U.S. Fish and Wildlife Service
Office of Subsistence Management
Fisheries Resource Monitoring Program

Abundance and run timing of adult salmon in Henshaw Creek, Kanuti National Wildlife Refuge, Alaska, 2002

Annual Report No. FIS 00-025-3

This report has been prepared to assess project progress. Review comments have not been addressed in this report but will be incorporated into the final report for this project.

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Annual Report Summary Page

Title: Abundance and run timing of adult salmon in Henshaw Creek, Kanuti National Wildlife Refuge, Alaska 2002.

Study Number: FIS 00-025-3

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Management Regions: Yukon River

Information Type: Stock status and trends of chinook and chum salmon

Issues(s) Addressed: The abundance and run timing of salmon spawning populations within the Yukon River drainage are one of many issues identified specifically by various Regional Advisory Councils and are also stated in the Yukon River Comprehensive Management Plan for Alaska. Even though there has been an increase in escapement data from the Koyukuk River drainage, but many tributaries remain unstudied. Chinook and summer chum salmon escapement counts from Henshaw Creek may assist managers in making decisions during in-season run activity with the intent to provide post season evaluation of various management practices and potentially assisting in developing future run projections.

The objective for this project was to identify spawning populations within the Henshaw Creek drainage. The use of a resistence board weir permitted the collection of data from chinook and summer chum salmon spawning populations that address run size and timing, age composition, sex ratios, and length distribution. In addition, this information is used to close the information gap between other projects along the Koyukuk River

Study Cost: $60,000 **Study Duration:** May 2001 to March 2003

Key Words: subsistence fishery, chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, Yukon River drainage, Koyukuk River, Henshaw Creek, spawning adults, stock status/trends, escapement, resistence board weir.

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Abstract.—A resistence board weir was operated between June 29 and August 2, 2002, to estimate escapement numbers and collect biological data from adult salmon returning to Henshaw Creek, a tributary of the Koyukuk River in north-central Alaska. This was the third year of a multi-year project to study chinook *Oncorhynchus tshawytscha* and summer chum *O. keta* salmon populations. A total of 649 chinook salmon and 25,249 summer chum salmon passed through the weir. The median date of passage for chinook salmon was July 14, 2002. The chinook run was composed of 34% females. The age distribution was predominately age 1.3 (36%) and age 1.4 (31%) fish. The average female chinook length was 820 mm with a range from 540 mm to 975 mm. The average male chinook length was 637 mm with a range from 410 mm to 950 mm. The median date of passage for summer chum salmon was July 15, 2002. The summer chum salmon run was composed of 60% females. The age distribution was predominately age 0.4 (81%) fish. The average female summer chum salmon length was 556 mm with a range from 450 mm to 635 mm. The average male summer chum salmon length was 592 mm with a range from 515 mm to 805 mm. Four resident species were recorded migrating through the weir; longnose sucker *Catostomus catostomus* (N=3,125), Arctic grayling *Thymallus arcticus* (N=142), whitefish *Coregonus spp.* (N=8), and northern pike *Esox lucius* (N=1). Chinook and summer chum salmon escapement counts from Henshaw Creek may assist managers in making decisions during in-season run activity with the intent to provide post season evaluation of various management practices and potentially assisting in developing future run projections. Information collected from this study will also be used to compare the chinook and summer chum salmon runs with other studies on the Koyukuk River.

Introduction

Chinook *Oncorhynchus tshawytscha* and chum *O. keta* salmon spawning in Henshaw Creek contribute to the subsistence and commercial fisheries within the Yukon River drainage. Chinook salmon enter the Yukon River in mid June and continue through early July. Summer chum salmon enter the Yukon River in mid June, while fall chum salmon enter in late July or early August. Spawning chinook salmon utilize tributaries along the entire Yukon River, while the summer chum salmon utilize those tributaries along the lower and middle areas of the Yukon River. Recent declines of Yukon River salmon stocks, particularly summer and fall chum salmon (Bergstrom et al. 1995; Kruse 1998), have led to harvest restrictions, subsistence fishery closures, and spawning escapements below management goals (JTC 2001). Accurate escapement estimates are required to determine the exploitation rates, marine survival rates, and spawner recruit relations of Pacific salmon stocks (Labelle 1994). In addition, healthy salmon escapements to individual tributary spawning areas are required to maintain genetic diversity and sustainable harvests. Management of salmon populations within the Yukon River is complicated due to the mixed stock nature of this fishery (Tobin and Harper 1998).

In an effort to understand the mixed stock fishery within the Yukon River there are multiple tributary and mainstem escapement studies conducted each year, which provides fishery managers with an indication of run strength for chinook and chum salmon stocks. Historically, the Alaska Department of Fish and Game, Division of Commercial Fisheries (ADF&G-DCF) has conducted and compiled a data base on relative abundance of salmon stocks from many tributaries in interior Alaska. This database is primarily made up of aerial surveys (Barton 1984), which are highly variable and are used as spawning strength. More in-depth studies along the Yukon River provide managers with information required to assess the run in-season (Vania and Golembeski 2000). These studies include the Emmonak test fishery, subsistence and commercial harvest reports, Pilot station sonar, and the East Fork Andreafsky River weir.

On the Koyukuk River various studies have been conducted over the past 10 years that monitor escapement counts using either fish weirs or counting towers. These studies include the Gisasa River weir study (1994-2001), the South Fork Koyukuk River weir study (1996-1997; Wiswar 1998), the Clear Creek counting tower study (1995-2001), the Henshaw Creek counting tower study (1999), and the Henshaw Creek weir study (2000-2001).

Henshaw Creek is one of many tributaries flowing into the Koyukuk River drainage on the Kanuti National Wildlife Refuge (Refuge). The Kanuti National Wildlife Refuge (Refuge) lies near the Arctic Circle with the Brooks Range to the north and the Ray Mountains to the south (USFWS 1993). In accordance with the Alaska National Interests Lands Conservation Act of 1980, the Refuge was established to conserve fish and wildlife populations and habitats in their natural diversity and to provide the opportunity for continued subsistence uses by local residents (USFWS 1993). Obtaining accurate escapement and stock assessment estimates from adult salmon are important components in refining fishery management practices and fulfilling Congressional mandates.

In an effort to increase the understanding of Koyukuk River salmon resources, a resistence board weir project was installed on Henshaw Creek in 2001. Historically, salmon escapement data has been collected from Henshaw Creek starting with aerial surveys and progressing to a resistence board weir in later years. Since 1960, aerial survey escapement estimates on Henshaw Creek ranged from six to 561 chinook and 12 to 25,780 summer chum salmon (Barton 1994, Appendix 1). In 1999 a counting tower was operated on Henshaw Creek, however due to high water the study only estimated 12 chinook and 1,250 summer chum salmon (VanHatten 1999). In 2000 a resistence board weir replaced the counting tower and estimated 193 chinook and 24,406 summer chum salmon (VanHatten and Wiswar 2002). In 2001, 1,091 chinook and 34,777 summer chum salmon were recorded migrating through the weir (VanHatten 2002).

The 2002 objectives of the Henshaw Creek weir study were to: 1) determine daily escapement and run timing of adult salmon, 2) determine age, sex, and length compositions of adult salmon, and 3) determine the movement of resident fish as they move upstream.

Study Area

Henshaw Creek is a small, clear water tributary of the Koyukuk River in north-central Alaska (Figure 1). The headwaters originate in the Alatna Hills, and the river flows southeasterly for 144 km before entering the Koyukuk River. The climate of this area is cold and continental, which is characterized by extreme seasonal temperature variations and very low precipitation. There is an extreme range in air temperature with recorded temperatures of 18^o to 21^o C in summer months to recorded lows of -57^o C in winter months (USFWS 1993). Stream flows are highest during the spring months, due to snow melt, with sporadic high discharge periods throughout the summer months, in response to local rain showers (USFWS 1993).

Channel configuration is typically meandering with alternating cut banks and gravel bars. The substrate varies from gravel and cobble in high velocity areas to mud and silt in eddies and sloughs. The lower portion of Henshaw Creek has channel characteristics that are more uniform in appearance with gradual sloping mud banks and emergent shoreline vegetation (USFWS 1993). The weir site is approximately 1.5 km upstream from the mouth of Henshaw Creek. The width of the channel at the weir site ranges from 27 to 29 m with an average depth of 0.6 m. Substrate size ranges from large gravel to small cobble (50-150 mm in diameter).

