MIDDLE FORK GOODNEWS RIVER FISHERIES STUDIES, 1998

By

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OFFICE OF EQUAL OPPORTUNITY (OEO) STATEMENT

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ABSTRACT

Abundance, age, sex, and length data are summarized for 1998 Middle Fork Goodnews River spawning escapements of Pacific salmon *Oncorhynchus* as part of an ongoing project to collect baseline information. The escapement of 4,584 chinook salmon *O. tshawytscha*, exceeded the escapement goal (3,500) for the first time since 1995. The escapement of 47,951 sockeye salmon *O. nerka*, and 28,905 chum salmon *O. keta*, exceeded the escapement goals of 25,000 and 15,000 fish, respectively. In most years the project has not been operational during a majority of the pink salmon *O. gorbuscha*, and coho salmon *O. kisutch* runs, and no escapement goals have been established. However, the operation of the floating weir in 1998 allowed the majority of pink and coho salmon to be counted. Escapements of pink and coho salmon were 10,376 and 35,441 fish, respectively.

The escapement for chinook salmon in the 1990s has ranged from 1,903 to 4,836 fish (average 3,215 fish). The escapement for sockeye salmon ranged from 26,453 to 57,504 fish (average 40,949 fish), and the chum salmon escapement ranged from 6,410 to 40,125 fish (average 25,084 fish).

The predominant age classes of the fish sampled at the escapement project were age-1.3 sockeye, age-0.3 chum, and age-2.1 coho salmon. The age composition in the 1998 escapement was consistent with the age composition seen in most years.

KEY WORDS: Goodnews, chinook, sockeye, chum, pink, coho, escapement, *Oncorhynchus*, *tshawytscha*, *nerka*, *keta*, *gorbuscha*, *kitsutch*

INTRODUCTION

The Goodnews River originates in the Ahklun mountains and flows southwest approximately 60 miles to Goodnews Bay (Figure 1). The Middle Fork parallels the length of the mainstem (North Fork) Goodnews River before joining near its mouth. The Goodnews River system drains an area of approximately 910 square miles and contains many lakes. All five species of Pacific salmon reside in the Goodnews River drainage. The Alaska Department of Fish and Game (ADF&G) has operated a counting tower from 1981 through 1990, and a weir since 1991 on the Middle Fork Goodnews River (Schultz 1982, 1984a, 1984b, 1985, 1987; Schultz and Burkey 1989; Burkey 1989, 1990; Menard 1998).

Salmon Fisheries

Subsistence and commercial fisheries occur in Goodnews Bay, and sport and subsistence fisheries occur in the Goodnews River drainage (Burkey, et. al. 1997). District 5 (Goodnews Bay), is the southernmost salmon district in the Kuskokwim Area (Figure 2). Commercial fishing has occurred annually since 1968 in Goodnews Bay. Commercial fishing is conducted primarily with the use of drift gillnets in tidal channels in Goodnews Bay and a few set gillnets near the mouth of the bay. In 1998, commercial harvests of chinook *Oncorhynchus tshawytscha* were above average, and commercial harvests of sockeye *O. nerka*, coho *O. kisutch*, pink *O. gorbuscha*, and chum *O. keta* salmon were below the most recent ten-year (1988 -1997) harvest average (Appendix 1). The pink salmon commercial harvest may not truly reflect abundance as pink salmon is the least commercially valuable species and is not targeted. Historically, the return of pink salmon in even years is larger than returns in odd years.

Beginning in 1996, the number of permits fished has been less than half of the number of permits fished in the early 1990s. From 1991 to 1995, the number of permits fished ranged from 111 to 118, but in 1996, 1997, and 1998 there were 53, 54, and 50 permits fished, respectively. The lower harvest of sockeye and chum salmon in 1998 may be due to approximately one-third less permit holders participating this year during July when compared with previous years.

Subsistence fishing is allowed throughout the Goodnews River drainage and in Goodnews Bay. Residents of the Goodnews Bay villages have long depended upon the fishery resources as a source of food. The Department has quantified subsistence harvests in Goodnews Bay since 1977. Harvest estimates are made from interviews with subsistence fishing families in October or November (Appendix 2).

Sport fishing occurs throughout the Goodnews River drainage. Many sport fish anglers take float trips from the lakes to Goodnews Bay. In the 1990s there has been one semi-permanent sport fishing lodge located on the North Fork Goodnews River approximately one mile upriver from the confluence of the North and Middle Forks. Also, there is one temporary sport fish camp located on

the Middle Fork Goodnews River, approximately 15 miles upriver from the confluence of the North and Middle Forks. The most recent sport fishing effort estimate available is for 1997. That estimate of 6,342 angler-days (Howe et al. 1998) was nearly triple the reported previous year's effort of 2,322 angler-days (Howe et al. 1997). Howe et al. (1998) reported a five-year average (1993 - 97) of 2,802 angler-days.

Project History

The Middle Fork Goodnews River project is the third oldest continuing salmon escapement assessment project in the Kuskokwim Area. The Middle Fork Goodnews River study site for both the tower operations from 1981 through 1990 and for the weir operations from 1991 through 1998 was approximately 11 river miles (18 km) from Goodnews Bay village (Figure 1).

The project was initiated as a counting tower in 1981 and operated for ten seasons. A major drawback to the tower project was the lack of visibility under high and turbid water conditions. This made it difficult to identify the salmon species, particularly when the salmon lacked spawning coloration. Another drawback to the tower project was the high labor costs because of the need to conduct counts of fish passage on an hourly basis.

In 1991 a fixed-panel weir was installed approximately 200 meters downstream from the counting tower location. Labor costs were lowered because the passage of fish through the weir could be controlled, eliminating the need to monitor the fish passage hourly. The live trap connected to the weir eliminated the need for beach seining to capture salmon for age-sex-length (ASL) information. Because of the efficiency of the weir the personnel needed for project operations was reduced from three to two.

The fixed-panel weir was operated from 1991 through mid-season in 1997. Species identification improved with the weir, as the observer was now within five feet of the salmon passing upstream. During high water events, frequent monitoring was necessary to detect any openings that allowed fish to pass upstream without being enumerated. Openings in the weir occurred most often at the base, where the current would dig a hole in the gravel underneath the weir panel. In some years, periods of high water required the weir to be removed from the stream to prevent it from being "washed out" downstream.

In late July 1997, the fixed-panel weir was removed and a new resistance-board "floating weir" was installed. The resistance-board weir was able to handle higher water levels and a heavier debris load than the fixed-panel weir. The use of a resistance-board weir allowed the project to operate, for the first time, into September, which is traditionally a time period of higher water. In 1998 the resistance-board weir was used throughout the project duration.

Escapement Objectives

Preliminary escapement objectives of 3,000 to 4,000 chinook, 35,000 to 45,000 sockeye and 13,000 to 18,000 chum salmon were established in 1983 (Schultz, 1984b). The escapement objective for sockeye salmon was lowered to 20,000 to 30,000 in 1989 (Burkey, 1990). Evaluation of the sockeye salmon exploitation rate in previous years indicated that historical harvest levels could be maintained with a reduced escapement objective (Appendix 2). The average estimated sockeye exploitation rate (subsistence and commercial), in the 1990s, was 29% with a range of 15 to 43% (Appendix 2).

The biological escapement goals (BEG's) for chinook, sockeye, and chum salmon were set at 3,500 chinook, 25,000 sockeye, and 15,000 chum salmon. The BEG's represent those escapement levels thought to be necessary to maintain returns at current levels, and are based on historical aerial surveys, counting tower and weir information. BEG's are useful in evaluating abundance trends and the success of fishery management strategies. Inseason cumulative escapement estimates can be compared with historical migratory timing to qualitatively assess whether BEG's will be achieved. This information helps the managers of the Goodnews Bay commercial fishery determine the appropriate level of commercial fishing effort. Continued assessment of salmon returns may include adjustments of the BEG's in the future to optimize salmon production.

METHODS

Materials

The resistance-board weir was approximately 130 ft (39.6 m) in length and attached at one end to a fixed-panel weir and at the other end to a fixed-picket weir. The resistance-board "floating weir" consisted of two major parts. The weir was anchored to the stream bottom with duckbill anchors that secured a steel rail that ran perpendicular to the stream flow. The 4 ft (1.22m) wide and 20 ft (6.10 m) long panels had two hooks which attached to a cable on the steel rail. Each panel was comprised of 18, PVC Schedule 40, pipes (1in diameter), with 2 ft (.61m) by 4 ft resistance boards attached to the downstream edge. The resistance boards provide lift to buoy the downstream end of the panel above the water.

The fixed-panel weir consisted of three major parts. Seven wooden tripods, composed of three beams, 4 in (10.16 cm) by 6 in (15.24 cm), and a sandbag platform per tripod, were installed from the right bank (facing downstream) to the beginning of the resistance-board weir (approximately 50 ft). Sandbags were placed on the tripod platform to provide stability against the current. Two 3 in (7.62 cm) diameter aluminum pipes (10 ft, 3.05 m) were positioned to span the distance between the front legs of adjacent tripods. The third major part of the weir consisted of weir panels positioned to rest on the upstream surface of the aluminum pipe. Weir panels consisted of fifteen

aluminum pipes (pickets) 1 in (2.54 cm) in diameter, and measured 2ft 6in (.76 m) wide by 6 ft 8 in (2.03 m) in length.

The fixed-picket weir is similar to the fixed-panel weir. The fixed-picket weir was approximately 10 ft long, and extended from the resistance-board weir to the left bank. One tripod was used and horizontal aluminum bars with holes, to allow individual pipes to be placed through, were placed across the tripod. The aluminum bars were secured to shore and individual pipes (1 in diameter) were slid through the bar holes.

Escapement Estimates

Fish were counted at different locations along the weir depending on water conditions. If the water level was high, the fish congregated behind the fixed-picket portion of the weir and a few pickets could be removed to allow for the upstream passage of fish. At lower water levels, the fish were counted through the weir by partially removing a panel, in the fixed-panel section of the weir, or in the resistance-board section of the weir a specialized passing chute panel could be opened to allow fish passage. To help identify the salmon species in the deeper water, a lightly colored board, which aided visibility, was placed on the stream bottom.

High water levels in 1998 delayed the installation of the weir until early July. The weir was fish tight at 2100 hours on July 4. In 1997, the weir was installed on June 11, and the first sockeye and chum salmon passed through the weir on June 13, and the first chinook salmon on June 14. To account for the portion of the salmon run missed before the weir was operational, an interpolation based on the previous year's passage was used. The escapement from 1993 – 1997, excluding 1996 (due to paucity of data), was used to estimate the historical average proportion of passage through July 4 (Appendix 4). In cases where the weir was not "fish tight" for a short duration, a simple interpolation was used to estimate fish passage based on the estimated time there was a breach in the weir.

Migration Timing

To evaluate fish travel time between the Goodnews Bay commercial fishery and the weir site, the cumulative escapement counts were compared with the cumulative commercial fishery catch. A plot of both the cumulative commercial catch and the cumulative escapement counts to date was made. Initiation of the fishery, fishing conditions, salmon abundance and many other factors can influence the estimate of travel time and this method was used as a very approximate estimate of travel time.

Age, Sex, and Length

Escapement sampling was conducted based on a pulse sampling design (Molyneaux and DuBois 1996). Most sampling effort was focused on sockeye, chum, and coho salmon, and a limited

number of chinook salmon were also sampled. The sample size goal for each pulse sample was 200 fish per species. Each pulse sample was used to estimate the ASL composition of the run for a given temporal stratum. A weighted mean, based on relative fish passage during each defined stratum as the weight, was used to estimate age composition of the total season passage.

Fish were captured with a trap installed in the fixed-panel weir. A weir panel would be moved to allow salmon to pass upstream into the trap and the panel would be replaced to prevent their downstream movement.

Scales were collected from the left side of the fish approximately two rows above the lateral line in the area crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963). Scales were mounted on gum cards and impressions made on cellulose acetate cards with a heated hydraulic press (Clutter and Whitesel 1956). Salmon were measured to the nearest one-half centimeter from the middle of the eye to the fork of the tail. The sex of each fish was determined from external characteristics.

Ages for salmon were determined by examining scales (Mosher 1968). European notation (e.g., 2.2; Koo 1962) was used to record ages: numerals preceding the decimal refer to number of freshwater annuli and numerals following the decimal refer to number of marine annuli. Total age from time of egg deposition or brood year is the sum of these numbers plus one.

Aerial Survey

The Department usually conducts spawning ground aerial surveys each year on the Goodnews River system (Appendix 3). Aerial surveys occur from a fixed-wing airplane at a height of approximately 500 feet. Aerial surveys count only a percentage of the fish present, which may vary depending on the experience of the surveyor, weather conditions and the spawning stage of the salmon at the time of the survey. The total estimate of passage on both the North and Middle Forks Goodnews River uses both the weir and aerial survey data (Appendix 2). The percentage of the salmon observed by the surveyor on the Middle Fork was calculated by comparing the aerial survey count above the weir site with the weir count through that date. The North Fork aerial survey count is then adjusted for observer efficiency to estimate the escapement in that river up until and including the date of the aerial survey. Expanding the aerial survey count of the entire Goodnews River to estimate total escapement based on this relationship assumes the surveyor was observing the same percentage of the fish throughout the survey area. The final estimate of North Fork escapement is then adjusted for the percentage of passage through the Middle Fork weir after the survey.

Escapement objectives based on aerial index counts (Appendix 3) do not represent total escapement, but may reflect annual spawner abundance trends when made using standard survey methods under acceptable survey conditions. Escapement objectives for North Fork Goodnews River and Lake aerial surveys are 1,600 chinook, 15,000 sockeye and 17,000 chum salmon.

Escapement objectives for Middle Fork Goodnews River and Lakes aerial surveys are 800 chinook, 5,000 sockeye and 4,000 chum salmon.

Atmospheric and Hydrological Observations

Project personnel recorded standard environmental factors during project operations. Water level, precipitation, air and water temperatures were normally recorded at the site. Visual estimates of wind velocity and sky conditions were also recorded.

RESULTS

Escapement Estimates

Estimates of salmon escapement in 1998 at the Middle Fork Goodnews River weir were 4,584 chinook, 47,951 sockeye, 28,905 chum, 10,376 pink, and 35,441 coho salmon (Table 1). From July 4 thorough mid-September, 2,916 Dolly Varden were enumerated (Table 2). Carcass counts on the upstream side of the weir were 546 chinook, 634 sockeye, 6,077 chum, 3,319 pink, and 33 coho salmon (Table 3). There were 26 Dolly Varden and 6 rainbow trout carcasses counted during the season.

The escapement goal of 3,500 chinook salmon was reached for the first time since 1995 (Appendix 13). In the 1990s the chinook salmon escapement goal has been reached in only four of nine years. The estimated chinook salmon escapement in the years 1990 through 1998 ranged from 1,903 in 1992 to 4,836 in 1995. The average escapement from 1990 through 1998 was 3,215 chinook salmon.

The escapement goal of 25,000 sockeye has been reached for nine consecutive years (Appendix 13). The estimated sockeye salmon escapement in the years 1990 through 1998 ranged from 26,452 in 1993 to 57,504 in 1996. The average escapement from 1990 through 1998 was 40,949 sockeye salmon.

The escapement goal of 15,000 chum salmon was reached in 1998, and in the 1990s has been reached in eight of nine years. The estimated chum salmon escapement in the years 1990 through 1998 ranged from 6,410 in 1990 to 40,125 in 1996. The average escapement from 1990 through 1998 was 25,084 chum salmon.

No escapement goals have been established for pink or coho salmon. Except for 1997 and 1998, the project had been terminated before a significant proportion of the pink and coho salmon migration had occurred. The highest escapements recorded were 38,705 pink salmon in 1994, and previous to 1998, 10,869 coho salmon in 1996.

Migration Timing

Because of the late installation of the weir no estimate of migration timing for chinook, sockeye and chum salmon was attempted. However, migration timing curves of chinook, sockeye, chum were plotted (Figures 4 - 6) using the historical migration timing information to compare with 1998 estimates. Comparisons of the migration timing with historical migration timing will be analyzed in the Discussion section of the report. The coho migration timing curve (Figure 7) shows the travel time from the commercial fishery to the weir to be approximately ten days in 1998.

Age, Sex, and Length

Chinook salmon were not captured in sufficient numbers in the weir trap to allow an estimate of age, sex and length composition. Samples from the chinook salmon commercial gillnet catch were comprised of age 3 to 7 years old fish (Appendix 5). Mean length of the commercial catch increased with increasing age (Appendix 6).

Sockeye salmon sampled were predominantly age 1.3 (Table 4), however, the first third of the run was not sampled and the age, sex and length composition of the season's escapement could not be estimated. Mean length of the samples was larger for males than females in all brood years. Mean length in the same brood year, but different age group, e.g. ages 1.3 and 2.2, exhibited larger size in the age group having more ocean years (Table 5).

Chum salmon sampled were primarily age-0.3 fish. There was a tendency for the proportion of age-0.4 fish to decline and the proportion of age-0.3 fish to increase as the season progressed (Table 6). Also, there was a large proportion of males at the start of the run and a large proportion of females at the end of the run. The mean length of males was larger than females in each age class in both the escapement (Table 7) and the commercial catch (Appendix 10).

