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CREEL AND ESCAPEMENT STATISTICS FOR THE ALAGNAK RIVER DURING 1988[1]

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX TABLES

ABSTRACT

A roving creel survey was conducted on a 19.2 kilometer (11.5 mile) section of the lower Alagnak River from 24 June through 4 August 1988. An estimated 13,287 angler-hours of sport fishing effort were expended on the lower river. This effort resulted in a catch (fish kept plus fish released) of 2,954 chinook salmon *Oncorhynchus tshawytscha*, 1,393 pink salmon *Oncorhynchus gorbuscha*, 538 chum salmon *Oncorhynchus keta*, 79 coho salmon *Oncorhynchus kisutch*, and 121 rainbow trout *Oncorhynchus mykiss*. Of this catch, an estimated 1,243 chinook salmon, 49 coho salmon, 178 chum salmon, 162 pink salmon, and 18 rainbow trout were harvested (kept). The spawning escapement of chinook salmon into the Alagnak drainage during 1988 was estimated to be 7,900 fish. Age 1.3 chinook salmon were the most abundant age group in both the sport harvest (53 percent) and spawning escapement (61 percent).

KEY WORDS: chinook salmon, *Oncorhynchus tshawytscha*, pink salmon, *Oncorhynchus gorbuscha*, coho salmon, *Oncorhynchus kisutch*, chum salmon, *Oncorhynchus keta*, rainbow trout, *Oncorhynchus mykiss*, creel survey, sport harvest, sport catch, sport effort, escapement, age composition, Alagnak River, Bristol Bay.

INTRODUCTION

The Alagnak River is located within the Bristol Bay Wild Trout Zone, approximately 64 km (40 mi) north of Naknek (Figure 1). Besides having an abundance of rainbow trout *Oncorhynchus mykiss*, Arctic grayling *Thymallus arcticus*, and Dolly Varden *Salvelinus malma*, the Alagnak River sustains significant runs of five species of Pacific salmon *O. spp.* Sport fishing effort on the Alagnak River has increased in recent years (Mills 1988).

A major component of the recreational fishery in the Alagnak River is the fishery for chinook salmon *O. tshawytscha* which occurs in the lower 20 km of the river. Sport harvests of chinook salmon have increased steadily from 1981 through 1987 (Mills 1988). During 1988, anglers were permitted a daily harvest of three chinook salmon, only two of which could be over 28 inches (ADF&G 1988). The daily bag and possession limits of other salmon (sockeye *O. nerka*, chum *O. keta*, pink *O. gorbuscha*, and coho *O. kisutch*) during 1988 were five fish in combination. Since the Alagnak River is located within the Bristol Bay Wild Trout Zone, terminal tackle was restricted to unbaited, single hook artificial lures from 8 June through 31 October.

Data describing the sport fishery on the Alagnak River has been limited to the statewide harvest mail survey compiled by Mills (1988). Escapement data have been routinely reported in the ADF&G, Commercial Fisheries Division, Bristol Bay Annual Management Report Series (ADF&G 1981-1989). To better improve our understanding of the sport fishery on the Alagnak River and evaluate current management practices and regulations governing the fishery, a creel survey of the fishery was initiated during 1988. Specific objectives of the survey were to:

1. estimate the sport effort participating in the sport fishery in the lower Alagnak River from 24 June through 4 August 1988;
2. estimate the number of chinook, coho, pink, and chum salmon and rainbow trout caught (fish landed) and harvested (fish retained) in the sport fishery on the lower Alagnak River from 24 June through 4 August 1988;
3. estimate the number of chinook salmon in the spawning escapement to the Alagnak River drainage during 1988; and,
4. estimate the size and age compositions of chinook salmon harvested in the sport fishery and in the spawning escapement to the Alagnak River during 1988.

METHODS

Creel Survey

The survey area started 7.5 km upstream of the confluence of the Alagnak and Kvichak Rivers and extended upstream 19.2 km (Figure 2). Virtually all of the fishing effort for chinook salmon is concentrated in this section of the river. Three temporal components were defined on the basis of run timing and angler activity: component one (24 June to 3 July), component two (4 July to 23 July), and component three (24 July to 4 August). Component two is