Methods

Weir Operation.—A resistence board weir was operated to collect escapement counts and biological information from adult salmon as they migrated into Henshaw Creek. Construction and installation methods for operating a resistance board weir were described by Tobin (1994). Each picket of the weir was schedule 40 polyvinyl chloride (PVC) electrical conduit with a 2.5 cm inside diameter and spaced 3.2 cm apart, from center to center, between individual pickets (Wiswar 2001). Visual inspection of the weir was conducted on a daily basis for holes and structural integrity. During visual inspection, the weir was cleaned of debris and fish carcasses. A live trap installed near mid-channel allowed migrating salmon and resident species to pass through the weir.

Biological Data.—Run timing and abundance of adult salmon were estimated by recording and plotting the number of each species of fish migrating through the weir each day. All non-salmon species were not handled as they migrated through the weir. Because these species were not handled it was difficult to identify different whitefish species, therefore all whitefish species were grouped under the sub-family Coregoninae.

The counting schedule consisted of counting migrating fish species 24 hours a day, 7 days a week for the duration of the project. The 24-hour counting period was divided into four 6-hour periods. The daily counting schedule began at 0001 hours and ended at midnight. Each crew member was assigned a designated 6-hour period to conduct their counts. During those time periods when biological sampling was conducted, an additional crew member would assist.

The start date of the project is based on two factors: 1) when the first salmon was caught by subsistence fishermen on lower Yukon River for each year, gives an indication that salmon will be returning to Henshaw Creek within a 6-week period, and 2) run timing of previous year's salmon escapement. The criterion for selecting the end date of the project is based on daily percent of run to date. For Henshaw Creek the end date is selected when the daily count is less than 1% of the run for consecutive days. The daily escapement count and sex ratios were reported daily to the U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Office (USFWS-FFWO) daily.

Data Analysis.—A stratified random sampling scheme was used to collect age, length, and sex ratio information from both adult salmon species. Calculations for sex and age information were treated as a stratified random sample (Cochran 1977) and statistical weeks were the strata. Each statistical week was defined as beginning on Monday and ending on Sunday. Sampling began at the beginning of each week and, generally, was conducted over a 3-4 day period to collect the targeted 160 fish/species/week. Daily sex ratios were collected using two methods: 1) sex of each fish was recorded when sampling for age and length, and 2) sex of a fish was identified throughout the day. For identifying fish throughout the day, fish were opportunistically sexed. Crew members physically handled and identified sex of the fish as they migrated into the trap. Sex of each fish was determined by secondary sex characteristics.

Scales were used for ageing salmon and reported using the European technique (Foerster 1968). Three scales were collected from chinook samples and one scale from summer chum salmon. Scales were sampled from the area located on the left side of the fish and two rows above the lateral line on a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Scales from both adult salmon species were sent to ADF&G-DCF for processing.

Lengths of chinook and summer chum salmon were measured to the nearest 5 mm from mid eye to fork of the caudal fin (MEL).

Within a week, the proportion of the sample composed of a given sex or age, p_{ij}, was calculated as

$$p_{ij} = \frac{n_{ij}}{n_j},$$

where n_{ij} is the number of fish by sex i or age i sampled in week j, and n_j is the total number of fish sampled in week j. The variance of p_{ij} was calculated as

$$v(p_{ij}) = \frac{p_{ij}(1 - p_{ij})}{n_j - 1}.$$

Sex and age compositions for the total run of chinook and chum salmon of a given sex/age, p_i, were calculated as

$$p_i = \sum_{j=1} W_j p_{ij} \ ,$$

where the stratum weight (W_j) was calculated as

$$W_j = \frac{N_j}{N} \, ,$$

and N_j equals the total number of fish of a given species passing through the weir during week *j*, and *N* is the total number of fish of a given species passing through the weir during the run. Variance of sex and age compositions for the run were calculated as

$$v(p_i) = \sum_{j=1} W_j^2 v(p_{ij}) \, .$$

Results

Weir Operation.—Operation of the weir began on June 29 and continued through August 2, 2002. There were no missed counts during the operation of the weir. Spawning activity of summer chum salmon, e.g. females digging redds, immediately upstream of the weir resulted in areas where gravel accumulated on the weir panels. These areas and floating debris were cleaned off the weir on a daily basis. In 2002 the daily percent of run to date was below 0.5% for three consecutive days (July 31-August 2). Therefore, the weir was halted on August 2 when the daily run to date was 0.15%.

Biological Data.—In 2002 649 chinook salmon, 25,249 summer chum salmon (Figure 2; Table 1), and 3,276 resident fish (Table 1) were counted as they migrated through the weir. The most abundant resident species was longnose sucker *Catostomus catostomus* (N=3,125) followed by Arctic grayling *Thymallus arcticus* (N=142), whitefish *Coregonus spp.* (N=8), and northern pike *Esox lucius* (N=1; Table 1).

Chinook salmon.—The first chinook salmon was counted on July 1 and the last chinook was counted on August 2, 2002 (Figure 2; Table 1). The first quartile migrated through the weir by July 10 and the median migration date was July 14 (Table 1). The seasonal chinook salmon sex ratio was comprised of 34% females (Figure 3; Table 2). The weekly female sex ratio started low at 26%, then varied throughout the run from 29% to 34%, ending at 33% in the last week (Table 2). There were 386 chinook salmon sampled for age composition with 39 (10%) of the samples classified as unknown. Age composition of chinook salmon sampled made up four age groups: age 1.5 (2%), age 1.4 (31%), age 1.3 (36%), and age 1.2 (30%; Table 3). The average female chinook salmon length was 820 mm with a range from 540 mm to 975 mm (Table 4). The average male chinook salmon length was 637 mm with a range from 410 mm to 950 mm (Table 4).

Summer Chum salmon.—The first summer chum salmon counted was on the first day of operation (June 29) with a daily count of 35 fish, and the last chum counted was on August 2, 2002, with a daily count of 76 fish (Figure 2; Table 1). The 2002 summer chum salmon run was bimodal with the first peak occurring on July 8 (1,646 fish/day) and the second peak occurring on July 15, 2002 (1,870 fish/day; Figure 4; Table 1). Between July 14 and July 20, 42% of the run had migrated through the weir. The median migration date was July 15 (Table 1). The seasonal sex ratio was comprised of 60% females (Table 2). The weekly female sex ratio increased throughout the run, from 52% to 72% (Table 2). There were 875 summer chum salmon sampled for age composition with 143 (16%) classified as unknown. Age composition of chum salmon made up three age groups; age 0.5 (4%), age 0.4 (81%), and age 0.3 (16%; Table 3). The average female summer chum salmon length was 556 mm with a range from 450 mm to 635 mm (Table 4). The average male summer chum salmon length was 592 mm with a range from 515 mm to 805 mm (Table 4).

Discussion

Weir operation.—The weir performed well and was effective in allowing accurate counts of migrating salmon to be recorded and the collection of biological data. The integrity of the weir withstood the weather conditions of this area. High water level can submerge weir panels thus allowing fish to pass over or around the weir undetected (Tobin 1994). Although there were multiple rain events throughout the season, the water level did not impede the counting schedule. Picket spacing within the trap and the weir panels were adequate to prevent adult chinook and summer chum salmon from passing through the weir. However, some small fish species, e.g. jack chinook salmon, Arctic grayling and whitefish spp., likely passed through the weir undetected.

Escapement and run timing.—The Yukon River chinook and summer chum salmon escapement abundance estimates have improved the last three years, 2000, 2001, and 2002. Projects conducted below the Koyukuk River drainage reported this type of trend for chinook salmon (JTC 2002). This trend of increasing chinook salmon escapement counts between 2000, 2001, and 2002 was not seen on either Henshaw Creek or the Gisasa River. Henshaw Creek is located 753 km up river from the mouth of the Koyukuk River and Gisasa River is located 90 km up river. There is significant variation in escapement counts between these years, which gives an indication of a cyclical pattern. Unfortunately, a longer time series is needed to make this hypothesis.

On Henshaw Creek there was an 82% increase in chinook salmon escapement counts between 2000 (N=193) and 2001 (N=1,091) and a 41% decrease between 2001 and 2002 (N=649; Figure 5). This trend was also noticed on the Gisasa River, where there was a 32% increase in chinook salmon escapement counts between 2000 (N=2,089) and 2001 (N=3,052) and a 36% decrease between 2001 and 2002 (N= 1,931; Figure 5; VanHatten, unpublished data).

