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Creel and Escapement Statistics for the Chinook and Coho Salmon Fisheries in the Lower Naknek River, Alaska, during 1991

by

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Lewis G. Coggins, Jr.

Alaska Department of Fish and Game
Division of Sport Fish
Anchorage, Alaska

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ABSTRACT

An estimated 41,538 hours of effort were expended by recreational anglers fishing the lower Naknek River from 1 June through 1 September 1991. Most of the effort (28,814 hours or 69%) occurred during the June and July chinook salmon fishery and was 42% below the 1986-1990 average of 49,665 hours. The remaining effort in August (12,724 hours or 31%) was directed at coho salmon and was similar to the 1986-1990 average of 12,787 hours. Anglers caught (landed) and harvested (kept) an estimated 3,663 and 3,115 (85% harvested) chinook salmon *Oncorhynchus tshawytscha*, 4,828 and 4,475 (93% harvested) coho salmon *Oncorhynchus kisutch*, 904 and 759 (84% harvested) chum salmon *Oncorhynchus keta*, and 447 and 94 (21% harvested) rainbow trout *Oncorhynchus mykiss*. Age-1.3 (41%) and -1.4 (40%) chinook salmon, and age-2.1 (83%) coho salmon dominated the harvest. The spawning escapement of chinook salmon, as determined by aerial survey counts of live fish, was 4,391 fish which was below the 1986-1990 average of 5,961 fish. An emergency order which prohibited fishing for chinook salmon in King Salmon Creek and Paul's Creek, as well as the waters surrounding their confluences with the Naknek River, took effect 1 June. These closures were enacted in an attempt to provide adequate chinook salmon escapement into these streams. The emergency order was only partially effective as Paul's Creek received an above average escapement while King Salmon Creek received a below average escapement.

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

INTRODUCTION

The Naknek River (Figure 1) supports the largest chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, and rainbow trout *Oncorhynchus mykiss* sport fisheries in southwestern Alaska. Sport fishing effort in the Naknek River drainage has increased steadily from 4,675 angler-days in 1977 to 14,120 angler days in 1989 (Mills 1979-1990). On-site creel surveys conducted in 1987, 1988, and 1989 indicate a high level of effort, averaging over 70,000 angler-hours in the lower Naknek River (Dunaway and Bingham 1991). Ease of access to the river and regularly scheduled airline service from Anchorage to King Salmon contribute to the popularity of the Naknek River sport fisheries.

Adult chinook salmon first enter the Naknek River in late May. The majority of the run migrates through the lower section of river during a 4 to 5 week period beginning in mid-June, and abundance peaks in early July. Coho salmon are first available to the recreational fishery in mid to late July, with peak catches occurring in mid-August. By the middle of September, the coho salmon run into the Naknek River has declined to insignificant levels and the sport fishery for coho salmon is virtually over.

On-site creel surveys have been conducted by the Alaska Department of Fish and Game (ADF&G) on the Naknek River sporadically since 1967 (Gwartney 1976, 1978, 1979, and 1980; Minard 1987 and 1989; Minard and Brookover 1988; Dunaway 1990; and Dunaway and Bingham 1991). In some instances, the sport harvest has constituted a significant removal of the total annual return. For example, in 1987, anglers harvested an estimated 11,420 chinook salmon, or nearly 48% of the total annual return (Minard and Brookover 1988). This signified the sport fishery as the largest component of harvest followed by the commercial fishery (21%) and subsistence fishery (4%), which harvested 5,000 and 1,000 chinook salmon, respectively. The chinook and coho salmon fisheries on the Naknek River occur primarily in the lower portion of the river between Smelt Creek and Big Creek (Figure 1).

The objectives of the 1991 lower Naknek River creel survey were:

1. to estimate angling effort (in angler-hours), during the period 1 June to 15 September;

2. to estimate catch (fish kept plus released), harvest (fish kept), and CPUE (catch per unit effort) of chinook and coho salmon caught in the lower Naknek River, from 1 June to 15 September;

3. to estimate the distribution of catches and harvests of coho and chinook salmon by angler-day;

4. to estimate the age, sex, and length composition of chinook and coho salmon harvested by the sport fishery in the lower Naknek River;

5. to index by aerial survey the spawning escapement of chinook salmon in Paul's, King Salmon, and Big creeks and the mainstem of the Naknek River; and

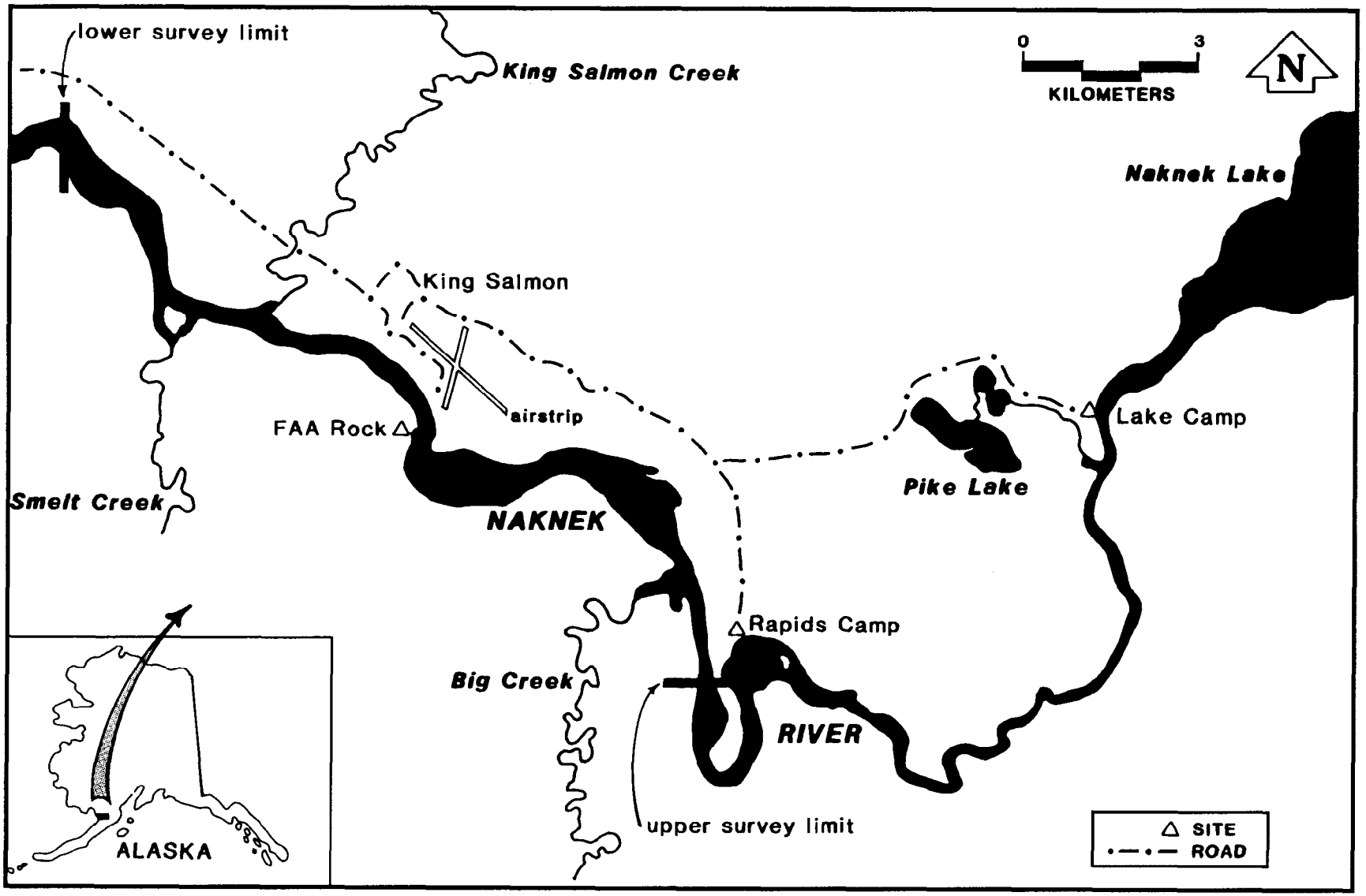


Figure 1. The lower Naknek River study site, 1991.

6. to estimate the age, sex, and length composition of the chinook salmon escapement into Big Creek and the mainstem of the Naknek River.

Initial regulations for anglers seeking chinook salmon on the Naknek River during 1991 permitted a daily bag and possession limit, from 1 May to 31 July, of three chinook salmon, only one of which could be greater than 71 cm (28 in) in length (ADF&G 1991). On 28 May, the Department of Fish and Game, Division of Sport Fish, issued an emergency order that closed the waters of King Salmon and Paul's creeks, as well as the waters surrounding their confluences with the Naknek River, to fishing for chinook salmon from 1 June through 31 July. This action was in response to 3 consecutive years of below average escapements of chinook salmon observed in these systems. Bag limits of five other salmon (sockeye *O. nerka*, chum *O. keta*, coho salmon, or pink *O. gorbuscha*) with no size limit, and one rainbow trout 45.7 cm (18 inches) or less in length, were also allowed. Only unbaited artificial lures were permitted in the Naknek River drainage from 1 March through 14 November. Fishing was prohibited above the ADF&G markers at Rapids Camp (Figure 1) from 10 April through 7 June, to protect spawning rainbow trout.

METHODS

Creel Survey Study Design

A roving creel survey (Neuhold and Lu 1957) was conducted to count and interview anglers as well as sample the sport harvest in the lower Naknek River from 1 June to 15 September. A stratified three-stage random sampling design formed the basis for estimating effort (in angler-hours), catch, and harvest rates (fish per angler-hour). Angler counts were considered instantaneous counts and represent angler effort for the sample in which the count was conducted. Angler interviews were used to estimate catch and harvest rates. Sampled days represented the first sampling stage; periods within days represented the second sampling stage; angler counts within periods represented the third sampling stage for the angler effort estimation, and angler interviews represented the third sampling stage for catch and harvest rate estimation.

Information from angler interviews was also used to estimate the distribution of catches and harvests of chinook salmon and coho salmon by angler-day. The "distribution of catches and harvests by angler-day" was defined as the proportion of angler-days that resulted in catches and/or harvests of one or more chinook or coho salmon, two or more chinook or coho salmon, etc. Angler counts were also used in estimating these proportions in order to obtain sample and stratum weights. Additionally, a bag limit analysis was performed using a subsample of the total angler interview data. The subsample was generated using angler count data to weight angler interview data proportional to angler effort.

Preseason, the 107-day study period was divided into the following 11 temporal components: component 1 (6/1-6/21), component 2 (6/22-6/30), component 3 (7/1-7/7), component 4 (7/8-7/14), component 5 (7/15-7/21), component 6 (7/22-7/31), component 7 (8/1-8/7), component 8 (8/8-8/14), component 9 (8/15-8/21), component 10 (8/22-8/31), and component 11 (9/1-9/15). These components were

selected to coincide with shifts in angling effort and were similar to those used in previous surveys. For the first six components of the survey, the angling day was considered to be 16 hours long and was divided into four 4-hour sampling periods: A 0630-1029 hours, B 1030-1429 hours, C 1430-1829 hours, and D 1830-2229 hours. For components 7 through 11, the angling day was shortened to 12 hours to account for reduced daylight hours, and was divided into three 4-hour sampling periods: A 0800-1159 hours, B 1200-1559 hours, and C 1600-1959 hours.

Sampling intensity varied by temporal component and was determined to approximate the changes in angler effort observed during previous surveys. During the first temporal component, only one technician was used to make angler counts and conduct interviews. Previous surveys indicated that this period represents the building phase of the fishery, and accordingly, less resources are needed to sample the fishery during the first component. For components 2 through 10, fishing effort was expected to increase substantially, and accordingly, sampling intensity was increased to two technicians. During the last component (9/1-9/15), fishing effort was declining and sampling intensity was reduced again to one technician.

A sampling trip consisted of a 4-hour shift, and a survey technician was responsible for two shifts per sampling day, which were selected at random from the three to four periods available. During the first and last components, only a single survey clerk was employed. During these two seasonal components, two types of sampling trips were conducted. During the majority of the sampled days, a single count was conducted within each of the two sampled periods. During the time not spent counting anglers, the single technician conducted angler interviews. Additionally, during 3 of the sampled days within these two components, the single technician conducted four counts (of the four possible count times) during each sampled period. During these count samples, no angler interviews were conducted. The purpose of conducting these count-only samples is directed at estimating the within period angler effort variance, which is inestimable during samples with only one angler count. Due to the constraint of only one available technician during the first and last temporal component, concurrent multiple counts and angler interviews could not be conducted.

Days for conducting the combined single count and angler interview sample sessions were selected at random without replacement (WOR) during the first and last seasonal components. Days for conducting the count-only sample sessions were selected at random (WOR) from the days not selected for the combined samples. As noted above, within each sampled day, two sample periods will be selected at random (WOR) from the available periods within each day. A count time for the single count and angler interview sample sessions were selected at random from one of four possible 60 minute count times.

During the remaining seasonal components, two technicians were deployed. During the majority of days sampled within each temporal component, four (of the possible four) angler counts were conducted within each sampled period. Angler interviews were conducted concurrently by the technician not conducting the angler counts. Accordingly, during these sampled days, both technicians were deployed on the river at the same time. Some additional days were sampled at random within each temporal component in which only one angler count (out of the four possible) was conducted within each sampled period.

During the time not spent counting anglers, anglers were interviewed. During these additional days, only one technician was deployed on the river at a time. This sample design allowed us to estimate all sampling stage components of variance.

Days for conducting the combined four-count and angler interview sample sessions were independently selected at random (WOR) during temporal components 2-10. Days for conducting the remaining single count and angler interview sample sessions were selected at random (WOR) from the days not selected for the combined four-count samples. As noted above, within each sampled day, two sample periods were selected at random (WOR) from the available periods within each day. As before, a single count time was selected at random from one of the four possible 60 minute count times within each period for the samples with only one count.

Creel Survey Data Collection

Sampling consisted of angler counts, obtaining catch, harvest, and effort information from anglers who have completed fishing (completed-trip interviews), and collecting age, weight, and length information from harvested fishes. During sample sessions with only one technician, a single count was conducted and anglers were interviewed during the remaining time in each period. During combined angler count interview sample sessions conducted by two technicians, nearly all completed-trip anglers were interviewed as they exited surveyed access locations in the fishery during each sampled 4-hour period. Completed-trip anglers who exited the fishery more than once during the day were asked to report their entire day's effort, catch, and harvest.

Creel Survey Data Analysis

Angler Effort, Catch, And Harvest:

Angler effort, catch, and harvest, their associated variances, and standard errors were estimated for the creel survey using the following procedures. A random estimator was used to estimate angler effort on a sample by sample basis. Catch and harvest estimates for each sample were obtained by a ratio estimator: by combining the estimated effort (for the sample) with estimates of catch per unit effort (CPUE) and harvest per unit effort (HPUE) obtained from the angler interviews. The CPUE and HPUE estimates were obtained by the jackknife estimation approach (Efron 1982). The jackknife approach for estimating CPUE and HPUE was appropriate since most other estimators were known to be biased (for use as ratio estimators, i.e., for expansion), and the jackknife estimate has been shown to be less biased and procedures existed for correcting some of this bias (see Cochran 1977, section 6.15, pages 174-177; and Smith 1980).

The individual sample estimates of effort, catch, and harvest were then used in a stratified three-stage estimation approach (Cochran 1977) to obtain total estimates, both within temporal components and across temporal components, as noted in Appendix A1.

Catch per Unit Effort:

Catch per unit effort (CPUE) of anglers fishing for chinook or coho salmon in the Naknek River recreational fishery surveyed during 1991 was estimated by the procedures noted below. The anglers were treated as individual units in a test fishery operating under the traditional linear model:

$$[c/e]_i = q\ N + \epsilon_i$$

where: c/e was the catch per unit of effort (angler-hours) during the *ith* angler-trip; N was abundance (of the fish); q was the catchability coefficient; and ϵ was random error with mean = 0 and variance = σ^2.

Hence the estimates of CPUE were obtained from unweighted means for each stratum of the fishery as detailed in Appendix A2.

Distributions of Angler Catches and Harvests:

The distribution of catches and harvests was estimated as described in the following text. The "distribution of catches and harvests" was defined as the fraction p_k of angler-trips in which "k" or more fish were caught, then "k" can be expressed as k = 1 to k_{max}. Additionally, we defined p_k to be the proportion of angler-trips that caught or harvested zero fish for k = 0. If k_{max} = 10, then one set of data was analyzed 11 times to obtain all possible fractions p_k in a set. Because there is a set of p_k's for both catch and harvest there were two sets of p_k's. Besides the k_{max} iterations, there was stratification. For each iteration from 0 to k_{max}, there were calculations for each temporal component in the fishery. Calculations were conducted separately for each species.

As an example, begin with the fraction of angler-days in which 1 or more coho salmon were caught. The first step was to code the data prior to calculation. The coding was necessary because not all sampling periods (days) were the same "size"; more anglers fish during some periods than others. Ignoring these differences in "size" would have promoted bias in estimates of angler success when statistics were then averaged across sampling periods within a temporal component. The coding adjusted for this possible discrepancy (Sukhatme et al. 1984). After coding, standard three-stage estimation procedures (Cochran 1977) were used to estimate the various proportions, their variances and standard errors, as outlined in detail in Appendix A3.

Assumptions:

The assumptions necessary for unbiased point and variance estimates of angler effort, catch, harvest, CPUE, catch and harvest distribution, and proportion of harvest by bag size, obtained by the procedures outlined above included the following:

1. interviewed anglers accurately reported their hours of fishing effort and the number of fish by species released;

2. interviewed anglers were representative of the total angler population;

3. no significant fishing effort occurred during the hours not included in the fishing day;

4. no significant fishing effort occurred in areas not covered by the survey; and

5. catch and harvest rate and duration of fishing trip were independent (DiCostanzo 1956).

We also assumed that the catchability coefficient (q) does not change in a manner that negates the use of CPUE as an index of abundance. Finally, we assumed that "good" (or for that matter "poor") anglers are not selectively fishing during certain periods of the fishery (for unbiased CPUE as an index of abundance).

Biological Sampling of the Harvest

Sport harvested chinook and coho salmon encountered during the angler interview portion of the creel survey were measured to the nearest millimeter for mid-eye to fork-of-tail length, weighed to the nearest 100 grams, and sexed based on external characteristics. In addition, three scales were removed from the preferred area[1] and mounted on an adhesive-coated card. Adhesive-coated cards were thermohydraulically pressed against acetate cards and the resulting scale impressions displayed on a microfiche projector for age determination[2].

Estimates of mean (and associated standard error) length and weight by age group of chinook and coho salmon sampled from the sport harvest were calculated using the procedures outlined by Sokal and Rohlf (1981, Boxes 4.2 and 7.1, pages 56 and 139).

Estimates of age composition (percent) for the subsampled chinook and coho salmon were calculated for each temporal component. Estimates of proportion of fish harvested by age class across all temporal components were obtained by a weighted mean procedure. Complete details of the estimation procedures are presented in Appendix B1.

Escapement Survey

Since 1967, the Alaska Department of Fish and Game has conducted aerial surveys to index the escapement of chinook salmon into key spawning areas of the Naknek River drainage. Counts of live and dead chinook salmon were made primarily from fixed wing aircraft by an observer wearing Polaroid sunglasses. Surveys were confined to the Paul's, King Salmon, and Big creek drainages as well as the mainstem of the Naknek River. Several survey flights were

[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 as used on sockeye salmon by Clutter and Whitesel (1956).

[2] 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.

conducted over the course of the summer of 1991, starting in late July and continuing through late August. No accounting was made for fish that had already left the system or for fish that were undetectable or had not yet arrived.

Expansion of raw counts to account for stream life, missed fish, missed sections of the stream, or visibility were not made since the technical basis for expansion is dubious. The actual raw number of chinook salmon observed will be considered the escapement index. Escapement indices are considered to be minimum escapement estimates. By following consistent survey procedures among years and conducting these surveys at standard times, escapement indices can be treated as a relative measure of the abundance of salmon on the spawning grounds.

Age and size composition of chinook salmon escapement into Big Creek was estimated from samples collected on the spawning grounds. Chinook salmon carcasses encountered were sampled for length, sex, and age data. Fork length (mid-eye to fork-of-tail) was measured to the nearest millimeter, sex was determined, and four scales taken from the preferred area were selected and mounted on gummed cards for ageing purposes. The objective of sampling chinook salmon escapement in the mainstem Naknek River was abandoned in mid-August due to low abundance of spawning chinook salmon.

