

FISHERY DATA SERIES NO. 91

CREEL AND ESCAPEMENT  
STATISTICS FOR THE NAKNEK RIVER,  
ALASKA, DURING 1988<sup>1</sup>

By

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TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES.....	ii
LIST OF FIGURES.....	iv
LIST OF APPENDIX TABLES.....	v
ABSTRACT.....	1
INTRODUCTION.....	2
METHODS.....	2
Creel Survey.....	2
Spawning Escapement Surveys.....	8
Size, Sex, and Age Sampling.....	8
RESULTS.....	9
Creel Statistics.....	9
Spawning Escapement.....	14
Size, Sex, and Age Compositions.....	14
DISCUSSION.....	26
LITERATURE CITED.....	32
APPENDIX.....	34

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Estimated effort (angler-hours), by temporal component, for the sport fishery in the lower Naknek River, 1988..	10
2. Estimated catch and harvest of chinook salmon by the sport fishery in the lower Naknek River, 1988.....	11
3. Estimated catch and harvest of coho salmon by the sport fishery in the lower Naknek River, 1988.....	12
4. Estimated catch and harvest of rainbow trout by the sport fishery in the lower Naknek River, 1988.....	13
5. Estimated effort (angler-hours), by temporal component and period, for the sport fishery in the upper Naknek River, 1988.....	15
6. Estimated catch and harvest rates (fish per angler-hour), by species and temporal component, by the sport fishery in the upper Naknek River, 1988.....	16
7. Estimated catch and harvest, by species, by the sport fishery in the upper Naknek River, 1988.....	18
8. Catch and harvest, by species, by the sport fishery in the lower and upper sections of the Naknek River, 1988.	20
9. Estimates of chinook salmon escapement from aerial surveys in the Naknek River drainage, 1988.....	21
10. Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, sampled from the sport harvest from the Naknek River, 1988.....	22
11. Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, sampled from the Big Creek and Naknek River escapements, 1988..	23
12. Mean lengths (millimeters) and weights (kilograms) of coho salmon, by sex and age group, sampled from the sport harvest from the Naknek River, 1988.....	24
13. Mean lengths (millimeters) and weights (kilograms) of rainbow trout, by age group, sampled (1) using sport gear (catch) and (2) from the sport harvest in the upper river from the Naknek River, 1988.....	25

LIST OF TABLES (Continued)

<u>Table</u>	<u>Page</u>
14. Harvests and escapements of chinook salmon returning to the Naknek River, 1967-1988.....	28
15. Harvests of coho salmon and rainbow trout by the sport fishery in the Naknek River, 1977-1988.....	29
16. Effort, harvest, catch, and catch rate statistics for anglers fishing the upper Naknek River during the period 15 August through 15 October 1978, 1981, 1983, 1984, 1987, and 1988. Length statistics of harvested rainbow trout during these years are also presented....	30

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. The Naknek River study site.....	3
2. Harvests of chinook salmon (1967-1988) and rainbow trout (1977-1988) by the sport fishery in the Naknek River.....	27
3. Effort, catch and harvest statistics and mean length with 95 percent confidence intervals of rainbow trout harvested in the fall (15 August-15 October) fishery in the Naknek River.....	31

LIST OF APPENDIX TABLES

<u>Appendix Table</u>	<u>Page</u>
1. Angler counts in the lower Naknek River sport fishery, 1988.....	35
2. Angler counts for the sport fishery in the upper Naknek River, 1988.....	36
3. Summary of daily angler effort (angler-hours) and catch rates (CPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988.....	38
4. Summary of daily angler effort (angler-hours) and harvest rates (HPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988.....	40
5. Summary of daily angler effort (angler-hours) and catch rates (CPUE, fish per angler-hour) for rainbow trout, coho, sockeye, and pink salmon, and Arctic grayling from angler interviews in the sport fishery in the upper Naknek River, 1988.....	42
6. Summary of daily angler effort (angler-hours) and harvest rates (HPUE, fish per angler-hour) for rainbow trout, coho, chinook, and sockeye salmon, and Arctic grayling from angler interviews in the sport fishery in the upper Naknek River, 1988.....	43





## ABSTRACT

An estimated 100,946 hours of effort were expended by recreational anglers fishing the Naknek River from 1 June through 13 October 1988. Anglers caught (landed) and harvested (kept) an estimated 6,396 and 5,380 (84 percent) chinook salmon *Oncorhynchus tshawytscha*, 4,324 and 4,065 (94 percent) coho salmon *Oncorhynchus kisutch*, and 6,633 and 1,187 (18 percent) rainbow trout *Oncorhynchus mykiss*, respectively. Age 1.4 chinook salmon (58 percent), age 2.1 coho salmon (77 percent), and age 4 rainbow trout (37 percent) dominated the harvest. The spawning escapement of chinook salmon, as determined by aerial survey counts of live fish expanded for missed areas, was estimated to be 11,750 fish. The spawning escapement was comprised primarily of age 1.3 and 1.4 fish. Catch, harvest, and size statistics collected from rainbow trout harvested during the fall (15 August to 15 October) fishery in the Naknek River suggest abundance of older larger fish may be declining.

KEY WORDS: chinook salmon, *Oncorhynchus tshawytscha*, sockeye salmon, *Oncorhynchus nerka*, coho salmon, *Oncorhynchus kisutch*, rainbow trout, *Oncorhynchus mykiss*, sport harvest, sport effort, creel survey, escapement, Naknek River, Bristol Bay.

## INTRODUCTION

The recreational fishery on the Naknek River (Figure 1) is the largest and fastest growing sport fishery in both effort and harvest in the Bristol Bay area (Mills 1988). Historically, the fishery has targeted chinook *Oncorhynchus tshawytscha* and coho salmon *O. kisutch* in the lower river and resident fishes, particularly rainbow trout *O. mykiss*, in the upper river. Sport effort and harvest in the Naknek river has increased during recent years (Mills 1988). In response to these increases, the Alaska Department of Fish and Game (ADF&G), Division of Sport Fish, initiated a creel survey of the sport fishery for chinook salmon in 1986 (Minard 1987). The survey was expanded in 1987 (Minard and Brookover 1988) to include the fisheries for other anadromous and resident species. The survey is used to estimate sport fishing effort, catch (fish landed), and harvest (fish retained) and the age, sex, and size compositions of the harvest.

The objectives of this report are to present:

1. estimates of the number of angler-hours of sport fishing effort expended on the Naknek River from the outlet of Naknek Lake to Smelt Creek from 8 June to 15 October 1988;
2. estimates of the numbers of chinook and coho salmon and rainbow trout caught and harvested on the Naknek River from the outlet of Naknek Lake to Smelt Creek from 8 June to 15 October 1988;
3. estimates of the age and sex compositions and mean length-at-age statistics of chinook and coho salmon and rainbow harvested in the Naknek River from the outlet of Naknek Lake to Smelt Creek from 8 June to 15 October 1988;
4. estimates of the numbers of chinook salmon spawning in the Naknek River drainage during 1988; and,
5. estimates of the age and sex compositions and mean length-at-age statistics of the chinook salmon spawning escapement in the Naknek River drainage during 1988.

Surveys of the sport fishery for chinook salmon in the Naknek River were most recently conducted in 1975 (Gwartney 1976), 1978 (Gwartney 1979), 1979 (Gwartney 1980), 1986 (Minard 1987), and 1987 (Minard and Brookover 1988). Surveys of the sport fishery for rainbow trout in the Naknek River were most recently conducted in 1978, 1981, 1983, and 1984 (Gwartney 1985), and 1987 (Minard and Brookover 1988).

## METHODS

### Creel Survey

Anglers fishing the Naknek River during 1988 were permitted a daily bag and possession limit, from 1 May to 31 July, of three chinook salmon, only one of

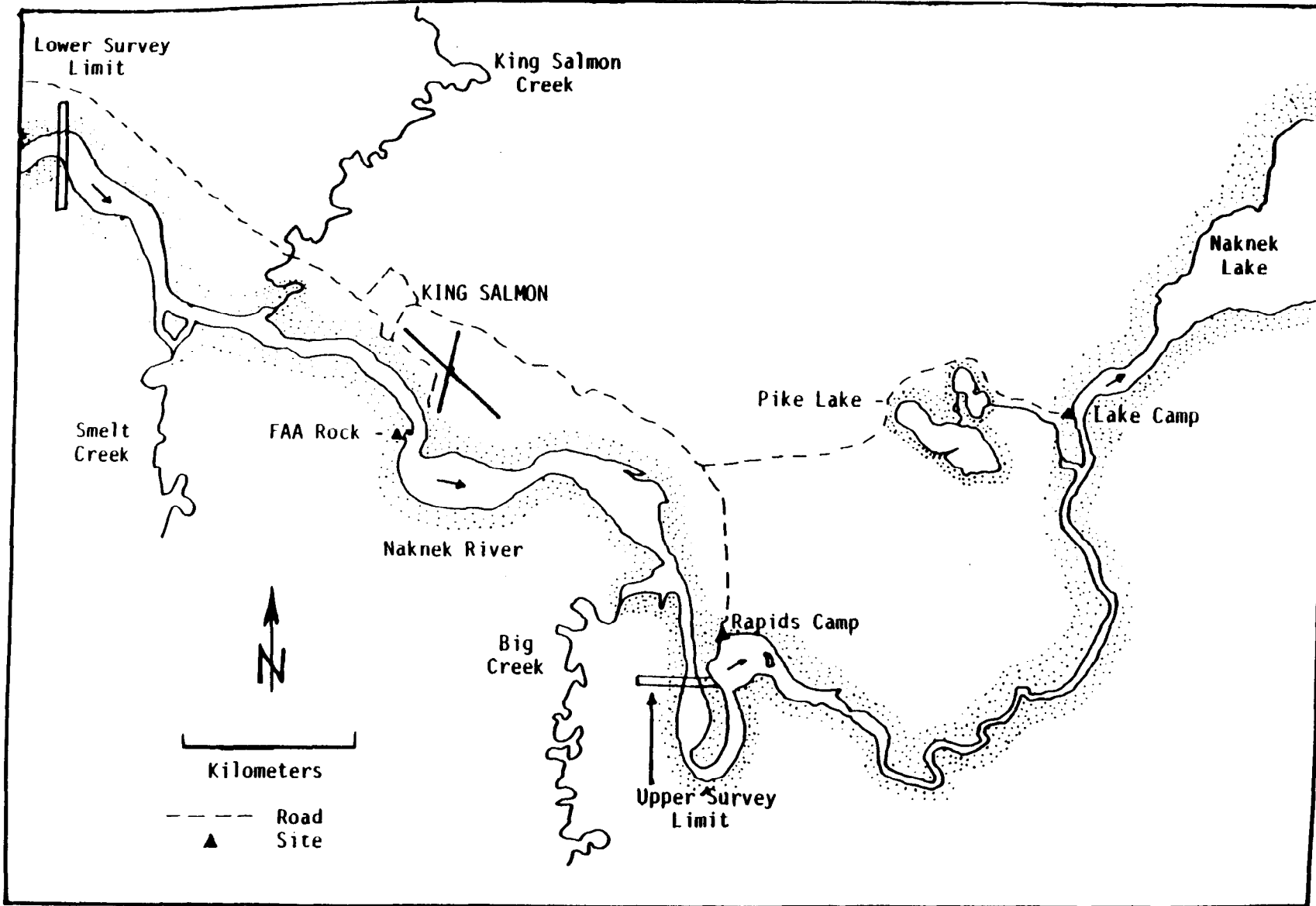


Figure 1. The Naknek River study site.

which could be greater than 71 cm (28 in) in length (ADF&G 1988). No chinook salmon were permitted to be retained during the balance of the year. Five other salmon (sockeye *O.nerka*, chum *O.keta*, coho, or pink *O. gorbuscha*) with no size limit, and two rainbow trout, only one of which could be greater than 51 cm (20 in), were also allowed. Only unbaited artificial lures were permitted in the Naknek River drainage from 1 March through 14 November. No fishing above the ADF&G markers at Rapids Camp was allowed from 10 April through 7 June, to protect spawning rainbow trout.