Coho salmon sampled were primarily age-2.1 fish. Age-1.1 and age-3.1 coho salmon comprised approximately 10% of the species escapement (Table 8). Length measurements taken in 1998 did not exhibit noticeable differences in length between sexes of age-2.1 coho salmon (Table 9). There were not enough samples of the other age classes to make comparisons.

Aerial Survey

In 1998, one aerial survey of the Goodnews River drainage was flown on July 24. Only the aerial survey escapement objective of sockeye (5,000) in the Middle Fork Goodnews River and Lakes was met. Overall, in the 1990s escapement objectives by aerial surveys for both components of the Goodnews River drainage (North Fork Goodnews River and Lake, and Middle Fork Goodnews River and Lakes) were reached in only two years for chinook salmon and one year for sockeye salmon (Appendix 3). However, in only three of nine years were there acceptable survey conditions throughout the drainage.

Atmospheric and Hydrological Observations

Observations at the project site were taken from June 12 until September 18 (Table 10). Air temperatures ranged from 21 to 75 degrees Fahrenheit and water temperatures ranged from 42 to 58 degrees Fahrenheit. The highest water level was at the initiation of the project (Figure 3). The water level reached its lowest point in mid-August and began to rise with the increased precipitation after that time.

DISCUSSION

Although the resistance-board "floating weir" has allowed the project to operate during higher water periods, the installation process can be delayed due to water conditions. In 1998, the installation of the resistance-board weir was delayed approximately three weeks because of high water. Interpolations, based on historical data, were used to estimate fish passage during the time the weir was not operational. The weir was operational from 2100 hours on July 4 until 1200 hours on September 17. Estimates were made for chinook, sockeye, and chum salmon for the period of the run before July 5.

Escapement Estimates

In 1998 the escapement of chinook salmon was estimated at 4,584 fish. The actual count of chinook salmon was 3,097 fish and an additional 1,487 chinook (approximately 32%) were estimated to have passed before July 5. This estimation of passage before the weir was operational was based on historical passage at the weir from four of the five previous years (Appendix 4). However, this total passage estimate should be used as a guideline only because a significant portion of the run was missed.

The management strategy the last five years has been to delay the first commercial fishery opening, until the last week in June, in an attempt to increase escapement of chinook salmon into the Goodnews River drainage. This strategy has resulted in the escapement goal of chinook salmon, past the weir, being met three times in the five year period, 1994 – 1998. The previous five years, 1989 – 1993, the chinook escapement goal had been met one time. In 1998, the first commercial opening, on June 30, was the latest the commercial fishing season opened since 1971. Despite the later start of commercial fishing, the 1998 harvest of chinook salmon was the largest since 1985 (Appendix 1).

The strategy to delay the initiation of the commercial fishery also affects sockeye and chum escapement. During the last five years both sockeye and chum escapement goals were reached (Appendix 13). In 1998, the escapement of sockeye salmon was estimated at 47,951 fish. The actual count of sockeye salmon was 32,837 fish and an additional 15,114 sockeye (approximately

32%) were estimated to have passed before July 5. This estimation of passage, before the weir was operational, was based on historical passage at the weir from four of the five previous years (Appendix 4). The passage of chum salmon previous to July 5 was also estimated by the same method. The escapement of chum salmon was estimated at 28,905 fish, which was comprised of the actual count of 25,783 fish and an additional 3,122 chum (approximately 11%) were estimated to have passed before July 5 (Appendix 4).

The escapement for pink salmon was estimated at 10,376 fish. This was the actual number of fish counted from July 5 until September 17. The first pink salmon to pass through the weir was on July 6. In the last decade, in even years, cumulative pink passage before July 5 has ranged from 24 to 194 fish. Also, some pink salmon likely passed after the weir was removed, but the number is believed to be minimal as less than 0.2% of the pink salmon enumerated for the season were counted in the last five days.

The escapement for coho salmon was estimated at 35,441 fish. The actual number counted was 34,441 fish and 1,000 fish were estimated to have passed through a hole in the weir on August 20 (Rob Stewart, ADF&G, personal communication). No estimate was made for the number of coho salmon that passed the weir site after 1200 hours on September 17. There were likely a few thousand coho salmon that passed the weir site after counting was terminated. In the last one and one-half days of counting, approximately 6% of the coho escapement to date was counted.

The number of carcasses on the upstream side of the weir was enumerated (Table 3) and as in most previous years, chum salmon made up the majority of the carcasses. The large number of chum carcasses, and in even-years pink carcasses, on the weir potentially indicates that their freshwater life span is shorter than that of other species. In addition, the number of carcasses on the weir was likely a function of distance of spawning activity from the weir.

In 1998 the passage of Dolly Varden was enumerated at the weir (Table 2). No attempt was made to estimate the passage of Dolly Varden before the weir was operational due to the paucity of data. The previous year the first Dolly Varden was observed on June 24 and approximately 15% of run had passed prior to July 5. Regardless of the late weir installation, the escapement count of 2,916 Dolly Varden in 1998 exceeded the 1997 escapement of 2,852 Dolly Varden. Previous to 1997, Dolly Varden escapement was not estimated.

Whitefish and rainbow trout were not enumerated. Some whitefish are small enough to pass through the spaces between the PVC pipe in the weir panels making an accurate count impossible. A few rainbow trout did move upstream and downstream through the weir and were assumed to be resident fish.

Migration Timing

Migration timing curves of chinook, sockeye, chum and coho salmon were plotted in Figures 4 – 7. The escapement run timing curves, for chinook, sockeye, and chum salmon were initiated on July 4 using the estimated percentages from previous year's passage. As there are confounding factors in estimating the migration timing some assumptions were made. In the commercial fishery the majority of the harvest is occurring on the stocks of each fork, and the assumption is that the run timing is the same for each fork. Also, the commercial harvest removes fish from the run and therefore effects escapement past the weir. The historical average used in estimating passage at the weir was taken from four of the preceding five years. The historical average from 1981 – 1997 does appear in Appendix 4, as a comparison, but was not used. The more recent historical average was used because in the past five years the commercial fishery has begun in the last few days of June, whereas preceding 1993 the commercial fishery usually began in mid-June.

Fish passage at the weir in both the 1981 – 1997 historical average excluding those years eliminated (1982, 1985, 1989, 1991, 1992, and 1996) due to paucity of data, and the mid-1990s historical average (1993 – 1997, excluding 1996) show the midpoint of the chinook run to be July 10 (Appendix 4). The estimated chinook passage through July 4 differs by two percent between the two historical averages. This difference may be due to later initiation of the commercial fishery in recent years or simply the effect of the fewer number of years used in the mid-1990s historical average. The midpoint of the sockeye run is one day later, and the midpoint of the chum run is two days later in the mid-1990s historical average. The estimated passage through July 4 for the historical averages differs by four percent for sockeye and one percent for chum salmon. The differences between the historical averages may be the result of variances in the commercial fishery harvest or that there are fewer years comprising the mid-1990s historical average.

The mid-1990s historical run timing past the weir for chinook, sockeye and chum salmon are plotted with the 1998 commercial catch and escapement (Figures 4 – 6). The 1998 escapement run timing curves for chinook, sockeye and chum begin on July 4 using the mid-1990s historical average. Assuming the initialization of the 1998 run timing curve is correct, the chum and sockeye runs show normal run timing and the chinook run is later than normal. If the chinook run was later than normal, then the number of chinook salmon passing the weir site previous to July 5 may have been overestimated.

The plots of chinook, chum, and coho salmon appear similar in that the cumulative percentage of the commercial catch of each species precedes the escapement cumulative percentage. However, for sockeye salmon the pattern is reversed, as the escapement cumulative percentage precedes the cumulative percentage of the commercial catch.

The similarities of the chinook, chum, and coho migration timing curves may indicate that the estimate of chinook and chum passage, before July 5, is reasonably accurate. Similar migration timing patterns in chinook and chum salmon had been seen in previous years and estimates of

migration timing for chinook and chum have ranged from 10 to 18 days (Burkey 1989; Schultz and Burkey 1989). No estimate of coho travel time is available from previous years due to the paucity of data. However, in 1998 the weir was in place for the initiation of the coho run until ten days after the commercial fishery and the migration time from the commercial fishery to the weir was approximately ten days (Figure 7).

The sockeye salmon travel time from the commercial fishery to the weir site has been estimated at five to seven days in previous years (Burkey 1989; Schultz and Burkey 1989). Also, a comparable migration timing curve for sockeye was seen in the 1980s, as the escapement cumulative percentage usually exceeded the cumulative percentage of the commercial catch by July 1 (Burkey 1989). The similarities in the migration timing curve for sockeye salmon between previous years and 1998 may indicate that the estimate of sockeye passage, before July 5, is reasonably accurate.

Age, Sex, and Length

Age compositions of escapements can sometimes be useful for developing stock-recruitment models, which can be used to project run size. Most chinook salmon return to the Middle Fork Goodnews River as 4-, 5- and 6-year-old fish (Menard 1998). In 1998 few chinook salmon were captured and therefore no determination of the age and sex composition of the run was possible. The lack of chinook salmon samples was because of the inability to capture them in the weir trap. The chinook salmon appear reluctant to enter the weir trap when there were numerous sockeye and chum salmon entering the trap (Rob Stewart, ADF&G, personal communication).

Most sockeye salmon return to the Middle Fork Goodnews River as 5-year-old fish (Menard 1998). As in previous years the majority of the sockeye salmon sampled in 1998 at the weir (Table 4), and the majority of the fish harvested in the commercial fishery were 5-year-old fish (Appendix 7). Every year, from 1990 through 1997, age-1.3 sockeye salmon dominated the ASL samples (Menard 1998). Of those fish sampled in the escapement, length comparisons were similar to previous years. The mean length of males was larger than females in each brood year in both the escapement (Table 5) and the commercial catch (Appendix 8).

Most chum salmon return as 4- and 5-year-old fish (age classes 0.3 and 0.4), and comprise over 90% of the samples at the project (Menard 1998). In 1998 over 85% of the chum salmon sampled at the weir (Table 6) and in the commercial catch (Appendix 9) were age-0.3 fish. Although age-0.3 chum salmon are often the majority age class in the escapement, the higher than usual percentage of age-0.3 fish in 1998 may have been more the result of a weak run of age-0.4 fish. In 1997, the age-0.3 fish comprised slightly more than 30% of the escapement (Menard 1998). The normal tendency for the proportion of age-0.4 fish to decline and the proportion of age-0.3 fish to increase as the season progressed was observed in 1998.

Most coho salmon return to the Middle Fork Goodnews River as 4-year-old fish (age 2.1) and nearly all coho salmon returning to spawn had spent one year in salt water. In 1998, except for age-

3.1 female coho salmon, little variation was seen in the lengths between the sex and age classes, and may be a result of the almost universal one-year saltwater residency of coho salmon. The smaller size of the age-3.1 female coho salmon observed in 1998 may be due to the small sample size. There is little coho salmon ASL data from previous years and the lack of data does not allow for length comparisons between years.

The coho salmon escapement age composition (Table 8) was similar to the age composition from the commercial catch samples (Appendix 11). Approximately 88% of the commercial samples were age-2.1 fish and 90% of the fish sampled from the weir trap were age 2.1. The mean length of the commercial catch samples was slightly larger than the escapement samples (Table 9). There was no significant difference in the size of age-1.1, -2.1, and -3.1 coho salmon commercial catch samples (Appendix 12).

Aerial Survey

Department personnel conducted one aerial survey of the Goodnews River drainage under fair conditions on July 24. During some of the survey the wind affected counting as it created ripples on the water and made counting difficult. Historically, aerial surveys of the Goodnews River have had limited success, primarily because of the large area involved and poor weather conditions. In the 1990s, because of these limitations, the management staff believes only two surveys provided an accurate assessment of escapement indices for chinook and sockeye salmon, and only one survey provided an accurate assessment index for chum salmon.

No aerial surveys were conducted for coho salmon due to rainy weather and high water conditions. Few surveys for coho salmon have been flown in the past due to poor conditions.

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Table 1. Middle Fork Goodnews River estimated daily salmon escapement, 1998.

DATE	CHINOOK		SOCKEYE		CHUM		COHO		PINK	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
7/04 [a]	1,487	1,487	15,114	15,114	3,122	3,122	0	0	0	0
7/05	105	1,592	1,831	16,945	589	3,711	0	0	0	0
7/06	155	1,747	2,248	19,193	746	4,457	0	0	23	23
7/07	131	1,878	2,311	21,504	996	5,453	0	0	48	71
7/08	199	2,077	1,678	23,182	396	5,849	0	0	46	117
7/09	106	2,183	2,487	25,669	381	6,230	0	0	77	194
7/10	58	2,241	2,484	28,153	487	6,717	0	0	80	274
7/11	147	2,388	1,592	29,745	1,302	8,019	0	0	53	327
7/12	203	2,591	2,695	32,440	2,713	10,732	0	0	249	576
7/13	185	2,776	1,801	34,241	1,273	12,005	0	0	192	768
7/14	58	2,834	1,371	35,612	748	12,753	0	0	172	940
7/15	40	2,874	1,647	37,259	520	13,273	0	0	220	1,160
7/16	118	2,992	1,629	38,888	786	14,059	0	0	217	1,377
7/17	22	3,014	1,020	39,908	605	14,664	0	0	186	1,563
7/18	166	3,180	873	40,781	1,192	15,856	0	0	136	1,699
7/19	191	3,371	1,109	41,890	1,360	17,216	0	0	120	1,819
7/20	63	3,434	714	42,604	655	17,871	0	0	158	1,977
7/21	184	3,618	836	43,440	1,271	19,142	0	0	393	2,370
7/22	227	3,845	832	44,272	1,096	20,238	0	0	281	2,651
7/23	96	3,941	516	44,788	816	21,054	0	0	356	3,007
7/24	65	4,006	280	45,068	817	21,871	0	0	295	3,302
7/25	34	4,040	222	45,290	616	22,487	0	0	270	3,572
7/26	34	4,074	228	45,518	717	23,204	1	1	253	3,825
7/27	15	4,089	222	45,740	618	23,822	1	2	218	4,043
7/28	24	4,113	121	45,861	351	24,173	1	3	59	4,102
7/29	24	4,137	152	46,013	174	24,347	3	6	30	4,132
7/30	13	4,150	238	46,251	1,005	25,352	2	8	203	4,335
7/31	50	4,200	276	46,527	531	25,883	2	10	144	4,479
8/01	27	4,227	178	46,705	599	26,482	13	23	249	4,728
8/02	118	4,345	150	46,855	519	27,001	37	60	407	5,135
8/03	40	4,385	164	47,019	296	27,297	51	111	386	5,521
8/04	12	4,397	106	47,125	73	27,370	5	116	98	5,619
8/05	10	4,407	78	47,203	163	27,533	6	122	105	5,724
8/06	19	4,426	70	47,273	159	27,692	12	134	119	5,843
8/07	28	4,454	53	47,326	174	27,866	12	146	154	5,997
8/08	1	4,455	41	47,367	121	27,987	7	153	108	6,105
8/09	20	4,475	63	47,430	221	28,208	38	191	206	6,311
8/10	14	4,489	27	47,457	152	28,360	93	284	254	6,565
8/11	7	4,496	15	47,472	70	28,430	50	334	171	6,736
8/12	4	4,500	11	47,483	79	28,509	30	364	228	6,964
8/13	0	4,500	13	47,496	35	28,544	9	373	105	7,069
8/14	8	4,508	29	47,525	50	28,594	18	391	249	7,318
8/15	7	4,515	31	47,556	80	28,674	167	558	412	7,730

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Table 1. (page 2 of 2)

DATE	CHINOOK		SOCKEYE		CHUM		COHO		PINK	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
8/16	15	4,530	80	47,636	106	28,780	2,016	2,574	973	8,703
8/17	11	4,541	20	47,656	6	28,786	77	2,651	36	8,739
8/18	6	4,547	42	47,698	20	28,806	157	2,808	178	8,917
8/19	2	4,549	38	47,736	25	28,831	1,003	3,811	248	9,165
8/20 [b]	4	4,553	59	47,795	21	28,852	4,511	8,322	324	9,489
8/21	3	4,556	15	47,810	14	28,866	556	8,878	104	9,593
8/22	3	4,559	11	47,821	4	28,870	323	9,201	58	9,651
8/23	2	4,561	28	47,849	1	28,871	1,235	10,436	180	9,831
8/24	1	4,562	11	47,860	6	28,877	1,220	11,656	72	9,903
8/25	4	4,566	13	47,873	4	28,881	1,408	13,064	52	9,955
8/26	2	4,568	7	47,880	4	28,885	1,513	14,577	77	10,032
8/27	5	4,573	15	47,895	6	28,891	1,075	15,652	53	10,085
8/28	3	4,576	8	47,903	0	28,891	771	16,423	38	10,123
8/29	1	4,577	7	47,910	0	28,891	1,277	17,700	25	10,148
8/30	2	4,579	8	47,918	2	28,893	1,894	19,594	50	10,198
8/31	1	4,580	3	47,921	0	28,893	830	20,424	15	10,213
9/01	0	4,580	4	47,925	1	28,894	1,155	21,579	19	10,232
9/02	1	4,581	2	47,927	1	28,895	755	22,334	28	10,260
9/03	0	4,581	1	47,928	2	28,897	962	23,296	12	10,272
9/04	1	4,582	5	47,933	2	28,899	969	24,265	9	10,281
9/05	0	4,582	3	47,936	1	28,900	1,252	25,517	14	10,295
9/06	0	4,582	0	47,936	0	28,900	604	26,121	8	10,303
9/07	1	4,583	5	47,941	0	28,900	1,841	27,962	16	10,319
9/08	0	4,583	1	47,942	0	28,900	491	28,453	12	10,331
9/09	0	4,583	1	47,943	1	28,901	132	28,585	5	10,336
9/10	1	4,584	1	47,944	4	28,905	1,806	30,391	10	10,346
9/11	0	4,584	0	47,944	0	28,905	856	31,247	5	10,351
9/12	0	4,584	3	47,947	0	28,905	915	32,162	11	10,362
9/13	0	4,584	0	47,947	0	28,905	421	32,583	0	10,362
9/14	0	4,584	1	47,948	0	28,905	292	32,875	6	10,368
9/15	0	4,584	0	47,948	0	28,905	484	33,359	4	10,372
9/16	0	4,584	3	47,951	0	28,905	1,423	34,782	3	10,375
9/17	0	4,584	0	47,951	0	28,905	659	35,441	1	10,376

[a] Estimate made for fish passage before weir in operation. Weir was fish tight at 2100.