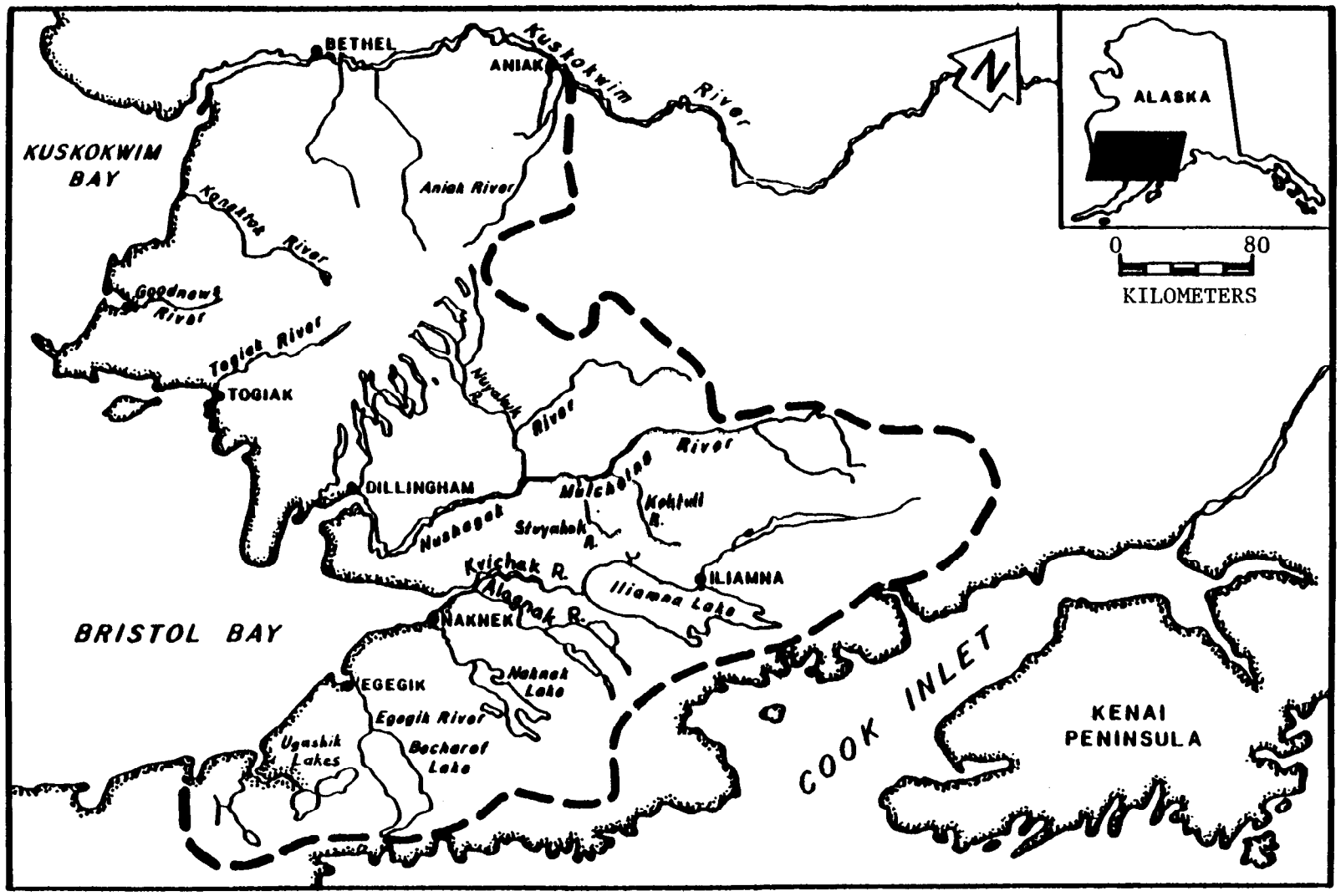

Figure 1. The Wild Trout Management Area of Bristol Bay, Alaska.

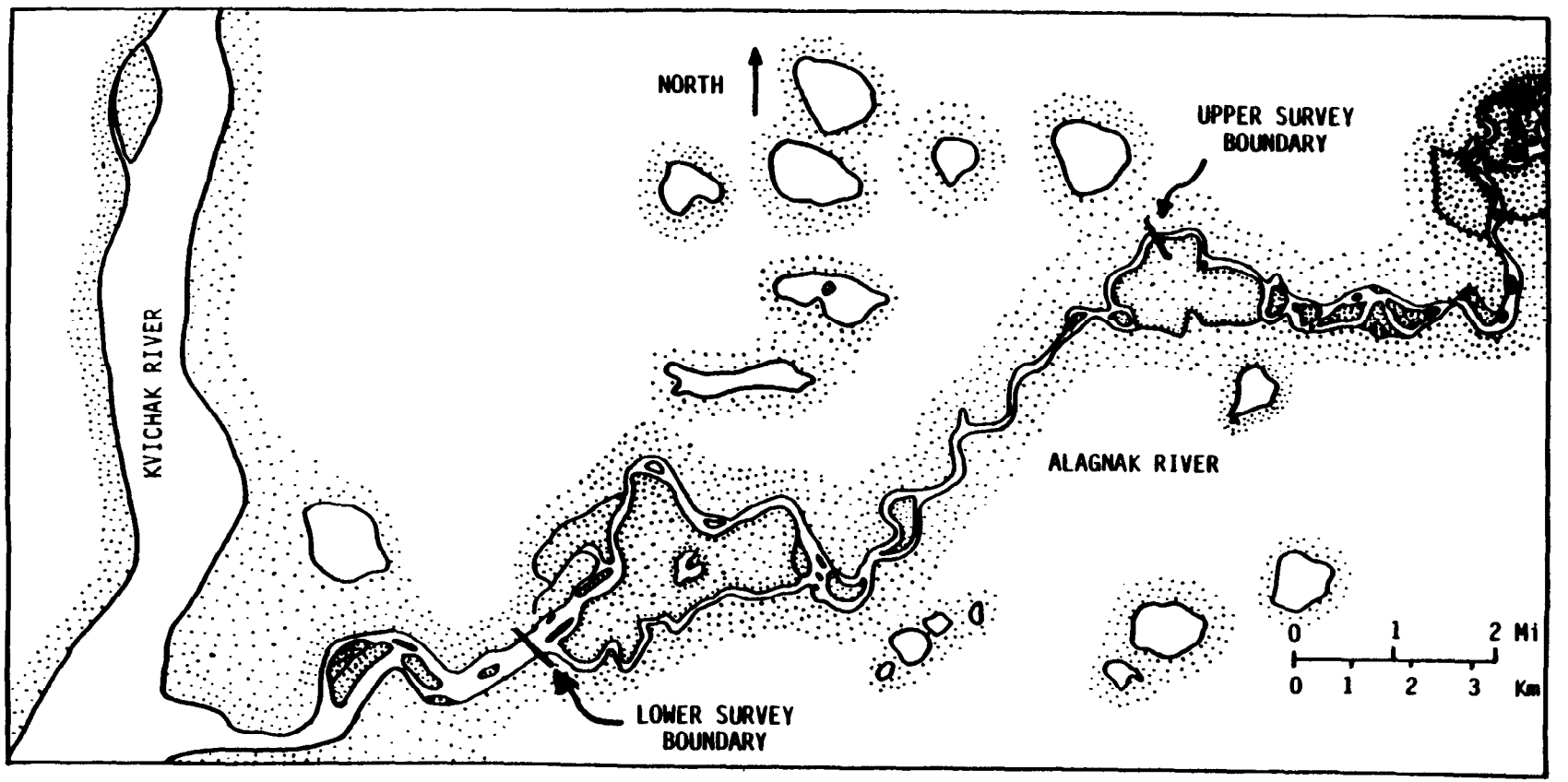

Figure 2. The creel survey study site on the lower Alagnak River, Alaska.

considered to be the peak fishing component, while components one and three are considered the pre- and post-peak components. The fishing day was considered to be 18 hours long and was divided into three time strata for the purpose of the survey: Period A (0600-1159), Period B (1200-1759), and Period C (1800-2400). Guided fishing accounts for the majority of the fishing effort on the Alagnak River and typically occurs between the hours of 0900 to 1800 hours.