The creel survey was conducted in two reaches of the river (Figure 1). The upper area starts at the outlet of Naknek Lake and extends downstream 19.3 km (Figure 1). Anglers fishing this area primarily target rainbow trout, Dolly Varden *Salvelinus malma*, and Arctic grayling *Thymallus arcticus*. The lower survey area extends from the downstream boundary of the upper study area 12.9 km to a point downstream of Smelt Creek. Anglers fishing in this area primarily target salmon.

Roving creel surveys (Neuhold and Lu 1957) using a stratified, random sampling design were used to count anglers, conduct angler interviews, and sample the sport harvest in each study area. Counts of anglers were used to estimate fishing effort in units of angler-hours. Interviews of anglers provided estimates of catch (fish landed) and harvest (fish kept) rates (fish per angler-hour).

The fishery in the lower survey area primarily targets chinook and coho salmon. Chinook salmon first enter the Naknek River in late May and the majority of the run typically migrates through the lower section of river during a 4 to 5 week period commencing in mid-June. Coho salmon first enter the river in mid-July and continue to be caught by anglers through September. To reflect changes in salmon abundance, the study period (1 June through 11 September) in the lower survey area was stratified into 12 temporal components: (1) 1 June through 30 June; (2) 1 July through 7 July; (3) 8 July through 14 July; (4) 15 July through 21 July; (5) 22 July through 28 July; (6) 29 July through 31 July; (7) 1 August through 7 August, (8) 8 August through 14 August; (9) 15 August through 21 August; (10) 22 August through 28 August; (11) 29 August through 31 August; and (12) 1 September through 11 September. For the first six temporal components, the fishing day was defined as 18 hours in duration (0600 to 2400 hrs) with each day being divided into three 6-hour time strata: period A (0600-1159 hrs); period B (1200-1759 hrs); and period C (1800-2400 hrs). For temporal components 7 through 12, the fishing day was defined as 15 hours in duration (0700 to 2200 hrs) with each day divided into three 5-hour time strata as follows: period A (0700-1159 hrs); period B (1200-1659 hrs); and period C (1700-2200 hrs).

The fishery in the upper survey area primarily targets rainbow trout and has a period of high angler effort in June, followed by a period of low effort through the summer, followed by another period of high effort in the fall. Effort levels, thought to reflect seasonal availability of rainbow trout (Burger and Gwartney 1986), were used to define temporal components in the upper survey area. The survey was scheduled from 8 June through 15 October and was divided into five temporal components: (1) 9 June through 6 July;

(2) 7 July through 31 July; (3) 1 August through 11 September; (4) 12 September through 2 October; and (5) 3 October through 13 October. During the first three temporal components, the angler day and daily time strata were defined as period A (0600-1159 hrs), period B (1200-1759 hrs), and C (1800-2400 hrs). During the fourth and fifth temporal components, the length of the angler day was decreased to 12 hours and each day was divided into two time strata: period A (0800-1359 hrs) and period B (1400-2000 hrs).

In both survey areas, angler effort and catch and harvest were estimated separately for each temporal component. Shifts in sampling intensity between the upper and lower areas were intended to reflect seasonal changes in angling effort. Specific periods to be sampled within each temporal component were randomly selected without replacement from those available.

In both survey areas, one count was conducted immediately prior to and after a randomly selected 4-hour survey period. To conduct a count, a boat was driven through the survey area at a near constant speed and all anglers that were actively fishing were counted. The count was completed within 40 to 60 minutes and was considered an instantaneous count (Neuhold and Lu 1957). It was not possible to differentiate between guided and unguided anglers.

Interviews were conducted during the remaining time between the counts. Most anglers were interviewed as they exited the fishery (completed-trip interviews). Additionally, some anglers were interviewed while they were still fishing (incomplete-trip interviews). All interviews were of individual anglers. For each angler interviewed, the following information was recorded: the number of hours fished, the number of fish in the angler's possession by species, the number of fish released by species, whether the angler was guided or not guided, the type of gear used (fly, spin, or bait), and the angler's state or country of residency.

Effort in the lower river was estimated by period and week within each temporal component using a random sampling design. Effort ( $E_j$ ) was estimated within each temporal component as follows:

$$\hat{E}_j = \sum_{k=1}^w \sum_{i=1}^p H_{ik} \bar{x}_{ik}, \quad [1]$$

where:

$H_{ik}$  = the total number of hours of possible fishing time in period  $i$  during week  $k$  of component  $j$ ,

$\bar{x}_{ik}$  = the mean angler count for period  $i$  during week  $k$ ,

$w$  = the week  $k$  during component  $j$ , and

$p$  = the period  $i$  of week  $k$  during component  $j$ .

The variance of  $\hat{E}_j$  was estimated as follows:

$$V(\hat{E}_j) = \sum_{i=1}^p [H_{ik}^2 (s_k^2/m_{ik})] \quad [2]$$

where:

$$s_k^2 = [ \sum_{i=1}^{d_1} (y_{ilk} - \bar{Y}_{ik})^2 ] / (m_{ik} - 1) \quad [3]$$

and

$y_{ilk}$  = an angler count made during day l, period i, and week k, of component j

$\bar{Y}_{ik}$  = the mean angler count for period i and week k of component j, and

$m_{ik}$  = the number of angler counts conducted during period i and week k of component j.

Effort in the upper river study area was estimated for each temporal component of the fishery using a stratified random sampling approach by period only. Within each temporal component, effort ( $E_j$ ) was estimated as follows:

$$\hat{E}_j = \sum_{i=1}^p H_i \bar{x}_i, \quad [4]$$

where:

$H_i$  = the total number of hours of possible fishing time in period i of component j,

$\bar{x}_i$  = the mean angler count for period over all weeks, and

p = the period i of component j.

The variance of  $\hat{E}_j$  was estimated as follows:

$$V(\hat{E}_j) = \sum_{i=1}^p [H_i^2 (s^2/m_i)], \quad [5]$$

where:

$$s^2 = [ \sum_{k=1}^w \sum_{i=1}^p (y_{k1} - \bar{Y}_i)^2 ] / (m_i - 1) \quad [6]$$

and

$y_{ik}$  = an angler count made during day  $l$  and period  $i$  of component  $j$ ,

$\bar{Y}_i$  = the mean angler count for period  $i$  of component  $j$ ,

$m_i$  = the number of angler counts conducted during period  $i$  of component  $j$ , and

$w$  = the week  $k$  of component  $j$ .

The total number of angler-hours of effort for the season was estimated by summing the estimates of effort for each of the temporal components. Because these are independent estimates, the variance for the total number of angler-hours of effort is the sum of the individual variances for each temporal component estimate.

Mean catch per unit effort (catch per angler-hour) was estimated for each temporal component as:

$$\overline{\text{CPUE}}_j = \frac{\sum_{h=1}^{m_j} c_{jh}}{E_j} / \frac{\sum_{h=1}^{m_j} e_{jh}}{E_j} \quad [7]$$

where:

$m_j$  = the number of anglers interviewed during component  $j$ ,

$c_{jh}$  = the catch by angler  $h$  interviewed during component  $j$ , and

$e_{jh}$  = the effort (number of hours) expended by angler  $h$  at the time of the interview.

Omitting the finite population correction factor, the variance of mean  $\text{CPUE}_j$  was approximated as (Jessen 1978):

$$V(\overline{\text{CPUE}}_j) = (\bar{C}_j / \bar{E}_j)^2 [s_c^2 / \bar{C}_j^2 + s_e^2 / \bar{E}_j^2 - (2r_j s_c s_e / \bar{C}_j \bar{E}_j)], \quad [8]$$

where:

$\bar{C}_j$  = the mean catch of a particular species by anglers in component  $j$ ,

$\bar{E}_j$  = the mean effort by anglers in component  $j$ ,

$s_c^2$  = the two-stage variance estimate for  $\bar{C}_j$ ,

$s_e^2$  = the two-stage variance estimate for  $\bar{E}_j$ , and

$r_j$  = the correlation coefficient for  $\bar{C}_j$  and  $\bar{E}_j$ .

The catch of a particular species during component j was estimated by:

$$\hat{C}_j = \hat{E}_j(\overline{CPUE}_j) \quad [9]$$

The variance of the estimated catch by component was estimated using the product of two independent random variables as described in Goodman (1960).

Harvest rates and total harvest of a particular species was estimated for each temporal component by substituting appropriate harvests for catches in equations 7, 8, and 9.

Total catch and harvest of a particular species for the season within each fishery was estimated by summing the estimates of catch and harvest for each of the temporal components. Because these are independent estimates, the variances of the total catch and harvest estimates are the sums of the individual variances for each temporal component.

The assumptions necessary for these analyses are:

1. incomplete-trip angler CPUE provide an unbiased estimate of completed-trip angler CPUE;
2. interviewed anglers were representative of the total angler population and anglers were interviewed in proportion to their abundance on the day of the interview;
3. no significant fishing effort occurred between 2400 hours and 0600 hours;
4. catch and effort by individual anglers are normally distributed random variables;
5. catch rate and duration of fishing trip are independent (DiConstanzo 1956); and,
6. there are no significant differences between catch or harvest rates between periods within each day.

#### Spawning Escapement Surveys

The numbers of spawning chinook salmon of all sizes in the Naknek River drainage were estimated from aerial counts conducted from fixed wing aircraft. No accounting was made for fish that had already spawned and left the system or for fish that had not yet arrived.

#### Size, Sex, and Age Sampling

Chinook and coho salmon carcasses encountered during the creel surveys and foot and float surveys of spawning grounds were measured to the nearest millimeter for mid-eye to fork-of-tail length, weighed to the nearest 10 grams, and sexed based on external characteristics. In addition, three



scales were removed from the preferred area<sup>1</sup> and mounted on an adhesive-coated card. The fork length of all resident species was recorded to the nearest millimeter, and the weight to the nearest tenth of a kilogram. A scale smear was collected from rainbow trout harvested from the sport fishery and caught by Department personnel using hook and line in the upper section of the Naknek River. The smear was taken from the preferred area and four scales per fish were later mounted on an adhesive-coated card. Adhesive-coated cards were later thermohydraulically pressed against acetate cards and the resulting scale impressions were displayed on a microfiche projector for age determination<sup>2</sup>.

The proportional age compositions of harvested chinook and coho salmon, rainbow trout, and spawning chinook salmon were estimated. Letting  $p_h$  be the estimated proportion of age group  $h$ , the variance of  $p_h$  was estimated using the normal approximation to the binomial (Schaeffer et al. 1979):

$$V(\hat{p}_h) = \hat{p}_h(1-\hat{p}_h)/(n_T-1), \quad [11]$$

where  $n_T$  is the number of legible chinook salmon scales read. Mean length (millimeters) and weight (kilograms) at age by sex and their variances were estimated using standard procedures.

## RESULTS

### Creel Statistics

The creel survey on the lower Naknek River was conducted from 1 June to 11 September. The mean number of anglers counted on the lower river section are listed in Table 1 for temporal components one through twelve. Total effort in the lower river was estimated to be 89,129 angler-hours, with about 44% of the effort occurring during the month of July. Catch and harvest rates for chinook and coho salmon in the lower river study area peaked during components six (7/29-7/31) and eight (8/8-8/14), respectively (Appendix Table 3 and Tables 2 and 3). Catch and harvest rates of other species (rainbow trout, Dolly Varden, and Arctic grayling) were generally small. An estimated 6,357 chinook salmon were caught (landed) in the lower river study area, of which 5,359 (84%) were harvested (Table 2). An estimated 4,070 coho salmon were caught in the lower river of which 3,839 (94%) were harvested (Table 3). Catches of rainbow trout from the lower river totaled 409 with 57% being retained (Table 4).

<sup>1</sup> The left side of the fish approximately two rows above the lateral line and on the diagonal row downward from the posterior insertion of the dorsal fin (Clutter and Whitesel 1956).

<sup>2</sup> For salmon, the numeral preceding the decimal is the number of freshwater annuli, whereas the numeral following the decimal is the number of marine annuli (European method). Total age from brood year is the sum of the two numerals plus one.

Table 1. Estimated effort (angler-hours), by temporal component, for the sport fishery in the lower Naknek River, 1988.

