NULATO RIVER SALMON ESCAPEMENT PROJECT, 2002

By
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ABSTRACT

Chinook and summer chum salmon migrating into the Nulato River were counted using counting towers to estimate the spawning abundance in 2002. Before 1994, salmon escapements to the Nulato River were previously indexed only by aerial surveys. Beginning in 1994, a cooperative tower counting project was formed by the Tanana Chiefs Council, Nulato Tribal Council and the Alaska Department of Fish and Game. The Nulato Tribal Council and the Alaska Department of Fish and Game estimated the daily passage of summer chum salmon *Oncorhynchus keta* and chinook salmon *O. tshawytscha* using visual observations from towers during the period June 23 to July 24, 2002. Counting periods that were missed, were interpolated for chum salmon and chinook salmon. Total estimated escapements into the Nulato River were 2,696 chinook salmon and 72,230 summer chum salmon. Observations of commercial harvests, aerial survey data, and other escapement projects indicate that chinook salmon and summer chum salmon runs to the Yukon River were below average but could support a small commercial harvest and still meet escapement and subsistence needs. Escapement goals were generally achieved throughout the Yukon River drainage for chinook but fell short for summer chum salmon.

KEY WORDS: chinook, chum, salmon, Nulato River, commercial, harvest, aerial survey, Yukon River, Tanana Chiefs Conference, Nulato Tribal Council

INTRODUCTION

The goal of the Nulato River Tower project is to provide area managers an inseason escapement index for the upper portion of the Yukon River District 4 management area. This project also assesses the age and sex composition of the summer chum salmon escapement into the Nulato River.

Historical aerial survey indices indicate summer chum salmon returning to the Nulato River (river kilometer [rkm] 777) may be the largest producer of summer chum salmon above the Anvik River (rkm 512) (Sandone 1995). Spawning chinook salmon also utilize the Nulato River. Some pink and coho salmon have been reported to spawn in the Nulato River but do not spawn in significant numbers. Management of subsistence and commercially targeted salmon species requires reliable run strength and run timing information from harvests and escapement information as salmon migrate through Yukon River districts. Ground based escapement projects throughout the Yukon River drainage are typically operated on tributaries that are easily accessible and/or are considered to be an important spawning tributary. These escapement projects provide researchers and managers quality escapement information and age, sex and size information that can be used for management of Yukon River salmon resources.

Nulato River escapements were previously indexed using aerial survey methodology. Aerial survey methods are inexpensive compared to ground based projects but sacrifice timely and quality information. Aerial survey indices are susceptible to a host of negative factors, which influence the quality of the data, therefore do not provide accurate escapement estimates of chinook or summer chum migrating into the Nulato River. There is a lack of quality historical escapement information for Nulato River chinook and summer chum salmon. Without this information, determinations of what the escapement objectives should be and whether escapement objectives are being met in this portion of the Yukon River, are difficult to ascertain. Pilot Station Sonar, test fishing indices, age and sex composition information, and commercial and subsistence harvests provide run strength and run timing information of salmon migrating up the Yukon River mainstem. However, these assessment projects and their indices do not provide quality escapement information for specific tributaries being used to index salmon runs in various districts of the Yukon River.

The Yukon River drainage supports major stocks of chinook salmon *Oncorhynchus tshatscha*, summer and fall run chum salmon *O. keta*, and coho salmon *O. kisutch*. These species contribute to commercial and subsistence fisheries throughout the Yukon River drainage. Pink salmon *O. gorbuscha* and sockeye salmon *O. nerka* are also indigenous to the Yukon River. Pink salmon return to lower drainage tributaries and typically have stronger runs in even numbered years. Sockeye salmon are documented less frequently. Neither of the two later species are harvested commercially or targeted to any extent for subsistence use. Summer chum salmon are distinguished from fall chum salmon by their earlier entry timing (early June to mid-July) into the Yukon River. Summer chum salmon are smaller in size with spawning distributions into lower and middle Yukon River drainages. Fall chum salmon enter the Yukon River from mid-July to the first of September, are larger, and spawn primarily in middle to upper portions of the Yukon River drainage.

Before 1994, relatively few projects provided spawning escapement information for the various Yukon River salmon stocks. Lower river test fishing catch rates, inseason passage estimates from Pilot Station Sonar (rkm 198) and the Anvik River sonar project (rkm 587) provided most of the available information used to make management decisions concerning commercial and subsistence harvests of summer chum salmon in District 4 (Figure 1).

Salmon returning to the Nulato River are most likely harvested in commercial and subsistence fisheries in coastal areas near the Yukon River delta and throughout the mainstem Yukon River. These areas include the Coastal District, Districts 1, 2, and 3 and most of District 4 (Figure 1). There was not an inseason salmon escapement, monitoring project within the upper portion of District 4 to serve as an index for run size and quality (sex composition) of spawning escapements in that portion of the river prior to the Nulato River tower project. Federal agencies and private organizations have increased their involvement and participation by developing and implementing additional spawning escapement and assessment projects. These projects provide managers inseason escapement information necessary to manage for escapements. Operation of an inseason escapement monitoring project for summer chum salmon within the upper portion of District 4 would serve as an index for the middle Yukon River area and provide fishery managers additional information concerning the size and quality of spawning escapement in this area. Additional stock identification studies for mixed stock fisheries could provide information to develop stream specific biological escapement goals.

A thorough review of the Nulato River and probable contribution of salmon production from this stream to the Yukon River is presented in the report *Nulato River Salmon Escapement Project, 1994* (Sandone 1995), which was the first year of operation. With the exception of 1995, Nulato River salmon escapement reports have been written annually (Headlee 1996; Paulus 1997; Paulus *et. al.* 2001; Lingnau and De Hovanisian 2001, Lingnau and Moore 2002; Lingnau 2002a; Lingnau 2002b). The 1995 field project data was reported only as a brief summary by Paul Headlee, Water Resource Specialist, TCC. This report presents information gathered during the 2002 field season.

Nulato River Escapement Assessment

The Nulato River is one of the department's primary aerial survey index areas for assessment of the relative magnitude of chinook and summer chum salmon spawning escapement. All escapement goals pertaining to the Nulato River were, and presently are, based on aerial survey counts of salmon.

Under the Policy For Statewide Salmon Escapement Goals (5 AAC 39.223), the Department of Fish and Game and the Board of Fisheries are charged with the duty to conserve and develop Alaska's salmon fisheries on the sustained yield principle. Therefore, the establishment of salmon escapement goals is the responsibility of both the board and the department working collaboratively. The purpose of this policy is to establish the concepts, criteria, and procedures for establishing and modifying salmon escapement goals and to establish a process that facilitates public review of allocative issues associated with escapement goals.

The department's responsibility is to (1) document existing salmon escapement goals for all salmon stocks that are currently managed for an escapement goal; (2) establish biological escapement goals (BEG) for salmon stocks for which the department can reliably enumerate salmon escapement levels, as well as total annual returns; (3) establish sustainable escapement goals (SEG) for salmon stocks for which the department can reliably estimate escapement levels when information is insufficient to enumerate total annual returns and the range of escapements that are used to develop a BEG. Because there is a lack of information of the Nulato River summer chum salmon stocks, no BEG or SEG has been established.

A chinook salmon aerial survey based escapement goal range of 400 to 1,100 was proposed in 1981 for the entire Nulato River (Buklis 1993). Similar to summer chum salmon aerial survey goals, this goal went through several changes (Sandone 1995). Chinook salmon escapement goals for the Yukon River were reevaluated in the spring of 1991 and were made effective for the 1992 season (Buklis 1993). At that time, minimum interim escapement goals for chinook salmon, based on aerial survey counts, were established for both forks: 800 for the North Fork and 500 for the South Fork. Under the escapement goal policy, these goals were redefined as SEGs. Information from the tower counting project may be used to re-evaluate the escapement objectives for the Nulato River in the future.

Study Area

The Nulato River is a narrow river with a substrate consisting mainly of gravel and cobble. The river is formed from two main branches, the North Fork and South Fork, which converge approximately 9 kilometer (km) above its mouth. Both forks of the Nulato River originate at an elevation of approximately 600 meter (m). From its source, the South Fork flows in a northeasterly and easterly direction about 98 km to the confluence with the North Fork. From its source, the North Fork, mostly flows in a northeasterly and easterly direction and is approximately 114 km long. The North Fork drainage includes the Kalasik Creek drainage, approximately 54 km in length. The mainstem Nulato River joins the Yukon River at rkm 777 at an approximate elevation of 33 m (Sandone 1995).

The Nulato River tower site is located approximately 5 km upstream of the confluence of the Nulato and Yukon Rivers (Figure 2). The water is typically clear with some brown (tannic) staining from peat and organic material along the watershed. Most of the chum salmon spawning area is upstream of the tower site.

Objectives

The objectives of this study were to:

1. Estimate the total escapement of summer chum and chinook salmon into the Nulato River using tower-counting methodology;

2. Estimate the age and sex composition of the summer chum spawning population;

3. Monitor climatological and hydrological conditions at the tower site

4. River conditions permitting, install a floating weir to estimate the total escapement of summer chum and chinook salmon.

METHODS

Site Selection and Preparation

The current site was selected in 1994 (Figure 2) after completing a reconnaissance of the mainstem Nulato River. The criteria used for selection included: 1) Location below most, if not all, chum salmon spawning areas; 2) A single, relatively narrow channel; and 3) Relatively shallow river depth to facilitate observation of migrating salmon from the towers. The south side (right bank) of the river is a wide gravel bar with gradual decline and the north side (left bank) is characterized as a cut bank with a rapid decline. River bottom profiles were measured and profiled to determine the best place to position the counting towers (Figure 3).

On each bank of the river, two sections of scaffold were combined to make a 6 m high tower. The right bank tower was placed in the river to reduce the width of the counting area. A 15 m long weir of wire fencing and T-stakes extended from the right bank to the tower to divert fish into the counting area. To make the fish easier to see, light-colored sandbags, with sand, were distributed side by side across the counting area. This light-colored background improved the ability of the crew to see and count fish. Observers wore polarized glasses to reduce glare.

Escapement Estimation Sampling

Tower counting operations were conducted 7 days a week, 24 hours a day, for a 15-minute period each hour on each bank. The left bank counting period began at the top of the hour and the right bank began at the bottom of the hour. The observer counted fish passage by species and noted the direction of movement (upstream or downstream). Hand-held tally counters were used to record the observed tower counts. These counts were then transferred to data forms immediately after completion of a shift. Each count was expanded for each hour and each bank by dividing the count by the proportion of the hour counted. Missed counts were estimated by averaging the counts for the hours before and after the missed hourly count. When salmon were not counted for a portion of a day, the expanded total daily count for that day was estimated by dividing the expanded partial daily count by the mean proportion of the count, for the corresponding hours for the day before and day after having full 24-hour counts. When counting was not conducted for a full day, the salmon passage estimate for that day was calculated as the mean salmon passage for the day before and after. When counting was not conducted for more than one full day, the passage for those days were estimated by interpolating between the last full day and first full day of counts after counting resumed.

The daily passage for each bank was calculated by summing the expanded hourly counts for each

species, for each bank. The total daily passage estimate for each species was the sum of the expanded count for each bank.

Age-Sex-Size Sampling

When the Nulato River tower project was initiated in 1994, dates needed to be established to define sampling strata for collecting age-sex-length (ASL) information. Run timing information did not exist for the Nulato River. Aerial survey information seemed to indicate, however, that the timing of peak abundance for summer chum salmon in the Nulato River was historically similar to that of the Anvik River for which sonar daily passage estimates were available dating back to 1979 (Sandone, 1995). Strata periods were initially selected for the Nulato River based on those used on the Anvik River, and were described as: early, June 20 to July 3; early-middle, July 4-8; late-middle, July 9-13 and late, July 14-26 (Sandone 1995). These strata were altered postseason to increase the number of samples used for each stratum.

The sample goal for each species was based on 95% precision with 10% accuracy for each time stratum. The season ASL sample goal was set at 640 chum salmon and all chinook salmon, with 160 chum salmon sampled in each of the strata described above. Beyond the required ASL sample, an additional 200 chum salmon per stratum were to be caught and observed for male-female ratio. The additional 200 fish per strata, combined with the 160 summer chum salmon per strata, would yield a total sex ratio sample goal of 1,480 fish for the season on the Nulato River to define the quality of the escapement. For chinook salmon escapement, a sample size of 100 fish per stratum (4 strata) was the season goal based on the number of age classes that were expected in the run. While beach seine catches were expected to yield the desired total chum salmon sample, the chinook salmon sample would unlikely be achieved because of the difficulty of catching chinook salmon by beach seine.

A beach seine 31 m long, 66 meshes deep of 6.35 cm mesh, was used to catch salmon for ASL samples. Data such as date, time of seine, number and sex of fish were recorded. Captured salmon were identified by species and sex, measured to the nearest 5 mm (mid-eye to fork-of-tail), sampled for scales and adipose fin-clipped to prevent re-sampling. Scales were taken from an area posterior to the base of the dorsal fin and above the lateral line on the left side of the fish (Clutter and Whitesel 1956). One scale was taken from chum salmon and three scales were taken from chinook salmon. Scales were wiped clean to remove slime and tissue and affixed to a gum-surfaced scale card with numbers that corresponded to recording form. The scales were processed and aged postseason, and ASL data compiled and summarized.

Hydrological and Climatological Sampling

Climatological and hydrological data were collected at approximately 1800 hours each day at the campsite. Relative stream depth was monitored on a staff gauge marked in 0.1-foot increments with measurements subsequently converted to cm. Water temperature was measured in Celsius (°C) near shore at a depth of about 0.5 m. Daily maximum and minimum air temperatures were recorded in °C using a "high-low" thermometer. Subjective notes describing wind speed and

direction, cloud cover and precipitation were recorded by the crew.

Weir Installation

In response to the 1993 Western Alaska chum salmon failure, a grant, the Western Alaska Disaster Grant (WADG), funded numerous projects to improve and better understand salmon runs in Western Alaska. Part of this funding was dedicated to construct a floating weir to be used on the mainstem of the Nulato River. The existing tower project provides quality and escapement abundance of summer chum salmon. However, abundance of spawning chinook salmon is still obtained by aerial survey, and few chinook salmon are captured in beach seines for ASL information. By installing a weir project on the Nulato River, quality abundance estimates and ASL data of both chinook and chum salmon will increase significantly.

Two potential sites were located in the fall of 2000. One site, Site 1, was 0.2 river kilometer (km) downstream of the confluence of the two forks and 7.2 km upstream from the confluence of the Nulato and Yukon River. A second location, Site 2, was 1.6 km downstream of the tower site and 4.0 km above the Yukon River confluence. Both locations have their advantages and disadvantages. Observations during the beginning of the 2002 field season indicated the 2001 flood may have changed the channel characteristics somewhat and a second reconnaissance trip was scheduled 2002.

RESULTS AND DISCUSSION

Escapement Estimation

Counting towers were operated on each bank of the Nulato River from June 23 to July 24 in 2002 (Table 1). Counting was interrupted at 0200 until 1300 on June 27. Estimates were calculated for summer chum and chinook salmon by interpolating counts as described under the methods section. There were some counts for June 23 and July 24. However, because of the limited data, no expansions were possible.

The water level was the lowest local residents could remember in years. Although these conditions sometimes made travel difficult, the low and clear water, prevalent throughout the season, allowed quality counting for both summer chum and chinook salmon. Because of high water throughout the season in 2001, no escapement estimates were calculated. All calculated averages do not include 2002 so that comparisons of this year to the historical average are plausible.

Spatial distribution of summer chum salmon is normally close to the riverbank, which brings them close to the towers where they are easier to observe and count. Therefore, over the course of the season, counts of summer chum salmon are thought to be a good estimate of the total escapement passage. In 1994, Sandone (1995) observed that chinook salmon typically travel in the deepest part of the channel or near the middle of the river, where many were probably not

seen and counted. Therefore, the escapement estimate of chinook salmon is to be considered a conservative estimate and below the actual escapement.

Chinook Salmon

The chinook salmon escapement estimate into the Nulato River was 1,632 for the right bank and 1,064 for the left bank for a total 2,696 chinook salmon (Table 1). Figure 4 illustrates the relative passage rate estimate by day for each bank. A degree of bank orientation was observed in 2002 with 60.5% observed on the right bank and 39.5% of the estimated total passage observed on the left bank. Detailed passage by date, hour and bank can be found in Appendix A.