[b] The crew estimated 1,000 coho salmon passed through a hole in the weir. The total number for this date includes the 1,000 fish.

Table 2. Middle Fork Goodnews River estimated daily escapement of Dolly Varden, 1998.

Date	Daily	Cum	Date	Daily	Cum
7/04 [a]	1	1	8/11	18	2,818
7/05	3	4	8/12	3	2,821
7/06	7	11	8/13	1	2,822
7/07	7	18	8/14	2	2,824
7/08	13	31	8/15	1	2,825
7/09	42	73	8/16	12	2,837
7/10	45	118	8/17	5	2,842
7/11	37	155	8/18	4	2,846
7/12	97	252	8/19	1	2,847
7/13	113	365	8/20 [b]	-	2,847
7/14	167	532	8/21	8	2,855
7/15	148	680	8/22	3	2,858
7/16	105	785	8/23	3	2,861
7/17	192	977	8/24	8	2,869
7/18	283	1,260	8/25	9	2,878
7/19	231	1,491	8/26	1	2,879
7/20	170	1,661	8/27	10	2,889
7/21	300	1,961	8/28	5	2,894
7/22	204	2,165	8/29	1	2,895
7/23	172	2,337	8/30	4	2,899
7/24	89	2,426	8/31	1	2,900
7/25	126	2,552	9/01	1	2,901
7/26	29	2,581	9/02	1	2,902
7/27	25	2,606	9/03	7	2,909
7/28	8	2,614	9/04	0	2,909
7/29	4	2,618	9/05	3	2,912
7/30	23	2,641	9/06	1	2,913
7/31	29	2,670	9/07	2	2,915
8/01	17	2,687	9/08	0	2,915
8/02	23	2,710	9/09	0	2,915
8/03	21	2,731	9/10	0	2,915
8/04	11	2,742	9/11	1	2,916
8/05	12	2,754	9/12	0	2,916
8/06	11	2,765	9/13	0	2,916
8/07	7	2,772	9/14	0	2,916
8/08	3	2,775	9/15	0	2,916
8/09	9	2,784	9/16	0	2,916
8/10	16	2,800	9/17	0	2,916

[a] In 1998 the weir was "fish tight" on July 4 at 2100 hours. No estimate was made for Dolly Varden passage before 2100 hours on July 4.

[b] Weir not "fish tight" for several hours due to hole. No estimate was made for Dolly Varden passage.

Table 3. Middle Fork Goodnews River daily carcass count at weir, 1998.

DATE	CHINOOK		SOCKEYE		CHUM		COHO		PINK		DOLLY		RAINBOW	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
7/04 [a]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/09	0	0	1	1	0	0	0	0	0	0	0	0	0	0
7/10	0	0	2	3	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	3	2	2	0	0	0	0	0	0	1	1
7/12	0	0	0	3	4	6	0	0	1	1	0	0	0	1
7/13	0	0	0	3	1	7	0	0	0	1	0	0	0	1
7/14	0	0	0	3	4	11	0	0	1	2	0	0	0	1
7/15	0	0	0	3	4	15	0	0	0	2	0	0	0	1
7/16	0	0	0	3	3	18	0	0	0	2	0	0	0	1
7/17	0	0	0	3	2	20	0	0	2	4	1	1	0	1
7/18	0	0	0	3	3	23	0	0	0	4	0	1	0	1
7/19	0	0	2	5	5	28	0	0	1	5	0	1	0	1
7/20	0	0	1	6	3	31	0	0	1	6	0	1	0	1
7/21	0	0	0	6	4	35	0	0	1	7	1	2	0	1
7/22	0	0	1	7	16	51	0	0	1	8	0	2	0	1
7/23	0	0	0	7	18	69	0	0	0	8	1	3	0	1
7/24	1	1	5	12	48	117	0	0	3	11	1	4	0	1
7/25	1	2	3	15	96	213	0	0	1	12	0	4	1	2
7/26	1	3	3	18	112	325	0	0	5	17	0	4	0	2
7/27	0	3	6	24	134	459	0	0	3	20	0	4	1	3
7/28	4	7	2	26	119	578	0	0	2	22	0	4	1	4
7/29	0	7	3	29	74	652	0	0	3	25	1	5	0	4
7/30	2	9	11	40	324	976	0	0	13	38	4	9	0	4
7/31	1	10	6	46	199	1,175	0	0	5	43	1	10	0	4
8/01	2	12	4	50	300	1,475	0	0	20	63	1	11	0	4
8/02	8	20	4	54	322	1,797	0	0	33	96	1	12	0	4
8/03	4	24	13	67	425	2,222	0	0	71	167	1	13	0	4
8/04	6	30	5	72	323	2,545	0	0	56	223	0	13	0	4
8/05	11	41	7	79	395	2,940	0	0	71	294	0	13	0	4
8/06	17	58	0	79	258	3,198	0	0	97	391	1	14	0	4
8/07	21	79	4	83	311	3,509	0	0	100	491	0	14	0	4
8/08	18	97	2	85	239	3,748	0	0	82	573	0	14	0	4
8/09	27	124	7	92	331	4,079	0	0	138	711	0	14	0	4
8/10	25	149	14	106	315	4,394	0	0	176	887	1	15	0	4
8/11	47	196	28	134	280	4,674	0	0	197	1,084	0	15	1	5
8/12	23	219	9	143	220	4,894	0	0	147	1,231	0	15	0	5
8/13	36	255	21	164	159	5,053	0	0	156	1,387	0	15	1	6
8/14	13	268	21	185	84	5,137	0	0	68	1,455	0	15	0	6
8/15	30	298	46	231	174	5,311	0	0	163	1,618	1	16	0	6
8/16	41	339	35	266	176	5,487	0	0	196	1,814	0	16	0	6
8/17	38	377	32	298	117	5,604	1	1	117	1,931	0	16	0	6
8/18	27	404	36	334	63	5,667	0	1	93	2,024	0	16	0	6
8/19	31	435	32	366	100	5,767	0	1	110	2,134	0	16	0	6
8/20	20	455	30	396	80	5,847	0	1	100	2,234	1	17	0	6
8/21	21	476	19	415	64	5,911	0	1	60	2,294	0	17	0	6
8/22	9	485	6	421	24	5,935	0	1	36	2,330	1	18	0	6
8/23	3	488	7	428	13	5,948	0	1	6	2,336	0	18	0	6

-Continued-

Table 3. (page 2 of 2)

DATE	CHINOOK		SOCKEYE		CHUM		COHO		PINK		DOLLY		RAINBOW	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
8/24	11	499	18	446	21	5,969	1	2	39	2,375	4	22	0	6
8/25	8	507	18	464	14	5,983	1	3	25	2,400	0	22	0	6
8/26	5	512	16	480	21	6,004	0	3	32	2,432	0	22	0	6
8/27	3	515	10	490	7	6,011	1	4	28	2,460	0	22	0	6
8/28	8	523	15	505	11	6,022	0	4	24	2,484	0	22	0	6
8/29	2	525	15	520	8	6,030	1	5	36	2,520	1	23	0	6
8/30	5	530	7	527	5	6,035	3	8	11	2,531	1	24	0	6
8/31	4	534	11	538	7	6,042	1	9	39	2,570	1	25	0	6
9/01	0	534	14	552	9	6,051	0	9	24	2,594	0	25	0	6
9/02	1	535	12	564	5	6,056	1	10	19	2,613	0	25	0	6
9/03	1	536	4	568	3	6,059	1	11	46	2,659	0	25	0	6
9/04	2	538	8	576	3	6,062	0	11	88	2,747	0	25	0	6
9/05	2	540	11	587	3	6,065	1	12	89	2,836	0	25	0	6
9/06	2	542	10	597	3	6,068	0	12	75	2,911	0	25	0	6
9/07	1	543	7	604	1	6,069	1	13	79	2,990	0	25	0	6
9/08	2	545	5	609	1	6,070	1	14	53	3,043	0	25	0	6
9/09	0	545	2	611	0	6,070	2	16	62	3,105	0	25	0	6
9/10	0	545	3	614	3	6,073	2	18	48	3,153	1	26	0	6
9/11	1	546	4	618	2	6,075	6	24	61	3,214	0	26	0	6
9/12	0	546	4	622	0	6,075	2	26	43	3,257	0	26	0	6
9/13	0	546	4	626	0	6,075	2	28	19	3,276	0	26	0	6
9/14	0	546	4	630	1	6,076	0	28	11	3,287	0	26	0	6
9/15	0	546	0	630	0	6,076	3	31	23	3,310	0	26	0	6
9/16	0	546	4	634	1	6,077	2	33	9	3,319	0	26	0	6
9/17 [b]	0	546	0	634	0	6,077	0	33	0	3,319	0	26	0	6

[a] Weir installed and fish tight on July 4 at 2100 hours.

[b] Weir removed on September 17 at 1200 hours.

Table 4. Age and sex composition of Middle Fork Goodnews River weir sockeye salmon escapement samples, 1998.

		Brood Year and Age Group [a]						
		1994		1993		1992		Total
		0.3	1.2	1.3	2.2	1.4	2.3	
Stratum Dates:	6/13 - 7/4							
Sampling Dates: [b]								
Sample Size:	0							
Total	Percent of Sample							
	Number in Escapement							15,114 [c]
Stratum Dates:	7/5 - 11							
Sampling Dates:	7/8 - 9							
Sample Size:	181							
Male	Percent of Sample	1.7	4.4	31.0	2.2	1.1	5.5	45.9
	Number in Escapement	243	647	4,527	324	162	808	6,709
Female	Percent of Sample	0.0	10.5	37.0	2.8	0.0	3.9	54.1
	Number in Escapement	0	1,536	5,416	404	0	566	7,922
Total	Percent of Sample	1.7	14.9	68.0	5.0	1.1	9.4	100.0
	Number in Escapement	243	2,183	9,943	728	162	1,374	14,631
Stratum Dates:	7/12 - 17							
Sampling Dates:	7/14 - 15							
Sample Size:	179							
Male	Percent of Sample	1.1	10.0	25.7	2.2	1.7	1.1	41.9
	Number in Escapement	113	1,022	2,612	227	170	113	4,258
Female	Percent of Sample	0.6	12.3	38.5	3.4	0.0	3.4	58.1
	Number in Escapement	57	1,249	3,917	341	0	341	5,905
Total	Percent of Sample	1.7	22.3	64.2	5.6	1.7	4.5	100.0
	Number in Escapement	170	2,271	6,529	568	170	454	10,163
Stratum Dates:	7/18 - 9/17							
Sampling Dates:	7/21 - 22							
Sample Size:	182							
Male	Percent of Sample	2.2	6.6	32.9	0.6	0.0	3.3	45.6
	Number in Escapement	177	530	2,651	44	0	265	3,668
Female	Percent of Sample	1.6	15.9	27.5	4.9	0.0	4.4	54.4
	Number in Escapement	132	1,282	2,210	398	0	354	4,375
Total	Percent of Sample	3.8	22.5	60.4	5.5	0.0	7.7	100.0
	Number in Escapement	309	1,812	4,861	442	0	619	8,043
Stratum Dates:	Season							
Sampling Dates: [b]								
Sample Size:	542							
Total	Percent of Sample							
	Number in Escapement							47,951

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Sampling dates and number of samples do not meet criteria for estimating escapement percentages of stratum.

[c] There were no fish counted in this stratum and this number was estimated based on historical data.

Table 5. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Middle Fork Goodnews River sockeye salmon escapement samples captured in weir trap, 1998.

		Brood Year and Age Group					
		1994		1993		1992	
		0.3	1.2	1.3	2.2	1.4	2.3
Sample Date:	7/8 - 9						
Sample Size:	181						
Male	Mean Length	553	506	566	483	613	558
	Std. Error	16	8	3	21	3	12
	Range	530-585	465-535	520-620	425-520	610-615	500-610
	Sample Size	3	8	56	4	2	10
Female	Mean Length	-	477	532	493	-	541
	Std. Error	-	4	3	12	-	5
	Range	-	420-505	430-565	455-525	-	515-555
	Sample Size	0	19	67	5	0	7
Sample Dates:	7/14 - 15						
Sample Size:	179						
Male	Mean Length	573	506	564	520	590	533
	Std. Error	13	6	4	9	28	28
	Range	560-585	465-545	500-615	495-540	540-635	505-560
	Sample Size	2	18	46	4	3	2
Female	Mean Length	540	475	530	487	-	532
	Std. Error	-	4	3	8	-	10
	Range	540-540	435-510	455-595	470-515	-	490-560
	Sample Size	1	22	69	6	0	6
Sample Dates:	7/21 - 22						
Sample Size:	182						
Male	Mean Length	563	509	561	580	-	563
	Std. Error	18	9	3	-	-	6
	Range	520-605	465-560	495-615	580-580	-	550-590
	Sample Size	4	12	60	1	0	6
Female	Mean Length	533	484	529	476	-	514
	Std. Error	6	3	4	6	-	11
	Range	525-545	455-535	460-620	450-495	-	450-545
	Sample Size	3	29	50	9	0	8
Sample Dates:	Season						
Sampling Dates: [a]							
Male	Mean Length						
	Std. Error						
	Range						
	Sample Size						
Female	Mean Length						
	Std. Error						
	Range						
	Sample Size						

[a] Sampling dates do not meet criteria for estimating mean length for the season.

Table 6. Age and sex composition of Middle Fork Goodnews River weir chum salmon escapement samples, 1998.

		Brood Year and Age Group [a]				
		1995	1994	1993	1992	Total
		0.2	0.3	0.4	0.5	
Stratum Dates :	6/14 - 7/13 [b]					
Sampling Dates:	7/9 - 11					
Sample Size:	203					
Male	Percent of Sample	0.0	48.8	11.8	0.0	60.6
	Number in Escapement	0	5,858	1,417	0	7,275
Female	Percent of Sample	0.0	31.0	7.9	0.5	39.4
	Number in Escapement	0	3,722	948	60	4,730
Total	Percent of Sample	0.0	79.8	19.7	0.5	100.0
	Number in Escapement	0	9,580	2,365	60	12,005
Stratum Dates:	7/14 - 7/20					
Sampling Dates:	7/16 - 7/17					
Sample Size:	194					
Male	Percent of Sample	0.5	46.9	5.7	0.0	53.1
	Number in Escapement	29	2,751	334	0	3,115
Female	Percent of Sample	0.0	39.2	7.7	0.0	46.9
	Number in Escapement	0	2,299	452	0	2,751
Total	Percent of Sample	0.5	86.1	13.4	0.0	100.0
	Number in Escapement	29	5,051	786	0	5,866
Stratum Dates:	7/21 - 7/27					
Sampling Dates:	7/23 - 7/25					
Sample Size: [c]	200					
Male	Percent of Sample	0.4	37.6	3.1	0.0	41.1
	Number in Escapement	24	2,240	184	0	2,448
Female	Percent of Sample	0.6	53.9	4.4	0.0	58.9
	Number in Escapement	35	3,205	263	0	3,503
Total	Percent of Sample	1.0	91.5	7.5	0.0	100.0
	Number in Escapement	60	5,445	446	0	5,951
Stratum Dates:	7/28 - 9/10					
Sampling Date:	7/30					
Sample Size:	108					
Male	Percent of Sample	0.0	29.6	2.8	0.0	32.4
	Number in Escapement	0	1,505	142	0	1,647
Female	Percent of Sample	0.0	64.8	2.8	0.0	67.6
	Number in Escapement	0	3,294	142	0	3,436
Total	Percent of Sample	0.0	94.4	5.6	0.0	100.0
	Number in Escapement	0	4,798	285	0	5,083

- Continued -

Table 6. (page 2 of 2)

		Brood Year and Age Group [a]				
		1995	1994	1993	1992	Total
		0.2	0.3	0.4	0.5	
Stratum Dates:	Season [d]					
Sample Size:	705					
Male	Percent of Sample	0.2	42.7	7.2	0.0	50.1
	Number in Escapement	54	12,354	2,077	0	14,485
Female	Percent of Sample	0.1	43.3	6.2	0.2	49.9
	Number in Escapement	35	12,520	1,805	60	14,420
Total	Percent of Sample	0.3	86.1	13.4	0.2	100.0
	Number in Escapement	89	24,874	3,882	60	28,905

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Approximately 26% (3,122 fish) of the escapement in this stratum was estimated from historical data.