Temporal Component	Dates	Number of Counts	Anglers Per Count	SE <sup>1</sup>	Estimated Effort			Relative Precision <sup>3</sup>
					Hours	SE <sup>1</sup>	95% CI <sup>2</sup>	
1	6/01-6/30	26	69.2	92.43	35,717	6,734	22,519 - 48,915	37.0%
2	7/01-7/07	13	88.2	6.98	11,110	244	9,386 - 12,834	15.5%
3	7/08-7/14	10	74.3	10.74	9,366	1,354	6,713 - 12,019	28.3%
4	7/15-7/21	11	68.8	17.41	8,671	2,193	4,372 - 12,970	49.6%
5	7/22-7/28	13	63.9	6.78	8,047	855	6,371 - 9,723	20.8%
6	7/29-7/31	6	43.5	14.93	2,349	806	769 - 3,929	67.3%
June & July Total		53			39,543	2,966	33,730 - 45,356	14.7%
7	8/01-8/07	13	34.0	5.43	3,571	571	2,453 - 4,689	31.3%
8	8/08-8/14	12	39.7	6.32	4,172	664	2,871 - 5,473	31.2%
9	8/15-8/21	12	26.1	3.89	2,739	409	1,938 - 3,540	29.3%
10	8/22-8/28	13	18.7	3.83	1,966	402	1,178 - 2,754	40.1%
11	8/29-8/31	7	5.4	0.98	566	103	364 - 768	35.7%
August Total		57			13,014	1,051	10,953 - 15,075	15.8%
12	9/01-9/11	18	5.6	1.71	855	219	427 - 1,283	50.1%
Season Total		154			89,129	7,436	74,555 - 103,703	16.4%

<sup>1</sup> Standard error.

<sup>2</sup> Confidence interval

<sup>3</sup> Relative precision ( $\alpha = 0.05$ )

Table 2. Estimated catch and harvest of chinook salmon by the sport fishery in the lower Naknek River, 1988.

Temporal Component	Date	Effort (Ang. - Hours)	Catch				Harvest				Percent Harvested
			CPUE <sup>1</sup>	SE <sup>2</sup>	Number	SE	HPUE <sup>3</sup>	SE	Number	SE	
1	6/1-6/30	35,717	0.0648	0.0118	2,314	602	0.0563	0.0097	2,011	510	87%
2	7/1-7/7	11,110	0.0879	0.0085	977	95	0.0675	0.0063	750	91	77%
3	7/8-7/14	9,366	0.0810	0.0114	759	107	0.0723	0.0103	677	136	89%
4	7/15-7/21	8,671	0.1038	0.0140	900	121	0.0846	0.0099	734	203	82%
5	7/22-7/28	8,047	0.1067	0.0108	859	87	0.1020	0.0111	821	125	96%
6	7/29-7/31	2,349	0.1719	0.0286	404	67	0.1563	0.0254	367	138	91%
7	8/1-8/7	3,571	0.0222	0.0059	79	21	0.0000	0.0000	0	0	0%
8	8/8-8/14	4,172	0.0130	0.0139	54	58	0.0000	0.0000	0	0	0%
9	8/15-8/21	2,739	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
10	8/22-8/28	1,966	0.0015	0.0012	3	2	0.0000	0.0000	0	0	0%
11	8/29-8/31	566	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
12	9/1-9/11	855	0.0096	0.0042	8	4	0.0000	0.0000	0	0	0%
Season		89,129			6,357	643			5,359	603	84%

<sup>1</sup> Catch per unit effort (fish caught per angler-hour)

<sup>2</sup> Standard error.

<sup>3</sup> Harvest per unit effort (fish harvested per angler-hour)

Table 3. Estimated catch and harvest of coho salmon by the sport fishery in the lower Naknek River, 1988.

Temporal Component	Date	Effort (Ang.- Hours)	Catch				Harvest				Percent Harvested
			CPUE <sup>1</sup>	SE <sup>2</sup>	Number	SE	HPUE <sup>3</sup>	SE	Number	SE	
1	6/1-6/30	35,717	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
2	7/1-7/7	11,110	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
3	7/8-7/14	9,366	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
4	7/15-7/21	8,671	0.0000	0.0000	0	0	0.0000	0.0012	0	0	0%
5	7/22-7/28	8,047	0.0012	0.0012	10	9	0.0012	0.0149	10	9	100%
6	7/29-7/31	2,349	0.0254	0.0149	60	35	0.0254	0.0259	60	39	100%
7	8/1-8/7	3,571	0.1494	0.0272	534	97	0.1289		460	117	86%
8	8/8-8/14	4,172	0.4645	0.1032	1,938	430	0.4428	0.1041	1847	520	95%
9	8/15-8/21	2,739	0.2529	0.0236	693	65	0.2482	0.0233	680	120	98%
10	8/22-8/28	1,966	0.2329	0.2304	458	453	0.2268	0.0217	446	100	97%
11	8/29-8/31	566	0.2833	0.1281	160	77	0.2523	0.0305	143	31	89%
12	9/1-9/11	855	0.2550	0.0976	218	83	0.2261	0.0801	193	83	89%
Season		89,129			4,070	647			3,839	563	94%

<sup>1</sup> Catch per unit effort (fish caught per angler-hour)

<sup>2</sup> Standard error.

<sup>3</sup> Harvest per unit effort (fish harvested per angler-hour)

Table 4. Estimated catch and harvest of rainbow trout by the sport fishery in the lower Naknek River, 1988.

Temporal Component	Date	Effort (Ang.- Hours)	Catch				Harvest				Percent Harvested
			CPUE <sup>1</sup>	SE <sup>2</sup>	Number	SE	HPUE <sup>3</sup>	SE	Number	SE	
1	6/1-6/30	35,717	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
1	6/1-6/30	35,717	0.0053	0.0028	189	106	0.0032	0.0028	114	99	60%
2	7/1-7/7	11,110	0.0034	0.0016	38	17	0.0034	0.0016	38	18	100%
3	7/8-7/14	9,366	0.0014	0.0013	13	12	0.0007	0.0011	7	10	50%
4	7/15-7/21	8,671	0.0051	0.0022	44	19	0.0045	0.0006	39	20	88%
5	7/22-7/28	8,047	0.0012	0.0006	10	5	0.0012	0.0034	10	5	100%
6	7/29-7/31	2,349	0.0059	0.0034	14	8	0.0059	0.0010	14	9	100%
7	8/1-8/7	3,571	0.0034	0.0021	12	7	0.0017	0.0010	6	4	50%
8	8/8-8/14	4,172	0.0029	0.0035	12	14	0.0009	0.0004	4	2	31%
9	8/15-8/21	2,739	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0%
10	8/22-8/28	1,966	0.0046	0.0024	9	5	0.0000	0.0000	0	0	0%
11	8/29-8/31	566	0.0974	0.0282	55	19	0.0000	0.0000	0	0	0%
12	9/1-9/11	855	0.0144	203.47	12	17	0.0000	0.0000	0	0	0%
Season		89,129			409	114			231	104	57%

<sup>1</sup> Catch per unit effort (fish caught per angler-hour)

<sup>2</sup> Standard error.

<sup>3</sup> Harvest per unit effort (fish harvested per angler-hour)

The survey on the upper section was conducted from 8 June to 13 October. Mean number of anglers counted on the upper river section for components one through five are listed in Table 5. Total effort in the upper section was estimated to be 11,817 angler-hours. Catch rates of rainbow trout in the upper river study area were highest during temporal component four (9/12-10/2), averaging nearly one fish per angler-hour (Appendix Table 5 and Table 6). Harvest rates of rainbow trout were similar during all five components but were greatest during the last two (Appendix Table 6 and Table 6). Catch and harvest rates for pink and sockeye salmon peaked in components three (8/1-9/11), and four (9/12-10/2), respectively. Catches and harvests of rainbow trout in the upper river study area totaled 6,224 and 956 (15%) respectively (Table 7). Sockeye salmon catches totalled 2,697 of which 41% were harvested. Nearly all (89%) the 254 coho salmon caught in this section were harvested. Catches and harvests for the most popular sport species were 6,396 and 5,380 chinook salmon, 4,324 and 4,065 coho salmon, and 6,633 and 1,187 rainbow trout, respectively (Table 8).

#### Spawning Escapement

Escapement of chinook salmon estimated during aerial surveys and expanded for missed sections of the river was estimated to be 11,750 (Table 9). The largest number of fish (7,400) were observed in the mainstem Naknek River, a record for that section of the drainage. Big Creek and the mainstem of the Naknek River accounted for most (31% and 63%, respectively) of the expanded escapement estimates.

#### Size, Sex, and Age Compositions

Approximately 55% of the chinook salmon sampled from the sport harvest ( $n = 343$ ) were males (Table 10). Age 1.4 fish were most common (58%), followed by age 1.3 (21%) and age 1.2 fish (12%). Mean length and weight of chinook salmon sampled from the sport harvest was 794 mm (SE = 9.34,  $n = 343$ ) and 10.6 kg (SE = 0.54,  $n = 79$ ), respectively. The largest chinook salmon sampled weighed 21.25 kg (47 lbs). The sex and size compositions of the escapement (Table 11) were similar to that observed in the sport harvest, however the age composition was predominantly age 1.3 fish in the escapement.

Age 2.1 coho salmon accounted for 77% of the sport harvest followed by 18% age 1.1 (Table 12). Fifty two percent of the harvest were males. Mean length and weight of harvested coho salmon were 602 mm ( $n=507$ , SE=1.66), and 4.0 kg ( $n=207$ , SE=0.05), respectively. The largest coho salmon sampled was an age 2.1 male that weighed 6.0 kg (13.2 lbs).

Rainbow trout samples collected, using hook and line, from the catchable population in the upper Naknek River, suggest anglers are selectively harvesting larger fish. Of 79 fish sampled, most (39.5%) were age 3 (Table 13). The average length and weight were estimated to be 352 mm, and 0.5 kg respectively. Differences in mean length between the sport harvest and catch samples were tested using a t-test (MINITAB 1988). This test showed significant differences ( $p < 0.001$ ) in the mean lengths of the two groups suggesting the catchable population is smaller on the average than the

Table 5. Estimated effort (angler-hours), by temporal component and period, for the sport fishery in the upper Naknek River, 1988.

Component	Period <sup>1</sup>	Number of Counts	Anglers Per Count	SE <sup>2</sup>	Estimated Effort			Relative Precision <sup>4</sup>
					Hours	SE	95% CI <sup>3</sup>	
1 (6/9-7/6)	A	5	3.8	2.35	638	395	(137)- 1,413	121.5%
	B	6	5.3	1.61	896	270	367 - 1,425	59.0%
	C	4	6.5	1.66	1,092	77	546 - 1,638	50.0%
	All	15			2,626	554	1,540 - 3,712	41.3%
2 (7/7-7/31)	A	2	1.5	1.50	225	225	(216)- 666	196.0%
	B	10	17.8	3.20	2,670	479	1,730 - 3,610	35.2%
	C	9	3.6	0.90	533	37	269 - 797	49.6%
	All	21			3,428	547	2,357 - 4,499	31.2%
3 (8/1-9/11)	A	9	4.0	1.71	840	359	137 - 1,543	83.7%
	B	18	10.3	2.26	2,170	475	1,239 - 3,101	42.9%
	C	9	1.6	0.78	327	46	4 - 650	98.6%
	All	36			3,337	617	2,127 - 4,547	36.3%
4 (9/12-10/2)	A	13	7.6	1.86	960	234	502 - 1,418	47.7%
	B	12	10.6	2.82	1,334	356	637 - 2,031	52.3%
	All	25			2,294	426	1,459 - 3,129	36.4%
5 (10/3-10/13)	A	7	0.9	0.46	57	30	(2)- 116	104.2%
	B	7	1.1	0.70	75	47	(16)- 166	121.5%
	All	14			132	56	23 - 241	82.4%
Season Total		111			11,817	1,082	9,696 - 13,938	17.9%

<sup>1</sup> For Temporal Components 1, 2, and 3: A (0600-1159), B (1200-1759), C (1800-2400).

