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, 2001

Annual Report No. FIS00-025-2

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, Koyukuk National Wildlife Refuge, Alaska 2001.

Study Number: FIS00-025-2

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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 spawning populations of salmon within the Yukon River drainage is one of many issues identified specifically by the Regional Advisory Councils and the Yukon River Comprehensive Management Plan for Alaska. While there has been an increase in escapement data from the Koyukuk River drainage in recent years, many tributaries remain unstudied. The escapement numbers from this study will assist in providing in-season information for managers and allow for post-season evaluation of management practices and future run projections.

Study Cost: $245,210.00 **Study Duration:** May 2001 to March 2003

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

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Table of Contents

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Abstract.—A resistence board weir was operated between June 25 and August 12, 2001 to collect biological information from adult salmon returning to Henshaw Creek, a tributary of the Koyukuk River in north central Alaska. This was the second year of a multi-year project to study chinook *Oncorhynchus tshawytscha* and chum *O. keta* salmon populations. A total of 1,091 chinook salmon and 34,777 chum salmon passed through the weir. There were four resident species that migrated through the weir; longnose sucker *Catostomus catostomus* (N=2,378), Arctic grayling *Thymallus arcticus* (N=239), northern pike *Esox lucius* (N=8), and whitefish *Coregonus spp.* (N=2).The median date of passage for chinook salmon was July 19. The chinook run was composed of 40% females. The age distribution was predominately age 1.4 (45%) and age 1.3 (42%) fish. The median date of passage for chum salmon was July 20. The chum salmon run was composed of 61% females. The age distribution was predominately age 0.4 (63%) fish.

Introduction

Henshaw Creek is one of many tributaries flowing into the Koyukuk River drainage on the Kanuti National Wildlife Refuge. The upper reaches of Henshaw Creek, as well as other tributaries of the Koyukuk River provide spawning and rearing habitat for chinook *Oncorhynchus tshawytscha* and chum *O. keta* salmon (USFWS 1993). Local villagers from the surrounding communities depend on these populations to meet their subsistence lifestyles. Recent declines of the Yukon River salmon stocks, particularly summer and fall chum salmon (Bergstrom et al. 1995; Kruse 1998), have led to harvest restrictions, complete fishery closures, and spawning escapements below management goals. Accurate escapement estimates are required to determine the exploitation rates, marine survival, and spawner recruit relations of Pacific salmon stocks (Labelle 1994). In addition adequate escapements to individual tributaries and main stem spawning areas are required to maintain genetic diversity and sustainable harvests, but management is complicated by the mixed stock nature of the

Yukon River fishery (Tobin and Harper 1998). In an attempt to understand these mixed salmon stocks there are several studies conducted along the lower main stem of the Yukon River that provides managers with information required to assess the run in-season (Vania and Golembeski 2000).

Monitoring salmon escapement with counting towers and fish weirs (Tobin 1994) provides managers with information about individual stocks. In addition, the Alaska Department of Fish and Game-Division of Commercial Fisheries (ADF&G-DCF) has collected and compiled a large historical data base for escapement estimates within several tributaries. This data base is primarily made up of aerial surveys (Barton 1984), which are highly variable and represents an index of relative run strength. Stock status and escapement projects that have operated in the Koyukuk River drainage include the Gisasa River, 1994-2001 (Wiswar 2001), South Fork Koyukuk River, 1996-1997, (Wiswar 1998), and Clear Creek counting tower, 1994-2001, (C. Kretsinger, Bureau of Land Management, Fairbanks, personal communication), and Henshaw Creek, 2000-2001 (VanHatten and Wiswar, in preparation).

There is a history of escapement data collected from Henshaw Creek starting with aerial surveys and progressing to a resistance board wier. Since 1960, aerial survey estimates in Henshaw Creek of escapement ranged from six to 561 chinook and 12 to 25,780 chum salmon (Barton1984; Appendix 1). In 1999 a counting tower was operated on Henshaw Creek, however due to high water, the study only counted 12 chinook and 1,520 chum salmon (VanHatten 1999). In 2000 the weir material from the South Fork Koyukuk weir project was installed in Henshaw Creek and was used to estimate 193 chinook and 24,406 chum salmon (VanHatten and Wiswar 2002)..