A roving creel survey (Neuhold and Lu 1957) using a stratified, random sampling design was used to count anglers, conduct angler interviews, and sample the sport harvest. Count and count/interview sessions were scheduled randomly among periods within each temporal component. Sampling intensity varied between temporal components. Strata within a given temporal component were sampled with relatively equal intensity. Counts of anglers were used to estimate fishing effort in units of angler-hours, while angler interviews provided estimates of catch and harvest rates (fish per angler-hour). Catch and harvest rate estimates were derived from interviews with anglers who had not completed fishing for the day (referred to as incomplete trips). It is assumed that catch and harvest rates of incomplete trips provided an unbiased estimate of catch and harvest rates of completed trips.

The sampling levels for the pre- and post-peak components (24 June to 3 July and 24 July to 4 August, respectively) were nine count/interview sessions with three additional angler counts per 7-day week. Peak component (4 July to 23 July) sampling levels were increased to 12 angler count/interview sessions and six additional angler counts per week.

Within each designated count/interview session, one angler count was conducted. The remaining time in the session was spent interviewing anglers and obtaining age and size information from the sport harvest. Each count and count/interview session started at the upstream boundary of the survey area. If a count/interview was scheduled, a coin was tossed to determine if an angler count or angler interviews were to be conducted first. For counting anglers, a boat was driven through the survey area at a near constant rate of speed and all anglers 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 during the count.

All interviews were of individual anglers and were not party interviews. The survey clerk attempted to obtain a random sample of 5% to 10% of the available anglers so that the number of anglers interviewed was kept proportional to effort during the sample unit (Neuhold and Lu 1957, DiConstanzo 1956). For each angler contacted, 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 the angler, by species, and whether the angler was guided or not guided. Additionally, data on gear type (fly or spin), outboard motor size, and angler demographics were obtained and recorded.

Completed-trip angler information was collected from voluntary report forms given to interviewed anglers. The voluntary report form requested the time

fishing started and ended, the catch by species, and the number of fish retained, by species. Anglers were asked to mail the postage-paid forms to the Alaska Department of Fish and Game, Dillingham office.

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

$$\hat{E}_j = \sum_{i=1}^{p} H_i \bar{x}_i; \qquad [1]$$

where:

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

$\bar{x}_i$ = the mean angler count for period i during temporal component j.

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

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

where:

$$s^2 = [\sum_{h=1}^{w} \sum_{i=1}^{p} (y_{ik}-\bar{Y}_i)^2]/(m_i-1); \qquad [3]$$

and:

y_{ik} = a count of anglers made during day k and period i,

$\bar{Y}_i$ = the mean count of anglers for period i, and

m_i = the number of counts of anglers conducted during period i.

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:

$$\overline{CPUE}_j = \sum_{h=1}^{m_j} c_{jh} \; / \; \sum_{h=1}^{m_j} e_{jh}; \qquad [4]$$

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 $CPUE_j$ was approximated as (Jessen 1978):

$$V(\overline{CPUE}_j) = (\bar{C}_j/\bar{E}_j)^2 \left[s_c^2/\bar{C}_j^2 + s_e^2/\bar{E}_j^2 - (2r_j s_c s_e/\bar{C}_j\bar{E}_j)\right]; \qquad [5]$$

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 of $\bar{C}_j$,

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

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

The catch of each species during temporal component j was estimated by:

$$\hat{C}_j = \hat{E}_j(\overline{CPUE}_j). \qquad [6]$$

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

Harvest rates and total harvest of species j was estimated for each temporal component by substituting appropriate harvests for catches in equations 4, 5, and 6.

Total catch and harvest of a species j for the season 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 600 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. catch and harvest rates do not vary between periods within days.

Spawning Escapement Surveys

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

Size, Sex, and Age Sampling

Chinook salmon carcasses encountered during the creel and float surveys of spawning grounds were measured for mid-eye to fork-of-tail length (to the nearest millimeter), weighed (to the nearest 10 grams), and sexed based on external characteristics. Three scales were removed from the preferred area[1] of each fish and mounted on an adhesive coated card. Cards were thermo-hydraulically pressed against acetate cards and the resulting scale impressions were displayed on a microfiche projector for age determination[2].

The proportional age composition of the sport harvest and escapement was estimated when sample sizes were sufficient. Letting p_h equal 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):

$$\hat{V}(p_h) = \hat{p}_h(1-\hat{p}_h)/(n_T-1) \qquad [7]$$

where n_T is the number of scales read. Mean length and weight at age by sex and their variances were estimated using standard normal procedures.

[1] 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).

[2] 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.

RESULTS

Creel Statistics

The creel survey of the sport fishery on the lower Alagnak River was conducted from 24 June to 4 August 1988. Daily counts of anglers are presented, by strata, in Appendix Table 1. Daily harvest and catch rates for all interviewed anglers for chinook, coho, chum, and pink salmon, and rainbow trout are presented in Appendix Tables 2 and 3, respectively.

Total sport effort on the lower section of the Alagnak River was estimated to be 13,287 angler-hours during the survey period (Table 1). Most of the fishing effort (10,393 angler hours or 78%) occurred during the second temporal component. Effort during components one and three was estimated at 374 and 2,520 angler-hours, respectively. Based on completed-trip data, the mean length of an angler day was estimated to be 7.9 hours (n=28, SE=0.38).

Mean catch rates for chinook salmon (all anglers) were highest during component two (4 July-23 July) at 0.23 fish per hour (Table 2). Chinook salmon catch and harvest rates during component one (24 June-3 July) averaged 0.13 and 0.06 fish per hour, respectively. Mean catch and harvest rates during component three (24 July-4 August) were similar to the mean catch and harvest rates of component two, averaging 0.21 and 0.10 fish per hour, respectively. Mean catch rates for all anglers for chum and pink salmon (0.11 and 0.55 fish per hour) were greatest during component three; however, harvest rates for both species were low.

Mean catch rates for chinook salmon for guided anglers were considerably higher than those for unguided anglers in every component (Table 3). The estimated seasonal catch rate for guided anglers (0.26 fish per hour) was 215% higher than the estimated seasonal catch rate for unguided anglers (0.12 fish per hour). Harvest rate estimates for guided and unguided anglers for chinook salmon were similar throughout the season, with the seasonal harvest rate for guided anglers estimated at 0.10 fish per hour and the seasonal harvest rate for unguided anglers estimated at 0.08 fish per hour.

