominant age class in seven of the past eight seasons. Smolt outmigration estimates from the 2004 season indicate a smaller number of age-2. smolt outmigrated than in the 2003 season, suggesting that a lower number of age-2.2 sockeye will return in 2006 than in 2005. The smolt outmigration information conflicts with the sibling relationship information, making estimation difficult. Our confidence in this forecast is fair.

Mark Witteveen, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Frazer Lake (Dog Salmon Creek)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 204 | 17–398 |
| Escapement Goal | 105 | 70–150 |
| Harvest Estimate | 99 | |

**Forecast Methods**

The 2006 Frazer Lake (Dog Salmon Creek) sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1993–2004) 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 significantly different from zero ($P < 0.25$). Ocean-age-3 sockeye salmon were predicted from prior year ocean-age-2 returns ($P = 0.01$) and ocean-age-2 sockeye were predicted from prior year ocean-age-1 returns ($P = 2.0 \times 10^{-4}$). Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. Both ocean-age-1 and ocean-age-4 sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns. Regression and median estimates were summed to estimate the total Frazer sockeye salmon run for 2006. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each ocean age class.

**Forecast Discussion**

The 2006 forecast is 180,000 fish less than the 2005 forecast (384,000) and about 422,000 fish less than the actual 2005 run estimate of 626,000 fish. The 2006 run should be composed of approximately 58% ocean-age-3 fish and 28% ocean-age-2 fish. If realized, this run will be 261,000 fish less than the recent 10-year average (1996–2005) run of 464,000 fish. Overall, the confidence in the 2006 Frazer Lake forecast is fair, due to the low abundance of the ocean-age-1 predictor age class (lowest in the past decade) and, therefore, the 2006 return of ocean-age-2 sockeye represents the greatest source of uncertainty. An alternative forecast based on the condition factor of outmigrating sockeye smolt resulted in an estimate of 295,000 sockeye suggesting the run may be in the upper portion of the range. The projected harvest of 99,000 fish is based on achievement of $S_{msy}$ or the midpoint (105,000) of the escapement goal range.

M.B. Foster, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Upper Station (Olga Lakes, Early Run)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 120 | 61–179 |
| Escapement Goal | 30 | 30–65 |
| Harvest Estimate | 90 | |

**Forecast Methods**

The 2006 Upper Station early-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1989–2004) 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 significantly different from zero ($P < 0.25$). Ocean-age-3 sockeye salmon were predicted from prior year ocean-age-2 returns ($P = 3.2 \times 10^{-2}$) and ocean-age-2 sockeye were predicted from prior year ocean-age-1 returns ($P = 6.7 \times 10^{-4}$). Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. Both ocean-age-1 and ocean-age-4 sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns. Regression and median estimates were summed to estimate the total Upper Station sockeye salmon early run for 2006. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each ocean age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast is 50,000 fish less than the 2005 forecast (17,000) and about 36,000 fish less than the actual 2005 run estimate of 156,000 fish. The 2006 run should be composed of approximately 69% ocean-age-2 fish and 27% ocean-age-3 fish. If realized, this run will be 14,000 fish less than the recent 10-year average (1996–2005) run of 135,000 fish. It appears the 2006 run will be substantially smaller than the record run in 2004 (269,000). Overall, the confidence in the 2006 Upper Station early-run forecast is good; regression relationships are strong and predictors are well situated within the range. The projected harvest of 90,000 fish is based on achievement of the lower end (30,000) of the escapement goal range.