Temporal Components 3 through 5; A (0800-1359), B (1400-2000).

<sup>2</sup> Standard error.

<sup>3</sup> Confidence interval.

<sup>4</sup> Relative precision ( $\alpha = 0.05$ ).

Table 6. Estimated catch and harvest rates (fish per angler-hour), by species and temporal component, by the sport fishery in the upper Naknek River, 1988.

Species	Temporal Component <sup>1</sup>	Catch Rate		Harvest Rate	
		Fish/Hr	SE <sup>2</sup>	Fish/Hr	SE <sup>2</sup>
Rainbow Trout	1	0.6602	0.1409	0.0448	0.0226
	2	0.3874	0.1120	0.0781	0.0280
	3	0.2470	0.0809	0.0597	0.0156
	4	0.9662	0.0696	0.1512	0.0344
	5	0.9280	0.2428	0.1791	0.0933
Coho Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0000	0.0021	0.0031	0.0021
	3	0.0679	0.0309	0.0597	0.0285
	4	0.0068	0.0142	0.0068	0.0142
	5	0.0000	0.0000	0.0000	0.0000
Chinook Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0062	0.0091	0.0062	0.0091
	3	0.0054	0.0068	0.0000	0.0000
	4	0.0000	0.0000	0.0000	0.0000
	5	0.0000	0.0000	0.0000	0.0000
Sockeye Salmon	1	0.0056	0.0049	0.0056	0.0049
	2	0.2905	0.0592	0.2749	0.0569
	3	0.1981	0.0883	0.0733	0.0209
	4	0.4470	0.2293	0.0090	0.0104
	5	0.0000	0.0000	0.0000	0.0000
Pink Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0000	0.0000	0.0000	0.0000
	3	0.4126	0.0803	0.0407	0.0365
	4	0.0700	0.0433	0.0090	0.0104
	5	0.0000	0.0000	0.0000	0.0000
Arctic Grayling	1	0.0727	0.0300	0.0000	0.0000
	2	0.0094	0.0060	0.0062	0.0028
	3	0.0163	0.0043	0.0081	0.0035
	4	0.1761	0.0417	0.0406	0.0081
	5	0.0326	0.0378	0.0163	0.0189

-Continued-



Table 6. Estimated catch and harvest rates (fish per angler-hour), by species and temporal component, by the sport fishery in the upper Naknek River, 1988 (continued).

Species	Temporal Component <sup>1</sup>	Catch Rate		Harvest Rate	
		Fish/Hr	SE <sup>2</sup>	Fish/Hr	SE <sup>2</sup>
Dolly	1	0.0000	0.0000	0.0000	0.0000
Varden	2	0.0000	0.0000	0.0000	0.0000
	3	0.0054	0.0029	0.0027	0.0008
	4	0.0971	0.0166	0.0384	0.0099
	5	0.0326	0.0222	0.0326	0.0222

<sup>1</sup> Component 1: 6/9-7/6; Component 2: 7/7-7/31; Component 3: 8/1-9/11; Component 4: 9/12-10/2; Component 5: 10/3-10/13

Table 7. Estimated catch and harvest, by species, by the sport fishery in the upper Naknek River, 1988.

Species	Temporal Component <sup>1</sup>	Catch				Harvest				Percent of Catch Harvested
		Number	SE <sup>2</sup>	95% CI <sup>3</sup>	R.P. <sup>4</sup>	Number	SE <sup>2</sup>	95% CI <sup>3</sup>	RP <sup>4</sup>	
Rainbow	1	1,734	514	726 - 2,742	58.1%	118	63	(6) - 242	104.7%	6.8%
Trout	2	1,328	434	477 - 2,179	64.1%	268	104	64 - 472	76.1%	20.2%
	3	824	306	224 - 1,424	72.8%	199	63	75 - 323	62.1%	24.2%
	4	2216	441	11,353 - 3,079	39.0%	347	101	150 - 544	56.9%	15.7%
	5	122	60	5 - 239	95.6%	24	15	(5) - 53	122.5%	19.7%
<b>Total</b>		<b>6,224</b>	<b>863</b>	<b>44,533 - 7,915</b>	<b>27.2%</b>	<b>956</b>	<b>171</b>	<b>621 - 1,291</b>	<b>35.0%</b>	<b>15.4%</b>
Coho	1	0	0	0 - 0		0	0	0 - 0		0.0%
Salmon	2	11	7	(3) - 25	127.2%	11	7	(3) - 25	127.2%	100.0%
	3	227	110	12 - 442	94.6%	199	100	2 - 396	98.8%	87.7%
	4	16	32	(47) - 79	395.1%	16	32	(47) - 79	395.1%	100.0%
	5	0	0	0 - 0		0	0	0 - 0		0.0%
<b>Total</b>		<b>254</b>	<b>114</b>	<b>30 - 478</b>	<b>88.3%</b>	<b>226</b>	<b>106</b>	<b>19 - 433</b>	<b>91.6%</b>	<b>89.0%</b>
Sockeye	1	15	13	(10) - 40	167.8%	15	13	(10) - 40	167.8%	100.0%
Salmon	2	996	256	495 - 1,497	50.3%	942	244	463 - 1,421	50.8%	94.6%
	3	661	314	45 - 1,277	93.2%	245	82	84 - 406	65.7%	37.1%
	4	1,025	551	(54) - 2,104	105.3%	21	24	(25) - 67	220.9%	2.0%
	5	0	0	0 - 0		0	0	0 - 0		0.0%
<b>Total</b>		<b>2,697</b>	<b>684</b>	<b>11,357 - 4,037</b>	<b>49.7%</b>	<b>1,223</b>	<b>259</b>	<b>715 - 1,731</b>	<b>41.5%</b>	<b>45.3%</b>
Pink	1	0	0	0 - 0		0	0	0 - 0		0.0%
Salmon	2	0	0	0 - 0		0	0	0 - 0		0.0%
	3	1,377	366	659 - 2,095	52.1%	136	122	104 - 376	176.4%	9.9%
	4	161	102	(39) - 361	124.1%	0	0	0 - 0		0.0%
	5	0	0	0 - 0		0	0	0 - 0		0.0%
<b>Total</b>		<b>1,538</b>	<b>380</b>	<b>793 - 2,283</b>	<b>48.5%</b>	<b>136</b>	<b>122</b>	<b>104 - 376</b>	<b>176.4%</b>	<b>8.8%</b>
Arctic	1	191	87	21 - 361	89.2%	0	0	0 - 0		0.0%
Grayling	2	32	21	(9) - 73	128.5%	21	10	1 - 41	94.7%	65.6%
	3	54	17	20 - 88	62.4%	27	12	3 - 51	90.7%	50.0%
	4	404	120	168 - 640	58.4%	93	25	44 - 142	52.9%	23.0%
	5	4	5	(6) - 14	240.0%	2	2	(3) - 7	240.0%	50.0%
<b>Total</b>		<b>685</b>	<b>151</b>	<b>389 - 981</b>	<b>43.2%</b>	<b>143</b>	<b>30</b>	<b>84 - 202</b>	<b>41.0%</b>	<b>20.9%</b>

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Table 7. Estimated catch and harvest, by species, by the sport fishery in the upper Naknek River, 1988 (continued).

Species	Temporal Component <sup>1</sup>	Catch				Harvest				Percent of Catch Harvested		
		Number	SE <sup>2</sup>	95% CI <sup>3</sup>	R.P. <sup>4</sup>	Number	SE <sup>2</sup>	95% CI <sup>3</sup>	RP <sup>4</sup>			
Dolly	1	0	0	0 -	0	0	0 -	0		0.0%		
Varden	2	0	0	0 -	0	0	0 -	0		0.0%		
	3	18	10	(2)-	38	110.5%	9	3	3 -	15	68.9%	50.0%
	4	223	56	114 -	332	49.1%	88	28	34 -	142	61.5%	39.5%
	5	4	3	(2)-	10	155.0%	4	3	(2)-	10	155.0%	100.0%
Total		245	57	134 -	356	45.5%	101	28	46 -	156	54.3%	41.2%

<sup>1</sup> Component 1: 6/9-7/6; Component 2: 7/7-7/31; Component 3: 8/1-9/11; Component 4: 9/12-10/2; Component 5: 10/3-10/13.

<sup>2</sup> Standard Error.

<sup>3</sup> Confidence interval.

<sup>4</sup> Relative precision ( $\alpha = 0.05$ ).

Table 8. Catch and harvest, by species, by the sport fishery in the lower and upper sections of the Naknek River, 1988.

Effort (Ang-Hrs)	Chinook		Coho		Sockeye		Pink		Rainbow Trout		A. Grayling <sup>1</sup>	
	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest
<u>Lower River (6/1-9/13)</u>												
89,129	6,357	5,359	4,070	3,839	280	239	6,917	2,146	409	231	49	14
<u>Upper River (6/8-10/30)</u>												
11,817	39	21	254	226	2,697	1,223	1,538	136	6,224	956	685	143
<u>Both Sections Combined</u>												
100,946	6,396	5,380	4,324	4,065	2,977	1,462	8,455	2,282	6,633	1,187	734	157

<sup>1</sup> Arctic grayling.

Table 9. Estimates of chinook salmon escapement from aerial surveys in the Naknek River drainage, 1988.

Survey Dates	Location	Escapement
August 9	Big Creek	3,600
August 8	Pauls Creek	150
August 8	King Salmon Creek	600
August 8,9	Naknek River	7,400
	Drainage Total	11,750

Table 10. Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, sampled from the sport harvest from the Naknek River, 1988.

	Age Group					Total <sup>3</sup>
	1.1	1.2	1.3	1.4	1.5	
<u>Males</u>						
Percent	6.7%	11.4%	12.8%	23.0%	0.9%	54.8%
Av Length	430	524	801	910	935	743
Std Error <sup>1</sup>	12.42	11.58	13.31	13.42	11.78	15.36
Sample Size	23	39	44	79	3	188
Av Weight	2.3	2.5	11.5	9.7	12.7	10.0
Std Error <sup>2</sup>		0.44		1.15	1.22	0.94
Sample Size	1	6	1	10	23	41
<u>Female</u>						
Percent	0.3%	0.3%	8.5%	34.7%	1.4%	45.2%
Av Length	420	620	817	870	902	856
Std Error <sup>1</sup>			13.93	5.05	37.28	5.96
Sample Size	1	1	29	119	5	155
Av Weight		3.8	11.0	11.5	11.8	11.2
Std Error <sup>2</sup>			0.95	0.54	2.84	0.50
Sample Size		1	9	26	3	39
<u>Both Sexes</u>						
Percent	7.0%	11.7%	21.3%	57.7%	2.3%	100.0%
Av Length	430	526	808	886	914	794
Std Error <sup>1</sup>	11.9	11.54	9.73	6.29	23.43	9.34
Sample Size	24	40	73	198	8	343
Av Weight	2.3	2.7	10.3	12.1	11.8	10.6
Std Error <sup>2</sup>		0.41	0.75	0.64	0.28	0.54
Sample Size	1	7	19	49	3	79

<sup>1</sup> Standard error of length estimate.

<sup>2</sup> Standard error of weight estimate.

<sup>3</sup> Includes both aged and unaged samples.

Table 11. Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, sampled from the Big Creek and Naknek River escapements, 1988.