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). Although there are no villages located within the Refuge, the local villagers living downstream of the Refuge depend on both salmon species for subsistence use. 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, to fulfill treaty international treaty obligations, and to provide the opportunity for continued subsistence uses by local residents (USFWS 1993). The objectives of the Henshaw Creek weir 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 moved upstream.

Study Area

Henshaw Creek is a small clear water tributary of the Koyukuk River in north-central Alaska (Figure 1). The head waters 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 a extreme range in air temperature with recorded temperatures of 18º to 21º C in summer months to recorded lows of -57º C in winter months (USFWS 1993). Stream flows are highest during the spring months in response to snow melt with sporadic high discharge periods throughout the summer in response to local rain showers (USFWS 1993).

Channel configuration is typically meandering with alternating cut bank and gravel bars. The substrate varies from gravel and cobble in higher velocity currents to mud and silt in eddies and

sloughs. Lower stream channel characteristics 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 27-29 m with an average depth of 0.6 m. Substrate is made up of cobble.

Methods

Weir Operation.—A resistence board weir was operated to collect biological information from adult salmon and resident species as they migrated into Henshaw Creek. Construction and installation of the weir was 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 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. The weir was placed approximately 1.5 km from the confluence to the Koyukuk River. A live trap, installed near mid-channel, allowed salmon and resident species to pass upstream.

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 whitefish species *Coregonus* and *Prosopium* spp. were grouped under the subfamily Coregoninea. Daily counts began at 0001 hours and ended at midnight.

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. Daily sex ratios were collected using two methods: 1) sex were recorded when sampling for age and length, and 2) salmon were sexed during counts throughout the day. For sex ratios collected throughout the day crew members physically handled and sexed the fish as they migrated into the trap. 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 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 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 25 and continued through August 12, 2001. Spawning activity immediately upstream of the weir resulted in areas where gravel accumulated on the weir panels.

Biological Data.—During the study, 1,091 chinook salmon, 34,777 chum salmon (Figure 2 and Appendix 2), and 2,627 resident fish (Appendix 2) were counted as they migrate upstream through the weir. The most abundant resident species was longnose sucker *Catostomus catostomus* (N=2,378) followed by Arctic grayling *Thymallus arcticus* (N=239), northern pike *Esox lucius* (N=8), and whitefish *Coregonus spp.* (N=2) (Appendix 2).

Chinook salmon.—The first chinook salmon passed the weir on July 7 and the last chinook counted was on August 12 (Figure 2; Appendix 2). Between July 14 and July 23, 79% of the run had migrated through the weir. The median migration date was July 19 (Appendix 2). The seasonal sex ratio was comprised of 40% females (Table 1). The weekly female sex ratio started low at 21% and increased throughout the run reaching a maximum of 55% during weeks of July 16 and 23 (Table 1). There were 430 chinook salmon sampled for age composition with 53 (12%) samples classified as unknown age. Age composition of chinook salmon sampled made up four age groups: age 1.5 (1%), age 1.4 (45%), age 1.3 (42%), and age 1.2 (12%) (Table 2). The average female chinook salmon length was 828.1 mm with a range from 605 mm to 925 mm MEL (Table 3). The average male chinook salmon length was 687.4 mm with a range from 450 mm to 1,015 mm MEL (Table 3).

Chum salmon.—The first chum salmon passed the weir on July 9 and the last chum counted

was on August 12, 2001 (Figure 2; Appendix 2). Between July 11 and July 31, 93% of the run had migrated through the weir. The median migration date was July 20 (Appendix 2). The seasonal sex ratio was comprised of 61% females (Table 4). The weekly female sex ratio ranged from 59% to 68% (Table 4). There were 789 chum salmon sampled for age composition with 162 (21%) classified as unknown. Age composition of chum salmon made up four age groups; age 0.5 (2%), age 0.4 (63%), age 0.3 (34%), and age 0.2 (0%) (Table 5). The average female chum salmon length was 548.6 mm with a range from 430 mm to 665 mm MEL (Table 6). The average male chum salmon length was 583.8 mm with a range from 480 mm to 730 mm MEL (Table 6).