M. B. Foster, Finfish Research Biologist, Kodiak

**Forecast Area: Kodiak, Upper Station (Olga Lakes, Late Run)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 283 | 112–454 |
| Escapement Goal | 186 | 120–265 |
| Harvest Estimate | 97 | |

**Forecast Methods**

The 2006 Upper Station late-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent outmigration year (1994–2004) 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 significantly different from zero ($P<0.25$). Ocean-age-3 sockeye salmon were predicted from prior year ocean-age-2 returns ($P = 3.1 \times 10^{-3}$) and ocean-age-2 sockeye were predicted from prior year ocean-age-1 returns ($P=0.11$). Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. Both ocean-age-1 and ocean-age-4 sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns. Regression and median estimates were summed to estimate the total Upper Station sockeye salmon late run for 2006. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each ocean age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast is 309,000 fish less than the 2005 forecast (592,000) and about 2,000 fish more than the actual 2005 run estimate of 281,000 fish. The 2006 run should be composed mostly of ocean-age-2 fish (85%). If realized, this run will be 134,000 fish less than the recent 10-year average (1996–2005) run of 416,000 fish. The late-run sockeye production from Upper Station has been weak since the late 1990s and it appears production will remain weak in 2006. Overall, the confidence in the 2006 Upper Station late-run forecast is fair due to the strength of the ocean-age-2 sockeye regression relationship which represents the greatest source of uncertainty. The projected harvest of 97,000 fish is based on achievement of the midpoint (18,000) of the escapement goal range.

M. B. Foster, Finfish Research Biologist, Kodiak

**Appendix A6.–**Chignik.

**Forecast Area: Chignik**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|---|
| **Total Production** | | | |
| Early Run (Black Lake) | Total Run Estimate | 1,210 | 1,060–2,760 |
| | Escapement Goal | 350 | 350–400 |
| | Harvest Estimate [a] | 855 | |
| Late Run (Chignik Lake) | Total Run Estimate | 282 | 285–1,086 |
| | Escapement Objective [b] | 250 | 250–300 |
| | Harvest Estimate [c] | 32 | |
| Total Chignik System | Total Run Estimate | 1,490 | |
| | Escapement Objective [b] | 600 | 1,350–3,850 |
| | Harvest Estimate [a] | 887 | 600–700 |

[a] These figures include harvests of Chignik-bound sockeye salmon from the Southeastern District Mainland and the Cape Igvak fisheries; approximately 703,000 sockeye salmon are projected to be harvested in the Chignik Management Area.

[b] The Chignik Lake late-run escapement goal is 200,000–250,000 sockeye salmon, resulting in an escapement goal for the entire run of 550,000–650,000. However, managers try to achieve an additional escapement objective of 50,000 sockeye salmon in August and September.

[c] No harvest of Chignik Lake late-run sockeye salmon was predicted to occur as the total run estimate does not allow for the achievement of the late-run escapement goals.

**Forecast Methods**

The forecasts for the 2006 early and late Chignik sockeye salmon runs were based on available data from 1980 to the present. Simple linear regressions were modeled using sibling, outmigration year, escapement age class, temperature data, and year class return relationships. Each regression model was assessed with standard regression diagnostic procedures. Regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The variance of each estimate was calculated from the error structure of the regression. Prediction intervals were estimated at a coverage probability of 80%. Median estimators were used to estimate production of age classes where regression relationships were not significant.

The predicted 2006 early-run ocean-age-3 (3-ocean) sockeye salmon returns were estimated based on the abundance of prior ocean-age-2 (2-ocean) sockeye salmon ($P = 2.2 \times 10^{-5}$). Prediction intervals of 80% were calculated using the variance of the regression model. Following non-significant regression results, the early-run ocean-age-1 (1-ocean; age-1.1 and age-2.1), ocean-age-2 (2-ocean; age-0.2, age-1.2, age-2.2, and age-3.2), and ocean-age-4 (4-ocean; age-1.4 and age-2.4) age class components were predicted by calculating the median returns. Prediction intervals for each median were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns.