The Henshaw Creek summer chum salmon escapement count did not follow the same trend as the chinook salmon escapement. In 2002, the Henshaw Creek summer chum salmon escapement count (N=25,249) was 27% below the 2001 escapement count (N=34,777) and 3% above the 2000 escapement count (24,406; Figure 6). In comparison, the Gisasa River summer chum salmon escapement trend did follow the chinook salmon trend. The 2002 Gisasa River chinook salmon (N=33,125) was 54% higher than the 2001 escapement (N=17,936) and 34% higher than the 2000 escapement (N=11,410; Figure 6; VanHatten, unpublished data). Due to the complex nature and the environmental variables associated during salmon life cycles it is unknown why escapement counts vary between years.

The 2002 chinook and summer chum salmon season passage at the Henshaw Creek weir does not account for the entire Henshaw Creek spawning population. There was some fraction of the population spawning below the weir during the field season. A foot survey of this area showed that the number of salmon spawning was below 0.5% of the run. In addition, salmon were migrating past the weir site after the August 2 stop date. The proportion of salmon passing the weir site after the stop date are not substantial and therefore the escapement counts are conservative numbers.

The similarities in run timing of chinook and summer chum salmon populations arriving on the spawning grounds can be accounted for through one or more of three mechanisms. First, populations with the farthest to travel may be entering the Koyukuk River earlier than those traveling to lower river tributaries. Second, the time entry into the Koyukuk River is similar, but the fish going farther swim faster. Third, the milling time is inversely proportional to the distance chinook and summer chum salmon need to travel to their spawning grounds (Molyneaux et al. 1997). Chinook salmon migration rates vary along the Yukon River, with rates ranging from 20.1 km/day for those fish traveling in the lower portions of the river to 54.4 km/day for fish traveling to the upper portion of the river (JTC 2002).

Despite these considerations, the overall run timing of the Henshaw Creek chinook salmon passage was similar to the Gisasa River project (Figure 7). The Henshaw Creek chinook salmon population showed the same run timing pattern as the Gisasa River chinook salmon population. The first quartile passed the Henshaw Creek and Gisasa River weirs on the same day, July 10, and the median passage date was within one day of each other Figure 7). The chinook salmon run timing on both Henshaw Creek and Gisasa River does not follow any of the mechanisms stated above.

The summer chum salmon run timing in Henshaw Creek was not similar to the Gisasa River project (Figure 8). On Henshaw Creek the first quartile passed the weir on July 10, four days after the first quartile passed on the Gisasa River (VanHatten, unpublished data). The median passage date was also four days later on Henshaw Creek (Figure 8). These results show that summer chum salmon populations take longer to migrate farther up the Koyukuk River. Unfortunately, there is very little information concerning run timing or swimming speed of chinook and summer chum salmon in the Koyukuk River drainage. A radio telemetry study has been conducted by both ADF&G and National Oceanic and Atmospheric Administration, which tracks migration behavior of chinook salmon. Unfortunately, this study is focused on the main stem Yukon River and less than 2% of the chinook salmon that were tagged on the Yukon River migrated into the Koyukuk River (Eiler, NOAA, personal communication). A sample size of this size makes it difficult to understand migration patterns of Koyukuk River salmon.

Age Distribution.—The ASL data collected from chinook and summer chum salmon on Henshaw Creek was not limited to the sample size (Table 3). The sample sizes for chinook (N=386) and summer chum (N=875) throughout the season, provided a large enough sample size to adequately describe the age, sex, and length distributions. The seasonal sample size represented 53% of the population, with the sample sizes being well distributed over the course of the run.

The 2002 chinook salmon data show that the brood years 1996 and 1997 may have been strong on Henshaw Creek and the Gisasa River. In 2002 on Henshaw Creek, the age class 1.4 (brood year 1996) represented 31% of the population and in 2001 the age class 1.3 (brood year 1996) represented 42% of the population. On the Gisasa River these age classes were not as strong but were represented with age class 1.4 representing 23% of the population in 2002 and age class 1.3 representing 25% of the population in 2001 (Appendix 4; VanHatten, unpublished data). On Henshaw Creek the 1997 chinook salmon brood year may have been strong since age class 1.3

dominated, representing 35% of the population and in 2001 age class 1.2 was present, making up 12% of the population. This trend was also seen on the Gisasa River in 2002 with age class 1.3 dominating the run, representing 36% of the population and in 2001 the age class 1.2 was present, making up 18% of the population (Appendix 4; VanHatten, unpublished data). Although escapement data are insufficient previous returns from the 1997 brood year, age class 1.2 in 2001 and age class 1.3 in 2002, indicate that proportion of age 1.4 fish in the escapement may be larger in 2003.

The 2002 summer chum salmon data show that the brood year 1997 may have been strong on Henshaw Creek but not on Gisasa River. In 2002 on Henshaw Creek the 1997 brood year appeared to dominate the run, with 81% age 0.4 fish and in 2001 age 0.3 fish being represented, 34% of the population (Appendix 5). On the Gisasa River it is difficult to determine which brood year was strong because there is no noticeable trend between 2002 and 2001 (VanHatten, unpublished data). In 2002 the dominant age class was age 0.3 fish and in 2001 the dominate age class was 0.4 fish (Appendix 5). In 2002 the age class from the brood year 1997 was represented as age 0.4 (37%) fish and in 2001 the age class 0.3 represented 11% of the populations. These levels of representation for each age class in 2002 and 2002 does not mean the 1997 brood year was strong. The analysis of the data shows that the proportion of returning age 0.4 fish may be larger based on the proportion of age 0.3 fish present in the 2002 escapement.

Unfortunately, the Henshaw Creek weir has only been operated for three years and therefore it is difficult to determine if these brood years are represented in other years. There are possible explanations why there is an increase or decrease in age class size from year to year. As stated by Kruse (1998) the changes in age classes can be attributed to changes in either marine or freshwater environment. Depending on the environment the fish are living in during the time of change, single (freshwater) or multiple age (marine) classes can be affected.

Sex ratio.—Sex ratios of salmon escapements are indicative of the general health of the run. A large salmon escapement does not mean the run is healthy unless the stocks have a good representation of females. Generally, during the salmon spawning period, there are higher proportions of males during the early stages of the run while the females dominate during the later stages (Beacham and Starr 1982). Low numbers of females can negatively affect the production of a system even though environmental factors may be favorable. For example data from Henshaw Creek chinook salmon escapement counts showed the female sex ratios ranged from 34% in 2002 to 40% in 2001 to 21% in 2000 (VanHatten 2002). In comparison, the Gisasa River data show the female sex ratios range from 20% in 2002 to 42% in 2001 to 36% in 2000 (VanHatten, unpublished data). The summer chum salmon population showed a stronger percentage of females for both the Henshaw Creek and Gisasa River. On Henshaw Creek the female sex ratios ranged from 60% in 2002 to 61% in 2001 and to 57% in 2000 (VanHatten, unpublished data). On the Gisasa River the female sex ratios ranged from 51% in 2002 to 49% in 2001 and 2000 (VanHatten 2002). Given this information the chinook and summer chum salmon populations in Henshaw Creek has the potential for being healthy but there are more environmental variables that are needed to make this conclusion. Although the percent of females in Henshaw Creek escapement is within range of the percent of female escapement in Gisasa River for it years of operation (1994-2002) it is not understood how these percentages affect the overall health of the population.

Resident species were counted and recorded throughout the study time period. There is very little information concerning movement of resident fish species in Henshaw Creek, but there was an increase in the number of resident species moving through the weir in 2002 compared to 2001 and 2000 (VanHatten 2002). In 2003 biological data, age, sex, and length information, will be collected from resident species migrating through the weir to establish baseline data and characterize these populations. This database will allow for a better understanding of resident species in Henshaw Creek.

Providing timely and accurate escapement counts to fishery mangers is the main objective of this project. In 2002 daily counts and sex ratios of Henshaw Creek chinook and summer chum salmon were provided throughout the season. During the upcoming 2003 field season daily similar escapement data will again be provided. Considering the amount of time and money invested in this project it would be beneficial to managers to continue operation of the Henshaw Creek weir for a full salmon life cycle. The information collected during this time period will establish a database for chinook and summer chum salmon populations. In addition, this database will allow post-season evaluation of management actions. Establishing a chinook and summer chums salmon database in Henshaw Creek will allow for description of trends in percent of female in each escapement and escapement counts and run of timing of resident species. Once the collection of several years of data has been completed that information can be used to compare with historical data from other streams to confirm or deny escapement trends. The Henshaw Creek database can be used for assessing salmon run characteristics on the upper Koyukuk River while the Gisasa River database can be used for the lower Koyukuk River. Due to the complexity of the Yukon River fishery stocks and the difficulty in managing them, it is vital to continue collecting information from individual salmon populations on Henshaw Creek and the Gisasa River.

