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# FORECASTS OF THE 1996 SOCKEYE SALMON RUNS TO BRISTOL BAY

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A REPORT TO THE
PACIFIC SEAFOOD PROCESSORS ASSOCIATION

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## KEY WORDS

Alaska, Bristol Bay fishery, forecasts, Port Moller, sockeye salmon, fish size

# INTRODUCTION

Salmon runs are characterized by large year-to-year variation in number, most of which is expressed in the annual catches because escapement requirements that are nearly constant from year to year have priority. During the past 20 yr, the largest annual catches of sockeye salmon (*Oncorhynchus nerka*) in the major Alaskan fisheries have all been more than 10x greater than the smallest catch (Fig. 1). In the Bristol Bay sockeye fisheries (the largest in the world), the extreme of variation occurred when the catch went from <1 million fish in 1973 to nearly 40 million fish just 10 yr later. This year-to-year variation poses problems for the fishing industry when trying to prepare for the harvesting, processing, transportation, and sale of the salmon with a great deal of uncertainty. An accurate forecast of the catches can solve many of these problems and greatly assist fishery managers in regulating fishing early in the run. For the industry a forecast is most useful when available well in advance of the run (i.e., ≥6 mo).

Sockeye salmon forecasts mostly depend on relationships between numbers of fish in a run and estimates of the numbers of fish at earlier times in their life (e.g., the approaching run, immature fish at sea, seaward migrant smolt, fry in lakes, or number of parent spawners [escapement]). In addition or sometimes as a substitute, characteristics of the salmon (body size, age, sex) or the salmon's environment (temperature) may be used if the measurement explains some of the variation in past runs. The accuracy of a Bristol Bay forecast is largely dependent on (1) how far in advance the forecast is made, (2) the accuracy of the estimates of fish numbers or substitute measures, and (3) the forecaster's experience and methods used.

Measurements needed to forecast the Bristol Bay sockeye salmon runs were not made routinely until about 1950; the first forecasts were made by biologists from the Fisheries Research Institute (FRI) and from what is now the National Marine Fisheries Service (NMFS) late in that decade. Around 1962, the Alaska Department of Fish and Game (ADFG) assembled a staff of biologists to make annual forecasts of the runs from inshore observations (escapements, smolt, age, etc.), and in 1985 salmon processors asked that FRI make forecasts from these same data to provide a second opinion. This report presents a review of the 1995 season and forecasts of the 1996 sockeye salmon runs to Bristol Bay, which are based mostly on preliminary statistics provided by ADFG.

# REVIEW OF THE 1995 RUN

## Forecasts and Actual Runs

The FRI prediction of total run to Bristol Bay in 1995 was 53 million with a 34 million catch, and the ADFG predictions were nearly the same at 50 and 40 million (Table 1). The ADFG forecasts resulting from their statistical analyses were increased by ~33% to adjust for a recent tendency to under-forecast the runs (Geiger and Simpson 1995). Therefore, their database for the 1995 forecast actually indicated a lower run than forecast by FRI. The total 1995 run and catch

(61 and 44 million) as well as the individual district runs were greater than the pre-season forecasts from both agencies.

The catch of 44.3 million was 29% greater than we predicted and the largest ever for Bristol Bay. For the past 8 yr, the catches have differed from our forecasts by an average of 29% (range: 3% to 74%) and from the ADFG forecasts by an average of 39% (range: 10% to 125%). Therefore, both forecasts were relatively accurate in predicting a large catch in 1995.

In addition to the pre-season forecasts, we have made in-season forecasts each year since 1987 from a test-fishing program based out of Port Moller. This project, which was originally operated by ADFG (1968–1985), has provided more accurate predictions than pre-season forecasts because we are estimating the relative abundance of the run just 6–8 d before arrival in the fishing districts. Prior to the 1995 season, a Bristol Bay almanac was provided to processors so they could make daily forecasts of the final 1995 run beginning June 20. The forecast method was based on the past daily cumulative Port Moller indices and the past runs, and assumed average run timing. Very early in 1995 (about June 20), the test boat catches indicated that the run was going to be large and comparable to the pre-season forecasts (Table 2). However the sockeye at Port Moller were small and distributed farther offshore than in past years, which suggested that the 1995 indicies might be underestimating the abundance. The Port Moller samples did provide an accurate estimate of the age composition in the 1995 run as did the False Pass fishery (Table 3).

The run timing in 1995 was expected to be average or a little later than average based on water temperatures in the North Pacific. The large 1995 run was spread out in time, but the mid-point was about average.

## THE FISHERIES

The Port Moller program indicated that the 1995 run was going to be large and about average in timing. The first major catch was made on June 25 in the Egegik fishery (Tables 4 and 5). Total daily catches exceeded 1 million from June 27 to July 18, with the largest single day catch on July 6 (2.9 million), which was also the 50% point for the total catch. Management of the 1995 Naknek/Kvichak fishery was again outstanding as escapement goals were achieved in both major rivers with a large run to the Kvichak but only an average run to the Naknek. There was some overescapement in the Egegik, Wood, Igushik and Ugashik rivers, which all had relatively large runs; however, only the escapement to Igushik is likely to result in lower future production.

## FISH SIZE

The sockeye salmon caught in Bristol Bay in 1995 averaged 5.3 lb as in 1994 and were the smallest since 1970 (Table 6). This was caused by a high percentage of 2-ocean fish (71%) and small size by age and sex (Fig. 2). The body size of Bristol Bay sockeye is inversely related to the number of fish in the run (large run-small fish) and is influenced indirectly by water temperature and the length of time the fish has to grow in the spring of the year it returns. Winter and

spring weather over southwest Alaska has been relatively mild since 1976 (Fig. 3), but we do not know what the spring nearshore surface temperatures in the Gulf of Alaska were in 1994. The sockeye caught in the False Pass fishery were also small this year and they were very difficult to catch, just as in 1994. This indicates that some unusual ocean conditions have prevailed for the past 2 yr.

## FORECASTS FOR 1996

The statistics used to forecast the 1996 Bristol Bay sockeye salmon runs came from several sources: (1) the numbers, ages, lengths, and weights of adult salmon in the catches and escapements and smolt in the seaward migrations were from annual reports by ADFG (e.g., Stratton and Crawford 1994, Crawford and Cross 1994); (2) the relative numbers, ages, and lengths of fry in the Wood River and Kvichak lake systems were from annual reports by FRI (e.g., Rogers et al. 1995); and (3) air temperatures for Bristol Bay were from monthly reports by the U.S. Weather Bureau. The Bristol Bay run statistics used in forecasting do not include estimates of interceptions (i.e., fish caught on the high seas or at False Pass). We are forecasting the inshore run from inshore statistics. The climate for the 3 brood years (1990–92) that will contribute to the 1996 run was generally favorable (Fig. 3).

Run predictions were made (usually 4) for each major age group and summed to obtain a forecast for a river system. The river system forecasts were summed to predict the run to a fishing district, and the predicted catch was obtained by subtracting the recent 5-yr average of escapements. To predict the return of an age group in 1995, we assembled all relevant statistics from past brood years (since 1981) and submitted them to a stepwise multiple regression procedure. When no measurement (variable) was significantly correlated with past variation in a run, then the average run in the past 5 yr was used to predict the 1996 run. Only adult returns since 1985 (1981 brood year) were used because of a recent shift in the ocean age composition towards more 3-ocean fish, and the production of sockeye salmon at Egegik has increased greatly since 1980. Egegik was a low producer relative to the size of the lake (second largest in Bristol Bay); now production is more in line with the other systems in Bristol Bay. In addition, the more recent years are likely to better predict events in 1996 than earlier observations. An exception to this was in the forecast of age 1.2 returns to the Kvichak (which has mainly 2-ocean fish). Here I used statistics starting with the 1974 brood year (1978 run) because recent years did not provide a statistically significant forecast and a 5-yr average was not appropriate.

The forecast of the total 1996 Bristol Bay sockeye salmon run is 45.2 million with a predicted catch of 33.4 million (Table 7). Over the past 5 yr, there have been large runs of 3-ocean fish, especially relative to the returns of 2-ocean fish in the preceding years (Table 8). The 2-ocean fish were generally small for these years, so we might expect a large return of 3-ocean fish in 1996 from the small but numerous 2-ocean fish in 1995.

The databases and forecast statistics are presented in Tables 9–14. The Egegik, Ugashik, and Nushagak are expected to have larger runs in 1996 than they had in 1995; however, the Naknek/Kvichak is expected to have a much smaller run in 1996 mainly as a result of the low return of jacks in 1995 (Fig. 4). Because past runs have sometimes differed considerably from the pre-season forecasts, it will again be very important for the industry to have an accurate in-season forecast from the Port Moller test fishery.

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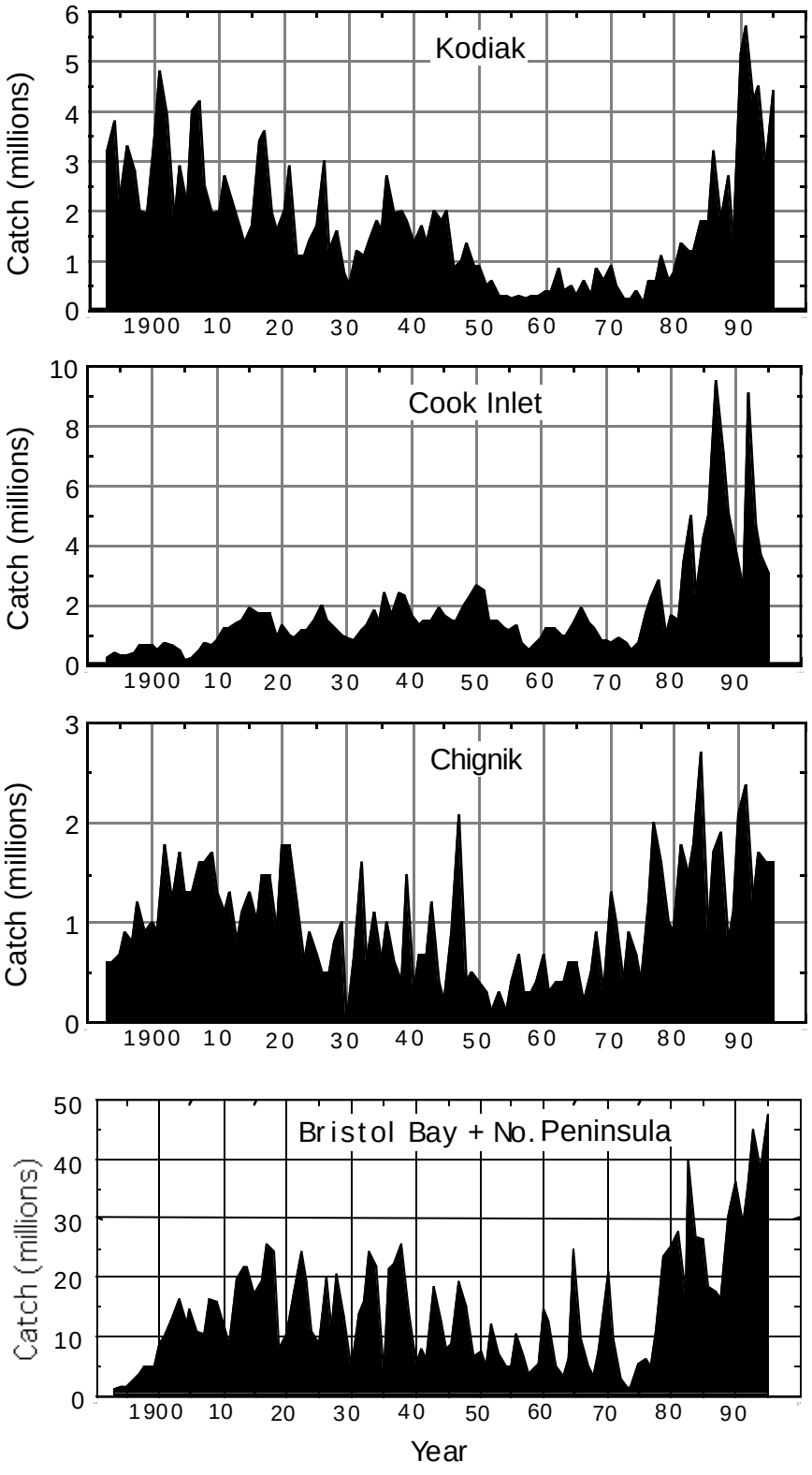


Figure 1. Annual commercial catches of sockeye salmon in the major Alaskan fisheries, 1893–1995.