Ocean age class relationships and temperature indices were analyzed for the late run forecast. Two-ocean sockeye salmon were predicted from prior year 1-ocean returns using simple linear regression, ($P = 2.1\times10^{-4}$). Three-ocean sockeye salmon were predicted by regressing the ratio between 2- and 3-ocean fish (same outmigration year) on a temperature index ($P = 0.003$). The temperature index was constructed using the average summer temperatures (May–September) from the corresponding outmigration year. Temperature data were obtained from the King Salmon Airport climate database. Four-ocean sockeye salmon were predicted from prior year 3-ocean returns using simple linear regression, ($P = 3.7\times10^{-3}$). Estimates of variance were calculated from each regression. Ocean-age-1 sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the $10^{th}$ and $90^{th}$ percentiles of the returns. The variances associated with individual regression estimates by age class were summed to calculate 80% prediction intervals.

The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted using a median and the combined regression.

The total early- and late-run forecasts were calculated by summing individual and pooled age class estimates. When the median returns by age class were used, the $10^{th}$ and $90^{th}$ percentiles of the data were used to describe the range of the data The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals range for each ocean age class. Regression and median estimates were summed to estimate the total Chignik watershed sockeye salmon run for 2006; The combined early- and late-run 80% prediction interval was calculated by summing the lower prediction bounds and upper prediction bounds of the two runs.

**Forecast Discussion**

The 2006 sockeye salmon run to the Chignik River is expected to be approximately 1.49 million fish. The early run is expected to be approximately 1.21 million fish. The late run is expected to be approximately 282,000 fish. The 2006 sockeye salmon run to Chignik is expected to be approximately 963,000 fish less than the recent 10-year average run (2.45 million) and 714,000 fish less than the 2005 run (2.20 million).

The projected harvest estimate for the early run of 855,000 fish is based on achievement of the lower end of the early-run escapement goal range of 350,000 fish. The projected harvest estimate for the late run of 32,000 fish is based on achievement of the lower end of the late-run management objective range through September 15 (250,000 sockeye salmon). Harvest estimates for the both runs include Chignik-bound sockeye salmon harvested in the Cape Igvak Section of the Kodiak Management Area and the Southeastern District Mainland of the Alaska Peninsula Management Area.

Approximately 82% of the 2006 early run was estimated using ocean age class relationships. Using sibling relationships, the 2005 early run was overestimated by approximately 26%. Approximately 98% of the 2006 late run was estimated using simple linear regression relationships incorporating temperature indices. Climate indices were initially used in 2004 to forecast the 2005 Chignik late-run using ocean age class ratio and simple regression models, which underestimated the late run by approximately 11%. Prior to 2004, median estimators have typically been used due to poor sibling relationships.

Available smolt data were analyzed and a significant multiple linear regression relationship was found using the total number of outmigrating smolt and a temperature index to predict the subsequent 3-ocean returns (about 82.6% of the run). This estimate was then expanded proportionally to account for other ocean ages not calculated by the simple regressions. The temperature index was constructed using the average temperatures during April–November from the corresponding outmigration year. Temperature data were obtained from the King Salmon Airport climate database. In 2005, returns were predicted using a different multiple regression approach which underestimated the total run by about 41%. The smolt-based forecast of the 2006 Chignik total sockeye salmon run is 954,000 sockeye salmon, which is significantly less (533,000) than that predicted from ocean-age and sibling relationships and median estimates (1.49 million).

The disparity between the smolt forecast and the ocean age class forecast suggests the actual run may fall in the lower half of the forecast range. Given this ancillary information, our confidence in this forecast is fair.

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Heather Finkle , Finfish Research Biologist, Alaska Peninsula
M .B. Foster, Finfish Research Biologist, Kodiak

**Appendix A7.–**Bristol Bay

**Forecast Area: Bristol Bay**

**Species: Sockeye Salmon**

| Forecast of the 2006 Return | Forecast Estimate (millions) | Forecast Range (millions) |
|---|---|---|
| **Total Production** | | |
| Total Run | 32.7 | 27–38 |
| Escapement Goal | 9.0 | |
| Commercial Common Property Harvest | 23.7 | |

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

| District | Sockeye Salmon Forecast |
|---|---|
| Naknek-Kvichak | 6.9 million |
| Egegik | 8.2 million |
| Ugashik | 2.5 million |
| Nushagak | 5.6 million |
| Togiak | 0.4 million |

**Forecast Methods**

The forecast for the sockeye salmon run to Bristol Bay in 2006 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 (age-1.2, age-1.3, age-2.2, and age-2.3, plus age-0.3 and age-1.4 for Nushagak River). Adult escapement and return data from brood years 1976–2002 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. Tested models included simple linear regression, multiple regressions, and five-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 2003–2005.