[c] The sex composition was estimated by interpolating from adjacent strata.

[d] The number of fish in the "Season" summary are the stratum sums. "Season" percentages are derived from the sums.

Table 7. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Middle Fork Goodnews River chum salmon escapement samples captured in weir trap, 1998.

		Brood Year and Age Group			
		1995	1994	1993	1992
		0.2	0.3	0.4	0.5
Sample Date:	7/9-11				
Sample Size:	203				
Male	Mean Length	-	593	613	-
	Std. Error	-	2	5	-
	Range	-	525-650	580-675	-
	Sample Size	0	99	24	0
Female	Mean Length	-	566	595	640
	Std. Error	-	3	7	-
	Range	-	520-620	550-650	640-640
	Sample Size	0	63	16	1
Sample Date:	7/16-17				
Sample Size:	194				
Male	Mean Length	575	592	626	-
	Std. Error	-	4	10	-
	Range	575-575	480-685	590-710	-
	Sample Size	1	91	11	0
Female	Mean Length	-	553	568	-
	Std. Error	-	4	13	-
	Range	-	475-640	470-630	-
	Sample Size	0	76	15	0
Sample Dates:	7/30				
Sample Size:	108				
Male	Mean Length	-	585	620	-
	Std. Error	-	5	15	-
	Range	-	540-635	601-650	-
	Sample Size	0	32	3	0
Female	Mean Length	-	553	570	-
	Std. Error	-	3	12	-
	Range	-	501-600	550-590	-
	Sample Size	0	70	3	0
Sample Dates:	Season [a]				
Sample Size:	505				
Male	Mean Length	575	591	617	-
	Range	575-575	480-685	580-710	-
	Sample Size	1	222	38	0
Female	Mean Length	-	557	582	640
	Range	-	475-640	470-650	640-640
	Sample Size	0	209	34	1

[a] Season mean lengths are weighted by the catch in each stratum.

Table 8. Age and sex composition of Middle Fork Goodnews River weir coho salmon escapement samples, 1998.

		Brood Year and Age Group [a]			
		1995	1994	1993	Total
		1.1	2.1	3.1	
Stratum Dates:	7/25 - 8/22				
Sampling Dates:	8/19				
Sample Size:	39				
Male	Percent of Sample	0.0	43.6	2.6	46.2
	Number in Escapement	0	4,011	236	4,247
Female	Percent of Sample	5.1	48.7	0.0	53.8
	Number in Escapement	472	4,482	0	4,954
Total	Percent of Sample	5.1	92.3	2.6	100.0
	Number in Escapement	472	8,493	236	9,201
Stratum Dates:	8/23 - 29				
Sampling Dates:	8/26 - 27				
Sample Size:	132				
Male	Percent of Sample	7.6	44.7	0.0	52.3
	Number in Escapement	644	3,799	0	4,443
Female	Percent of Sample	3.0	43.9	0.8	47.7
	Number in Escapement	257	3,734	64	4,056
Total	Percent of Sample	10.6	88.6	0.8	100.0
	Number in Escapement	901	7,533	64	8,499
Stratum Dates:	8/30 - 9/5				
Sampling Dates:	9/2 - 3				
Sample Size:	143				
Male	Percent of Sample	2.8	40.6	0.0	43.4
	Number in Escapement	219	3,170	0	3,389
Female	Percent of Sample	3.5	52.4	0.7	56.6
	Number in Escapement	273	4,100	55	4,428
Total	Percent of Sample	6.3	93.0	0.7	100.0
	Number in Escapement	492	7,270	55	7,817
Stratum Dates:	9/6 - 9/17				
Sampling Dates:	9/9 - 10				
Sample Size:	115				
Male	Percent of Sample	3.5	24.3	0.9	28.7
	Number in Escapement	345	2,416	86	2,848
Female	Percent of Sample	7.8	60.9	2.6	71.3
	Number in Escapement	777	6,041	259	7,076
Total	Percent of Sample	11.3	85.2	3.5	100.0
	Number in Escapement	1,122	8,457	345	9,924

- Continued -

Table 8. (page of 2 of 2)

		Brood Year and Age Group [a]			
		1995	1994	1993	Total
		1.1	2.1	3.1	
Stratum Dates:	Season [b]				
Sample Size:	429				
Male	Percent of Sample	3.4	37.8	0.9	42.1
	Number In Escapement	1,208	13,396	322	14,926
Female	Percent of Sample	5.0	51.8	1.1	57.9
	Number In Escapement	1,779	18,358	378	20,515
Total	Percent of Sample	8.4	89.6	2.0	100.0
	Number In Escapement	2,987	31,574	700	35,441

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] The number of fish in "Season" summaries are the strata sums; "Season" percentages are derived from the sums.

Table 9. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Middle Fork Goodnews River coho salmon escapement samples captured in weir trap, 1998.

		Brood Year and Age Group		
		1995	1994	1993
		1.1	2.1	3.1
Sample Date:	8/19			
Sample Size:	39			
Male	Mean Length	-	576	575
	Std. Error	-	14	-
	Range	-	480-680	575-575
	Sample Size	0	17	1
Female	Mean Length	645	611	-
	Std. Error	10	6	-
	Range	635-655	565-655	-
	Sample Size	2	19	0
Sample Date:	8/26 - 27			
Sample Size:	132			
Male	Mean Length	602	601	-
	Std. Error	7	6	-
	Range	550-625	455-680	-
	Sample Size	10	59	0
Female	Mean Length	603	605	615
	Std. Error	18	4	-
	Range	555-635	540-655	615-615
	Sample Size	4	58	1
Sample Date:	9/2 - 3			
Sample Size:	143			
Male	Mean Length	569	625	-
	Std. Error	14	6	-
	Range	550-610	490-700	-
	Sample Size	4	58	0
Female	Mean Length	594	611	555
	Std. Error	19	5	-
	Range	550-640	400-680	555-555
	Sample Size	5	75	1
Sample Date:	9/9 - 10			
Sample Size:	115			
Male	Mean Length	605	613	620
	Std. Error	23	8	-
	Range	545-655	490-660	620-620
	Sample Size	4	28	1
Female	Mean Length	613	609	513
	Std. Error	7	4	52
	Range	585-655	510-665	420-600
	Sample Size	9	70	3

- Continued -

Table 9. (page 2 of 2)

		Brood Year and Age Group		
		1995	1994	1993
		1.1	2.1	3.1
Sample Dates:	Season [a]			
Sample Size:	429			
Male	Mean Length	597	601	587
	Range	545-655	455-700	575-620
	Sample Size	18	162	2
Female	Mean Length	617	609	537
	Range	550-655	400-680	420-615
	Sample Size	20	222	5

[a] Season mean lengths are weighted by the catch in each stratum.

Table 10. Middle Fork Goodnews River meteorological and hydrological observations, 1998.

	0800 Weather						2000 Weather						Daily Conditions		
		Wind		Temperature (F)		Water		Wind		Temperature (F)		Water	Air		Precip.
Date	Sky[a]	(kts)	Precip.[b]	Air	Water	Lev. (in)[c]	Sky[a]	(kts)	Precip.[b]	Air	Water	Lev. (in)[c]	Min	Max	(mm)
6/12	4	Calm	1	46	44	41.00	4	S 10	3	46	44	40.00	38	58	trace
6/13	4	S 5	1	44	45	38.00	3	S 10	2	54	45	36.00	40	60	0.0
6/14	4	Calm	1	37	45	35.00	4	SW 15	1	47	45	34.50	38	62	0.0
6/15	3	Calm	1	40	46	33.00	1	W 15	1	58	47	32.00	32	68	0.0
6/16	5	W 5	1	46	47	31.00	2	W 15	1	54	47	30.00	30	60	0.0
6/17	2	SW 5	1	40	47	30.00	3	W 10	1	56	47	29.00	30	65	0.0
6/18	4	E 10	1	38	47	28.75	4	SE 15	4	48	47	28.50	30	60	2.5
6/19	4	Calm	2	40	45	31.00	4	SE 15	4	44	44	32.00	40	52	8.2
6/20	4	SE 10	4	41	45	33.50	4	SW 15	2	43	44	34.75	40	49	12.5
6/21	4	W 5	1	44	43	36.75	1	SW 15	1	50	43	36.00	37	58	0.2
6/22	2	NE 5	1	44	44	33.50	4	SE 10	1	53	48	31.75	31	66	0.0
6/23	3	W 15	1	50	45	31.00	4	SW 20	1	47	46	28.50	44	54	0.2
6/24	4	Calm	1	47	46	28.00	1	SW 15	1	55	47	28.00	41	62	0.0
6/25	5	Calm	1	42	47	27.75	4	SW 15	1	55	48	26.25	33	68	0.0
6/26	4	W 10	3	46	47	26.00	4	SW 5	1	50	47	24.75	44	56	trace
6/27	4	Calm	1	48	46	24.00	1	W 15	1	54	46	23.00	45	65	0.0
6/28	5	Calm	1	43	46	22.50	1	W 15	1	55	53	22.50	34	60	0.0
6/29	5	Calm	1	43	48	21.50	3	SW 10	1	57	53	20.25	39	68	0.0
6/30	3	Calm	1	54	50	20.75	3	SW 15	2	67	54	20.75	45	75	1.5
7/01	3	NE 5	1	53	53	21.00	4	SE 10	4	58	50	22.50	38	67	5.4
7/02	2	NE 10	1	47	49	22.75	4	Calm	2	57	49	23.75	41	65	1.0
7/03	4	E 10	1	52	50	22.75	4	Calm	3	54	52	22.50	49	69	1.7
7/04	5	Calm	1	52	50	22.00	4	Calm	2	52	52	22.50	43	70	19.6
7/05	4	W 5	3	50	51	21.75	4	SW 5	3	51	52	21.25	37	56	4.0
7/06	3	Calm	1	51	52	21.00	3	S 10	1	57	53	20.25	43	67	0.3
7/07	3	Calm	1	50	53	19.75	2	W 10	1	62	51	18.25	40	74	0.0
7/08	4	Calm	3	47	49	18.25	4	SW 10	1	50	50	18.00	40	61	trace
7/09	4	Calm	4	48	47	17.50	4	Calm	3	48	48	17.50	45	51	3.1
7/10	5	Calm	3	50	49	17.00	3	Calm	1	60	52	16.50	43	64	trace
7/11	2	N 5	1	57	50	16.00	1	NW 15	1	58	56	15.50	50	72	0.0
7/12	4	SW 10	1	50	56	15.25	1	W 20	1	58	58	15.00	44	61	0.0
7/13	4	SW 5	1	50	53	14.75	3	NW 10	1	60	52	14.50	45	65	0.0
7/14	5	Calm	1	50	52	14.25	3	SW 15	1	55	52	14.00	42	62	0.0
7/15	4	S 5	3	48	52	13.75	4	SE 5	4	53	50	13.75	45	56	8.3
7/16	4	Calm	3	50	48	13.75	3	E 10	1	56	52	13.50	45	65	1.7
7/17	4	Calm	1	52	49	13.00	4	S 5	1	54	51	13.50	45	62	0.0
7/18	4	SE 5	1	50	45	13.50	3	SE 10	2	55	44	12.50	46	61	1.1
7/19	1	NE 10	1	57	46	11.75	2	NE 5	1	61	54	11.75	42	76	0.0
7/20	3	Calm	1	44	54	11.50	3	NE 5	1	60	54	11.00	42	71	0.0
7/21	3	SE 5	1	52	54	10.75	3	SE 5	1	63	54	10.50	48	72	0.0
7/22	3	Calm	1	53	55	10.25	3	S 10	1	62	57	10.00	52	73	1.2
7/23	2	Calm	1	51	56	10.00	3	SE 10	1	65	-	-	45	74	0.5
7/24	3	Calm	2	49	55	9.50	4	SE 10	2	63	-	-	44	70	4.0
7/25	4	W 5	3	53	-	-	4	SW 10	1	55	54	9.50	46	61	0.5
7/26	4	Calm	2	52	-	-	4	Calm	2	55	53	10.00	49	61	16.1
7/27	4	Calm	3	51	52	10.25	4	W 5	3	50	52	10.00	48	58	1.5
7/28	4	SW 5	3	50	50	9.75	3	SW 10	1	52	53	9.50	48	55	1.3
7/29	5	Calm	3	44	53	9.25	3	NW 10	1	53	53	9.25	39	69	trace
7/30	4	SW 5	1	51	53	9.00	2	NW 10	1	65	-	-	42	65	0.0
7/31	5	Calm	1	40	53	8.25	1	NW 10	1	65	-	-	33	70	0.0

-Continued-

Table 10. (page 2 of 2)

	0800 Weather						2000 Weather						Daily Conditions		
		Wind		Temperature (F) Water				Wind		Temperature (F) Water			Air		Precip.
Date	Sky[a]	(kts)	Precip.[b]	Air	Water	Lev. (in)[c]	Sky[a]	(kts)	Precip.[b]	Air	Water	Lev. (in)[c]	Min	Max	(mm)
8/01	4	E 5	1	52	54	8.00	4	SE 10	2	57	54	8.00	40	60	2.5
8/02	4	S 10	4	54	53	8.75	4	S 5	3	52	52	10.00	40	60	19.0
8/03	4	Calm	1	47	51	13.00	4	SW 5	3	52	51	13.00	49	55	1.5
8/04	4	Calm	4	58	50	12.00	4	W 5	1	54	52	11.50	45	58	2.3
8/05	3	W 15	1	50	51	11.50	3	W 15	2	48	50	11.25	41	59	1.1
8/06	3	Calm	2	46	49	11.00	3	N 15	2	47	49	10.75	40	57	0.5
8/07	3	N 5	2	48	48	10.50	3	N 20	2	48	50	10.00	39	59	6.2
8/08	3	N 5	1	46	50	10.00	2	N 15	1	55	50	9.75	39	62	0.0
8/09	4	Calm	1	52	50	9.50	3	W 10	1	50	50	9.25	43	60	0.0
8/10	2	Calm	1	38	51	8.75	1	W 10	1	51	-	-	35	70	0.0
8/11	1	Calm	1	28	50	8.50	3	W 10	1	56	-	-	27	66	0.0
8/12	4	S 10	1	50	50	8.00	4	S 20	3	52	-	-	42	62	trace
8/13	4	S 15	2	48	50	7.75	4	S 10	3	50	50	8.25	45	55	6.7
8/14	4	S 5	1	52	50	8.50	4	SW 10	3	52	51	8.50	48	59	trace
8/15	4	SW 5	3	54	51	8.50	4	SW 15	4	54	51	8.50	50	58	14.8
8/16	4	SW 30	2	48	50	9.50	4	W 35	2	45	50	11.00	42	52	7.6
8/17	4	NW 10	2	42	48	11.00	3	NW 10	2	47	48	10.75	40	55	3.9
8/18	4	W 5	3	41	49	10.50	4	S 15	1	48	49	10.00	39	55	1.1
8/19	4	S 35	4	45	49	10.50	4	SW 10	3	50	49	12.75	42	53	30.6
8/20	4	SW 10	3	48	48	22.50	4	SW 0-5	3	45	45	21.50	43	51	23.5
8/21	4	SW 10	3	48	46	21.50	3	NW 10-1	2	46	44	19.25	44	50	40.0
8/22	3	Calm	1	38	44	18.75	4	SE 5-10	1	49	43	18.00	31	53	2.3
8/23	4	SW 5-1	3	49	43	18.75	5	SW 20-2	3	45	44	21.00	33	51	7.2
8/24	4	SW 0-5	2	44	42	19.25	4	SW 15	3	45	-	22.00	42	50	7.0
8/25	3	Calm	2	38	44	21.50	3	W 5	2	46	47	23.00	34	54	9.9
8/26	1	Calm	1	31	45	23.50	4	W 10	2	45	47	21.50	29	55	2.9
8/27	4	Calm	1	37	45	20.50	3	W 5	2	45	-	-	35	53	1.8
8/28	2	Calm	1	30	45	19.75	2	NW 5	2	48	47	19.25	28	57	3.0
8/29	1	Calm	1	28	47	18.75	4	E 5	1	48	48	18.00	23	58	0.2
8/30	4	SE 15	3	51	47	18.75	4	SE 10	4	48	47	19.75	42	53	15.5
8/31	3	NE 20	1	50	47	21.50	3	NE 5	1	50	46	20.00	40	54	0.3
9/01	4	NW 10	1	48	46	19.00	4	NW 10	1	50	46	18.50	35	55	0.0
9/02	4	NW 10	3	50	45	17.50	4	Calm	1	52	45	17.00	33	55	trace
9/03	4	Calm	1	49	44	16.75	4	SW 5	3	52	-	-	32	63	trace
9/04	3	Calm	2	52	45	17.00	4	Calm	2	50	-	-	36	65	1.3
9/05	4	Calm	1	43	45	16.50	3	S 10	2	48	-	-	40	55	0.2
9/06	3	Calm	1	45	45	15.75	3	NW 5	1	48	-	-	33	62	trace
9/07	3	NW 10	1	42	45	14.75	2	NW 10	1	50	-	-	38	58	2.0
9/08	1	Calm	1	22	45	14.00	2	SW 5	1	60	-	-	21	68	0.0
9/09	4	E 5	1	44	45	13.00	4	E 10	2	49	-	-	38	54	2.7
9/10	4	Calm	3	45	46	12.75	4	Calm	1	53	-	-	41	59	1.1
9/11	4	Calm	2	45	47	12.75	4	Calm	1	49	45	-	42	63	1.9
9/12	4	Calm	1	44	48	12.25	4	W 0-5	1	45	45	12.00	42	54	1.5
9/13	2	Calm	1	38	43	12.00	3	NW 10	1	44	-	-	35	55	trace
9/14	4	Calm	1	40	44	11.25	4	Calm	3	48	-	-	37	52	1.6
9/15	4	Calm	3	48	44	11.00	4	S 20	2	49	-	-	45	50	2.6
9/16	4	S 10	2	47	46	11.00	4	S 10	3	49	48	11.50	45	51	6.5
9/17	4	S 10	1	43	48	13.00	4	S 20	2	50	46	13.00	35	52	2.5
9/18	4	S 5	1	42	44	12.50	-	-	-	-	-	-	-	-	-

[a] Sky code: 1 - Clear sky, cloud covering not more than 1/10 of sky, 2 - Cloud covering not more than 1/2 of sky, 3 - Cloud covering more than 1/2 of sky, 4 - Overcast, 5 -Fog or thick haze.