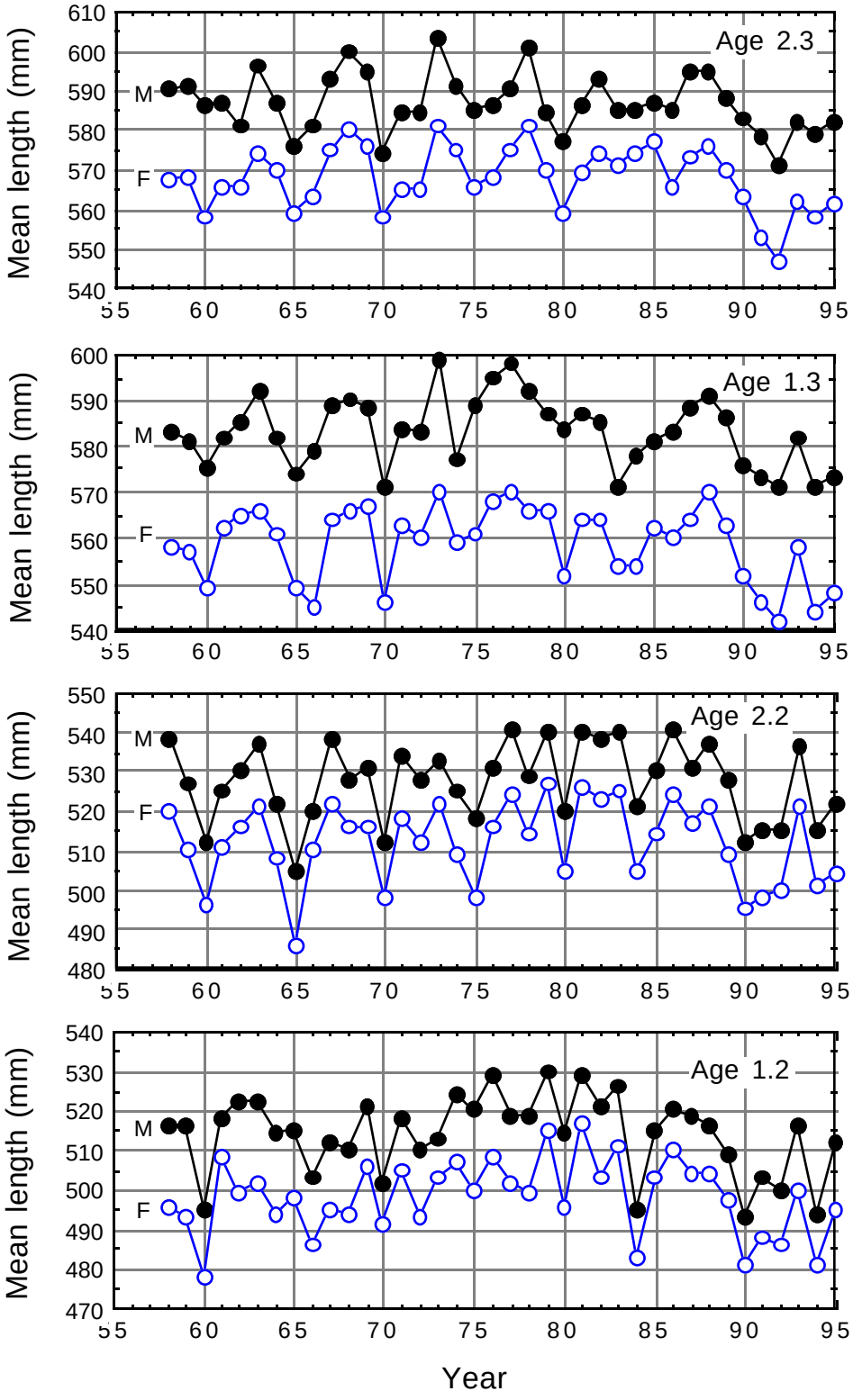


Figure 2. Annual mean lengths (mid-eye to tail fork) by age and sex for sockeye salmon in the Bristol Bay runs, 1958–95.

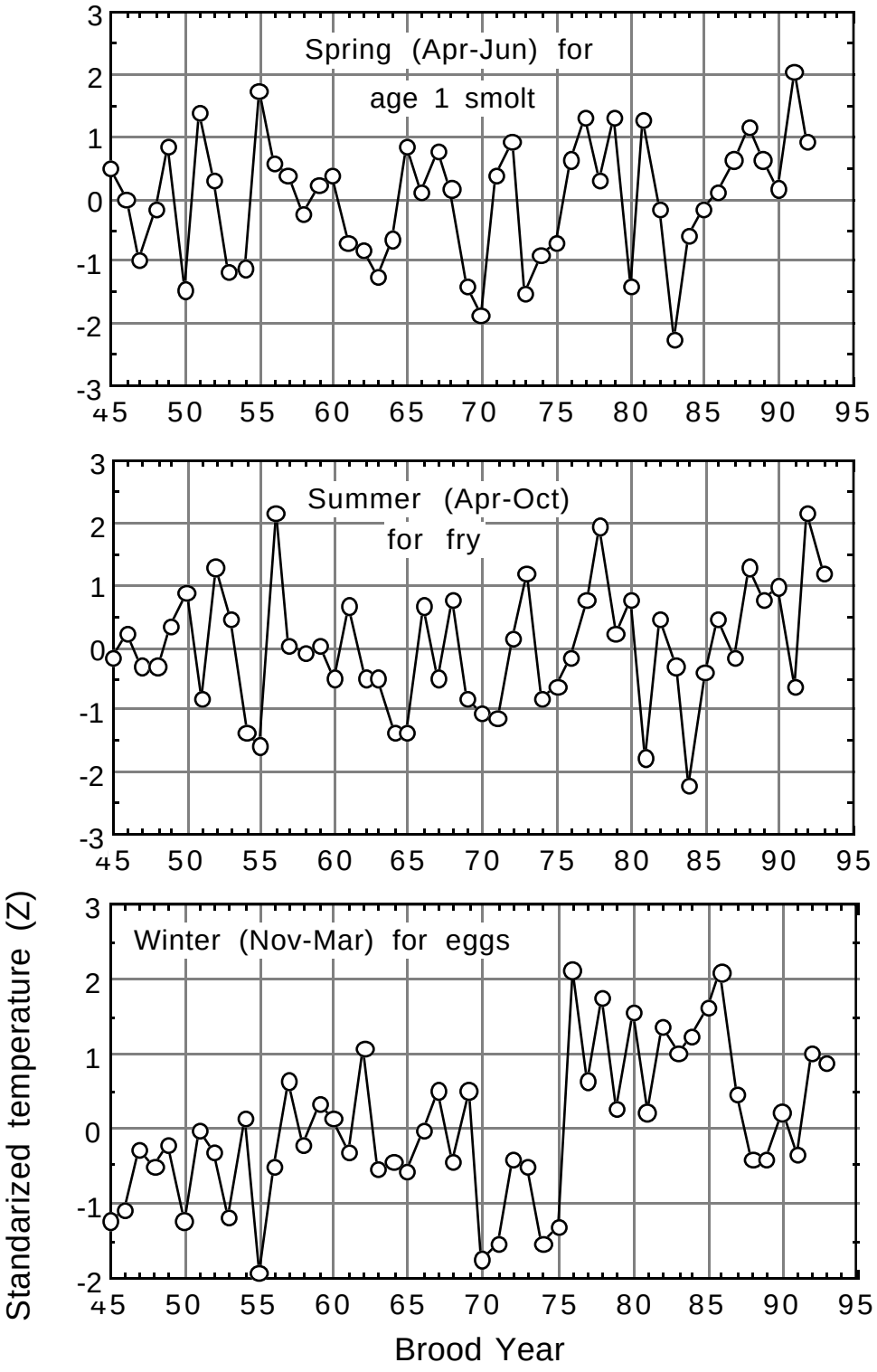


Figure 3. Relative air temperatures (number of standard deviations from the mean) in Bristol Bay (Dillingham and King Salmon) for sockeye salmon brood years, 1945–93.

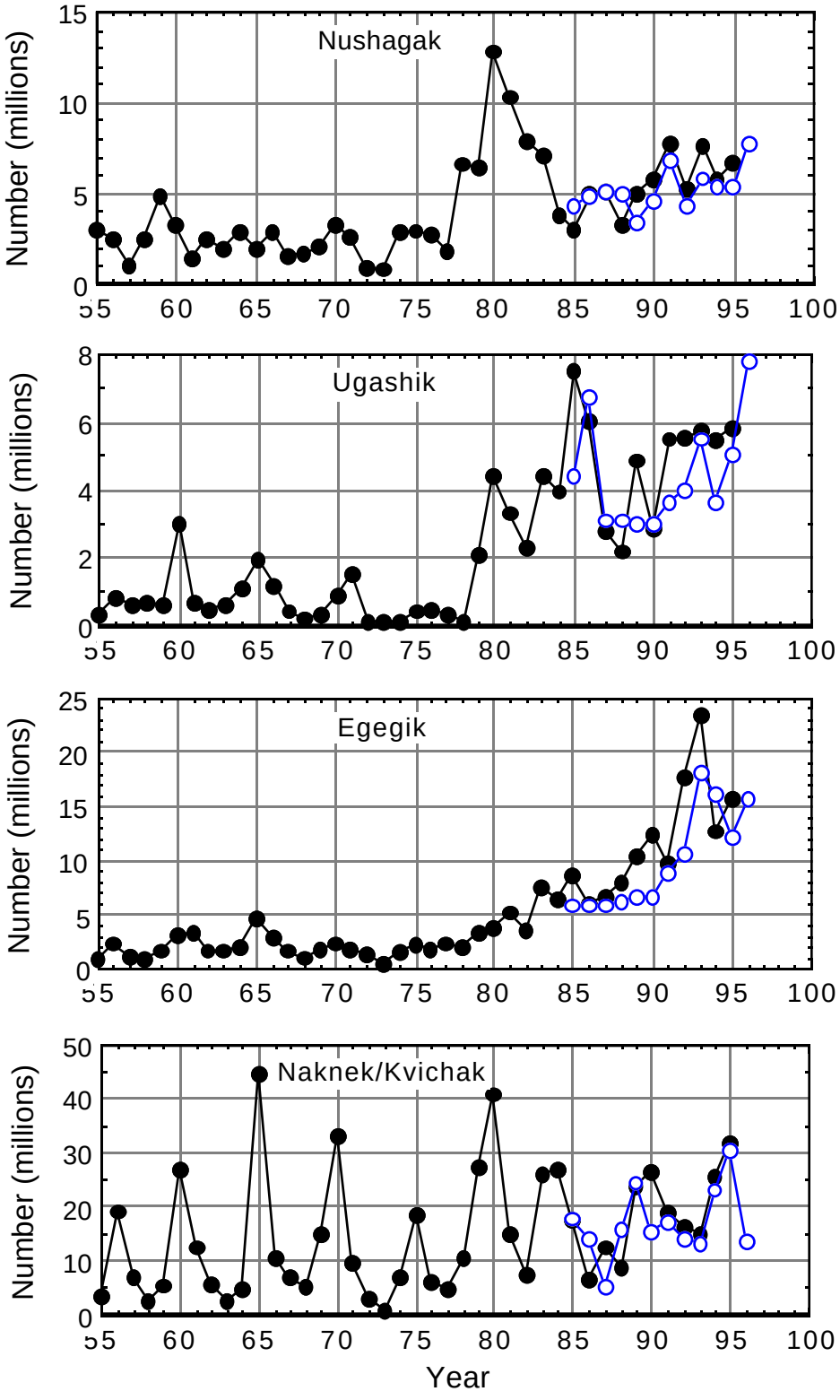


Figure 4. Sockeye salmon runs to the four major Bristol Bay fishing districts, 1955–95, and the FRI pre-season forecasts, 1985–96.