Discussion

Weir operation.—The weir performed well and was effective in allowing accurate counts of migrating salmon. Picket spacing of the trap and with weir panels were adequate to prevent adult chinook and chum salmon from passing between the pickets. However, smaller resident species may have passed through the weir undetected.

High water levels can temporarily submerge weir panels (Booth 1993; Tobin 1994) resulting in the need to estimate escapement over the submerged panels. During the 2000 field season high water caused counting to be stopped for a total of 8 days resulting in the need to estimate escapement during high water levels. In an effort to overcome this problem the site was moved 0.5 km upstream to an area that was more favorable for counting. While there were high water events during 2001 field season the water level was not high enough to impede counting.

Biological data.—The 2001 chinook salmon escapement was the largest recorded escapement in the 2-year history of operating a floating weir. The chinook salmon run in Henshaw Creek was 82% higher in 2001 than 2000 (N=193 estimate; Appendix 5). This was also seen on the Gisasa River where the chinook run was 32% higher in 2001 (N=3,052) than 2000 (N=2,089). The peak dates of return for 2000 and 2001 are shown in Figure 2 and presented in Appendix 5. In 2000 and 2001 the median dates of salmon migrating past the weir are within 3 days of each other (July 16 in 2000 and July 19 in 2001).

There were 430 chinook and 789 chum salmon sampled which provided a sample size that adequately described the age, sex, and length distribution. The results show that in 2001 the dominate age class was age 1.4 (45%) and in 2000 the dominate age class was age 1.3 (VanHatten and Wiswar, 2002). This gives an indication that the 1995 brood year was relatively strong but because there is only two years of data it is difficult to assume that this was the cause of high escapement. There are different causes that result in different age classes being dominant from one year to the next. As stated by Kruse (1998) these causes could be either marine or freshwater variables that when changed could lead to a decrease or increase in age class size. Depending on the environment salmon are living in during a time of change, single or multiple age classes can be affected. Changes in fresh water habitat such as an increase in turbidity or decrease in flow can greatly affect a single age class. In addition, any changes in the marine environment will affect multiple age classes (Kruse 1998).

Even though there was a higher escapement count in 2001 this does not necessarily mean a higher quality run unless sex ratio changes also. The 2001 chinook salmon sex ratio was higher than the sex ratio in 2000 (22%). This trend was also seen in the chum salmon run with 59% females in

2000 and 63% in 2001. Combining this information with the escapement count could possibly indicate that in Henshaw Creek the chinook and chum salmon runs are getting healthier. In order to understand what is happening to the chinook and summer chum salmon stocks throughout their life cycles a much longer time series is needed from Henshaw Creek.

Resident species were counted and recorded throughout the study time period. This is very little data concerning movement of resident fish species in Henshaw Creek, but there was an increase in the number for each resident species in 2001 (Appendix 5) over last year