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 2001 through 2005 runs.

A total of 32.7 million sockeye salmon are expected to return to Bristol Bay in 2006. This prediction is similar (2% higher) to the previous 10-year mean of total runs (32.1 million; range of 19.7 million–44.7 million). The 80% confidence bounds for 2006 forecasted run ranged from 27.0 million–38.5 million. All systems are expected to exceed their minimum spawning escapement goals except Kvichak River. There is a forecasted shortfall of 60,000 sockeye salmon to Kvichak River based on escapement goal of 2.0 million fish and forecasted run of 1.94 million fish. The Department does not actively manage for an escapement goal on Alagnak River. The expected escapement to Alagnak River was forecast to be 2.0 million sockeye salmon based on Alagnak River developing as forecast and the commercial fisheries in Bristol Bay being managed similar to recent years.

A run of 32.7 million sockeye salmon can potentially produce a total harvest of 23.7 million fish if all escapement goals are met at their mid range and industry is capable of taking the surplus fish. A harvest of this size would be 26% higher than the previous 10-year mean harvest (18.8 million; range was 9.9 million to 29.5 million). The expected harvest from Alagnak River takes into account the expected escapement for Alagnak River.

The forecasted run to each District and river system was as follows: 11.98 million to Naknek-Kvichak District (1.94 million to Kvichak River; 2.86 million to Alagnak River; 7.17 million to Naknek River); 9.3 million to Egegik District; 3.34 million to Ugashik District; 7.52 million to Nushagak District (4.67 to Wood River; 2.0 million to Nushagak River; 0.85 million to Igushik River) and 0.58 million to Togiak District.

The forecasted total run of 32.7 million sockeye salmon is expected to be comprised of 13.76 million age-1.3 fish (42%) followed by 8.85 million age-1.1 fish (27%) , 5.87 million age-2.2 fish (18%), 3.95 million age-2.3 fish (12%) and 290,000 age-0.3 and age-1.4 fish (1%).

**Forecast Discussion**

There is always uncertainty in forecasting returns of sockeye salmon to Bristol Bay. The 2006 forecast is no different than previous years. The total run forecast this year may be biased low. This is based upon the uncertainty in predicting the returns of age-1.2 sockeye salmon and the recent tendency to underforecast total run and expected harvests. We had large returns of age-1.1 fish to Naknek, Egegik and Wood river systems during 2005. In addition, we had age-1.1 fish return to Kvichak, Alagnak and Ugashik river systems. The large presence of age-1.1 fish in the 2005 run suggests a large return of age-1.2 fish in 2006. We used both age-1.1 sibling and spawner-return data to forecast age-1.2 fish in 2006. However, if we had only used age-1.1 sibling data in the forecast, we would have forecast a larger return of age-1.2 fish in 2006 to Egegik, Naknek and Wood river systems and to a lesser extent to Kvichak, Alagnak and Ugashik river systems.

Similar methods have been used to produce the Bristol Bay sockeye salmon forecast since 2001. The methods during this recent time have performed fairly well. There is still a tendency for the forecasts and expected harvests to be biased low. The five previous total run forecasts (2001–2005) have been within 9% of the total run and have averaged 4% below the total run. The forecast run differences have ranged from 18% below in 2005 to 10% above in 2001. The expected harvests have been within 14% of the actual harvest and have averaged 10% below the actual harvest for the last five years. The expected harvest differences have ranged from 9% below in 2002 to 33% above 2004. Even though the differences between the overall forecasts and expected harvests are improvements over previous forecasting methods, we will continue to work on improving our ability to forecast sockeye salmon returning to Bristol Bay.