Table 1. Comparisons of forecasts and runs of Bristol Bay sockeye in millions, 1988–95.

| | | Pre-season forecasts | | | | | | Port | Moller |
|---|---|---|---|---|---|---|---|---|---|
| | | ADF&G | | FRI | | Actual | | forecast | (7/2-6) |
| Year | District | Run | Catch | Run | Catch | Run | Catch | Run | Catch |
| 1988 | Nak/Kvi | 11.4 | 5.2 | 15.7 | 9.5 | 8.8 | 3.5 | 8.0 | |
| | Egegik | 5.6 | 4.6 | 6.2 | 5.2 | 8.0 | 6.4 | 8.0 | |
| | Ugashik | 3.2 | 2.5 | 3.1 | 2.3 | 2.2 | 1.5 | 1.5 | |
| | Nushagak | 5.6 | 4.0 | 5.0 | 3.4 | 3.2 | 1.7 | 3.5 | |
| | Togiak | 0.7 | 0.5 | 0.6 | 0.4 | 1.0 | 0.7 | 1.0 | |
| | TOTAL | 26.5 | 16.8 | 30.6 | 20.8 | 23.2 | 13.8 | 22.0 | 12 |
| 1989 | Nak/Kvi | 16.0 | 6.8 | 24.3 | 15.0 | 23.5 | 13.8 | 26.5 | 16.0 |
| | Egegik | 5.6 | 4.6 | 6.7 | 5.7 | 10.5 | 8.9 | 8.0 | 7.0 |
| | Ugashik | 3.6 | 2.9 | 3.0 | 2.2 | 4.9 | 3.1 | 2.5 | 1.5 |
| | Nushagak | 3.1 | 1.4 | 3.4 | 2.0 | 4.9 | 2.8 | 5.0 | 3.5 |
| | Togiak | 0.6 | 0.5 | 0.6 | 0.5 | 0.2 | 0.1 | + | + |
| | TOTAL | 28.9 | 16.2 | 38.0 | 25.4 | 44.0 | 28.7 | 42.0 | 28.0 |
| 1990 | Nak/Nek | 13.0 | 5.8 | 15.3 | 8.1 | 26.4 | 17.1 | 23.0 | 14.0 |
| | Egegik | 5.6 | 4.6 | 6.6 | 5.5 | 12.3 | 10.1 | 8.0 | 6.5 |
| | Ugashik | 3.1 | 2.4 | 3.0 | 2.3 | 2.9 | 2.1 | 3.0 | 2.0 |
| | Nushagak | 3.4 | 1.7 | 4.6 | 3.0 | 5.7 | 3.6 | 4.0 | 2.5 |
| | Togiak | 0.3 | 0.2 | 0.3 | 0.1 | 0.4 | 0.2 | 0.5 | + |
| | TOTAL | 25.4 | 14.7 | 29.8 | 19.0 | 47.6 | 33.1 | 38.5 | 25.0 |
| 1991 | Nak/Nek | 14.1 | 8.9 | 17.0 | 9.5 | 18.6 | 10.6 | 17.0 | 7.0 |
| | Egegik | 8.2 | 7.2 | 8.9 | 7.8 | 9.6 | 6.8 | 7.0 | 5.0 |
| | Ugashik | 3.5 | 2.8 | 3.6 | 2.7 | 5.5 | 3.0 | 5.0 | 4.0 |
| | Nushagak | 3.8 | 2.1 | 6.8 | 4.8 | 7.7 | 5.3 | 8.0 | 4.5 |
| | Togiak | 0.4 | 0.2 | 0.4 | 0.2 | 0.8 | 0.5 | + | + |
| | TOTAL | 30.0 | 21.2 | 36.7 | 25.0 | 42.2 | 26.2 | 37.0 | 20.5 |
| 1992 | Nak/Kvi | 16.9 | 9.7 | 13.8 | 7.2 | 15.9 | 9.4 | 14.0 | 8.0 |
| | Egegik | 10.7 | 9.7 | 10.4 | 9.0 | 17.6 | 15.7 | 16.0 | 14.0 |
| | Ugashik | 4.3 | 3.6 | 4.0 | 3.0 | 5.5 | 3.4 | 5.0 | 4.0 |
| | Nushagak | 4.6 | 2.9 | 4.3 | 2.5 | 5.2 | 2.9 | 5.0 | 3.0 |
| | Togiak | 0.6 | 0.4 | 0.5 | 0.3 | 0.8 | 0.6 | 0.5 | + |
| | TOTAL | 37.1 | 26.3 | 33.0 | 22.0 | 45.0 | 32.0 | 41.0 | 29.0 |
| 1993 | Nak/Nek | 15.5 | 9.3 | 13.1 | 6.9 | 14.6 | 8.9 | 12.0 | 7.0 |
| | Egegik | 15.8 | 14.8 | 18.2 | 16.2 | 23.3 | 21.8 | 18.5 | 17.0 |
| | Ugashik | 4.9 | 4.2 | 5.5 | 4.5 | 5.7 | 4.3 | 5.0 | 4.0 |
| | Nushagak | 5.1 | 3.3 | 6.0 | 4.0 | 7.6 | 5.3 | 6.0 | 4.0 |
| | Togiak | 0.5 | 0.4 | 0.5 | 0.3 | 0.7 | 0.5 | 0.5 | 0.3 |
| | TOTAL | 41.8 | 32.0 | 43.3 | 31.9 | 51.9 | 40.8 | 42.0 | 32.3 |
| 1994 | Nak/Nek | 22.5 | 13.3 | 23.1 | 13.1 | 25.6 | 16.3 | 25.2 | 14.0 |
| | Egegik | 18.5 | 17.5 | 16.2 | 14.2 | 12.7 | 10.8 | 11.3 | 10.0 |
| | Ugashik | 5.5 | 4.8 | 3.6 | 2.9 | 5.4 | 4.4 | 3.0 | 2.0 |
| | Nushagak | 5.5 | 3.8 | 5.3 | 3.5 | 5.9 | 3.4 | 5.0 | 3.0 |
| | Togiak | 0.5 | 0.4 | 0.6 | 0.4 | 0.5 | 0.3 | 0.5 | 0.3 |
| | TOTAL | 52.5 | 39.7 | 48.8 | 34.1 | 50.1 | 35.2 | 45.0 | 29.3 |
| 1995 | Nak/Kvi | 30.8 | 19.6 | 30.2 | 17.7 | 31.8 | 20.4 | 25.1 | 13.8 |
| | Egegik | 13.1 | 12.1 | 12.1 | 10.0 | 15.7 | 14.5 | 13.0 | 11.5 |
| | Ugashik | 5.4 | 4.7 | 5.0 | 3.4 | 5.8 | 4.5 | 5.0 | 4.0 |
| | Nushagak | 5.3 | 3.5 | 5.3 | 3.0 | 6.7 | 4.4 | 5.6 | 3.6 |
| | Togiak | 0.5 | 0.4 | 0.5 | 0.3 | 0.7 | 0.5 | 0.5 | 0.3 |
| | TOTAL | 55.1 | 40.3 | 53.1 | 34.4 | 60.7 | 44.3 | 49.2 | 33.2 |

Table 2. Summary of 1995 Bristol Bay sockeye in-season forecasts from the Port Moller test boat.

| Date | Almanac forecast | Date issued | Comment |
|---|---|---|---|
| June | | | |
| 12 | | 12 | Index for 6/12 is a record high of 32. Temperatures in the North Pacific have been used |
| 15 | | | to forecast run timing for 1995--prediction is for average to 2 days later than average. |
| 16 | | | |
| 17 | | 17 | Based on sockeye lengths they are running about 75% 2-ocean. |
| 18 | | | |
| 19 | | | |
| 20 | 54 | | |
| 21 | 52 | | |
| 22 | 49 | 22 | Run will probably be between 45 and 55 million. Expect PM forecasts to drop for a few |
| 23 | 49 | | days then increase; should be strong showing in the bay on the 25th. PM fish are small |
| 24 | 48 | | and concentrated offshore. |
| 25 | 47 | | |
| 26 | 48 | | |
| 27 | 48 | | |
| 28 | 48 | | |
| 29 | 50 | 29 | Largest index so far (185), fish still concentrated offshore. |
| 30 | 49 | | |
| 1 | 48 | 1 | Forecasts by district totaling 49 million with 33 million catch were made from C & E |
| 2 | 50 | | through 6/30 and PM index through 7/1. |
| 3 | 50 | | |
| 4 | 50 | | |
| 5 | 51 | | |
| 6 | 50 | | |
| 7 | | | |
| Final run= 61 catch= 44 | | | Run timing was average |

Table 3. Comparison of the age compositions of sockeye salmon in Bristol Bay runs with age compositions in Port Moller catches, the False Pass fishery and pre-season forecasts.