Biological data collected from the escapement were processed in a manner similar to that already described for samples taken from the harvest, except data were not treated in a stratified manner nor were finite population correction factors (FPC's) applied. Since we did not estimate the absolute abundance of the escapement, estimated proportions by age class and their variances were estimated directly from the sample data (i.e., using equations B1.1 and B1.2, Appendix B1, without the FPC).

RESULTS

Creel Statistics

The creel survey on the lower Naknek River was conducted from 1 June to 15 September 1991. However, postseasonal evaluation of the data from temporal component 11 (9/1-9/15) indicated that, with the exception of 1 September, angler effort had dropped below a threshold where sufficient data could be collected to produce unbiased effort, catch, and harvest estimates. Therefore, data from 1 September were combined with temporal component 10 (i.e., component 10 was extended to include 1 September) and effort, catch, and harvest estimates were generated for the period 1 June through 1 September.

Total effort in the lower Naknek River was estimated to be 41,538 angler-hours (SE = 1,896), with peak effort estimates during the chinook salmon fishery occurring in early July and peak effort estimates for the coho salmon fishery occurring in mid-August (Table 1 and Appendix C1). Analysis of 1,270 completed-trip interviews indicated that the catch rate for chinook salmon was highest (0.159) during temporal component 6 (i.e., 22 July to 31 July) (Table 2), and that the catch rate for coho salmon was highest (0.526) during temporal component 7 (i.e., 1 August to 7 August) (Table 3). An estimated

Table 1. Estimated effort (angler-hours), by temporal component, for the sport fishery in the lower Naknek River, 1 June to 1 September 1991.

Temporal Component	Days Sampled	Est. Angler-Hours	SE	95% Confidence Interval			
				Lower		Upper	RP[a]
1 (6/01-6/21)	12	2,940	612	1,740	--	4,140	40.8%
2 (6/22-6/30)	6	6,456	905	4,681	--	8,231	27.5%
3 (7/01-7/07)	5	7,190	1,058	5,116	--	9,264	28.8%
4 (7/08-7/14)	5	4,010	408	3,210	--	4,809	19.9%
5 (7/15-7/21)	5	3,791	777	2,269	--	5,313	40.2%
6 (7/22-7/31)	9	4,427	370	3,702	--	5,151	16.4%
7 (8/01-8/07)	5	2,587	319	1,961	--	3,213	24.2%
8 (8/08-8/14)	5	2,794	177	2,447	--	3,141	12.4%
9 (8/15-8/21)	5	3,782	274	3,245	--	4,319	14.2%
10 (8/22-9/01)	8	3,561	409	2,759	--	4,363	22.5%
Season Total	65	41,538	1,896	37,822	--	45,254	8.9%

[a] Relative precision of 95% confidence interval.

Table 2. Catch per unit effort as an indicator of fish abundance for the chinook salmon sport fishery in the lower Naknek River, 1 June to 31 July 1991.

Temporal Component	CPUE[a]	Standard Error	95% Confidence Interval	
			Lower	Upper
1 (6/01-6/21)	0.02424	0.00683	0.01086 -	0.03762
2 (6/22-6/30)	0.09106	0.00941	0.07262 -	0.10950
3 (7/01-7/07)	0.11550	0.01214	0.09171 -	0.13929
4 (7/08-7/14)	0.13157	0.01905	0.09423 -	0.16891
5 (7/15-7/21)	0.15424	0.02284	0.10948 -	0.19900
6 (7/22-7/31)	0.15889	0.01850	0.12262 -	0.19516
All	0.11697	0.00651	0.10421 -	0.12973

[a] Catch per unit effort in angler-hours.

Table 3. Catch per unit effort as an indicator of fish abundance for the coho salmon sport fishery in the lower Naknek River, 22 July to 1 September 1991.

Temporal Component	CPUE[a]	Standard Error	95% Confidence Interval	
			Lower	Upper
6 (7/22-7/31)	0.03722	0.00818	0.02119	0.05325
7 (8/01-8/07)	0.52647	0.06512	0.39884	0.65410
8 (8/08-8/14)	0.29957	0.02909	0.24256	0.35658
9 (8/15-8/21)	0.32360	0.03081	0.26322	0.38398
10 (8/22-9/01)	0.19656	0.01935	0.15864	0.23448
All	0.22153	0.01213	0.19777	0.24530

[a] Catch per unit effort in angler-hours.

3,663 chinook salmon (SE = 367.5) were caught (landed) in the study area, of which 3,115 (SE = 343.3) (85%) were harvested (Table 4, Appendix C2, and Appendix C3). An estimated 4,828 coho salmon (SE = 529.3) were caught (landed) in the study area, of which 4,475 (SE = 524.7) (93%) were harvested (Table 5 and Appendix C4). In the final portion of the coho salmon run, a significant amount of sport fishing effort had shifted upstream of the survey area boundary; for this reason the estimates of coho salmon catch and harvest should be considered minimums for the entire Naknek River.

Anglers are estimated to have also caught 904, and kept 759, chum salmon (Table 6 and Appendix C5). Additionally, a catch of 447 rainbow trout, and harvest of 94, were estimated for the lower Naknek River (Table 7 and Appendix C6). The principal rainbow trout fishery on the Naknek River occurs in the upper reaches of the river, hence, the estimates of catch and harvest for the rainbow trout fishery should also be considered minimums for the entire Naknek River.

Bag Limit and Angler Catch and Harvest Distribution Analyses

A subsample of angler interview data was generated proportional to effort. This subsample was analyzed to examine the distribution of percent anglers by bag size and the distribution of percent harvest by bag composition (Figures 2 and 3). Over 70% of anglers left the chinook salmon fishery with daily bags containing zero chinook salmon, while less than 1% left the fishery with daily bags containing three chinook salmon (Figure 2a). Nearly 94% of the chinook salmon harvest was accounted for by the first fish (Figure 2b). In other words, daily bags containing 3 fish contained the first fish, the second fish, and the third fish. Daily bags containing 2 fish contained the first fish and the second fish. Daily bags containing one fish contained only the first fish. As above, 94% of the harvest was accounted for by the first fish, and only 1% of the harvest was accounted for by third fish. If regulations were enacted which reduced the bag limit from 3 to 2 fish, a 1% reduction in the total chinook salmon harvest could be expected (Figure 2b), and this regulation would affect less than 1% of the anglers (Figure 2a).

Nearly 65% of anglers left the coho salmon fishery with daily bags containing zero coho salmon, while approximately 3% left the fishery with daily bags containing five coho salmon (Figure 3a). Over 47% of the coho salmon harvest was accounted for by the first fish, and nearly 5% of the harvest was accounted for by the fifth fish (Figure 3b). If the bag limit was reduced from five fish to four fish, then a reduction in harvest could be expected of approximately 5% (Figure 3b), and less than 4% of anglers would be affected (Figure 3a).

Since this analysis is based only on anglers interviewed, and does not account for effects of bag limit changes on angler behavior, the accuracy of extrapolating this analysis to the entire fishery is somewhat problematic. However, this analysis represents a useful tool in partially predicting the effect of bag limit reductions on harvest and currently participating anglers.

In addition to the bag limit analysis, a catch-harvest distribution analysis was completed to examine the proportions of angler-trips in which one or more fish, two or more fish, three or more fish, etc. were caught or one or more

Table 4. Estimated catch and harvest of chinook salmon by the sport fishery in the lower Naknek River, 1 June to 1 September 1991.

Temporal Component and Date	Catch[a] Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Harvest Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Percent of Catch Harvested
1 (6/01-6/21)	93	29.4	35	151	61.9%	93	29.4	35	151	61.9%	100%
2 (6/22-6/30)	517	96.3	328	706	36.5%	503	93.3	320	686	36.4%	97%
3 (7/01-7/07)	1,246	290.8	676	1,816	45.8%	1,153	288.6	587	1,719	49.1%	93%
4 (7/08-7/14)	506	79.3	351	661	30.7%	488	77.0	337	639	30.9%	96%
5 (7/15-7/21)	520	123.6	278	762	46.6%	431	101.0	233	629	45.9%	83%
6 (7/22-7/31)	735	135.4	470	1,000	36.1%	447	94.0	263	631	41.2%	61%
7 (8/01-8/07)	7	5.4	0	18	151.2%	0	0.0	0	0	--	0%
8 (8/09-8/14)	14	9.5	0	33	133.0%	0	0.0	0	0	--	0%
9 (8/15-8/21)	0	0.0	0	0	--	0	0.0	0	0	--	--
10 (8/22-9/01)	25	17.0	0	58	133.2%	0	0.0	0	0	--	--
Season Total	3,663	367.5	2,943	4,383	19.7%	3,115	343.3	2,442	3,788	21.6%	85%

[a] Catch = total fish kept + total fish released.
[b] Relative precision of 95% confidence interval.

Table 5. Estimated catch and harvest of coho salmon by the sport fishery in the lower Naknek River, 1 June to 1 September 1991.

Temporal Component and Date	Catch[a] Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Harvest Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Percent of Catch Harvested
1 (6/01-6/21)	0	0.0	0 -	0	--	0	0.0	0 -	0	--	--
2 (6/22-6/30)	0	0.0	0 -	0	--	0	0.0	0 -	0	--	--
3 (7/01-7/07)	0	0.0	0 -	0	--	0	0.0	0 -	0	--	--
4 (7/08-7/14)	0	0.0	0 -	0	--	0	0.0	0 -	0	--	--
5 (7/15-7/21)	8	10.7	0 -	29	261.6%	8	10.7	0 -	29	261.6%	100%
6 (7/22-7/31)	170	54.8	63 -	277	63.2%	170	54.8	63 -	277	63.2%	100%
7 (8/01-8/07)	1,347	234.9	887 -	1,807	34.2%	1,245	228.8	797 -	1,693	36.0%	92%
8 (8/09-8/14)	824	129.1	571 -	1,077	30.7%	667	87.6	495 -	839	25.7%	81%
9 (8/15-8/21)	1,690	430.4	846 -	2,534	49.9%	1,631	437.6	773 -	2,485	52.6%	97%
10 (8/22-9/01)	789	141.2	512 -	1,066	35.1%	754	143.8	472 -	1,036	37.4%	96%
Season Total	4,828	529.3	3,791 -	5,865	21.5%	4,475	524.7	3,447 -	5,503	23.0%	93%

[a] Catch = total fish kept + total fish released
[b] Relative precision of 95% confidence interval.

Table 6. Estimated catch and harvest of chum salmon by the sport fishery in the lower Naknek River, 1 June to 1 September 1991.

Temporal Component and Date	Catch[a] Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Harvest Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Percent of Catch Harvested
1 (6/01-6/21)	0	0.0	0	0	--	0	0.0	0	0	--	--
2 (6/22-6/30)	55	28.0	0	110	99.7%	55	28.0	0	110	99.7%	100%
3 (7/01-7/07)	130	46.6	39	221	70.3%	130	46.6	39	221	70.3%	100%
4 (7/08-7/14)	91	45.7	1	181	98.4%	80	44.7	0	168	109.6%	88%
5 (7/15-7/21)	140	47.2	47	233	66.1%	129	46.7	37	221	71.0%	92%
6 (7/22-7/31)	285	86.2	116	454	59.3%	237	74.5	91	383	61.6%	83%
7 (8/01-8/07)	130	42.2	47	213	63.6%	70	33.0	5	135	92.3%	54%
8 (8/09-8/14)	41	14.6	12	70	70.0%	36	14.3	8	64	78.0%	88%
9 (8/15-8/21)	32	19.9	0	71	122.2%	22	12.8	0	47	114.2%	69%
10 (8/22-9/01)	0	0.0	0	0	--	0	0.0	0	0	--	--
Season Total	904	130.7	648	1,160	28.3%	759	118.9	526	992	30.7%	84%

[a] Catch = total fish kept + total fish released
[b] Relative precision of 95% confidence interval.

Table 7. Estimated catch and harvest of rainbow trout by the sport fishery in the lower Naknek River, 1 June to 1 September 1991.

Temporal Component and Date	Catch[a] Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Harvest Estimate	SE	95% Confidence Interval Lower	Upper	RP[b]	Percent of Catch Harvested
1 (6/01-6/21)	136	73.4	0	280	105.8%	41	31.5	0	103	150.4%	30%
2 (6/22-6/30)	48	19.7	9	87	80.3%	14	12.2	0	38	171.5%	29%
3 (7/01-7/07)	15	7.9	0	30	103.2%	4	4.3	0	12	212.1%	27%
4 (7/08-7/14)	9	6.5	0	22	141.3%	0	0.0	0	0	---	0%
5 (7/15-7/21)	9	6.8	0	22	148.1%	4	3.6	0	11	177.3%	44%
6 (7/22-7/31)	52	21.3	10	94	80.2%	15	9.3	0	33	121.4%	29%
7 (8/01-8/07)	57	55.9	0	167	192.3%	0	0.0	0	0	---	0%
8 (8/09-8/14)	0	0.0	0	0	---	0	0.0	0	0	---	---
9 (8/15-8/21)	29	16.6	0	62	108.8%	11	8.2	0	27	145.4%	38%
10 (8/22-9/01)	92	44.9	0	180	112.0%	5	4.1	0	13	159.5%	5%
Season Total	447	108.6	234	660	47.6%	94	36.6	22	166	76.4%	21%

[a] Catch = total fish kept + total fish released
[b] Relative precision of 95% confidence interval.

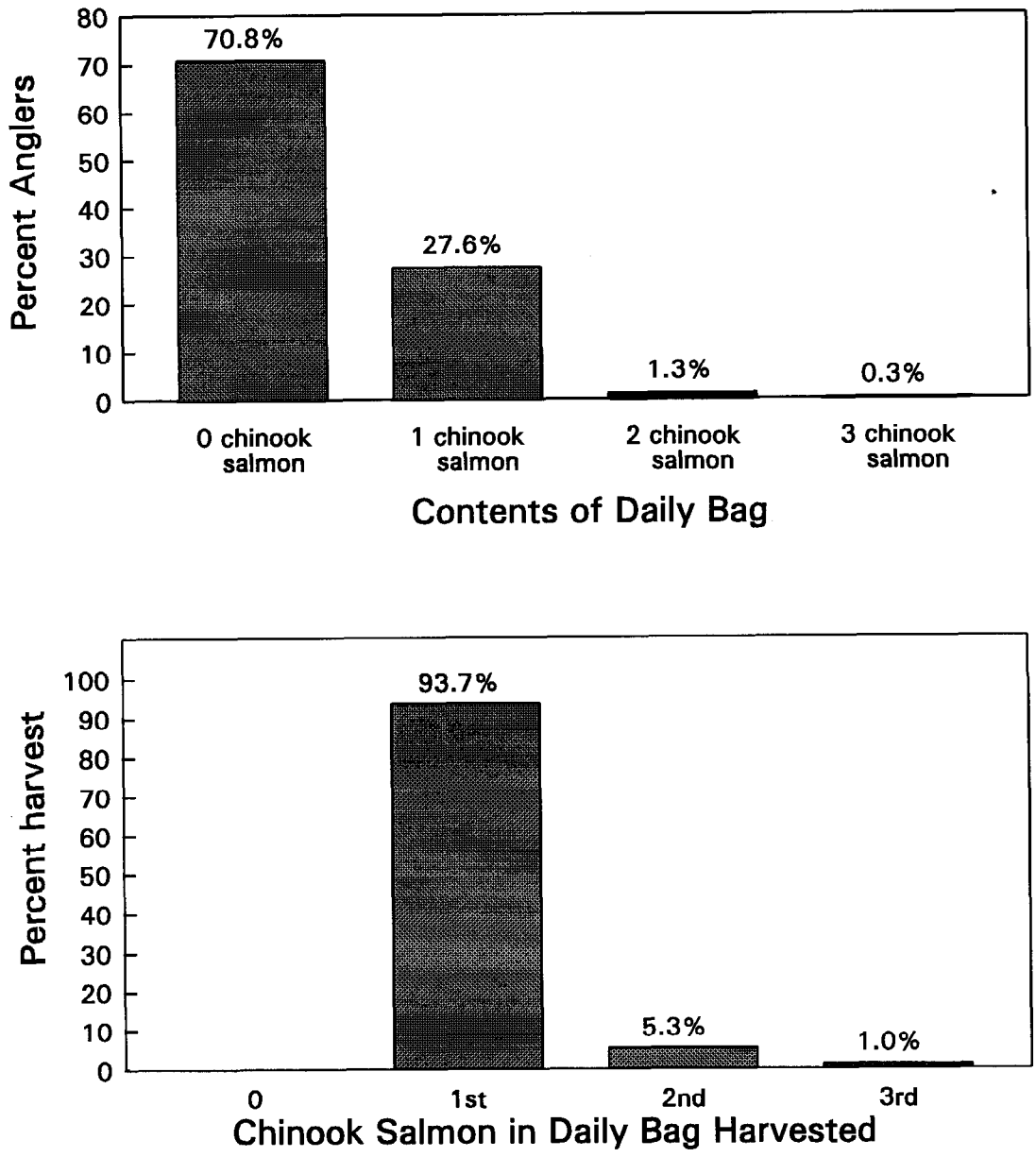
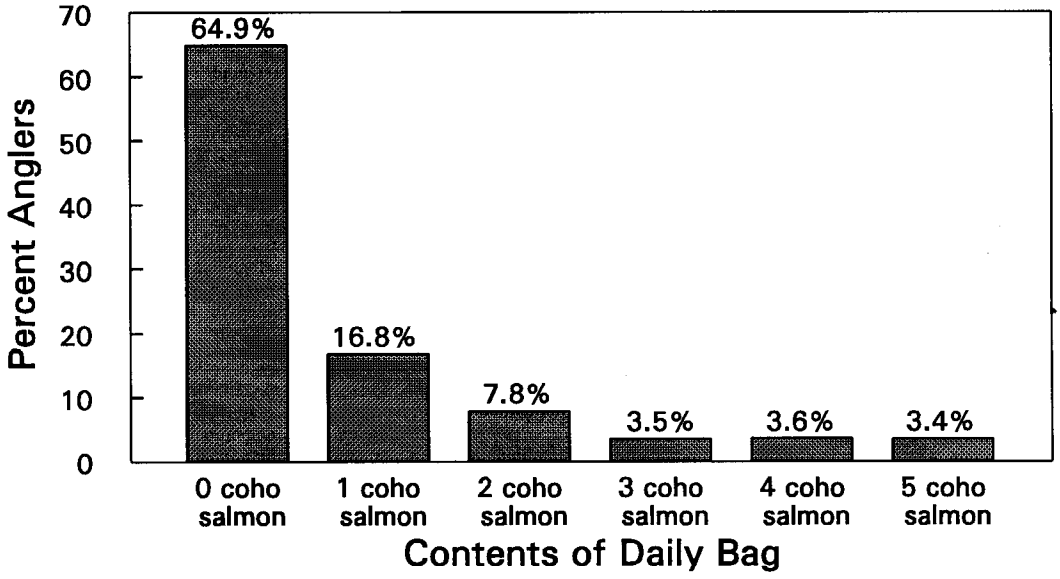


Figure 2. Bag limit analysis for the 1991 lower Naknek River chinook salmon sport fishery.



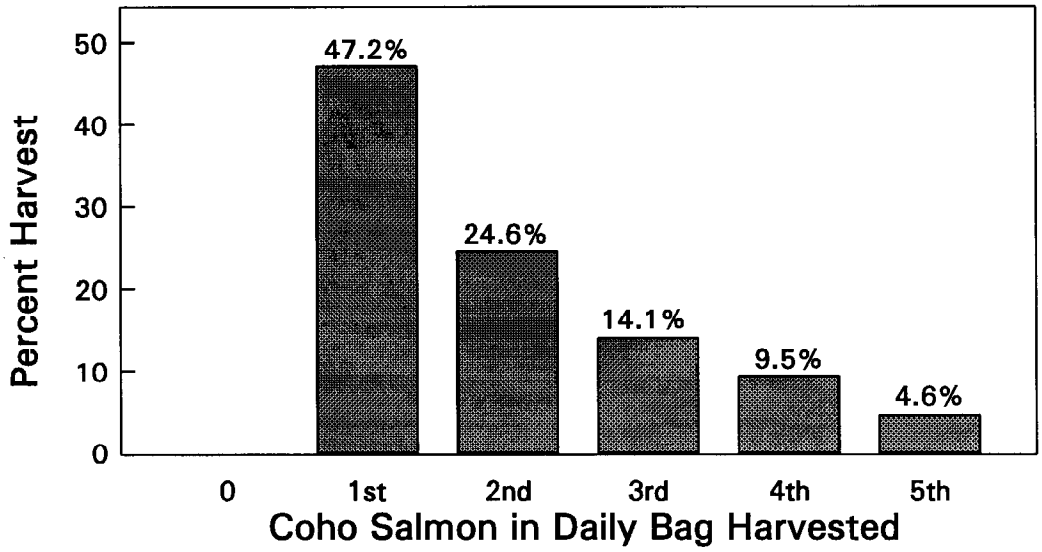


Figure 3. Bag limit analysis for the 1991 lower Naknek River coho salmon sport fishery.

fish, two or more fish, three or more fish, etc., were harvested (Figures 4 and 5). These analyses provide useful information with regard to angler success, but they are most useful in providing insight into the character of the fishery. It is obvious that both the chinook and coho salmon fisheries on the Naknek River were very consumptive. The proportion of angler trips corresponding to a given number of fish caught, and the proportion of angler trips corresponding to the same number of fish harvested, were very similar in both the chinook and coho salmon fisheries. This indicates that both fisheries have high retention rates, at times approaching 100%.