	Age Class					Total <sup>2</sup>
	1.1	1.2	1.3	1.4	1.5	
<b>BIG CREEK</b>						
<u>Males</u>						
Percent	4.7%	6.7%	21.3%	20.0%	0.4%	53.10%
Av Length	553	670	859	905	895	826
Std Error <sup>1</sup>	24.70	22.83	11.68	8.71		11.58
Sample Size	12	17	54	51	1	135
<u>Females</u>						
Percent	0.0%	2.4%	25.2%	18.5%	0.8%	46.90%
Av Length		727	819	845	890	825
Std Error		24.94	7.68	7.39	15.00	5.72
Sample Size		6	64	47	2	119
<u>Both Sexes</u>						
Percent	4.7%	9.1%	46.5%	38.5%	1.1%	100.00%
Av Length	553	685	837	876	892	826
Std Error	24.70	18.60	6.99	6.49	8.82	6.70
Sample Size	12	23	118	98	3	254
<b>NAKNEK RIVER</b>						
<u>Males</u>						
Percent	1.6%	3.1%	30.7%	14.1%	0.7%	50.2%
Av Length	538	657	883	922	951	876
Std Error	46.67	19.91	7.96	7.05	22.98	7.47
Sample Size	7	13	131	60	3	214
<u>Females</u>						
Percent	0.00%	1.6%	33.4%	13.9%	0.9%	49.8%
Av Length		803	849	874	871	856
Std Error		24.59	3.94	6.22	37.99	3.48
Sample Size		7	142	59	4	212
<u>Both Sexes</u>						
Percent	1.6%	4.7%	64.1%	28.0%	1.6%	100.00%
Av Length	538	773	865	898	906	866
Std Error	46.67	15.96	4.44	5.18	27.38	4.15
Sample Size	7	20	273	119	7	426

<sup>1</sup> Standard error of length estimates.

<sup>2</sup> Includes both aged and unaged fish.

Table 12. Mean lengths (millimeters) and weights (kilograms) of coho salmon, by sex and age group, sampled from the sport harvest from the Naknek River, 1988.

	Age Group					Total
	Unknown	1.1	1.2	2.1	3.1	
<u>Males</u>						
Percent	13.0%	8.4%	0.8%	29.1%	0.6%	51.9%
Av Length <sub>1</sub>	602	597	591	608	594	604
Std Error <sup>1</sup>	4.85	6.80	23.01	3.34	4.67	2.48
Sample Size	65	42	4	145	3	259
Av Weight <sub>2</sub>	4.1	4.1	4.1	4.2		4.2
Std Error <sup>2</sup>	0.17	0.19	0.63	0.12		0.09
Sample Size	24	17	2	66		109
<u>Females</u>						
Percent	10.6%	6.0%	0.6%	29.1%	0.2%	46.5%
Av Length <sub>1</sub>	604	591	575	603	605	601
Std Error <sup>1</sup>	3.25	7.01	22.30	2.19	0.00	1.83
Sample Size	53	30	3	145	1	232
Av Weight <sub>2</sub>	3.9	3.7		3.9		3.8
Std Error <sup>2</sup>	0.12	0.14		0.07		0.06
Sample Size	16	17		57		90
<u>Unknowns</u>						
Percent	0.6%	0.2%	0.0%	0.8%	0.0%	
Av Length <sub>1</sub>	610	305		605		569
Std Error <sup>1</sup>	13.23			15.03		
Sample Size	3	1	0	4	0	8
Av Weight <sub>2</sub>	3.5			3.5		3.5
Std Error <sup>2</sup>	0.15			0.09		0.12
Sample Size	2	0	0	3	0	5
<u>Both Sexes</u>						
Percent	24.2%	14.6%	1.4%	59.0%	0.8%	100.00%
Av Length <sub>1</sub>	603	591	584	605	597	602
Std Error <sup>1</sup>	2.98	6.26	15.23	1.98	4.35	1.66
Sample Size	121	73	7	294	4	499
Av Weight <sub>2</sub>	4.0	3.9	4.1	4.0		4.0
Std Error <sup>2</sup>	0.11	0.12	0.63	0.07		0.05
Sample Size	42	34	2	126		204

<sup>1</sup> Standard error of length estimates.

<sup>2</sup> Standard error of weight estimates.

<sup>3</sup> Includes all fish, both aged and unaged.



Table 13. Mean lengths (millimeters) and weights (kilograms) of rainbow trout, by age group, sampled (1) using sport gear (catch) and (2) from the sport harvest in the upper river from the Naknek River, 1988.

	Age Group									TOTAL <sup>3</sup>
	Unknown	2	3	4	5	6	7	8	9	
<b>Catch</b>										
Percent		14.0%	39.5%	14.0%	16.0%	4.7%	9.3%	2.3%	0.0%	100.0%
Mean Ln	401	249	287	312	392	433	508	526		352
Std Err <sup>1</sup>	38.42	25.43	6.94	12.55	16.77	29.41	14.79			10.94
Sample Size	11	6	22	13	15	6	5	1	0	73
Mean Wt	0.1	0.4	0.2	0.4	0.7	0.8	1.2	2.0		0.5
Std Err <sup>2</sup>	0.11		0.53	0.44	0.93	0.20	0.13			0.90
Sample Size	14	1	6	3	3	2	3	1	0	31
<b>Harvest</b>										
Percent		8.5%	14.9%	37.2%	19.1%	7.4	0.6%	1.1%	1.1%	100.0%
Mean Ln	464	256	295	339	371	499	564	598	660	377
Std Err <sup>1</sup>	25.27	13.86	10.39	5.29	10.57	43.98	25.87			10.61
Sample Size	7	8	14	35	18	6	0	1	1	84
Mean Wt	1.3	0.1	0.3	0.5	0.6	1.4	1.9	2.0	2.8	0.8
Std Err <sup>2</sup>	0.54	0.40	0.61	0.80	0.61	0.42	0.35			0.86
Sample Size	5	6	8	27	17	5	9	1	1	74

<sup>1</sup> Standard error of length estimates.

<sup>2</sup> Standard error of weight estimates.

<sup>3</sup> Includes all fish, both aged and unaged.

fish being retained by sport fishermen, with the estimated difference being approximately 25 mm.

Age 4 rainbow trout comprised 37% (Table 13) of the sport harvest (n = 99). Average length and weight of harvested rainbow trout was 377 mm and 0.8 kg, respectively. The largest rainbow trout sampled was 685 mm (27 in) long and weighed 4.0 kg (9 lbs).

## DISCUSSION

Total angling effort (100,946 hours) on the Naknek River during 1988 climbed 43% from the record level (70,373 hours) observed in 1987 (Minard and Brookover 1988). Most of the increase occurred in the lower river section, where effort rose from 59,932 hours in 1987 to 89,129 hours in 1988. Growth in this fishery continues to occur despite significant changes in regulations designed to reduce angler efficiency and harvest of chinook salmon. Development of more commercial facilities in King Salmon and promotion of the Naknek River as a less crowded alternative to more popular fisheries within the state is having notable effects.

The 1988 harvest (5,380) of chinook salmon from the Naknek River dropped significantly (Figure 2) from the level observed in 1987 (11,419) even though total run size in those 2 years was similar (Table 14). Regulatory changes, including reduction in chinook salmon bag limits, a seasonal closure to the taking of chinook salmon after July 31, and restricting terminal tackle to artificial lures only within the Naknek drainage, contributed to the reduced harvest.

The estimated escapement of 11,750 chinook salmon is the fifth largest on record since 1967 (Table 14). Overall exploitation (sport, commercial and subsistence) was approximately 53% and is considered to be within acceptable limits. No regulatory changes for this fishery appear necessary at this time.

Harvest of coho salmon from the Naknek River is increasing annually with the 1988 sport harvest of 4,065 setting a new record for this fishery (Table 15). Escapement estimates for coho salmon in the Naknek River drainage are unavailable and consequently an exploitation rate can not be calculated for this stock.

Harvest estimates for rainbow trout from the Naknek River are available from 1977 through 1988 (Table 15). Harvest increased from 1978 (371 fish) through 1984 (2,881 fish), and then declined to the levels observed in 1987 and 1988 (Figure 2). Approximately half of the Naknek River rainbow trout catch and harvest takes place in the upper section of the river during the late summer and fall. Creel data for the fall (15 August to 15 October) fishery is presented in Table 16 and Figure 3. As shown in Figure 3, effort has increased since 1978, catch rate has fluctuated with no apparent trend, and harvest rate, since 1981, has declined. These data alone do not point to any serious biological problem, however, as also shown in Figure 3, the mean length of harvested rainbow trout has dropped over this period. Samples

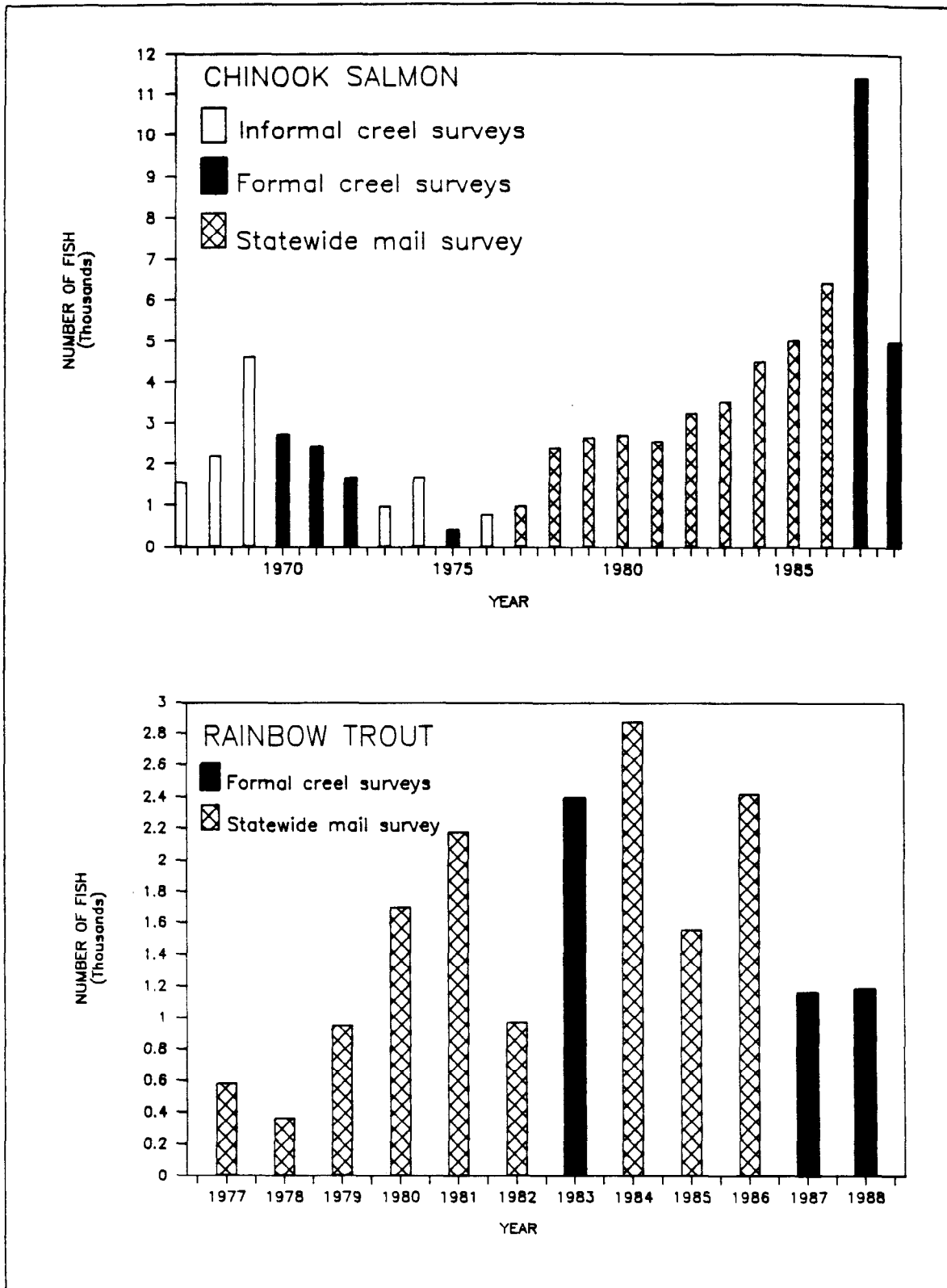


Figure 2. Harvests of chinook salmon (1967-1988) and rainbow trout (1977-1988) by the sport fishery in the Naknek River.

Table 14. Harvests and escapements of chinook salmon returning to the Naknek River, 1967-1988.