Acknowledgments

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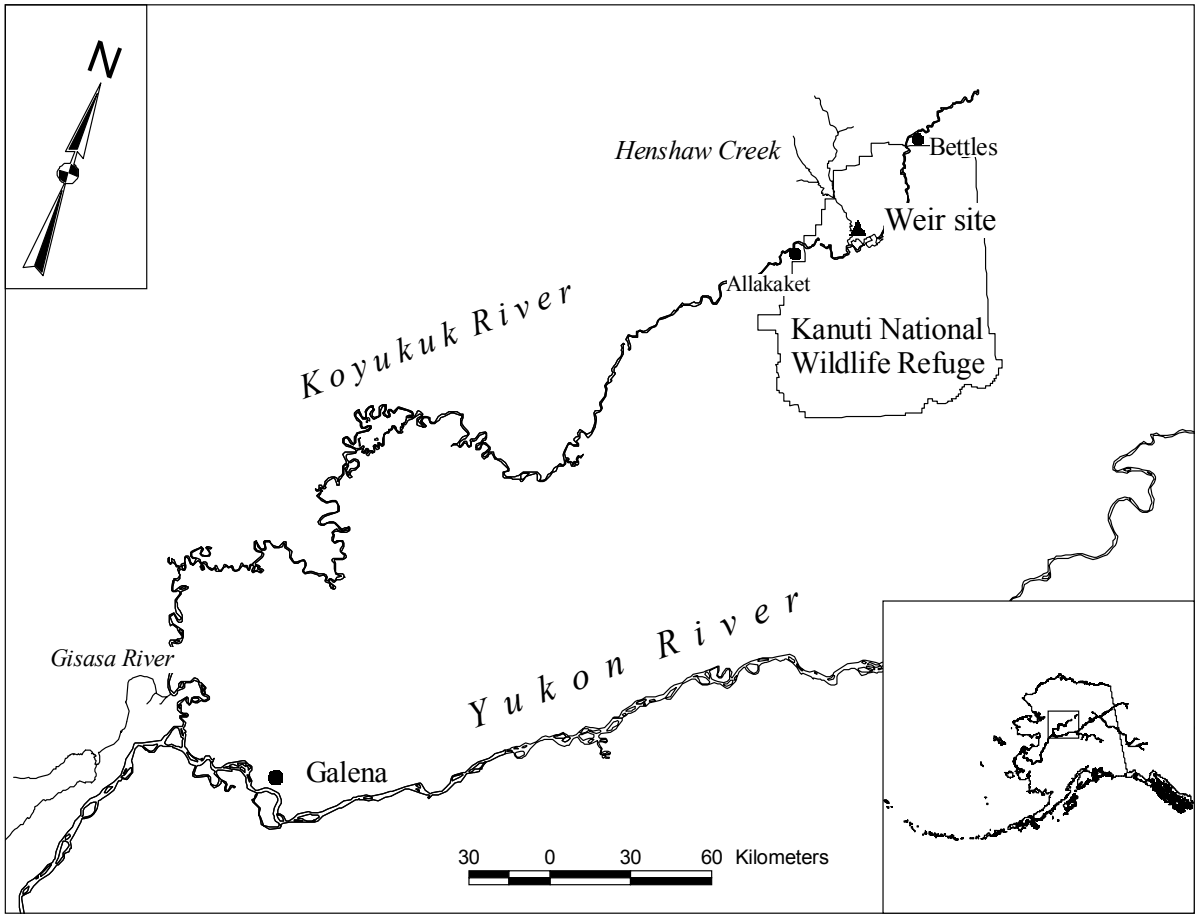

Figure 1.—Location of weir site, Henshaw Creek, Alaska, 2001.