The first quartile day of passage occurred on July 5 (Table 2), three days earlier than the 8-year average (1994-2000) (Table 3, Figure 5) of July 8. The median day occurred on July 9, three days earlier than the 8-year average of July 12, and the last quartile occurred on July 13 three days earlier than the 8-year average of July 16. Historical run timing by year can be found in Appendix B. The total chinook salmon estimated escapement was 43.8% above the 8-year average. Chinook salmon exhibited a diurnal migratory behavior in 2002. Chinook salmon generally migrated upriver with the highest passage typically occurring between 1500 and 2300 hours and the lowest passage occurring between 0200 and 0800 hours (Table 4, Figure 6).

Aerial surveys conducted in 2002 were rated good for both tributaries. The aerial survey count of chinook salmon was 687 for the North Fork and 897 for the South Fork for a combined aerial survey count of 1,584. This is above the combined escapement objective of 1,300 chinook salmon.

Summer Chum Salmon

The estimated summer chum salmon escapement from June 24 through July 23 was 41,629 on the right bank and 30,601 on the left bank for a total of 72,230 chum salmon. Expanded data for each bank are presented in Table 1 and Figure 4. This was the largest escapement estimate since 1997 but below the 1994-2000 average of 112,143 salmon (Table 5, Figure 5). The first quartile day of passage occurred on July 2 (Table 2), one day earlier than the 7-year average (1994-2000) of July 3 (Table 5). The median day occurred on July 6, two days earlier than the 7-year average of July 8, and the last quartile occurred on July 11 one day earlier than the 7-year average of July 12.

Passage of summer chum salmon in the Nulato River in 2002 demonstrated a less distinct diurnal pattern than in the past. Table 1 and Figure 4 illustrates the spatial distribution with 57.6% of the run counted on the right bank, the side of the river with the wide gravel bar and gradual decline, and the remaining fish passing the left bank which is characterized with a steep decline. Table 4 and Figure 6 illustrates the diurnal pattern with hourly counts increasing steadily in the afternoon on both banks, typically peaking between 2100 and 0100 hours, then decreasing to the lowest passage rate period occurring between 0300 and 1300 hours. Detailed passage by date, hour and bank can be found in Appendix A.

The distribution of 2002 counts by day verifies observations by the crew that the preponderance of the run passed the tower site during counting operations, and counts increased during the first

few days and tapered off during the last week (Table 2, Figure 4). Fifty percent of the run occurred during the ten days between the 1st and 3rd quartile out of the 32-day counting period. Historical run timing by year can be found in Appendix B.

Run timing of escapements vary, depending on the location of the spawning tributary. When comparing the average mid-point of the Nulato River escapement to the average mid-point of Pilot Station counts, there is 10 days between the midpoints. The Nulato River Tower is roughly 396 km above Pilot Station Sonar. Therefore, the swimming rate between these two projects is 39.6 km per day. Anvik River Sonar is comparable with 10 days between the average midpoints and 391 km between the two projects for an approximate swimming rate of 39.1 km per day. This swimming rate compares favorable to the 42 km per day calculated in 1994 by Sandone (1995).

Age-Sex-Size

Nulato escapement ASL sampling in 2002 was completed on 460 summer chum salmon captured by beach seine. Sampling was done at a site approximately 100 m upstream from the north (left) bank tower during the early portion of the season. There were not enough samples to break the migration into four strata. Three strata were used in 2002, each defining a third of the run.

For the pooled sample weighted by escapement, 61.6 % were age-0.3 fish, 36.4% were age-0.4 fish, 1.7% were age-0.5 fish, with the remaining 0.2% being age 0.2-fish (Table 6, Appendix C). The weighted sex ratio was 27.0% females and 73.0% males. Mean lengths ranged from 540.0 mm to 639.2 mm for males and 544.3 mm to 557.6 mm for females. For males, age-0.5 had the greatest mean length while age-0.4 females had the greatest mean length.

When comparing the three strata, age-0.3 fish predominated the three strata, followed by age-0.4 fish. The percentage of females increased through the season but failed to dominate any of the strata. Males were predominant across all age classes (Figure 7).

Too few chinook salmon were caught in the beach seines to make an analysis of age and sex composition of the chinook run. No carcass-sampling project was conducted on the Nulato River, therefore no escapement age and sex for chinook salmon information is available.

Hydrology and Climate

For most tributaries of the Yukon River, the water is usually highest during or shortly after breakup, and generally continues to drop during the summer as the snow pack decreases. Storage capacity of the Nulato River watershed, appears to be minimal with limited retention of rainfall in the upper areas of the drainage. The Nulato River, similar to the Anvik River, has rapid changes in water depth when substantial rainfall occurs. These flood conditions make counting difficult or impossible because of the suspended solids, detritus, tannic staining, and increased water depth.

Intermittent rainfall for the Nulato River drainage was observed on 23 out of 35 recorded weather days, with 10 days recording no rainfall (Table 7). The highest water level was recorded on the first day of recorded measurements (June 18) and the lowest water level was recorded on July 2 (Table 7, Figure 8). A water thermometer was not available until June 28. Water temperatures ranged from 8.0°C to 14.5°C, a range of 6.5 °C during the season. A High/Low air temperature thermometer was not available for the 2002 season. The air temperature, recorded daily at 1800, ranged from 6.0°C to 30.0°C, a range of 24.0 °C during the season.

Weir Installation

On July 24, an ADFG Fish & Wildlife Technician and a USFWS project leader, both intimately familiar with weirs, located an acceptable weir location just below the confluence of the North and South Fork Nulato Rivers. Weir Site 1 and Weir Site 2 (Figure 3) depicts the bottom profiles of the area for the new site. The width of the site was 190 ft. with 6 ft. high steep mud banks and mature trees on each bank. The substrate was mostly mixed gravel with some small cobble and sand present. The profile was level and flow relatively even across the width of the stream. The middle of the stream is stable, however tree snags were present along both banks and removed to improve site characteristics. Since water levels are likely to be high during project startup in mid June, it was decided that the substrate rail would be installed before freeze up this fall (Figure 9). The rest of the weir will be installed next season as soon as stream conditions allow personnel to work safely in dry suits. Overall conditions at this site are good for the installation and operation of a resistance board weir.

Between August 15 and August 18, Rob Stewart (ADF&G), Eryn Kahler (ADF&G), and Andrew Corcoran (BSFA) successfully installed the substrate rail at the Nulato River Weir site.

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TABLES AND FIGURES

Table 1. Nulato River tower daily expanded counts for chinook and summer chum salmon by bank and total by day, 2002.

	Chinook salmon expanded counts			Chum salmon expanded counts		
Date	Right Bank	Left Bank	Total [a]	Right Bank	Left Bank	Total [a]
23-Jun	0	0	0	0	8	8
24-Jun	0	0	0	106	80	186
25-Jun	4	4	8	204	228	432
26-Jun	4	4	8	700	420	1,120
27-Jun	28	32	60	1,088	1,102	2,190
28-Jun	36	22	58	1,656	1,372	3,028
29-Jun	40	56	96	2,628	1,648	4,276
30-Jun	68	64	132	1,816	1,475	3,291
1-Jul	28	24	52	1,080	1,232	2,312
2-Jul	46	16	62	1,727	1,224	2,951
3-Jul	44	20	64	1,564	1,262	2,826
4-Jul	76	40	116	2,316	1,896	4,212
5-Jul	64	32	96	2,524	1,908	4,432
6-Jul	176	64	240	3,176	2,120	5,296
7-Jul	112	88	200	3,108	2,188	5,296
8-Jul	52	54	106	2,236	1,600	3,836
9-Jul	112	52	164	2,472	1,584	4,056
10-Jul	132	72	204	2,156	1,380	3,536
11-Jul	88	44	132	1,364	916	2,280
12-Jul	124	56	180	1,548	968	2,516
13-Jul	102	52	154	1,522	1,072	2,594
14-Jul	64	32	96	1,374	828	2,202
15-Jul	44	32	76	1,040	800	1,840
16-Jul	32	32	64	1,060	768	1,828
17-Jul	20	24	44	776	650	1,426
18-Jul	20	12	32	686	344	1,030
19-Jul	20	16	36	422	384	806
20-Jul [b]	8	32	40	564	428	992
21-Jul [b]	24	36	60	296	268	564
22-Jul	20	20	40	228	248	476
23-Jul	44	12	56	192	140	332
24-Jul	0	20	20	0	60	60
Totals	1,632	1,064	2,696	41,629	30,601	72,230
Proportoins	0.605	0.395		0.576	0.424	

[a] The 1st and 3rd quartiles are indicated within the boxed areas and the mid-point is indicated in bold o

[b] Missed counting periods were interpolated for summer chum and chinook salmon.

Table 2. Nulato River tower daily and cumulative counts and proportions for chinook and summer chum salmon, 2002.

	Chinook Salmon				Summer Chum Salmon			
	Counts		Proportions		Counts		Proportions	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
23-Jun	0	0	0.000	0.000	8	8	0.000	0.000
24-Jun	0	0	0.000	0.000	186	194	0.003	0.003
25-Jun	8	8	0.003	0.003	432	626	0.006	0.009
26-Jun	8	16	0.003	0.006	1,120	1,746	0.016	0.024
27-Jun	60	76	0.022	0.028	2,190	3,936	0.030	0.054
28-Jun	58	134	0.022	0.050	3,028	6,964	0.042	0.096
29-Jun	96	230	0.036	0.085	4,276	11,240	0.059	0.156
30-Jun	132	362	0.049	0.134	3,291	14,531	0.046	0.201
1-Jul	52	414	0.019	0.154	2,312	16,843	0.032	0.233
2-Jul	62	476	0.023	0.177	2,951	19,794	0.041	0.274
3-Jul	64	540	0.024	0.200	2,826	22,620	0.039	0.313
4-Jul	116	656	0.043	0.243	4,212	26,832	0.058	0.371
5-Jul	96	752	0.036	0.279	4,432	31,264	0.061	0.433
6-Jul	240	992	0.089	0.368	5,296	36,560	0.073	0.506
7-Jul	200	1,192	0.074	0.442	5,296	41,856	0.073	0.579
8-Jul	106	1,298	0.039	0.481	3,836	45,692	0.053	0.633
9-Jul	164	1,462	0.061	0.542	4,056	49,748	0.056	0.689
10-Jul	204	1,666	0.076	0.618	3,536	53,284	0.049	0.738
11-Jul	132	1,798	0.049	0.667	2,280	55,564	0.032	0.769
12-Jul	180	1,978	0.067	0.734	2,516	58,080	0.035	0.804
13-Jul	154	2,132	0.057	0.791	2,594	60,674	0.036	0.840
14-Jul	96	2,228	0.036	0.826	2,202	62,876	0.030	0.870
15-Jul	76	2,304	0.028	0.855	1,840	64,716	0.025	0.896
16-Jul	64	2,368	0.024	0.878	1,828	66,544	0.025	0.921
17-Jul	44	2,412	0.016	0.895	1,426	67,970	0.020	0.941
18-Jul	32	2,444	0.012	0.907	1,030	69,000	0.014	0.955
19-Jul	36	2,480	0.013	0.920	806	69,806	0.011	0.966
20-Jul [a]	40	2,520	0.015	0.935	992	70,798	0.014	0.980
21-Jul [a]	60	2,580	0.022	0.957	564	71,362	0.008	0.988
22-Jul	40	2,620	0.015	0.972	476	71,838	0.007	0.995
23-Jul	56	2,676	0.021	0.993	332	72,170	0.005	0.999
24-Jul	20	2,696	0.007	1.000	60	72,230	0.001	1.000

[a] Missed counting periods due to high water were interpolated for summer chum and chinook salmon.

Table 3. Annual Nulato River tower passage estimates and associated passage-timing statistics for chinook salmon escapements, 1994-2002.

Year	Tower Passage Estimate	Day of First Salmon Counts	First Quartile Day	Median Day	Third Quartile Day	First Count & First Quartile	Days Between Quartiles: First & Median	Days Between Quartiles: Median & Third	Days Between Quartiles: First & Third
1994	1,795	5-Jul	11-Jul	14-Jul	19-Jul	6	3	5	8
1995	1,412	26-Jun	11-Jul	16-Jul	20-Jul	15	5	4	9
1996	756	26-Jun	7-Jul	11-Jul	15-Jul	11	4	4	8
1997	4,811	23-Jun	4-Jul	8-Jul	13-Jul	11	4	5	9
1998	1,504	24-Jun	10-Jul	14-Jul	17-Jul	16	4	3	7
1999	1,932	3-Jul	10-Jul	14-Jul	19-Jul	7	4	5	9
2000	916	28-Jun	5-Jul	7-Jul	10-Jul	7	2	3	5
[a] 2001									
2002	2,696	25-Jun	5-Jul	9-Jul	13-Jul	10	4	4	8
[b] Mean	1,875	27-Jun	8-Jul	12-Jul	16-Jul	10.4	3.7	4.1	7.9
[b] Median	1,504	26-Jun	10-Jul	14-Jul	17-Jul	11.0	4.0	4.0	8.0
[b] SE	1,363	4.5	2.9	3.4	3.7	4.0	1.0	0.9	1.5

[a] Because of high water throughout the season, only four days of counting occurred. No expansions were calculated.

[b] Mean, Median and Standard Errors (SE) do not include the current year so that historical comparisons are plausible.

Table 4. Season total counts and proportions by hour for Nulato River chinook and summer chum salmon, 2002.

Hour Ending	Chinook Salmon		Summer Chum Salmon	
	Counts	Proportions	Counts	Proportions
1:00	86	0.032	3,657	0.051
2:00	54	0.020	3,055	0.042
3:00	77	0.029	2,401	0.033
4:00	57	0.021	2,510	0.035
5:00	90	0.033	2,276	0.032
6:00	31	0.012	2,557	0.035
7:00	42	0.015	2,508	0.035
8:00	72	0.027	2,127	0.029
9:00	80	0.030	2,340	0.032
10:00	74	0.027	2,661	0.037
11:00	133	0.049	2,701	0.037
12:00	148	0.055	2,835	0.039
13:00	147	0.054	2,378	0.033
14:00	106	0.039	2,642	0.037
15:00	169	0.063	2,929	0.041
16:00	140	0.052	3,075	0.043
17:00	142	0.053	3,198	0.044
18:00	172	0.064	3,360	0.047
19:00	164	0.061	4,131	0.057
20:00	108	0.040	3,456	0.048
21:00	184	0.068	4,028	0.056
22:00	172	0.064	3,948	0.055
23:00	116	0.043	3,526	0.049
24:00	132	0.049	3,932	0.054
Total	2,696	1.000	72,230	1.000

Table 5. Annual Nulato River tower passage estimates and associated passage-timing statistics for summer chum salmon escapements, 1994-2002.

	Year	Tower Passage Estimate	Day of First Salmon Counts	First Quartile Day	Median Day	Third Quartile Day	First Count & First Quartile	Days Between Quartiles: First & Median	Days Between Quartiles: Median & Third	Days Between Quartiles: First & Third
	1994	148,762	29-Jun	4-Jul	9-Jul	13-Jul	5	5	4	9
	1995	236,890	21-Jun	2-Jul	7-Jul	11-Jul	11	5	4	9
	1996	129,694	21-Jun	27-Jun	3-Jul	8-Jul	6	6	5	11
	1997	158,171	20-Jun	30-Jun	5-Jul	8-Jul	10	5	3	8
	1998	52,041	22-Jun	7-Jul	12-Jul	15-Jul	15	5	3	8
	1999	30,076	24-Jun	7-Jul	11-Jul	16-Jul	13	4	5	9
	2000	29,366	24-Jun	5-Jul	9-Jul	14-Jul	11	4	5	9
[a]	2001									
	2002	72,230	23-Jun	2-Jul	6-Jul	11-Jul	9	4	5	9
[b]	Mean	112,143	23-Jun	3-Jul	8-Jul	12-Jul	10.0	4.8	4.3	9.0
[b]	Median	129,694	22-Jun	4-Jul	9-Jul	13-Jul	10.5	5.0	4.5	9.0
[b]	SE	78,026	3.1	3.7	3.2	3.2	3.3	0.7	0.9	0.9

[a] Because of high water throughout the season, only four days of counting occurred. No expansions were calculated.

[b] Mean, Median and Standard Errors (SE) do not include the current year so that historical comparisons are plausible.

Table 6. Nulato River summer chum salmon weighted age and sex composition and mean length, 2002.