Year <sup>1</sup>	Harvest				Escapement Index	Total Return	% Exploitation by the Sport Fishery
	Commercial	Subsistence	Sport	Total			
1967	3,705	500	1,579	5,784	2,218	8,002	20%
1968	6,398	500	2,203	9,101	7,120	16,221	14%
1969	19,016	400	4,631	24,047	8,922	32,969	14%
1970	19,037	300	2,730	22,067	4,361	26,428	10%
1971	10,254	200	2,417	12,871	2,866	15,737	15%
1972	2,262	400	1,668	4,330	2,791	7,121	23%
1973	951	600	1,000	2,551	2,625	5,176	19%
1974	480	1,000	1,700	3,180	2,575	5,755	30%
1975	964	700	427	2,091	3,704	5,795	7%
1976	4,064	900	800	5,764	9,150	14,914	5%
1977	4,373	1,300	1,005	6,678	10,800	17,478	6%
1978	6,930	1,200	2,406	10,536	9,075	19,611	12%
1979	10,415	1,200	2,669	14,284	7,150	21,434	12%
1980	7,517	1,500	2,729	11,746			
1981	11,048	1,000	2,581	14,629	8,920	23,549	11%
1982	12,425	1,100	3,264	16,789	17,000	33,789	10%
1983	8,955	1,000	3,545	13,500	13,400	27,887	13%
1984	8,972	900	4,524	14,396	12,400	27,022	17%
1985	5,697	979	5,038	11,714	4,100	16,008	31%
1986	3,552	1,000	6,462	11,014	8,350	19,364	33%
1987	5,000	1,000	11,419	17,419	6,500	23,920	48%
21 Year							
Average	7,239	842	3,086	11,166	7,201	18,409	17%
1988	6,677	1,000	5,380	13,057	11,750	24,807	22%

<sup>1</sup> Data reported in Minard (1987).

Table 15. Harvests of coho salmon and rainbow trout by the sport fishery in the Naknek River, 1977-1988.

Year <sup>1</sup>	Sport Harvest	
	Coho Salmon	Rainbow Trout
1977	297	586
1978	646	371
1979	300	954
1980	818	1,705
1981	1,156	2,184
1982	1,676	975
1983	1,385	3,724
1984	2,332	2,881
1985	1,281	1,561
1986	1,942	2,425
1987	2,579	1,246
11 - Yr Average	1,310	1,692
1988	4,065	1,187

<sup>1</sup> Data reported in Minard (1987).

Table 16. Effort, harvest, catch, and catch rate statistics for anglers fishing the upper Naknek River during the period 15 August through 15 October 1978, 1981, 1983, 1984, 1987, and 1988. Length statistics of harvested rainbow trout during these years are also presented.

Year	Effort	Catch	Catch/Hr.	Harvest	Proportion Retained	Length (mm)		
	(Ang-Hrs)					Mean	SE <sup>1</sup>	SS <sup>2</sup>
1978	1,896	847	0.45	248	0.29	484	20.2	55
1981	3,025	4,322	1.43	860	0.20	444	6.2	218
1983	6,755	4,182	0.62	1,452	0.35	430	5.7	135
1984	4,611	3,092	0.67	570	0.18	466	-- <sup>3</sup>	-- <sup>3</sup>
1987	4,450	4,779	0.62	434	0.09	423	9.3	81
1988	6,246	3,147	0.50	566	0.18	377	10.6	99

<sup>1</sup> Standard Error.

<sup>2</sup> Sample Size

<sup>3</sup> Not available.

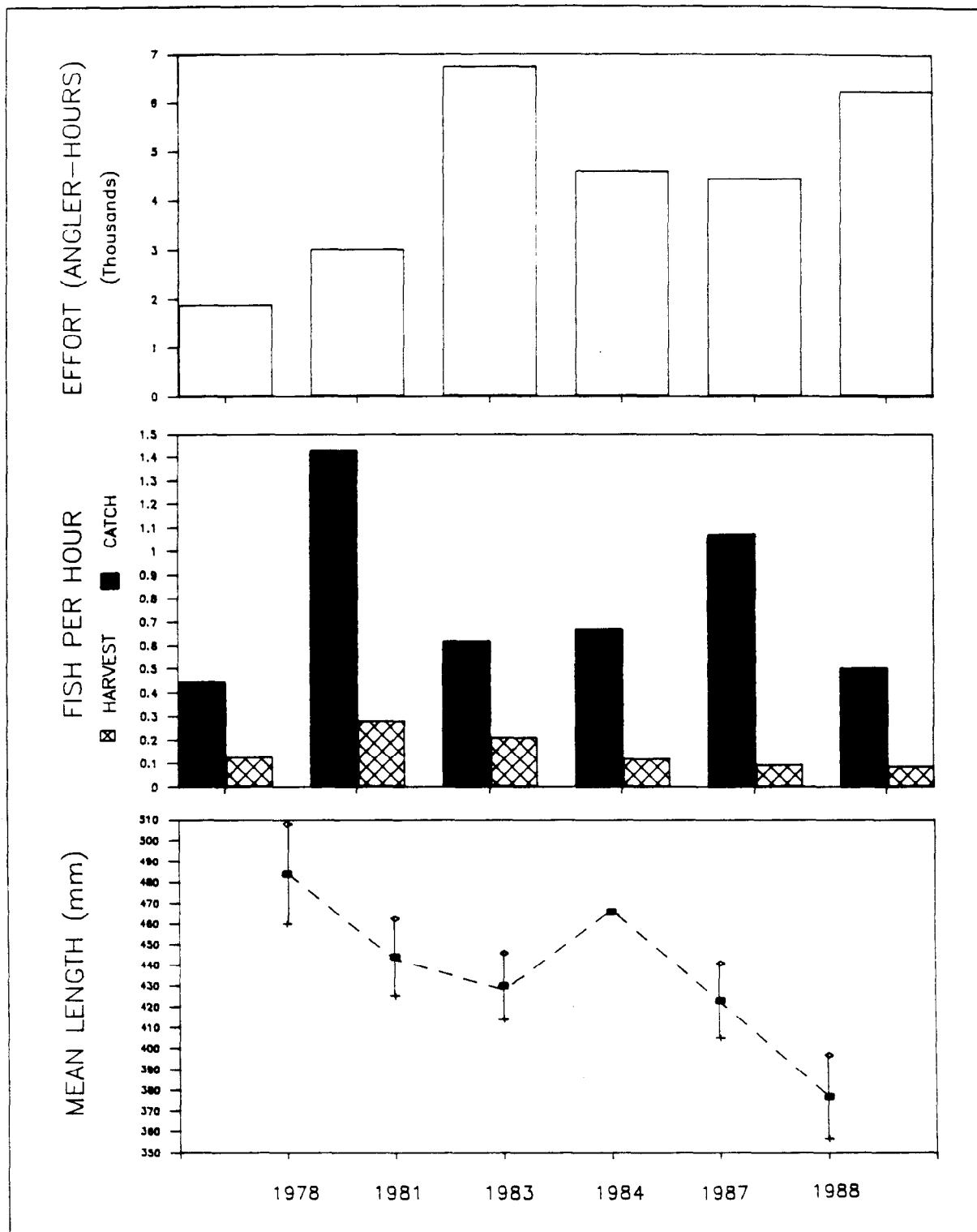


Figure 3. Effort, catch and harvest statistics and mean length with 95 percent confidence intervals of rainbow trout harvested in the fall (15 August-15 October) fishery in the Naknek River.

collected from the 1988 catch and harvest clearly show that anglers are selecting larger fish for harvest and therefore a drop in the mean length of harvested fish may be indicative of a decline in the average size of the catchable population.

Additional analysis of historic size and age data is necessary to more thoroughly test the hypothesis that size and age composition of Naknek River rainbow trout stocks has shifted. If the results of that analysis are consistent with the findings presented in this report, then regulatory changes designed to protect larger, older year classes may be necessary.

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**APPENDIX**

Appendix Table 1. Angler counts in the lower Naknek River sport fishery, 1988.

Date	Wd/We 1/	Period			Date	Wd/We 1/	Period		
		A	B	C			A	B	C
6/01	Wd		13		7/27	Wd		74	18
6/02	Wd				7/28	Wd		79	48
6/03	Wd		6		7/29	Wd			
6/04	We		22		7/30	We	8	50	68
6/05	We			13	7/31	We	68	64	3
6/06	Wd	3			8/01	Wd			
6/07	Wd		9		8/02	Wd	23	36	
6/08	Wd		1		8/03	Wd	41	61	
6/09	Wd				8/04	Wd	44	40	
6/10	Wd				8/05	Wd		43	15
6/11	We			40	8/06	We	29	116	
6/12	We				8/07	We	4	93	3
6/13	Wd				8/08	Wd	44	60	25
6/14	Wd				8/09	Wd	30	62	
6/15	Wd	40	54		8/10	Wd	30	35	
6/16	Wd				8/11	Wd	2	19	29
6/17	Wd				8/12	Wd	70	109	
6/18	We				8/13	We			
6/19	We	31	77		8/14	We			
6/20	Wd				8/15	Wd		58	4
6/21	Wd				8/16	Wd	15	56	
6/22	Wd		75	53	8/17	Wd	40	41	
6/23	Wd				8/18	Wd	0	55	
6/24	Wd		130	63	8/19	Wd		51	16
6/25	We				8/20	We	0	66	
6/26	We		194	47	8/21	We			
6/27	Wd		136	63	8/22	Wd	0	8	
6/28	Wd	166	156		8/23	Wd	2	34	26
6/29	Wd	140	119		8/24	Wd	26	45	
6/30	Wd		132	16	8/25	Wd		41	2
7/01	Wd	18	159	61	8/26	Wd			
7/02	We				8/27	We	12	34	
7/03	We				8/28	We		51	4
7/04	We	53	174	107	8/29	Wd		12	0
7/05	Wd	44	127	71	8/30	Wd	0	11	2
7/06	Wd		149	42	8/31	Wd	5	15	
7/07	Wd		118	123	9/01	Wd			
7/08	Wd		204	44	9/02	Wd	5	5	6
7/09	We				9/03	We		26	11
7/10	We				9/04	We			
7/11	Wd		82	117	9/05	We		17	2
7/12	Wd	8	144		9/06	Wd	1	3	1
7/13	Wd		148		9/07	Wd	2	13	
7/14	Wd	14	152	37	9/08	Wd	0	3	
7/15	Wd		145	41	9/09	Wd	0	0	
7/16	We	111	115		9/10	We			
7/17	We		126	22	9/11	We	2	4	
7/18	Wd								
7/19	Wd								
7/20	Wd		78	36					
7/21	Wd	10	87	44					
7/22	Wd	99	101						
7/23	We	74	57	61					
7/24	We	88	79						
7/25	Wd								
7/26	Wd	32	66						

1/ Wd = Weekday; We = Weekend/Holiday.

Appendix Table 2. Angler counts for the sport fishery in the upper Naknek River, 1988

Date	Wd/We 1/	Period			Date	Wd/We 1/	Period		
		A	B	C			A	B	C
6/08	Wd				7/20	Wd			
6/09	Wd			2	7/21	Wd			
6/10	Wd				7/22	Wd			
6/11	We				7/23	We			
6/12	We	0			7/24	We		12	6
6/13	Wd	1			7/25	Wd		40	0
6/14	Wd	2	3		7/26	Wd			
6/15	Wd				7/27	Wd		8	3
6/16	Wd				7/28	Wd	0	12	
6/17	Wd		6	7	7/29	Wd			
6/18	We				7/30	We			
6/19	We				7/31	We			
6/20	Wd	13	1		8/01	Wd			
6/21	Wd				8/02	Wd		4	0
6/22	Wd				8/03	Wd		1	0
6/23	Wd		3	7	8/04	Wd			
6/24	Wd				8/05	Wd		23	2
6/25	We				8/06	We			
6/26	We				8/07	We			
6/27	Wd				8/08	Wd			
6/28	Wd				8/09	Wd		9	3
6/29	Wd		12	10	8/10	Wd			
6/30	Wd	3	7		8/11	Wd			
7/01	Wd				8/12	Wd	3	11	
7/02	We				8/13	We			
7/03	We				8/14	We	17	24	
7/04	We				8/15	Wd			
7/05	Wd				8/16	Wd	2	12	
7/06	Wd				8/17	Wd		2	0
7/07	Wd				8/18	Wd		2	
7/08	Wd		22	6	8/19	Wd	2	6	
7/09	We	3	17		8/20	We			
7/10	We		8	4	8/21	We			
7/11	Wd		17	1	8/22	Wd			
7/12	Wd				8/23	Wd			
7/13	Wd				8/24	Wd	6	15	
7/14	Wd		13	7	8/25	Wd	2	2	
7/15	Wd				8/26	Wd			
7/16	We		29	5	8/27	We			
7/17	We				8/28	We	2	16	
7/18	Wd				8/29	Wd			
7/19	Wd			0	8/30	Wd			

-Continued-

Appendix Table 2. Angler counts for the sport fishery in the upper Naknek River, 1988 (continued).