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Tim Baker, Bristol Bay Research Project Leader, Anchorage

**Appendix A7.–**Page 3 of 4.

**Forecast Area: Bristol Bay**

**Species: Chinook Salmon**

| Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Run** | 221 | 161–281 |
| Inriver Run Goal[1] | 75 | |
| Additional Sport and Subsistence Harvest | 6 | |
| Commercial Common Property Harvest | 141 | |

[a] The Nushagak inriver goal is 75,000 Chinook salmon, which provides for a BEG of 65,000 spawners and a harvest of 10,000 Chinook salmon by upriver subsistence and sport fisheries.

**Forecast Methods**

The 2006 Nushagak District Chinook salmon forecast is the sum of individual predictions of five age classes (age-1.1, age-1.2, age-1.3, age-1.4, and age-1.5). Data sets in the analyses included adult escapement and return data from brood years 1978-2003.

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 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 2003–2005.

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 2001 through 2005 runs. A total of 221,000 Chinook salmon were forecast to return to the Nushagak River in 2006. This forecast is 39% higher than the 10-year mean (15,000; range of 75,000 in 2000 to 261,000 in 2005). The 80% confidence bounds for the forecast ranged from 161,000–281,000. A run of 221,000 Chinook salmon can potentially produce an expected harvest of 141,000 fish. A harvest this size would be the largest harvest of Chinook salmon in the last 10 years and almost three times greater than the 10-mean harvest (53,000; range of 39,000 in 2002 to 117,000 in 1998).

A simple average of recent returns was used to forecast age-1.1 and age-1.5 abundance. The top model for age-1.2 abundance used age-1.1 returns and spawning escapements as predictors. The best age-1.3 model was based on the relationship between sibling returns in succeeding years (e.g., age-1.3 returns for 2006 based on age-1.2 returns in 2005). A sibling model that incorporated time series parameters was the best predictor for age-1.4 returns.

Age composition of the forecasted total run is <1% (<1,000) age-1.1, 13% (30,000) age-1.2, 37% (83,000) age-1.3, 48% (106,000) age-1.4, and 1% (2,000) age-1.5. The 2006 forecasted total run of 221,000 Chinook salmon is almost 1.5 times greater than the previous 10- and 20-year mean total run of approximately 150,000.

There is always uncertainty when forecasting returns of Chinook salmon to the Nushagak River. The 2006 forecast is no different than previous years. The greatest uncertainty in the 2006 forecast is predicting the return of age-1.4 Chinook salmon. We anticipate a large return of age-1.4 Chinook salmon based on the large sibling return of age-1.3 fish that occurred in 2005. The 2005 return of age-1.3 fish was the second largest return in the last 20 years. However, we have also had a tendency to over-forecast age-1.4 returns in the last five years. The forecasted differences for age-1.4 Chinook salmon the past five years (2001–2005) have ranged from 6% below in 2004 to 35% above in 2003.

## Forecast Discussion

Similar methods have been used to produce the Nushagak Chinook salmon forecast since 2001. The forecast methods during this recent time have performed fairly well on average. There is still a tendency for the forecasts to be biased low and expected harvests to be high. The five previous total run forecasts (2001–2005) have averaged 11% below the total run. The forecast run differences have ranged from 58% below in 2004 to 9% above in 2003. The expected harvests have averaged 35% above the actual harvest for the last five years. The expected harvest differences have ranged from 57% below in 2004 to 73% above in 2001. We will continue to work on improving our ability to forecast Chinook salmon returning to the Nushagak River.