| Year | | Age composition (%) 1.2 | 2.2 | 1.3 | 2.3 | All .2 | All .3 | Forecast/run (millions) |
|---|---|---|---|---|---|---|---|---|
| 1989 | ADF&G | 22 | 45 | 24 | 9 | 67 | 33 | 28.9 |
| | FRI | 13 | 62 | 18 | 7 | 75 | 25 | 38 |
| | False Pass | 8 | 62 | 13 | 15 | 70 | 28 | |
| | Port Moller | 13 | 45 | 22 | 17 | 58 | 39 | 37 |
| | BB run | 11 | 62 | 16 | 9 | 73 | 26 | 43.8 |
| 1990 | ADF&G | 19 | 42 | 26 | 13 | 61 | 39 | 25.4 |
| | FRI | 16 | 40 | 28 | 16 | 56 | 44 | 29.8 |
| | False Pass | 16 | 37 | 20 | 25 | 53 | 45 | |
| | Port Moller | 10 | 37 | 24 | 26 | 48 | 52 | 56 |
| | BB run | 14 | 41 | 21 | 20 | 56 | 43 | 47.8 |
| 1991 | ADF&G | 28 | 25 | 31 | 16 | 53 | 47 | 30 |
| | FRI | 41 | 14 | 31 | 14 | 55 | 45 | 36.7 |
| | False Pass | 21 | 33 | 36 | 6 | 54 | 46 | |
| | Port Moller | 12 | 14 | 55 | 13 | 28 | 71 | 37 |
| | BB run | 19 | 20 | 46 | 11 | 39 | 60 | 42.1 |
| 1992 | ADF&G | 19 | 39 | 27 | 13 | 58 | 42 | 37.1 |
| | FRI | 18 | 39 | 27 | 14 | 57 | 43 | 33 |
| | False Pass | 6 | 35 | 25 | 30 | 42 | 58 | |
| | Port Moller | 8 | 35 | 31 | 22 | 43 | 53 | 45 |
| | BB run | 13 | 34 | 27 | 22 | 47 | 50 | 44.9 |
| 1993 | ADF&G | 23 | 41 | 21 | 14 | 64 | 35 | 41.8 |
| | FRI | 16 | 41 | 20 | 21 | 56 | 43 | 43.3 |
| | False Pass | 14 | 46 | 14 | 23 | 61 | 38 | |
| | Port Moller | 7 | 27 | 19 | 44 | 34 | 65 | 45 |
| | BB run | 13 | 33 | 18 | 33 | 46 | 53 | 51.9 |
| 1994 | ADF&G | 14 | 43 | 19 | 22 | 57 | 43 | 52.5 |
| | FRI | 17 | 37 | 15 | 29 | 55 | 45 | 48.8 |
| | False Pass | 8 | 34 | 33 | 22 | 42 | 57 | |
| | Port Moller | 7 | 42 | 20 | 28 | 50 | 50 | 41 |
| | BB run | 8 | 56 | 14 | 18 | 65 | 34 | 50.1 |
| 1995 | ADF&G | 16 | 53 | 17 | 13 | 69 | 31 | 55.1 |
| | FRI | 9 | 50 | 19 | 20 | 59 | 41 | 53.1 |
| | False Pass | 19 | 57 | 12 | 11 | 76 | 24 | |
| | Port Moller | 14 | 51 | 15 | 19 | 65 | 34 | 49.2 |
| | BB Run | 16 | 56 | 12 | 14 | 73 | 27 | 60.7 |

Forecasts and runs do not include jacks (ages 1.1 and 2.1).
The Port Moller forecast is on 6/30 and the age composition is through 6/30 only.
In 1989 and 1993, the percentage of 2-ocean fish increased with date, whereas in 1990 the percentage of 2-ocean fish at Port Moller decreased with date.

Table 4. Timing of Nushagak and Naknek/Kvichak sockeye catches, 1958–95.

| | Nushagak | | | | | Naknek/Kvichak | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Catch | Percentage through: | | | | Catch | Percentage through: | | | |
| Year | (millions) | 6/25 | 6/30 | 7/5 | 7/10 | (millions) | 6/25 | 6/30 | 7/5 | 7/10 |
| 1958 | 1.1 | 5 | 40 | 73 | 88 | 0.9 | 2 | 27 | 48 | 91 |
| 59 | 1.7 | 1 | 3 | 38 | 74 | 1.7 | 4 | 8 | 35 | 61 |
| 60 | 1.5 | 12 | 36 | 62 | 71 | 9.8 | 1 | 17 | 50 | 69 |
| 61 | 0.5 | 9 | 29 | 71 | 84 | 8.2 | 1 | 32 | 80 | 96 |
| 62 | 1.5 | 4 | 4 | 62 | 82 | 2.2 | 14 | 28 | 48 | 78 |
| 63 | 0.8 | + | + | 61 | 91 | 1.0 | 5 | 29 | 70 | 85 |
| 64 | 1.4 | 7 | 18 | 63 | 80 | 2.2 | 5 | 16 | 26 | 92 |
| 65 | 0.8 | 13 | 28 | 49 | 73 | 19.1 | 5 | 29 | 50 | 72 |
| 66 | 1.2 | 2 | 3 | 39 | 73 | 5.4 | 2 | 20 | 63 | 93 |
| 67 | 0.6 | 18 | 73 | 87 | 89 | 2.3 | 26 | 55 | 77 | 86 |
| 68 | 0.7 | 17 | 66 | 80 | 92 | 1.2 | 4 | 33 | 45 | 92 |
| 69 | 0.8 | + | + | 58 | 81 | 4.7 | 1 | 18 | 59 | 77 |
| 70 | 1.2 | 2 | 15 | 59 | 89 | 17.8 | 3 | 31 | 65 | 91 |
| 71 | 1.3 | 1 | 5 | 21 | 53 | 5.9 | 1 | 10 | 28 | 43 |
| 72 | 0.4 | 1 | 10 | 50 | 96 | 1.1 | 10 | 53 | 76 | 94 |
| 73 | 0.3 | 1 | 29 | 77 | 77 | 0.2 | 14 | 29 | 79 | 79 |
| 74 | 0.5 | 0 | 0 | 26 | 64 | 0.5 | 0 | 0 | 13 | 65 |
| 75 | 0.6 | 0 | 0 | + | 62 | 3.1 | 0 | 0 | 17 | 57 |
| 76 | 1.2 | 2 | 8 | 49 | 68 | 2.5 | 0 | 8 | 40 | 62 |
| 77 | 0.6 | 3 | 21 | 66 | 79 | 2.2 | 1 | 23 | 76 | 84 |
| 78 | 3.1 | 5 | 21 | 62 | 92 | 5.1 | 2 | 26 | 26 | 82 |
| 79 | 3.3 | 7 | 40 | 63 | 82 | 15.0 | 7 | 32 | 63 | 84 |
| 80 | 4.5 | 0 | 0 | 28 | 72 | 15.1 | 1 | 3 | 33 | 71 |
| 81 | 7.5 | 5 | 18 | 49 | 83 | 11.0 | 5 | 22 | 60 | 86 |
| 82 | 5.9 | 1 | 19 | 54 | 86 | 5.0 | 2 | 19 | 45 | 86 |
| 83 | 5.1 | 1 | 18 | 53 | 78 | 21.6 | 2 | 25 | 58 | 82 |
| 84 | 2.2 | 11 | 24 | 51 | 78 | 14.2 | 3 | 11 | 38 | 75 |
| 85 | 1.3 | + | 21 | 48 | 86 | 8.1 | 2 | 37 | 68 | 82 |
| 86 | 2.8 | + | 8 | 33 | 68 | 2.9 | 1 | 1 | 36 | 52 |
| 87 | 3.3 | 6 | 15 | 32 | 73 | 4.9 | 1 | 3 | 6 | 27 |
| 88 | 1.7 | 0 | 16 | 58 | 58 | 3.6 | 7 | 18 | 52 | 56 |
| 89 | 2.9 | 0 | 16 | 59 | 80 | 13.9 | 7 | 25 | 57 | 80 |
| 90 | 3.3 | 0 | 0 | 17 | 65 | 17.4 | 1 | 11 | 46 | 70 |
| 91 | 5.3 | 0 | 1 | 38 | 77 | 10.6 | 1 | 4 | 44 | 76 |
| 92 | 2.9 | 1 | 15 | 39 | 61 | 9.3 | 2 | 10 | 38 | 72 |
| 93 | 5.3 | 5 | 29 | 67 | 91 | 8.9 | 12 | 40 | 78 | 94 |
| 94 | 3.4 | 2 | 2 | 26 | 68 | 16.3 | + | + | 15 | 58 |
| 95 | 4.5 | 1 | 26 | 56 | 73 | 20.4 | 1 | 19 | 40 | 71 |
| Average (1981-95) | 3.8 | 3 | 15 | 45 | 75 | 11.2 | 3 | 18 | 45 | 71 |

+ = less than 1%

Table 5. Timing of Egegik and Ugashik sockeye catches, 1958–95.

| | Egegik | | | | | Ugashik | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Catch | Percentage through: | | | | Catch | Percentage through: | | | |
| Year | (millions) | 6/25 | 6/30 | 7/5 | 7/10 | (millions) | 6/25 | 6/30 | 7/5 | 7/10 |
| 1958 | 0.5 | 3 | 19 | 72 | 92 | 0.4 | 5 | 32 | 58 | 89 |
| 59 | 0.7 | 7 | 17 | 37 | 66 | 0.4 | 5 | 12 | 28 | 65 |
| 60 | 1.4 | 8 | 22 | 42 | 68 | 0.8 | 3 | 13 | 31 | 63 |
| 61 | 2.7 | 14 | 33 | 58 | 96 | 0.4 | 5 | 11 | 40 | 77 |
| 62 | 0.6 | 10 | 26 | 67 | 88 | 0.2 | 7 | 7 | 26 | 72 |
| 63 | 0.7 | 5 | 14 | 44 | 81 | 0.2 | 6 | 25 | 51 | 72 |
| 64 | 1.1 | 11 | 28 | 33 | 85 | 0.6 | 6 | 10 | 20 | 66 |
| 65 | 3.2 | 7 | 42 | 68 | 88 | 0.9 | 3 | 23 | 48 | 83 |
| 66 | 2.1 | 8 | 17 | 68 | 96 | 0.4 | 3 | 9 | 32 | 78 |
| 67 | 1.1 | 37 | 84 | 95 | 95 | 0.2 | 32 | 52 | 65 | 82 |
| 68 | 0.7 | 18 | 72 | 99 | 99 | 0.1 | 6 | 34 | 56 | 83 |
| 69 | 0.9 | 10 | 41 | 72 | 99 | 0.2 | 2 | 6 | 82 | 91 |
| 70 | 1.4 | 23 | 37 | 76 | 95 | 0.2 | 7 | 29 | 29 | 56 |
| 71 | 1.3 | 6 | 17 | 34 | 76 | 1.0 | + | 2 | 12 | 50 |
| 72 | 0.8 | 9 | 25 | 82 | 100 | + | … | … | … | … |
| 73 | 0.2 | 12 | 56 | 96 | 96 | + | … | … | … | … |
| 74 | 0.2 | 2 | 2 | 42 | 94 | + | … | … | … | … |
| 75 | 1.0 | + | 2 | 18 | 94 | + | … | … | … | … |
| 76 | 1.3 | 2 | 12 | 62 | 93 | 0.2 | 2 | 5 | 18 | 60 |
| 77 | 1.8 | 7 | 30 | 62 | 86 | 0.1 | 28 | 28 | 28 | 28 |
| 78 | 1.2 | 13 | 30 | 30 | 71 | + | … | … | … | … |
| 79 | 2.3 | 16 | 38 | 71 | 85 | 0.4 | 2 | 8 | 18 | 22 |
| 80 | 2.6 | 2 | 10 | 41 | 74 | 0.9 | + | 3 | 8 | 33 |
| 81 | 4.4 | 12 | 34 | 64 | 89 | 2.1 | 2 | 7 | 19 | 55 |
| 82 | 2.4 | 11 | 28 | 33 | 87 | 1.1 | 2 | 11 | 25 | 74 |
| 83 | 6.8 | 3 | 28 | 58 | 84 | 3.3 | 1 | 10 | 30 | 58 |
| 84 | 6.3 | 7 | 34 | 49 | 75 | 2.7 | 2 | 10 | 27 | 44 |
| 85 | 7.5 | 6 | 44 | 59 | 86 | 6.3 | 1 | 13 | 31 | 65 |
| 86 | 5.0 | 2 | 6 | 43 | 63 | 4.9 | 2 | 2 | 29 | 54 |
| 87 | 5.4 | 3 | 34 | 58 | 80 | 2.1 | 3 | 3 | 30 | 56 |
| 88 | 6.4 | 18 | 41 | 63 | 80 | 1.5 | 4 | 4 | 7 | 21 |
| 89 | 8.7 | 8 | 28 | 51 | 73 | 3.2 | 2 | 2 | 8 | 43 |
| 90 | 10.0 | 1 | 4 | 36 | 74 | 2.1 | 2 | 2 | 12 | 47 |
| 91 | 6.8 | + | 4 | 49 | 75 | 3.0 | 1 | 1 | 10 | 54 |
| 92 | 15.7 | 7 | 18 | 49 | 78 | 3.4 | 1 | 3 | 3 | 21 |
| 93 | 21.8 | 17 | 42 | 78 | 95 | 4.3 | 3 | 5 | 19 | 75 |
| 94 | 10.8 | 2 | 6 | 36 | 72 | 4.4 | + | 1 | 4 | 30 |
| 95 | 14.5 | 11 | 30 | 53 | 74 | 4.5 | 1 | 9 | 27 | 50 |
| Average (1981-95) | 8.8 | 8 | 25 | 52 | 79 | 3.3 | 2 | 6 | 19 | 50 |