[b] Precipitation code: 1 - None, 2 - Scattered showers, 3 - Mist, 4 - Rain.

[c] Water Level was measured to the nearest quarter of an inch.

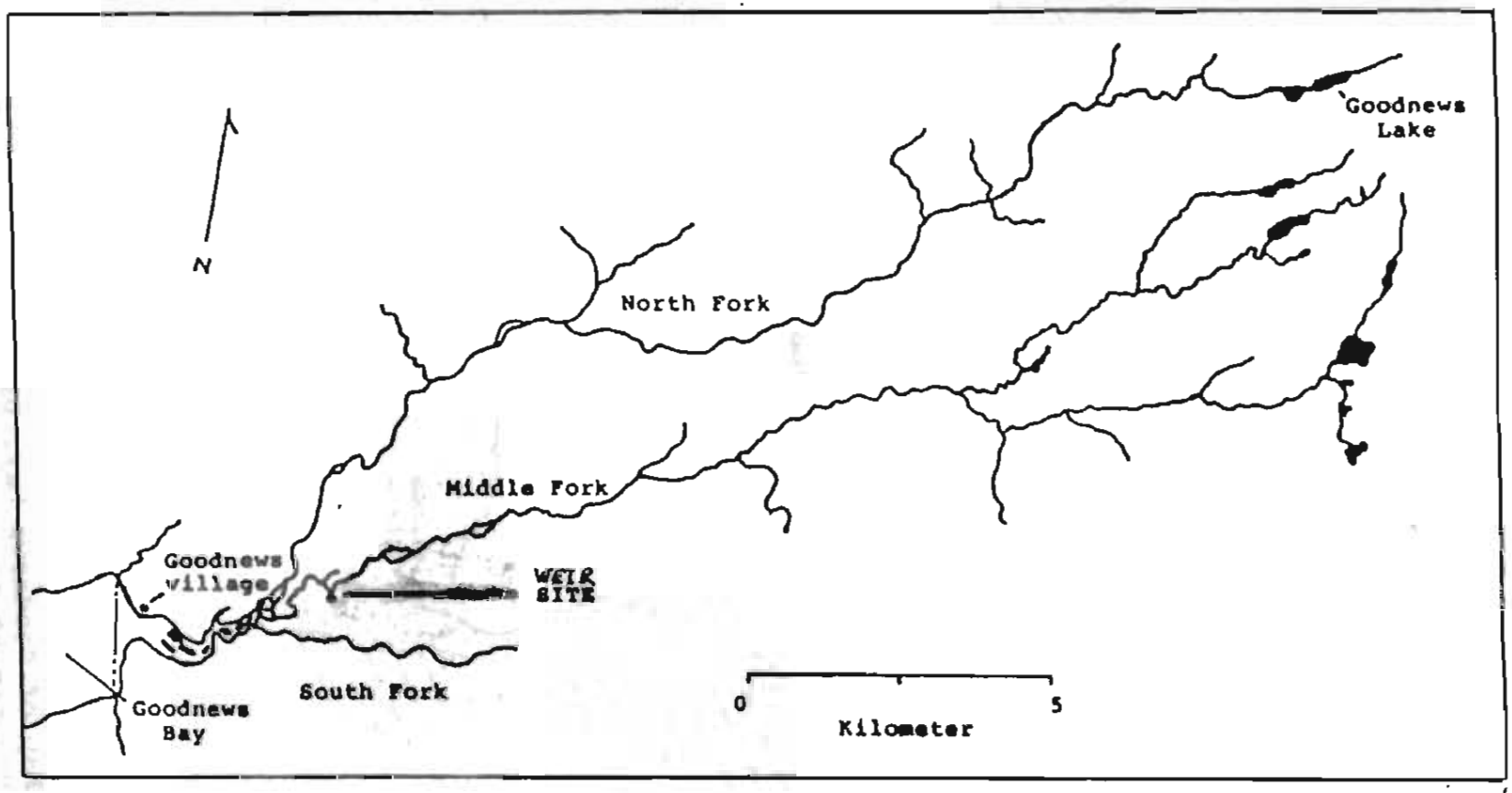


Figure 1. Map of the Goodnews River drainage.

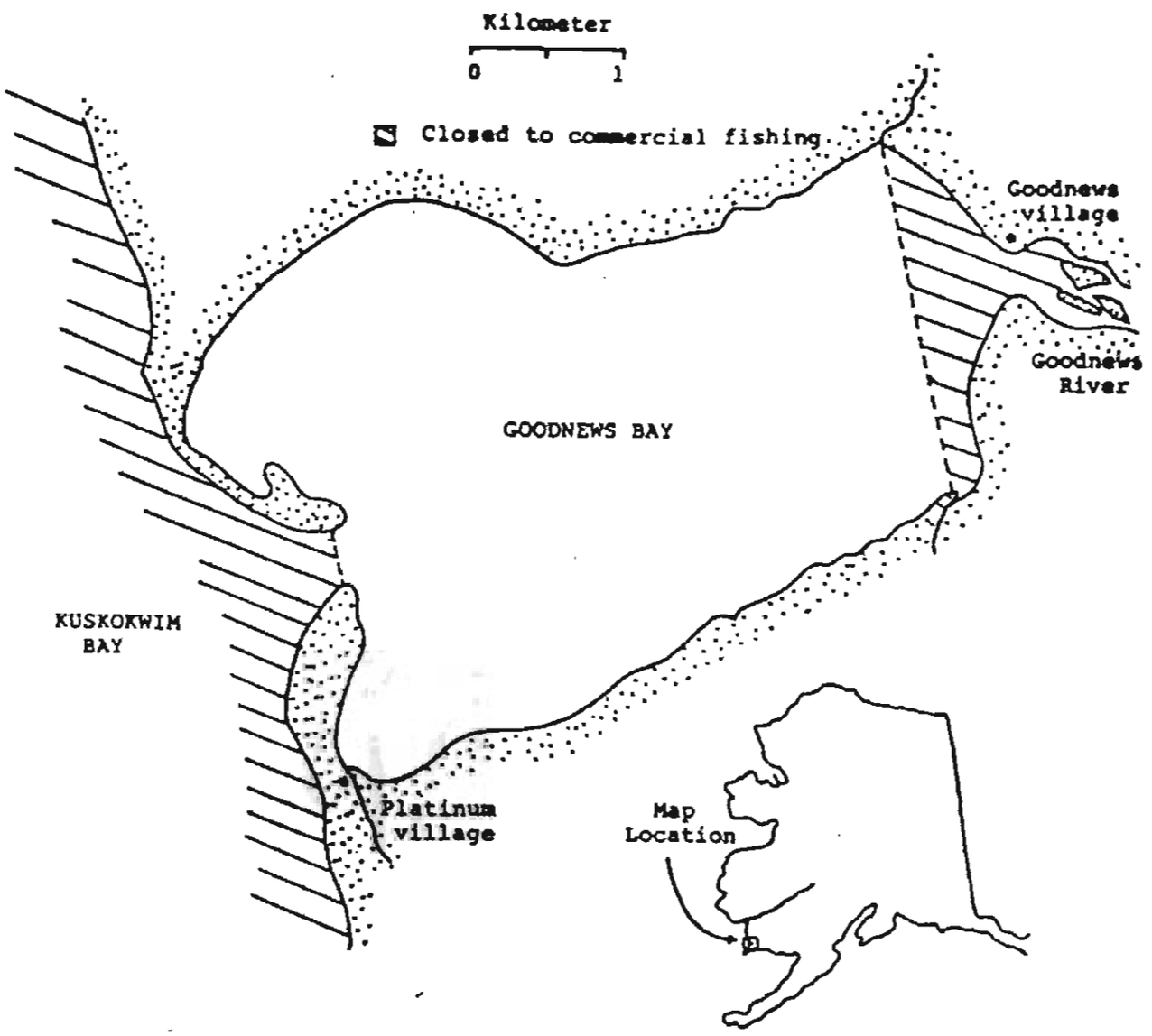
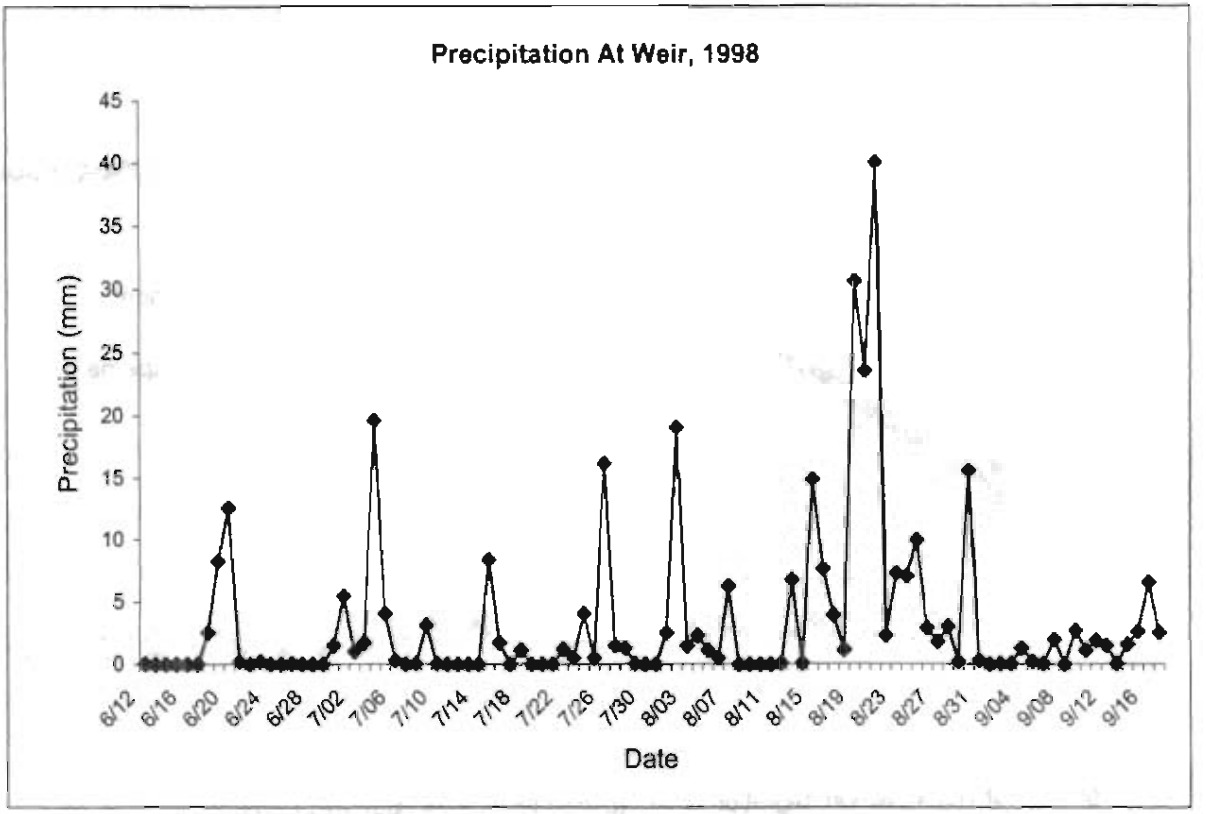


Figure 2. Map of Goodnews Bay, District 5, of the Kuskokwim Management Area.



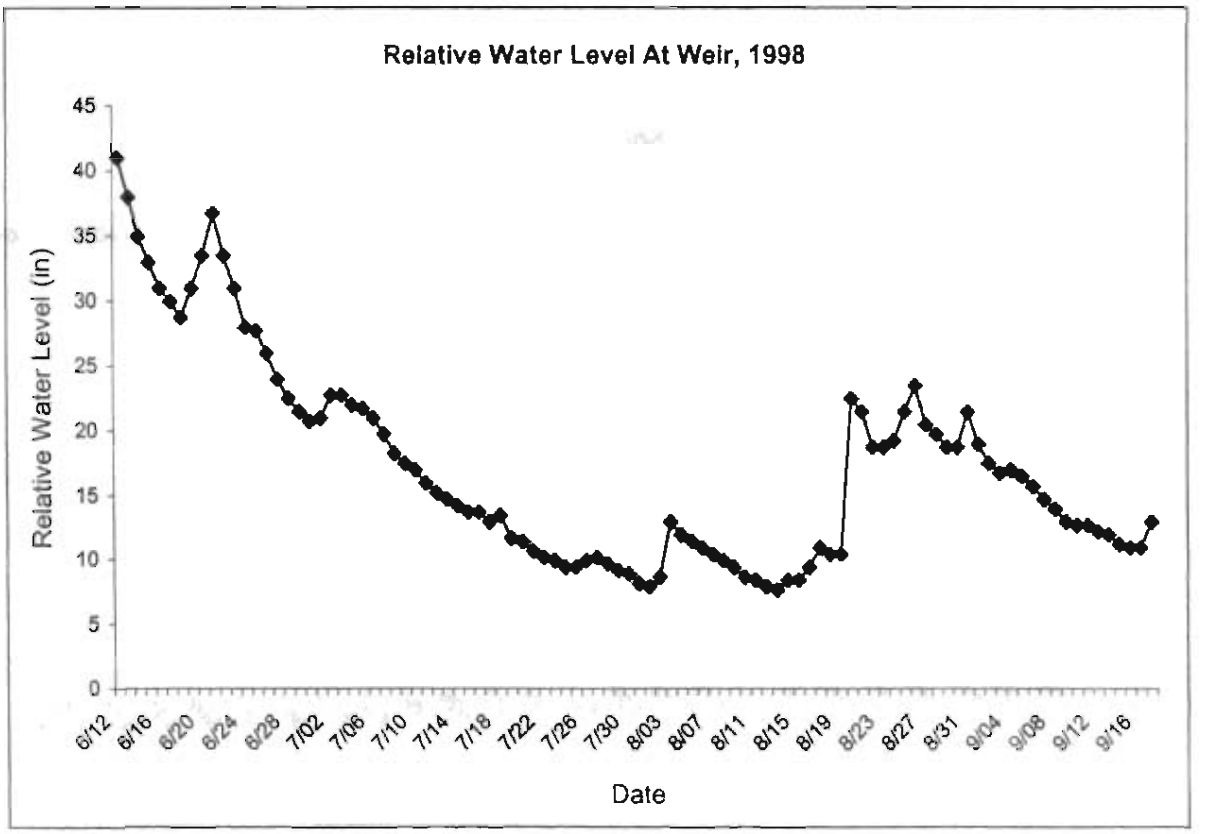


Figure 3. Precipitation and relative water level, Middle Fork Goodnews River weir, 1998.