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Table 1.—Daily and cumulative (chinook and summer chum salmon only) counts of fish passing through the Henshaw Creek weir, Alaska, 2002. (Cum=cumulative). * indicates first, median, and third quartile of the run.

	Chinook salmon		Summer chum salmon		Longnose sucker	Arctic grayling	Whitefish spp.	Northern pike
Date	Daily	Cum	Daily	Cum	Daily	Daily	Daily	Daily
29-Jun	0	0	35	35	30	2	0	0
30-Jun	0	0	22	57	3	10	0	0
1-Jul	1	1	55	112	5	12	0	0
2-Jul	0	1	187	299	5	9	0	0
3-Jul	2	3	237	536	0	13	0	0
4-Jul	0	3	321	857	0	6	0	0
5-Jul	1	4	285	1,142	13	9	2	0
6-Jul	9	13	585	1,727	13	5	0	0
7-Jul	10	23	1,362	3,089	32	7	1	0
8-Jul	29	52	1,380	4,469	51	5	0	0
9-Jul	62	114	1,646	6,115	85	5	0	1
10-Jul	51	*165	1,079	*7,194	605	6	0	0
11-Jul	65	230	741	7,935	582	2	1	0
12-Jul	64	294	779	8,714	86	0	0	0
13-Jul	30	324	982	9,696	2	0	0	0
14-Jul	58	*382	1,480	11,176	0	0	0	0
15-Jul	31	413	1,839	*13,015	0	3	0	0
16-Jul	44	*457	1,870	14,885	146	2	0	0
17-Jul	37	494	1,796	16,681	297	0	0	0
18-Jul	29	523	1,501	18,182	68	0	0	0
19-Jul	33	556	1,309	*19,491	19	4	1	0
20-Jul	20	576	1,055	20,546	0	1	0	0
21-Jul	12	588	879	21,425	2	2	0	0
22-Jul	20	608	567	21,992	81	0	0	0
23-Jul	8	616	547	22,539	31	0	0	0
24-Jul	8	624	585	23,124	85	0	1	0
25-Jul	1	625	384	23,508	191	1	0	0
26-Jul	4	629	233	23,741	59	0	0	0
27-Jul	4	633	377	24,118	24	6	0	0
28-Jul	1	634	338	24,456	78	0	0	0
29-Jul	5	639	302	24,758	427	28	0	0
30-Jul	4	643	135	24,893	50	2	1	0
31-Jul	2	645	174	25,067	51	1	0	0
1-Aug	3	648	106	25,173	4	0	1	0
2-Aug	1	649	76	25,249	0	1	0	0
Total	649		25,249		3,125	142	8	1

Table 2.—Sex ratios and sample size of chinook and summer chum salmon sampled at Henshaw Creek weir, Alaska, 2002. SEs are in parentheses. Season total is calculated from weighted abundance of weekly totals. N = sample size of fish examined.

Time period	Run size	N	Percent female	Estimated number of females
Chinook salmon				
Jun 29-Jul 7	23	23	26 (9.4)	6
Jul 8-14	359	302	34 (2.7)	124
Jul 15-22	206	155	34 (3.8)	70
Jul 22-28	46	38	29 (7.5)	13
Jul 29-Aug 2	15	15	33 (12.6)	5
Season total	649	533	34 (2.1)	218
Summer chum salmon				
Jun 29-Jul 7	3,089	1,213	52 (1.4)	1,609
Jul 8-14	8,087	6,521	59 (0.6)	4,737
Jul 15-22	10,249	10,169	60 (0.5)	6,198
Jul 22-28	3,031	3,031	62 (0.9)	1,884
Jul 29-Aug 2	793	793	72 (1.6)	571
Season total	25,249	21,727	60 (0.3)	15,000

Table 3.—Percent weekly age estimates and brood years of chinook and summer chum salmon sampled at Henshaw Creek weir, Alaska, 2002. SEs are in parentheses. Season total is calculated from weighted abundance of weekly totals. N=sample size of fish examined.

Chinook salmon

				Brood year and age			
				1995	1996	1997	1998
Time period	Run size	N	Unknown	1.5	1.4	1.3	1.2
Jun 29-Jul 7	23	22	1	0 (0.0)	9 (6.3)	55 (10.9)	36 (10.5)
Jul 8-14	359	144	18	3 (1.4)	32 (3.9)	38 (4.0)	28 (3.7)
Jul 15-22	206	134	16	2 (1.3)	34 (4.1)	36 (4.2)	28 (3.9)
Jul 22-28	46	36	2	0 (0.0)	39 (8.2)	22 (7.0)	39 (8.2)
Jul 29-Aug 2	15	11	2	9 (9.1)	18 (12.2)	27 (14.1)	45 (15.7)
Season total	649	347	39	2 (0.9)	31 (2.6)	36 (2.7)	30 (2.5)

Summer chum salmon

				1996	1997	1998
				0.5	0.4	0.3
Jun 29-Jul 7	3,089	184	47	4 (1.4)	88 (2.4)	9 (2.1)
Jul 8-14	8,087	138	28	7 (2.2)	81 (3.3)	12 (2.7)
Jul 15-21	10,249	129	21	1 (0.8)	82 (3.4)	17 (3.3)
Jul 22-28	3,333	145	20	4 (1.7)	77 (3.5)	19 (3.3)
Jul 29-Aug 2	491	136	26	3 (1.5)	74 (3.8)	24 (3.7)
Season total	25,249	732	142	4 (1.5)	81 (1.8)	16 (1.7)

Table 4.—Length at age of female and male chinook and summer chum salmon sampled at Henshaw Creek weir, Alaska, 2002.

	Female				Male			
		Mid-eye to fork length (mm)				Mid-eye to fork length (mm)		
Age	N	Mean	Median	Range	N	Mean	Median	Range
Chinook salmon								
1.2	1	540 (0.0)	540	540-540	104	521 (7.2)	520	410-860
1.3	24	784 (13.4)	800	610-890	101	699 (6.2)	700	545-930
1.4	75	832 (6.3)	830	715-975	34	797 (10.5)	788	685-950
1.5	7	853 (22.0)	865	740-920	1	895 (0.0)	895	895-895
Total	107	820 (6.4)	830	540-975	240	637 (8.1)	655	410-950
Summer chum salmon								
0.3	79	543 (3.5)	540	450-630	35	577 (5.1)	570	540-690
0.4	348	559 (1.3)	560	465-635	242	595 (2.3)	590	515-805
0.5	14	570 (6.0)	570	540-600	14	589 (7.6)	585	540-640
Total	441	556 (1.3)	560	450-635	291	592 (2.1)	590	515-805