Escapement Statistics

Aerial surveys of the Naknek River drainage chinook salmon spawning areas were conducted on 30 July (Paul's Creek), 5 August (King Salmon Creek), 12 August (Big Creek), and 20 August (mainstem Naknek River). These surveys counted a total escapement of 4,391 fish (Table 8). Approximately 2,340 fish (53%) were observed spawning in Big Creek. Another 1,655 fish or nearly 38% of the total escapement were counted in the mainstem Naknek River. The survey dates are believed to coincide with the peak abundance on the spawning grounds.

Size, Sex, and Age Compositions of the Harvest

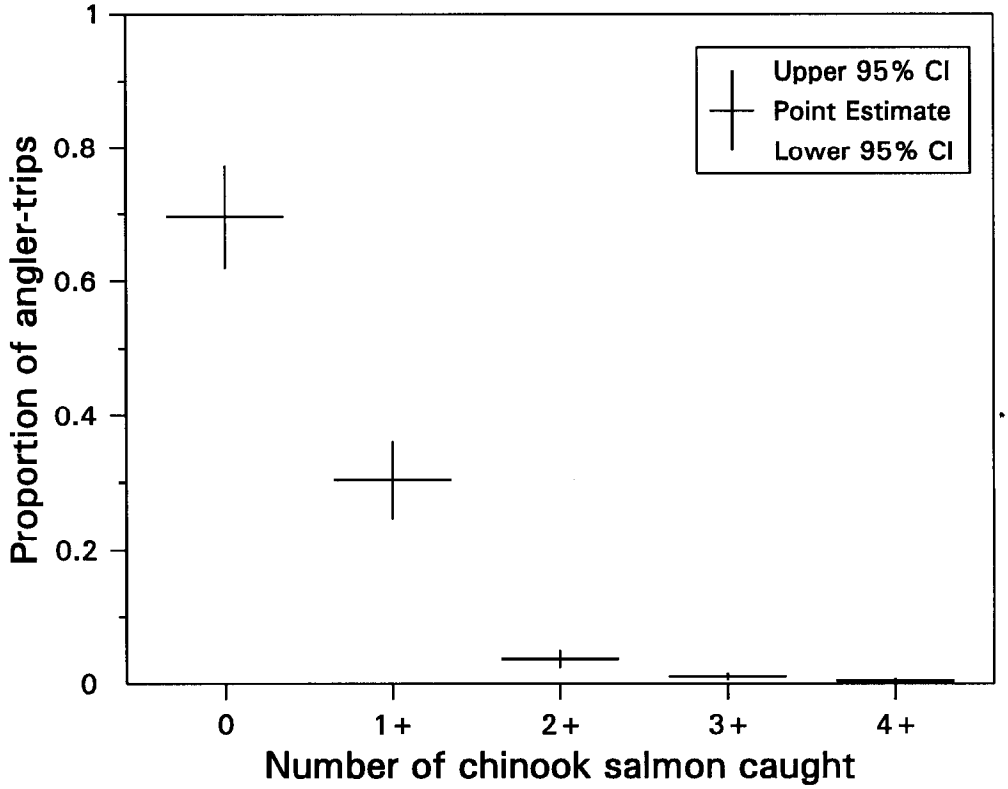
Nearly 56% of the 257 chinook salmon sampled from the sport harvest were males (Table 9). The majority of the harvest were age-1.3 fish (41%) or age-1.4 fish (40%). Age-1.2 fish comprised 18% of the harvest. Data collected from the sport harvest of chinook salmon yielded a mean length of 727 mm (SE = 11.64, n = 260) and a mean weight of 7.66 kg (SE = 29.65, n = 260). The largest chinook salmon sampled measured 1,015 mm (40.6 in) in length and weighed 20.2 kg (44.4 lbs).

Over 57% of the 578 coho salmon sampled from the sport harvest were males (Table 10). The majority of the coho salmon harvest were age-2.1 fish (83%). Data collected from the sport harvest of coho salmon yielded a mean length of 581 mm (SE = 1.85, n = 578) and a mean weight of 3.52 kg (SE = 3.44, n = 578). The largest coho salmon sampled measured 660 mm (26.4 in) in length and weighed 6.0 kg (13.2 lb).

Size, Sex, and Age Compositions of the Escapement

Over 59% of the 158 chinook salmon sampled from the Big Creek escapement were males (Table 11). The predominant age class was age 1.4 (69%) with age 1.3 (22%) contributing the next largest component. The objective of sampling the escapement in the mainstem Naknek River was abandoned in mid-August. The poor run strength into the mainstem Naknek River made it too difficult to collect an adequate sample from the escapement.

Computerized data files used to generate these analyses are listed in Appendix D.



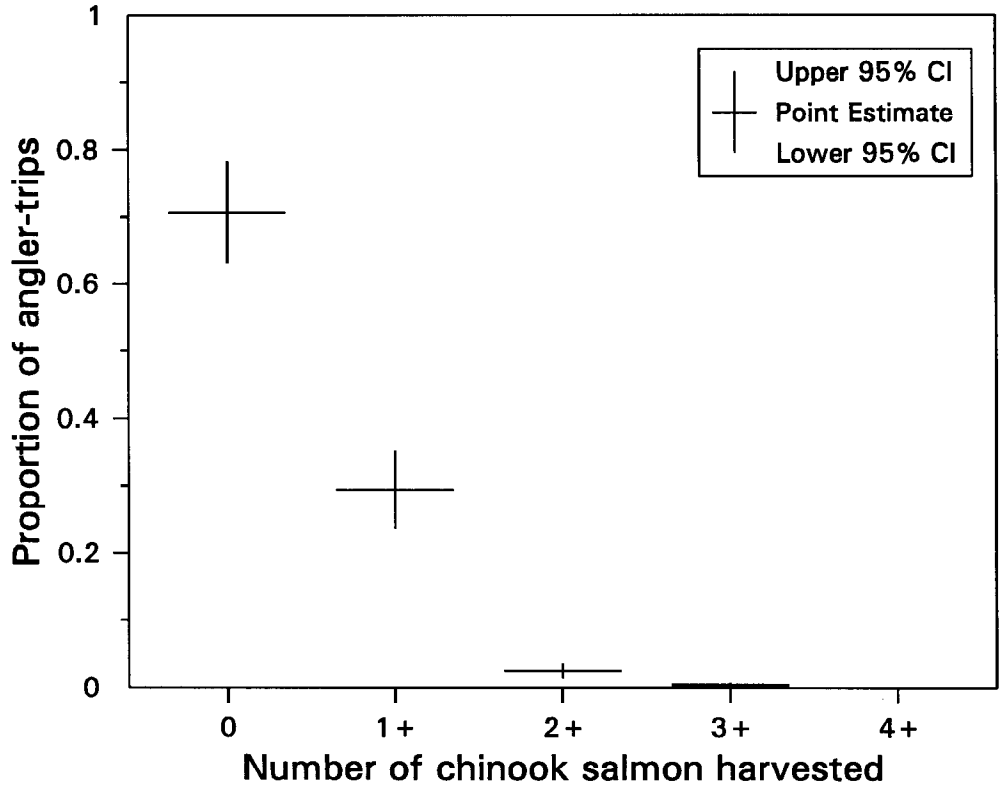
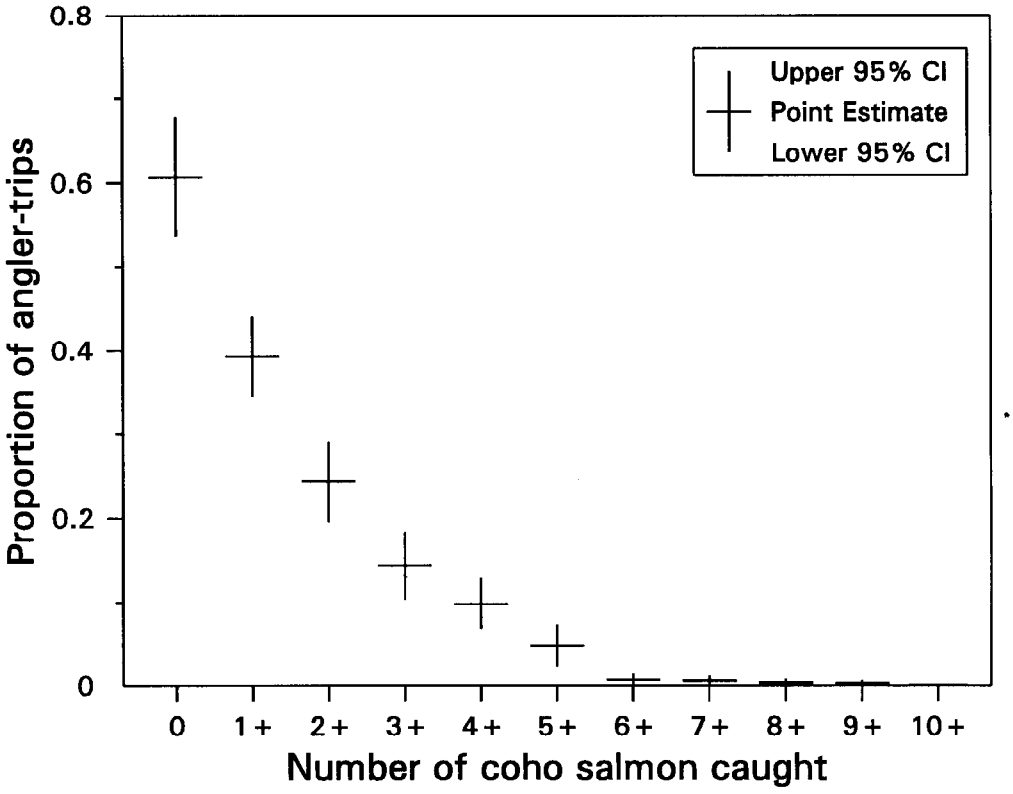


Figure 4. Catch and harvest distribution by angler-trips for the 1991 lower Naknek River chinook salmon sport fishery.



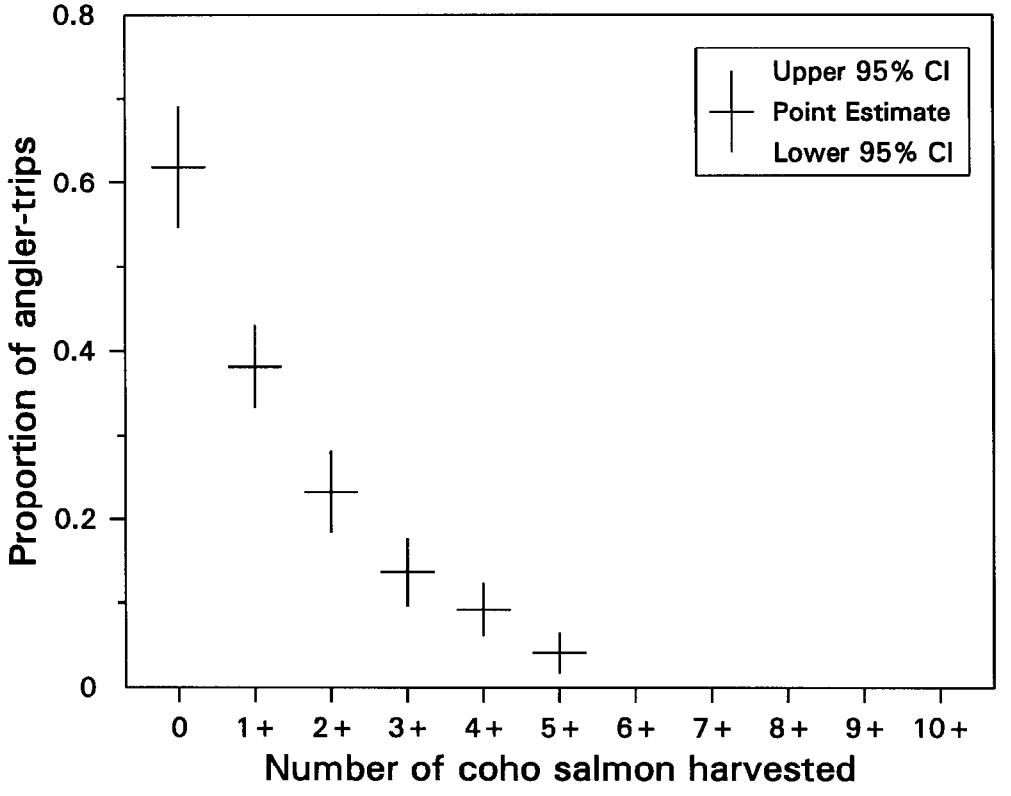


Figure 5. Catch and harvest distribution by angler-trips for the 1991 lower Naknek River coho salmon sport fishery.

Table 8. Unexpanded aerial escapement counts of chinook salmon in the Naknek River drainage, 1970-1991.[a]

Year	Mainstem Naknek	Paul's Creek	King Salmon Creek	Big Creek	Total
1970	3,060	NC[b]	260	825	4,145
1971	1,639	52	704	490	2,885
1972	351	156	1,224	1,060	2,791
1973	1,315	NC[b]	115	1,106	2,536
1974	NC[b]	91	495	860	1,446
1975	2,250	144	279	779	3,452
1976	5,950	31	180	970	7,131
1977	4,830	NC[b]	1,860	NC[b]	6,690
1978	NC[b]	NC[b]	NC[b]	NC[b]	NC[b]
1979	NC[b]	NC[b]	NC[b]	NC[b]	NC[b]
1980	300	17	NC[b]	30	347
1981	2,890	NC[b]	591	790	4,271
1982	5,360	340	980	1,930	8,610
1983	2,860	290	460	4,220	7,830
1984	790	400	385	3,420	4,995
1985	590	NC[b]	NC[b]	NC[b]	590
1986	2,200	73	102	1,542	3,917
1987	2,800	7	290	1,353	4,450
1988	7,380	150	600	3,600	11,730
1989	1,700	50	100	860	2,710
1990	4,500	150	350	2,000	7,000
1986-90 Average	3,716	86	288	1,871	5,961
Percent	62%	1%	50%	32%	
1991	1,655	121	275	2,340	4,391
Percent	38%	3%	6%	53%	

[a] Unpublished data, ADF&G Sport Fish and Commercial Fisheries Divisions aerial survey files, King Salmon and Dillingham, Alaska.
[b] No counts made.

Table 9. Age composition (percent), mean length (millimeters), and mean weight (grams) of chinook salmon, by sex and age group, of samples collected from the sport harvest on the lower Naknek River, 1 June to 31 July 1991.

	Age Group					
	Unknown	1.2	1.3	1.4	1.5	Total[a]
Females						
Percentage[b]			20.45	23.12	0.700	44.27
SE[c]			3.6516	3.7907	0.5262	5.2897
Sample size	11		43	51	2	107
Mean Length[d]	852		783	864	842	830
SE[d]	39.03		16.05	8.25	13.00	9.22
Sample Size	11		43	51	2	107
Mean Weight[d]	1015		813	1051	975	950
SE[d]	109.25		45.48	40.57	75.00	30.61
Sample Size	11		43	51	2	107
Males						
Percentage[b]		17.96	20.34	17.24	1.190	55.73
SE[c]		3.2737	3.3632	3.4020	0.1728	5.7993
Sample Size	17	50	49	33	1	150
Mean Length[d]	588	470	701	880	960	652
SE[d]	42.49	10.08	25.05	16.11		16.58
Sample Size	17	50	49	33	1	150
Mean Weight[d]	440	190	716	1234	1500	629
SE[d]	94.21	13.12	66.15	69.76		43.19
Sample Size	17	50	49	33	1	150

-continued-

Table 9. (Page 2 of 2).

	Age Group					
	Unknown	1.2	1.3	1.4	1.5	Total[a]
All Samples						
Percentage[b]		17.96	40.79	40.36	0.890	100.00
SE[c]		3.2737	5.0929	5.2147	0.5559	
Sample size	29[e]	50	92	86[f]	3	260
Mean Length[d]	694	470	739	870	881	727
SE[d]	37.28	10.08	15.82	7.90	40.04	11.64
Sample Size	29[e]	50	92	86[f]	3	260
Mean Weight[d]	668	190	762	1123	1150	766
SE[d]	85.50	13.12	41.25	37.19	180.28	29.65
Sample Size	29[e]	50	92	86[f]	3	260

[a] Total includes both aged and unaged samples.
[b] Percent age compositions are weighted (i.e., estimated through a stratified design).
[c] SE of percent age compositions are also weighted and are the square root of the variance with the finite population correction factor applied.
[d] Estimated mean lengths, weights, and associated SE's are not weighted (i.e., estimated as if they were obtained through a simple random sampling design).
[e] Includes one unknown age fish of unknown sex.
[f] Includes two age 1.4 fish of unknown sex.

Table 10. Age composition (percent), mean length (millimeters), and mean weight (grams) of coho salmon, by sex and age group, of samples collected from the sport harvest on the lower Naknek River, 22 July to 1 September 1991.

	Age Group						
	Unknown	1.1	1.2	2.1	2.2	3.1	Total[a]
Females							
Percentage[b]		34.9	0.090	37.8	0.580	1.00	42.99
SE[c]		0.9146	0.0800	4.1320	0.3949	0.4480	4.2747
Sample size	50	17	1	185	2	5	260
Mean Length[d]	570	552	540	581	587	597	577
SE[d]	5.55	12.25		2.69	4.50	13.29	2.39
Sample Size	50	17	1	185	2	5	260
Mean Weight[d]	323	285	250	336	340	334	330
SE[d]	8.67	17.39		4.68	40.00	28.04	4.01
Sample Size	50	17	1	185	2	5	260
Males							
Percentage[b]		7.58	1.06	45.22	0.650	2.500	57.01
SE[c]		1.4662	0.5584	4.7752	0.3785	0.7445	5.0953
Sample Size	42	35	4	222	3	12	318
Mean Length[d]	590	558	563	586	568	606	584
SE[d]	5.94	8.66	36.65	3.29	26.24	10.59	2.73
Sample Size	42	35	4	222	3	12	318
Mean Weight[d]	375	325	357	375	373	392	370
SE[d]	11.61	15.54	64.73	6.19	23.33	27.94	5.12
Sample Size	42	35	4	222	3	12	318

-continued-

Table 10. (Page 2 of 2).

	Age Group						
	Unknown	1.1	1.2	2.1	2.2	3.1	Total[a]
All Samples							
Percentage[b]		11.06	1.15	83.05	1.22	3.51	100.00
SE[c]		1.8107	0.5654	7.8766	0.5505	0.8951	
Sample size	92	52	5	407	5	17	578
Mean Length[d]	579	556	559	584	576	604	581
SE[d]	4.16	7.02	28.77	2.17	15.24	8.28	1.85
Sample Size	92	52	5	407	5	17	578
Mean Weight[d]	346	312	336	357	360	375	352
SE[d]	7.55	12.09	54.55	4.10	19.75	21.93	3.44
Sample Size	92	52	5	407	5	17	578

[a] Total includes both aged and unaged samples.
[b] Percent age compositions are weighted (i.e., estimated through a stratified design).
[c] SE of percent age compositions are also weighted and are the square root of the variance with the finite population correction factor applied.
[d] Estimated mean lengths, weights, and associated SE's are not weighted (i.e., estimated as if they were obtained through a simple random sampling design).

Table 11. Age composition (percent) and mean lengths (millimeters) of chinook salmon sampled from the Big Creek escapement, 1991.