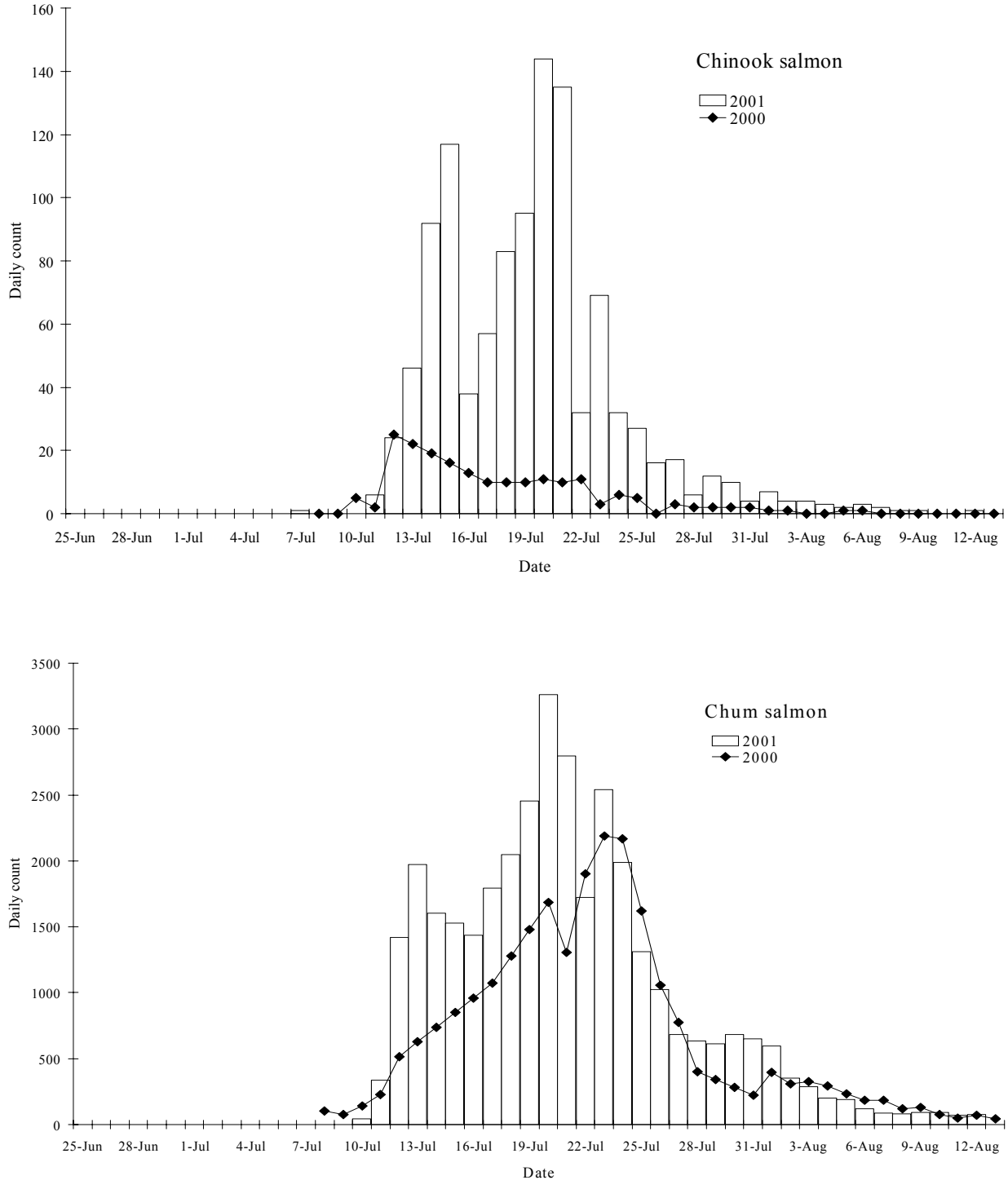

Figure 2.—Daily counts of chinook and chum salmon sampled at Henshaw Creek, Alaska, 2001, with estimates from 2000.

Table 1.—Estimated sex ratio of chinook salmon sampled at Henshaw Creek, Alaska, 2001. SEs are in parentheses.

Time period	Total number of salmon counted	N	Percent female	Estimated number of females
Jun 25-Jul 1	0	0		
Jul 2-8	1	1	0	0
Jul 9-15	285	192	21 (2.9)	59
Jul 16-22	584	584	43 (2.1)	254
Jul 23-29	179	157	55 (4.0)	98
Jul 30-Aug 5	34	33	55 (8.8)	19
Aug 6-13	8	8	50 (18.9)	4
Season total	1,091	975	40 (1.5)	434

Table 2.—Percent weekly age estimates of chinook salmon sampled at Henshaw Creek, Alaska, 2001. SEs are in parentheses.

			Brood year and age			
			1994	1995	1996	1997
Time period	Total number of salmon counted	N	1.5	1.4	1.3	1.2
Jun 25-Jul 1	0	0				
Jul 2-8	1	1	0	0	100	0
Jul 9-15	285	155	1 (0.6)	30 (3.7)	63 (3.9)	6 (2.0)
Jul 16-22	584	102	1 (1.0)	47 (5.0)	38 (4.8)	14 (3.4)
Jul 23-29	179	87	1 (1.1)	59 (5.3)	24 (4.6)	16 (4.0)
Jul 30-Aug 5	34	25	4 (4.0)	56 (10.0)	24 (8.7)	16 (7.5)
Aug 6-12	8	7	0	57 (20.2)	14 (14.3)	29 (18.4)
Season total	1,091	377	1 (0.6)	45 (3.0)	42 (2.9)	12 (2.0)

Table 3.—Lengths of chinook salmon sampled at Henshaw Creek, Alaska, 2001.