Table 6. Average weights of sockeye in the Bristol Bay commercial catches, 1960–95.

| | 2-ocean | | | 3-ocean | | | All | All | All | BB Catch | Percent | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Male | Female | Combined | Male | Female | Combined | males | females | fish | millions | 3-ocean | females |
| 1960 | 4.7 | 4.0 | 4.4 | 7.2 | 6.0 | 6.5 | 4.9 | 4.7 | 4.8 | 14 | 20 | 38 |
| 61 | 5.4 | 4.7 | 5.2 | 7.4 | 6.2 | 6.8 | 6.7 | 5.9 | 6.3 | 12 | 71 | 49 |
| 62 | 5.6 | 4.8 | 5.2 | 7.4 | 6.3 | 6.8 | 6.0 | 5.3 | 5.7 | 5 | 27 | 50 |
| 63 | 5.7 | 4.9 | 5.3 | 7.9 | 6.5 | 7.1 | 6.6 | 5.5 | 6.0 | 3 | 51 | 54 |
| 64 | 5.4 | 4.7 | 5.1 | 7.7 | 6.5 | 7.0 | 5.8 | 5.3 | 5.6 | 6 | 27 | 47 |
| 65 | 4.7 | 4.2 | 4.5 | 6.9 | 5.9 | 6.3 | 4.9 | 4.5 | 4.7 | 24 | 11 | 40 |
| 66 | 5.1 | 4.7 | 4.9 | 7.5 | 6.3 | 6.7 | 6.9 | 6.0 | 6.3 | 9 | 80 | 62 |
| 67 | 5.6 | 4.9 | 5.2 | 7.7 | 6.5 | 6.9 | 6.3 | 5.6 | 5.9 | 4 | 39 | 56 |
| 68 | 5.4 | 4.8 | 5.1 | 8.0 | 6.7 | 7.2 | 6.4 | 5.8 | 6.1 | 3 | 47 | 53 |
| 69 | 5.5 | 4.9 | 5.2 | 7.4 | 6.4 | 6.9 | 5.7 | 5.2 | 5.4 | 7 | 15 | 52 |
| 70 | 5.0 | 4.5 | 4.8 | 6.7 | 5.7 | 6.0 | 5.2 | 4.7 | 5.0 | 21 | 10 | 47 |
| 71 | 5.3 | 4.7 | 4.9 | 7.2 | 6.0 | 6.5 | 6.4 | 5.5 | 5.9 | 10 | 62 | 60 |
| 72 | 5.4 | 4.7 | 5.1 | 7.6 | 6.3 | 6.9 | 6.6 | 5.8 | 6.2 | 2 | 60 | 48 |
| 73 | 5.5 | 5.1 | 5.3 | 8.4 | 6.8 | 7.5 | 7.9 | 6.6 | 7.2 | 1 | 86 | 53 |
| 74 | 5.5 | 4.9 | 5.2 | 7.5 | 6.6 | 7.1 | 6.0 | 5.4 | 5.7 | 1 | 27 | 52 |
| 75 | 5.4 | 4.7 | 5.1 | 7.7 | 6.4 | 6.9 | 6.0 | 5.4 | 5.7 | 5 | 32 | 49 |
| 76 | 5.7 | 4.9 | 5.4 | 8.0 | 6.7 | 7.2 | 6.4 | 5.8 | 6.1 | 6 | 40 | 47 |
| 77 | 5.5 | 4.9 | 5.2 | 8.3 | 6.8 | 7.5 | 7.0 | 6.2 | 6.6 | 5 | 60 | 53 |
| 78 | 5.4 | 4.7 | 5.1 | 8.2 | 6.6 | 7.3 | 6.5 | 5.6 | 6.1 | 10 | 44 | 48 |
| 79 | 5.8 | 5.2 | 5.5 | 7.4 | 6.3 | 6.8 | 6.1 | 5.5 | 5.8 | 21 | 20 | 50 |
| 80 | 5.2 | 4.6 | 4.9 | 7.4 | 6.0 | 6.6 | 5.8 | 5.0 | 5.4 | 24 | 29 | 51 |
| 81 | 5.7 | 5.0 | 5.3 | 7.6 | 6.4 | 7.0 | 6.7 | 5.7 | 6.2 | 26 | 53 | 52 |
| 82 | 5.3 | 4.8 | 5.0 | 7.5 | 6.4 | 6.9 | 7.0 | 6.0 | 6.5 | 15 | 77 | 50 |
| 83 | 5.7 | 4.8 | 5.2 | 7.1 | 6.2 | 6.6 | 5.9 | 5.1 | 5.5 | 37 | 18 | 52 |
| 84 | 5.1 | 4.5 | 4.9 | 7.2 | 6.3 | 6.7 | 5.8 | 5.2 | 5.5 | 25 | 35 | 46 |
| 85 | 5.4 | 4.7 | 5.1 | 7.3 | 6.4 | 6.8 | 6.2 | 5.5 | 5.8 | 24 | 44 | 48 |
| 86 | 5.7 | 4.9 | 5.3 | 7.4 | 6.2 | 6.7 | 6.6 | 5.7 | 6.1 | 16 | 57 | 54 |
| 87 | 5.3 | 4.8 | 5.0 | 7.5 | 6.5 | 6.9 | 6.3 | 5.7 | 6.0 | 16 | 49 | 53 |
| 88 | 5.4 | 4.7 | 5.1 | 7.6 | 6.6 | 7.1 | 6.7 | 5.9 | 6.3 | 14 | 60 | 47 |
| 89 | 5.3 | 4.6 | 4.9 | 7.4 | 6.2 | 6.8 | 6.0 | 5.0 | 5.5 | 28 | 29 | 53 |
| 90 | 5.0 | 4.6 | 4.8 | 7.4 | 6.2 | 6.7 | 6.1 | 5.4 | 5.8 | 33 | 50 | 53 |
| 91 | 5.1 | 4.3 | 4.7 | 7.2 | 5.9 | 6.5 | 6.5 | 5.4 | 5.9 | 26 | 67 | 54 |
| 92 | 4.8 | 4.3 | 4.6 | 6.7 | 5.7 | 6.1 | 5.8 | 5.1 | 5.5 | 32 | 58 | 45 |
| 93 | 5.5 | 4.7 | 5.1 | 7.3 | 6.2 | 6.7 | 6.4 | 5.6 | 6.0 | 41 | 54 | 53 |
| 94 | 4.9 | 4.4 | 4.6 | 7.0 | 5.7 | 6.3 | 5.7 | 4.9 | 5.3 | 35 | 39 | 54 |
| 95 | 5.1 | 4.4 | 4.8 | 7.0 | 6.1 | 6.3 | 5.6 | 4.9 | 5.3 | 44 | 29 | 45 |
| Means 85-94 | 5.2 | 4.6 | 4.9 | 7.3 | 6.2 | 6.7 | 6.2 | 5.4 | 5.8 | 27 | 51 | 51 |

Table 7. Forecasts of the 1996 Bristol Bay sockeye runs.

| River system | District | Runs by age group (millions) 1.2 | 2.2 | 2-ocean | 0.3 | 1.3 | 2.3 | 3-ocean | Total | Catch |
|---|---|---|---|---|---|---|---|---|---|---|
| Kvichak | | 1.9 | 1.5 | 3.4 | | 1.6 | 3.0 | 4.6 | 8.0 | |
| Naknek | | 0.3 | 0.7 | 1.0 | | 1.9 | 1.6 | 3.5 | 4.5 | |
| Branch | | 0.2 | 0.2 | 0.4 | | 0.2 | 0.1 | 0.3 | 0.7 | |
| | Naknek/Kvichak | 2.4 | 2.4 | 4.8 | | 3.7 | 4.7 | 8.4 | 13.2 | 7.5 |
| | Egegik | 0.8 | 6.0 | 6.8 | | 1.7 | 7.2 | 8.9 | 15.7 | 13.8 |
| | Ugashik | 0.9 | 1.2 | 2.1 | | 3.7 | 2.0 | 5.7 | 7.8 | 6.1 |
| Wood | | 1.6 | 0.1 | 1.7 | | 2.1 | 0.1 | 2.2 | 3.9 | |
| Igushik | | 0.1 | 0.1 | 0.2 | | 1.6 | 0.1 | 1.7 | 1.9 | |
| Nush/Nuy | | 0.1 | + | 0.1 | 0.7 | 1.1 | + | 1.8 | 1.9 | |
| | Nushagak | 1.8 | 0.2 | 2.0 | 0.7 | 4.8 | 0.2 | 5.7 | 7.7 | 5.4 |
| | Togiak | 0.1 | + | 0.1 | | 0.6 | 0.1 | 0.7 | 0.8 | 0.6 |
| | Bristol Bay | 6.0 | 9.8 | 15.8 | 0.7 | 14.5 | 14.2 | 29.4 | 45.2 | 33.4 |

+ indicates less than 100,000 predicted

Catches estimated by subtracting recent (5-year) mean escapements from runs

Table 8. Bristol Bay sockeye runs by age group, 1958–95, and forecasts for 1996.