An estimated 2,954 chinook salmon were caught in the sport fishery during the survey period of which 1,243 (42%) were harvested (Table 4). The majority of the chinook salmon catch and harvest occurred during temporal component two (4 July-23 July). Catch and harvest of pink salmon during the survey period was estimated to be 1,393 fish and 162 fish (12%), respectively. A total of 538 chum salmon were caught of which 178 (33%) were harvested. Rainbow trout catch totaled 121 fish with 15% (18 fish) being harvested. Estimated harvest and catch figures for pink, chum, and coho salmon, and rainbow trout are considered to be minimum estimates due to the limited extent (time and area) of this creel survey. While the creel survey was curtailed at the end of the chinook salmon fishery, additional catches and harvests of rainbow trout and chum, pink, and especially coho salmon, occurred during August and September.

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

Temporal Component[1]	Strata[2]	Counts			Effort		
		Number	Mean	SE[3]	Ang-Hrs	SE[3]	RP[4]
1	A	5	0.0	0.0	0	0.0	
	B	6	3.8	1.7	230	99.7	
	C	5	2.4	1.5	144	90.2	
	All				374	134.4	70.2%
2	A	16	21.6	6.9	2,588	830.4	
	B	18	49.7	5.3	5,967	637.9	
	C	19	15.3	1.9	1,838	225.7	
	All				10,393	1,071.2	20.2%
3	A	8	10.3	6.1	738	440.2	
	B	6	17.0	4.0	1,224	289.2	
	C	4	7.8	3.9	558	284.0	
	All				2,520	598.4	46.5%
Season					13,287	1,234.4	18.2%

[1] Component 1: 6/24-7/3, Component 2: 7/4-7/23, Component 3: 7/24-8/4.

[2] Strata A: 0600-1200, Strata B: 1200-1800, Strata C: 1800-2400.

[3] Standard error.

[4] Relative precision (α=0.05).

Table 2. Catch per angler-hour and harvest per angler-hour by species and temporal component for the sport fishery in the lower Alagnak River, 1988.

Species	Sampling Component[1]	Catch Rate		Harvest Rate	
		Fish/Hr	SE[2]	Fish/Hr	SE[2]
Chinook Salmon	1	0.1274	0.0572	0.0637	0.0370
	2	0.2285	0.0174	0.0942	0.0087
	3	0.2108	0.0399	0.0951	0.0200
Coho Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0058	0.0058	0.0029	0.0026
	3	0.0077	0.0087	0.0077	0.0087
Chum Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0256	0.0096	0.0128	0.0034
	3	0.1080	0.0234	0.0180	0.0092
Pink Salmon	1	0.0000	0.0000	0.0000	0.0000
	2	0.0006	0.0005	0.0000	0.0000
	3	0.5502	0.1982	0.0643	0.0345
Rainbow Trout	1	0.0637	0.0420	0.0000	0.0000
	2	0.0081	0.0022	0.0017	0.0015
	3	0.0051	0.0069	0.0000	0.0000

[1] Component 1: 6/24-7/3, Component 2: 7/4-7/23), Component 3: 7/24-8/4.

[2] Standard error.

Table 3. Catch and harvest rates (fish per angler-hour) of chinook salmon by guided and unguided anglers for the sport fishery in the lower Alagnak River, 1988.

Temporal Component[1]	No. Interviews		Catch Rate		Harvest Rate	
	Guided	Unguided	Guided	Unguided	Guided	Unguided
1	18	0	0.1274	----	0.0637	----
2	349	154	0.2724	0.1256	0.1006	0.0849
3	105	14	0.2284	0.0529	0.0966	0.0529
Season	472	168	0.2591	0.1204	0.0965	0.0826

[1] Component 1: 6/24-7/3, Component 2: 7/4-7/23, Component 3: 7/24-8/4.

Table 4. Estimated catch and harvest by species for the sport fishery in the lower Alagnak River, 1988.

Species	Temporal Component[1]	Catch			Harvest		
		Number	SE[2]	RP[3]	Number	SE[2]	RP[3]
Chinook	1	48	26	107.4%	24	15	126.5%
	2	2,375	304	25.0%	979	135	27.1%
	3	531	160	58.9%	240	75	61.3%
	Total	2,954	344	22.8%	1,243	155	24.5%
Coho	1	0	0		0	0	
	2	60	61	198.3%	30	27	177.2%
	3	19	22	225.8%	19	22	225.8%
	Total	79	65	160.1%	49	35	139.4%
Chum	1	0	0		0	0	
	2	266	103	75.9%	133	38	55.5%
	3	272	86	62.2%	45	25	109.1%
	Total	538	134	49.0%	178	45	49.8%
Pink	1	0	0		0	0	
	2	6	5	163.3%	0	0	
	3	1,387	586	82.9%	162	93	112.2%
	Total	1,393	586	82.5%	162	93	112.2%
Rainbow Trout	1	24	17	138.6%	0	0	
	2	84	24	56.8%	18	16	174.6%
	3	13	17	260.3%	0	0	
	Total	121	34	55.6%	18	16	174.6%

[1] Component 1: 6/24-7/3, Component 2: 7/4-7/23, Component 3: 7/24-8/4.

[2] Standard error.

[3] Relative precision at α=0.05.

Spawning Escapement

The spawning escapement of chinook salmon into the Alagnak River drainage was estimated to be 7,900 fish (Table 5).

Size, Sex, and Age Compositions

Males comprised 68% of the chinook salmon (n=194) harvested in the sport fishery (Table 6). Age 1.3 fish were the most abundant age group in the harvest (53%). Mean length and weight of harvested chinook salmon was 818 mm (n=194) and 10.8 kg (n=188) respectively. The largest chinook salmon sampled during the survey was 1,135 mm long and weighed 24.8 kg (55 pounds).

A total of 256 spawned-out chinook salmon carcasses were sampled during float trips of the spawning grounds. The age compositions of the sampled portions of the sport harvest and spawning escapements (Figure 3) were significantly different ($p=0.02$), with most of the overall differences due to differences in the proportions of age 1.0, 1.1, and 1.4 fish. The mean length-at-age of the sampled portions of the sport harvest (Table 6) and spawning escapement (Table 7) was similar.