Date	Wd/We 1/	Period			Date	Wd/We 1/	Period	
		A	B	C			A	B
8/31	Wd							
9/01	Wd		0	0	10/05	Wd		
9/02	Wd				10/06	Wd	1	
9/03	We		30	2	10/07	Wd	0	0
9/04	We		24	0	10/08	We	2	1
9/05	We				10/09	We	0	5
9/06	Wd				10/10	We	0	0
					10/11	Wd		2
9/07	Wd	0	2		10/12	Wd		
9/08	Wd	2	3		10/13	Wd	0	0
9/09	Wd							
9/10	We		2	7				
9/11	We							
9/12	Wd	0	10					
9/13	Wd	6						
9/14	Wd	5	2					
9/15	Wd							
9/16	Wd		7					
9/17	We	17	23					
9/18	We	5						
9/19	Wd		1					
9/20	Wd							
9/21	Wd							
9/22	Wd							
9/23	Wd	4	10					
9/24	We	19						
9/25	We	10	36					
9/26	Wd	2	11					
9/27	Wd	0	6					
9/28	Wd	7	5					
9/29	Wd							
9/30	Wd							
10/01	We	19	10					
10/02	We	5	6					
10/03	Wd	3	0					
10/04	Wd							

1/ Wd = Weekday; We = Weekend/Holiday.

Appendix Table 3. Summary of daily angler effort (angler-hours) and catch rates (CPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988.

Wd/ Date	Sample We 1/ Size	Effort		Chinook			Coho			Rainbow Trout			Pink			Chum		
		Mean	SE 2/ CPUE	Mean	SE 2/ CPUE	CPUE	Mean	SE 2/ CPUE	CPUE	Mean	SE 2/ CPUE	CPUE	Mean	SE 2/ CPUE	CPUE	Mean	SE 2/ CPUE	CPUE
601	Wd 11	2.400	0.500	0.090	0.091	0.038	0.000	0.000	0.000	0.270	0.141	0.115	0.000	0.000	0.000	0.000	0.000	0.000
603	Wd 16	3.100	0.340	0.060	0.063	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
604	We 15	3.400	0.410	0.130	0.091	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
606	Wd 4	2.600	0.630	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
607	Wd 5	1.900	0.480	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
608	Wd 31	3.000	0.090	0.030	0.032	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
611	We 66	4.200	0.300	0.090	0.042	0.022	0.000	0.000	0.000	0.050	0.034	0.011	0.000	0.000	0.000	0.000	0.000	0.000
615	Wd 37	3.900	0.240	0.190	0.085	0.048	0.000	0.000	0.000	0.050	0.038	0.014	0.000	0.000	0.000	0.000	0.000	0.000
619	We 17	2.700	0.330	0.060	0.059	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
622	Wd 38	3.200	0.280	0.390	0.096	0.122	0.000	0.000	0.000	0.080	0.044	0.024	0.000	0.000	0.000	0.030	0.026	0.008
624	Wd 31	5.300	0.540	0.160	0.067	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
626	We 65	6.400	0.340	0.260	0.067	0.041	0.000	0.000	0.000	0.020	0.015	0.002	0.000	0.000	0.000	0.020	0.015	0.002
627	Wd 64	8.100	0.390	0.520	0.107	0.063	0.000	0.000	0.000	0.020	0.016	0.002	0.000	0.000	0.000	0.030	0.031	0.004
628	Wd 34	4.700	0.300	1.180	0.191	0.248	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.029	0.006
629	Wd 30	5.000	0.220	0.700	0.109	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.070	0.046	0.013
630	Wd 37	6.000	0.500	0.270	0.074	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.060	0.014
701	Wd 118	5.900	0.210	0.520	0.090	0.087	0.000	0.000	0.000	0.010	0.008	0.001	0.000	0.000	0.000	0.080	0.025	0.013
704	We 98	4.800	0.220	0.360	0.053	0.075	0.000	0.000	0.000	0.010	0.010	0.002	0.000	0.000	0.000	0.110	0.050	0.024
705	Wd 91	5.900	0.340	0.680	0.138	0.116	0.000	0.000	0.000	0.070	0.034	0.011	0.000	0.000	0.000	0.420	0.105	0.071
706	Wd 54	6.700	0.370	0.540	0.111	0.080	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.460	0.144	0.069
707	Wd 47	6.200	0.350	0.430	0.104	0.068	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
708	Wd 50	7.200	0.510	0.520	0.108	0.073	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.044	0.008
711	Wd 46	4.100	0.350	0.590	0.134	0.142	0.000	0.000	0.000	0.020	0.022	0.005	0.000	0.000	0.000	0.000	0.000	0.000
712	Wd 28	6.100	0.660	0.680	0.155	0.112	0.000	0.000	0.000	0.040	0.036	0.006	0.000	0.000	0.000	0.110	0.060	0.018
713	Wd 52	7.400	0.330	0.210	0.069	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.310	0.139	0.041
714	Wd 36	7.700	0.360	0.810	0.148	0.104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
715	Wd 45	6.200	0.380	0.690	0.190	0.112	0.000	0.000	0.000	0.070	0.038	0.011	0.000	0.000	0.000	0.000	0.000	0.000
716	We 42	2.800	0.130	0.550	0.103	0.194	0.000	0.000	0.000	0.050	0.033	0.017	0.000	0.000	0.000	0.000	0.000	0.000
717	We 64	5.700	0.460	0.550	0.120	0.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
720	Wd 50	7.900	0.480	0.360	0.085	0.046	0.000	0.000	0.000	0.040	0.040	0.005	0.000	0.000	0.000	0.000	0.000	0.000
721	Wd 60	6.700	0.370	0.920	0.210	0.136	0.000	0.000	0.000	0.020	0.017	0.002	0.000	0.000	0.000	0.030	0.023	0.005
722	Wd 32	3.900	0.120	0.560	0.142	0.143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
723	We 97	4.700	0.260	0.370	0.059	0.080	0.000	0.000	0.000	0.010	0.010	0.002	0.000	0.000	0.000	0.010	0.010	0.002
724	We 48	3.800	0.140	0.420	0.093	0.108	0.020	0.021	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
726	Wd 33	3.700	0.260	0.360	0.114	0.098	0.030	0.030	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.008

-Continued-

Appendix Table 3. Summary of daily angler effort (angler-hours) and catch rates (CPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988 (continued).

Date	Wd/ We 1/	Sample Size	Effort		Chinook			Coho			Rainbow Trout			Pink			Chum		
			Mean	SE 2/	Mean	SE 2/	CPUE	Mean	SE 2/	CPUE	Mean	SE 2/	CPUE	Mean	SE 2/	CPUE	Mean	SE 2/	CPUE
727	Wd	55	7.200	0.410	0.670	0.082	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
728	Wd	61	6.800	0.220	0.950	0.100	0.140	0.000	0.000	0.000	0.020	0.016	0.002	0.020	0.016	0.002	0.000	0.000	0.000
730	We	73	4.100	0.230	0.860	0.107	0.209	0.040	0.030	0.010	0.010	0.014	0.003	0.010	0.014	0.003	0.000	0.000	0.000
731	We	53	4.000	0.200	0.470	0.079	0.119	0.190	0.097	0.048	0.040	0.026	0.010	0.170	0.084	0.043	0.000	0.000	0.000
802	Wd	13	3.000	0.310	0.000	0.000	0.000	1.150	0.436	0.380	0.000	0.000	0.000	0.150	0.104	0.051	0.000	0.000	0.000
803	Wd	47	3.900	0.170	0.150	0.052	0.038	0.550	0.275	0.141	0.020	0.021	0.005	0.830	0.253	0.211	0.000	0.000	0.000
804	Wd	44	4.100	0.220	0.250	0.080	0.061	0.200	0.120	0.050	0.000	0.000	0.000	1.090	0.270	0.265	0.000	0.000	0.000
805	Wd	61	4.200	0.280	0.050	0.028	0.012	0.790	0.167	0.188	0.000	0.000	0.000	4.230	0.972	1.009	0.000	0.000	0.000
806	We	36	2.700	0.200	0.030	0.028	0.010	0.470	0.180	0.176	0.060	0.039	0.021	2.390	0.444	0.889	0.030	0.028	0.010
807	We	116	3.600	0.150	0.030	0.017	0.010	0.520	0.088	0.145	0.010	0.009	0.002	2.120	0.306	0.595	0.010	0.009	0.002
808	Wd	81	3.900	0.180	0.000	0.000	0.000	1.320	0.243	0.339	0.000	0.000	0.000	1.950	0.562	0.500	0.000	0.000	0.000
809	Wd	22	3.900	0.190	0.050	0.045	0.012	3.050	0.413	0.775	0.000	0.000	0.000	4.680	2.387	1.191	0.000	0.000	0.000
810	Wd	16	3.400	0.320	0.000	0.000	0.000	3.810	0.449	1.130	0.000	0.000	0.000	0.130	0.085	0.037	0.000	0.000	0.000
811	Wd	32	3.300	0.360	0.250	0.250	0.075	2.160	0.394	0.645	0.060	0.063	0.019	2.560	0.625	0.766	0.000	0.000	0.000
813	We	40	3.200	0.140	0.000	0.000	0.000	0.420	0.107	0.133	0.000	0.000	0.000	4.350	0.751	1.365	0.000	0.000	0.000
815	Wd	47	5.600	0.220	0.000	0.000	0.000	1.530	0.237	0.274	0.000	0.000	0.000	3.620	0.663	0.646	0.000	0.000	0.000
816	Wd	32	3.100	0.100	0.000	0.000	0.000	0.910	0.226	0.296	0.000	0.000	0.000	0.840	0.266	0.276	0.000	0.000	0.000
817	Wd	37	4.400	0.270	0.000	0.000	0.000	1.510	0.259	0.343	0.000	0.000	0.000	1.620	0.370	0.367	0.000	0.000	0.000
818	Wd	16	3.400	0.070	0.000	0.000	0.000	0.500	0.183	0.146	0.000	0.000	0.000	0.880	0.386	0.256	0.000	0.000	0.000
819	Wd	38	5.600	0.450	0.000	0.000	0.000	1.210	0.262	0.216	0.000	0.000	0.000	3.080	0.638	0.548	0.000	0.000	0.000
820	We	18	3.200	0.190	0.000	0.000	0.000	0.220	0.101	0.069	0.000	0.000	0.000	2.220	0.619	0.695	0.000	0.000	0.000
822	Wd	13	3.800	0.100	0.000	0.000	0.000	0.920	0.265	0.240	0.000	0.000	0.000	1.460	0.386	0.380	0.000	0.000	0.000
823	Wd	33	4.400	0.380	0.030	0.030	0.007	1.760	0.302	0.395	0.030	0.030	0.007	2.480	0.473	0.559	0.000	0.000	0.000
824	Wd	17	3.700	0.380	0.000	0.000	0.000	0.760	0.235	0.208	0.000	0.000	0.000	1.120	0.401	0.304	0.000	0.000	0.000
825	Wd	27	5.500	0.560	0.000	0.000	0.000	1.150	0.237	0.208	0.070	0.051	0.013	0.330	0.141	0.060	0.000	0.000	0.000
827	We	18	3.100	0.190	0.000	0.000	0.000	0.280	0.158	0.089	0.000	0.000	0.000	0.170	0.090	0.053	0.000	0.000	0.000
828	We	44	4.400	0.390	0.000	0.000	0.000	0.770	0.152	0.177	0.000	0.000	0.000	0.930	0.376	0.214	0.000	0.000	0.000
829	Wd	16	5.900	0.540	0.000	0.000	0.000	1.940	0.470	0.328	0.810	0.400	0.138	0.690	0.285	0.116	0.000	0.000	0.000
830	Wd	26	4.800	0.450	0.000	0.000	0.000	1.270	0.449	0.263	0.350	0.241	0.072	1.350	0.549	0.279	0.040	0.038	0.008
831	Wd	2	2.900	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
902	Wd	21	4.500	0.430	0.050	0.048	0.011	1.100	0.337	0.246	0.100	0.095	0.021	1.430	0.541	0.321	0.000	0.000	0.000
903	We	11	3.800	0.750	0.090	0.091	0.024	0.270	0.141	0.072	0.000	0.000	0.000	0.360	0.244	0.096	0.000	0.000	0.000
905	We	10	3.700	0.970	0.000	0.000	0.000	0.500	0.307	0.135	0.000	0.000	0.000	0.100	0.100	0.027	0.000	0.000	0.000
906	Wd	11	1.800	0.360	0.000	0.000	0.000	0.730	0.359	0.402	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
907	Wd	2	3.000	0.000	0.000	0.000	0.000	2.000	0.000	0.667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
908	Wd	2	3.000	0.000	0.000	0.000	0.000	3.000	1.000	1.000	0.500	0.500	0.167	0.000	0.000	0.000	0.000	0.000	0.000
911	We	2	1.800	0.000	0.000	0.000	0.000	2.000	2.000	1.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1/ Wd = Weekday; We = Weekend.