		Brood Year and Age Group				
		1996	1995	1994	1993	
		0.2	0.3	0.4	0.5	Total
Male	No. in Escapement	148	31,271	20,178	1,103	52,700
	Percent of Sample	0.2	43.3	27.9	1.5	73.0
	Mean Length (mm)	540.0	583.6	597.6	639.2	
	Std. Deviation	0.0	28.2	62.3	49.0	
Female	No. in Escapement	0	13,237	6,145	148	19,530
	Percent of Sample	0.0	18.3	8.5	0.2	27.0
	Mean Length (mm)		544.3	557.6	555.0	
	Std. Deviation		27.5	25.1	0.0	
Total	No. in Escapement	148	44,508	26,323	1,251	72,230
	Percent of Sample	0.2	61.6	36.4	1.7	100.0

Table 7. Nulato River tower project climatological and hydrological observations, 2002.

Date	Time	Precipitation (code\amt)	Wind (Direction and) Velocity	Sky (code)	Temperature (°C) Air	Temperature (°C) Water	Water Guage (cm)	Water Color (code)
18-Jun	18:00	0	Calm	5			79.25	Tr
19-Jun	18:00	Trace	NE 5	1	30.0		74.98	Tr
20-Jun	18:00	0	E 7	2	24.0		72.54	Tr
21-Jun	18:00	0	NW 10	3	28.0		67.67	Lt
22-Jun	18:00	0	SW 12	3	26.0		65.23	Cl
23-Jun	18:00	I	Calm	3	15.0		62.18	Cl
24-Jun	18:00	I	Calm	1	17.0		60.96	Cl
25-Jun	18:00	I	SE 5	2	25.0		58.22	Cl
26-Jun	18:00	I	N 8	3	22.0		56.69	Cl
27-Jun	18:00	I	Calm	4	22.0		55.47	Cl
28-Jun	18:00	R	N 5	2	15.0	8.0	54.56	Cl
29-Jun	18:00	I	Calm	4	13.0	9.0	53.64	Cl
30-Jun	18:00	0	Calm	2	22.0	10.0	51.51	Cl
01-Jul	18:00	0	NW 15	1	20.0	12.0	49.07	Cl
02-Jul	18:00	R	Calm	4	6.0	9.0	48.16	Cl
03-Jul	18:00	I	W 5	1	15.0	11.0	49.68	Cl
04-Jul	18:00	I	N 5	4	11.0	9.0	49.68	Cl
05-Jul	18:00	I	Calm	4	15.0	8.0	50.29	Cl
06-Jul	18:00	R	NE 15	4	15.0	9.0	50.29	Cl
07-Jul	18:00	I	N 8	4	15.0	10.0	49.99	Cl
08-Jul	18:00	I	Calm	2	15.0	11.0	49.38	Cl
09-Jul	18:00	I	Calm	3	20.0	11.0	49.07	Cl
10-Jul	18:00	I	Calm	3	17.0	12.0	48.77	Cl
11-Jul	18:00	I	Calm	4	16.0	11.0	49.38	Cl
12-Jul	18:00	I	Calm	4	21.0	11.0	56.08	Cl
13-Jul	18:00	I	Calm	4	12.0	11.0	59.13	Cl
14-Jul	19:15	I	Calm	4	18.0	11.0	59.13	Cl
15-Jul	18:00	I	Calm	3	22.0	11.0	59.44	Cl
16-Jul	18:00	I	Calm	3	26.0	13.0	57.61	Cl
17-Jul	21:00	0	SE 5	1	24.0	14.0	56.69	Cl
18-Jul	18:00	0	Calm	1	30.0	14.5	61.26	Cl
19-Jul	19:15	I	NW 5	1	24.0	14.5	58.22	Cl
20-Jul	19:15	0	NW 5	5	19.0	12.0	56.69	Cl
21-Jul	18:00	I	Calm	4	24.0	13.0	55.78	Cl
22-Jul	18:00	I	Calm	4	20.0	12.0	54.25	Cl
23-Jul	18:00	0	Calm	2	24.0	12.0	53.04	Cl
24-Jul	18:00	I	W 8	5	18.0	11.0	51.21	Cl

Codes

SKY	PRECIPITATION		WATER COLOR	
0 No observation made	I	Intermitten	Clr	Clear
1 Clear sky, not over 10% cloud cover	R	Continuous	Dk grn	Dark green
2 Cloud cover not over 50%	S	Snow	Lt grn	Light green
3 Cloud cover over 50% of sky	S&R	Mixed snov	Br	Brown
4 Completely overcast	H	Hail	Dk	Dark Brown
5 Fog or thick haze or smoke	T	Thunder sh	Tr	Turbid: murky or glacial

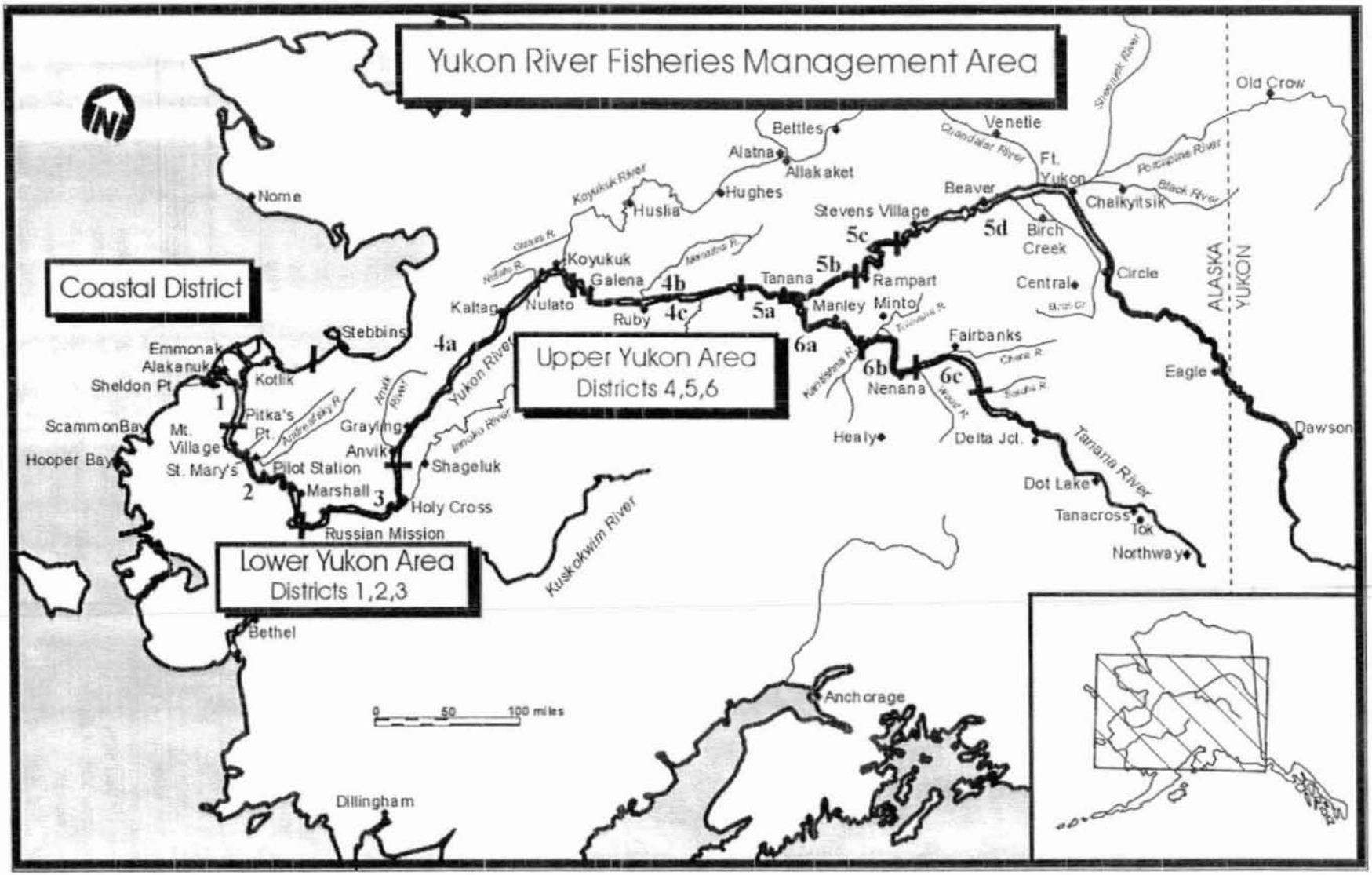


Figure 1. Alaska portion of the Yukon River showing villages and fishing district boundaries.

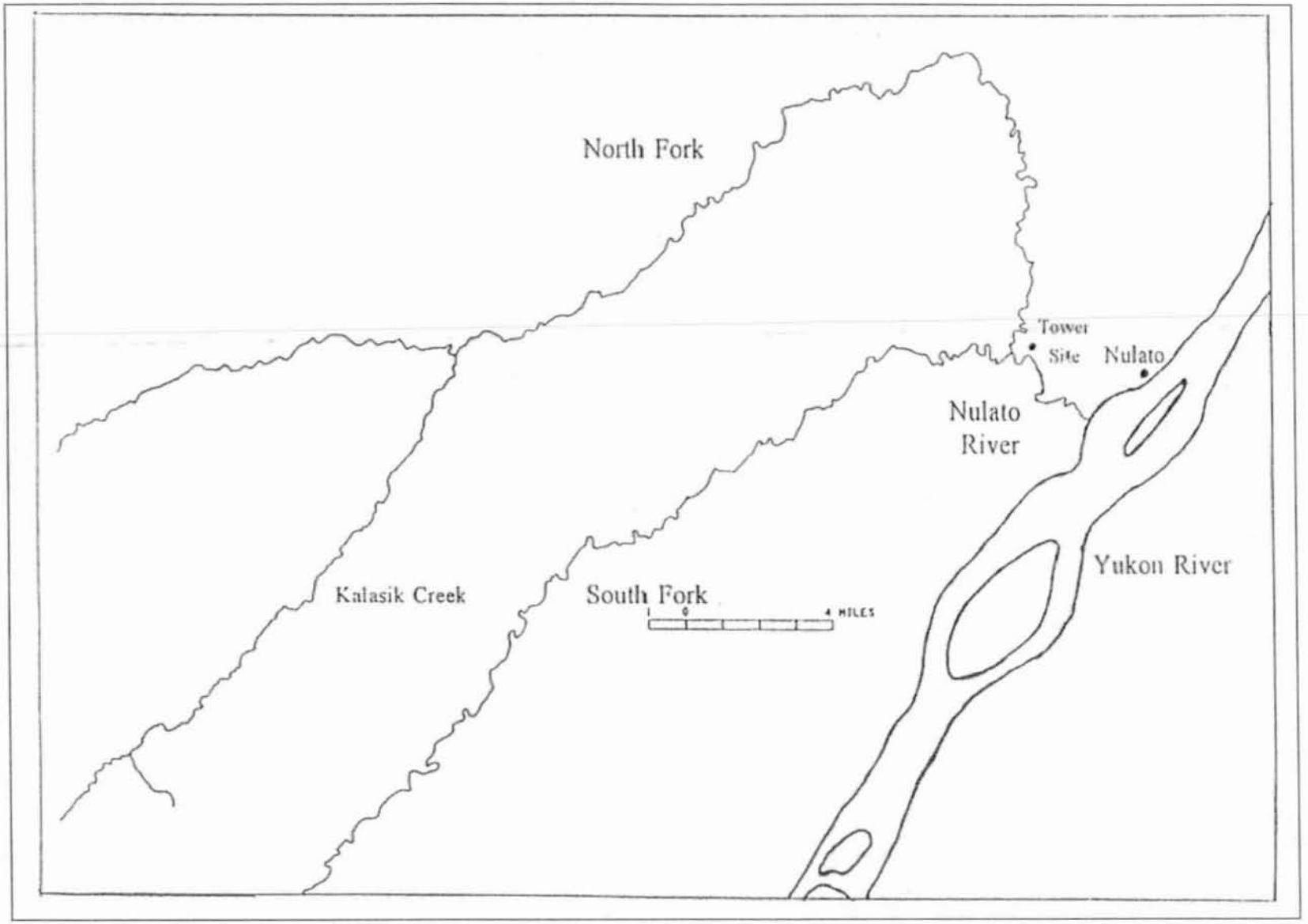
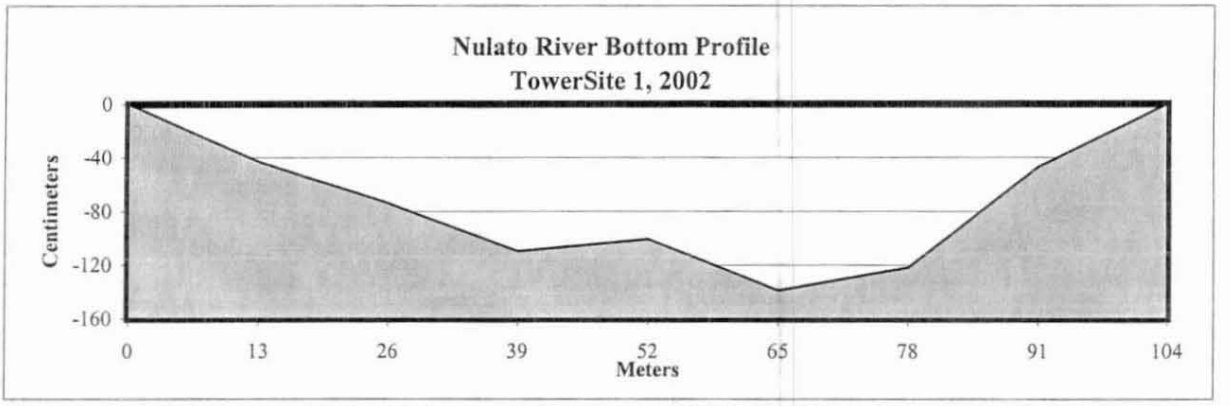
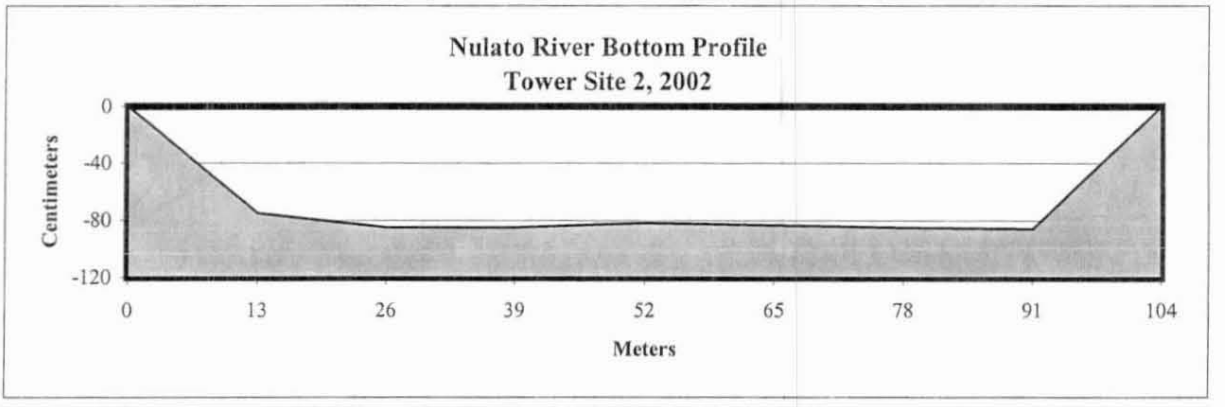
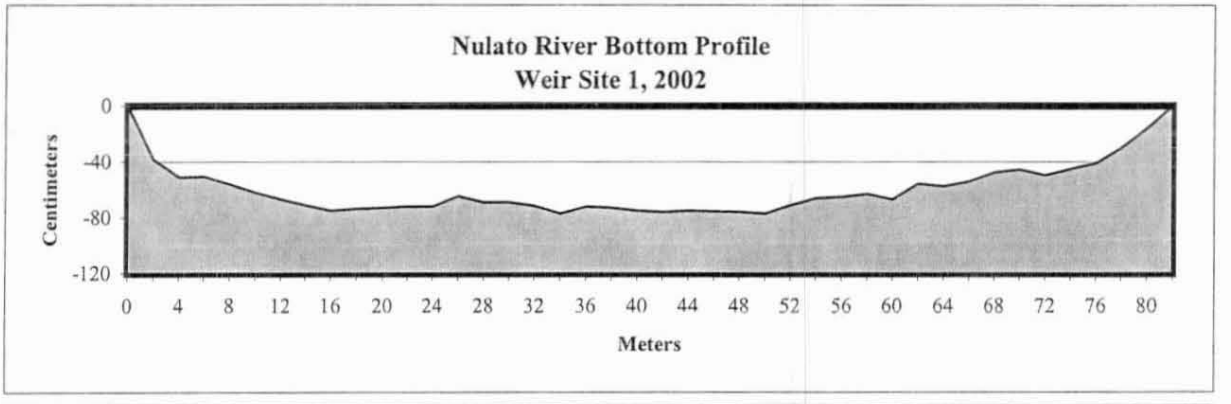


Figure 2. The Nulato River drainage showing the counting tower site.