	Age Group					
	Unknown	1.2	1.3	1.4	1.5	Total[a]
Females						
Percent		0.7	5.9	31.1	3.0	40.7
SE[b]		0.74	2.04	4.00	1.46	4.24
Sample Size	10	1	8	42	4	65
Mean Length	818	803	806	823	876	823
SE[c]	14.22		15.76	8.15	6.69	6.22
Sample Size	10	1	8	42	4	65
Males						
Percent		3.7	16.3	37.8	1.5	59.3
SE[b]		1.63	3.19	4.19	1.04	4.24
Sample Size	13	5	22	51	2	93
Mean Length	815	530	742	847	927	802
SE[c]	33.91	32.09	20.63	10.59	17.50	12.17
Sample Size	13	5	22	51	2	93
All Samples						
Percent		4.4	22.2	68.9	4.4	100.0
SE[b]		1.78	3.59	4.00	1.78	
Sample Size	23	6	30	93	6	158
Mean Length	816	575	759	836	893	811
SE[c]	19.76	52.51	16.40	6.95	12.54	7.63
Sample Size	23	6	30	93	6	158

[a] Includes both aged and unaged fish.
[b] Standard error of age composition estimates.
[c] Standard error of length estimates.

DISCUSSION

Creel survey data from 1986 to 1990 were reanalyzed by temporal components comparable[3] to those used in 1991 (Tables 12 and 13)[4]. The 1991 lower Naknek River creel survey documented an effort level during the chinook salmon fishery which is the lowest observed in the last 6 years (Table 12). Chinook salmon catch and harvest estimates for 1991 lagged well behind the 1986 to 1990 estimate average in each temporal component of the survey (Table 12). The 1991 sport harvest estimate also represents the lowest harvest since 1981 (Table 14 and Figure 6). The total run estimate of 13,034, which is only slightly below the 19-year average of 16,442, does not appear to be the cause of the low catch and harvest estimates (Table 14). The low catch and harvest estimates are most likely due to reduced levels of effort.

The low estimate of effort continued through the coho salmon fishery remaining below the 1988-1989 average effort estimate (Table 13). The coho salmon catch and harvest estimates for 1991 were higher than the 1988-1989 average estimates in 4 of 6 temporal components, as well as overall (Table 13). In addition, the 1991 sport harvest estimate represents the second highest estimate of total harvest yet recorded (Mills 1979-1991) (Table 15 and Figure 7).

If we examine the accumulated effort estimate for 1991 during the chinook salmon fishery (28,814 angler-hours) versus the accumulated average estimate from 1986 through 1990 (49,655 angler-hours), the 1991 estimate represents a reduction, from the 1986-1990 estimates, by 42% (Table 12). A similar analysis of accumulated effort during the 1991 coho salmon fishery (17,151 angler-hours) versus the 1988-1989 accumulated average estimate (21,609 angler-hours), represents a reduction of 21% (Table 13). The reduction of effort during the chinook salmon season is approximately twice as large as the reduction during the coho salmon season. A possible explanation of this non-uniform reduction may be due to the emergency orders which were issued for the Naknek River chinook salmon fishery in 1990 and 1991.

A major item of concern with regard to managing Naknek coho salmon stocks is that despite substantial growth in the fishery since the early 1980s, nothing is known about Naknek drainage coho salmon escapements (Table 15). Without present and historic information on escapement, it is impossible to determine the effects of fishing regulations on fish stocks or on exploitation rate.

In summary, the 1991 estimates of chinook salmon catch and harvest were significantly less than any in the past 6 years (Table 16).

The 1991 estimates of coho salmon catch and harvest are greater than the catch and harvest estimate for 1988, but are slightly less than the catch and harvest estimates for 1989 (Table 17).

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[3] The repartitioning and reanalysis of portions of the previous 4 years' data (corresponding to the 1990 time periods) produced different estimates than appear in the original reports.

[4] Minard (1989). Note: June and July total effort estimate in Minard (1989) (Table 1, page 10) was incorrect as published and should be 75,260 angler-hours.

Table 12. Historical estimates of effort (angler-hours), catch, and harvest from creel surveys conducted on the lower Naknek River chinook salmon sport fishery.[a]

Temporal Component	1986[b]	1987[c]	1988[d]	1989[e]	1990[f]	86-90 Average	Accumulated Average Est.	1991	1991 Accumulated Estimate
Fishing Effort (Angler-Hours)									
6/1-6/21	3,996	4,193	9,734	7,655	7,623	6,640	6,600	2,940	2,940
6/22-6/30	10,350	8,401	17,241	16,949	11,480	12,884	19,484	6,456	9,396
7/1-7/7	9,781	11,195	11,110	11,613	7,392	10,218	29,702	7,190	16,586
7/8-7/14	9,597	10,416	9,366	7,665	5,076	8,424	38,126	4,010	20,596
7/15-7/21	2,604	6,334	8,671	6,006	4,294	5,582	43,708	3,791	24,387
7/22-7/31	3,906	5,902	10,396	5,745	3,787	5,947	49,655	4,427	28,814
Catch Estimates									
6/1-6/21	741	309	248	413	655	473	457	93	93
6/22-6/30	877	2,682	1,081	1,037	1,373	1,410	1,867	517	610
7/1-7/7	2,339	3,432	961	908	901	1,708	3,575	1,246	1,856
7/8-7/14	2,377	2,546	724	830	484	1,392	4,967	506	2,362
7/15-7/21	549	1,859	1,014	603	493	904	5,871	520	2,882
7/22-7/31	860	1,621	1,314	444	359	920	6,791	735	3,617
Harvest Estimates									
6/1-6/21	670	309	248	413	650	458	442	93	93
6/22-6/30	816	2,414	947	976	1,284	1,287	1,729	503	596
7/1-7/7	1,976	2,636	724	784	864	1,397	3,126	1,153	1,749
7/8-7/14	2,118	2,495	642	554	138	1,189	4,316	488	2,237
7/15-7/21	443	1,615	758	508	180	701	5,016	431	2,668
7/22-7/31	845	1,178	1,229	586	134	794	5,811	447	3,115

[a] This table was produced by partitioning and reanalyzing portions of the original data that correspond to the temporal components used in 1991. The reanalysis was done only for the portions of each survey that occurred between 1 June and 31 July: estimates presented here may differ from those in the original reports.

[b] Minard (1987).

[c] Minard and Brookover (1988).

[d] Minard (1989). Note: addition producing June and July total effort estimate (Table 1, page 10 in Minard 1989) is incorrect and should be 75,260 angler-hours.

[e] Dunaway (1990).

[f] Dunaway and Bingham (1991).

Table 13. Historical estimates of effort (angler-hours), catch, and harvest from creel surveys conducted on the lower Naknek River coho salmon sport fishery.[a]

Temporal Component	1988[b]	1989[c]	88-89 Average	Accumulated Average Est. 1991	1991	1991 Accumulated Estimate
Fishing Effort (Angler-Hours)						
7/22-7/31	10,396	5,745	8,071	8,071	4,427	4,427
8/1-8/7	3,571	3,683	3,627	11,698	2,587	7,014
8/8-8/14	4,172	3,311	3,742	15,439	2,794	9,808
8/15-8/21	2,739	3,395	3,067	18,506	3,782	13,590
8/22-8/31	2,532	2,171	2,352	20,858	3,561[d]	17,151
9/1-9/15	855	647	751	21,609	--	--
Catch Estimates						
7/22-7/31	70	259	165	165	170	170
8/1-8/7	534	825	680	844	1,347	1,517
8/8-8/14	1,938	1,413	1,676	2,520	824	2,341
8/15-8/21	693	1039	866	3,386	1,690	4,031
8/22-8/31	618	662	640	4,026	789[d]	4,820
9/1-9/15	218	186	202	4,228	--	--
Harvest Estimates						
7/22-7/31	70	253	162	162	170	170
8/1-8/7	460	809	635	796	1,245	1,415
8/8-8/14	1,847	1,112	1,480	2,276	667	2,082
8/15-8/21	680	961	821	3,096	1,631	3,713
8/22-8/31	589	653	621	3,717	754[d]	4,467
9/1-9/15	193	175	184	3,901	--	--

[a] This table was produced by partitioning and reanalyzing portions of the original data that correspond to the temporal components used in 1991. The reanalysis was done only for the portions of each survey that occurred between 22 July and 15 September; estimates presented here may differ from those in the original reports.

[b] Minard (1989). Note: addition producing June and July total effort estimate (Table 1, page 10 in Minard 1989) is incorrect and should be 75,260 angler hours.

[c] Dunaway (1990).

[d] The 1991 estimates for the time period 8/22-8/31 are actually for the time period 8/22-9/1.

Table 14. Estimates of chinook salmon commercial, subsistence, and sport harvest plus escapement for the Naknek River fishery, 1970-1991.

Year	Harvest				Escapement[c]	Total[d]
	Commercial[a]	Subsistence	Sport[b]	Total	Index	Run
1970	19,037	300	2,730	22,067	4,145	26,212
1971	10,254	200	2,417	12,871	2,885	15,756
1972	2,262	400	1,668	4,330	2,791	7,121
1973	951	600	1,000	2,551	2,536	5,087
1974	480	1,000	1,700	3,180	1,446	4,626
1975	964	700	427	2,091	3,452	5,543
1976	4,064	900	800	5,764	7,131	12,895
1977	4,373	1,300	1,005	6,678	9,390	16,068
1978	6,930	1,200	2,406	10,536	9,350	19,886
1979	10,415	1,200	2,669	14,284	7,448	21,732
1980	7,517	1,500	2,729	11,746	--	--
1981	11,048	1,000	2,581	14,629	4,271	18,900
1982	12,425	1,100	3,264	16,789	8,610	25,399
1983	9,942	1,000	3,545	14,487	7,830	22,317
1984	9,198	900	4,524	14,622	4,995	19,617
1985	5,891	1,179	5,038	12,108	--	--
1986	3,552	1,295	6,462	11,309	3,917	15,226
1987	5,000	1,289	11,419	17,708	4,450	22,158
1988	6,677	1,057	5,380	13,114	11,730	24,844
1989	6,463	970	3,879	11,312	2,710	14,022
1990	3,749	985	3,250	7,984	7,000	14,984
All Years						
Average	6,723	956	3,281	10,960	5,584	16,442
Percent	61%	9%	30%			
1986 to 1990						
5 Year Avg	5,088	1,119	6,078	12,285	5,961	18,247
Percent	41%	9%	49%			
1991	4,528	1,000	3,115	8,643	4,391	13,034
Percent	52%	12%	36%			

[a] Commercial catches are for the Naknek/Kvichak district and in some years were impacted by price disputes. 1988-91 estimates are preliminary.

[b] Sport harvest estimated by informal creel survey for 1973, 74, and 76. Sport harvest estimated formally for 1970, 71, 72, 75, 86, 87, 88, 89, and 90. Sport harvest estimated by statewide survey 1977-1985.

[c] Actual raw count made from fixed wing aerial surveys.

[d] In all years, total run is to be considered a minimum number.

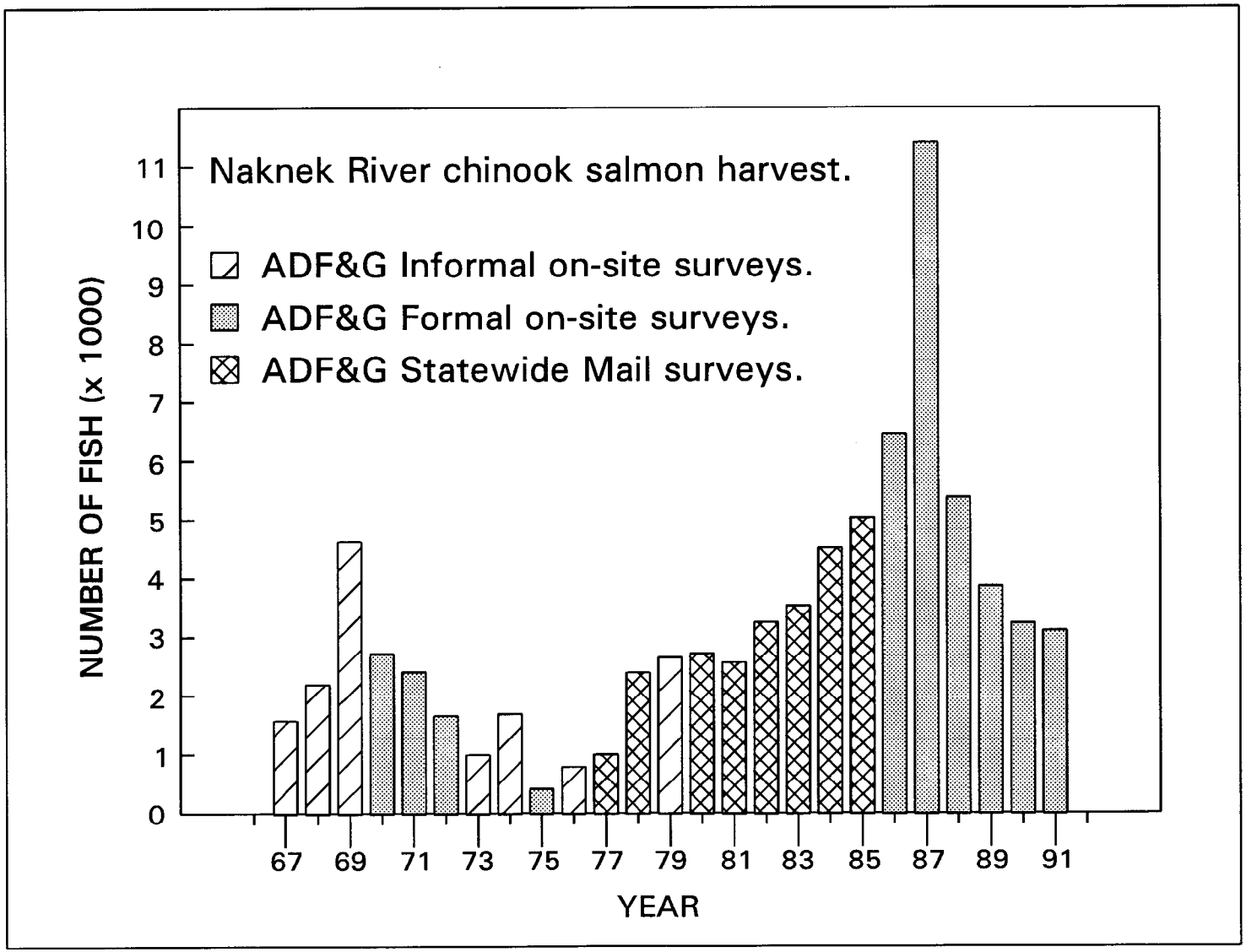

Figure 6. Estimated harvest of chinook salmon by the sport fishery in the Naknek River, 1967-1991.

Table 15. Estimates of coho salmon commercial, subsistence, and sport harvest from the Naknek River, 1971 to 1991.

Year	Harvest			
	Commercial[a]	Subsistence[b]	Sport	Total
1971	89	100	--	--
1972	402	100	--	--
1973	255	500	--	--
1974	916	200	--	--
1975	43	200	--	--
1976	1,195	600	--	--
1977	2,883	300	297	3,480
1978	913	300	646	1,859
1979	12,355	1,200	300	13,855
1980	7,802	800	818	9,420
1981	1,229	1,100	1,156	3,485
1982	10,586	1,000	1,676	13,262
1983	7,282	900	1,385	9,567
1984	3,209	600	2,332	6,141
1985	10,474	1,103	1,281	12,858
1986	5,824	650	1,942	8,416
1987	5,274	1,106	2,292	8,672
1988	28,352	813	4,065	33,230
1989	22,551	1,927	4,801	29,279
1990	13,403	726	2,179	16,308
1986 to 1990 5 Year Avg	15,081	1,044	3,056	19,181
Percent	79%	5%	16%	
1991	16,517	1,000	4,546	22,063
Percent	75%	5%	20%	

[a] Commercial harvest is for the Naknek/Kvichak district and 1988-1991 data are preliminary.

[b] 1991 data are preliminary.

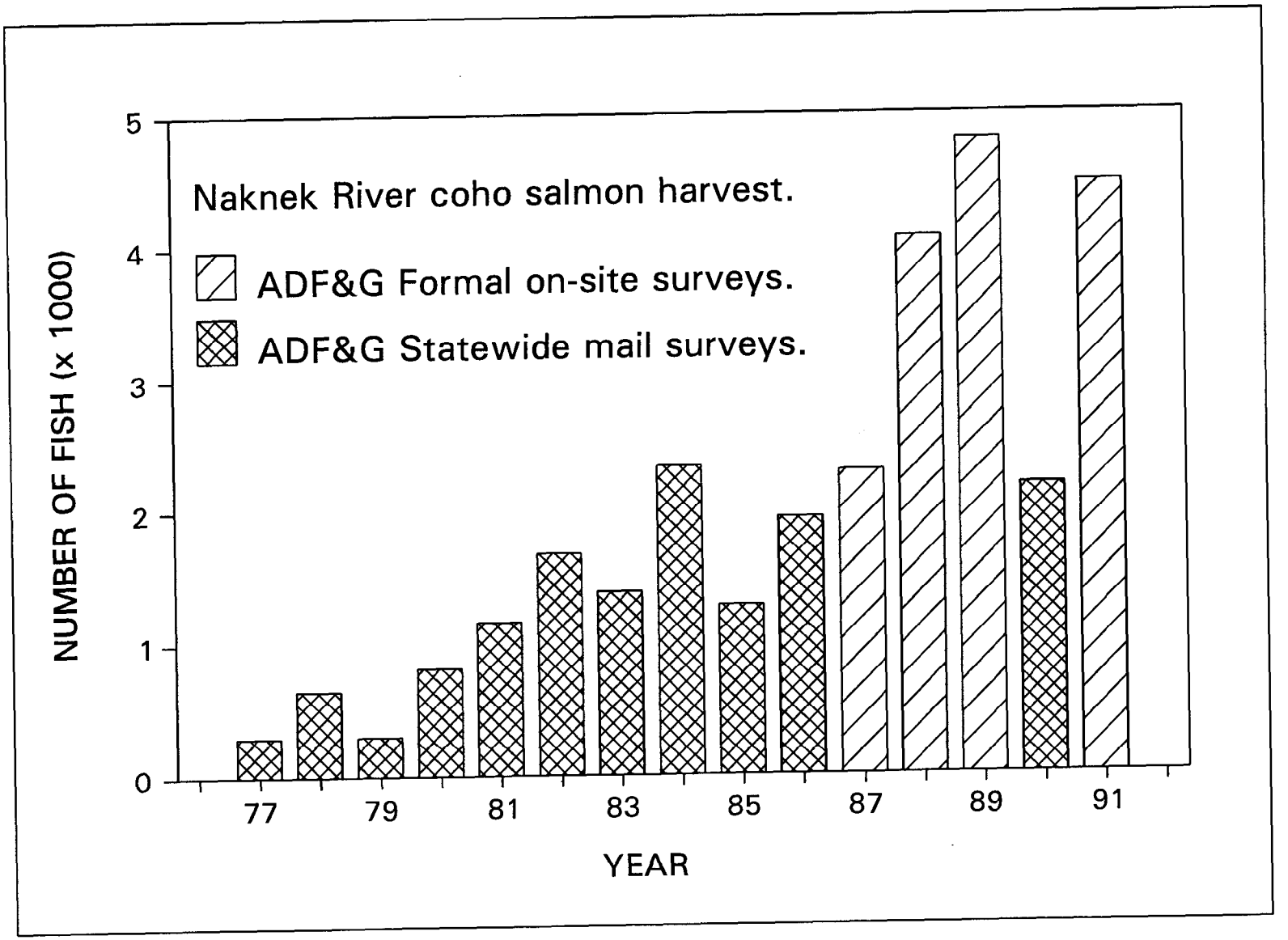

Figure 7. Estimated harvest of coho salmon by the sport fishery in the Naknek River, 1977-1991.

Table 16. Effort, catch, and harvest estimates of chinook salmon from creel surveys conducted in the Naknek River sport fishery, 1986-1991.