2/ Standard Error.



Appendix Table 4. Summary of daily angler effort (angler-hours) and harvest rates (HPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988.

Date	Wd/ We 1/	Sample Size	Effort		Chinook			Coho			Rainbow Trout			Pink			Chum		
			Mean	SE 2/	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE
601	Wd	11	2.400	0.500	0.090	0.091	0.038	0.000	0.000	0.000	0.270	0.141	0.115	0.000	0.000	0.000	0.000	0.000	0.000
603	Wd	16	3.100	0.340	0.060	0.063	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
604	We	15	3.400	0.410	0.130	0.091	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
606	Wd	4	2.600	0.630	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
607	Wd	5	1.900	0.480	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
608	Wd	31	3.000	0.090	0.030	0.032	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
611	We	66	4.200	0.300	0.080	0.039	0.018	0.000	0.000	0.000	0.050	0.034	0.011	0.000	0.000	0.000	0.000	0.000	0.000
615	Wd	37	3.900	0.240	0.190	0.085	0.048	0.000	0.000	0.000	0.030	0.027	0.007	0.000	0.000	0.000	0.000	0.000	0.000
619	We	17	2.700	0.330	0.060	0.059	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
622	Wd	38	3.200	0.280	0.390	0.096	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.026	0.008
624	Wd	31	5.300	0.540	0.160	0.067	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
626	We	65	6.400	0.340	0.230	0.053	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.015	0.002
627	Wd	64	8.100	0.390	0.390	0.073	0.048	0.000	0.000	0.000	0.020	0.016	0.002	0.000	0.000	0.000	0.030	0.031	0.004
628	Wd	34	4.700	0.300	0.910	0.088	0.192	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.029	0.006	
629	Wd	30	5.000	0.220	0.670	0.111	0.133	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.070	0.046	0.013	
630	Wd	37	6.000	0.500	0.270	0.074	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.060	0.014	
701	Wd	118	5.900	0.210	0.300	0.046	0.050	0.000	0.000	0.000	0.010	0.008	0.001	0.000	0.000	0.080	0.025	0.013	
704	We	98	4.800	0.220	0.360	0.053	0.075	0.000	0.000	0.000	0.010	0.010	0.002	0.000	0.000	0.110	0.050	0.024	
705	Wd	91	5.900	0.340	0.540	0.070	0.092	0.000	0.000	0.000	0.070	0.034	0.011	0.000	0.000	0.420	0.105	0.071	
706	Wd	54	6.700	0.370	0.430	0.068	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.460	0.144	0.069	
707	Wd	47	6.200	0.350	0.360	0.103	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
708	Wd	50	7.200	0.510	0.460	0.091	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.044	0.008	
711	Wd	46	4.100	0.350	0.520	0.111	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
712	Wd	28	6.100	0.660	0.680	0.155	0.112	0.000	0.000	0.000	0.040	0.036	0.006	0.000	0.000	0.110	0.060	0.018	
713	Wd	52	7.400	0.330	0.190	0.062	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.310	0.139	0.041	
714	Wd	36	7.700	0.360	0.670	0.132	0.086	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
715	Wd	45	6.200	0.380	0.600	0.121	0.097	0.000	0.000	0.000	0.040	0.031	0.007	0.000	0.000	0.000	0.000	0.000	
716	We	42	2.800	0.130	0.550	0.103	0.194	0.000	0.000	0.000	0.050	0.033	0.017	0.000	0.000	0.000	0.000	0.000	
717	We	64	5.700	0.460	0.410	0.085	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
720	Wd	50	7.900	0.480	0.340	0.084	0.043	0.000	0.000	0.000	0.040	0.040	0.005	0.000	0.000	0.000	0.000	0.000	
721	Wd	60	6.700	0.370	0.650	0.108	0.096	0.000	0.000	0.000	0.020	0.017	0.002	0.000	0.000	0.030	0.023	0.005	
722	Wd	32	3.900	0.120	0.560	0.142	0.143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
723	We	97	4.700	0.260	0.350	0.053	0.075	0.000	0.000	0.000	0.010	0.010	0.002	0.000	0.000	0.000	0.000	0.000	
724	We	48	3.800	0.140	0.380	0.077	0.098	0.020	0.021	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
726	Wd	33	3.700	0.260	0.360	0.114	0.098	0.030	0.030	0.008	0.000	0.000	0.000	0.000	0.000	0.030	0.030	0.008	

-Continued-

Appendix Table 4. Summary of daily angler effort (angler-hours) and harvest rates (HPUE, fish per angler-hour) for chinook and coho salmon, rainbow trout, and pink and chum salmon from angler interviews in the sport fishery in the lower Naknek River, 1988 (continued).

Date	Wd/ We 1/	Sample Size	Effort		Chinook			Coho			Rainbow Trout			Pink			Chum		
			Mean	SE 2/	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE	Mean	SE 2/	HPUE
727	Wd	55	7.200	0.410	0.600	0.067	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
728	Wd	61	6.800	0.220	0.950	0.100	0.140	0.000	0.000	0.000	0.020	0.016	0.002	0.020	0.016	0.002	0.000	0.000	0.000
730	We	73	4.100	0.230	0.780	0.096	0.189	0.040	0.030	0.010	0.010	0.014	0.003	0.010	0.014	0.003	0.000	0.000	0.000
731	We	53	4.000	0.200	0.430	0.079	0.110	0.190	0.097	0.048	0.040	0.026	0.010	0.150	0.083	0.038	0.000	0.000	0.000
802	Wd	13	3.000	0.310	0.000	0.000	0.000	1.150	0.436	0.380	0.000	0.000	0.000	0.150	0.104	0.051	0.000	0.000	0.000
803	Wd	47	3.900	0.170	0.000	0.000	0.000	0.170	0.076	0.043	0.020	0.021	0.005	0.510	0.139	0.130	0.000	0.000	0.000
804	Wd	44	4.100	0.220	0.000	0.000	0.000	0.140	0.062	0.033	0.000	0.000	0.770	0.192	0.188	0.000	0.000	0.000	
805	Wd	61	4.200	0.280	0.000	0.000	0.000	0.750	0.166	0.180	0.000	0.000	1.820	0.306	0.434	0.000	0.000	0.000	
806	We	36	2.700	0.200	0.000	0.000	0.000	0.470	0.180	0.176	0.000	0.000	1.810	0.345	0.672	0.000	0.000	0.000	
807	We	116	3.600	0.150	0.000	0.000	0.000	0.510	0.088	0.143	0.010	0.009	0.002	1.030	0.157	0.288	0.000	0.000	0.000
808	Wd	81	3.900	0.180	0.000	0.000	0.000	1.200	0.180	0.307	0.000	0.000	0.350	0.115	0.089	0.000	0.000	0.000	
809	Wd	22	3.900	0.190	0.000	0.000	0.000	3.050	0.413	0.775	0.000	0.000	0.360	0.224	0.092	0.000	0.000	0.000	
810	Wd	16	3.400	0.320	0.000	0.000	0.000	3.810	0.449	1.130	0.000	0.000	0.060	0.063	0.019	0.000	0.000	0.000	
811	Wd	32	3.300	0.360	0.000	0.000	0.000	2.000	0.365	0.598	0.000	0.000	0.560	0.242	0.168	0.000	0.000	0.000	
813	We	40	3.200	0.140	0.000	0.000	0.000	0.420	0.107	0.133	0.000	0.000	1.000	0.193	0.314	0.000	0.000	0.000	
815	Wd	47	5.600	0.220	0.000	0.000	0.000	1.530	0.237	0.274	0.000	0.000	0.130	0.078	0.023	0.000	0.000	0.000	
816	Wd	32	3.100	0.100	0.000	0.000	0.000	0.880	0.228	0.286	0.000	0.000	0.250	0.110	0.082	0.000	0.000	0.000	
817	Wd	37	4.400	0.270	0.000	0.000	0.000	1.490	0.250	0.336	0.000	0.000	0.080	0.060	0.018	0.000	0.000	0.000	
818	Wd	16	3.400	0.070	0.000	0.000	0.000	0.440	0.157	0.128	0.000	0.000	0.190	0.101	0.055	0.000	0.000	0.000	
819	Wd	38	5.600	0.450	0.000	0.000	0.000	1.180	0.255	0.211	0.000	0.000	0.630	0.166	0.112	0.000	0.000	0.000	
820	We	18	3.200	0.190	0.000	0.000	0.000	0.220	0.101	0.069	0.000	0.000	0.830	0.218	0.261	0.000	0.000	0.000	
822	Wd	13	3.800	0.100	0.000	0.000	0.000	0.920	0.265	0.240	0.000	0.000	0.850	0.222	0.220	0.000	0.000	0.000	
823	Wd	33	4.400	0.380	0.000	0.000	0.000	1.640	0.260	0.368	0.000	0.000	0.330	0.161	0.075	0.000	0.000	0.000	
824	Wd	17	3.700	0.380	0.000	0.000	0.000	0.760	0.235	0.208	0.000	0.000	0.940	0.406	0.256	0.000	0.000	0.000	
825	Wd	27	5.500	0.560	0.000	0.000	0.000	1.150	0.237	0.208	0.000	0.000	0.220	0.123	0.040	0.000	0.000	0.000	
827	We	18	3.100	0.190	0.000	0.000	0.000	0.280	0.158	0.089	0.000	0.000	0.110	0.076	0.035	0.000	0.000	0.000	
828	We	44	4.400	0.390	0.000	0.000	0.000	0.770	0.152	0.177	0.000	0.000	0.090	0.044	0.021	0.000	0.000	0.000	
829	Wd	16	5.900	0.540	0.000	0.000	0.000	1.880	0.437	0.317	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
830	Wd	26	4.800	0.450	0.000	0.000	0.000	1.040	0.274	0.215	0.000	0.000	0.230	0.128	0.048	0.000	0.000	0.000	
831	Wd	2	2.900	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
902	Wd	21	4.500	0.430	0.000	0.000	0.000	1.100	0.337	0.246	0.000	0.000	0.050	0.048	0.011	0.000	0.000	0.000	
903	We	11	3.800	0.750	0.000	0.000	0.000	0.270	0.141	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
905	We	10	3.700	0.970	0.000	0.000	0.000	0.500	0.307	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
906	Wd	11	1.800	0.360	0.000	0.000	0.000	0.450	0.282	0.251	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
907	Wd	2	3.000	0.000	0.000	0.000	0.000	2.000	0.000	0.667	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
908	Wd	2	3.000	0.000	0.000	0.000	0.000	1.500	0.500	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
911	We	2	1.800	0.000	0.000	0.000	0.000	2.000	2.000	1.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

1/ Wd = Weekday; We = Weekend.

2/ Standard Error.