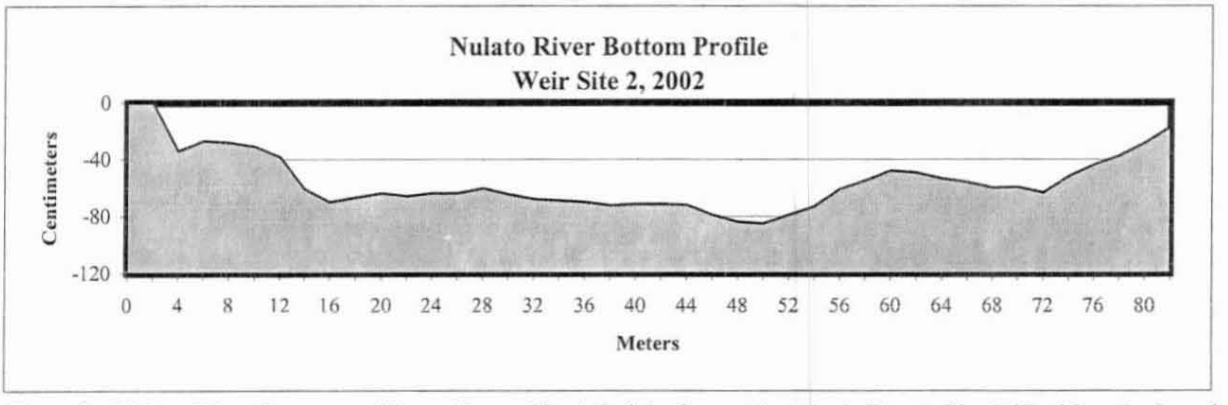
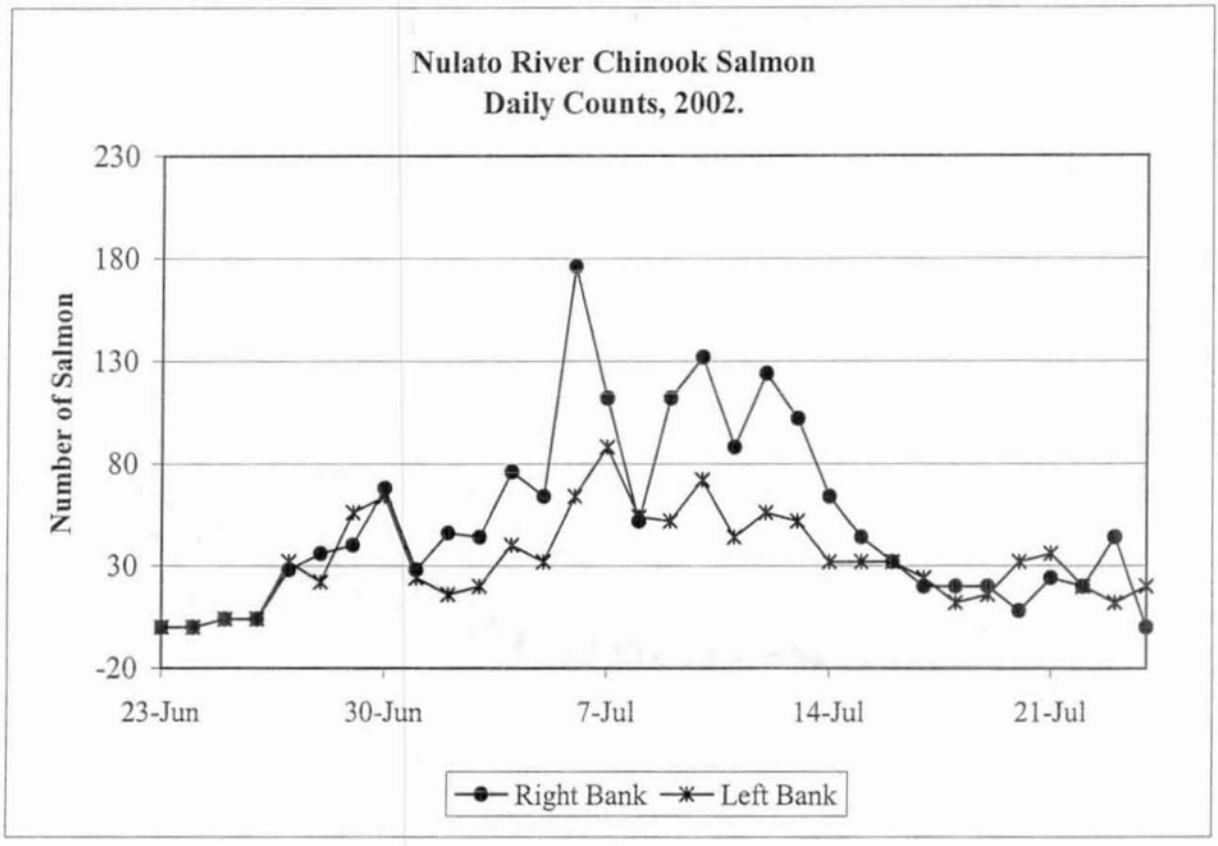


Figure 3. Nulato River bottom profiles at Tower Site 1 (original tower location), Tower Site 2 (final location), and two bottom profiles at possible weir locations just below the confluence of the North and South Fork Nulato Rivers, 2002.



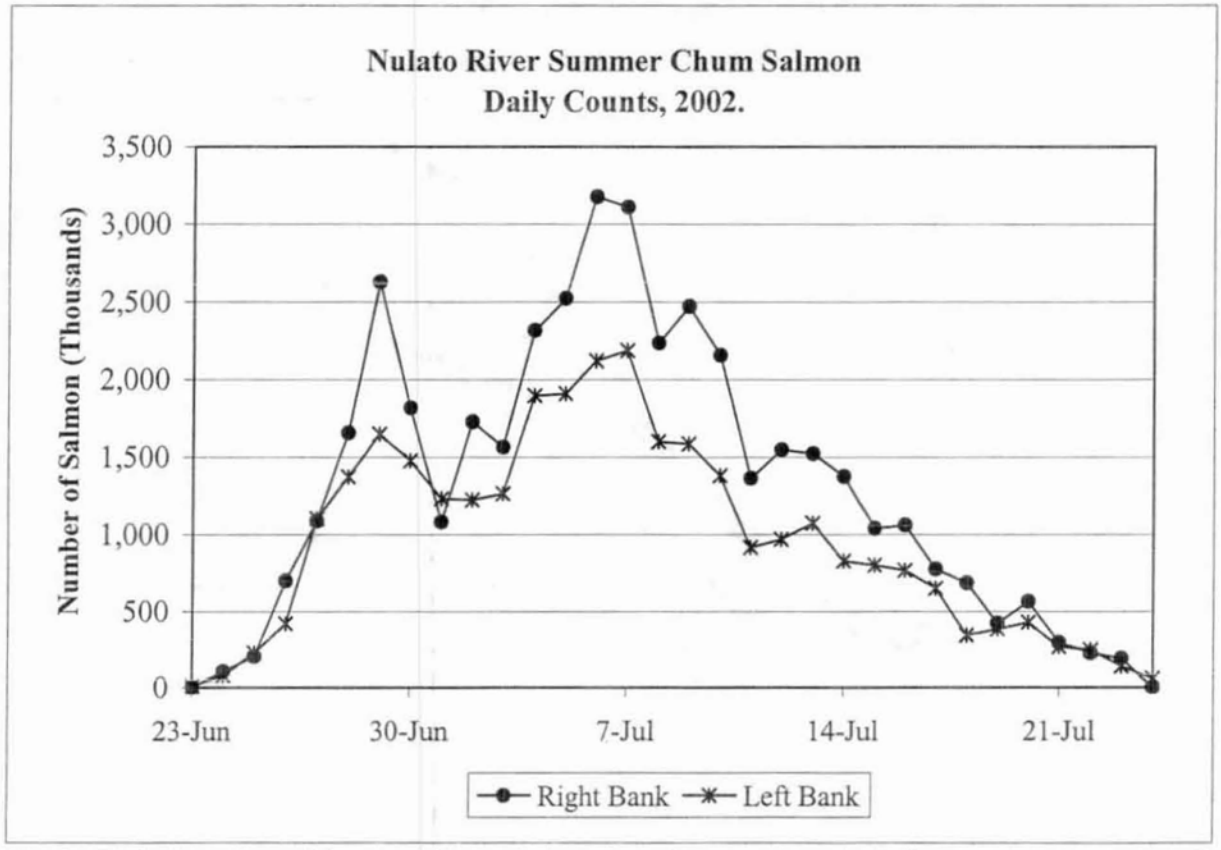
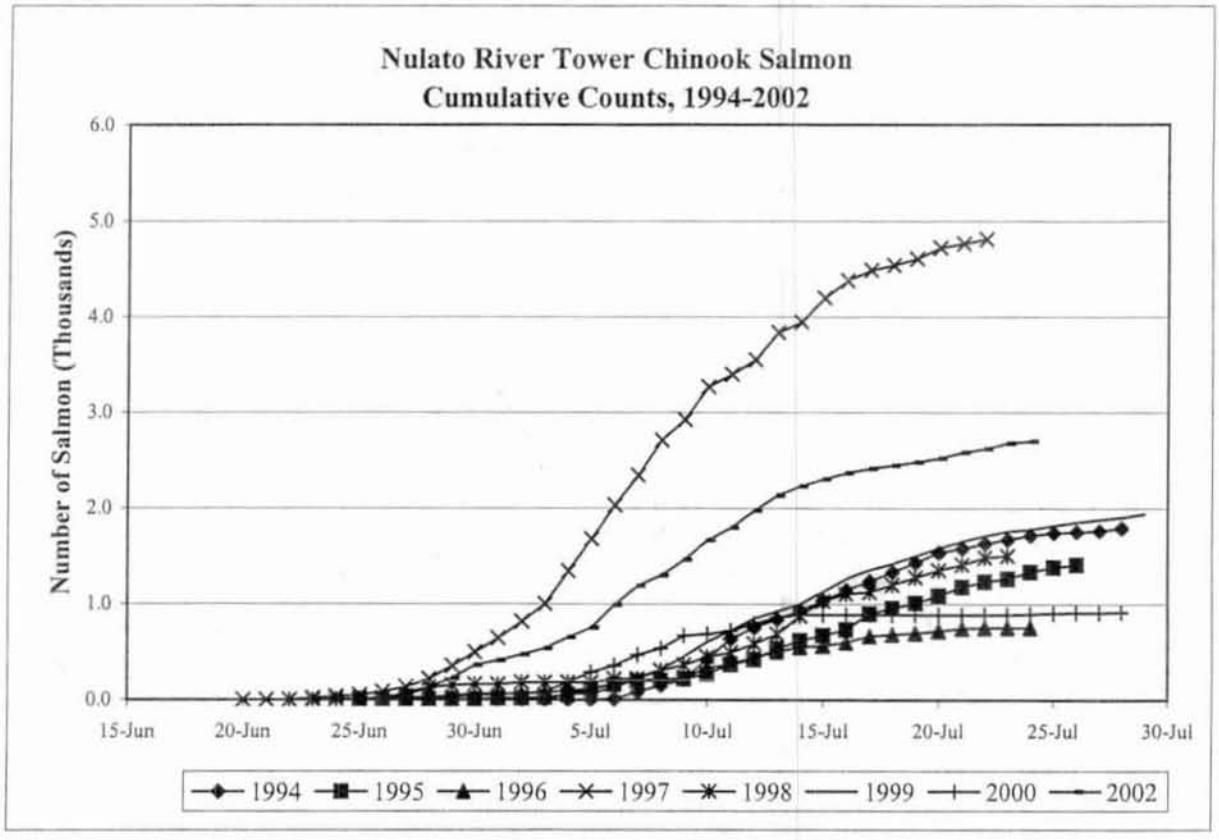


Figure 4. Nulato River chinook and summer chum salmon estimated daily counts by bank, 2002.



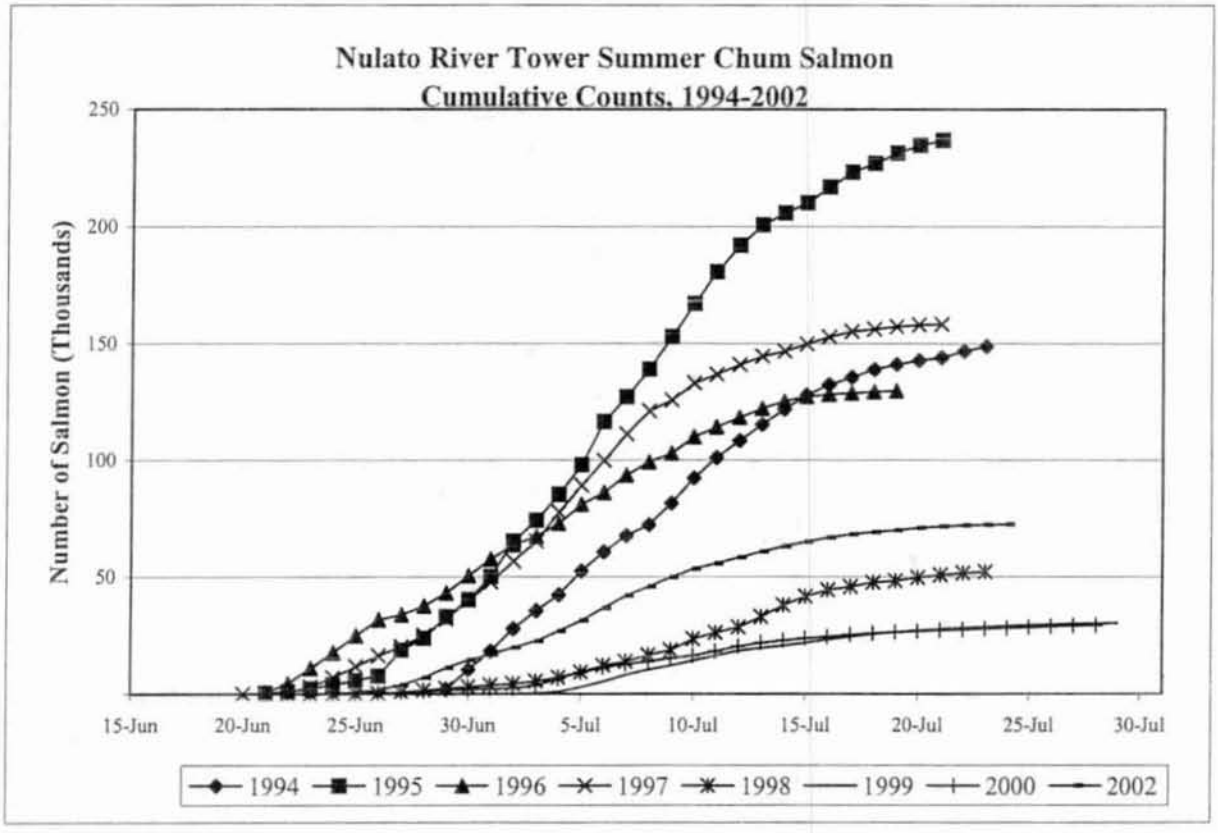
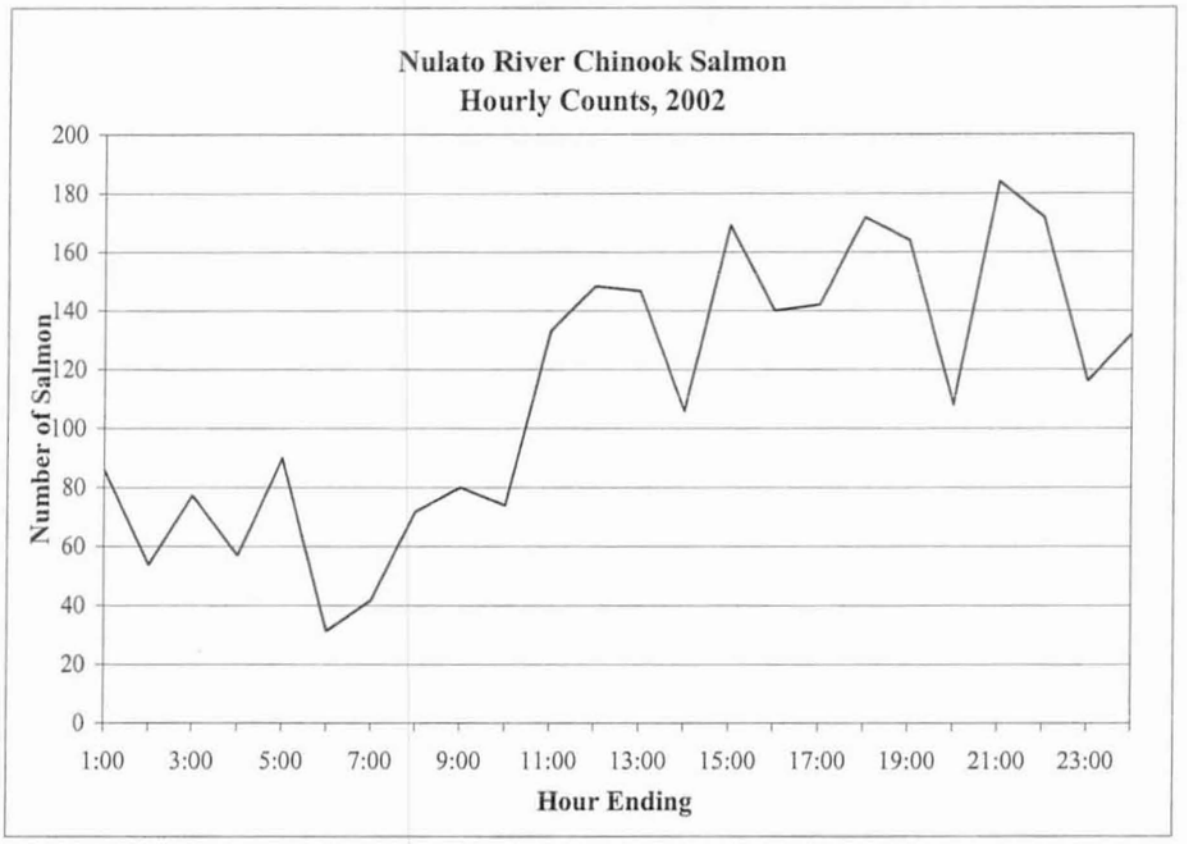