Year & Location[a]	Survey Period	Effort (angler-hours) Point Estimate	SE	95% Confidence Interval Lower	Upper	Catch Point Estimate	SE	95% Confidence Interval Lower	Upper	Harvest Point Estimate	SE	95% Confidence Interval Lower	Upper
1986[b]													
L	5/28-7/25	37,532	2,871	31,905	43,159	7,263	527	6,230	8,296	6,462	471	5,539	7,385
U		no survey											
	Total	37,532	2,871	31,905	43,159	7,263	527	6,230	8,296	6,462	471	5,539	7,385
1987[c]													
L	6/1-9/13	59,932	3,868	52,351	67,513	14,250	1,129	12,037	16,463	11,419	918	9,620	13,218
U	6/8-10/30	10,441	1,022	8,438	12,444	0		0	0	0		0	0
	Total	70,373	4,001	62,532	78,214	14,250	1,129	12,037	16,463	11,419	918	9,620	13,218
1988[d]													
L	6/1-9/13	89,129	7,436	74,554	103,704	6,357	643	5,097	7,617	5,359	603	4,177	6,541
U	6/8-9/13	11,817	1,082	9,696	13,938	39	1,454	0	2,889	21	952	0	1,887
	Total	100,946	7,514	86,218	115,674	6,396	1,590	3,280	9,512	5,380	1,127	3,171	7,589
1989[e]													
L	6/1-9/15	65,993	5,346	55,515	76,471	4,121	846	2,463	5,779	3,854		3,854	3,854
U	6/8-10-12	15,226	1,303	12,672	17,780	231	285	0	790	25	56	0	135
	Total	81,219	5,503	70,434	92,004	4,352	893	2,602	6,102	3,879	56	3,769	3,989
1990[f]													
L	6/1-7/31	39,653	2,186	35,368	43,938	4,265	528	3,230	5,300	3,250	434	2,399	4,101
U		no survey											
	Total	39,653	2,186	35,368	43,938	4,265	528	3,230	5,300	3,250	434	2,399	4,101
1991													
L	6/1-9/1	41,538	1,896	37,822	45,254	3,663	368	2,943	4,383	3,115	343	2,442	3,788
U		no survey											
	Total	41,538	1,896	37,822	45,254	3,663	368	2,943	4,383	3,115	343	2,442	3,788

[a] L = lower Naknek River: from the mouth of Paul's Creek upstream to 1.5 km above the mouth of Big Creek (exact boundaries have varied from year to year). U = upper Naknek River: from the outlet of Naknek Lake downstream to 1.5 km above the mouth of Big Creek (exact boundaries have varied from year to year).

[b] Minard (1987). Note confidence intervals appearing on page 11 of Minard (1987) appear to be incorrect; for this table the SE shown in Minard (1987) were assumed to be correct.

[c] Minard and Brookover (1988).

[d] Minard (1989). Note: addition producing June & July total effort estimate (Table 1, page 10 of Minard 1987 is incorrect and should be 75,260 angler-hours).

[e] Dunaway (1990).

[f] Dunaway and Bingham(1991).

Table 17. Effort, catch, and harvest estimates of coho salmon from creel surveys conducted on the Naknek River sport fishery, 1987, 1988, 1989, and 1991.

Year & Location[a]	Survey Period	Effort (angler-hours) Point Estimate	SE	95% Confidence Interval Lower	Upper	Catch Point Estimate	SE	95% Confidence Interval Lower	Upper	Harvest Point Estimate	SE	95% Confidence Interval Lower	Upper
1987[b]													
L	6/1-9/13	59,932	3,868	52,351	67,513	2,099	933	270	3,928	1,994	894	242	3,746
U	6/8-10/30	10,441	1,022	8,438	12,444	193	511	0	1,195	193	511	0	1,195
	Total	70,373	4,001	62,532	78,214	2,292	1,064	207	4,377	2,187	1,030	169	4,205
1988[c]													
L	6/1-9/11	89,129	7,436	74,554	103,704	4,070	647	2,802	5,338	3,839	563	2,736	4,942
U	6/9-10/13	11,817	1,082	9,696	13,938	254	114	31	477	226	106	18	434
	Total	100,946	7,514	86,218	115,674	4,324	657	3,036	5,612	4,065	573	2,942	5,188
1989[d]													
L	6/1-9/15	65,993	5,346	55,515	76,471	4,398	1,094	2,254	6,542	3,977	710	2,585	5,369
U	6/8-10/12	15,226	1,303	12,672	17,780	862	449	0	1,742	824	429	0	1,665
	Total	81,219	5,503	70,434	92,004	5,260	1,183	2,942	7,578	4,801	830	3,175	6,427
1991													
L	6/1-9/1	41,538	1,896	38,822	45,254	4,828	529	3,791	5,865	4,475	525	3,447	5,503
U		no survey											
	Total	41,538	1,896	37,822	45,254	4,828	529	3,791	5,865	4,475	525	3,447	5,503

[a] L = lower Naknek River: from the mouth of Paul's Creek upstream to 1.5 km above the mouth of Big Creek (exact boundaries have varied from year to year). U = upper Naknek River: from the outlet of Naknek Lake downstream to 1.5 km above the mouth of Big Creek (exact boundaries have varied from year to year).

[b] Minard and Brookover (1988).

[c] Minard (1989). Note: addition producing June & July total effort estimate (Table 1, page 10 of Minard 1987 is incorrect and should be 75,260 angler-hours).

[d] Dunaway (1990).

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APPENDIX A

Estimation Equations for Creel Survey Parameters

Appendix A1. Estimation equations for catch, harvest, and angler effort for the creel survey conducted during 1991 on the chinook and coho salmon sport fisheries in the Naknek River.

Angler effort, catch, and harvest, their associated variances, and standard errors were estimated for the creel survey using the following procedures. The following equations were <u>not</u> used to obtain estimates of CPUE or HPUE (and their variances) to describe individual angler catch or harvest rates. The CPUE and HPUE estimates presented here are only appropriate for expansion purposes (i.e., as used in a ratio estimation procedure).

The first step involved obtaining the jackknife estimated sample mean of CPUE (or HPUE) was:

$\overset{*}{CPUE}_{hijk}$ = the jackknifed CPUE for angler k in sample j within day i and temporal component h;

$$= \frac{\sum_{\substack{o=1 \\ o \neq k}}^{m_{hij}} c_{hijo}}{\sum_{\substack{o=1 \\ o \neq k}}^{m_{hij}} e_{hijo}}; \qquad \text{(A1.1)}$$

where: m_{hij} equaled the number of anglers interviewed within each sampled period during each sampled day; and c_{hijo} and e_{hijo} equaled the catch and angling effort in hours of each angler interviewed.

The jackknife mean CPUE for sample j within day i and temporal component h was then obtained from:

$$\overline{\overset{*}{CPUE}}_{hij} = \frac{\sum_{k=1}^{m_{hij}} \overset{*}{CPUE}_{hijk}}{m_{hij}}. \qquad \text{(A1.2)}$$

The bias correction (adapted from Efron 1982, equation 2.8, page 6) was performed as follows (note that if the bias correction, equation A1.3, resulted in a negative value, then the uncorrected version, equation A1.2, was used in all following equations):

$$\overline{\overset{*t}{CPUE}}_{hij} = [m_{hij} (\overline{CPUE}_{hij} - \overline{\overset{*}{CPUE}}_{hij})] + [\overline{\overset{*}{CPUE}}_{hij}]; \qquad \text{(A1.3)}$$

-continued-

where:

$$\overline{CPUE}_{hij} = \frac{\sum_{o=1}^{m_{hij}} c_{hijo}}{\sum_{o=1}^{m_{hij}} e_{hijo}}. \quad \text{(A1.4)}$$

The bias-corrected jackknife mean was expanded by the estimated angler effort for the sample to obtain the estimated catch for each sample period within each sampled day:

$$\hat{C}_{hij} = \hat{E}_{hij}\, \overline{CPUE}_{hij}^{*\dagger}; \quad \text{(A1.5)}$$

where:

$\hat{E}_{hij}$ = estimated angler effort (in hours) for each sample period;

$$= H_{hij}\, \bar{x}_{hij}; \quad \text{(A1.6)}$$

$$\bar{x}_{hij} = \frac{\sum_{q=1}^{r_{hij}} x_{hijq}}{r_{hij}}; \quad \text{(A1.7)}$$

H_{hij} equaled number of hours in sampling period j within day i and temporal component h; and x_{hijq} was the number of anglers counted fishing during each count sample, within each period.

The harvest for the sample was estimated similarly by substituting the appropriate harvest statistics into equations A1.1 to A1.5, above.

Estimates of angler effort, catch, and harvest for each day sampled were obtained as follows:

$\bar{\hat{Y}}_{hi}$ = mean of the sample estimates for each sampled day; in which Y represents E, C, or H for effort, catch, and harvest, respectively;

$$= \frac{\sum_{j=1}^{p_{hi}} \hat{Y}_{hij}}{p_{hi}}; \quad \text{(A1.8)}$$

-continued-

where: p_{hi} equaled number of periods sampled within each sampled day (set to 2 as per schedule); and

$\hat{Y}_{hij}$ = estimated sample value for effort (E, as obtained from equation A1.6, above), catch or harvest (C or H, as obtained from equation A1.5, above).

The estimated daily effort, catch, and harvest was obtained by expanding by the number of sampling periods in the day:

$$\hat{Y}_{hi} = P_{hi}\,\bar{\hat{Y}}_{hi}; \qquad \text{(A1.9)}$$

where: P_{hi} was the number of possible sampling periods within each day i for temporal component h (either equal to 4 for temporal components 1 through 6 or equal to 3 for temporal components 7 through 10).

Similarly, estimates for each temporal component were obtained as follows:

$\bar{\hat{Y}}_h$ = mean of the daily estimates for temporal component h; in which Y represents E, C, or H for effort, catch, and harvest, respectively;

$$= \frac{\sum_{i=1}^{d_h} \hat{Y}_{hi}}{d_h}; \qquad \text{(A1.10)}$$

where: d_h equaled the number of days sampled within each temporal component.

The estimated temporal component effort, catch, and harvest was obtained by expanding by the number of days in each temporal component:

$$\hat{Y}_h = D_h\,\bar{\hat{Y}}_h; \qquad \text{(A1.11)}$$

where: D_h was the number of days within each temporal component.

-continued-

The variance of the estimated catch for each temporal component was obtained by the three-stage variance equation (following the approach outlined by Cochran 1977), omitting the finite population correction factor (FPC) for the third stage units:

$$\hat{V}[\hat{C}_h] = \left[(1 - f_{1h}) \, D_h^2 \frac{S_{1h}^2}{d_h} \right] + \left[f_{1h} \frac{D_h^2}{d_h^2} \sum_{i=1}^{d_h} (1 - f_{2hi}) \, P_{hi}^2 \frac{S_{2hi}^2}{p_{hi}} \right] + \left[f_{1h} \frac{D_h^2}{d_{3h}^2} \sum_{i=1}^{d_{3h}} f_{2hi} \frac{P_{hi}^2}{p_{3hi}^2} \sum_{j=1}^{p_{3hi}} \hat{V}[\hat{C}_{hij}] \right] ; \qquad \text{(A1.12)}$$

where: f_{1h} equaled the sampling fraction for days (i.e., d_h / D_h); f_{2hi} equaled the sampling fraction for periods within each day (i.e., p_{hi} / P_{hi}); d_{3h} equaled the number of days sampled in each stratum in which at least one period was sampled with at least two anglers interviewed (i.e., number of days in which third-stage sampling variance could be estimated); p_{3hi} equaled with number of periods sampled within each day in which at least 2 anglers were interviewed;

S_{1h}^2 = the among day variance for the total angler catch estimate over all days sampled in each temporal component;

$$= \frac{\sum_{i=1}^{d_h} (\hat{C}_{hi} - \bar{\hat{C}}_h)^2}{d_h - 1} ; \qquad \text{(A1.13)}$$

S_{2hi}^2 = the among period variance for each sampled day;

$$= \frac{\sum_{j=1}^{p_{hi}} (\hat{C}_{hij} - \bar{\hat{C}}_{hi})^2}{p_{hi} - 1} ; \qquad \text{(A1.14)}$$

-continued-

$\hat{V}[\hat{C}_{hij}]$ = the within period variance for the estimated sample catch for each sample period, obtained by using Goodman's (1960) formula for estimating the variance of a product of random variates;

$$= (\hat{E}_{hij})^2 \, s^{*2}_{3hij} + (\overline{CPUE}^{*}_{hij})^2 \, \hat{V}[\hat{E}_{hij}] - s^{*2}_{3hij} \, \hat{V}[\hat{E}_{hij}] \; ; \qquad \text{(A1.15)}$$

s^{*2}_{3hij} = jackknife estimate of the variance for the jackknifed sample mean CPUE (adapted from Efron 1982, equation 3.2, page 13);

$$= \frac{(m_{hij} - 1)}{m_{hij}} \sum_{k=1}^{m_{hij}} (CPUE^{*}_{hijk} - \overline{CPUE}^{*}_{hij})^2 \; ; \text{ and} \qquad \text{(A1.16)}$$

$\hat{V}[\hat{E}_{hij}]$ = estimated variance of the angler effort estimate for each sampled period adapted from the successive differences equation appropriate for systematic sampling as suggested by Wolter (1985):

$$= \frac{H^2_{hij}}{r_{hij}} \; \frac{\sum_{q=2}^{r_{hij}} (x_{hijq} - x_{hij(q-1)})^2}{2\,(r_{hij} - 1)} \; . \qquad \text{(A1.17)}$$

Variance estimates for the estimated harvest were obtained by replacing the appropriate harvest statistics (h's and H's) for the catch statistics (c's and C's) in equations A1.12 through A1.16.

Temporal component estimates of the variance of the angler effort were obtained in a similar manner to those for catch and harvest. The primary difference was in the third major term in equation A1.12:

$$\hat{V}[\hat{E}_h] \approx \left[(1 - f_{1h}) \, D^2_h \frac{S^2_{1h}}{d_h} \right] + \left[f_{1h} \frac{D^2_h}{d^2_h} \sum_{i=1}^{d_h} (1 - f_{2hi}) \, P^2_{hi} \frac{S^2_{2hi}}{p_{hi}} \right] + \left[f_{1h} \frac{D^2_h}{d^2_{3h}} \sum_{i=1}^{d_{3h}} f_{2hi} \frac{P^2_{hi}}{p^2_{3h}} \sum_{j=1}^{p_{3h}} \hat{V}[\hat{E}_{hij}] \right] . \qquad \text{(A1.18)}$$

-continued-

The values for the terms in equation A1.18 were obtained by replacing the catch statistics (C's) by the appropriate effort statistics (E's) in equations A1.13 and A1.14, and equation A1.17 was used as is in the final term in equation A1.18.

Total angler effort, catch, or harvest across all temporal components and the associated variances were calculated by summing statistics across temporal components; and standard errors (SE's) were obtained by taking the square root of the associated variances.

Appendix A2. Estimation equations for catch per unit effort as an index of angler success for the creel survey conducted during 1991 on the chinook and coho salmon sport fisheries in the Naknek River.

Estimates of catch per unit effort (CPUE) as an index of fish abundance for the 1991 Naknek River chinook and coho salmon sport fisheries were obtained by first obtaining the mean CPUE for each angler:

$$CPUE_{hijo} = \frac{c_{hijo}}{e_{hijo}} ; \qquad (A2.1)$$

where all terms were as defined in Appendix A1.

The mean CPUE for each stratum of the fishery was then calculated over all anglers interviewed within stratum:

$$\overline{CPUE_h} = \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{p_{hi}} \sum_{o=1}^{m_{hij}} CPUE_{hijo}}{m} ; \qquad (A2.2)$$

where:

$$m = \sum_{i=1}^{d_h} \sum_{j=1}^{p_{hi}} m_{hij} ; \text{ and} \qquad (A2.3)$$

all other terms were as defined in Appendix A1.

The variances of the stratum estimates of CPUE were obtained by the following equation:

$$\hat{V}[\overline{CPUE_h}] = \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{p_{hi}} \sum_{o=1}^{m_{hij}} (CPUE_{hijo} - \overline{CPUE_h})^2}{m\,(m-1)} . \qquad (A2.4)$$

Appendix A3. Estimation equations for the distribution of catches and harvests for the creel survey conducted during 1991 on the chinook and coho salmon sport fisheries in the Naknek River.

The distribution of catches and harvest as described in the body of this report were estimated as described below for the 1991 survey. We first coded the data to correct for possible biases due to changing amounts of angler effort (in terms of angler-trips). From Sukhatme et al. (1984: equation 8.58; page 327):

$$y_{khijo} = \begin{cases} \hat{M}_{hij} / \bar{\hat{M}}^{*}_{hi} & \text{if catch or harvest made by interviewed angler } o \text{ during sample } j \text{ on day } i \text{ within temporal component } h \text{ caught 0 (for k=0) or k or more chinook or coho salmon;} \\ 0 & \text{otherwise;} \end{cases} \quad \text{(A3.1)}$$

where:

$\hat{M}_{hij}$ = estimated number of angler-trips for each sample, obtained from the ratio of the estimated angler effort for the sample divided by the mean angler effort from interviewed anglers for the sample;

$$= \frac{\hat{E}_{hij}}{\bar{e}_{hij}} ; \quad \text{(A3.2)}$$

$\hat{E}_{hij}$ was the angler effort estimate for the sample (as obtained from equation A1.6, Appendix A1);

$\bar{e}_{hij}$ = equaled the mean angler effort expended by anglers interviewed within each sample for their day of fishing;

$$\frac{\sum_{o=1}^{m_{hij}} e_{hijo}}{m_{hij}} ; \quad \text{(A3.3)}$$

-continued-

$\bar{\hat{M}}^{*}_{hi}$ = the "restricted" mean of the possible number of angler-day trips for each day estimated as the mean of the number of angler-day trips (restricted to periods in which one or more angler-day trips were estimated):

$$= \frac{\sum_{j=1}^{p^{*}_{hi}} \hat{M}^{*}_{hij}}{p^{*}_{hi}} ; \qquad \text{(A3.4)}$$

$\hat{M}^{*}_{hij}$ = estimated as in equation A3.2, above, but restricted to only estimates that are greater than zero;

p^{*}_{hi} equaled the number of periods during each day with at least one angler-trip estimated; and all other terms were as defined in Appendix A1.

The angler met the criterion if his or her catch $c_{hijo} \geq k$ where $k = 1$ to k_{max} or $c_{chijo} = 0$ for $k = 0$; otherwise $y_{khijo} = 0$. The data will be re-coded for each iteration from 1 to k_{max}. After coding, the average fraction and its variance were found for each temporal component:

$\equiv$
y_{kh} = estimated proportion of angler-trips in each temporal component that catch or harvest 0 or at least k coho salmon;

$$= \frac{\sum_{i=1}^{d_h} y_{khi}}{d_h} ; \qquad \text{(A3.5)}$$

where:

$=$
y_{khi} = mean proportion of angler-trips for day i that catch or harvest 0 or at least k fish;

$$= \frac{\sum_{j=1}^{p^{*}_{hi}} \bar{y}_{khij}}{p^{*}_{hi}} ; \text{ and} \qquad \text{(A3.6)}$$

-continued-

$\bar{y}_{khij}$ = mean sample proportion of angler-trips for each sample that catch or harvest 0 or at least k fish;

$$= \frac{\sum_{j=1}^{m_{hi}} y_{khijo}}{m_{hi}} . \qquad \text{(A3.7)}$$

The variance of the estimated proportion was obtained by the usual three-stage equation:

$$\hat{V}[\bar{y}_{kh}] \equiv = \left[(1 - f_{1h}) \frac{s_{1kh}^2}{d_h^*} \right] + \left[\frac{f_{1h}}{d_h^{*2}} \sum_{i=1}^{d_h^*} \left[(1 - f_{2hi}) \frac{s_{2khi}^2}{p_{hi}^*} \right] \right] + \left[\frac{f_{1h}}{d_h^{*2}} \sum_{i=1}^{d_h^*} \frac{f_{2hi}}{p_{hi}^{*2}} \sum_{j=1}^{p_{hi}^*} \frac{s_{3khij}^2}{m_{hij}} \right] ; \qquad \text{(A3.8)}$$

where:

$$s_{1kh}^2 = \frac{\sum_{i=1}^{d_h^*} (y_{khi} - \bar{\bar{y}}_{kh})^2}{d_h^* - 1} ; \qquad \text{(A3.9)}$$

$$s_{2khi}^2 = \frac{\sum_{j=1}^{p_{hi}^*} (\bar{y}_{khij} - \bar{y}_{khi})^2}{p_{hi}^* - 1} ; \qquad \text{(A3.10)}$$

$$s_{3khij}^2 = \frac{\sum_{o=1}^{m_{hij}} (y_{khijo} - \bar{y}_{khij})^2}{m_{hij} - 1} ; \qquad \text{(A3.11)}$$

and all other terms were as defined above or in Appendix A1.