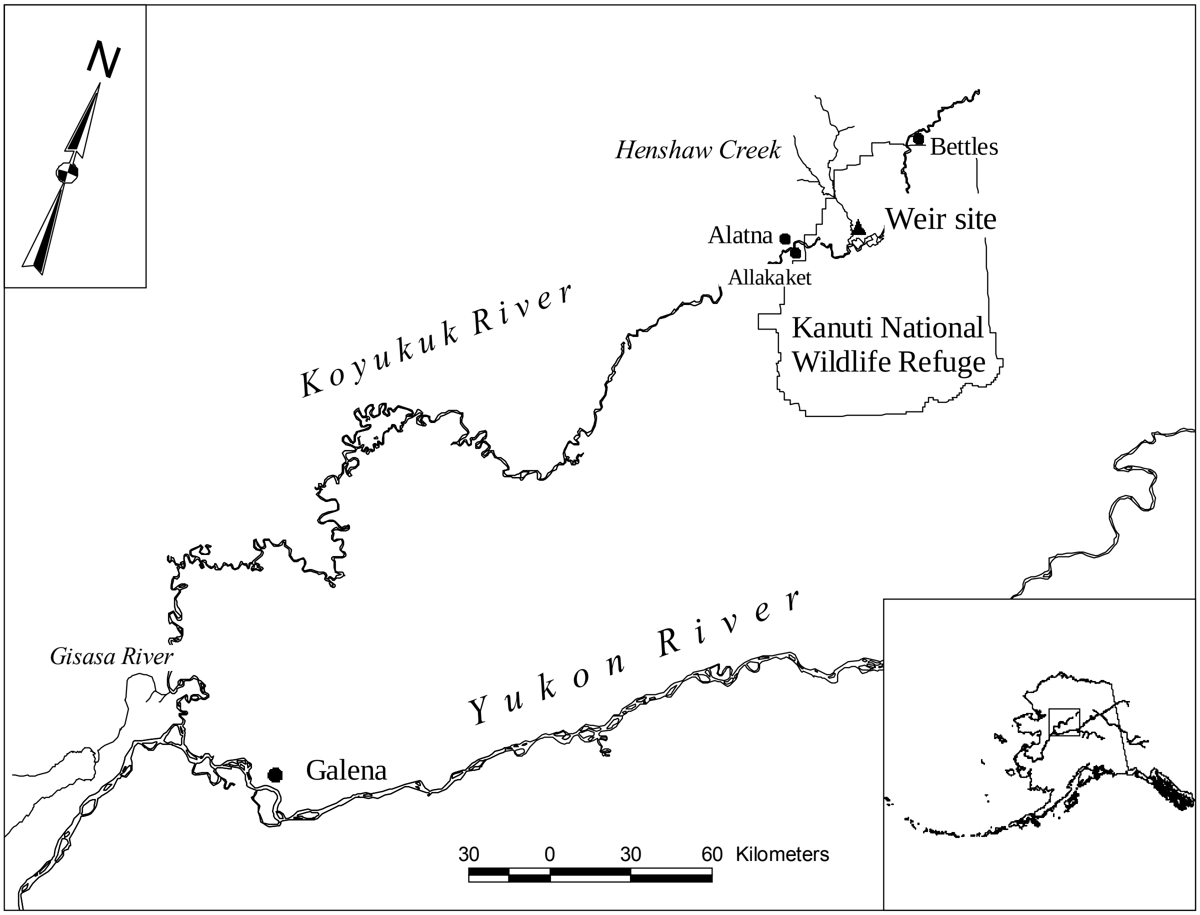

Figure 1.—Location of weir site, Henshaw Creek, Alaska, 2002.

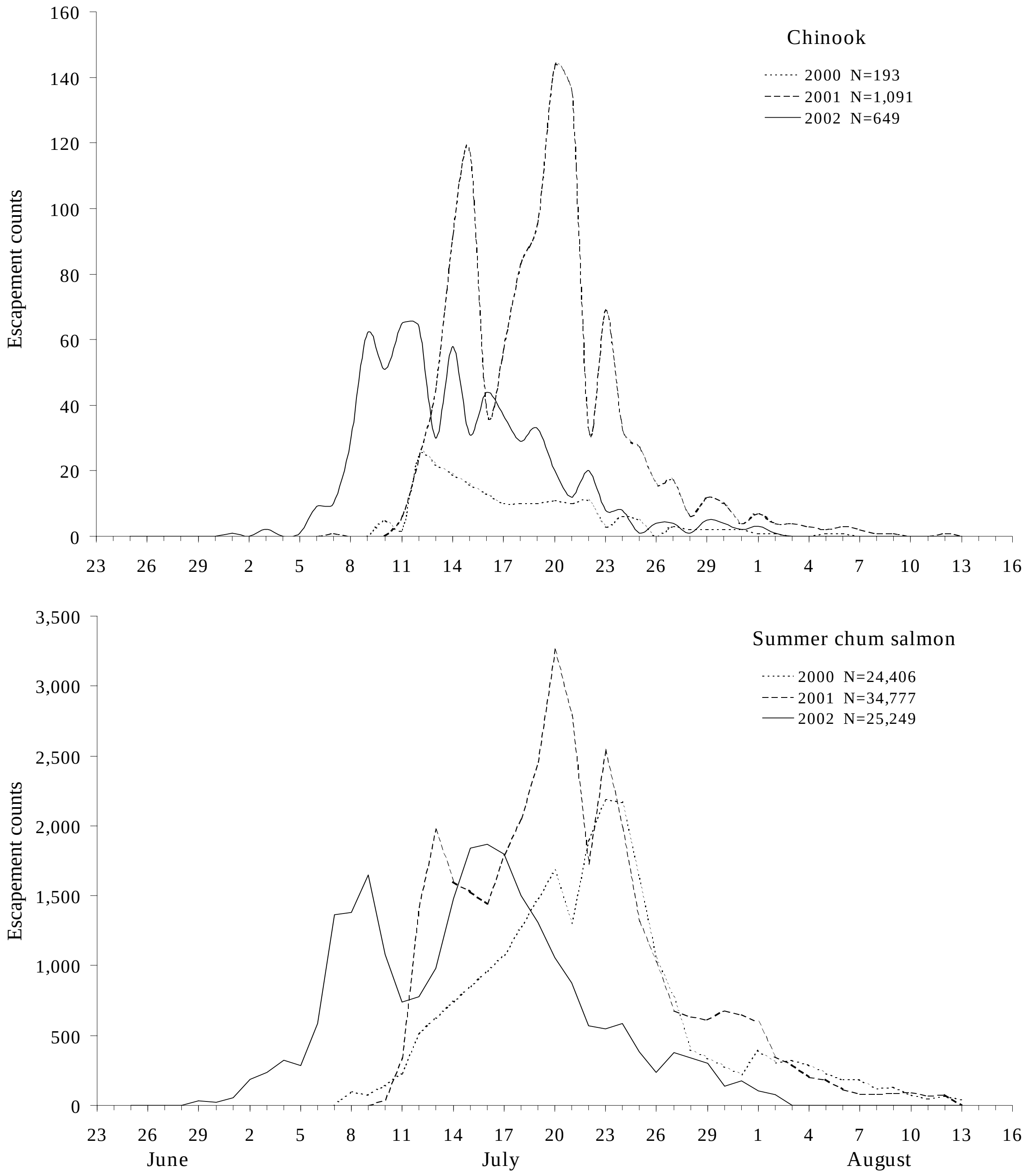

Figure 2.—Daily escapement counts of chinook and summer chum salmon recorded at Henshaw Creek, Alaska, 2000-2002.