DISCUSSION

The estimated sport harvest of 1,243 chinook salmon from the lower Alagnak River in 1988 is almost double the 1986 harvest reported in the statewide mail survey (Mills 1987). This, coupled with the 1987 harvest reported by Mills of 1,969 (Mills 1988), suggests an increasing trend in the annual sport harvest of chinook salmon (Figure 4). Growth of the recreational chinook salmon fishery, although dramatic in recent years, still appears to be well within acceptable limits given the relative consistency in spawning escapements (Table 5). Regulation changes adopted by the Alaska Board of Fisheries in 1987, as summarized in the introduction, appear to be satisfactory and no changes in seasons, bag, or possession limits are recommended at this time.

ACKNOWLEDGEMENTS

I wish to thank Mac Minard for his help in designing and conducting this study. I also wish to thank the regional biometric staff for the assistance with data analyses.

Table 5. Escapement estimates[1] for returns of chinook salmon in the Alagnak River, 1980-1988.

Year	Escapement Index[2]
1980	5,860
1981	8,540
1982	5,500
1983	3,500
1984	9,135
1985	9,518
1986	7,200
1987	5,363
Average	6,827[3]
1988	7,900

1 Estimates are based on unexpanded aerial surveys.

2 Data for 1980-1987 are reported from Alaska Department of Fish and Game, Commercial Fisheries Division, Annual Management Reports. Data for 1988 taken from Alaska Department of Fish and Game, Division of Commercial Fisheries, in press.

3 Standard error = 750.6.

Table 6. Sex, age, length (millimeters), and weight (kilograms) compositions of chinook salmon sampled from the sport harvest in the lower Alagnak River, 1988.

		Age Group						
		1.0	1.1	1.2	1.3	1.4	1.5	Total
Males								
	Percent	1.55%	3.09%	7.22%	39.69%	15.46%	0.52%	67.53%
	Std Error	1%	1%	2%	4%	3%	1%	3%
	Sample Size	3	6	14	77	30	1	131
	Av Length	407	426	594	820	935	1007	796
	Std Error	11.32	35.99	46.71	13.21	15.53		15.67
	Sample Size	3	6	14	77	30	1	131
	Av Weight	3.3	1.4	4.5	10.1	14.8	22.5	10.2
	Std Error	2.3	0.41	0.89	0.41	0.73		0.46
	Sample Size	3	6	13	74	30	1	127
Females								
	Percent	0.00%	0.52%	1.03%	13.40%	17.53%	0.00%	32.47%
	Std Error		1%	1%	2%	3%		3%
	Sample Size		1	2	26	34		63
	Av Length		357	634	855	900		864
	Std Error			119	10.46	15.54		14.13
	Sample Size		1	2	26	34		63
	Av Weight		0.5	1.8	11.0	13.6		12.1
	Std Error				0.37	0.35		0.39
	Sample Size		1	1	25	34		61
Both Sexes								
	Percent	1.55%	3.61%	8.25%	53.09%	32.99%	0.52%	100.00%
	Std Error	1%	1%	2%	4%	3%	1%	
	Sample Size	3	7	16	103	64	1	194
	Av Length	407	416	599	829	916	1007	818
	Std Error	11.32	31.97	42.24	10.31	11.14		11.74
	Sample Size	3	7	16	103	64	1	194
	Av Weight	3.3	1.2	4.3	10.4	14.2	22.5	10.8
	Std Error	2.33	0.37	0.85	0.33	0.4		0.34
	Sample Size	3	7	14	99	64	1	188