	Female				Male			
		Mid-eye to fork length (mm)				Mid-eye to fork length (mm)		
Time period	N	Mean	SE	Range	N	Mean	SE	Range
Jun 25-Jul 1	0				0			
Jul 2-8	0				1	715.0		
Jul 9-15	35	796.7	13.9	605-910	143	706.4	6.8	480-880
Jul 16-22	44	825.8	7.3	710-920	72	674.0	12.9	450-885
Jul 23-29	55	847.8	5.8	750-925	46	675.3	18.0	470-1015
Jul 30-Aug 5	15	843.0	14.5	735-920	12	691.7	38.7	475-870
Aug 6-12	3	791.7	8.8	775-805	4	592.5	62.3	470-745
Season total	152	828.1	4.8	605-925	278	687.4	6.1	450-1015

Table 4.—Estimated sex ratio of chum salmon sampled at Henshaw Creek, Alaska, 2001. SEs are in parentheses.

Time period	Total number of salmon counted	N	Percent female	Estimated number of females
Jun 25-Jul 1	0	0		
Jul 2-8	0	0		
Jul 9-15	6,901	137	63 (4.1)	4,332
Jul 16-22	15,506	160	59 (3.9)	9,207
Jul 23-29	8,792	535	59 (2.1)	5,226
Jul 30-Aug 5	2,963	427	67 (2.3)	1,971
Aug 6-12	615	298	68 (2.7)	419
Season total	34,777	1,557	61 (2.0)	22,023

Table 5.—Percent weekly age estimates of chum salmon sampled at Henshaw Creek, Alaska, 2001.

			Brood year and age			
			1995	1996	1997	1998
Time period	Total number of salmon counted	N	0.5	0.4	0.3	0.2
Jun 25-Jul 1	0	0				
Jul 2-8	0	0				
Jul 9-15	6,901	108	2 (1.3)	94 (2.4)	5 (2.0)	0
Jul 16-22	15,506	123	2 (1.1)	80 (3.6)	18 (3.5)	0
Jul 23-29	8,792	138	2 (1.2)	54 (4.3)	44 (4.2)	0
Jul 30-Aug 5	2,963	131	4 (1.7)	46 (4.4)	50 (4.4)	0
Aug 6-12	615	127	2 (1.4)	50 (4.5)	46 (4.4)	1 (0.8)
Season total	34,777	627	2 (0.7)	63 (2.0)	34 (2.0)	0 (0.0)

Table 6.—Lengths of chum salmon sampled at Henshaw Creek, Alaska, 2001.

	Females				Males			
		Mid-eye to fork length (mm)				Mid-eye to fork length (mm)		
Time period	N	Mean	SE	Range	N	Mean	SE	Range
Jun 25-Jul 1	0							
Jul 2-8	0							
Jul 9-15	86	549.6	4.0	450-630	50	588.2	5.1	520-670
Jul 16-22	95	575.5	3.1	510-665	65	618.7	6.0	530-730
Jul 23-29	97	551.4	3.4	485-635	71	574.2	4.2	505-670
Jul 30 - Aug 5	107	536.1	2.6	430-600	54	564.0	4.7	480-660
Aug 6-12	115	534.9	2.6	480-620	49	568.6	4.9	480-645
Season total	500	548.6	1.5	430-665	289	583.8	2.5	480-730

APPENDIX 1.—Historical chinook and chum salmon escapements for Henshaw Creek, Alaska, 1960-2001. 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 combination of various environmental conditions, wind, weather, water, visibility, bottom, time, distance surveyed, and spawn stage.

	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

APPENDIX 2.—Daily and cumulative (Cum) estimates of anadromous and resident species passing the weir at Henshaw Creek, Alaska, 2001.