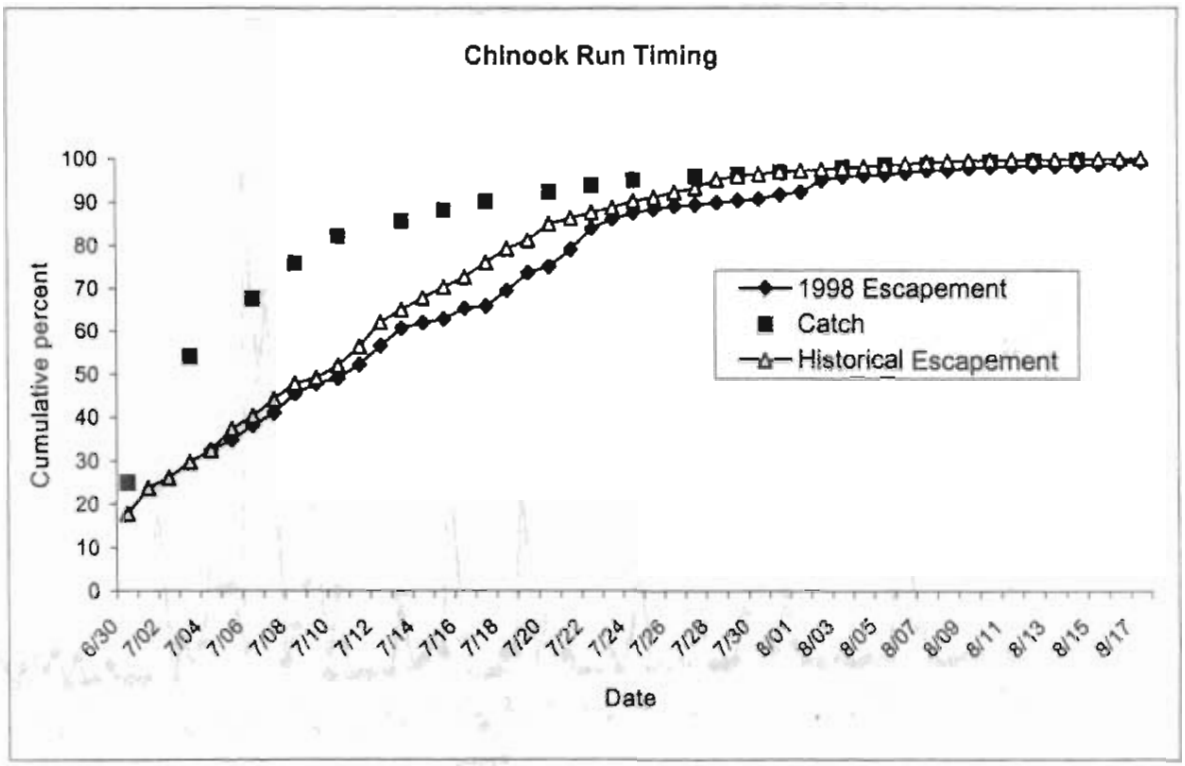


Figure 4. Chinook salmon migration timing at the Middle Fork Goodnews River weir.

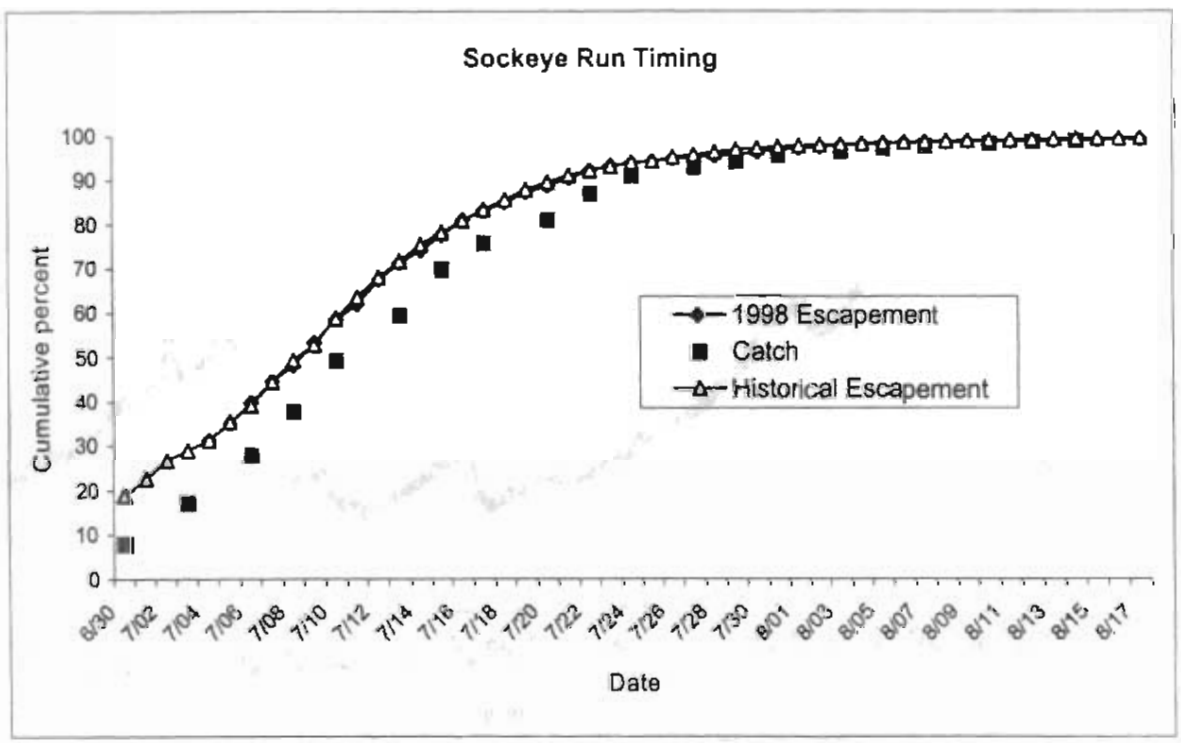


Figure 5. Sockeye salmon migration timing at the Middle Fork Goodnews River weir.

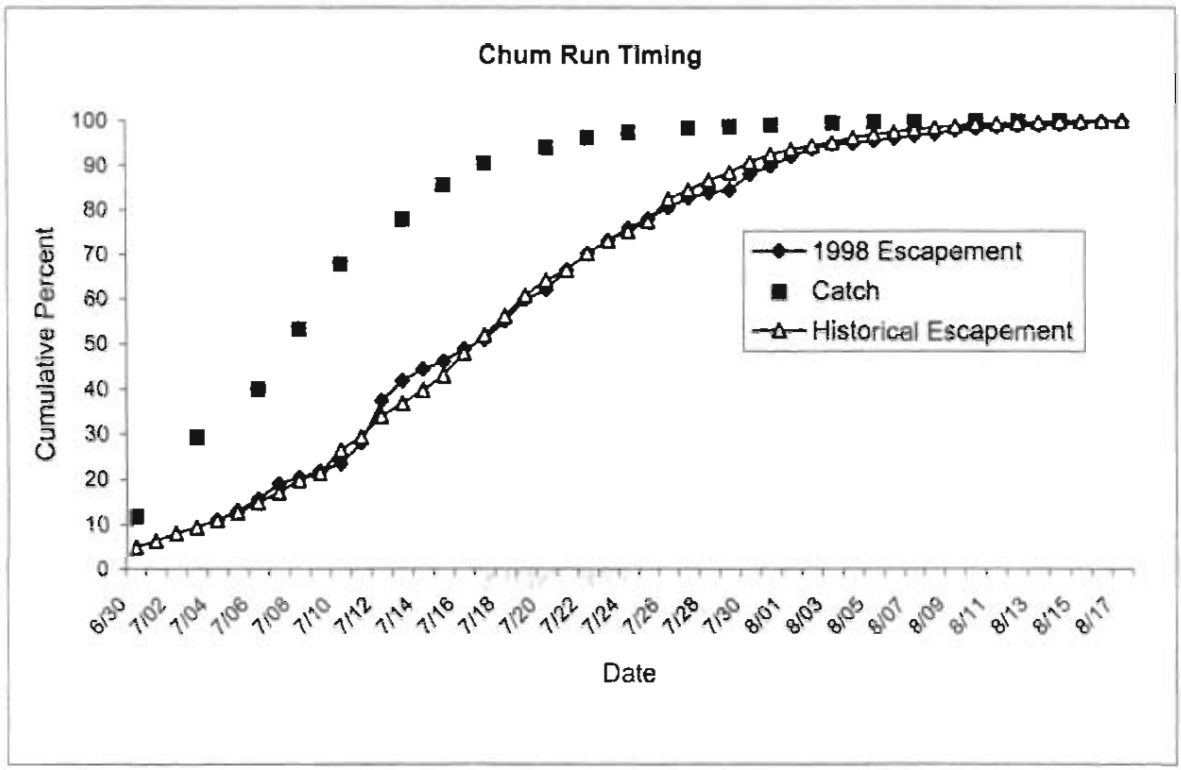


Figure 6. Chum salmon migration timing at the Middle Fork Goodnews River weir.

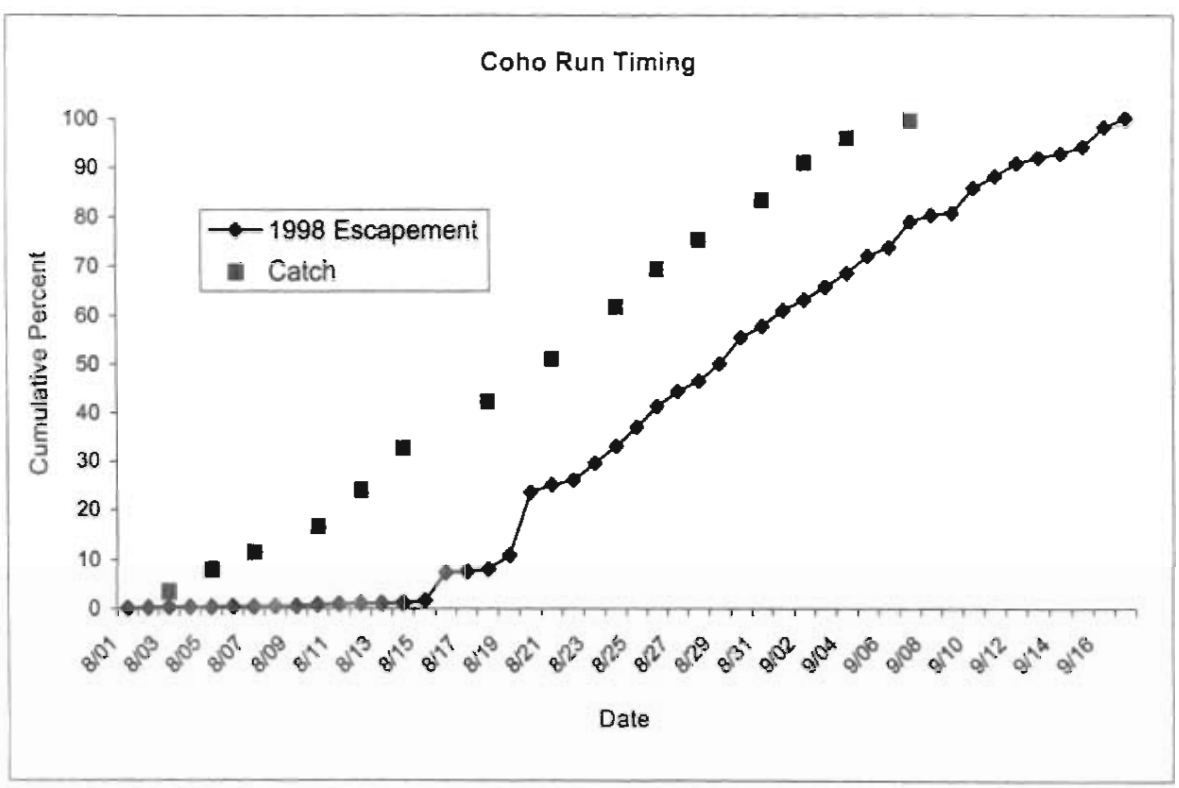


Figure 7. Coho salmon migration timing at the Middle Fork Goodnews River weir.

APPENDIX

Appendix 1. Goodnews Bay, District 5, commercial salmon harvest, 1968 - 1998.

Year	Chinook	Sockeye	Chum	Coho	Pink	Total
1968				5,458		5,458
1969	3,978	6,256	5,006	11,631	298	27,169
1970	7,163	7,144	12,346	6,794	12,183	45,630
1971	477	330	301	1,771	-	2,879
1972	264	924	1,331	925	66	3,510
1973	3,543	2,072	15,781	5,017	324	26,737
1974	3,302	9,357	8,942	21,340	16,373	59,314
1975	2,156	9,098	5,904	17,889	419	35,466
1976	4,417	5,575	10,354	9,852	8,453	38,651
1977	3,336	3,723	6,531	13,335	29	26,954
1978	5,218	5,412	8,590	13,764	9,103	42,087
1979	3,204	19,581	9,298	42,098	201	74,382
1980	2,331	28,632	11,748	43,256	7,832	93,799
1981	7,190	40,273	13,642	19,749	11	80,865
1982	9,476	38,877	13,829	46,683	4,673	113,538
1983	14,117	11,716	6,766	19,660	-	52,259
1984	8,612	15,474	14,340	71,176	4,711	114,313
1985	5,793	6,698	4,784	16,498	8	33,781
1986	2,723	25,112	10,355	19,378	4,447	62,015
1987	3,357	27,758	20,381	29,057	54	80,607
1988	4,964	36,368	33,059	30,832	5,509	110,732
1989	2,966	19,299	13,622	31,849	82	67,818
1990	3,303	35,823	13,194	7,804	629	60,753
1991	912	39,838	15,892	13,312	29	69,983
1992	3,528	39,194	18,520	19,875	14,310	95,427
1993	2,117	59,293	10,657	20,014	0	92,081
1994	2,570	69,490	28,477	47,499	18,017	166,053
1995	2,922	37,351	19,832	17,875	39	78,019
1996	1,375	30,717	11,093	43,836	22	87,043
1997	2,039	31,451	11,729	2,983	0	48,202
1998	3,675	27,161	14,155	21,246	411	66,648
Ten Year Average (1988 - 97)	2,670	39,882	17,608	23,588	7,697 [a]	87,611

[a] Even years only

Appendix 2. Historical estimated salmon run size and commercial exploitation rate, Goodnews River drainage, 1981 - 1998.

Year	Species	Middle Fork Tower Estimate	Middle Fork Aerial Survey Count as a Percentage of Tower Est.	North Fork Goodnews River Escapement Estimate	Goodnews Bay Subsistence Harvest Estimate	Goodnews Bay Commercial Harvest	Total Run Size Estimate	Exploitation [a] Rate (% of run)
1981	Chinook	3,688	[b]	7,766 [c]	1,409	7,190	20,053	43%
	Sockeye	49,108	[b]	100,029 [c]	3,511 [d]	40,273	192,921	23%
	Chum	21,827	[b]	53,799 [c]	-	13,642	89,268	15%
1982	Chinook	1,395	[b]	2,937 [c]	1,236	9,476	15,044	71%
	Sockeye	56,255	[b]	114,567 [c]	2,754 [d]	38,877	212,473	20%
	Chum	6,767	[b]	16,679 [c]	-	13,829	37,275	37%
1983	Chinook	6,022	36%	14,398	1,066	14,117	35,603	43%
	Sockeye	25,813	22%	69,955	1,518 [d]	11,716	109,002	12%
	Chum	15,548	[b]	38,323 [c]	-	6,766	60,637	11%
1984	Chinook	3,260	35%	8,743	629	8,612	21,244	43%
	Sockeye	32,053	27%	67,213	964	15,474	115,704	14%
	Chum	19,003	35%	117,739	189	14,340	151,271	10%
1985	Chinook	2,831	70%	7,979	426	5,793	17,029	37%
	Sockeye	24,131	11%	50,481	704	6,698	82,014	9%
	Chum	10,367	32%	25,025	348	4,784	40,524	13%
1986	Chinook	2,092	57%	4,094	555	2,723	9,464	35%
	Sockeye	51,069	28%	93,228	942	25,112	170,351	15%
	Chum	14,764	38%	51,910	191	10,355	77,220	14%
1987	Chinook	2,272	100%	4,490	816	3,357	10,935	38%
	Sockeye	28,871	85%	51,989	955	27,758	109,573	26%
	Chum	17,517	58%	37,802	578	20,381	76,278	27%
1988	Chinook	2,712	39%	5,419	310	4,964	13,405	39%
	Sockeye	15,799	30%	38,319	1,065	36,368	91,551	41%
	Chum	20,799	21%	39,501	448	33,059	93,807	36%
1989	Chinook	1,915	67%	2,891	467	2,966	8,239	42%
	Sockeye	21,186	60%	35,476	869	19,299	76,830	26%
	Chum	10,380	28%	15,495	760	13,622	40,257	36%
1990	Chinook	3,636	[b]	7,656 [c]	682	3,303	15,277	26%
	Sockeye	31,679	[b]	64,528 [c]	905	35,823	132,935	28%
	Chum	6,410	[b]	15,799 [c]	342	13,194	35,745	38%
1991 [e]	Chinook	1,952	[b]	4,521 [c]	682	912	8,067	20%
	Sockeye	47,397	[b]	96,544 [c]	900	39,838	184,679	22%
	Chum	27,525	[b]	67,844 [c]	106	15,892	111,367	14%
1992	Chinook	1,903	61%	1,854	252	3,528	7,537	50%
	Sockeye	27,268	21%	52,501	905	39,194	119,868	33%
	Chum	22,023	19%	16,084	662	18,520	57,289	33%

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Year	Species	Middle Fork Weir Estimate	Middle Fork Aerial Survey Count as a Percentage of Weir Est.	North Fork Goodnews River Escapement Estimate	Goodnews Bay Subsistence Harvest Estimate	Goodnews Bay Commercial Harvest	Total Run Size Estimate	Exploitation [a] Rate (% of run)
1993	Chinook	2,349	[b]	4,727 [c]	488	2,117	9,681	27%
	Sockeye	26,452	[b]	54,325 [c]	572	59,293	140,642	43%
	Chum	14,952	[b]	38,061 [c]	133	10,657	63,803	17%
1994	Chinook	3,856	[b]	7,866 [c]	657	2,570	14,949	22%
	Sockeye	55,751	[b]	115,405 [c]	652	69,490	241,298	29%
	Chum	34,849	[b]	91,653 [c]	402	28,477	155,381	19%
1995	Chinook	4,836	[b]	9,865 [c]	552	2,922	18,175	19%
	Sockeye	39,009	[b]	80,749 [c]	787	37,351	157,896	24%
	Chum	33,699	[b]	88,628 [c]	329	19,832	142,488	14%
1996	Chinook	2,930	[b]	5,977 [c]	526	1,375	10,808	18%
	Sockeye	58,264	[b]	120,606 [c]	763	30,717	210,350	15%
	Chum	40,450	[b]	106,384 [c]	326	11,093	158,253	7%
1997	Chinook	2,937	51%	7,216	449	2,039	12,641	20%
	Sockeye	35,530	57%	23,462	609	31,451	91,052	35%
	Chum	17,296	[b]	45,488 [c]	133	11,729	74,646	16%
1998	Chinook	4,584	18%	3,797	718	3,675	12,774	34%
	Sockeye	47,951	25%	14,693	508	27,161	90,313	31%
	Chum	28,905	15%	24,940	316	14,155	68,316	21%

[a] Commercial and subsistence exploitation.