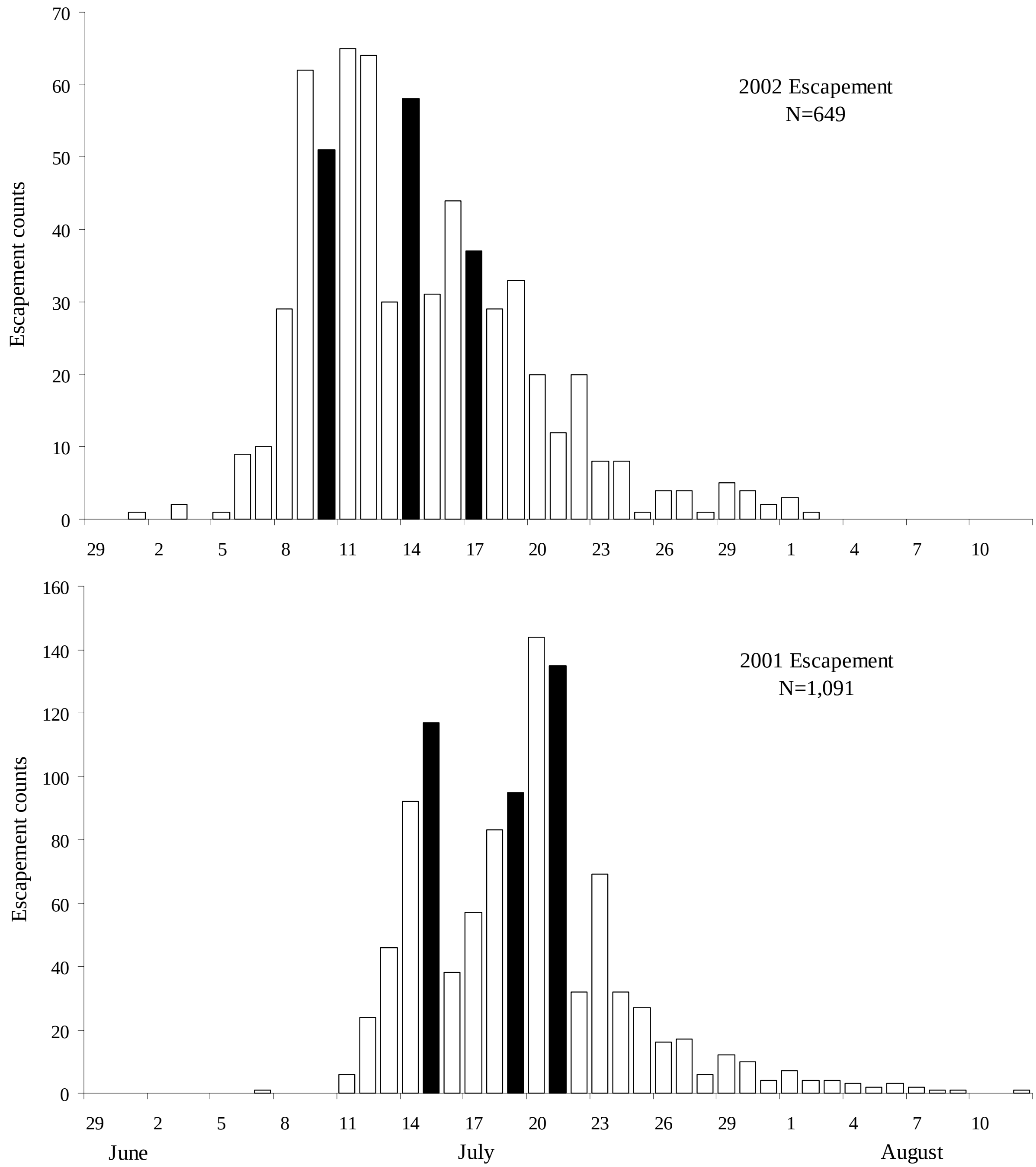

Figure 3.—Daily escapement counts of chinook salmon recorded at Henshaw Creek weir, Alaska, 2001-2002. Shaded areas represent first, middle, and third quartile of run.

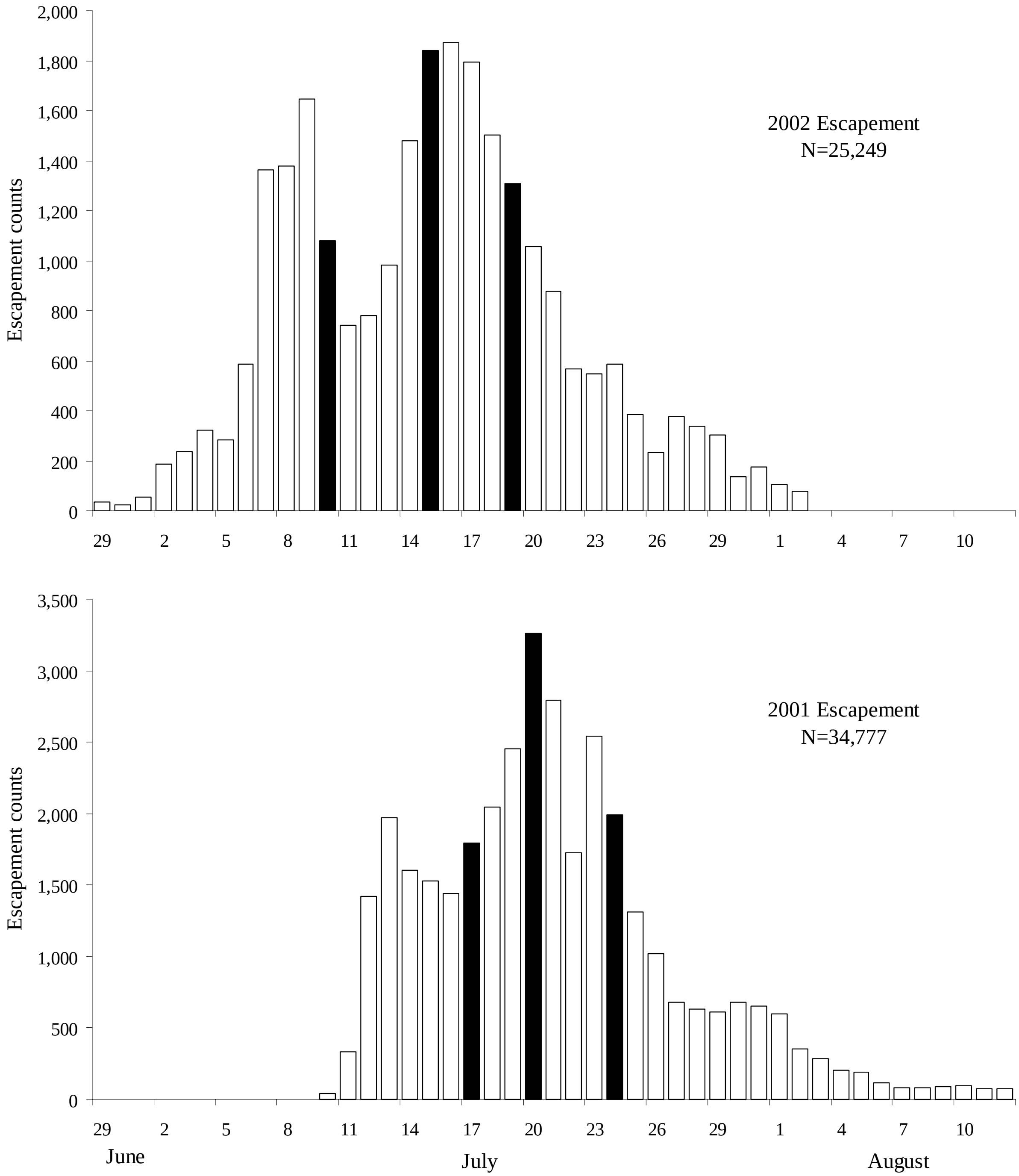

Figure 4.—Daily escapement counts of summer chum salmon recorded at Henshaw Creek, Alaska, 2001-2002. Shaded areas represent first, middle, and third quartile of run.

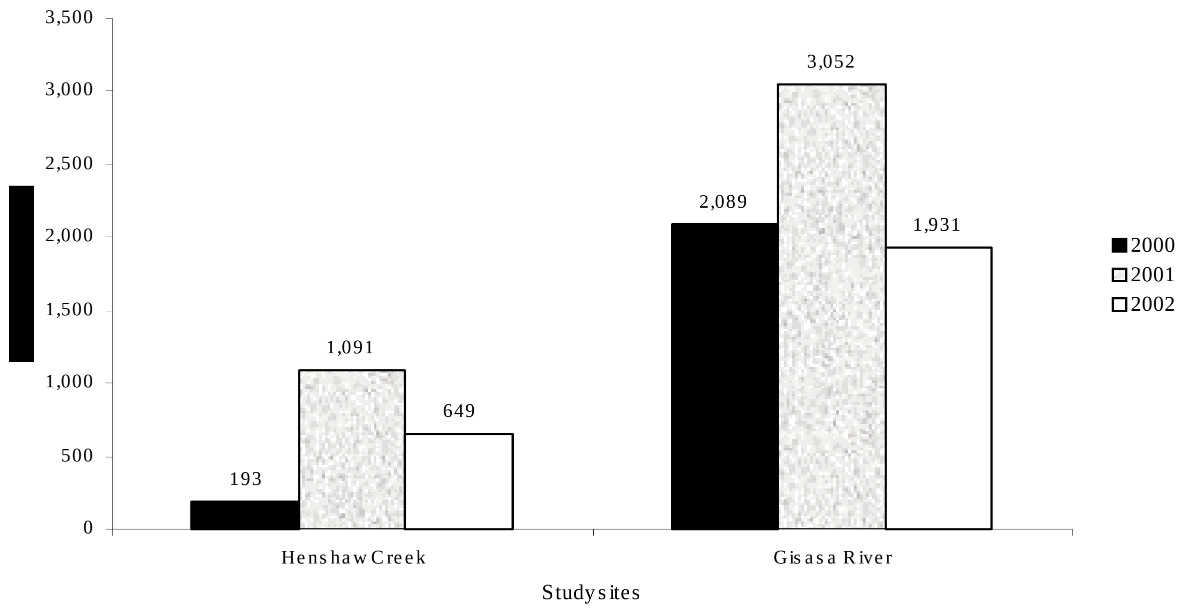

Figure 5.—Chinook salmon escapement counts at Henshaw Creek and Gisasa River, Alaska, 2000-2002.