| Year | 1-ocean | Age 1.2 | Age 2.2 | Total 2-ocean | Age 1.3 | Age 2.3 | Total 3-ocean | 4-ocean | Total catch | |
|---|---|---|---|---|---|---|---|---|---|---|
| 58 | | 1.5 | 1.5 | 3.0 | 1.4 | 1.3 | 2.7 | | 5.7 | 3 |
| 59 | | 4.8 | 5.8 | 10.9 | 1.0 | 0.9 | 1.9 | | 12.8 | 5 |
| 60 | | 30.0 | 2.0 | 32.0 | 2.8 | 1.5 | 4.3 | | 36.4 | 14 |
| 61 | + | 0.4 | 5.6 | 6.1 | 10.9 | 1.0 | 12.0 | + | 18.1 | 12 |
| 62 | + | 2.4 | 4.8 | 7.3 | 1.0 | 2.1 | 3.1 | + | 10.4 | 5 |
| 63 | + | 1.9 | 1.9 | 3.9 | 1.1 | 1.7 | 2.9 | + | 6.9 | 3 |
| 64 | 0.2 | 5.6 | 2.8 | 8.4 | 1.5 | 0.7 | 2.3 | + | 10.9 | 6 |
| 65 | + | 1.2 | 47.6 | 48.9 | 3.1 | 1.1 | 4.2 | + | 53.1 | 24 |
| 66 | + | 1.3 | 3.0 | 4.4 | 3.5 | 9.6 | 13.1 | + | 17.5 | 9 |
| 67 | + | 1.1 | 5.7 | 6.8 | 1.3 | 2.0 | 3.5 | + | 10.3 | 4 |
| 68 | 0.2 | 3.1 | 1.9 | 5.0 | 1.7 | 1.1 | 2.8 | + | 8.0 | 3 |
| 69 | 0.6 | 10.8 | 5.3 | 16.2 | 1.2 | 1.0 | 2.2 | + | 19.0 | 7 |
| 70 | + | 3.4 | 32.2 | 35.6 | 2.7 | 1.0 | 3.7 | 0.0 | 39.4 | 21 |
| 71 | + | 1.6 | 4.8 | 6.4 | 6.8 | 2.6 | 9.4 | + | 15.8 | 10 |
| 72 | + | 1.0 | 1.7 | 2.7 | 1.2 | 1.4 | 2.7 | + | 5.4 | 2 |
| 73 | + | 0.2 | 0.2 | 0.4 | 1.0 | 0.9 | 2.0 | + | 2.4 | 1 |
| 74 | 0.1 | 2.0 | 6.8 | 8.8 | 1.4 | 0.6 | 2.0 | + | 10.9 | 1 |
| 75 | + | 1.6 | 17.2 | 19.1 | 2.3 | 2.7 | 5.1 | + | 24.2 | 5 |
| 76 | + | 1.6 | 5.3 | 7.3 | 2.6 | 1.5 | 4.2 | + | 11.5 | 6 |
| 77 | + | 1.6 | 2.8 | 4.5 | 1.8 | 3.2 | 5.1 | + | 9.6 | 5 |
| 78 | 0.4 | 10.5 | 1.5 | 12.0 | 4.9 | 2.3 | 7.2 | 0.2 | 19.8 | 10 |
| 79 | 0.3 | 11.0 | 21.1 | 32.2 | 5.3 | 2.0 | 7.3 | + | 39.8 | 22 |
| 80 | 0.3 | 12.0 | 34.1 | 46.2 | 13.6 | 2.2 | 15.9 | + | 62.4 | 24 |
| 81 | + | 5.7 | 10.2 | 15.9 | 13.8 | 4.5 | 18.4 | + | 34.3 | 26 |
| 82 | 0.1 | 4.2 | 1.2 | 5.4 | 12.8 | 3.6 | 16.4 | 0.2 | 22.1 | 15 |
| 83 | 0.1 | 27.6 | 9.8 | 37.4 | 6.6 | 1.3 | 7.9 | 0.3 | 45.7 | 37 |
| 84 | 0.1 | 6.2 | 22.2 | 28.4 | 7.9 | 4.2 | 12.2 | + | 40.7 | 25 |
| 85 | 0.1 | 4.7 | 16.7 | 21.4 | 9.2 | 5.8 | 15.0 | + | 36.6 | 24 |
| 86 | + | 3.0 | 7.0 | 10.0 | 10.1 | 3.1 | 13.5 | 0.1 | 23.6 | 16 |
| 87 | + | 13.5 | 3.2 | 16.7 | 7.0 | 3.5 | 10.5 | + | 27.3 | 16 |
| 88 | 0.2 | 4.9 | 5.1 | 10.0 | 9.7 | 3.0 | 12.7 | 0.2 | 23.2 | 14 |
| 89 | 0.1 | 4.7 | 27.3 | 32.1 | 7.0 | 4.0 | 11.6 | 0.1 | 43.9 | 29 |
| 90 | + | 7.0 | 19.7 | 27.0 | 9.9 | 9.5 | 20.6 | 0.2 | 47.8 | 33 |
| 91 | 0.1 | 7.9 | 8.6 | 16.6 | 19.5 | 4.8 | 25.4 | 0.1 | 42.2 | 26 |
| 92 | 0.1 | 5.8 | 15.3 | 21.3 | 12.0 | 10.0 | 22.5 | 1.1 | 45.0 | 32 |
| 93 | 0.2 | 6.7 | 17.2 | 24.0 | 9.6 | 17.1 | 27.3 | 0.6 | 52.1 | 41 |
| 94 | 0.2 | 4.3 | 28.3 | 32.8 | 7.2 | 8.9 | 17.0 | 0.3 | 50.3 | 35 |
| 95 | + | 9.8 | 34.2 | 44.3 | 7.1 | 8.8 | 16.3 | 0.2 | 60.7 | 44 |
| 96 | | 6.0 | 9.8 | 15.8 | 14.5 | 14.2 | 29.4 | + | 45.2 | 33 |
| Means 1986-95 | 0.1 | 6.8 | 16.6 | 23.5 | 9.9 | 7.3 | 17.7 | 0.3 | 41.6 | 29 |

Table 9. Kvichak sockeye salmon statistics to forecast 1996 runs by freshwater age.

| Brood year | Escapement Number millions | Escapement Percent age .2 | Age 1 smolt Number millions | Age 1 smolt Mean weight | Adult Return (millions) 1.1 | 1.2 | 1.3 | Total | Smolt/ adult survival (%) | Mean length age 1.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 74 | 4.43 | 91 | 108 | 5.8 | .009 | 6.14 | 1.93 | 8.08 | 7.5 | 501 |
| 75 | 13.14 | 96 | 78 | 5.5 | .005 | 5.50 | 1.18 | 6.69 | 8.6 | 517 |
| 76 | 1.97 | 81 | 32 | 6.0 | .005 | 5.04 | .76 | 5.81 | 18.1 | 500 |
| 77 | 1.34 | 86 | 29 | 6.0 | .039 | 1.82 | .84 | 2.70 | 9.3 | 518 |
| 78 | 4.15 | 81 | 182 | 5.9 | .000 | 1.66 | 1.09 | 2.75 | 1.5 | 513 |
| 79 | 11.22 | 90 | 220 | 5.4 | .057 | 17.60 | 2.14 | 19.80 | 9.0 | 510 |
| 80 | 17.50 | 96 | 150 | 5.1 | .002 | 2.81 | 1.49 | 4.30 | 2.9 | 478 |
| 81 | 1.75 | 82 | 7 | 4.9 | .000 | .77 | .22 | .99 | 14.1 | 523 |
| 82 | 1.14 | 65 | 52 | 6.8 | .000 | .44 | .52 | .96 | 1.8 | 528 |
| 83 | 3.57 | 93 | 24 | 5.3 | .001 | 8.38 | 2.98 | 11.36 | 47.3 | 515 |
| 84 | 10.49 | 80 | 83 | 5.5 | .000 | 2.46 | 1.87 | 4.33 | 5.2 | 512 |
| 85 | 7.21 | 68 | 11 | 4.5 | .007 | 1.00 | 1.24 | 2.25 | 20.4 | 505 |
| 86 | 1.18 | 74 | 13 | 5.6 | .000 | .66 | 1.05 | 1.71 | 13.2 | 490 |
| 87 | 6.07 | 96 | 147 | 5.5 | .004 | 4.04 | 2.38 | 6.42 | 4.4 | 493 |
| 88 | 4.06 | 56 | 47 | 5.8 | .004 | 2.43 | 2.37 | 4.80 | 10.2 | 495 |
| 89 | 8.32 | 92 | 87 | 5.5 | .002 | 2.01 | 1.56 | 3.57 | 4.1 | 511 |
| 90 | 7.00 | 91 | 18 | 5.6 | .008 | 1.50 | 1.14 | 2.65 | 14.7 | 487 |
| 91 | 4.20 | 77 | 22 | 6.0 | .001 | 2.59 | 1.61 | | | 506 |
| 92 | 4.73 | 77 | 54 | 5.7 | .000 | 1.87 | | | | |

1) 96 forecast of age 1.2 from return of age 1.1 (.000) and number of smolt (54) for 1974-91. R^2=.77; F2,13=22.3 Y=-.07+129(age 1.1)+.036(smolt)

2) 96 forecast of age 1.3 from return of age 1.2 (2.59) and mean length of age 1.2 (506) for 1981-90. R^2=.81; F2,8=16.9 Y=10.7+.320(age 1.2)-.020 (1.2 length)

| Brood year | Escapement Number millions | Escapement Percent age .2 | Age 2 smolt Number millions | Age 2 smolt Mean weight | Adult Return (millions) 2.1 | 2.2 | 2.3 | Total | Smolt/ adult survival (%) | Mean length age 2.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 74 | 4.43 | 91 | 114 | 10.1 | .301 | 16.38 | .72 | 17.40 | 15.3 | 528 |
| 75 | 13.14 | 96 | 213 | 7.8 | .298 | 28.18 | .55 | 29.03 | 13.6 | 508 |
| 76 | 1.97 | 81 | 26 | 10.3 | .043 | 3.85 | .24 | 4.13 | 15.9 | 532 |
| 77 | 1.34 | 86 | 10 | 10.7 | .002 | .18 | .09 | .27 | 2.7 | 531 |
| 78 | 4.15 | 81 | 32 | 10.2 | .016 | 1.24 | .80 | 2.06 | 6.4 | 524 |
| 79 | 11.22 | 90 | 89 | 9.1 | .073 | 17.01 | 3.28 | 20.36 | 22.9 | 504 |
| 80 | 17.50 | 96 | 76 | 8.5 | .020 | 7.79 | .38 | 8.19 | 10.8 | 523 |
| 81 | 1.75 | 82 | 38 | 10.0 | .000 | .91 | .16 | 1.07 | 2.8 | 536 |
| 82 | 1.14 | 65 | 2 | 9.2 | .001 | .50 | .14 | .64 | 32.1 | 521 |
| 83 | 3.57 | 93 | 53 | 10.4 | .003 | 1.13 | .54 | 1.67 | 3.2 | 533 |
| 84 | 10.49 | 80 | 330 | 7.0 | .043 | 16.35 | 2.39 | 18.78 | 5.7 | 513 |
| 85 | 7.21 | 68 | 87 | 8.3 | .028 | 13.08 | 1.51 | 14.62 | 16.8 | 497 |
| 86 | 1.18 | 74 | 7 | 10.0 | .000 | 1.34 | 1.23 | 2.57 | 36.7 | 506 |
| 87 | 6.07 | 96 | 41 | 10.5 | .030 | 4.24 | .68 | 4.95 | 12.1 | 514 |
| 88 | 4.06 | 56 | 34 | 9.9 | .019 | 4.02 | .53 | 4.57 | 13.4 | 538 |
| 89 | 8.32 | 92 | 61 | 9.3 | .117 | 18.47 | 3.24 | 21.83 | 35.8 | 502 |
| 90 | 7.00 | 91 | 205 | 8.2 | .082 | 20.55 | 3.02 | | | 510 |
| 91 | 4.20 | 77 | 30 | 9.5 | .002 | 1.49 | | | | |

1) 96 forecast of age 2.2 from return of 2.1 (.002) and number of age 2 smolt (30), 1981-90. R^2= .93; F2,7= 43.5 Y= .486 + .146(age 2.1) + .034 (age 2 smolt)

2) 96 forecast of age 2.3 from return of age 2.2 (20.55) and regression for 1981-89. R^2=.86; F1,7=42.6 Y= .24 + .135 (age 2.2)

Table 10. Sockeye salmon escapements and returns to the Naknek and Branch rivers.