	Chinook salmon		Chum salmon		Longnose sucker	Arctic grayling	Northern pike	Whitefish spp.
Date	Daily	Cum	Daily	Cum	Daily	Daily	Daily	Daily
25-Jun	0	0	0	0	0	0	0	0
26-Jun	0	0	0	0	0	0	0	0
27-Jun	0	0	0	0	0	0	0	0
28-Jun	0	0	0	0	1	3	0	0
29-Jun	0	0	0	0	18	3	0	0
30-Jun	0	0	0	0	52	1	0	0
1-Jul	0	0	0	0	18	3	2	0
2-Jul	0	0	0	0	19	45	0	0
3-Jul	0	0	0	0	9	27	1	1
4-Jul	0	0	0	0	47	27	0	0
5-Jul	0	0	0	0	5	6	0	1
6-Jul	0	0	0	0	3	2	0	0
7-Jul	1	1	0	0	0	10	0	0
8-Jul	0	1	0	0	3	6	2	0
9-Jul	0	1	1	1	36	6	1	0
10-Jul	0	1	41	42	166	4	0	0
11-Jul	6	7	335	377	78	0	1	0
12-Jul	24	31	1,420	1,797	15	1	0	0
13-Jul	46	77	1,972	3,769	50	0	0	0
14-Jul	92	169	1,602	5,371	39	4	0	0
15-Jul	117	286	1,530	6,901	445	1	0	0
16-Jul	38	324	1,438	8,339	515	3	1	0
17-Jul	57	381	1,791	10,130	110	0	0	0
18-Jul	83	464	2,048	12,178	34	1	0	0
19-Jul	95	559	2,452	14,630	61	0	0	0
20-Jul	144	703	3,259	17,889	20	3	0	0
21-Jul	135	838	2,793	20,682	0	2	0	0
22-Jul	32	870	1,725	22,407	7	15	0	0
23-Jul	69	939	2,541	24,948	170	0	0	0
24-Jul	32	971	1,988	26,936	235	0	0	0
25-Jul	27	998	1,312	28,248	0	51	0	0
26-Jul	16	1,014	1,022	29,270	9	0	0	0
27-Jul	17	1,031	681	29,951	1	0	0	0
28-Jul	6	1,037	634	30,585	10	1	0	0
29-Jul	12	1,049	614	31,199	0	0	0	0
30-Jul	10	1,059	681	31,880	0	0	0	0
31-Jul	4	1,063	652	32,532	1	0	0	0
1-Aug	7	1,070	598	33,130	52	3	0	0
2-Aug	4	1,074	353	33,483	31	0	0	0
3-Aug	4	1,078	288	33,771	5	1	0	0

APPENDIX 2.—Continued.

	Chinook salmon		Chum salmon		Longnose sucker	Arctic grayling	Northern pike	Whitefish spp.
Date	Daily	Cum	Daily	Cum	Daily	Daily	Daily	Daily
4-Aug	3	1,081	203	33,974	0	0	0	0
5-Aug	2	1,083	188	34,162	24	1	0	0
6-Aug	3	1,086	117	34,279	83	1	0	0
7-Aug	2	1,088	84	34,363	0	2	0	0
8-Aug	1	1,089	80	34,443	0	1	0	0
9-Aug	1	1,090	90	34,533	0	1	0	0
10-Aug	0	1,090	94	34,627	0	4	0	0
11-Aug	0	1,090	73	34,700	0	0	0	0
12-Aug	1	1,091	77	34,777	6	0	0	0
Season total		1,091		34,777	2,378	239	8	2

APPENDIX 3.—Length at age of female and male chinook salmon sampled at Henshaw Creek, Alaska, 2001.

	Female				Male			
		Mid-eye to fork length (mm)				Mid-eye to fork length (mm)		
Age	N	Mean	SE	Range	N	Mean	SE	Range
1.2	0				44	533.9	8.9	450-740
1.3	24	786.5	17.3	605-905	142	697.4	5.6	490-860
1.4	108	834.4	4.8	620-835	55	777.6	7.2	640-885
1.5	0				4	842.5	37.8	770-915

APPENDIX 4.—Length at age of female and male chum salmon sampled at Henshaw Creek, Alaska, 2001.

	Female				Male			
		Mid-eye to fork length (mm)				Mid-eye to fork length (mm)		
Age	N	Mean	SE	Range	N	Mean	SE	Range
0.2	1	480.0			0			
0.3	149	532.6	2.4	430-640	64	559.5	4.5	480-650
0.4	254	558.6	2.1	450-665	144	594.2	3.6	520-725
0.5	8	546.9	11.4	500-595	7	577.1	8.4	550-620