-continued-

Once the estimated proportion and its variances were calculated for all temporal components in an iteration, the statistics were combined as weighted averages to estimate one set of statistics (p_k's) of catch or harvest distribution for the entire fishery (for each species):

$\hat{p}_k$ = the estimated fraction of completed angler-trips in which anglers caught 0 or k or more fish;

$$= \sum_{h=1}^{s} \hat{W}_h \, \bar{\bar{y}}_{kh} \; ; \qquad \text{(A3.12)}$$

$\hat{V}[\hat{p}_k]$ = variance estimate, obtained by treating the stratum weights as constants, rather than as estimates, and as such obtained approximately by (see Kish 1965, equations 2.8.5 and 2.8.7, pages 60 and 61);

$$\approx \sum_{h=1}^{s} \hat{W}_h^2 \, \hat{V}[\bar{\bar{y}}_{kh}] \; ; \qquad \text{(A3.13)}$$

where:

$\hat{W}_h$ = estimated relative stratum weight of temporal component *h* (equivalent to the ratio of the estimated number of angler-day trips for each temporal component compared to the total number of angler-trips for the fishery);

$$= \frac{\hat{A}_h}{\hat{A}} \; ; \qquad \text{(A3.14)}$$

$\hat{A}_h$ = estimated number of angler-trips for each temporal component;

$$= D_h \, \bar{\hat{M}}_h \; ; \qquad \text{(A3.15)}$$

$\bar{\hat{M}}_h$ = unrestricted mean estimated number of angler-trips for each component;

$$= \frac{\sum_{i=1}^{d_h} \hat{M}_{hi}}{d_h} \; ; \qquad \text{(A3.16)}$$

-continued-

$\hat{M}_{hi}$ = unrestricted estimated number of angler-trips for each sampled day;

$$= P_{hi} \bar{\hat{M}}_{hi} \; ; \qquad \text{(A3.17)}$$

$\bar{\hat{M}}_{hi}$ = unrestricted mean estimated number of angler-trips for each sampled day;

$$= \frac{\sum_{j=1}^{P_{hi}} \hat{M}_{hij}}{P_{hi}} \; ; \qquad \text{(A3.18)}$$

$\hat{A}$ equaled the total number of estimated angler-trips across all strata; and all other terms were as defined above.

These calculations were repeated for k=2, k=3, ..., and $k=k_{max}$ for the catches. When these calculations were complete, then the whole procedure was repeated for harvested fish.

Standard errors were obtained by taking the square root of the variance estimates.

APPENDIX B

Estimation Equations for Creel Survey Biological Parameters

Appendix B1. Estimation equations for the age composition in proportions for the fish harvested in the 1991 chinook and coho salmon sport fisheries in the Naknek River.

Proportions of each age class of fish harvested in each temporal component were calculated according to the following procedures:

$\hat{p}_{uh}$ = estimated proportion of the sampled chinook or coho salmon harvested that are age *u* within each temporal component;

$$= \frac{n_{uh}}{n_h}; \qquad \text{(B1.1)}$$

where: n_{uh} equaled the number of the sampled chinook or coho salmon harvested within each temporal component that are age *u*; and n_h equaled the total number of chinook or coho salmon sampled within each temporal component.

The variance of the estimated proportion of chinook or coho salmon harvested was estimated approximately by the standard equation for the variance of a binomial proportion (Cochran 1977, equation 3.8, page 52):

$$\hat{V}[p_{uh}] \approx \left(1 - \frac{n_h}{\hat{H}_h}\right) \frac{p_{uh}(1 - p_{uh})}{n_h - 1}; \qquad \text{(B1.2)}$$

where:

$\hat{H}_h$ equaled the estimated harvest of chinook or coho salmon in each stratum, obtained from equation A1.11, Appendix A1.

Next we estimated weighted proportions for each age class across all temporal components:

$$\hat{p}_u = \sum_{h=1}^{s} \hat{W}_h \hat{p}_{uh}; \qquad \text{(B1.3)}$$

where:

$$\hat{W}_h = \frac{\hat{H}_h}{\hat{H}}; \text{ and} \qquad \text{(B1.4)}$$

$\hat{H}$ equaled the total harvest over all temporal components.

-continued-

The variance of the estimated proportion of fish harvested which are age class *u* across all strata, was also obtained by Goodman's (1960) equation for the variance of the product of two random variates:

$$\hat{V}[\hat{p}_u] = \sum_{h=1}^{s} \left\{ \hat{W}_h^2 \, \hat{V}[\hat{p}_{uh}] + \hat{p}_{uh}^2 \, \hat{V}[\hat{W}_h] - \hat{V}[\hat{p}_{uh}] \, \hat{V}[\hat{W}_h] \right\} ; \qquad \text{(B1.5)}$$

where:

$$\hat{V}[\hat{W}_h] = \left[\frac{\hat{H}_h}{\hat{H}} \right]^2 \left\{ \frac{\hat{V}[\hat{H}_h]}{\hat{H}_h^2} + \frac{\hat{V}[\hat{H}]}{\hat{H}^2} - \frac{2 \, \hat{V}[\hat{H}_h]}{\hat{H}_h \, \hat{H}} \right\} . \qquad \text{(B1.6)}$$

APPENDIX C

Selected Summaries of Fishery Statistics

Appendix C1. Angler counts in the lower Naknek River sport fishery, 1991.

Temporal Components	Date	Time Periods A 0630 1029	B 1030 1429	C 1430 1829	D 1830 2230
1	01-Jun		5		0
1	02-Jun				
1	03-Jun	0	0		
1	04-Jun				
1	05-Jun		0	0	
1	06-Jun				
1	07-Jun	3.5[a]		9.25[a]	
1	08-Jun	3		36	
1	09-Jun				
1	10-Jun			9	1
1	11-Jun	0.75[a]	6.25[a]		
1	12-Jun		3	11	
1	13-Jun				
1	14-Jun				
1	15-Jun				
1	16-Jun		9		4
1	17-Jun				
1	18-Jun		19	13	
1	19-Jun		10.75[a]		22.5[a]
1	20-Jun				
1	21-Jun			33	11
2	22-Jun	50			14
2	23-Jun				
2	24-Jun			42.75[a]	21[a]
2	25-Jun		54	73	
2	26-Jun		51.25[a]		36[a]
2	27-Jun				
2	28-Jun	4	35		
2	29-Jun				
2	30-Jun		86.25[a]		70.75[a]

-continued-

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Temporal Components	Date	Time Periods A 0630 1029	B 1030 1429	C 1430 1829	D 1830 2230
3	01-Jul	116		129	
3	02-Jul	55[a]			45.25[a]
3	03-Jul				
3	04-Jul		76[a]		36[a]
3	05-Jul				
3	06-Jul	39.5[a]			26.25[a]
3	07-Jul			88	31
4	08-Jul		52[a]		17.25[a]
4	09-Jul				
4	10-Jul	17	32		
4	11-Jul	27	39		
4	12-Jul				
4	13-Jul	138[a]		56.75[a]	
4	14-Jul		40.5[a]		42[a]
5	15-Jul				
5	16-Jul	10.75[a]			2.75[a]
5	17-Jul				
5	18-Jul	12[a]		42.75[a]	
5	19-Jul		37		21
5	20-Jul	50		93	
5	21-Jul		52[a]		17.25[a]
6	22-Jul	31			25
6	23-Jul		25.75[a]	23.75[a]	
6	24-Jul		41		30
6	25-Jul			48.5	38.5[a]
6	26-Jul	17			14
6	27-Jul			52	23
6	28-Jul			24	16
6	29-Jul				
6	30-Jul		32[a]		11.5[a]
6	31-Jul	20.5[a]	24.5[a]		

-continued-

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Temporal Components	Date	Time Periods A 0800 1159	B 1200 1559	C 1600 2000
7	01-Aug	14.75[a]	24.25[a]	
7	02-Aug			
7	03-Aug	42[a]		26[a]
7	04-Aug			
7	05-Aug	23.25[a]		30.75[a]
7	06-Aug	21	26	
7	07-Aug	3	20	
8	08-Aug	16	20	
8	09-Aug		21.25[a]	21.75[a]
8	10-Aug			
8	11-Aug			
8	12-Aug		29	33
8	13-Aug		24.5[a]	30[a]
8	14-Aug	22[a]	32[a]	
9	15-Aug	21		31
9	16-Aug	42[a]		33.5[a]
9	17-Aug		30[a]	50.25[a]
9	18-Aug		40[a]	25[a]
9	19-Aug			
9	20-Aug			
9	21-Aug		34	31
10	22-Aug	29		31
10	23-Aug		48	37
10	24-Aug			
10	25-Aug	14	23	
10	26-Aug	27[a]	12.25[a]	
10	27-Aug	20		3
10	28-Aug			
10	29-Aug	17.25[a]	17[a]	
10	30-Aug			
10	31-Aug	11.25[a]	11[a]	

-continued-

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Temporal Components	Date	Time Periods A 0800 1159	B 1200 1559	C 1600 2000
10	01-Sep	17	6	
11	02-Sep			
11	03-Sep			
11	04-Sep			
11	05-Sep			
11	06-Sep			
11	07-Sep	1.5[a]	3[a]	
11	08-Sep	0		0
11	09-Sep			
11	10-Sep		0	0
11	11-Sep			
11	12-Sep		2	0
11	13-Sep		0	0
11	14-Sep	0[a]	0.5[a]	

[a] Values reflect the average of four separate in-period counts.

Appendix C2. Summary of daily angler effort (angler-hours), catch, and harvest for chinook salmon in the sport fishery in the lower Naknek River, 1991.

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
01	910601	B	1	5.00	5	20.0	0.00	0.00	0.00	0.00	0.00
01	910601	D	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	A	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910607	A	4	3.50	0	14.0	45.33	0.00	0.00	0.00	0.00
01	910607	C	4	9.25	0	37.0	76.00	0.00	0.00	0.00	0.00
01	910608	A	1	3.00	0	12.0	0.00	0.00	0.00	0.00	0.00
01	910608	C	1	36.00	24	144.0	0.00	0.00	0.00	0.00	0.00
01	910610	C	1	9.00	5	36.0	0.00	3.50	6.48	3.50	6.48
01	910610	D	1	1.00	4	4.0	0.00	0.00	0.00	0.00	0.00
01	910611	A	4	0.75	0	3.0	6.00	0.00	0.00	0.00	0.00
01	910611	B	4	6.25	0	25.0	44.00	0.00	0.00	0.00	0.00
01	910612	B	1	3.00	7	12.0	0.00	0.00	0.00	0.00	0.00
01	910612	C	1	11.00	10	44.0	0.00	1.11	1.25	1.11	1.25
01	910616	B	1	9.00	10	36.0	0.00	0.00	0.00	0.00	0.00
01	910616	D	1	4.00	8	16.0	0.00	0.00	0.00	0.00	0.00
01	910618	B	1	19.00	9	76.0	0.00	0.00	0.00	0.00	0.00
01	910618	C	1	13.00	13	52.0	0.00	0.87	0.78	0.87	0.78
01	910619	B	4	10.75	0	43.0	195.33	0.00	0.00	0.00	0.00
01	910619	D	4	22.50	0	90.0	60.00	0.00	0.00	0.00	0.00
01	910621	C	1	33.00	24	132.0	0.00	2.56	3.22	2.56	3.22
01	910621	D	1	11.00	15	44.0	0.00	0.71	0.50	0.71	0.50
02	910622	A	1	50.00	2	200.0	0.00	0.00	0.00	0.00	0.00
02	910622	D	1	14.00	7	56.0	0.00	0.00	0.00	0.00	0.00
02	910624	C	4	42.75	27	171.0	590.00	10.34	13.64	10.34	13.64
02	910624	D	4	21.00	24	84.0	124.00	8.82	10.21	8.82	10.21
02	910625	B	1	54.00	23	216.0	0.00	8.93	23.01	8.93	23.01
02	910625	C	1	73.00	43	292.0	0.00	23.06	32.17	21.51	26.39
02	910626	B	4	51.25	41	205.0	836.00	4.37	6.47	4.37	6.47
02	910626	D	4	36.00	36	144.0	247.33	5.82	5.59	5.82	5.59
02	910628	A	1	4.00	7	16.0	0.00	7.88	3.10	7.88	3.10
02	910628	B	1	35.00	24	140.0	0.00	24.29	20.09	24.29	20.09
02	910630	B	4	86.25	78	345.0	3387.33	32.41	57.02	31.21	51.61
02	910630	D	4	70.75	41	283.0	1678.00	13.94	16.11	13.94	16.11
03	910701	A	1	116.00	9	464.0	0.00	21.26	4330.05	21.26	4330.05
03	910701	C	1	129.00	60	516.0	0.00	58.63	105.72	46.26	38.16
03	910702	A	4	55.00	6	220.0	1586.00	54.57	150.95	54.57	150.95
03	910702	D	4	45.25	44	181.0	944.67	5.60	6.59	5.60	6.59
03	910704	B	4	76.00	59	304.0	2306.00	27.72	56.01	23.35	35.83
03	910704	D	4	36.00	46	144.0	38.67	5.27	3.61	5.27	3.61
03	910706	A	4	39.50	8	158.0	1026.00	39.50	403.41	39.50	403.41

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Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
03	910706	D	4	26.25	22	105.0	51.33	5.57	4.97	5.57	4.97
04	910708	B	4	52.00	31	208.0	1240.67	12.67	23.50	12.67	23.50
04	910708	D	4	17.25	27	69.0	65.33	5.41	1.57	4.24	0.85
04	910710	A	1	17.00	6	68.0	0.00	20.52	58.27	20.52	58.27
04	910710	B	1	32.00	11	128.0	0.00	15.31	21.19	15.31	21.19
04	910711	A	1	27.00	4	108.0	0.00	21.60	155.52	21.60	155.52
04	910711	B	1	39.00	15	156.0	0.00	8.89	21.31	8.89	21.31
04	910713	A	4	34.50	9	138.0	804.00	8.44	70.01	8.44	70.01
04	910713	C	4	56.75	39	227.0	585.33	13.07	16.10	11.75	15.06
04	910714	B	4	40.50	21	162.0	442.67	14.00	22.28	14.00	22.28
04	910714	D	4	42.00	17	168.0	241.33	11.94	14.81	11.94	14.81
05	910716	A	4	10.75	0	43.0	153.33	0.00	0.00	0.00	0.00
05	910716	D	4	2.75	0	11.0	49.33	0.00	0.00	0.00	0.00
05	910718	A	4	12.00	2	48.0	158.00	0.00	0.00	0.00	0.00
05	910718	C	4	42.75	27	171.0	92.00	19.87	21.64	19.87	21.64
05	910719	B	1	37.00	3	148.0	0.00	0.00	0.00	0.00	0.00
05	910719	D	1	21.00	7	84.0	0.00	4.21	19.92	0.00	0.00
05	910720	A	1	50.00	1	200.0	0.00	0.00	0.00	0.00	0.00
05	910720	C	1	93.00	29	372.0	0.00	35.68	82.44	24.57	40.34
05	910721	B	4	52.00	45	208.0	1061.33	18.32	40.56	10.69	15.86
05	910721	D	4	17.25	18	69.0	35.33	3.09	3.26	3.09	3.26
06	910722	A	1	31.00	2	124.0	0.00	0.00	0.00	0.00	0.00
06	910722	D	1	25.00	6	100.0	0.00	0.00	0.00	0.00	0.00
06	910723	B	4	25.75	28	103.0	177.33	10.16	9.89	9.16	7.15
06	910723	C	4	23.75	20	95.0	147.33	17.56	29.32	6.97	3.95
06	910724	B	1	41.00	23	164.0	0.00	1.41	2.05	0.00	0.00
06	910724	D	1	30.00	30	120.0	0.00	8.44	5.42	7.74	4.95
06	910725	C	4	48.50	37	194.0	2896.00	20.43	66.53	13.84	25.89
06	910725	D	4	38.50	33	154.0	237.33	8.14	10.03	2.34	2.80
06	910726	A	1	17.00	4	68.0	0.00	0.00	0.00	0.00	0.00
06	910726	D	1	14.00	17	56.0	0.00	2.45	1.92	2.45	1.92
06	910727	C	1	52.00	17	208.0	0.00	14.46	32.38	14.46	32.38
06	910727	D	1	23.00	15	92.0	0.00	13.35	25.07	4.19	6.16
06	910728	C	1	24.00	14	96.0	0.00	8.76	17.96	2.78	8.95
06	910728	D	1	16.00	22	64.0	0.00	2.86	2.19	2.86	2.19
06	910730	B	4	32.00	33	128.0	482.67	5.23	6.84	5.23	6.84
06	910730	D	4	11.50	29	46.0	198.00	0.36	0.13	0.36	0.13
06	910731	A	4	20.50	3	82.0	389.33	0.00	0.00	0.00	0.00
06	910731	B	4	24.50	22	98.0	348.67	5.06	6.49	5.06	6.49
07	910801	A	4	14.75	9	59.0	70.00	0.00	0.00	0.00	0.00
07	910801	B	4	24.25	10	97.0	81.33	0.00	0.00	0.00	0.00
07	910803	A	4	42.00	18	168.0	1475.33	0.00	0.00	0.00	0.00
07	910803	C	4	26.00	19	104.0	530.00	0.00	0.00	0.00	0.00
07	910805	A	4	23.25	6	93.0	315.33	0.00	0.00	0.00	0.00

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Appendix C2. (Page 3 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
07	910805	C	4	30.75	18	123.0	30.00	0.00	0.00	0.00	0.00
07	910806	A	1	21.00	2	84.0	0.00	0.00	0.00	0.00	0.00
07	910806	B	1	26.00	18	104.0	0.00	1.55	2.72	0.00	0.00
07	910807	A	1	3.00	2	12.0	0.00	0.00	0.00	0.00	0.00
07	910807	B	1	20.00	2	80.0	0.00	0.00	0.00	0.00	0.00
08	910808	A	1	16.00	6	64.0	0.00	0.00	0.00	0.00	0.00
08	910808	B	1	20.00	13	80.0	0.00	0.00	0.00	0.00	0.00
08	910809	B	4	21.25	36	85.0	16.67	0.70	0.50	0.00	0.00
08	910809	C	4	21.75	19	87.0	91.33	0.00	0.00	0.00	0.00
08	910812	B	1	29.00	16	116.0	0.00	0.00	0.00	0.00	0.00
08	910812	C	1	33.00	36	132.0	0.00	0.00	0.00	0.00	0.00
08	910813	B	4	24.50	17	98.0	162.00	2.98	9.47	0.00	0.00
08	910813	C	4	30.00	30	120.0	222.00	0.00	0.00	0.00	0.00
08	910814	A	4	22.00	3	88.0	71.33	0.00	0.00	0.00	0.00
08	910814	B	4	32.00	22	128.0	60.67	0.00	0.00	0.00	0.00
09	910815	A	1	21.00	4	84.0	0.00	0.00	0.00	0.00	0.00
09	910815	C	1	31.00	15	124.0	0.00	0.00	0.00	0.00	0.00
09	910816	A	4	42.00	9	168.0	456.67	0.00	0.00	0.00	0.00
09	910816	C	4	33.50	15	134.0	377.33	0.00	0.00	0.00	0.00
09	910817	B	4	30.00	28	120.0	104.67	0.00	0.00	0.00	0.00
09	910817	C	4	50.25	35	201.0	262.00	0.00	0.00	0.00	0.00
09	910818	B	4	40.00	53	160.0	739.33	0.00	0.00	0.00	0.00
09	910818	C	4	25.00	28	100.0	228.00	0.00	0.00	0.00	0.00
09	910821	B	1	34.00	16	136.0	0.00	0.00	0.00	0.00	0.00
09	910821	C	1	31.00	31	124.0	0.00	0.00	0.00	0.00	0.00
10	910822	A	1	29.00	11	116.0	0.00	0.00	0.00	0.00	0.00
10	910822	C	1	31.00	25	124.0	0.00	0.00	0.00	0.00	0.00
10	910823	B	1	48.00	11	192.0	0.00	0.00	0.00	0.00	0.00
10	910823	C	1	37.00	39	148.0	0.00	0.76	0.60	0.00	0.00
10	910825	A	1	14.00	14	56.0	0.00	0.00	0.00	0.00	0.00
10	910825	B	1	23.00	7	92.0	0.00	0.00	0.00	0.00	0.00
10	910826	A	4	27.00	4	108.0	19.33	0.00	0.00	0.00	0.00
10	910826	B	4	12.25	15	49.0	14.67	0.00	0.00	0.00	0.00
10	910827	A	1	20.00	8	80.0	0.00	0.00	0.00	0.00	0.00
10	910827	C	1	3.00	21	12.0	0.00	0.00	0.00	0.00	0.00
10	910829	A	4	17.25	11	69.0	60.00	0.00	0.00	0.00	0.00
10	910829	B	4	17.00	17	68.0	34.00	0.00	0.00	0.00	0.00
10	910831	A	4	11.25	9	45.0	36.00	0.00	0.00	0.00	0.00
10	910831	B	4	11.00	12	44.0	51.33	1.43	1.95	0.00	0.00
10	910901	A	1	17.00	7	68.0	0.00	0.00	0.00	0.00	0.00
10	910901	B	1	6.00	14	24.0	0.00	0.00	0.00	0.00	0.00
11	910907	A	4	1.50	0	6.0	6.00	0.00	0.00	0.00	0.00
11	910907	B	4	3.00	0	12.0	13.33	0.00	0.00	0.00	0.00
11	910908	A	1	0.00	2	0.0	0.00	0.00	0.00	0.00	0.00
11	910908	C	1	0.00	7	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

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Appendix C2. (Page 4 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
11	910910	C	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
11	910912	B	1	2.00	0	8.0	0.00	0.00	0.00	0.00	0.00
11	910912	C	1	0.00	6	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	C	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

[a] Temporal Components: 1 (6/01-6/21); 2 (6/22-6-30); 3 (7/01-7/07); 4 (7/08-7/14); 5 (7/15-7/21); 6 (7/22-7/31); 7 (8/01-8/07); 8 (8/08-8/14); 9 (8/15-8/21); 10 (8/22-9/01); 11 (9/02-9/15).