Naknek

| | Escapement | | Smolt millions | | Adult return (millions) | | | | | | | Mean length | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brood year | Number millions | % age .2 | age 1 | age 2 | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | Total | 1.2 | 2.2 |
| 81 | 1.80 | 29 | 37 | 49 | .004 | .76 | 2.48 | .008 | .46 | 1.46 | 5.17 | 475 | 502 |
| 82 | 1.16 | 13 | 32 | 13 | .003 | .18 | .75 | .000 | .21 | .45 | 1.59 | 477 | 487 |
| 83 | .89 | 65 | 6 | 19 | .000 | .14 | .48 | .007 | .32 | .45 | 1.40 | 475 | 506 |
| 84 | 1.24 | 65 | 22 | | .001 | .46 | .88 | .022 | 1.17 | 1.76 | 4.29 | 480 | 491 |
| 85 | 1.85 | 58 | | | .002 | .64 | 3.41 | .019 | 1.26 | 2.68 | 8.01 | 471 | 472 |
| 86 | 1.98 | 21 | | | .003 | 1.90 | 6.95 | .006 | 1.23 | 2.61 | 12.70 | 451 | 475 |
| 87 | 1.06 | 20 | | | .000 | .32 | 1.18 | .004 | .53 | 3.11 | 5.14 | 461 | 476 |
| 88 | 1.04 | 48 | | | .000 | .27 | .76 | .013 | .47 | .52 | 2.03 | 448 | 493 |
| 89 | 1.16 | 68 | | | .001 | .21 | .87 | .005 | 1.13 | .55 | 2.77 | 467 | 470 |
| 90 | 2.09 | 56 | | 29 | .001 | .39 | 1.18 | .046 | 1.30 | 1.63 | | 454 | 490 |
| 91 | 3.58 | 23 | 24 | 42 | .013 | .53 | 1.91 | .001 | .74 | | | 484 | |
| 92 | 1.61 | 26 | 33 | | .000 | .34 | | | | | | | |

1) 96 forecast of age 1.2 from recent 5-year average (.34).
2) 96 forecast of age 1.3 from return of 1.2 (.53) and regression of 1.3 on 1.2 returns.
   R^2= .94; F1,7= 136 Y= 3.72(1.2 return) - .06
3) 96 forecast of age 2.2 from escapement (3.58) and percent .2 in escapement (23).
   R^2= .65; F2,7= 6.6 Y= .68(escape.) + .011(percent .2)
4) 96 forecast of age 2.3 from 5-year mean (1.63)

Branch River

| | Escapement | | Adult return (millions) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Brood year | Number millions | % age .2 | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | Total |
| 81 | .08 | 49 | .000 | .05 | .17 | .000 | .05 | .01 | .28 |
| 82 | .24 | 15 | .000 | .17 | .13 | .000 | .00 | .00 | .30 |
| 83 | .10 | 85 | .000 | .14 | .13 | .000 | .03 | .00 | .30 |
| 84 | .22 | 37 | .001 | .15 | .14 | .000 | .04 | .02 | .35 |
| 85 | .12 | 30 | .003 | .35 | .11 | .000 | .09 | .01 | .56 |
| 86 | .23 | 64 | .001 | .33 | .26 | .000 | .19 | .01 | .79 |
| 87 | .15 | 63 | .000 | .15 | .16 | .000 | .16 | .08 | .55 |
| 88 | .19 | 60 | .001 | .15 | .14 | .000 | .26 | .04 | .59 |
| 89 | .20 | 79 | .005 | .33 | .16 | .002 | .17 | .16 | .83 |
| 90 | .17 | 85 | .002 | .26 | .12 | .000 | .32 | .06 | |
| 91 | .28 | 69 | .000 | .19 | .17 | .004 | .22 | | |
| 92 | .22 | 75 | .002 | .24 | | | | | |

1) 96 forecast for age 1.2 from return of age 1.1 (.002) and regression of 1.2 on 1.1 returns
   R^2= .57; F1,9= 11.7 Y= .15 + 45.5(age 1.1 return)
2) 96 forecasts of returns for ages 2.2, 1.3 and 2.3 from recent 5-year averages.

Table 11. Egegik sockeye salmon statistics to forecast runs by freshwater age.

| Smolt Year | Escapement Number millions | Escapement Percent age .2 | Age 1 smolt Number millions | Age 1 smolt Mean weight | Adult return (millions) 1.1 | 1.2 | 1.3 | Total | Smolt/ adult survival (%) | Mean length age 1.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89 | 1.27 | 54 | 72 | 8.9 | .000 | .86 | 4.34 | 5.20 | 7.2 | 496 |
| 94 | 1.94 | 63 | 55 | 9.7 | .000 | .78 | | | | |
| 85 | 0.79 | 88 | 55 | 10.4 | .002 | 1.72 | 2.69 | 4.41 | 8.0 | 509 |
| 88 | 1.15 | 74 | 36 | 10.2 | .002 | 1.76 | 3.59 | 5.35 | 14.9 | 483 |
| 93 | 2.79 | 56 | 20 | 9.3 | .001 | 1.33 | 1.68 | | | 502 |
| 84 | 1.03 | 88 | 17 | 10.1 | .002 | 1.01 | 1.79 | 2.80 | 16.5 | 510 |
| 86 | 1.17 | 69 | 14 | 9.0 | .001 | .58 | .93 | 1.51 | 10.8 | 502 |
| 92 | 2.19 | 70 | 6 | 9.7 | .000 | .40 | 1.33 | 1.73 | 28.8 | 480 |
| 91 | 1.61 | 58 | 5 | 10.3 | .000 | .59 | .43 | 1.02 | 20.4 | 522 |
| 90 | 1.61 | 57 | 4 | 9.6 | .001 | .40 | 1.43 | 1.83 | 45.7 | 472 |
| 87 | 1.10 | 67 | 4 | 11.6 | .000 | .54 | 1.33 | 1.87 | 46.8 | 511 |
| 83 | 0.69 | 71 | 2 | 9.5 | .000 | .52 | .95 | 1.47 | 73.5 | 519 |

1) 96 forecast of age 1.2 from return of age1.1 (.000) and number of age 1 smolt (55)
R^2= .70; F2,9= 10.7 Y= .42 + 324(age 1.1) + .0065(age 1 smolt)
2) 96 forecast of age 1.3 from number of age 1. smolt (20) and regression of age1.3 on age 1 smolt
R^2= .75; F1,9=27.4 Y= .82+ .043(age 1 smolt)

| Smolt Year | Escapement Number millions | Escapement Percent age .2 | Age 2 smolt Number millions | Age 2 smolt Mean weight | Adult return (millions) 2.1 | 2.2 | 2.3 | Total | Smolt/ adult survival (%) | Mean length age 2.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 1.61 | 58 | 89 | 15.6 | .063 | 10.24 | 5.48 | 15.78 | 17.7 | 520 |
| 90 | 1.27 | 54 | 52 | 14.5 | .064 | 8.41 | 10.73 | 19.20 | 36.9 | 492 |
| 87 | 1.17 | 69 | 46 | 14.1 | .083 | 6.17 | 4.74 | 10.91 | 23.7 | 524 |
| 94 | 2.77 | 56 | 39 | 13.7 | .020 | 6.00 | | | | |
| 93 | 2.19 | 70 | 38 | 12.2 | .065 | 9.28 | 7.15 | | | 512 |
| 84 | 0.70 | 71 | 32 | 12.2 | .060 | 3.30 | 1.39 | 4.69 | 14.7 | 528 |
| 86 | 0.79 | 88 | 30 | 15.7 | .007 | 3.03 | 2.61 | 5.64 | 18.8 | 520 |
| 89 | 1.15 | 74 | 27 | 15.4 | .010 | 3.79 | 4.21 | 8.00 | 29.6 | 502 |
| 92 | 1.61 | 54 | 17 | 13.3 | .034 | 5.98 | 3.92 | 9.90 | 58.2 | 488 |
| 88 | 1.10 | 67 | 13 | 14.3 | .031 | 4.17 | 1.22 | 5.39 | 41.5 | 498 |
| 85 | 1.03 | 29 | 11 | 16.8 | .012 | 1.74 | 1.59 | 3.33 | 30.3 | 529 |

1) 96 forecast of age 2.2 from number of smolt (39) and regression of smolt on return of 2.2
R^2= .60; F1,8= 12.0 Y= 2.17 + .097(age 2 smolt)
2) 96 forecast of age 2.3 from return of age 2.2 (9.28) and regression of 2.3 on 2.2 returns
R^2= .54: F1,8= 9.3 Y= .812(Age 2.2) - .15

Table 12. Ugashik sockeye salmon statistics to forecast runs by freshwater age.

| Brood year | Escapement Number millions | Escapement Percent age .2 | Age 1 smolt Number millions | Age 1 smolt Mean weight | Adult return (millions) 1.1 | 1.2 | 1.3 | Total | Smolt/ adult survival (%) | Mean length age 1.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 1.33 | 42 | 31 | 7.6 | .002 | 1.51 | 2.51 | 4.02 | 13.0 | 514 |
| 82 | 1.16 | 20 | 75 | 6.8 | .001 | .41 | .69 | 1.10 | 1.5 | 514 |
| 83 | 1.00 | 90 | 13 | 8.3 | .000 | .60 | .34 | 0.94 | 7.2 | 512 |
| 84 | 1.24 | 81 | 38 | 5.8 | .000 | .45 | .55 | 1.00 | 2.6 | 512 |
| 85 | 1.00 | 75 | 6 | 7.9 | .001 | .49 | .69 | 1.18 | 19.7 | 507 |
| 86 | 1.00 | 41 | 183 | 5.7 | .001 | .48 | 2.38 | 2.86 | 1.6 | 488 |
| 87 | 0.67 | 56 | 89 | 6.5 | .001 | .81 | 1.55 | 2.36 | 2.7 | 502 |
| 88 | 0.64 | 54 | 15 | 6.7 | .002 | .45 | .67 | 1.12 | 7.5 | 498 |
| 89 | 1.68 | 84 | 26 | 7.7 | .007 | .66 | .37 | 1.04 | 4.0 | 517 |
| 90 | 0.73 | 60 |  |  | .001 | .34 | .67 | 1.01 |  | 488 |
| 91 | 2.48 | 57 | 58 | 8.0 | .006 | 1.93 | 3.75 |  |  | 504 |
| 92 | 2.17 | 48 | 24 | 6.7 | .003 | .88 |  |  |  |  |

1) 96 forecast of age 1.2 from return age 1.1
R^2=.28; F1,8=3.0 Y=.54+112(age 1.1)
2) 96 forecast of age 1.3 from return of age1. 2 (1.93) and mean length of 1.2 (504)
R^2= .73; F2,7= 9.4 Y= 23.44 + 2.07(age 1.2) - .047(mean length age 1.2)

| Brood year | Escapement Number millions | Escapement Percent age.2 | Age 2 smolt Number millions | Age 2 smolt Mean weight | Adult return (millions) 2.1 | 2.2 | 2.3 | Total | Smolt/ adult survival (%) | Mean length age 2.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 1.33 | 42 | 83 | 10.3 | .004 | 2.20 | .90 | 3.10 | 3.7 | 524 |
| 82 | 1.16 | 22 | 21 | 11.8 | .001 | .58 | .72 | 1.30 | 6.2 | 517 |
| 83 | 1.00 | 90 | 15 | 10.9 | .006 | .59 | .30 | .89 | 5.9 | 528 |
| 84 | 1.24 | 80 | 21 | 11.1 | .054 | 3.50 | .69 | 4.24 | 20.2 | 523 |
| 85 | 1.00 | 75 | 33 | 10.8 | .002 | .95 | .46 | 1.41 | 4.3 | 504 |
| 86 | 1.00 | 41 | 32 | 10.7 | .001 | 1.83 | 1.63 | 3.46 | 10.8 | 506 |
| 87 | 0.67 | 56 | 39 | 11.8 | .010 | 1.78 | 2.26 | 4.04 | 10.4 | 499 |
| 88 | 0.64 | 58 | 48 | 11.6 | .026 | 2.03 | 2.18 | 4.24 | 8.8 | 527 |
| 89 | 1.68 | 84 |  |  | .014 | 2.43 | .93 | 3.37 |  | 490 |
| 90 | 0.73 | 61 | 12 | 12.5 | .015 | 2.23 | 2.01 |  |  | 517 |
| 91 | 2.48 | 57 | 6 | 11.2 | .001 | 1.22 |  |  |  |  |

1) 96 forecast of age 2.2 from return of age 2.1 (.001)
R^2= .63; F1,7= 11.8 Y=1.18 + 42.6(age 2.1)
2) 96 forecast of age 2.3 from return of age 2.2 (2.23) and escapement (.73)
R^2= .72; F2,5= 6.4 Y= 3.13+ .325 (age 2.2) - 2.53 (escape.)