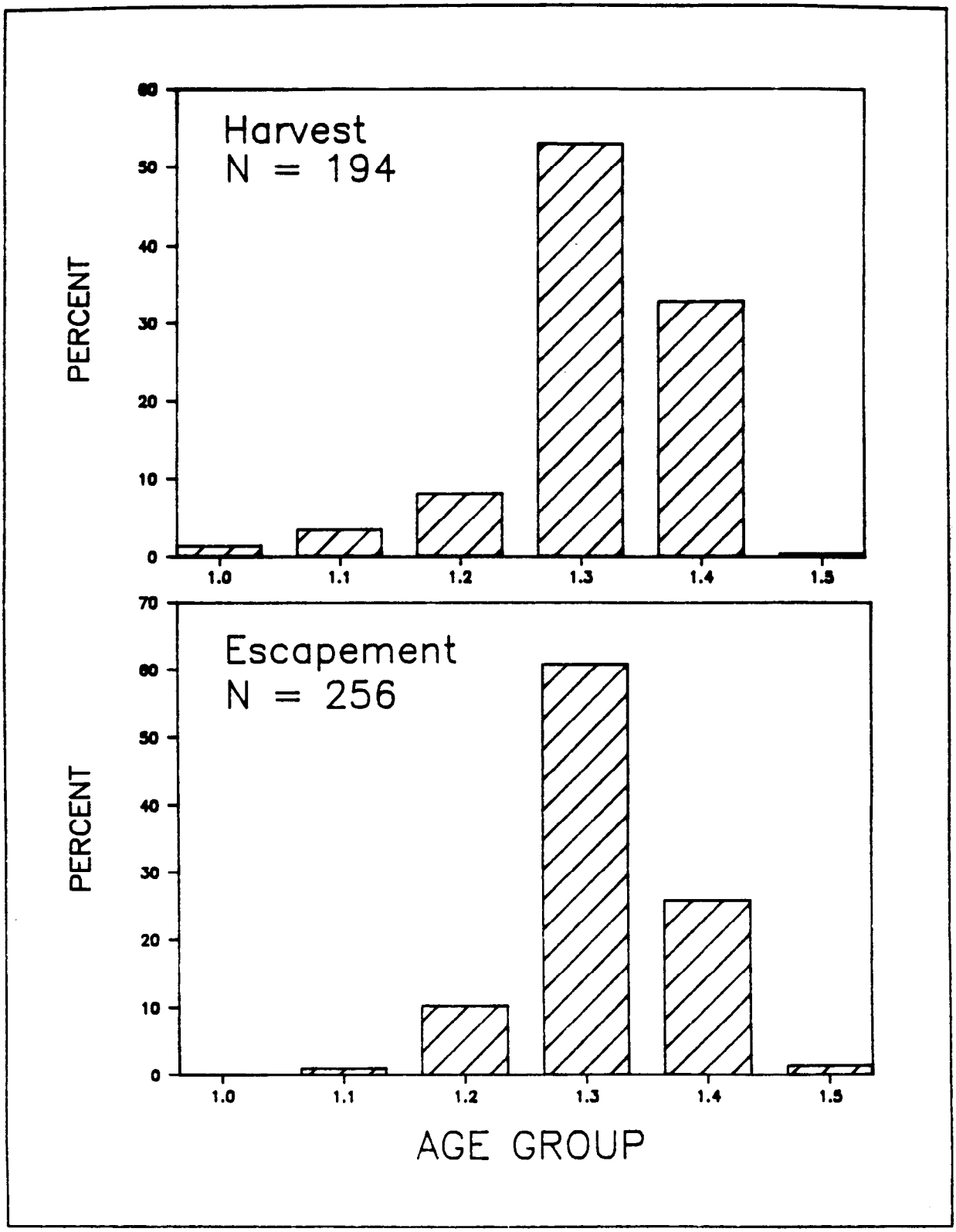

Figure 3. Age composition of chinook salmon harvested in the sport fishery and in the spawning escapement of the Alagnak River during 1988.

Table 7. Sex, age, and length (millimeters) compositions of the chinook salmon escapement in the Alagnak River, 1988.

	Age Group					
	1.1	1.2	1.3	1.4	1.5	Total
Males						
Percent	1.17%	5.47%	40.63%	14.45%	0.78%	62.50%
Std Error	1%	1%	3%	2%	1%	3%
Sample Size	3	14	104	37	2	160
Av Length	641	786	877	922	1024	877
Std Error	147.8	20.6	6.94	16.09	2.5	7.61
Sample Size	3	14	104	37	2	160
Females						
Percent	0.00%	5.08%	20.31%	11.33%	0.78%	37.50%
Std Error		1%	3%	2%	1%	3%
Sample Size		13	52	29	2	96
Av Length		818	874	919	951	882
Std Error		22.86	8.21	10.33	25.5	7.05
Sample Size		13	52	29	2	96
Both Sexes						
Percent	1.17%	10.55%	60.94%	25.78%	1.56%	100.00%
Std Error	1%	2%	3%	3%	1%	
Sample Size	3	27	156	66	4	256
Av Length	641	802	876	921	987	879
Std Error	147.8	15.37	5.36	10.03	23.53	5.43
Sample Size	3	27	156	66	4	256

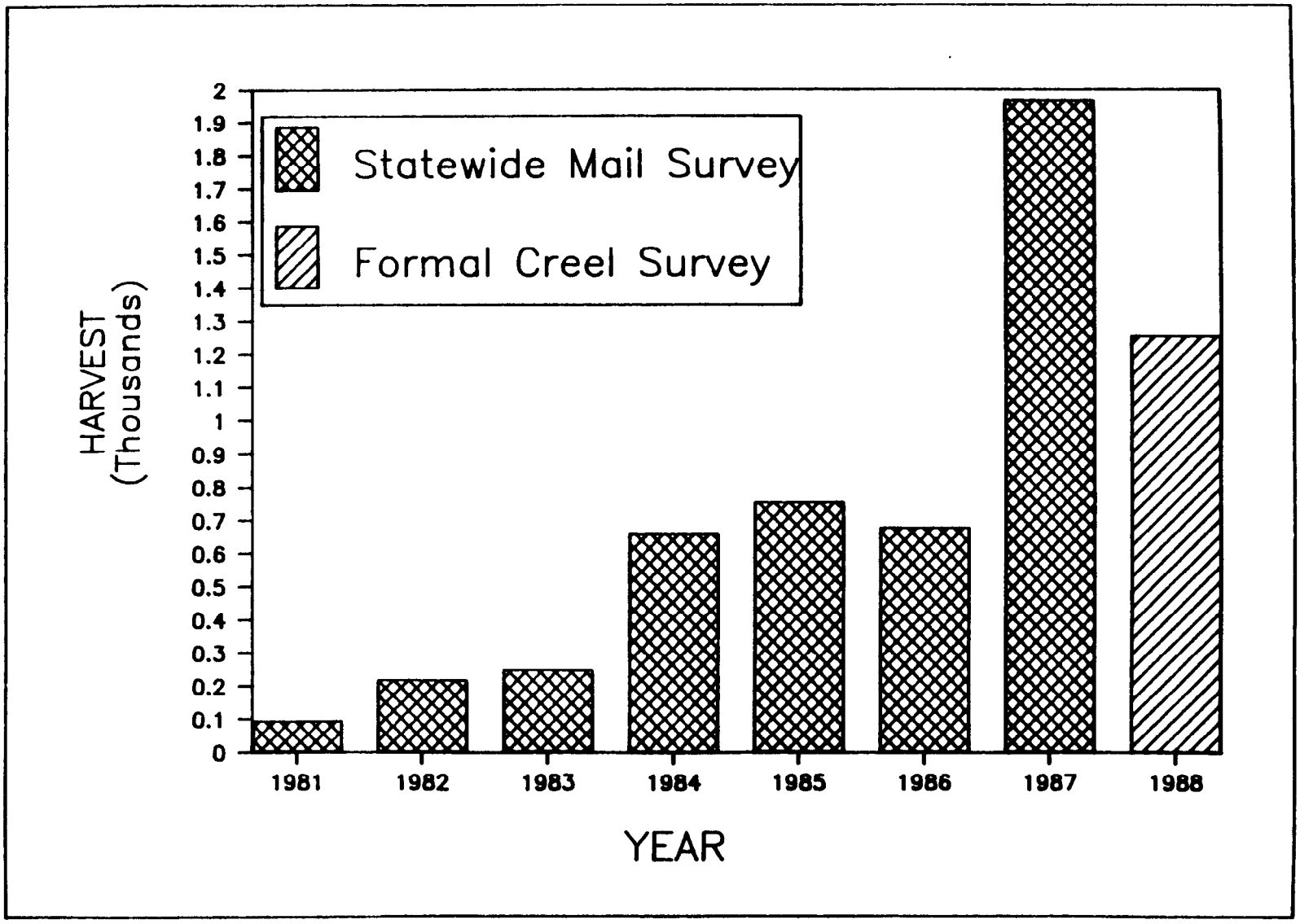

Figure 4. Harvest of chinook salmon in the sport fishery in the Alagnak River during the years 1981-1988.