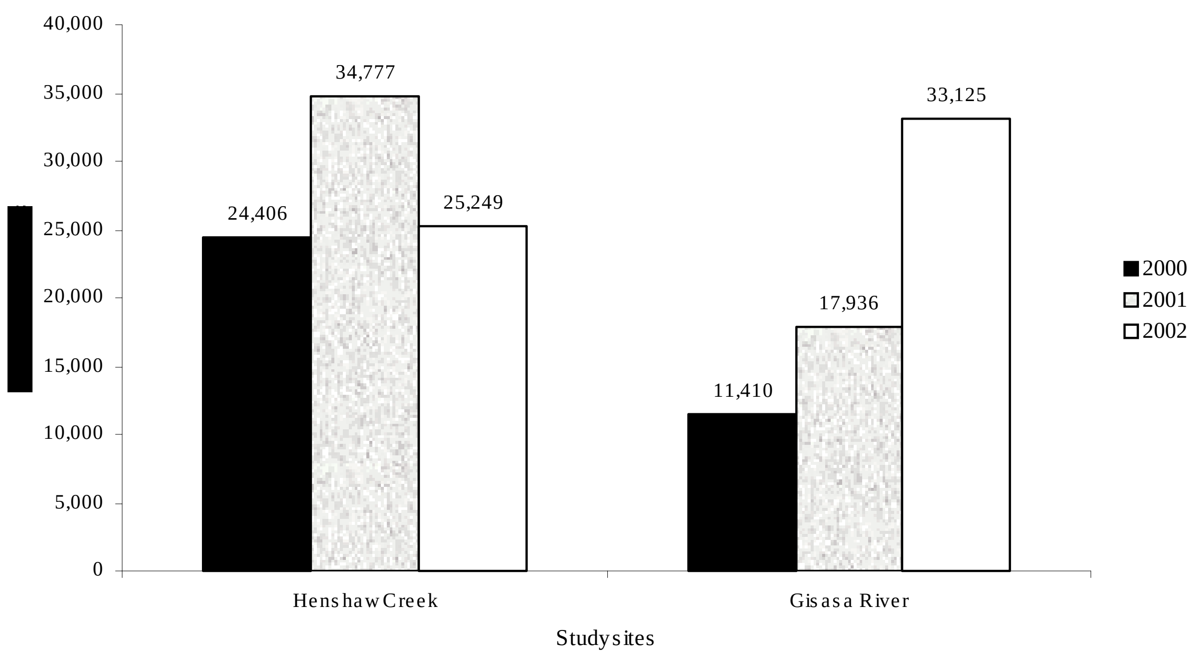

Figure 6.—Summer chum salmon escapement counts at Henshaw Creek and Gisasa River, Alaska, 2000-2002.

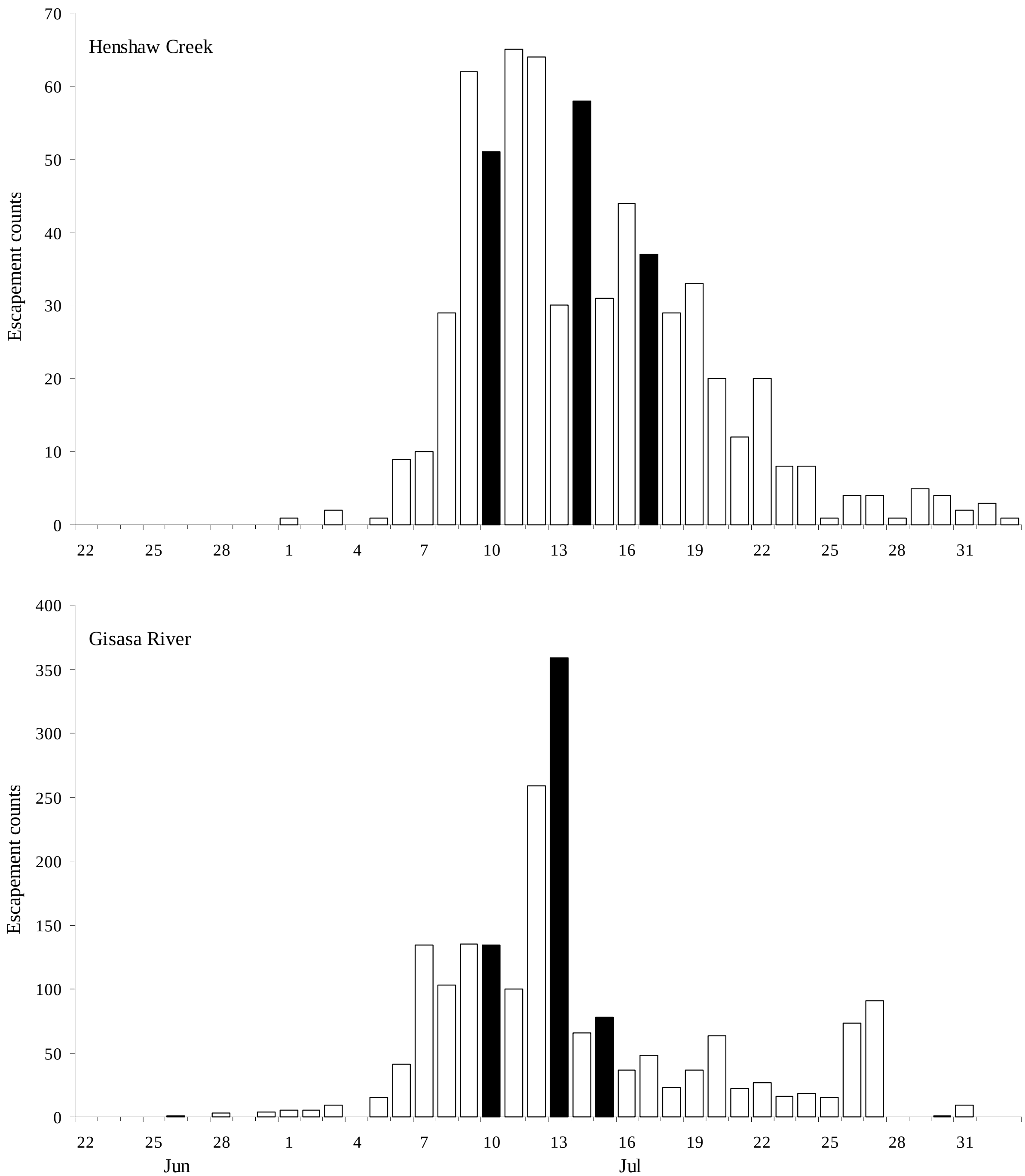

Figure 7.—Daily escapement counts of chinook salmon recorded at Henshaw Creek and Gisasa River weirs, Alaska, 2002. Shaded areas represent first, middle, and third quartile of run.