Table 13. Sockeye salmon escapements and returns to the Wood and Igushik Rivers.

Wood River

| Brood year | Escapement: Number millions | Escapement: Percent age .2 | Temperatures for: Fry Apr-Oct | Temperatures for: Smolt June | Adult Return (millions): 1.1 | 1.2 | 2.2 | 1.3 | 2.3 | Total | Mean length of 1.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 1.23 | 37 | 5.4 | 6.2 | .000 | .60 | .08 | 1.14 | .09 | 1.91 | 490 |
| 82 | .98 | 34 | 7.5 | 9.2 | .003 | .50 | .13 | .90 | .02 | 1.55 | 501 |
| 83 | 1.36 | 75 | 6.8 | 3.8 | .001 | 1.91 | .02 | 1.23 | .07 | 3.23 | 495 |
| 84 | 1.00 | 22 | 5.0 | 5.4 | .000 | .52 | .03 | 1.32 | .02 | 1.89 | 502 |
| 85 | .94 | 49 | 6.7 | 5.3 | .003 | 1.11 | .03 | 1.37 | .01 | 2.52 | 501 |
| 86 | .82 | 36 | 7.5 | 7.6 | .002 | 1.16 | .07 | 1.94 | .06 | 3.23 | 480 |
| 87 | 1.34 | 82 | 6.9 | 5.2 | .000 | 1.36 | .09 | .74 | .09 | 2.28 | 486 |
| 88 | .87 | 37 | 8.3 | 5.9 | .001 | 1.59 | .09 | 1.39 | .03 | 3.10 | 482 |
| 89 | 1.19 | 49 | 7.8 | 5.3 | .004 | 2.17 | .01 | 1.82 | .04 | 4.04 | 496 |
| 90 | 1.07 | 50 | 8.0 | 4.7 | .001 | 1.08 | .28 | 1.15 | .10 | | 477 |
| 91 | 1.16 | 36 | 6.5 | 8.8 | .012 | 2.53 | .11 | 2.15 | | | 496 |
| 92 | 1.29 | 73 | 9.1 | 8.1 | .001 | 1.61 | | | | | |

1) 96 return of age 1.2 from return age 1.1 (.001) and percent age .2 in escapement (73).
R^2=.67; F2,8= 8.0 Y= .08 + 204 (age 1.1) + .019 (% age .2)
2) 96 forecast of age 1.3 was from a forecast of percent age .2 in escapement (36) and return of age 1.2 (2.53). This forecast that the 2.53 was 54% of the total return; thus the return of age 1.3 in 1996 is 2.15 million.
3) 96 return of age 2.2 from recent 5-year average (.11).
4) 96 return of age 2.3 from escapement (1.07) and mean length of age 1.2 (477)
R^2= .86; F2,6= 18.2 Y= 1.08 + .114 (escapement) - .0023 (ML age 1.2)

Igushik

| Brood Year | Escapement: Number millions | Escapement: Percent age.2 | Mean air temp. for: Fry Apr-Oct | Mean air temp. for: Smolt June | Adult returns (millions): 1.2 | 2.2 | 1.3 | 2.3 | Total | Mean length of 1.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 81 | .59 | 24 | 5.8 | 6.2 | .15 | .00 | .83 | .05 | 1.03 | 512 |
| 82 | .42 | 5 | 7.6 | 9.2 | .05 | .01 | .48 | .01 | .55 | 548 |
| 83 | .18 | 73 | 6.8 | 3.8 | .15 | .01 | .33 | .03 | .52 | 508 |
| 84 | .19 | 9 | 5.0 | 5.4 | .03 | .05 | .63 | .03 | .74 | 525 |
| 85 | .21 | 37 | 6.7 | 5.3 | .51 | .08 | .90 | .08 | 1.57 | 525 |
| 86 | .31 | 7 | 7.5 | 7.6 | .23 | .03 | 2.20 | .03 | 2.49 | 494 |
| 87 | .17 | 40 | 6.9 | 5.2 | .16 | .01 | .57 | .03 | .77 | 516 |
| 88 | .17 | 12 | 8.3 | 5.9 | .19 | .04 | 1.02 | .04 | 1.29 | 503 |
| 89 | .46 | 49 | 7.8 | 5.3 | .48 | .06 | 1.05 | .05 | 1.64 | 519 |
| 90 | .37 | 25 | 8.0 | 4.7 | .16 | .18 | 1.36 | .11 | | 494 |
| 91 | .76 | 6 | 6.5 | 8.8 | .31 | .05 | 1.65 | | | 507 |
| 92 | .30 | 26 | 9.1 | 8.1 | .14 | | | | | |

1) 96 returns of age 1.2 and 2.2 from recent 5-year averages.
3) 96 return of age 1.3 from return of age 1.2 (.31), % age 2 in escape. (6) and length of 1.2 (504).
R^2= .83: F3,6= 9.7 Y= 12.65 + 1.63 (age 1.2) - .016(%.2 Esc) - .0225(Length 1.2)
4) 96 return of age 2.3 from return of age 2.2 and regression of age 2.3 on age 2.2
R^2= .43; F1,7= 5.3 Y= .024 + .474 (age 2.2)

Table 14. Sockeye salmon escapements and returns to the Nushagak and Togiak Rivers.

Nushagak/Nuyakuk

| Brood year | Escapement Number millions | Escapement Percent age .2 | Adult return (millions) 0.2 | 0.3 | 0.4 | 1.2 | 1.3 | 1.4 | Total | Mean length 1.2 | 1.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 1.01 | 13 | .01 | .12 | .01 | .16 | 1.43 | .06 | 1.79 | 487 | 554 |
| 82 | .60 | 7 | .04 | .33 | .05 | .16 | .85 | .06 | 1.49 | 497 | 572 |
| 83 | .40 | 35 | .10 | .57 | .12 | .11 | .62 | .02 | 1.54 | 502 | 570 |
| 84 | .59 | 16 | .01 | .22 | .03 | .12 | .55 | .02 | .95 | 493 | 568 |
| 85 | .50 | 48 | .06 | .49 | .06 | .06 | .59 | .01 | 1.27 | 459 | 558 |
| 86 | .99 | 6 | .06 | .83 | .06 | .11 | .67 | .21 | 1.94 | 471 | 554 |
| 87 | .39 | 28 | .14 | .92 | .25 | .04 | .52 | .10 | 1.97 | 462 | 541 |
| 88 | .48 | 16 | .07 | .52 | .12 | .21 | 1.39 | .06 | 2.37 | 468 | 573 |
| 89 | .50 | 14 | .07 | .47 | .03 | .12 | .66 | .02 | 1.37 | 480 | 555 |
| 90 | .67 | 22 | .05 | .75 | .10 | .04 | .24 | | | 454 | 556 |
| 91 | .50 | 5 | .01 | .13 | .05 | .17 | 1.08 | | | 461 | |
| 92 | .70 | 31 | .08 | .66 | | .12 | | | | | |
| 93 | .72 | 10 | | | | | | | | | |

2) 96 forecast of age 0.3 from age 0.2 return (.08) and regression of 0.3 on 0.2 return
R^2= .71; F1,9=22.2 Y = .21 + 5.11(0.2 return)

3) 96 forecast of age 0.4 from return of 0.2 (.01) and regression of 0.4 on 0.2 return
R^2=.57; F1,7= 9.1 Y = .213(age 0.3 return) - .025

4) 96 forecast of age 1.2 from 5-year average (.12).
R^2=.31; F1,8= 3.5 Y = .161 - .0023(Esc. % age .2)

5) 96 forecast of age 1.3 from return of age 1.2 (.24) and regression of 1.3 on 1.2 return
R^2=.72; F1,8= 20.7 Y = .09 + 5.83(age1.2 return)

Togiak

| Brood year | Escapement Number millions | Escapement Percent age .2 | Adult return (millions) 0.2 | 0.3 | 1.2 | 1.3 | 2.2 | 2.3 | Total | Mean length 1.2 | 1.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | .31 | 19 | .002 | .01 | .05 | .24 | .01 | .02 | .33 | 501 | 568 |
| 82 | .29 | 30 | .000 | .02 | .11 | .24 | .01 | .02 | .40 | 513 | 579 |
| 83 | .21 | 28 | .001 | .00 | .28 | .91 | .01 | .02 | 1.22 | 516 | 586 |
| 84 | .15 | 41 | .000 | .01 | .02 | .11 | .00 | .02 | .16 | 520 | 583 |
| 85 | .15 | 20 | .000 | .01 | .03 | .21 | .04 | .08 | .37 | 513 | 579 |
| 86 | .20 | 27 | .000 | .03 | .08 | .44 | .08 | .11 | .74 | 504 | 572 |
| 87 | .28 | 39 | .000 | .01 | .19 | .53 | .03 | .08 | .84 | 514 | 567 |
| 88 | .31 | 73 | .001 | .01 | .11 | .39 | .03 | .05 | .59 | 515 | 592 |
| 89 | .10 | 3 | .000 | .04 | .12 | .31 | .01 | .04 | .52 | 522 | 561 |
| 90 | .19 | 24 | .001 | .02 | .10 | .43 | .07 | .11 | .73 | 495 | 570 |
| 91 | .28 | 41 | .001 | .00 | .18 | .57 | .04 | | | 516 | |
| 92 | .19 | 24 | .001 | | .14 | | | | | | |

1) 96 forecasts of ages 1.2 and 2.2 from recent 5-year averages

2) 96 forecast of age 1.3 from return of 1.2 (.18) and regression of age 1.3 on 1.2 returns
R^2= .86; F1,8=47 Y = .089 + 2.67(age 1.2 return)

4) 96 forecast of age 2.3 from return of 2.2 (.07) and regression of 2.3 on 2.2 returns
R^2= .86; F1,7=43.5 Y= .018 + 1.274(age 2.2 return)