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APPENDIX

Appendix Table 1. Angler counts for the sport fishery on the lower Alagnak River, 1988.

Temporal Component[2]	Date	Strata[1] A	B	C
1	24-Jun		3	0
	25-Jun		0	
	26-Jun			1
	27-Jun			
	28-Jun	0		8
	29-Jun	0	6	3
	30-Jun	0	1	0
	01-Jul		2	
	02-Jul	0	11	
	03-Jul	0		
2	04-Jul	0	54	14
	05-Jul		37	4
	06-Jul	0	41	18
	07-Jul		84	11
	08-Jul	8	51	9
	09-Jul		43	20
	10 Jul	3	40	17
	11-Jul	11	40	11
	12-Jul	0	100	7
	13-Jul		94	22
	14-Jul	75		8
	15-Jul	0	51	16
	16-Jul	0	40	28
	17-Jul	70		22
	18-Jul	7	65	
	19-Jul	72	21	36
	20-Jul	17	45	6
	21-Jul	36	38	12
	22-Jul	10	24	21
	23-Jul	36	27	9
	24-Jul	0		

-Continued-

Appendix Table 1. Angler counts for the sport fishery on the lower Alagnak River, 1988 (continued).

Temporal Component[2]	Date	Strata[1] A	Strata[1] B	Strata[1] C
3	25-Jul	0		
	26-Jul		19	19
	27-Jul	0		4
	28-Jul	47		
	29-Jul			
	30-Jul	0	30	
	31-Jul	25	20	
	01-Aug		22	1
	02-Aug	10	3	7
	03-Aug	0	8	

[1] Strata A: 0600-1200, Strata B: 1200-1800, Strata C: 1800-2400.

[2] Temporal Components: 1 (6/24-7/3), 2 (7/4-7/23), and 3 (7/24-8/04).

Appendix Table 2. Summary of daily angler-effort (angler-hours) and harvest rates (HPUE, fish per angler-hour) for chinook, coho, chum, and pink salmon, and rainbow trout from angler interviews on the lower Alagnak River, 1988.

Date	We/Wd[1]	Sample Size	Effort		Chinook			Coho			Chum			Pink			Rainbow Trout		
			Mean	SE[2]	Mean	SE[2]	HPUE	Mean	SE[2]	HPUE	Mean	SE[2]	HPUE	Mean	SE[2]	HPUE	Mean	SE[2]	HPUE
6/26	We	2	4.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
6/28	Wd	3	4.3	0.00	0.33	0.333	0.078	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/02	We	5	4.4	0.09	0.40	0.245	0.090	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/03	We	8	0.4	0.08	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/04	We	22	3.2	0.30	0.68	0.153	0.214	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/05	Wd	25	4.6	0.56	0.56	0.154	0.122	0.00	0.000	0.000	0.08	0.055	0.017	0.00	0.000	0.000	0.00	0.000	0.000
7/06	Wd	29	4.0	0.28	0.48	0.128	0.122	0.00	0.000	0.000	0.03	0.034	0.009	0.00	0.000	0.000	0.00	0.000	0.000
7/07	Wd	5	4.1	1.49	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/08	Wd	6	0.8	0.11	0.17	0.167	0.222	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/09	We	32	4.8	0.52	0.28	0.092	0.059	0.00	0.000	0.000	0.09	0.052	0.020	0.00	0.000	0.000	0.00	0.000	0.000
7/10	We	20	4.4	0.21	0.25	0.099	0.057	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/11	Wd	25	2.2	0.40	0.20	0.082	0.092	0.16	0.160	0.074	0.24	0.133	0.111	0.00	0.000	0.000	0.00	0.000	0.000
7/12	Wd	30	3.3	0.31	0.20	0.101	0.060	0.00	0.000	0.000	0.13	0.063	0.040	0.00	0.000	0.000	0.00	0.000	0.000
7/13	Wd	36	3.1	0.29	0.36	0.099	0.117	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/14	Wd	41	2.5	0.25	0.41	0.105	0.165	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/16	We	11	5.6	1.46	0.55	0.207	0.098	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.09	0.091	0.016
7/17	We	48	1.6	0.16	0.25	0.076	0.155	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/18	Wd	49	4.3	0.24	0.47	0.101	0.110	0.00	0.000	0.000	0.02	0.020	0.005	0.00	0.000	0.000	0.04	0.029	0.010
7/19	Wd	58	2.3	0.20	0.16	0.054	0.069	0.02	0.017	0.008	0.03	0.034	0.015	0.00	0.000	0.000	0.00	0.000	0.000
7/20	Wd	12	8.0	0.93	0.42	0.193	0.052	0.00	0.000	0.000	0.08	0.083	0.010	0.00	0.000	0.000	0.00	0.000	0.000
7/21	Wd	34	3.5	0.59	0.03	0.029	0.008	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/22	Wd	20	2.3	0.47	0.10	0.069	0.044	0.00	0.000	0.000	0.05	0.050	0.022	0.00	0.000	0.000	0.00	0.000	0.000
7/23	We	28	1.7	0.30	0.18	0.090	0.102	0.00	0.000	0.000	0.04	0.036	0.020	0.00	0.000	0.000	0.00	0.000	0.000
7/25	Wd	9	1.9	0.31	0.22	0.147	0.116	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/26	Wd	25	4.4	0.39	0.36	0.114	0.081	0.00	0.000	0.000	0.08	0.055	0.018	0.20	0.115	0.045	0.00	0.000	0.000
7/27	Wd	4	3.8	0.55	0.75	0.250	0.198	0.00	0.000	0.000	0.00	0.000	0.000	1.00	1.000	0.264	0.00	0.000	0.000
7/28	Wd	27	2.0	0.21	0.04	0.037	0.019	0.00	0.000	0.000	0.11	0.062	0.056	0.15	0.088	0.074	0.00	0.000	0.000
7/29	Wd	5	5.3	0.10	0.80	0.374	0.150	0.20	0.200	0.038	0.40	0.245	0.075	0.20	0.200	0.038	0.00	0.000	0.000
7/30	We	13	4.4	0.12	0.69	0.133	0.157	0.00	0.000	0.000	0.00	0.000	0.000	0.23	0.231	0.052	0.00	0.000	0.000
7/31	We	19	2.0	0.22	0.11	0.072	0.052	0.00	0.000	0.000	0.00	0.000	0.000	0.05	0.053	0.026	0.00	0.000	0.000
8/01	Wd	11	4.4	0.42	0.55	0.207	0.124	0.00	0.000	0.000	0.00	0.000	0.000	0.36	0.152	0.083	0.00	0.000	0.000
8/02	Wd	3	0.8	0.00	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
8/03	Wd	11	1.7	0.46	0.09	0.091	0.054	0.18	0.182	0.108	0.00	0.000	0.000	0.27	0.195	0.162	0.00	0.000	0.000

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

[2] Standard Error.