Figure 5. Nulato River chinook and summer chum salmon cumulative counts, 1994-2002.



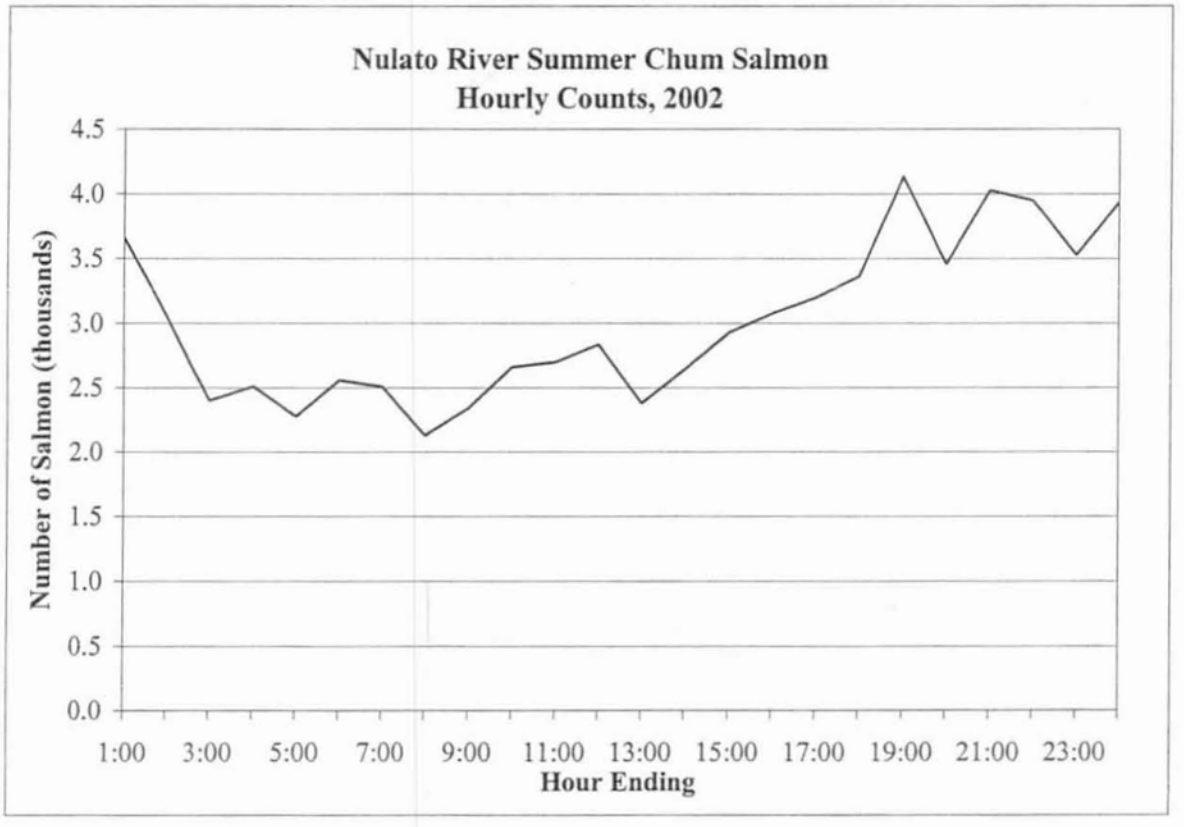
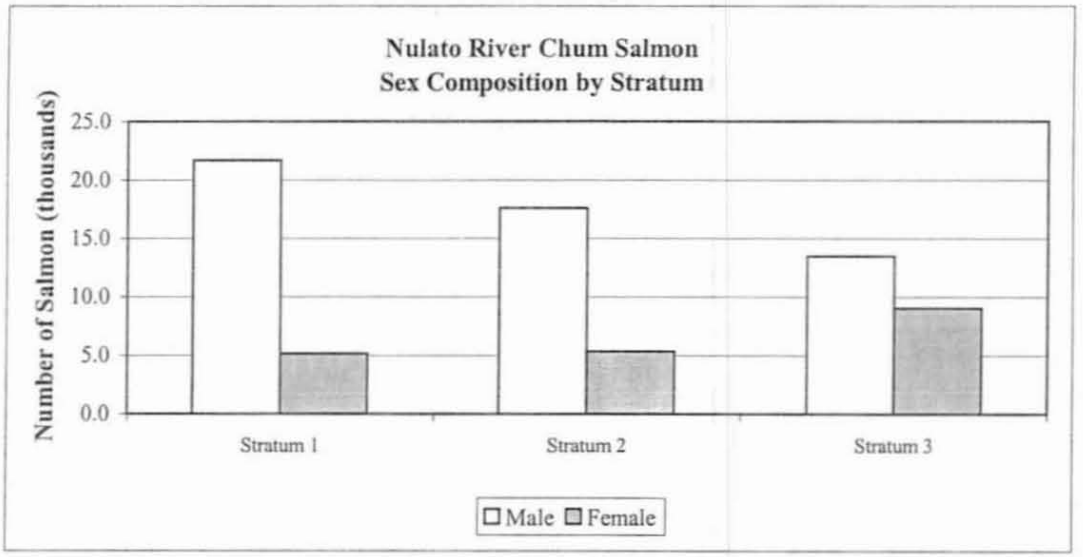
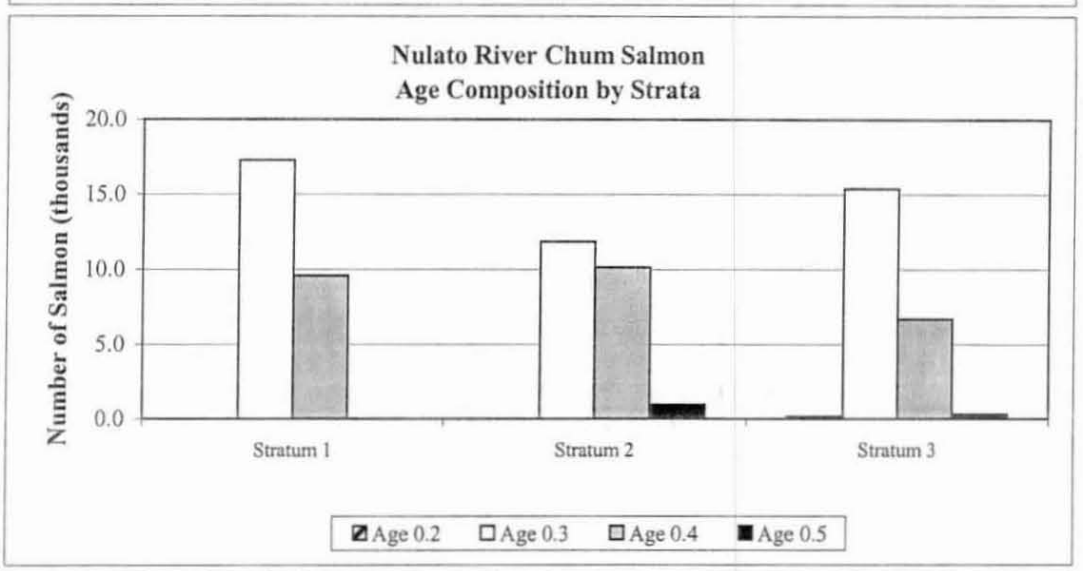


Figure 6. Nulato River chinook and summer chum salmon estimated daily counts by hour, 2002.





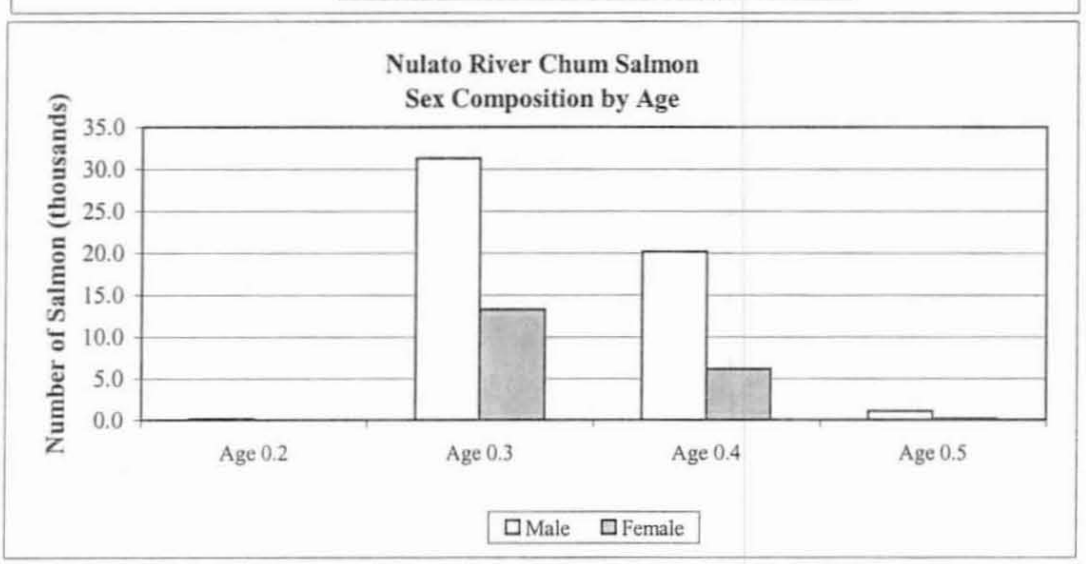
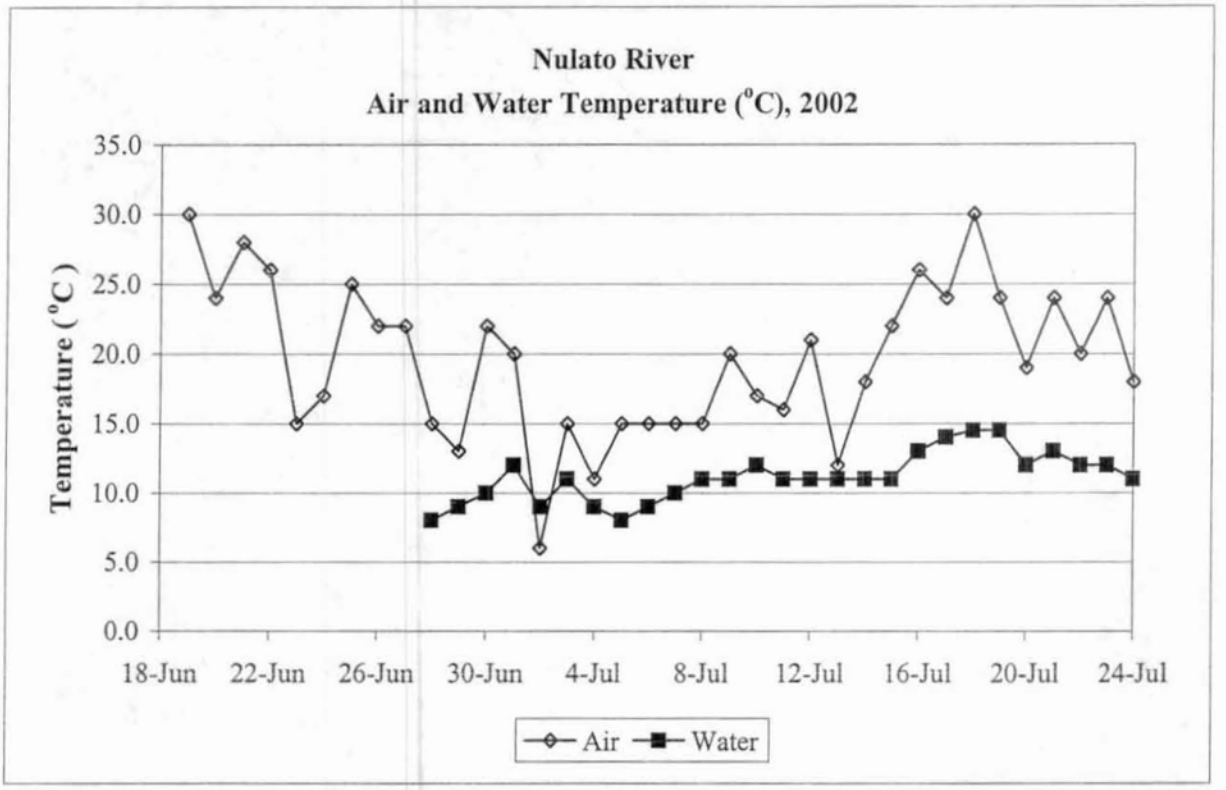


Figure 7. Nulato River summer chum salmon age and sex composition by stratum, and sex composition by age group, 2002.