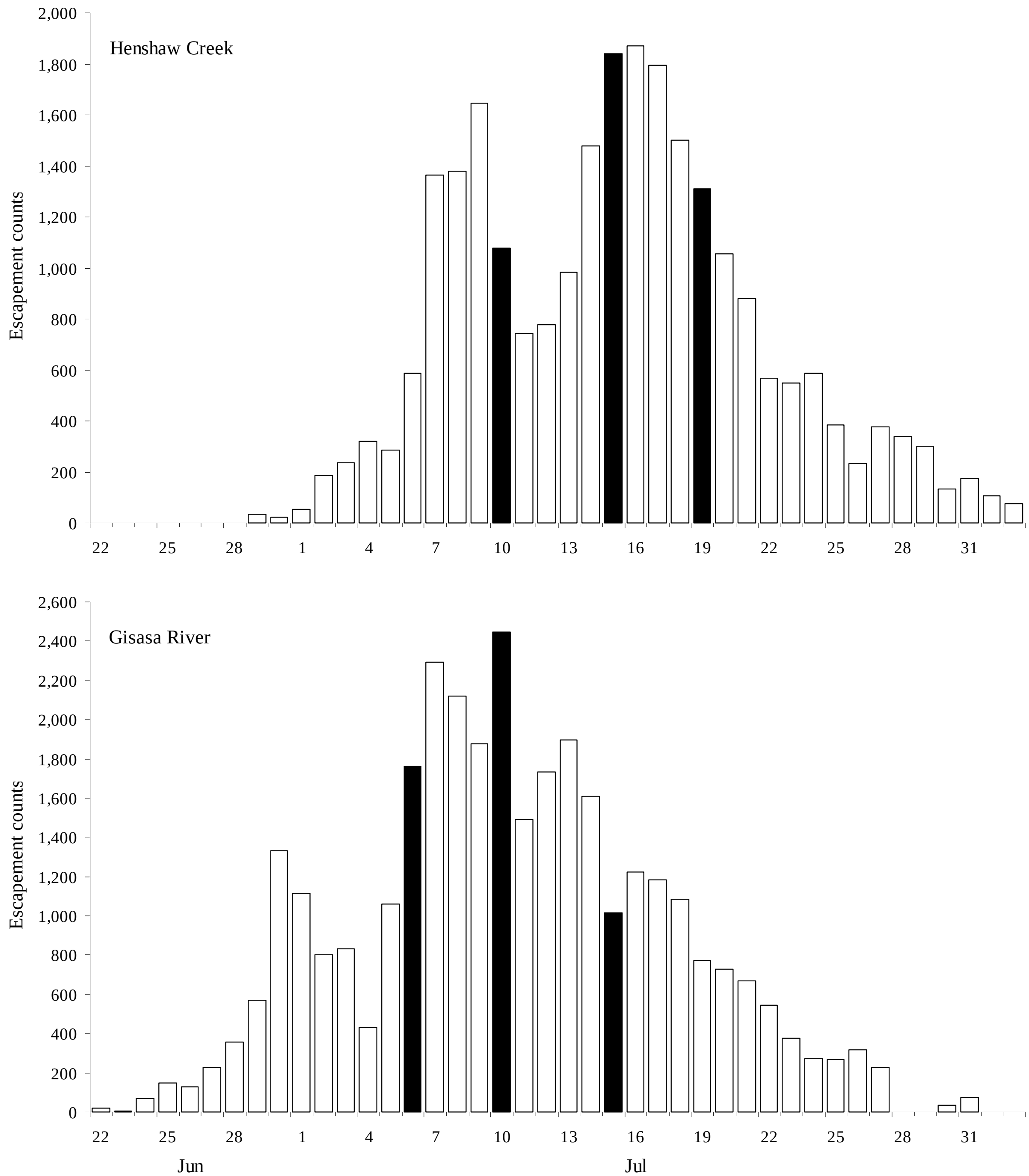

Figure 8.—Daily escapement counts of summer chum salmon recorded at Henshaw Creek and Gisasa River weirs, Alaska, 2002. Shaded areas represent first, middle, and third quartile of run.

APPENDIX 1.—Historical chinook and summer chum salmon escapements for Henshaw Creek, Alaska, 1960-2002. All data except weir and counting tower estimates are from Barton (1984) and ADF&G, unpublished data. Aerial index estimates are surveys that are rated as poor, fair, good, or any combination. Ratings are based on a combination of various environmental conditions, i.e. wind, weather, water, visibility, bottom, time, distance surveyed, and spawning stage of the run.

	Aerial index estimates			Counting tower		Weir	
Year	Chinook salmon	Chum salmon	Rating	Chinook salmon	Chum salmon	Chinook salmon	Chum salmon
1960			Poor				
1969	6	300	Not rated				
1975	118	1,219	Not rated				
1976	94	624	Fair				
1982	48	12	Fair				
1983	551	3,289	Good				
1984	253	532	Poor				
1985	393	3,724	Good				
1986	561	2,475	Fair				
1987	20	35	Not rated				
1988	180	1,106	Good-poor				
1989							
1990	369	1,237	Good-fair				
1991	455	2,148	Good				
1992							
1993							
1994	526	2,165	Fair				
1995							
1996	138	24,780	Fair				
1997							
1998	97	151	Fair				
1999				12	1,510		
2000						193	24,406
2001						1,091	34,777
2002						649	25,249

APPENDIX 2.—Daily and cumulative counts of chinook salmon passing through Henshaw Creek, weir, Alaska, 2000-2001. (Cum=cumulative). * indicate first, median, and third quartile of run.

	2000		2001	
Date	Daily	Cum	Daily	Cum
4-Jul			0	0
5-Jul			0	0
6-Jul			0	0
7-Jul			1	1
8-Jul	0	0	0	1
9-Jul	0	0	0	1
10-Jul	5	5	0	1
11-Jul	2	7	6	7
12-Jul	25	32	24	31
13-Jul	22	*54	46	77
14-Jul	19	73	92	169
15-Jul	16	89	117	*286
16-Jul	13	*102	38	324
17-Jul	10	112	57	381
18-Jul	10	122	83	464
19-Jul	10	132	95	*559
20-Jul	11	143	144	703
21-Jul	10	*153	135	*838
22-Jul	11	164	32	870
23-Jul	3	167	69	939
24-Jul	6	173	32	971
25-Jul	5	178	27	998
26-Jul	0	178	16	1,014
27-Jul	3	181	17	1,031
28-Jul	2	183	6	1,037
29-Jul	2	185	12	1,049
30-Jul	2	187	10	1,059
31-Jul	2	189	4	1,063
1-Aug	1	190	7	1,070
2-Aug	1	191	4	1,074
3-Aug	0	191	4	1,078
4-Aug	0	191	3	1,081
5-Aug	1	192	2	1,083
6-Aug	1	193	3	1,086
7-Aug			2	1,088
8-Aug			1	1,089
9-Aug			1	1,090
10-Aug			0	1,090
11-Aug			0	1,090
12-Aug			1	1,091
Total	193		1,091	

APPENDIX 3.—Daily and cumulative counts of summer chum salmon passing through Henshaw Creek, Alaska, 2000-2001. (Cum=cumulative). * indicate first, median, and third quartile of run.

	2000		2001	
Date	Daily	Cum	Daily	Cum
4-Jul			0	0
5-Jul			0	0
6-Jul			0	0
7-Jul			0	0
8-Jul	101	101	0	0
9-Jul	75	176	1	1
10-Jul	141	317	41	42
11-Jul	229	546	335	377
12-Jul	514	1,060	1,420	1,797
13-Jul	626	1,686	1,972	3,769
14-Jul	737	2,423	1,602	5,371
15-Jul	849	3,272	1,530	6,901
16-Jul	960	4,232	1,438	8,339
17-Jul	1,072	5,304	1,791	*10,130
18-Jul	1,276	*6,580	2,048	12,178
19-Jul	1,479	8,059	2,452	14,630
20-Jul	1,683	9,742	3,259	*17,889
21-Jul	1,306	11,048	2,793	20,682
22-Jul	1,903	*12,951	1,725	22,407
23-Jul	2,189	15,140	2,541	24,948
24-Jul	2,167	17,307	1,988	*26,936
25-Jul	1,619	*18,926	1,312	28,248
26-Jul	1,054	19,980	1,022	29,270
27-Jul	775	20,755	681	29,951
28-Jul	402	21,157	634	30,585
29-Jul	342	21,499	614	31,199
30-Jul	281	21,780	681	31,880
31-Jul	221	22,001	652	32,532
1-Aug	394	22,395	598	33,130
2-Aug	307	22,702	353	33,483
3-Aug	325	23,027	288	33,771
4-Aug	293	23,320	203	33,974
5-Aug	232	23,552	188	34,162
6-Aug	184	23,736	117	34,279
7-Aug	186	23,922	84	34,363
8-Aug	121	24,043	80	34,443
9-Aug	131	24,174	90	34,533
10-Aug	75	24,249	94	34,627
11-Aug	47	24,296	73	34,700
12-Aug	68	24,364	77	34,777
13-Aug	42	24,406		
Total	24,406		34,777	

APPENDIX 4.—Age distribution and brood year of chinook salmon sampled at Henshaw Creek and Gisasa River, Alaska, 2001-2002.

Henshaw Creek					
2001			2002		
Age	Brood year	Percent of run	Age	Brood year	Percent of run
1.5	1994	1 (0.6)	1.5	1995	2 (0.9)
1.4	1995	45 (3.0)	1.4	1996	31 (2.6)
1.3	1996	42 (2.9)	1.3	1997	36 (2.7)
1.2	1997	12 (2.0)	1.2	1998	30 (2.5)
Gisasa River					
1.5	1994	3 (0.9)	1.5	1995	3 (1.8)
1.4	1995	53 (2.5)	1.4	1996	23 (2.9)
1.3	1996	25 (2.2)	1.3	1997	42 (3.8)
1.2	1997	18 (2.0)	1.2	1998	32 (3.7)

APPENDIX 5.—Age distribution and brood year of summer chum salmon sampled at Henshaw Creek and Gisasa River, Alaska, 2001-2002.

Henshaw Creek					
2001			2002		
Age	Brood year	Percent of run	Age	Brood year	Percent of run
0.5	1995	2 (0.7)	0.5	1996	4 (1.5)
0.4	1996	63 (2.0)	0.4	1997	81 (1.8)
0.3	1997	34 (2.0)	0.3	1998	16 (1.7)
Gisasa River					
0.5	1995	4 (1.0)	0.5	1996	2 (0.5)
0.4	1996	80 (1.6)	0.4	1997	37 (2.1)
0.3	1997	11 (1.4)	0.3	1998	60 (2.1)
			0.2	1999	1 (0.3)