[b] Incomplete aerial survey results.

[c] Average Middle Fork/Goodnews River escapement estimate ratio for 1983 - 1989 used to estimate Goodnews River escapement in years with no aerial survey data. The years 1993 - 1997 include the results from 1992 in the escapement estimate ratio.

[d] Subsistence caught chum salmon is included in subsistence sockeye salmon harvest.

[e] Goodnews Tower Project changed to a weir project in 1991.

Appendix 3. Aerial survey results, Goodnews River drainage, 1980 - 1998.

Year	North Fork Goodnews River and Lake			Middle Fork Goodnews River and Lakes		
	Chinook	Sockeye	Chum	Chinook	Sockeye	Chum
1980	1,228	75,639	1,975	1,164	18,926	3,782
1981	[a]	[a]	[a]	[a]	[a]	[a]
1982	1,990	19,160	9,700	1,546	2,327	6,300
1983	2,600	9,650	[a]	2,500	5,900	[a]
1984	3,245	12,807	28,124	1,930	12,897	9,172
1985	3,535	2,843	4,415	869	7,401	1,780
1986	1,068	8,960	11,850	1,249	16,990	7,645
1987	2,244	19,786	12,103	2,222	24,533	9,696
1988	[a]	[a]	[a]	1,024	5,831	5,814
1989	651	3,605	[a]	1,277	8,044	2,922
1990	658	27,689	[a]	[a]	[a]	[a]
1991	[a]	[a]	[a]	[a]	[a]	[a]
1992	875	10,397	1,950	1,012	7,200	3,270
1993	[a]	[a]	[a]	[a]	[a]	[a]
1994	[a]	[a]	[a]	[a]	[a]	[a]
1995	3,314	[a]	[a]	[a]	[a]	[a]
1996	[a]	[a]	[a]	[a]	[a]	[a]
1997	3,611	12,610	[a]	1,447	19,843	[a]
1998	578	3,497	2,734	731	11,632	3,619
Escapement Objective [b]	1,600	15,000	17,000	800	5,000	4,000

[a] Information not available, poor survey, or survey conducted well before or after peak spawning.

[b] Escapement objectives are preliminary and are subject to change as additional data becomes available. Escapement objectives are based on aerial index counts which do not represent total escapement, but do reflect annual spawner abundance trends when made using standard survey methods under acceptable survey conditions.

Appendix 4. Historical cumulative proportion of chinook, sockeye, and chum salmon escapement at the Middle Fork Goodnews River weir.

	Chinook [a]		Sockeye [a]		Chum [a]	
Date	1981 - 1997	1993 - 1997	1981 - 1997	1993 - 1997	1981 - 1997	1993 - 1997
13-Jun	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
14-Jun	0.0000	0.0001	0.0001	0.0002	0.0000	0.0001
15-Jun	0.0000	0.0002	0.0003	0.0002	0.0000	0.0001
16-Jun	0.0000	0.0003	0.0004	0.0004	0.0000	0.0001
17-Jun	0.0004	0.0004	0.0006	0.0007	0.0000	0.0001
18-Jun	0.0005	0.0006	0.0010	0.0011	0.0001	0.0002
19-Jun	0.0014	0.0021	0.0020	0.0014	0.0001	0.0002
20-Jun	0.0028	0.0032	0.0035	0.0036	0.0001	0.0004
21-Jun	0.0053	0.0037	0.0063	0.0050	0.0002	0.0005
22-Jun	0.0087	0.0098	0.0135	0.0160	0.0016	0.0039
23-Jun	0.0163	0.0155	0.0224	0.0260	0.0028	0.0070
24-Jun	0.0314	0.0447	0.0372	0.0452	0.0041	0.0099
25-Jun	0.0480	0.0636	0.0560	0.0623	0.0081	0.0156
26-Jun	0.0692	0.0895	0.0758	0.0826	0.0111	0.0187
27-Jun	0.0896	0.1058	0.1059	0.1069	0.0173	0.0269
28-Jun	0.1100	0.1240	0.1341	0.1245	0.0229	0.0341
29-Jun	0.1350	0.1457	0.1676	0.1543	0.0300	0.0405
30-Jun	0.1668	0.1785	0.1999	0.1897	0.0400	0.0483
01-Jul	0.2132	0.2378	0.2398	0.2286	0.0583	0.0624
02-Jul	0.2419	0.2614	0.2833	0.2698	0.0739	0.0783
03-Jul	0.2733	0.2972	0.3157	0.2924	0.0908	0.0926
04-Jul	0.3036	0.3244	0.3549	0.3152	0.1115	0.1080
05-Jul	0.3474	0.3730	0.4083	0.3567	0.1354	0.1257
06-Jul	0.3797	0.4019	0.4548	0.3938	0.1567	0.1472
07-Jul	0.4236	0.4406	0.5083	0.4476	0.1811	0.1687
08-Jul	0.4583	0.4770	0.5601	0.4955	0.2064	0.1962
09-Jul	0.4838	0.4895	0.6066	0.5298	0.2364	0.2122
10-Jul	0.5236	0.5181	0.6583	0.5901	0.2847	0.2626
11-Jul	0.5667	0.5632	0.7049	0.6379	0.3222	0.2915
12-Jul	0.6058	0.6196	0.7460	0.6828	0.3675	0.3374
13-Jul	0.6376	0.6492	0.7821	0.7183	0.4029	0.3663
14-Jul	0.6742	0.6765	0.8151	0.7560	0.4371	0.3952
15-Jul	0.7099	0.7021	0.8444	0.7838	0.4827	0.4277
16-Jul	0.7369	0.7257	0.8703	0.8106	0.5391	0.4775
17-Jul	0.7687	0.7593	0.8896	0.8351	0.5677	0.5171
18-Jul	0.7977	0.7912	0.9076	0.8573	0.6293	0.5600
19-Jul	0.8206	0.8109	0.9240	0.8800	0.6626	0.6062
20-Jul	0.8497	0.8493	0.9370	0.8968	0.6980	0.6403
21-Jul	0.8679	0.8622	0.9484	0.9123	0.7310	0.6620
22-Jul	0.8909	0.8751	0.9581	0.9236	0.7761	0.6996

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	Chinook [a]		Sockeye [a]		Chum [a]	
Date	1981 - 1997	1993 - 1997	1981 - 1997	1993 - 1997	1981 - 1997	1993 - 1997
23-Jul	0.9094	0.8870	0.9651	0.9324	0.8126	0.7288
24-Jul	0.9281	0.9018	0.9710	0.9413	0.8370	0.7498
25-Jul	0.9386	0.9094	0.9746	0.9452	0.8614	0.7727
26-Jul	0.9493	0.9212	0.9794	0.9543	0.8922	0.8217
27-Jul	0.9570	0.9308	0.9823	0.9594	0.9089	0.8423
28-Jul	0.9681	0.9506	0.9858	0.9660	0.9340	0.8634
29-Jul	0.9746	0.9583	0.9881	0.9705	0.9475	0.8819
30-Jul	0.9796	0.9626	0.9901	0.9743	0.9601	0.9045
31-Jul	0.9826	0.9677	0.9912	0.9770	0.9677	0.9215
01-Aug	0.9845	0.9708	0.9922	0.9795	0.9725	0.9332
02-Aug	0.9865	0.9733	0.9930	0.9814	0.9760	0.9415
03-Aug	0.9883	0.9762	0.9935	0.9828	0.9792	0.9491
04-Aug	0.9906	0.9801	0.9942	0.9843	0.9833	0.9593
05-Aug	0.9923	0.9825	0.9949	0.9862	0.9865	0.9666
06-Aug	0.9939	0.9855	0.9954	0.9874	0.9887	0.9720
07-Aug	0.9957	0.9894	0.9960	0.9892	0.9913	0.9787
08-Aug	0.9967	0.9915	0.9966	0.9906	0.9928	0.9824
09-Aug	0.9975	0.9931	0.9971	0.9921	0.9941	0.9853
10-Aug	0.9980	0.9945	0.9975	0.9930	0.9960	0.9904
11-Aug	0.9983	0.9952	0.9977	0.9937	0.9965	0.9915
12-Aug	0.9983	0.9955	0.9980	0.9944	0.9972	0.9932
13-Aug	0.9987	0.9964	0.9983	0.9954	0.9978	0.9945
14-Aug	0.9989	0.9971	0.9985	0.9960	0.9982	0.9954
15-Aug	0.9991	0.9975	0.9988	0.9966	0.9986	0.9962
16-Aug	0.9993	0.9979	0.9990	0.9973	0.9989	0.9969
17-Aug	0.9994	0.9983	0.9991	0.9976	0.9991	0.9975
18-Aug	0.9995	0.9987	0.9993	0.9980	0.9994	0.9984
19-Aug	0.9996	0.9989	0.9993	0.9982	0.9995	0.9986
20-Aug	0.9996	0.9990	0.9995	0.9987	0.9997	0.9992
21-Aug	0.9998	0.9994	0.9996	0.9989	0.9998	0.9994
22-Aug	0.9998	0.9996	0.9997	0.9992	0.9999	0.9996
23-Aug	0.9999	0.9997	0.9998	0.9993	0.9999	0.9998
24-Aug	0.9999	0.9999	0.9999	0.9997	1.0000	0.9999
25-Aug	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

[a] The cumulative proportion does not include the years 1982, 1985, 1989, 1991, 1992, and 1996 due to either a late initiation of the project in that year or a number of missed days due to flooding.

Appendix 5. Age and sex composition of Goodnews Bay chinook salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group [a]					
		1995	1994	1993	1992	1991	Total
		1.1	1.2	1.3	1.4	1.5	
Stratum Dates:	6/30, 7/3						
Sampling Date:	6/30 [b]						
Sample Size:	189						
Male	Percent of Sample	0.5	11.1	54.0	11.1	0.0	76.7
	Number in Catch	11	221	1,073	221	0	1,526
Female	Percent of Sample	0.0	0.0	11.1	11.7	0.5	23.3
	Number in Catch	0	0	221	232	11	463
Total	Percent of Sample	0.5	11.1	65.1	22.8	0.5	100.0
	Number in Catch	11	221	1,294	453	11	1,989
Stratum Dates:	7/6, 7/8						
Sampling Date:	7/6 [b]						
Sample Size:	190						
Male	Percent of Sample	1.1	20.0	53.2	4.7	0.6	79.5
	Number in Catch	8	160	424	38	4	634
Female	Percent of Sample	0.0	0.0	10.0	10.0	0.5	20.5
	Number in Catch	0	0	80	80	4	164
Total	Percent of Sample	1.1	20.0	63.2	14.7	1.1	100.0
	Number in Catch	8	160	504	118	8	798
Stratum Dates:	7/10 - 9/4						
Sampling Dates:	7/13, 7/25						
Sample Size:	25						
Male	Percent of Sample	4.0	24.0	20.0	12.0	4.0	64.0
	Number in Catch	36	213	178	107	36	568
Female	Percent of Sample	0.0	0.0	16.0	16.0	4.0	36.0
	Number in Catch	0	0	142	142	35	320
Total	Percent of Sample	4.0	24.0	36.0	28.0	8.0	100.0
	Number in Catch	36	213	320	249	71	888
Stratum Dates:	Season [c]						
Sample Size:	404						
Male	Percent of Sample	1.5	16.2	45.6	10.0	1.1	74.2
	Number in Catch	54	594	1,675	365	40	2,728
Female	Percent of Sample	0.0	0.0	12.0	12.3	1.3	25.8
	Number in Catch	0	0	443	454	50	947
Total	Percent of Sample	1.5	16.2	57.6	22.3	2.4	100.0
	Number in Catch	54	594	2,118	819	90	3,675

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Sex of all fish was confirmed by visual inspection of gonads.

[c] The number of fish in the "Season" summary are the stratum sums. "Season" percentages are derived from the sums.

Appendix 6. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Goodnews Bay chinook salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group				
		1995	1994	1993	1992	1991
		1.1	1.2	1.3	1.4	1.5
Sample Date:	6/30					
Sample Size:	189					
Male	Mean Length	381	553	715	856	-
	Std. Error	-	10	6	16	-
	Range	381-381	471-666	539-876	708-990	-
	Sample Size	1	21	102	21	0
Female	Mean Length	-	-	793	852	923
	Std. Error	-	-	9	9	-
	Range	-	-	713-867	780-934	923-923
	Sample Size	0	0	21	22	1
Sample Date:	7/6					
Sample Size:	190					
Male	Mean Length	385	534	716	825	935
	Std. Error	5	6	5	19	-
	Range	380-390	455-628	585-854	718-895	935-935
	Sample Size	2	38	101	9	1
Female	Mean Length	-	-	774	850	819
	Std. Error	-	-	17	12	-
	Range	-	-	659-995	727-945	819-819
	Sample Size	0	0	19	19	1
Sample Dates:	7/13, 7/25					
Sample Size:	25					
Male	Mean Length	413	568	727	903	945
	Std. Error	-	16	33	34	-
	Range	413-413	505-620	643-836	855-970	945-945
	Sample Size	1	6	5	3	1
Female	Mean Length	-	-	762	820	865
	Std. Error	-	-	44	23	-
	Range	-	-	658-840	780-880	865-865
	Sample Size	0	0	4	4	1
Sample Dates:	Season [a]					
Sample Size:	404					
Male	Mean Length	402	553	716	866	944
	Range	380-413	455-666	539-876	708-990	935-945
	Sample Size	4	65	208	33	2
Female	Mean Length	-	-	780	842	873
	Range	-	-	658-995	727-945	819-923
	Sample Size	0	0	44	45	3

[a] Season mean lengths are weighted by the catch in each stratum.