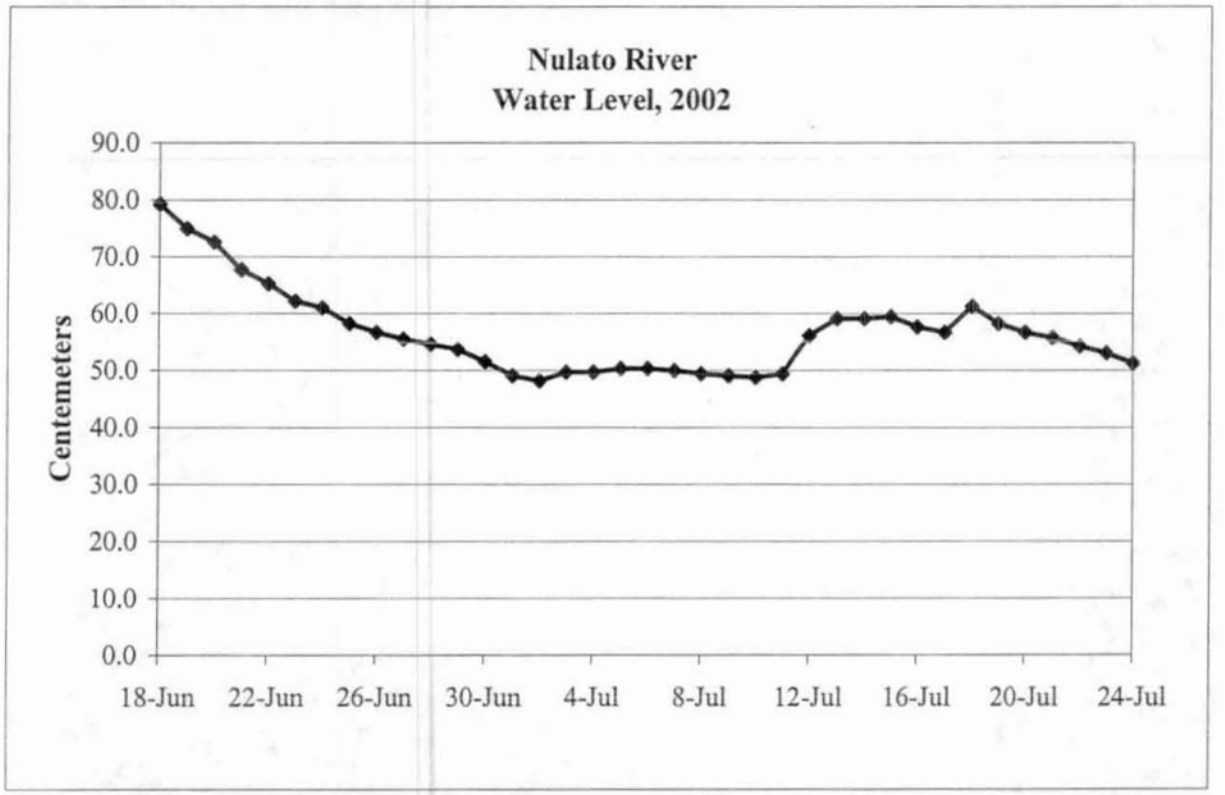


Figure 8. Nulato River tower escapement project climatological and hydrological observations, 2002.

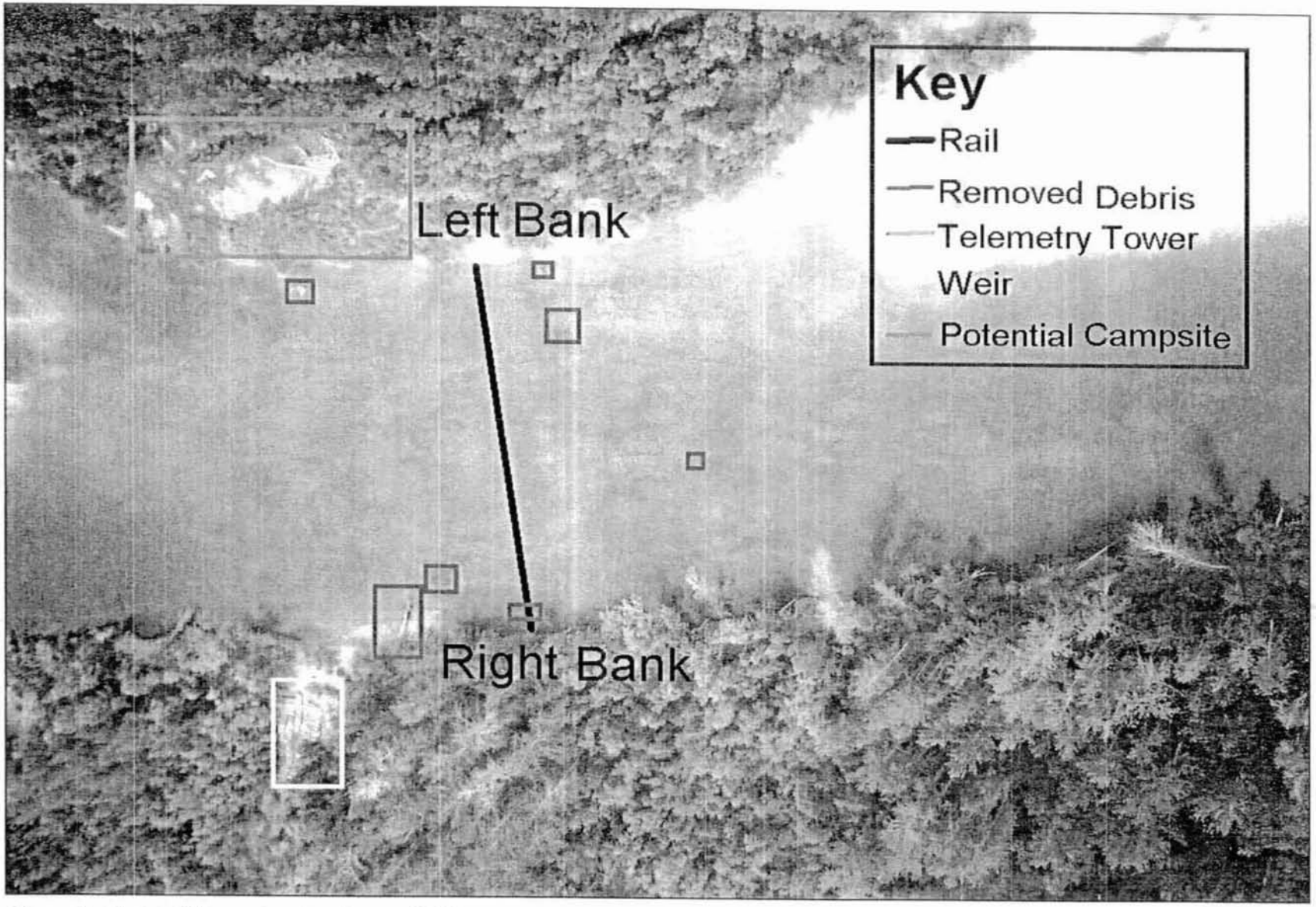


Figure 9. Nulato River wier site, August 2002.

APPENDIX TABLES

Appendix A.1. Right bank Nulato River expanded chinook salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																							
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
26-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
27-Jun	0	4	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	8	4	0	0	4	0	28
28-Jun	0	4	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	4	0	4	4	4	4	4	36
29-Jun	0	0	4	0	8	0	0	0	0	0	0	4	0	0	0	4	0	4	0	0	8	4	4	0	40
30-Jun	0	0	4	4	12	0	0	0	0	0	0	4	4	0	4	20	0	0	4	0	4	8	0	0	68
1-Jul	4	0	0	4	4	0	0	0	0	0	0	0	4	0	0	8	0	0	0	0	0	4	0	0	28
2-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	6	8	8	0	4	4	4	0	46
3-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	8	0	0	4	0	0	0	28	44
4-Jul	16	0	0	4	0	0	0	0	0	0	0	8	0	0	0	0	0	8	4	8	20	4	4	0	76
5-Jul	0	0	0	0	0	4	0	0	0	4	0	4	0	8	4	8	4	4	0	8	0	12	0	4	64
6-Jul	0	0	4	0	0	0	0	0	0	4	4	4	0	8	4	4	4	28	52	0	12	32	4	12	176
7-Jul	8	0	4	0	0	0	0	4	8	4	20	8	8	4	8	12	12	8	0	4	0	0	0	0	112
8-Jul	0	0	0	0	4	0	0	0	0	4	8	0	8	0	8	8	8	0	0	0	0	4	0	0	52
9-Jul	12	0	12	8	4	0	0	0	0	0	4	8	0	4	4	4	16	4	8	12	8	4	0	0	112
10-Jul	0	0	4	0	0	0	4	0	4	4	0	0	16	8	8	0	4	24	4	20	20	8	4	0	132
11-Jul	4	4	4	0	0	4	0	0	4	4	4	0	0	0	0	4	16	12	16	4	4	0	0	4	88
12-Jul	0	0	0	0	0	0	0	0	20	0	4	4	8	0	4	8	20	8	4	0	8	8	20	8	124
13-Jul	0	4	8	0	8	0	4	2	0	0	12	4	8	4	12	0	0	4	4	4	8	12	4	0	102
14-Jul	0	2	5	2	4	0	2	3	0	0	5	4	4	2	5	0	4	4	0	4	12	4	0	0	64
15-Jul	0	0	4	4	0	0	0	4	0	0	0	4	0	0	0	0	0	8	8	4	4	0	0	4	44
16-Jul	0	0	0	0	0	0	4	0	0	0	0	8	4	0	4	8	0	0	0	4	0	0	0	0	32
17-Jul	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	20
18-Jul	0	0	0	0	0	0	0	0	0	4	0	0	4	0	4	4	0	4	0	0	0	0	0	0	20
19-Jul	0	0	0	4	0	0	0	0	0	0	4	0	0	0	0	0	4	0	4	0	0	4	0	0	20
20-Jul	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	8
21-Jul	0	0	0	0	0	0	0	4	0	0	0	4	4	4	4	0	0	0	0	0	4	0	0	0	24
22-Jul	4	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0	20
23-Jul	0	0	0	0	4	0	0	8	4	0	0	4	4	4	8	0	0	4	4	0	0	0	0	0	44
24-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	56	22	53	30	48	12	22	29	40	36	65	76	80	46	93	104	106	136	132	84	124	120	52	68	1,632

Appendix A.2. Left bank Nulato River expanded chinook salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																								
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
26-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
27-Jun	0	0	0	0	0	0	4	4	4	0	0	0	0	4	0	4	0	0	0	8	4	0	0	0	32
28-Jun	4	4	0	4	0	0	0	0	0	2	4	0	4	0	0	0	0	0	0	0	0	0	0	0	22
29-Jun	0	0	0	0	4	0	0	4	0	0	0	16	4	0	4	0	0	0	0	8	4	4	4	4	56
30-Jun	4	0	0	3	6	3	0	3	0	0	0	13	3	0	0	0	4	4	0	0	0	8	8	4	64
1-Jul	8	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	24
2-Jul	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4	0	4	0	16
3-Jul	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	4	8	20
4-Jul	0	0	4	0	0	0	0	0	0	0	4	4	0	8	0	0	0	4	4	0	8	4	0	0	40
5-Jul	0	0	0	0	0	0	0	0	0	0	8	0	0	4	4	4	0	4	4	0	0	0	0	4	32
6-Jul	0	0	0	0	0	0	0	4	4	0	4	0	4	0	0	4	4	0	8	4	0	8	12	8	64
7-Jul	0	4	0	0	4	0	0	4	8	4	8	12	8	0	20	4	12	0	0	0	0	0	0	0	88
8-Jul	2	4	0	0	0	4	0	0	4	8	0	4	12	0	8	0	0	0	4	0	0	0	4	0	54
9-Jul	4	4	8	0	0	0	0	0	4	0	0	0	4	0	4	0	4	4	0	0	8	0	4	4	52
10-Jul	0	0	0	4	0	0	0	0	0	8	4	8	8	12	8	4	0	0	0	0	0	8	8	0	72
11-Jul	0	4	4	0	4	0	0	0	0	0	8	0	0	0	0	0	4	4	0	0	4	8	0	4	44
12-Jul	0	0	0	0	0	0	0	0	4	0	12	4	0	0	4	0	0	8	8	0	4	0	0	12	56
13-Jul	4	0	0	4	4	0	0	0	0	0	4	4	0	4	4	0	0	0	0	4	8	4	4	4	52
14-Jul	4	0	0	4	4	0	0	0	0	0	0	0	4	0	4	0	0	4	0	0	4	0	4	0	32
15-Jul	0	0	0	0	4	4	8	4	4	0	0	0	0	0	0	0	0	0	4	0	0	0	4	0	32
16-Jul	0	0	0	0	0	0	4	0	0	0	0	4	8	4	4	4	0	0	0	0	4	0	0	0	32
17-Jul	0	4	0	4	0	0	0	0	4	0	4	0	0	0	0	0	4	0	0	0	0	0	0	4	24
18-Jul	0	4	4	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	12
19-Jul	0	0	0	0	0	4	0	0	4	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	16
20-Jul	0	0	0	0	0	0	0	8	0	8	0	4	0	4	8	0	0	0	0	0	0	0	0	0	32
21-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	4	4	0	0	4	4	4	8	36
22-Jul	0	4	0	0	4	0	0	0	0	0	0	0	4	4	0	4	0	0	0	0	0	0	0	0	20
23-Jul	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	12
24-Jul	0	0	4	0	0	0	4	8	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Total	30	32	24	27	42	19	20	43	40	38	68	73	67	60	76	36	36	36	32	24	60	52	64	64	1,064

Appendix A.3. Right and left bank Nulato River combined expanded chinook salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																								
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4	0	0	0	8
26-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	8
27-Jun	0	4	0	0	0	4	4	4	4	0	0	4	0	4	0	4	0	0	8	12	4	0	4	0	60
28-Jun	4	8	0	4	0	0	4	0	0	6	4	0	4	0	0	0	0	4	0	4	4	4	4	4	58
29-Jun	0	0	4	0	12	0	0	4	0	0	0	20	4	0	4	4	0	4	0	8	12	8	8	4	96
30-Jun	4	0	4	7	18	3	0	3	0	0	0	17	7	0	4	20	4	4	4	0	4	16	8	4	132
1-Jul	12	0	0	8	8	4	0	0	0	0	0	0	4	0	0	8	0	0	0	0	0	8	0	0	52
2-Jul	0	0	0	0	4	0	0	0	0	0	4	0	0	0	8	4	6	8	8	0	8	4	8	0	62
3-Jul	0	0	0	0	0	0	0	0	0	0	4	0	4	0	4	0	8	0	0	4	0	0	4	36	64
4-Jul	16	0	4	4	0	0	0	0	0	0	4	12	0	8	0	0	0	12	8	8	28	8	4	0	116
5-Jul	0	0	0	0	0	4	0	0	0	4	8	4	0	12	8	12	4	8	4	8	0	12	0	8	96
6-Jul	0	0	4	0	0	0	0	4	4	4	8	4	4	8	4	8	8	28	60	4	12	40	16	20	240
7-Jul	8	4	4	0	4	0	0	8	16	8	28	20	16	4	28	16	24	8	0	4	0	0	0	0	200
8-Jul	2	4	0	0	4	4	0	0	4	12	8	4	20	0	16	8	8	0	4	0	0	4	4	0	106
9-Jul	16	4	20	8	4	0	0	0	4	0	4	8	4	4	8	4	20	8	8	12	16	4	4	4	164
10-Jul	0	0	4	4	0	0	4	0	4	12	4	8	24	20	16	4	4	24	4	20	20	16	12	0	204
11-Jul	4	8	8	0	4	4	0	0	4	4	12	0	0	0	0	4	20	16	16	4	8	8	0	8	132
12-Jul	0	0	0	0	0	0	0	0	24	0	16	8	8	0	8	8	20	16	12	0	12	8	20	20	180
13-Jul	4	4	8	4	12	0	4	2	0	0	16	8	8	8	16	0	0	4	4	8	16	16	8	4	154
14-Jul	4	2	5	6	8	0	2	3	0	0	5	4	8	2	9	0	4	8	0	4	16	4	4	0	96
15-Jul	0	0	4	4	4	4	8	8	4	0	0	4	0	0	0	0	0	8	12	4	4	0	4	4	76
16-Jul	0	0	0	0	0	0	8	0	0	0	0	12	12	4	8	12	0	0	0	4	4	0	0	0	64
17-Jul	8	8	0	4	0	0	0	0	4	0	4	0	0	0	0	8	4	0	0	0	0	0	0	4	44
18-Jul	0	4	4	0	0	0	0	0	0	4	0	0	4	4	4	4	0	4	0	0	0	0	0	0	32
19-Jul	0	0	0	4	0	4	0	0	4	4	4	0	0	0	0	4	4	0	4	0	0	4	0	0	36
20-Jul	0	0	0	0	0	0	0	8	0	12	0	4	4	4	8	0	0	0	0	0	0	0	0	0	40
21-Jul	0	0	0	0	0	0	0	4	0	0	0	4	4	12	4	0	4	4	0	0	8	4	4	8	60
22-Jul	4	4	0	0	4	0	4	4	0	0	0	0	4	4	0	4	0	0	4	0	0	4	0	0	40
23-Jul	0	0	0	0	4	0	0	12	4	0	0	4	4	4	12	4	0	4	4	0	0	0	0	0	56
24-Jul	0	0	4	0	0	0	4	8	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Total	86	54	77	57	90	31	42	72	80	74	133	148	147	106	169	140	142	172	164	108	184	172	116	132	2,696