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Chuck Brazil, Fred West and Tim Baker Bristol Bay Research Staff

**Appendix A8.–**Alaska Peninsula.

**Forecast Area: Alaska Peninsula, Bear Lake (Late Run)**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 678 | 392–964 |
| Escapement Goal | 117 | 117–195 |
| Harvest Estimate | 561 | |

**Forecast Methods**

The 2006 Bear River late-run sockeye salmon forecast was prepared primarily using median estimates and investigating simple linear regression models of ocean age class relationships with data from the past 15 years. In constructing and evaluating each of the regression models, standard regression diagnostics were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P<0.25$). The saltwater age-3 (3-ocean) sockeye salmon returns were predicted from the previous year 2-ocean returns using simple linear regression ($P = 0.02$). The 4-ocean sockeye salmon returns were predicted from the previous year 3-ocean returns using simple linear regression ($P = 0.13$). Estimates of variance were calculated from each regression. The remaining age classes, 1-ocean (age-0.1, age-1.1, age-2.1, and age-3.1) and 2-ocean (age-0.2, afe-1.2, age-2.2, and age-3.2), were calculated from the median estimates for each of the age class run estimates. The total run forecast was calculated by summing individual regression and pooled age class estimates. When the median return by age was used, the 80% prediction intervals were estimated by calculating the $10^{th}$ and $90^{th}$ percentiles of the data. Prediction intervals of 80% were calculated for the regression models using the variances estimated from the models. The overall 80% prediction interval was calculated as the square root of the sum of the squared 80% prediction intervals for each ocean age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 forecast for the Bear Lake late run is about 230,000 fish greater than the 2005 forecast (448,000), and about 32,000 fish greater than the actual 2005 run of 646,000 fish. The 2006 run should be composed of approximately 60% 2-ocean fish, estimated from a median, and 38% 3-ocean fish estimated from an ocean-age class relationship, accounting for 98% of the total run. If realized, this run will be 181,000 fish greater than the recent (1996–2005) 10-year average (497,000). Using primarily median estimates, the 2005 run was underestimated by approximately 31%.

The projected harvest of 561,000 fish is based on the achievement of the low bound of the escapement goal range (117,000). From a 10-year average, 2-ocean sockeye salmon comprised about 67% of the Bear Lake late run. Regression models failed to significantly predict 2-ocean returns ($P > 0.25$) therefore a median estimate was used. The 3-ocean run component historically comprises 29% of the Bear Lake late run. Because of the uncertainty associated with the variable predictive capabilities of the sibling data and that a majority of the run has been estimated based on a median, our confidence in this forecast is poor.

Heather Finkle, Finfish Research Biologist, Alaska Peninsula

**Forecast Area: Alaska Peninsula, Nelson River**

**Species: Sockeye Salmon**

| Preliminary Forecast of the 2006 Run | Forecast Estimate (thousands) | Forecast Range (thousands) |
|---|---|---|
| **Total Production** | | |
| Total Run Estimate | 555 | 284–826 |
| Escapement Goal | 150 | 97–219 |
| Harvest Estimate | 405 | |

**Forecast Methods**

The 2006 Nelson River sockeye salmon forecast was prepared primarily by investigating simple linear regression models of ocean age class relationships and temperature data from the past 18 years. In constructing and evaluating each of the regression models, standard regression diagnostics were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The saltwater-age-2 (2-ocean) sockeye salmon returns were predicted from a temperature index using simple linear regression ($P = 0.10$). The temperature index was constructed using the average summer temperatures (May–September) from the corresponding outmigration year. Temperature data were obtained from the Cold Bay Airport climate database. Three-ocean sockeye returns were predicted by linear regression of the ratio between 3- and 2-ocean fish (same outmigration year) on the Cold Bay temperature index ($P = 0.02$). Estimates of variance were calculated from each regression. The remaining 1-ocean age classes (age-0.1, age-1.1, age-2.1, and age-3.1) and 4-ocean age classes (age-0.4, age-1.4, and age-2.4) were calculated from the median estimates for each of the age class run estimates. The total run forecast was calculated by summing individual regression and pooled age class estimates. When the median return by age was used, the 80% prediction intervals were estimated by calculating the $10^{th}$ and $90^{th}$ percentiles of the data. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted using a median and the combined regression.