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

			Effort		Chinook			Coho			Chum			Pink			Rainbow Trout		
Date	We/Wd[1]	Sample Size	Mean	SE[2]	Mean	SE[2]	CPUE	Mean	SE[2]	CPUE	Mean	SE[2]	CPUE	Mean	SE[2]	CPUE	Mean	SE[2]	CPUE
6/26	We	2	4.5	0.00	0.50	0.500	0.111	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
6/28	Wd	3	4.3	0.00	0.33	0.333	0.078	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/02	We	5	4.4	0.09	0.80	0.374	0.180	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.40	0.400	0.090
7/03	We	8	0.4	0.08	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.13	0.125	0.323
7/04	We	22	3.2	0.30	0.95	0.180	0.300	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/05	Wd	25	4.6	0.56	1.68	0.281	0.367	0.00	0.000	0.000	0.12	0.066	0.026	0.00	0.000	0.000	0.00	0.000	0.000
7/06	Wd	29	4.0	0.28	1.17	0.222	0.296	0.00	0.000	0.000	0.10	0.058	0.026	0.00	0.000	0.000	0.07	0.048	0.017
7/07	Wd	5	4.1	1.49	0.80	0.374	0.195	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/08	Wd	6	0.8	0.11	0.17	0.167	0.222	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000
7/09	We	32	4.8	0.52	0.84	0.277	0.177	0.00	0.000	0.000	0.13	0.059	0.026	0.00	0.000	0.000	0.06	0.043	0.013
7/10	We	20	4.4	0.21	0.70	0.206	0.158	0.00	0.000	0.000	0.05	0.050	0.011	0.00	0.000	0.000	0.00	0.000	0.000
7/11	Wd	25	2.2	0.40	0.24	0.087	0.111	0.36	0.360	0.166	0.24	0.133	0.111	0.00	0.000	0.000	0.04	0.040	0.018
7/12	Wd	30	3.3	0.31	0.70	0.215	0.211	0.00	0.000	0.000	0.13	0.063	0.040	0.00	0.000	0.000	0.00	0.000	0.000
7/13	Wd	36	3.1	0.29	1.19	0.308	0.388	0.00	0.000	0.000	0.08	0.061	0.027	0.00	0.000	0.000	0.03	0.028	0.009
7/14	Wd	41	2.5	0.25	1.07	0.179	0.427	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.02	0.024	0.010
7/16	We	11	5.6	1.46	0.55	0.207	0.098	0.00	0.000	0.000	0.36	0.364	0.065	0.00	0.000	0.000	0.09	0.091	0.016
7/17	We	48	1.6	0.16	0.42	0.098	0.258	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.04	0.029	0.026
7/18	Wd	49	4.3	0.24	1.04	0.189	0.245	0.00	0.000	0.000	0.02	0.020	0.005	0.00	0.000	0.000	0.04	0.029	0.010
7/19	Wd	58	2.3	0.20	0.33	0.075	0.146	0.02	0.017	0.008	0.03	0.034	0.015	0.00	0.000	0.000	0.02	0.017	0.008
7/20	Wd	12	8.0	0.93	1.00	0.389	0.125	0.00	0.000	0.000	0.08	0.083	0.010	0.00	0.000	0.000	0.00	0.000	0.000
7/21	Wd	34	3.5	0.59	0.09	0.049	0.025	0.00	0.000	0.000	0.03	0.029	0.008	0.03	0.029	0.008	0.03	0.029	0.008
7/22	Wd	20	2.3	0.47	0.50	0.320	0.219	0.00	0.000	0.000	0.50	0.407	0.219	0.00	0.000	0.000	0.00	0.000	0.000
7/23	We	28	1.7	0.30	0.54	0.189	0.307	0.00	0.000	0.000	0.04	0.036	0.020	0.00	0.000	0.000	0.00	0.000	0.000
7/25	Wd	9	1.9	0.31	0.44	0.242	0.232	0.00	0.000	0.000	0.11	0.111	0.058	0.00	0.000	0.000	0.00	0.000	0.000
7/26	Wd	25	4.4	0.39	0.88	0.240	0.198	0.00	0.000	0.000	0.56	0.245	0.126	0.76	0.375	0.171	0.00	0.000	0.000
7/27	Wd	4	3.8	0.55	1.00	0.408	0.264	0.00	0.000	0.000	0.25	0.250	0.066	1.00	1.000	0.264	0.00	0.000	0.000
7/28	Wd	27	2.0	0.21	0.04	0.037	0.019	0.00	0.000	0.000	0.56	0.180	0.279	0.37	0.170	0.186	0.00	0.000	0.000
7/29	Wd	5	5.3	0.10	1.40	0.748	0.263	0.20	0.200	0.038	0.60	0.400	0.113	1.00	0.775	0.188	0.20	0.200	0.038
7/30	We	13	4.4	0.12	2.08	0.537	0.472	0.00	0.000	0.000	0.15	0.154	0.035	1.15	1.154	0.262	0.08	0.077	0.017
7/31	We	19	2.0	0.22	0.32	0.217	0.156	0.00	0.000	0.000	0.05	0.053	0.026	0.11	0.072	0.052	0.00	0.000	0.000
8/01	Wd	11	4.4	0.42	0.91	0.315	0.206	0.00	0.000	0.000	0.09	0.091	0.021	5.09	3.052	1.156	0.00	0.000	0.000
8/02	Wd	3	0.8	0.00	0.00	0.000	0.000	0.00	0.000	0.000	0.67	0.333	0.889	1.33	0.882	1.778	0.00	0.000	0.000
8/03	Wd	11	1.7	0.46	0.09	0.091	0.054	0.18	0.182	0.108	0.18	0.122	0.108	9.00	4.081	5.348	0.00	0.000	0.000

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

[2] Standard Error.