Appendix A.4.Right bank Nulato River expanded summer chum salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																							
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	2	0	0	0	0	2	0	4	0	2	2	0	0	2	0	0	4	8	23	28	0	24	4	0	106
25-Jun	4	0	0	0	0	4	0	8	0	4	4	0	0	4	0	0	8	16	44	12	12	52	20	12	204
26-Jun	52	4	4	4	0	8	0	4	16	0	24	8	24	16	16	16	24	8	16	32	12	44	68	300	700
27-Jun	32	52	84	20	0	28	44	60	16	0	32	16	20	64	60	8	20	16	80	32	80	164	84	76	1,088
28-Jun	60	48	12	16	12	28	28	20	60	224	52	48	28	72	12	24	52	92	108	132	128	172	120	108	1,656
29-Jun	112	168	44	92	96	72	100	44	24	40	216	300	68	24	68	80	72	124	192	100	160	148	152	132	2,628
30-Jun	60	112	49	69	74	53	65	45	22	51	116	161	45	76	64	72	104	64	96	60	212	60	48	40	1,816
1-Jul	128	60	56	48	56	36	32	48	20	64	20	28	24	44	76	56	44	36	40	32	40	24	28	40	1,080
2-Jul	52	68	98	128	120	103	80	44	56	44	28	36	36	80	56	48	42	36	368	16	48	68	48	24	1,727
3-Jul	104	36	40	64	48	52	28	36	32	36	12	28	40	60	104	116	92	76	76	80	88	76	68	172	1,564
4-Jul	48	32	28	40	60	24	56	60	72	68	92	128	76	80	148	112	76	116	176	120	268	168	152	116	2,316
5-Jul	120	64	72	88	52	72	48	36	80	60	80	104	76	96	84	92	164	108	96	212	108	208	184	220	2,524
6-Jul	108	52	88	72	64	108	124	88	68	92	88	104	72	116	156	192	232	184	136	208	236	220	112	256	3,176
7-Jul	180	168	104	104	16	80	212	120	148	156	188	148	132	92	124	196	180	168	76	124	36	104	160	92	3,108
8-Jul	184	84	112	96	52	52	64	36	76	84	88	92	72	160	116	84	84	64	124	76	160	68	28	180	2,236
9-Jul	196	144	156	92	84	68	88	104	68	136	96	104	56	84	56	84	132	100	92	124	136	92	84	96	2,472
10-Jul	60	48	56	48	68	44	60	32	36	52	48	72	72	124	116	100	132	164	220	172	100	124	120	88	2,156
11-Jul	60	56	72	60	68	76	60	60	68	68	44	44	32	44	32	28	76	64	76	84	32	40	40	80	1,364
12-Jul	56	52	44	52	40	36	24	28	64	12	20	36	60	48	68	80	136	116	100	84	124	72	112	84	1,548
13-Jul	84	60	36	32	84	72	44	30	16	40	76	68	56	60	88	104	36	80	84	44	76	68	84	100	1,522
14-Jul	75	56	30	58	62	84	47	44	34	36	51	45	49	58	73	71	68	52	88	64	108	48	52	20	1,374
15-Jul	56	44	20	76	32	84	44	52	48	28	20	16	36	48	48	28	52	80	64	56	16	24	40	28	1,040
16-Jul	44	32	24	24	36	16	40	12	12	68	60	60	88	68	100	108	36	24	24	24	28	40	44	48	1,060
17-Jul	44	36	24	64	44	48	36	12	24	24	24	32	20	12	36	28	32	44	24	44	36	36	32	20	776
18-Jul	28	28	32	16	18	20	28	0	36	8	24	28	16	28	28	24	60	40	48	44	32	24	28	48	686
19-Jul	36	28	20	36	32	4	24	14	4	16	8	12	4	0	4	24	28	24	20	16	8	12	20	28	422
20-Jul	24	8	24	0	4	8	8	20	24	44	40	32	44	20	32	36	44	16	28	24	24	28	16	16	564
21-Jul	16	8	12	12	0	4	0	4	12	0	4	16	12	24	20	16	0	16	12	32	24	24	12	16	296
22-Jul	12	12	4	0	8	20	8	20	4	0	4	16	8	24	8	12	12	8	20	4	4	8	4	8	228
23-Jul	12	8	0	4	4	4	16	28	16	8	4	0	4	16	4	4	4	4	20	0	0	20	8	4	192
24-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,049	1,567	1,345	1,414	1,235	1,309	1,408	1,113	1,156	1,465	1,565	1,782	1,270	1,644	1,797	1,843	2,046	1,948	2,571	2,080	2,336	2,260	1,972	2,452	41,629

Appendix A.5. Left bank Nulato River expanded summer chum salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																							
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	8
24-Jun	0	0	0	4	0	8	0	0	0	0	12	0	4	4	0	0	0	20	0	12	4	12	0	0	80
25-Jun	4	0	0	0	4	0	0	4	52	16	20	12	32	16	16	12	0	0	4	24	4	4	4	0	228
26-Jun	0	32	0	56	4	0	8	0	8	4	24	16	0	32	16	28	0	4	0	0	16	8	60	104	420
27-Jun	80	176	32	12	36	56	36	38	40	20	20	8	8	32	12	32	28	8	28	76	92	56	80	96	1,102
28-Jun	80	72	20	48	64	28	16	4	104	84	64	48	36	32	32	40	12	44	36	32	96	176	112	92	1,372
29-Jun	96	128	72	48	28	36	88	72	20	36	20	32	88	20	40	48	64	64	80	120	132	120	92	104	1,648
30-Jun	8	44	72	47	49	47	72	68	44	104	108	49	64	56	64	52	28	44	64	48	24	100	88	132	1,475
1-Jul	144	108	68	44	68	56	52	60	32	80	52	64	36	20	40	36	32	60	40	48	0	36	32	24	1,232
2-Jul	124	72	80	88	48	84	28	92	68	20	56	40	32	20	100	32	12	20	40	36	40	28	28	36	1,224
3-Jul	140	52	24	28	48	28	68	40	56	28	44	36	76	48	28	40	64	32	20	40	40	84	94	104	1,262
4-Jul	116	36	24	32	40	60	68	36	36	52	60	56	104	84	52	84	68	76	80	152	200	216	92	72	1,896
5-Jul	88	64	44	48	56	108	32	48	52	24	60	72	76	92	64	100	116	136	112	64	236	88	88	40	1,908
6-Jul	80	32	76	84	60	56	40	68	84	48	68	76	76	68	84	72	108	112	160	128	156	168	132	84	2,120
7-Jul	60	108	96	88	76	124	160	100	108	96	108	68	100	76	88	68	132	136	84	44	72	40	88	68	2,188
8-Jul	76	84	44	76	44	80	48	40	68	44	36	76	64	52	84	88	76	92	112	68	100	64	44	40	1,600
9-Jul	84	96	68	60	40	48	44	60	80	92	72	60	48	40	80	60	60	64	64	32	84	76	100	72	1,584
10-Jul	80	48	28	20	60	68	44	44	44	52	44	24	44	24	32	48	44	64	132	92	60	96	96	92	1,380
11-Jul	52	48	44	60	40	48	68	44	40	44	32	44	20	32	8	28	32	52	52	28	16	28	44	12	916
12-Jul	36	28	44	52	36	44	24	16	36	32	20	12	4	20	36	36	64	72	76	48	72	52	60	48	968
13-Jul	44	32	28	48	68	64	24	12	40	80	20	56	24	36	20	64	20	68	76	52	36	48	60	52	1,072
14-Jul	20	28	36	36	28	48	16	8	24	52	28	36	24	32	24	28	44	76	92	56	36	24	12	20	828
15-Jul	44	56	24	24	52	52	32	36	36	44	32	28	16	24	32	28	36	28	44	32	20	28	16	36	800
16-Jul	32	12	24	12	16	20	32	20	16	32	24	56	48	36	60	84	20	20	36	48	20	24	32	44	768
17-Jul	28	48	28	36	24	12	32	36	12	32	12	28	20	22	24	32	36	20	36	28	20	24	20	40	650
18-Jul	20	0	4	12	8	8	8	0	28	12	20	12	16	12	20	12	20	16	24	20	12	16	24	20	344
19-Jul	20	32	44	16	16	40	4	28	24	16	24	8	0	0	0	20	12	16	24	8	16	4	8	4	384
20-Jul	4	12	4	4	8	8	24	4	12	24	28	20	28	36	44	24	12	28	20	12	32	16	24	0	428
21-Jul	20	4	12	4	12	4	4	0	16	12	8	8	4	20	12	16	0	16	4	4	32	12	20	24	268
22-Jul	20	12	0	4	8	4	12	4	0	0	16	4	12	12	12	20	12	16	12	20	16	20	4	8	248
23-Jul	4	12	8	0	0	0	16	20	0	8	4	4	0	0	8	0	0	8	4	4	8	20	0	12	140
24-Jul	4	12	8	4	0	8	0	12	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
Total	1,608	1,488	1,056	1,095	1,041	1,247	1,100	1,014	1,184	1,196	1,136	1,053	1,108	998	1,132	1,232	1,152	1,412	1,560	1,376	1,692	1,688	1,554	1,480	30,601

Appendix A.6. Right and left bank Nulato River combined expanded summer chum salmon tower counts by hour and date, 2002.

	Hourly Counts (hour ending)																							
Date	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Total
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	8
24-Jun	2	0	0	4	0	10	0	4	0	2	14	0	4	6	0	0	4	28	23	40	4	36	4	0	186
25-Jun	8	0	0	0	4	4	0	12	52	20	24	12	32	20	16	12	8	16	48	36	16	56	24	12	432
26-Jun	52	36	4	60	4	8	8	4	24	4	48	24	24	48	32	44	24	12	16	32	28	52	128	404	1,120
27-Jun	112	228	116	32	36	84	80	98	56	20	52	24	28	96	72	40	48	24	108	108	172	220	164	172	2,190
28-Jun	140	120	32	64	76	56	44	24	164	308	116	96	64	104	44	64	64	136	144	164	224	348	232	200	3,028
29-Jun	208	296	116	140	124	108	188	116	44	76	236	332	156	44	108	128	136	188	272	220	292	268	244	236	4,276
30-Jun	68	156	121	116	124	100	136	113	66	155	224	210	109	132	128	124	132	108	160	108	236	160	136	172	3,291
1-Jul	272	168	124	92	124	92	84	108	52	144	72	92	60	64	116	92	76	96	80	80	40	60	60	64	2,312
2-Jul	176	140	178	216	168	187	108	136	124	64	84	76	68	100	156	80	54	56	408	52	88	96	76	60	2,951
3-Jul	244	88	64	92	96	80	96	76	88	64	56	64	116	108	132	156	156	108	96	120	128	160	162	276	2,826
4-Jul	164	68	52	72	100	84	124	96	108	120	152	184	180	164	200	196	144	192	256	272	468	384	244	188	4,212
5-Jul	208	128	116	136	108	180	80	84	132	84	140	176	152	188	148	192	280	244	208	276	344	296	272	260	4,432
6-Jul	188	84	164	156	124	164	164	156	152	140	156	180	148	184	240	264	340	296	296	336	392	388	244	340	5,296
7-Jul	240	276	200	192	92	204	372	220	256	252	296	216	232	168	212	264	312	304	160	168	108	144	248	160	5,296
8-Jul	260	168	156	172	96	132	112	76	144	128	124	168	136	212	200	172	160	156	236	144	260	132	72	220	3,836
9-Jul	280	240	224	152	124	116	132	164	148	228	168	164	104	124	136	144	192	164	156	156	220	168	184	168	4,056
10-Jul	140	96	84	68	128	112	104	76	80	104	92	96	116	148	148	148	176	228	352	264	160	220	216	180	3,536
11-Jul	112	104	116	120	108	124	128	104	108	112	76	88	52	76	40	56	108	116	128	112	48	68	84	92	2,280
12-Jul	92	80	88	104	76	80	48	44	100	44	40	48	64	68	104	116	200	188	176	132	196	124	172	132	2,516
13-Jul	128	92	64	80	152	136	68	42	56	120	96	124	80	96	108	168	56	148	160	96	112	116	144	152	2,594
14-Jul	95	84	66	94	90	132	63	52	58	88	79	81	73	90	97	99	112	128	180	120	144	72	64	40	2,202
15-Jul	100	100	44	100	84	136	76	88	84	72	52	44	52	72	80	56	88	108	108	88	36	52	56	64	1,840
16-Jul	76	44	48	36	52	36	72	32	28	100	84	116	136	104	160	192	56	44	60	72	48	64	76	92	1,828
17-Jul	72	84	52	100	68	60	68	48	36	56	36	60	40	34	60	60	68	64	60	72	56	60	52	60	1,426
18-Jul	48	28	36	28	26	28	36	0	64	20	44	40	32	40	48	36	80	56	72	64	44	40	52	68	1,030
19-Jul	56	60	64	52	48	44	28	42	28	32	32	20	4	0	4	44	40	40	44	24	24	16	28	32	806
20-Jul	28	20	28	4	12	16	32	24	36	68	68	52	72	56	76	60	56	44	48	36	56	44	40	16	992
21-Jul	36	12	24	16	12	8	4	4	28	12	12	24	16	44	32	32	0	32	16	36	56	36	32	40	564
22-Jul	32	24	4	4	16	24	20	24	4	0	20	20	20	36	20	32	24	24	32	24	20	28	8	16	476
23-Jul	16	20	8	4	4	4	32	48	16	16	8	4	4	16	12	4	4	12	24	4	8	40	8	16	332
24-Jul	4	12	8	4	0	8	0	12	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
Total	3,657	3,055	2,401	2,510	2,276	2,557	2,508	2,127	2,340	2,661	2,701	2,835	2,378	2,642	2,929	3,075	3,198	3,360	4,131	3,456	4,028	3,948	3,526	3,932	72,230

Appendix Table B.1.

Historic daily and cumulative Nulato River chinook salmon escapement passage estimates, and cumulative proportions 1994-2002.

	1994			1995			1996			1997		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun										0	0	0.00
21-Jun										0	0	0.00
22-Jun										0	0	0.00
23-Jun										20	20	0.00
24-Jun										16	36	0.01
25-Jun										16	52	0.01
26-Jun				4	4	0.00	12	12	0.02	32	84	0.02
27-Jun				4	8	0.01	12	24	0.03	52	136	0.03
28-Jun				0	8	0.01	8	32	0.04	84	220	0.05
29-Jun				0	8	0.01	4	36	0.05	136	356	0.07
30-Jun				0	8	0.01	8	44	0.06	144	500	0.10
1-Jul				8	16	0.01	12	56	0.07	144	644	0.13
2-Jul				0	16	0.01	8	64	0.08	172	816	0.17
3-Jul				12	28	0.02	13	77	0.10	184	1,000	0.21
4-Jul	0	0	0.00	24	52	0.04	19	96	0.13	344	1,344	0.28
5-Jul	3	3	0.00	64	116	0.08	24	120	0.16	336	1,680	0.35
6-Jul	6	9	0.01	44	160		48	168	0.22	352	2,032	0.42
7-Jul	72	81	0.05	36	196	0.14	40	208	0.28	308	2,340	0.49
8-Jul	72	153	0.09	8	204	0.14	8	216	0.29	368	2,708	0.56
9-Jul	60	213	0.12	16	220	0.16	12	228	0.30	212	2,920	0.61
10-Jul	216	429	0.24	52	272	0.19	108	336	0.44	344	3,264	0.68
11-Jul	208	637	0.35	100	372	0.26	36	372	0.49	128	3,392	0.71
12-Jul	120	757	0.42	52	424	0.30	80	452	0.60	152	3,544	0.74
13-Jul	84	841	0.47	112	536	0.38	52	504	0.67	290	3,834	0.80
14-Jul	92	933	0.52	84	620	0.44	48	552	0.73	108	3,942	0.82
15-Jul	100	1,033	0.58	56	676	0.48	16	568	0.75	252	4,194	0.87
16-Jul	112	1,145	0.64	60	736	0.52	36	604	0.80	184	4,378	0.91
17-Jul	92	1,237	0.69	164	900	0.64	64	668	0.88	108	4,486	0.93
18-Jul	96	1,333	0.74	56	956	0.68	16	684	0.90	52	4,538	0.94
19-Jul	100	1,433	0.80	56	1,012	0.72	16	700	0.93	68	4,606	0.96
20-Jul	104	1,537	0.86	76	1,088	0.77	24	724	0.96	116	4,722	0.98
21-Jul	44	1,581	0.88	92	1,180	0.84	24	748	0.99	44	4,766	0.99
22-Jul	51	1,632	0.91	56	1,236	0.88	8	756	1.00	45	4,811	1.00
23-Jul	40	1,672	0.93	28	1,264	0.90	0	756	1.00			
24-Jul	43	1,715	0.96	72	1,336	0.95	0	756	1.00			
25-Jul	28	1,743	0.97	48	1,384	0.98						
26-Jul	12	1,755	0.98	28	1,412	1.00						
27-Jul	8	1,763	0.98									
28-Jul	32	1,795	1.00									
29-Jul												
30-Jul												
31-Jul												
	1,795			1,412			756			4,811		