**Forecast Discussion**

The 2006 sockeye salmon run to the Nelson River is expected to be approximately 555,000 fish. The 2006 Nelson River sockeye salmon run is expected to be nearly the same as the recent 10-year average run (557,000) and 70,000 fish less than the 2005 run (625,000). The 2006 forecast is about 58,000 fish more than the 2005 forecast (497,000).

Of the 2006 Nelson River run, approximately 98% was estimated with regression using ocean age class relationships and temperature indices. Using primarily ocean class age relationships, the 2005 run was underestimated by approximately 26%. The projected harvest of 405,000 fish is based on the achievement of the approximate midpoint of the escapement goal range (150,000). Historically, 2-ocean sockeye salmon comprised about 63% of the Nelson River run and the regression model for 2-ocean fish was significant ($P = 0.10$). The regression relationship for the 3-ocean run component, which historically comprised 34% of the Nelson River run, also had a highly significant slope ($P = 0.02$). Because of these qualities, our confidence in this forecast is fair.

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**Appendix A9.–**Arctic-Yukon Kuskokwim.

**Forecast Area: Arctic-Yukon-Kuskokwim**

**Species: All Salmon**

The Alaska Department of Fish and Game does not produce formal run forecasts for any salmon runs in the Arctic-Yukon-Kuskokwim (AYK) 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 notably decreased for many stocks from 1998–2002. Causes for the loss of productivity have been the subject of much interest and concern, but to date unknown. Consequently, Chinook salmon stocks in the Yukon and Kuskokwim Rivers and Eastern Norton Sound have been classified as stocks of concern under the guidelines established in the Sustainable Salmon Fisheries Policy for the State of Alaska. Similarly, chum salmon from the Kuskokwim, Yukon (summer and fall), and Nome Areas have also been classified as stocks of concern. However, beginning in 2003, there has been an increasing trend of returning Chinook, chum and coho salmon particularly in the Yukon and Kuskokwim Rivers. Overall, salmon production increased during the last three years. Additionally, the Bering Sea trawl bycatch and Bering-Aleutian Salmon International Survey Plan (BASIS) study indicated the presence of large numbers of salmon in the Bering Sea in the summers of 2003, 2004, and 2005. The BASIS study did show a decline in the presence of immature chum and Chinook salmon in 2005. During the BOF meeting cycle in 2006–2007, it is likely the department will recommend discontinuing the stock of concern classification for several AYK stocks of concern that no longer fit the stock of concern definition.

The commercial harvest outlooks for the year 2006 qualitatively take recent abundance trends into account. Market conditions have not been accounted for in the harvest outlooks. Declining salmon markets, particularly for chum salmon flesh since 1994, salmon roe since 1997 and pink salmon flesh since 2000, have had a major impact on the commercial fisheries in the AYK Region. A continuation of these market trends in 2006, will likely result in much reduced harvests than the available harvest outlook projected, and lower exvessel value.

The commercial harvest outlook for the year 2006 can be found in the table below.

Commercial salmon harvest outlook for the AYK Region, year 2006, in thousands of fish.

| | Species | | | | | |
|---|---|---|---|---|---|---|
| Management Area | Chinook | Sockeye | Coho | Pink | Chum | Fall Chum |
| Kuskokwim River | 5–25 | 25–50 | 150–300 | 0–1 | 100–500 | |
| Kuskokwim Bay | 22–39 | 50–105 | 35–90 | 0–1 | 12–48 | |
| Kuskokwim Total | 27–64 | 75–155 | 185–390 | 0–2 | 112–548 | |
| Yukon | 30–60 | | 50–75 | | 500–900 | 100–400 |
| Norton Sound | 1–2 | 0 | 50–70 | 1,000 | 50–100 | |
| Kotzebue Sound | | | | | 100–150 | |