[b] Daily periods for temporal components 1-6: A (0630-1029); B (1030-1429); C (1430-1829); D (1830-2230).

Daily periods for temporal components 7-11: A (0800-1159); B (1200-1559); C (1600-2000).

Appendix C3. Summary of daily angler effort (angler-hours), catch, and harvest for jack chinook salmon in the sport fishery in the lower Naknek River, 1991.

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
01	910601	B	1	5.00	5	20.0	0.00	0.00	0.00	0.00	0.00
01	910601	D	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	A	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910607	A	4	3.50	0	14.0	45.33	0.00	0.00	0.00	0.00
01	910607	C	4	9.25	0	37.0	76.00	0.00	0.00	0.00	0.00
01	910608	A	1	3.00	0	12.0	0.00	0.00	0.00	0.00	0.00
01	910608	C	1	36.00	24	144.0	0.00	2.06	4.32	2.06	4.32
01	910610	C	1	9.00	5	36.0	0.00	2.37	7.94	2.37	7.94
01	910610	D	1	1.00	4	4.0	0.00	0.00	0.00	0.00	0.00
01	910611	A	4	0.75	0	3.0	6.00	0.00	0.00	0.00	0.00
01	910611	B	4	6.25	0	25.0	44.00	0.00	0.00	0.00	0.00
01	910612	B	1	3.00	7	12.0	0.00	0.00	0.00	0.00	0.00
01	910612	C	1	11.00	10	44.0	0.00	1.11	1.25	1.11	1.25
01	910616	B	1	9.00	10	36.0	0.00	0.00	0.00	0.00	0.00
01	910616	D	1	4.00	8	16.0	0.00	0.00	0.00	0.00	0.00
01	910618	B	1	19.00	9	76.0	0.00	0.00	0.00	0.00	0.00
01	910618	C	1	13.00	13	52.0	0.00	0.87	0.78	0.87	0.78
01	910619	B	4	10.75	0	43.0	195.33	0.00	0.00	0.00	0.00
01	910619	D	4	22.50	0	90.0	60.00	0.00	0.00	0.00	0.00
01	910621	C	1	33.00	24	132.0	0.00	2.57	3.20	2.57	3.20
01	910621	D	1	11.00	15	44.0	0.00	0.00	0.00	0.00	0.00
02	910622	A	1	50.00	2	200.0	0.00	0.00	0.00	0.00	0.00
02	910622	D	1	14.00	7	56.0	0.00	0.00	0.00	0.00	0.00
02	910624	C	4	42.75	27	171.0	590.00	7.36	14.90	7.36	14.90
02	910624	D	4	21.00	24	84.0	124.00	0.00	0.00	0.00	0.00
02	910625	B	1	54.00	23	216.0	0.00	0.00	0.00	0.00	0.00
02	910625	C	1	73.00	43	292.0	0.00	4.63	6.87	4.63	6.87
02	910626	B	4	51.25	41	205.0	836.00	0.00	0.00	0.00	0.00
02	910626	D	4	36.00	36	144.0	247.33	0.99	0.98	0.99	0.98
02	910628	A	1	4.00	7	16.0	0.00	0.00	0.00	0.00	0.00
02	910628	B	1	35.00	24	140.0	0.00	6.95	10.48	6.95	10.48
02	910630	B	4	86.25	78	345.0	3387.33	10.82	14.16	10.82	14.16
02	910630	D	4	70.75	41	283.0	1678.00	1.70	3.01	0.00	0.00
03	910701	A	1	116.00	9	464.0	0.00	0.00	0.00	0.00	0.00
03	910701	C	1	129.00	60	516.0	0.00	30.86	71.27	29.32	60.46
03	910702	A	4	55.00	6	220.0	1586.00	0.00	0.00	0.00	0.00
03	910702	D	4	45.25	44	181.0	944.67	4.46	7.80	1.12	1.27
03	910704	B	4	76.00	59	304.0	2306.00	20.44	43.69	18.97	37.28
03	910704	D	4	36.00	46	144.0	38.67	3.01	2.20	2.25	1.69

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Appendix C3. (Page 2 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
03	910706	A	4	39.50	8	158.0	1026.00	0.00	0.00	0.00	0.00
03	910706	D	4	26.25	22	105.0	51.33	2.75	4.28	2.75	4.28
03	910707	C	1	88.00	43	352.0	0.00	11.81	38.57	11.81	38.57
03	910707	D	1	31.00	35	124.0	0.00	7.85	5.68	6.99	5.69
04	910708	B	4	52.00	31	208.0	1240.67	27.32	62.43	25.51	59.19
04	910708	D	4	17.25	27	69.0	65.33	5.73	3.14	5.73	3.14
04	910710	A	1	17.00	6	68.0	0.00	0.00	0.00	0.00	0.00
04	910710	B	1	32.00	11	128.0	0.00	0.00	0.00	0.00	0.00
04	910711	A	1	27.00	4	108.0	0.00	0.00	0.00	0.00	0.00
04	910711	B	1	39.00	15	156.0	0.00	0.00	0.00	0.00	0.00
04	910713	A	4	34.50	9	138.0	804.00	0.00	0.00	0.00	0.00
04	910713	C	4	56.75	39	227.0	585.33	7.85	9.97	7.85	9.97
04	910714	B	4	40.50	21	162.0	442.67	5.97	11.42	3.97	7.85
04	910714	D	4	42.00	17	168.0	241.33	1.95	4.05	1.95	4.05
05	910716	A	4	10.75	0	43.0	153.33	0.00	0.00	0.00	0.00
05	910716	D	4	2.75	0	11.0	49.33	0.00	0.00	0.00	0.00
05	910718	A	4	12.00	2	48.0	158.00	0.00	0.00	0.00	0.00
05	910718	C	4	42.75	27	171.0	92.00	9.28	15.81	9.28	15.81
05	910719	B	1	37.00	3	148.0	0.00	11.95	127.77	11.95	127.77
05	910719	D	1	21.00	7	84.0	0.00	4.48	19.57	4.48	19.57
05	910720	A	1	50.00	1	200.0	0.00	0.00	0.00	0.00	0.00
05	910720	C	1	93.00	29	372.0	0.00	17.90	42.45	17.90	42.45
05	910721	B	4	52.00	45	208.0	1061.33	12.22	22.46	10.70	15.62
05	910721	D	4	17.25	18	69.0	35.33	11.49	11.48	10.48	10.98
06	910722	A	1	31.00	2	124.0	0.00	31.00	961.00	31.00	961.00
06	910722	D	1	25.00	6	100.0	0.00	0.00	0.00	0.00	0.00
06	910723	B	4	25.75	28	103.0	177.33	2.02	2.03	2.02	2.03
06	910723	C	4	23.75	20	95.0	147.33	11.23	18.69	9.46	17.46
06	910724	B	1	41.00	23	164.0	0.00	2.85	3.92	2.85	3.92
06	910724	D	1	30.00	30	120.0	0.00	7.28	4.57	7.28	4.57
06	910725	C	4	48.50	37	194.0	2896.00	48.98	567.37	17.24	42.85
06	910725	D	4	38.50	33	154.0	237.33	19.75	98.74	2.31	2.87
06	910726	A	1	17.00	4	68.0	0.00	0.00	0.00	0.00	0.00
06	910726	D	1	14.00	17	56.0	0.00	0.00	0.00	0.00	0.00
06	910727	C	1	52.00	17	208.0	0.00	20.18	154.69	20.18	154.69
06	910727	D	1	23.00	15	92.0	0.00	1.35	2.20	1.35	2.20
06	910728	C	1	24.00	14	96.0	0.00	31.99	332.98	12.95	46.80
06	910728	D	1	16.00	22	64.0	0.00	0.70	0.56	0.70	0.56
06	910730	B	4	32.00	33	128.0	482.67	30.25	255.70	14.42	35.02
06	910730	D	4	11.50	29	46.0	198.00	0.73	0.51	0.73	0.51
06	910731	A	4	20.50	3	82.0	389.33	0.00	0.00	0.00	0.00
06	910731	B	4	24.50	22	98.0	348.67	3.80	8.09	1.26	1.63
07	910801	A	4	14.75	9	59.0	70.00	0.00	0.00	0.00	0.00
07	910801	B	4	24.25	10	97.0	81.33	0.00	0.00	0.00	0.00

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Appendix C3. (Page 3 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
07	910803	A	4	42.00	18	168.0	1475.33	0.00	0.00	0.00	0.00
07	910803	C	4	26.00	19	104.0	530.00	0.00	0.00	0.00	0.00
07	910805	A	4	23.25	6	93.0	315.33	0.00	0.00	0.00	0.00
07	910805	C	4	30.75	18	123.0	30.00	1.08	1.27	0.00	0.00
07	910806	A	1	21.00	2	84.0	0.00	0.00	0.00	0.00	0.00
07	910806	B	1	26.00	18	104.0	0.00	0.00	0.00	0.00	0.00
07	910807	A	1	3.00	2	12.0	0.00	0.00	0.00	0.00	0.00
07	910807	B	1	20.00	2	80.0	0.00	0.00	0.00	0.00	0.00
08	910808	A	1	16.00	6	64.0	0.00	0.00	0.00	0.00	0.00
08	910808	B	1	20.00	13	80.0	0.00	0.00	0.00	0.00	0.00
08	910809	B	4	21.25	36	85.0	16.67	0.00	0.00	0.00	0.00
08	910809	C	4	21.75	19	87.0	91.33	1.52	2.12	0.00	0.00
08	910812	B	1	29.00	16	116.0	0.00	0.00	0.00	0.00	0.00
08	910812	C	1	33.00	36	132.0	0.00	0.00	0.00	0.00	0.00
08	910813	B	4	24.50	17	98.0	162.00	0.00	0.00	0.00	0.00
08	910813	C	4	30.00	30	120.0	222.00	0.00	0.00	0.00	0.00
08	910814	A	4	22.00	3	88.0	71.33	0.00	0.00	0.00	0.00
08	910814	B	4	32.00	22	128.0	60.67	0.00	0.00	0.00	0.00
09	910815	A	1	21.00	4	84.0	0.00	0.00	0.00	0.00	0.00
09	910815	C	1	31.00	15	124.0	0.00	0.00	0.00	0.00	0.00
09	910816	A	4	42.00	9	168.0	456.67	0.00	0.00	0.00	0.00
09	910816	C	4	33.50	15	134.0	377.33	0.00	0.00	0.00	0.00
09	910817	B	4	30.00	28	120.0	104.67	0.00	0.00	0.00	0.00
09	910817	C	4	50.25	35	201.0	262.00	0.00	0.00	0.00	0.00
09	910818	B	4	40.00	53	160.0	739.33	0.00	0.00	0.00	0.00
09	910818	C	4	25.00	28	100.0	228.00	0.00	0.00	0.00	0.00
09	910821	B	1	34.00	16	136.0	0.00	0.00	0.00	0.00	0.00
09	910821	C	1	31.00	31	124.0	0.00	0.00	0.00	0.00	0.00
10	910822	A	1	29.00	11	116.0	0.00	0.00	0.00	0.00	0.00
10	910822	C	1	31.00	25	124.0	0.00	0.00	0.00	0.00	0.00
10	910823	B	1	48.00	11	192.0	0.00	0.00	0.00	0.00	0.00
10	910823	C	1	37.00	39	148.0	0.00	0.00	0.00	0.00	0.00
10	910825	A	1	14.00	14	56.0	0.00	0.00	0.00	0.00	0.00
10	910825	B	1	23.00	7	92.0	0.00	0.00	0.00	0.00	0.00
10	910826	A	4	27.00	4	108.0	19.33	0.00	0.00	0.00	0.00
10	910826	B	4	12.25	15	49.0	14.67	0.00	0.00	0.00	0.00
10	910827	A	1	20.00	8	80.0	0.00	0.00	0.00	0.00	0.00
10	910827	C	1	3.00	21	12.0	0.00	0.00	0.00	0.00	0.00
10	910829	A	4	17.25	11	69.0	60.00	0.00	0.00	0.00	0.00
10	910829	B	4	17.00	17	68.0	34.00	0.00	0.00	0.00	0.00
10	910831	A	4	11.25	9	45.0	36.00	0.00	0.00	0.00	0.00
10	910831	B	4	11.00	12	44.0	51.33	7.09	10.05	0.00	0.00
10	910901	A	1	17.00	7	68.0	0.00	0.00	0.00	0.00	0.00
10	910901	B	1	6.00	14	24.0	0.00	0.00	0.00	0.00	0.00

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Appendix C3. (Page 4 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
11	910907	A	4	1.50	0	6.0	6.00	0.00	0.00	0.00	0.00
11	910907	B	4	3.00	0	12.0	13.33	0.00	0.00	0.00	0.00
11	910908	A	1	0.00	2	0.0	0.00	0.00	0.00	0.00	0.00
11	910908	C	1	0.00	7	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	C	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
11	910912	B	1	2.00	0	8.0	0.00	0.00	0.00	0.00	0.00
11	910912	C	1	0.00	6	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	B	4	0.50	0	2.0	2.67	0.00	0.00	0.00	0.00
11	910915	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	C	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

[a] Temporal Components: 1 (6/01-6/21); 2 (6/22-6-30); 3 (7/01-7/07); 4 (7/08-7/14); 5 (7/15-7/21); 6 (7/22-7/31); 7 (8/01-8/07); 8 (8/08-8/14); 9 (8/15-8/21); 10 (8/22-9/01); 11 (9/02-9/15).

[b] Daily periods for temporal components 1-6: A (0630-1029); B (1030-1429); C (1430-1829); D (1830-2230).

Daily periods for temporal components 7-11: A (0800-1159); B (1200-1559); C (1600-2000).

Appendix C4. Summary of daily angler effort (angler-hours), catch, and harvest for coho salmon in the sport fishery in the lower Naknek River, 1991.

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
01	910601	B	1	5.00	5	20.0	0.00	0.00	0.00	0.00	0.00
01	910601	D	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	A	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910607	A	4	3.50	0	14.0	45.33	0.00	0.00	0.00	0.00
01	910607	C	4	9.25	0	37.0	76.00	0.00	0.00	0.00	0.00
01	910608	A	1	3.00	0	12.0	0.00	0.00	0.00	0.00	0.00
01	910608	C	1	36.00	24	144.0	0.00	0.00	0.00	0.00	0.00
01	910610	C	1	9.00	5	36.0	0.00	0.00	0.00	0.00	0.00
01	910610	D	1	1.00	4	4.0	0.00	0.00	0.00	0.00	0.00
01	910611	A	4	0.75	0	3.0	6.00	0.00	0.00	0.00	0.00
01	910611	B	4	6.25	0	25.0	44.00	0.00	0.00	0.00	0.00
01	910612	B	1	3.00	7	12.0	0.00	0.00	0.00	0.00	0.00
01	910612	C	1	11.00	10	44.0	0.00	0.00	0.00	0.00	0.00
01	910616	B	1	9.00	10	36.0	0.00	0.00	0.00	0.00	0.00
01	910616	D	1	4.00	8	16.0	0.00	0.00	0.00	0.00	0.00
01	910618	B	1	19.00	9	76.0	0.00	0.00	0.00	0.00	0.00
01	910618	C	1	13.00	13	52.0	0.00	0.00	0.00	0.00	0.00
01	910619	B	4	10.75	0	43.0	195.33	0.00	0.00	0.00	0.00
01	910619	D	4	22.50	0	90.0	60.00	0.00	0.00	0.00	0.00
01	910621	C	1	33.00	24	132.0	0.00	0.00	0.00	0.00	0.00
01	910621	D	1	11.00	15	44.0	0.00	0.00	0.00	0.00	0.00
02	910622	A	1	50.00	2	200.0	0.00	0.00	0.00	0.00	0.00
02	910622	D	1	14.00	7	56.0	0.00	0.00	0.00	0.00	0.00
02	910624	C	4	42.75	27	171.0	590.00	0.00	0.00	0.00	0.00
02	910624	D	4	21.00	24	84.0	124.00	0.00	0.00	0.00	0.00
02	910625	B	1	54.00	23	216.0	0.00	0.00	0.00	0.00	0.00
02	910625	C	1	73.00	43	292.0	0.00	0.00	0.00	0.00	0.00
02	910626	B	4	51.25	41	205.0	836.00	0.00	0.00	0.00	0.00
02	910626	D	4	36.00	36	144.0	247.33	0.00	0.00	0.00	0.00
02	910628	A	1	4.00	7	16.0	0.00	0.00	0.00	0.00	0.00
02	910628	B	1	35.00	24	140.0	0.00	0.00	0.00	0.00	0.00
02	910630	B	4	86.25	78	345.0	3387.33	0.00	0.00	0.00	0.00
02	910630	D	4	70.75	41	283.0	1678.00	0.00	0.00	0.00	0.00
03	910701	A	1	116.00	9	464.0	0.00	0.00	0.00	0.00	0.00
03	910701	C	1	129.00	60	516.0	0.00	0.00	0.00	0.00	0.00
03	910702	A	4	55.00	6	220.0	1586.00	0.00	0.00	0.00	0.00
03	910702	D	4	45.25	44	181.0	944.67	0.00	0.00	0.00	0.00
03	910704	B	4	76.00	59	304.0	2306.00	0.00	0.00	0.00	0.00
03	910704	D	4	36.00	46	144.0	38.67	0.00	0.00	0.00	0.00