(Continued)

	1998 [a]			1999[b]			2000			2001		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun												
21-Jun												
22-Jun	0	0	0.00									
23-Jun	0	0	0.00									
24-Jun	8	8	0.01	0	0	0.00	0	0	0.00			
25-Jun	4	12	0.01	0	0	0.00	0	0	0.00			
26-Jun	4	16	0.01	0	0	0.00	0	0	0.00			
27-Jun	28	44	0.03	0	0	0.00	0	0	0.00			
28-Jun	88	132	0.09	0	0	0.00	28	28	0.03			
29-Jun	20	152	0.10	0	0	0.00	16	44	0.05			
30-Jun	12	164	0.11	0	0	0.00	20	64	0.07			
1-Jul	0	164	0.11	0	0	0.00	0	64	0.07			
2-Jul	20	184	0.12	0	0	0.00	0	64	0.07			
3-Jul	0	184	0.12	8	8	0.00	20	84	0.09			
4-Jul	0	184	0.12	48	56	0.03	104	188	0.21			
5-Jul	0	184	0.12	16	72	0.04	104	292	0.32			
6-Jul	36	220	0.15	52	124	0.06	68	360	0.39			
7-Jul	4	224	0.15	104	228	0.12	112	472	0.52			
8-Jul	84	308	0.20	94	322	0.17	68	540	0.59			
9-Jul	60	368	0.24	132	454	0.23	132	672	0.73			
10-Jul	84	452	0.30	154	608	0.31	16	688	0.75			
11-Jul	44	496	0.33	116	724	0.37	36	724	0.79			
12-Jul	92	588	0.39	128	852	0.44	72	796	0.87			
13-Jul	102	690	0.46	72	924	0.48	64	860	0.94			
14-Jul	184	874	0.58	76	1,000	0.51	28	888	0.97			
15-Jul	156	1,030	0.68	128	1,128	0.58	0	888	0.97			
16-Jul	76	1,106	0.74	136	1,264	0.65	0	888	0.97			
17-Jul	20	1,126	0.75	94	1,358	0.70	0	888	0.97			
18-Jul	76	1,202	0.80	64	1,422	0.73	0	888	0.97			
19-Jul	78	1,280	0.85	80	1,502	0.77	0	888	0.97			
20-Jul	72	1,352	0.90	82	1,584	0.82	0	888	0.97			
21-Jul	60	1,412	0.94	70	1,654	0.85	0	888	0.97			
22-Jul	72	1,484	0.99	59	1,713	0.88	0	888	0.97			
23-Jul	20	1,504	1.00	48	1,761	0.91	0	888	0.97			
24-Jul				20	1,781	0.92	8	896	0.98			
25-Jul				40	1,821	0.94	8	904	0.99			
26-Jul				34	1,855	0.95	4	908	0.99			
27-Jul				28	1,883	0.97	0	908	0.99			
28-Jul				24	1,907	0.98	8	916	1.00			
29-Jul				36	1,943	1.00						
30-Jul												
31-Jul												
	1,504			1,943			916					

(Continued)

	2002		
Date	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun			
16-Jun			
17-Jun			
18-Jun			
19-Jun			
20-Jun			
21-Jun			
22-Jun			
23-Jun	0	0	0.00
24-Jun	0	0	0.00
25-Jun	8	8	0.00
26-Jun	8	16	0.01
27-Jun	60	76	0.03
28-Jun	58	134	0.05
29-Jun	96	230	0.09
30-Jun	132	362	0.13
1-Jul	52	414	0.15
2-Jul	62	476	0.18
3-Jul	64	540	0.20
4-Jul	116	656	0.24
5-Jul	96	752	0.28
6-Jul	240	992	0.37
7-Jul	200	1,192	0.44
8-Jul	106	1,298	0.48
9-Jul	164	1,462	0.54
10-Jul	204	1,666	0.62
11-Jul	132	1,798	0.67
12-Jul	180	1,978	0.73
13-Jul	154	2,132	0.79
14-Jul	96	2,228	0.83
15-Jul	76	2,304	0.85
16-Jul	64	2,368	0.88
17-Jul	44	2,412	0.89
18-Jul	32	2,444	0.91
19-Jul	36	2,480	0.92
20-Jul	40	2,520	0.93
21-Jul	60	2,580	0.96
22-Jul	40	2,620	0.97
23-Jul	56	2,676	0.99
24-Jul	20	2,696	1.00
25-Jul			
26-Jul			
27-Jul			
28-Jul			
29-Jul			
30-Jul			
31-Jul			
	2,696		

[a] Missed counting periods were interpolated for summer chum and chinook salmon where sufficient data existed.

[b] High water deterred counting in 2001 except for a few days, which are not reported.

Appendix Table B.2.

Historic daily and cumulative Nulato River summer chum salmon escapement passage estimates, and cumulative proportions 1994-2002.

	1994			1995			1996			1997		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun										64	64	0.00
21-Jun				452	452	0.00	700	700	0.01	168	232	0.00
22-Jun				692	1,144	0.00	3,684	4,384	0.03	524	756	0.00
23-Jun				1,056	2,200	0.01	6,612	10,996	0.08	2,344	3,100	0.02
24-Jun				1,880	4,080	0.02	6,680	17,676	0.14	3,816	6,916	0.04
25-Jun				1,612	5,692	0.02	7,196	24,872	0.19	4,856	11,772	0.07
26-Jun				2,044	7,736	0.03	6,792	31,664	0.24	4,592	16,364	0.10
27-Jun				10,884	18,620	0.08	2,082	33,746	0.26	3,868	20,232	0.13
28-Jun				5,196	23,816	0.10	3,812	37,558	0.29	4,816	25,048	0.16
29-Jun	2,001	2,001	0.01	9,184	33,000	0.14	5,542	43,100	0.33	6,972	32,020	0.20
30-Jun	8,355	10,356	0.07	7,188	40,188	0.17	7,271	50,371	0.39	7,916	39,936	0.25
1-Jul	7,898	18,254	0.12	9,716	49,904	0.21	7,104	57,475	0.44	7,656	47,592	0.30
2-Jul	9,604	27,858	0.19	15,110	65,014	0.27	6,076	63,551	0.49	8,900	56,492	0.36
3-Jul	7,601	35,459	0.24	9,068	74,082	0.31	3,624	67,175	0.52	8,596	65,088	0.41
4-Jul	6,708	42,167	0.28	11,064	85,146	0.36	5,484	72,659	0.56	12,432	77,520	0.49
5-Jul	10,188	52,355	0.35	12,700	97,846	0.41	8,320	80,979	0.62	11,432	88,952	0.56
6-Jul	8,092	60,447	0.41	18,504	116,350	0.49	4,968	85,947	0.66	10,748	99,700	0.63
7-Jul	7,008	67,455	0.45	10,704	127,054	0.54	7,460	93,407	0.72	11,368	111,068	0.70
8-Jul	4,704	72,159	0.49	11,960	139,014	0.59	5,728	99,135	0.76	9,944	121,012	0.77
9-Jul	9,232	81,391	0.55	14,008	153,022	0.65	3,664	102,799	0.79	4,664	125,676	0.79
10-Jul	10,744	92,135	0.62	14,004	167,026	0.71	7,104	109,903	0.85	7,388	133,064	0.84
11-Jul	8,776	100,911	0.68	13,684	180,710	0.76	4,144	114,047	0.88	3,756	136,820	0.87
12-Jul	7,327	108,238	0.73	11,356	192,066	0.81	4,224	118,271	0.91	4,153	140,973	0.89
13-Jul	6,931	115,169	0.77	8,660	200,726	0.85	3,888	122,159	0.94	3,558	144,531	0.91
14-Jul	6,535	121,704	0.82	5,172	205,898	0.87	3,132	125,291	0.97	2,256	146,787	0.93
15-Jul	6,140	127,844	0.86	4,232	210,130	0.89	1,920	127,211	0.98	3,016	149,803	0.95
16-Jul	4,440	132,284	0.89	6,728	216,858	0.92	916	128,127	0.99	3,016	152,819	0.97
17-Jul	3,211	135,495	0.91	6,464	223,322	0.94	676	128,803	0.99	2,392	155,211	0.98
18-Jul	3,332	138,827	0.93	3,716	227,038	0.96	520	129,323	1.00	924	156,135	0.99
19-Jul	2,215	141,042	0.95	4,400	231,438	0.98	371	129,694	1.00	1,080	157,215	0.99
20-Jul	1,712	142,754	0.96	3,368	234,806	0.99				760	157,975	1.00
21-Jul	1,208	143,962	0.97	2,084	236,890	1.00				196	158,171	1.00
22-Jul	2,808	146,770	0.99									
23-Jul	1,992	148,762	1.00									
24-Jul												
25-Jul												
26-Jul												
27-Jul												
28-Jul												
29-Jul												
30-Jul												
31-Jul												
Total	148,762			236,890			129,694			158,171		

(Continued)

	1998 [a]			1999[b]			2000			2001		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun												
21-Jun												
22-Jun	0	0	0.00									
23-Jun	4	4	0.00									
24-Jun	36	40	0.00	0	0	0.00	4	4	0.00			
25-Jun	56	96	0.00	0	0	0.00	148	152	0.01			
26-Jun	180	276	0.01	0	0	0.00	284	436	0.01			
27-Jun	588	864	0.02	0	0	0.00	240	676	0.02			
28-Jun	770	1,634	0.03	0	0	0.00	364	1,040	0.04			
29-Jun	722	2,356	0.05	0	0	0.00	672	1,712	0.06			
30-Jun	716	3,072	0.06	0	0	0.00	200	1,912	0.07			
1-Jul	708	3,780	0.07	24	24	0.00	244	2,156	0.07			
2-Jul	496	4,276	0.08	12	36	0.00	220	2,376	0.08			
3-Jul	1,092	5,369	0.10	256	292	0.01	1,256	3,632	0.12			
4-Jul	1,688	7,057	0.14	720	1,012	0.03	2,940	6,572	0.22			
5-Jul	2,284	9,342	0.18	1,964	2,976	0.10	2,564	9,136	0.31			
6-Jul	2,880	12,222	0.23	2,220	5,196	0.17	2,104	11,240	0.38			
7-Jul	1,584	13,806	0.27	2,876	8,072	0.27	1,472	12,712	0.43			
8-Jul	2,752	16,558	0.32	2,368	10,440	0.34	1,168	13,880	0.47			
9-Jul	2,192	18,750	0.36	1,716	12,156	0.40	1,468	15,348	0.52			
10-Jul	4,768	23,518	0.45	2,122	14,278	0.47	1,004	16,352	0.56			
11-Jul	2,712	26,230	0.50	2,096	16,374	0.54	1,916	18,268	0.62			
12-Jul	2,292	28,522	0.55	2,092	18,466	0.61	2,056	20,324	0.69			
13-Jul	4,384	32,906	0.63	1,140	19,606	0.65	1,596	21,920	0.75			
14-Jul	4,860	37,766	0.73	1,008	20,614	0.68	968	22,888	0.78			
15-Jul	3,804	41,570	0.80	1,296	21,910	0.72	881	23,769	0.81			
16-Jul	2,780	44,350	0.85	1,332	23,242	0.77	796	24,565	0.84			
17-Jul	1,288	45,638	0.88	1,204	24,446	0.81	711	25,276	0.86			
18-Jul	1,856	47,494	0.91	1,100	25,546	0.84	623	25,899	0.88			
19-Jul	734	48,228	0.93	912	26,458	0.87	533	26,432	0.90			
20-Jul	1,340	49,568	0.95	650	27,108	0.90	455	26,887	0.92			
21-Jul	1,144	50,712	0.97	582	27,690	0.91	360	27,247	0.93			
22-Jul	816	51,528	0.99	513	28,203	0.93	273	27,520	0.94			
23-Jul	513	52,041	1.00	444	28,647	0.95	376	27,896	0.95			
24-Jul				420	29,067	0.96	308	28,204	0.96			
25-Jul				388	29,455	0.97	372	28,576	0.97			
26-Jul				311	29,766	0.98	330	28,906	0.98			
27-Jul				233	29,999	0.99	300	29,206	0.99			
28-Jul				156	30,155	1.00	160	29,366	1.00			
29-Jul				128	30,283	1.00						
30-Jul												
31-Jul												
Total	52,041			30,283			29,366					

(Continued)

	2002		
Date	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun			
16-Jun			
17-Jun			
18-Jun			
19-Jun			
20-Jun			
21-Jun			
22-Jun			
23-Jun	8	8	0.00
24-Jun	186	194	0.00
25-Jun	432	626	0.01
26-Jun	1,120	1,746	0.02
27-Jun	2,190	3,936	0.05
28-Jun	3,028	6,964	0.10
29-Jun	4,276	11,240	0.16
30-Jun	3,291	14,531	0.20
1-Jul	2,312	16,843	0.23
2-Jul	2,951	19,794	0.27
3-Jul	2,826	22,620	0.31
4-Jul	4,212	26,832	0.37
5-Jul	4,432	31,264	0.43
6-Jul	5,296	36,560	0.51
7-Jul	5,296	41,856	0.58
8-Jul	3,836	45,692	0.63
9-Jul	4,056	49,748	0.69
10-Jul	3,536	53,284	0.74
11-Jul	2,280	55,564	0.77
12-Jul	2,516	58,080	0.80
13-Jul	2,594	60,674	0.84
14-Jul	2,202	62,876	0.87
15-Jul	1,840	64,716	0.90
16-Jul	1,828	66,544	0.92
17-Jul	1,426	67,970	0.94
18-Jul	1,030	69,000	0.96
19-Jul	806	69,806	0.97
20-Jul	992	70,798	0.98
21-Jul	564	71,362	0.99
22-Jul	476	71,838	0.99
23-Jul	332	72,170	1.00
24-Jul	60	72,230	1.00
25-Jul			
26-Jul			
27-Jul			
28-Jul			
29-Jul			
30-Jul			
31-Jul			
	72,230		

[a] Missed counting periods were interpolated for summer chum and chinook salmon where sufficient data existed.

[b] High water deterred counting in 2001 except for a

Appendix C. Nulato River summer chum salmon age and sex composition by stratum and weighted season total, 2002.

Strata Dates [a]	Sample Size			Brood Year and (Age Group) 1999 (0.2)	1998 (0.3)	1997 (0.4)	1996 (0.5)	Total
June 23-July 5	104	Males	No. in Escapement	0	13,674	7,998	0	21,672
			Percent of Sample	0	51.0	29.8	0.0	80.8
		Females	No. in Escapement	0	3,612	1,548	0	5,160
			Percent of Sample	0	13.5	5.8	0.0	19.2
		Subtotal	No. in Escapement	0	17,286	9,546	0	26,832
			Percent of Sample	0.0	64.4	35.6	0.0	100.0
July 6-10	120	Males	No. in Escapement	0	9,166	7,447	955	17,568
			Percent of Sample	0	40.0	32.5	4.2	76.7
		Females	No. in Escapement	0	2,674	2,674	0	5,348
			Percent of Sample	0	11.7	11.7	0.0	23.3
		Subtotal	No. in Escapement	0	11,840	10,121	955	22,916
			Percent of Sample	0.0	51.7	44.2	4.2	100.0
July 11-24	152	Males	No. in Escapement	148	8,431	4,733	148	13,460
			Percent of Sample	0.7	37.5	21.1	0.7	59.9
		Females	No. in Escapement	0	6,951	1,923	148	9,022
			Percent of Sample	0	30.9	8.6	0.7	40.1
		Subtotal	No. in Escapement	148	15,382	6,656	296	22,482
			Percent of Sample	0.7	68.4	29.6	1.3	100.0
Seasonal	376	Males	No. in Escapement	148	31,271	20,178	1,103	52,700
			Percent of Sample	0.2	43.3	27.9	1.5	73.0
		Females	No. in Escapement	0	13,237	6,145	148	19,530
			Percent of Sample	0.0	18.3	8.5	0.2	27.0
		Total	No. in Escapement	148	44,508	26,323	1,251	72,230
			Percent of Sample	0.2	61.6	36.4	1.7	100.0

[a] Because of the lack of samples early in the season, three strata were used to describe age and sex composition in 2002.