Appendix 7. Age and sex composition of Goodnews Bay sockeye salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group [a]									
		1994		1993			1992		1991		Total
		0.3	1.2	0.4	1.3	2.2	1.4	2.3	2.4	3.3	
Stratum Dates:	6/30, 7/3										
Sampling Dates:	6/30 [b]										
Sample Size:	141										
Male	Percent of Sample	0.0	4.3	0.0	41.1	0.0	0.0	3.6	0.0	0.0	48.9
	Number in Catch	0	200	0	1,932	0	0	167	0	0	2,299
Female	Percent of Sample	1.4	2.1	0.0	43.3	0.0	0.0	3.5	0.7	0.0	51.1
	Number in Catch	67	100	0	2,032	0	0	166	33	0	2,398
Total	Percent of Sample	1.4	6.4	0.0	84.4	0.0	0.0	7.1	0.7	0.0	100.0
	Number in Catch	67	300	0	3,964	0	0	333	33	0	4,697
Stratum Dates:	7/6, 7/8										
Sampling Dates:	7/6 [b]										
Sample Size:	174										
Male	Percent of Sample	2.3	4.0	0.0	46.5	2.3	0.0	2.3	0.0	0.0	57.5
	Number in Catch	129	226	0	2,609	129	0	129	0	0	3,221
Female	Percent of Sample	1.1	3.5	0.0	34.5	1.7	0.0	1.7	0.0	0.0	42.5
	Number in Catch	64	193	0	1,932	96	0	96	0	0	2,383
Total	Percent of Sample	3.4	7.5	0.0	81.0	4.0	0.0	4.0	0.0	0.0	100.0
	Number in Catch	193	419	0	4,541	225	0	225	0	0	5,604
Stratum Dates:	7/10, 7/13, 7/15										
Sampling Dates:	7/13										
Sample Size:	172										
Male	Percent of Sample	1.2	4.1	0.0	37.2	4.1	0.6	5.8	0.0	0.6	53.5
	Number in Catch	101	355	0	3,239	354	51	506	0	51	4,656
Female	Percent of Sample	2.3	4.0	0.0	35.5	1.1	0.0	3.5	0.0	0.0	46.5
	Number in Catch	203	354	0	3,087	101	0	304	0	0	4,049
Total	Percent of Sample	3.5	8.1	0.0	72.7	5.2	0.6	9.3	0.0	0.6	100.0
	Number in Catch	304	709	0	6,326	455	51	810	0	51	8,705
Stratum Dates:	7/17, 7/20, 7/22										
Sampling Dates:	7/20										
Sample Size:	176										
Male	Percent of Sample	2.9	5.7	0.6	34.7	2.8	0.6	7.9	0.0	0.0	55.1
	Number in Catch	132	263	26	1,607	132	26	369	0	0	2,556
Female	Percent of Sample	1.1	4.5	0.0	30.1	2.3	1.1	5.7	0.0	0.0	44.9
	Number in Catch	52	211	0	1,397	105	53	263	0	0	2,081
Total	Percent of Sample	4.0	10.2	0.6	64.8	5.1	1.7	13.6	0.0	0.0	100.0
	Number in Catch	184	474	26	3,004	237	79	632	0	0	4,637

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		Brood Year and Age Group [a]									
		1994		1993			1992		1991		Total
		0.3	1.2	0.4	1.3	2.2	1.4	2.3	2.4	3.3	
Stratum Dates:	7/24 - 9/7										
Sampling Dates:	7/27										
Sample Size:	77										
Male	Percent of Sample	1.3	7.8	0.0	32.4	3.9	0.0	11.7	0.0	0.0	57.1
	Number in Catch	46	274	0	1,142	137	0	411	0	0	2,010
Female	Percent of Sample	1.3	6.5	0.0	23.4	0.0	0.0	11.7	0.0	0.0	42.9
	Number in Catch	45	229	0	823	0	0	411	0	0	1,508
Total	Percent of Sample	2.6	14.3	0.0	55.8	3.9	0.0	23.4	0.0	0.0	100.0
	Number in Catch	91	503	0	1,965	137	0	822	0	0	3,518
Stratum Dates:	Season [c]										
Sample Size:	740										
Male	Percent of Sample	1.5	4.9	0.1	38.8	2.8	0.3	5.8	0.0	0.2	54.3
	Number in Catch	407	1,317	26	10,529	752	77	1,582	0	51	14,741
Female	Percent of Sample	1.6	4.0	0.0	34.1	1.1	0.2	4.6	0.1	0.0	45.7
	Number in Catch	432	1,087	0	9,271	303	53	1,241	33	0	12,420
Total	Percent of Sample	3.1	8.9	0.1	72.9	3.9	0.5	10.4	0.1	0.2	100.0
	Number in Catch	839	2,404	26	19,800	1,055	130	2,823	33	51	27,161

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Sex of all fish was confirmed by visual inspection of gonads.

[c] The number of fish in the "Season" summary are the stratum sums. "Season" percentages are derived from the sums.

Appendix 8. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Goodnews Bay sockeye salmon commercial gillnet catch samples, 1998.

		1994		1993			1992		1991	
		0.3	1.2	0.4	1.3	2.2	1.4	2.3	2.4	3.3
Sample Dates:	6/30									
Sample Size:	141									
Male	Mean Length	-	513	-	577	-	-	585	-	-
	Std. Error	-	11	-	3	-	-	6	-	-
	Range	-	484-562	-	525-619	-	-	571-604	-	-
	Sample Size	0	6	0	58	0	0	5	0	0
Female	Mean Length	530	483	-	548	-	-	528	584	-
	Std. Error	2	7	-	2	-	-	6	-	-
	Range	528-532	468-491	-	508-584	-	-	512-544	584-584	-
	Sample Size	2	3	0	61	0	0	5	1	0
Sample Dates:	7/6									
Sample Size:	174									
Male	Mean Length	570	525	-	576	535	-	566	-	-
	Std. Error	8	6	-	3	28	-	2	-	-
	Range	557-592	495-541	-	456-621	485-583	-	561-570	-	-
	Sample Size	4	7	0	81	4	0	4	0	0
Female	Mean Length	534	500	-	542	492	-	521	-	-
	Std. Error	24	7	-	4	8	-	11	-	-
	Range	510-558	482-532	-	452-603	479-506	-	499-538	-	-
	Sample Size	2	6	0	60	3	0	3	0	0
Sample Dates:	7/13									
Sample Size:	172									
Male	Mean Length	560	530	-	566	537	565	570	-	565
	Std. Error	5	15	-	3	11	-	9	-	-
	Range	555-565	505-615	-	440-615	510-575	565-565	500-605	-	565-565
	Sample Size	2	7	0	64	7	1	10	0	1
Female	Mean Length	544	510	-	544	503	-	544	-	-
	Std. Error	10	3	-	2	3	-	6	-	-
	Range	525-570	500-520	-	500-580	500-505	-	520-565	-	-
	Sample Size	4	7	0	61	2	0	6	0	0
Sample Dates:	7/20									
Sample Size:	176									
Male	Mean Length	566	512	634	574	542	597	582	-	-
	Std. Error	6	9	-	3	5	-	6	-	-
	Range	545-582	467-556	634-634	505-620	524-552	597-597	534-607	-	-
	Sample Size	5	10	1	61	5	1	14	0	0
Female	Mean Length	544	487	-	548	486	538	558	-	-
	Std. Error	10	6	-	4	10	27	5	-	-
	Range	534-554	463-518	-	485-583	458-499	511-565	537-583	-	-
	Sample Size	2	8	0	53	4	2	10	0	0

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		1994		1993			1992		1991	
		0.3	1.2	0.4	1.3	2.2	1.4	2.3	2.4	3.3
Sample Dates:	7/27									
Sample Size:	77									
Male	Mean Length	590	526	-	588	518	-	580	-	-
	Std. Error	-	14	-	4	14	-	12	-	-
	Range	590-590	500-595	-	530-615	490-535	-	515-625	-	-
	Sample Size	1	6	0	25	3	0	9	0	0
Female	Mean Length	575	485	-	547	-	-	545	-	-
	Std. Error	-	7	-	4	-	-	9	-	-
	Range	575-575	465-505	-	510-570	-	-	505-570	-	-
	Sample Size	1	5	0	18	0	0	9	0	0
Sample Dates:	Season [a]									
Sample Size:	740									
Male	Mean Length	568	522	634	574	534	576	576	-	565
	Range	545-592	467-615	634-634	440-621	485-583	565-597	500-625	-	565-565
	Sample Size	12	36	1	289	19	2	42	0	1
Female	Mean Length	544	496	-	545	494	538	543	584	-
	Range	510-575	463-532	-	452-603	458-506	511-565	499-583	584-584	-
	Sample Size	11	29	0	253	9	2	33	1	0

[a] Season mean lengths are weighted by the catch in each stratum.

Appendix 9. Age and sex composition of Goodnews Bay chum salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group [a]				
		1995	1994	1993	1992	Total
		0.2	0.3	0.4	0.5	
Stratum Dates : 6/30, 7/3						
Sampling Dates: 6/30 [b]						
Sample Size: 197						
Male	Percent of Sample	0.0	55.9	8.1	0.5	64.5
	Number in Catch	0	2,304	335	21	2,660
Female	Percent of Sample	0.0	28.4	6.6	0.5	35.5
	Number in Catch	0	1,173	272	21	1,466
Total	Percent of Sample	0.0	84.3	14.7	1.0	100.0
	Number in Catch	0	3,477	607	42	4,126
Stratum Dates : 7/6, 7/8						
Sampling Dates: 7/6 [b]						
Sample Size: 136						
Male	Percent of Sample	0.7	41.2	7.3	0.0	49.3
	Number in Catch	25	1,397	250	0	1,672
Female	Percent of Sample	0.0	38.2	11.8	0.7	50.7
	Number in Catch	0	1,298	399	25	1,722
Total	Percent of Sample	0.7	79.4	19.1	0.7	100.0
	Number in Catch	25	2,695	649	25	3,394
Stratum Dates: 7/10, 7/13, 7/15						
Sampling Dates: 7/13						
Sample Size: 100						
Male	Percent of Sample	0.0	40.0	3.0	0.0	43.0
	Number in Catch	0	1,830	137	0	1,967
Female	Percent of Sample	1.0	49.0	7.0	0.0	57.0
	Number in Catch	46	2,241	320	0	2,607
Total	Percent of Sample	1.0	89.0	10.0	0.0	100.0
	Number in Catch	46	4,071	457	0	4,574
Stratum Dates: 7/17 - 9/4						
Sampling Dates: 7/20						
Sample Size: 36						
Male	Percent of Sample	0.0	44.5	2.8	0.0	47.2
	Number in Catch	0	916	57	0	973
Female	Percent of Sample	0.0	47.2	5.5	0.0	52.8
	Number in Catch	0	973	115	0	1,088
Total	Percent of Sample	0.0	91.7	8.3	0.0	100.0
	Number in Catch	0	1,889	172	0	2,061

- Continued -

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		Brood Year and Age Group [a]				
		1995	1994	1993	1992	Total
		0.2	0.3	0.4	0.5	
Stratum Dates:	Season [c]					
Sample Size:	469					
Male	Percent of Sample	0.2	45.5	5.5	0.2	51.4
	Number in Catch	25	6,447	779	21	7,272
Female	Percent of Sample	0.3	40.2	7.8	0.3	48.6
	Number in Catch	46	5,685	106	46	6,883
Total	Percent of Sample	0.5	85.7	13.3	0.5	100.0
	Number in Catch	71	12,132	885	67	14,155

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Sex of all fish was confirmed by visual inspection of gonads.

[c] The number of fish in the "Season" summary are the stratum sums. "Season" percentages are derived from the sums.

Appendix 10. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Goodnews Bay chum salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group			
		1995	1994	1993	1992
		0.2	0.3	0.4	0.5
Sample Date:	6/30				
Sample Size:	197				
Male	Mean Length	-	592	614	639
	Std. Error	-	2	7	-
	Range	-	534-637	570-665	639-639
	Sample Size	0	110	16	1
Female	Mean Length	-	577	580	580
	Std. Error	-	3	6	-
	Range	-	534-623	545-620	580-580
	Sample Size	0	56	13	1
Sample Date:	7/6				
Sample Size:	136				
Male	Mean Length	522	594	605	-
	Std. Error	-	4	6	-
	Range	522-522	505-684	576-634	-
	Sample Size	1	56	10	0
Female	Mean Length	-	566	572	591
	Std. Error	-	3	5	-
	Range	-	456-614	536-612	591-591
	Sample Size	0	52	16	1
Sample Date:	7/13				
Sample Size:	100				
Male	Mean Length	-	576	587	-
	Std. Error	-	4	11	-
	Range	-	535-665	565-600	-
	Sample Size	0	40	3	0
Female	Mean Length	565	553	584	-
	Std. Error	-	3	9	-
	Range	565-565	500-595	560-630	-
	Sample Size	1	49	7	0
Sample Date:	7/20				
Sample Size:	36				
Male	Mean Length	-	571	585	-
	Std. Error	-	6	-	-
	Range	-	520-617	585-585	-
	Sample Size	0	16	1	0
Female	Mean Length	-	548	530	-
	Std. Error	-	5	5	-
	Range	-	520-587	525-535	-
	Sample Size	0	17	2	0

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		Brood Year and Age Group			
		1995	1994	1993	1992
		0.2	0.3	0.4	0.5
Sample Dates:	Season [a]				
Sample Size:	469				
Male	Mean Length	522	585	604	639
	Range	522-522	505-684	565-665	639-639
	Sample Size	1	222	30	1
Female	Mean Length	565	560	573	586
	Range	565-565	456-623	525-630	580-591
	Sample Size	1	174	38	2

[a] Season mean lengths are weighted by the catch in each stratum.

Appendix 11. Age and sex composition of Goodnews Bay coho salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group [a]			
		1995	1994	1993	Total
		1.1	2.1	3.1	
Stratum Dates: 7/15 - 8/10 Sampling Dates: 8/7 [b] Sample Size: 68					
Male	Percent of Sample	8.8	44.1	1.5	54.4
	Number in Catch	311	1,556	52	1,919
Female	Percent of Sample	0.0	44.1	1.4	45.6
	Number in Catch	0	1,556	52	1,608
Total	Percent of Sample	8.8	87.8	2.9	40.6
	Number in Catch	311	1,279	104	3,527
Stratum Dates: 8/12 - 18 Sampling Dates: 8/14 [b] Sample Size: 87					
Male	Percent of Sample	4.6	51.7	2.3	58.6
	Number in Catch	250	2,809	125	3,183
Female	Percent of Sample	5.7	34.5	1.1	41.4
	Number in Catch	312	1,872	62	2,247
Total	Percent of Sample	10.3	86.2	3.4	100.0
	Number in Catch	562	4,681	187	5,430
Stratum Dates: 8/21 - 9/7 Sampling Dates: 8/24 [b] Sample Size: 160					
Male	Percent of Sample	3.8	35.6	1.3	40.6
	Number in Catch	461	4,378	153	4,992
Female	Percent of Sample	6.2	52.5	0 6	59.4
	Number in Catch	768	6,452	77	7,297
Total	Percent of Sample	10	88.1	1.9	100.0
	Number in Catch	1,229	10,830	230	12,289
Stratum Dates: Season [c] Sampling Dates: 8/7, 8/14, 8/21 Sample Size: 315					
Male	Percent of Sample	4.8	41.2	1.6	47.5
	Number in Catch	1,022	8,743	330	10,095
Female	Percent of Sample	5.1	46.5	0.9	52.5
	Number in Catch	1,080	9,880	191	11,151
Total	Percent of Sample	9.9	87.7	2.5	100.0
	Number in Catch	2,102	18,623	521	21,246

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding.

[b] Sex of all fish was confirmed by visual inspection of gonads.

[c] The number of fish in the "Season" summary are the stratum sums. "Season" percentages are derived from the sums.

Appendix 12. Length (mm measured from mid-orbit to fork-of-tail) by age and sex of Goodnews Bay coho salmon commercial gillnet catch samples, 1998.

		Brood Year and Age Group		
		1995	1994	1993
		1.1	2.1	3.1
Sample Date:	8/7 [a]			
Sample Size:	68			
Male	Mean Length	575	592	571
	Std. Error	25	7	-
	Range	513-665	517-673	571-571
	Sample Size	6	30	1
Female	Mean Length	-	605	638
	Std. Error	-	6	-
	Range	-	540-666	638-638
	Sample Size	0	30	1
Sample Date:	8/14 [a]			
Sample Size:	87			
Male	Mean Length	609	610	630
	Std. Error	24	6	10
	Range	549-657	475-662	620-639
	Sample Size	4	45	2
Female	Mean Length	628	596	645
	Std. Error	6	7	-
	Range	609-641	520-660	645-645
	Sample Size	5	30	1
Sample Date:	8/24 [a]			
Sample Size:	160			
Male	Mean Length	622	620	640
	Std. Error	11	5	13
	Range	583-648	510-674	627-652
	Sample Size	6	57	2
Female	Mean Length	615	614	646
	Std. Error	9	2	-
	Range	549-646	543-667	646-646
	Sample Size	10	84	1
Sample Date:	Season [b]			
Sample Size:	315			
Male	Mean Length	613	620	621
	Range	511-695	471-705	570-652
	Sample Size	36	336	10
Female	Mean Length	619	614	622
	Range	549-650	471-680	555-646
	Sample Size	25	354	11

[a] Sex of all fish was confirmed by visual inspection of gonads.

[b] Season mean lengths are weighted by the catch in each stratum.

Appendix 13. Historical salmon escapement at the Middle Fork Goodnews River project, 1981 - 1998.

Year	Operating period [a]	Chinook	Sockeye	Chum	Pink	Coho [b]
1981	June 13 - Aug. 15	3,688	49,108	21,827	1,327	357
1982	June 23 - Aug. 03	1,395	56,255	6,767	13,855	62
1983	June 11 - July 28	6,027	25,813	15,548	34	0
1984	June 15 - July 31	3,260	32,053	19,003	13,744	249
1985	June 27 - July 31	2,831	24,131	10,367	144	282
1986	June 16 - July 24	2,080	51,069	14,764	8,133	163
1987	June 22 - July 30	2,272	28,871	17,517	62	62
1988	June 23 - July 30	2,712	15,799	20,799	6,781	6
1989	June 29 - July 31	1,915	21,186	10,380	246	145
1990	June 20 - July 24	3,636	31,679	6,410	3,378	0
1991	June 29 - Aug. 25	1,952	47,397	27,525	1,694	1,978
1992	June 21 - Aug. 25	1,903	27,267	22,023	23,030	[c]
1993	June 22 - Aug. 18	2,349	26,452	14,952	318	1,451
1994	June 22 - Aug. 16	3,856	55,751	34,849	38,705	[c]
1995	June 19 - Aug. 28	4,836	39,009	33,669	330	5,415
1996	June 18 - Aug. 23	2,882	57,504	40,125	20,105	10,869
1997	June 12 - Sept. 17	2,937	35,530	17,296	940	9,619
1998	July 04 - Sept. 17	4,584	47,951	28,905	10,376	35,441

[a] In years where the project was intiated later than normal, interpolation was used to estimate escapement for the time period missed.

[b] The coho escapement continues into October and the majority of the run was not counted (except in 1997 and 1998).

[c] A number of days were missed due to flooding and no interpolation was attempted.