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Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
03	910706	A	4	39.50	8	158.0	1026.00	0.00	0.00	0.00	0.00
03	910706	D	4	26.25	22	105.0	51.33	0.00	0.00	0.00	0.00
03	910707	C	1	88.00	43	352.0	0.00	0.00	0.00	0.00	0.00
03	910707	D	1	31.00	35	124.0	0.00	0.00	0.00	0.00	0.00
04	910708	B	4	52.00	31	208.0	1240.67	0.00	0.00	0.00	0.00
04	910708	D	4	17.25	27	69.0	65.33	0.00	0.00	0.00	0.00
04	910710	A	1	17.00	6	68.0	0.00	0.00	0.00	0.00	0.00
04	910710	B	1	32.00	11	128.0	0.00	0.00	0.00	0.00	0.00
04	910711	A	1	27.00	4	108.0	0.00	0.00	0.00	0.00	0.00
04	910711	B	1	39.00	15	156.0	0.00	0.00	0.00	0.00	0.00
04	910713	A	4	34.50	9	138.0	804.00	0.00	0.00	0.00	0.00
04	910713	C	4	56.75	39	227.0	585.33	0.00	0.00	0.00	0.00
04	910714	B	4	40.50	21	162.0	442.67	0.00	0.00	0.00	0.00
04	910714	D	4	42.00	17	168.0	241.33	0.00	0.00	0.00	0.00
05	910716	A	4	10.75	0	43.0	153.33	0.00	0.00	0.00	0.00
05	910716	D	4	2.75	0	11.0	49.33	0.00	0.00	0.00	0.00
05	910718	A	4	12.00	2	48.0	158.00	0.00	0.00	0.00	0.00
05	910718	C	4	42.75	27	171.0	92.00	0.00	0.00	0.00	0.00
05	910719	B	1	37.00	3	148.0	0.00	0.00	0.00	0.00	0.00
05	910719	D	1	21.00	7	84.0	0.00	0.00	0.00	0.00	0.00
05	910720	A	1	50.00	1	200.0	0.00	0.00	0.00	0.00	0.00
05	910720	C	1	93.00	29	372.0	0.00	2.21	5.09	2.21	5.09
05	910721	B	4	52.00	45	208.0	1061.33	0.00	0.00	0.00	0.00
05	910721	D	4	17.25	18	69.0	35.33	0.00	0.00	0.00	0.00
06	910722	A	1	31.00	2	124.0	0.00	0.00	0.00	0.00	0.00
06	910722	D	1	25.00	6	100.0	0.00	7.46	66.62	7.46	66.62
06	910723	B	4	25.75	28	103.0	177.33	0.00	0.00	0.00	0.00
06	910723	C	4	23.75	20	95.0	147.33	0.89	0.77	0.89	0.77
06	910724	B	1	41.00	23	164.0	0.00	0.00	0.00	0.00	0.00
06	910724	D	1	30.00	30	120.0	0.00	0.00	0.00	0.00	0.00
06	910725	C	4	48.50	37	194.0	2896.00	0.00	0.00	0.00	0.00
06	910725	D	4	38.50	33	154.0	237.33	0.00	0.00	0.00	0.00
06	910726	A	1	17.00	4	68.0	0.00	0.00	0.00	0.00	0.00
06	910726	D	1	14.00	17	56.0	0.00	0.82	0.71	0.82	0.71
06	910727	C	1	52.00	17	208.0	0.00	5.63	36.74	5.63	36.74
06	910727	D	1	23.00	15	92.0	0.00	10.49	44.16	10.49	44.16
06	910728	C	1	24.00	14	96.0	0.00	20.96	71.33	20.96	71.33
06	910728	D	1	16.00	22	64.0	0.00	0.00	0.00	0.00	0.00
06	910730	B	4	32.00	33	128.0	482.67	10.39	35.13	10.39	35.13
06	910730	D	4	11.50	29	46.0	198.00	2.14	1.46	2.14	1.46
06	910731	A	4	20.50	3	82.0	389.33	0.00	0.00	0.00	0.00
06	910731	B	4	24.50	22	98.0	348.67	17.81	45.55	17.81	45.55
07	910801	A	4	14.75	9	59.0	70.00	83.64	268.55	62.65	143.67
07	910803	A	4	42.00	18	168.0	1475.33	18.10	132.05	18.10	132.05

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Appendix C4. (Page 3 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
07	910801	B	4	24.25	10	97.0	81.33	95.65	770.42	95.65	770.42
07	910803	C	4	26.00	19	104.0	530.00	47.20	188.58	47.20	188.58
07	910805	A	4	23.25	6	93.0	315.33	56.73	515.03	56.73	515.03
07	910805	C	4	30.75	18	123.0	30.00	26.78	64.85	18.93	25.50
07	910806	A	1	21.00	2	84.0	0.00	84.00	1296.00	84.00	1296.00
07	910806	B	1	26.00	18	104.0	0.00	27.50	110.22	19.68	67.28
07	910807	A	1	3.00	2	12.0	0.00	21.60	5.76	21.60	5.76
07	910807	B	1	20.00	2	80.0	0.00	20.00	44.44	20.00	44.44
08	910808	A	1	16.00	6	64.0	0.00	3.96	13.48	3.96	13.48
08	910808	B	1	20.00	13	80.0	0.00	18.93	26.90	18.93	26.90
08	910809	B	4	21.25	36	85.0	16.67	35.99	46.36	24.00	27.60
08	910809	C	4	21.75	19	87.0	91.33	17.44	33.73	15.99	33.88
08	910812	B	1	29.00	16	116.0	0.00	29.81	144.72	29.81	144.72
08	910812	C	1	33.00	36	132.0	0.00	45.13	61.20	38.11	34.40
08	910813	B	4	24.50	17	98.0	162.00	60.05	489.09	24.57	79.77
08	910813	C	4	30.00	30	120.0	222.00	25.01	33.05	25.01	33.05
08	910814	A	4	22.00	3	88.0	71.33	39.00	349.57	39.00	349.57
08	910814	B	4	32.00	22	128.0	60.67	18.91	46.07	18.91	46.07
09	910815	A	1	21.00	4	84.0	0.00	75.00	549.62	75.00	549.62
09	910815	C	1	31.00	15	124.0	0.00	47.69	76.02	47.69	76.02
09	910816	A	4	42.00	9	168.0	456.67	22.72	1370.89	22.72	1370.89
09	910816	C	4	33.50	15	134.0	377.33	59.46	191.29	59.46	191.29
09	910817	B	4	30.00	28	120.0	104.67	30.25	46.31	30.25	46.31
09	910817	C	4	50.25	35	201.0	262.00	46.04	143.47	34.30	82.85
09	910818	B	4	40.00	53	160.0	739.33	43.49	119.34	43.49	119.34
09	910818	C	4	25.00	28	100.0	228.00	21.27	22.54	21.27	22.54
09	910821	B	1	34.00	16	136.0	0.00	32.82	194.32	32.82	194.32
09	910821	C	1	31.00	31	124.0	0.00	24.77	61.86	15.61	33.79
10	910822	A	1	29.00	11	116.0	0.00	27.59	61.09	27.59	61.09
10	910822	C	1	31.00	25	124.0	0.00	17.93	11.21	15.50	10.51
10	910823	B	1	48.00	11	192.0	0.00	25.46	215.80	25.46	215.80
10	910823	C	1	37.00	39	148.0	0.00	30.06	30.61	28.54	30.38
10	910825	A	1	14.00	14	56.0	0.00	13.31	9.68	13.31	9.68
10	910825	B	1	23.00	7	92.0	0.00	43.84	55.35	43.84	55.35
10	910826	A	4	27.00	4	108.0	19.33	48.38	924.99	48.38	924.99
10	910826	B	4	12.25	15	49.0	14.67	11.44	5.23	11.44	5.23
10	910827	A	1	20.00	8	80.0	0.00	8.14	17.70	8.14	17.70
10	910827	C	1	3.00	21	12.0	0.00	1.91	0.55	1.91	0.55
10	910829	A	4	17.25	11	69.0	60.00	26.98	14.84	26.98	14.84
10	910829	B	4	17.00	17	68.0	34.00	11.75	28.34	11.75	28.34
10	910831	A	4	11.25	9	45.0	36.00	0.00	0.00	0.00	0.00
10	910831	B	4	11.00	12	44.0	51.33	5.73	18.05	5.73	18.05
10	910901	A	1	17.00	7	68.0	0.00	8.95	75.19	0.00	0.00
10	910901	B	1	6.00	14	24.0	0.00	5.52	10.93	5.52	10.93

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Appendix C4. (Page 4 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
11	910907	B	4	3.00	0	12.0	13.33	0.00	0.00	0.00	0.00
11	910908	A	1	0.00	2	0.0	0.00	0.00	0.00	0.00	0.00
11	910908	C	1	0.00	7	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	C	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
11	910912	B	1	2.00	0	8.0	0.00	0.00	0.00	0.00	0.00
11	910912	C	1	0.00	6	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	B	4	0.50	0	2.0	2.67	0.00	0.00	0.00	0.00
11	910915	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	C	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

[a] Temporal Components: 1 (6/01-6/21); 2 (6/22-6-30); 3 (7/01-7/07); 4 (7/08-7/14); 5 (7/15-7/21); 6 (7/22-7/31); 7 (8/01-8/07); 8 (8/08-8/14); 9 (8/15-8/21); 10 (8/22-9/01); 11 (9/02-9/15).

[b] Daily periods for temporal components 1-6: A (0630-1029); B (1030-1429); C (1430-1829); D (1830-2230).

Daily periods for temporal components 7-11: A (0800-1159); B (1200-1559); C (1600-2000).

Appendix C5. Summary of daily angler effort (angler-hours), catch, and harvest for chum salmon in the sport fishery in the lower Naknek River, 1991.

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
01	910601	B	1	5.00	5	20.0	0.00	0.00	0.00	0.00	0.00
01	910601	D	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	A	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910607	A	4	3.50	0	14.0	45.33	0.00	0.00	0.00	0.00
01	910607	C	4	9.25	0	37.0	76.00	0.00	0.00	0.00	0.00
01	910608	A	1	3.00	0	12.0	0.00	0.00	0.00	0.00	0.00
01	910608	C	1	36.00	24	144.0	0.00	0.00	0.00	0.00	0.00
01	910610	C	1	9.00	5	36.0	0.00	0.00	0.00	0.00	0.00
01	910610	D	1	1.00	4	4.0	0.00	0.00	0.00	0.00	0.00
01	910611	A	4	0.75	0	3.0	6.00	0.00	0.00	0.00	0.00
01	910611	B	4	6.25	0	25.0	44.00	0.00	0.00	0.00	0.00
01	910612	B	1	3.00	7	12.0	0.00	0.00	0.00	0.00	0.00
01	910612	C	1	11.00	10	44.0	0.00	0.00	0.00	0.00	0.00
01	910616	B	1	9.00	10	36.0	0.00	0.00	0.00	0.00	0.00
01	910616	D	1	4.00	8	16.0	0.00	0.00	0.00	0.00	0.00
01	910618	B	1	19.00	9	76.0	0.00	0.00	0.00	0.00	0.00
01	910618	C	1	13.00	13	52.0	0.00	0.00	0.00	0.00	0.00
01	910619	B	4	10.75	0	43.0	195.33	0.00	0.00	0.00	0.00
01	910619	D	4	22.50	0	90.0	60.00	0.00	0.00	0.00	0.00
01	910621	C	1	33.00	24	132.0	0.00	0.00	0.00	0.00	0.00
01	910621	D	1	11.00	15	44.0	0.00	0.00	0.00	0.00	0.00
02	910622	A	1	50.00	2	200.0	0.00	0.00	0.00	0.00	0.00
02	910622	D	1	14.00	7	56.0	0.00	0.00	0.00	0.00	0.00
02	910624	C	4	42.75	27	171.0	590.00	0.00	0.00	0.00	0.00
02	910624	D	4	21.00	24	84.0	124.00	1.10	1.29	1.10	1.29
02	910625	B	1	54.00	23	216.0	0.00	0.00	0.00	0.00	0.00
02	910625	C	1	73.00	43	292.0	0.00	1.51	2.43	1.51	2.43
02	910626	B	4	51.25	41	205.0	836.00	0.00	0.00	0.00	0.00
02	910626	D	4	36.00	36	144.0	247.33	0.00	0.00	0.00	0.00
02	910628	A	1	4.00	7	16.0	0.00	1.35	1.79	1.35	1.79
02	910628	B	1	35.00	24	140.0	0.00	3.43	5.96	3.43	5.96
02	910630	B	4	86.25	78	345.0	3387.33	10.78	20.67	10.78	20.67
02	910630	D	4	70.75	41	283.0	1678.00	0.00	0.00	0.00	0.00
03	910701	A	1	116.00	9	464.0	0.00	0.00	0.00	0.00	0.00
03	910701	C	1	129.00	60	516.0	0.00	12.35	21.63	12.35	21.63
03	910702	A	4	55.00	6	220.0	1586.00	13.64	182.56	13.64	182.56
03	910702	D	4	45.25	44	181.0	944.67	0.00	0.00	0.00	0.00
03	910704	B	4	76.00	59	304.0	2306.00	4.36	6.54	4.36	6.54
03	910704	D	4	36.00	46	144.0	38.67	0.00	0.00	0.00	0.00

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Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
03	910706	A	4	39.50	8	158.0	1026.00	0.00	0.00	0.00	0.00
03	910706	D	4	26.25	22	105.0	51.33	3.65	8.70	3.65	8.70
03	910707	C	1	88.00	43	352.0	0.00	9.80	35.75	9.80	35.75
03	910707	D	1	31.00	35	124.0	0.00	2.49	3.81	2.49	3.81
04	910708	B	4	52.00	31	208.0	1240.67	9.14	22.06	9.14	22.06
04	910708	D	4	17.25	27	69.0	65.33	0.38	0.15	0.38	0.15
04	910710	A	1	17.00	6	68.0	0.00	17.14	89.72	17.14	89.72
04	910710	B	1	32.00	11	128.0	0.00	0.00	0.00	0.00	0.00
04	910711	A	1	27.00	4	108.0	0.00	0.00	0.00	0.00	0.00
04	910711	B	1	39.00	15	156.0	0.00	0.00	0.00	0.00	0.00
04	910713	A	4	34.50	9	138.0	804.00	0.00	0.00	0.00	0.00
04	910713	C	4	56.75	39	227.0	585.33	0.00	0.00	0.00	0.00
04	910714	B	4	40.50	21	162.0	442.67	6.00	19.49	2.00	4.01
04	910714	D	4	42.00	17	168.0	241.33	0.00	0.00	0.00	0.00
05	910716	A	4	10.75	0	43.0	153.33	0.00	0.00	0.00	0.00
05	910716	D	4	2.75	0	11.0	49.33	0.00	0.00	0.00	0.00
05	910718	A	4	12.00	2	48.0	158.00	0.00	0.00	0.00	0.00
05	910718	C	4	42.75	27	171.0	92.00	4.59	6.81	3.07	4.61
05	910719	B	1	37.00	3	148.0	0.00	11.95	127.77	11.95	127.77
05	910719	D	1	21.00	7	84.0	0.00	0.00	0.00	0.00	0.00
05	910720	A	1	50.00	1	200.0	0.00	0.00	0.00	0.00	0.00
05	910720	C	1	93.00	29	372.0	0.00	6.80	13.38	6.80	13.38
05	910721	B	4	52.00	45	208.0	1061.33	7.62	11.60	6.09	9.33
05	910721	D	4	17.25	18	69.0	35.33	9.05	48.94	9.05	48.94
06	910722	A	1	31.00	2	124.0	0.00	0.00	0.00	0.00	0.00
06	910722	D	1	25.00	6	100.0	0.00	15.64	262.92	15.64	262.92
06	910723	B	4	25.75	28	103.0	177.33	2.03	2.01	1.01	1.03
06	910723	C	4	23.75	20	95.0	147.33	4.31	3.42	4.31	3.42
06	910724	B	1	41.00	23	164.0	0.00	25.46	175.81	11.34	25.53
06	910724	D	1	30.00	30	120.0	0.00	1.44	0.97	1.44	0.97
06	910725	C	4	48.50	37	194.0	2896.00	16.19	84.47	16.19	84.47
06	910725	D	4	38.50	33	154.0	237.33	0.00	0.00	0.00	0.00
06	910726	A	1	17.00	4	68.0	0.00	0.00	0.00	0.00	0.00
06	910726	D	1	14.00	17	56.0	0.00	3.19	4.24	3.19	4.24
06	910727	C	1	52.00	17	208.0	0.00	32.73	389.45	32.73	389.45
06	910727	D	1	23.00	15	92.0	0.00	5.99	9.06	5.99	9.06
06	910728	C	1	24.00	14	96.0	0.00	0.00	0.00	0.00	0.00
06	910728	D	1	16.00	22	64.0	0.00	0.76	0.55	0.76	0.55
06	910730	B	4	32.00	33	128.0	482.67	15.69	47.53	9.23	17.77
06	910730	D	4	11.50	29	46.0	198.00	1.07	0.43	1.07	0.43
06	910731	A	4	20.50	3	82.0	389.33	0.00	0.00	0.00	0.00
06	910731	B	4	24.50	22	98.0	348.67	3.87	7.90	3.87	7.90
07	910801	A	4	14.75	9	59.0	70.00	13.87	82.24	9.91	70.15
07	910801	B	4	24.25	10	97.0	81.33	8.07	61.44	0.00	0.00

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Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
07	910803	A	4	42.00	18	168.0	1475.33	4.49	21.37	0.00	0.00
07	910803	C	4	26.00	19	104.0	530.00	0.00	0.00	0.00	0.00
07	910805	A	4	23.25	6	93.0	315.33	0.00	0.00	0.00	0.00
07	910805	C	4	30.75	18	123.0	30.00	5.47	5.74	2.14	2.61
07	910806	A	1	21.00	2	84.0	0.00	0.00	0.00	0.00	0.00
07	910806	B	1	26.00	18	104.0	0.00	7.95	23.07	6.41	20.64
07	910807	A	1	3.00	2	12.0	0.00	0.00	0.00	0.00	0.00
07	910807	B	1	20.00	2	80.0	0.00	6.67	44.44	6.67	44.44
08	910808	A	1	16.00	6	64.0	0.00	0.00	0.00	0.00	0.00
08	910808	B	1	20.00	13	80.0	0.00	4.09	4.90	4.09	4.90
08	910809	B	4	21.25	36	85.0	16.67	0.00	0.00	0.00	0.00
08	910809	C	4	21.75	19	87.0	91.33	0.00	0.00	0.00	0.00
08	910812	B	1	29.00	16	116.0	0.00	1.75	3.09	1.75	3.09
08	910812	C	1	33.00	36	132.0	0.00	2.32	2.98	0.76	0.61
08	910813	B	4	24.50	17	98.0	162.00	3.01	4.65	3.01	4.65
08	910813	C	4	30.00	30	120.0	222.00	3.40	11.84	3.40	11.84
08	910814	A	4	22.00	3	88.0	71.33	0.00	0.00	0.00	0.00
08	910814	B	4	32.00	22	128.0	60.67	0.00	0.00	0.00	0.00
09	910815	A	1	21.00	4	84.0	0.00	0.00	0.00	0.00	0.00
09	910815	C	1	31.00	15	124.0	0.00	0.00	0.00	0.00	0.00
09	910816	A	4	42.00	9	168.0	456.67	0.00	0.00	0.00	0.00
09	910816	C	4	33.50	15	134.0	377.33	0.00	0.00	0.00	0.00
09	910817	B	4	30.00	28	120.0	104.67	1.77	1.60	1.77	1.60
09	910817	C	4	50.25	35	201.0	262.00	1.47	2.25	1.47	2.25
09	910818	B	4	40.00	53	160.0	739.33	0.00	0.00	0.00	0.00
09	910818	C	4	25.00	28	100.0	228.00	8.27	17.36	4.74	12.01
09	910821	B	1	34.00	16	136.0	0.00	0.00	0.00	0.00	0.00
09	910821	C	1	31.00	31	124.0	0.00	0.00	0.00	0.00	0.00
10	910822	A	1	29.00	11	116.0	0.00	0.00	0.00	0.00	0.00
10	910822	C	1	31.00	25	124.0	0.00	0.00	0.00	0.00	0.00
10	910823	B	1	48.00	11	192.0	0.00	0.00	0.00	0.00	0.00
10	910823	C	1	37.00	39	148.0	0.00	0.00	0.00	0.00	0.00
10	910825	A	1	14.00	14	56.0	0.00	0.00	0.00	0.00	0.00
10	910825	B	1	23.00	7	92.0	0.00	0.00	0.00	0.00	0.00
10	910826	A	4	27.00	4	108.0	19.33	0.00	0.00	0.00	0.00
10	910826	B	4	12.25	15	49.0	14.67	0.00	0.00	0.00	0.00
10	910827	A	1	20.00	8	80.0	0.00	0.00	0.00	0.00	0.00
10	910827	C	1	3.00	21	12.0	0.00	0.00	0.00	0.00	0.00
10	910829	A	4	17.25	11	69.0	60.00	0.00	0.00	0.00	0.00
10	910829	B	4	17.00	17	68.0	34.00	0.00	0.00	0.00	0.00
10	910831	A	4	11.25	9	45.0	36.00	0.00	0.00	0.00	0.00
10	910831	B	4	11.00	12	44.0	51.33	0.00	0.00	0.00	0.00
10	910901	A	1	17.00	7	68.0	0.00	0.00	0.00	0.00	0.00
10	910901	B	1	6.00	14	24.0	0.00	0.00	0.00	0.00	0.00

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Appendix C5. (Page 4 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
11	910907	A	4	1.50	0	6.0	6.00	0.00	0.00	0.00	0.00
11	910907	B	4	3.00	0	12.0	13.33	0.00	0.00	0.00	0.00
11	910908	A	1	0.00	2	0.0	0.00	0.00	0.00	0.00	0.00
11	910908	C	1	0.00	7	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	C	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
11	910912	B	1	2.00	0	8.0	0.00	0.00	0.00	0.00	0.00
11	910912	C	1	0.00	6	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	B	4	0.50	0	2.0	2.67	0.00	0.00	0.00	0.00
11	910915	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	C	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

[a] Temporal Components: 1 (6/01-6/21); 2 (6/22-6-30); 3 (7/01-7/07); 4 (7/08-7/14); 5 (7/15-7/21); 6 (7/22-7/31); 7 (8/01-8/07); 8 (8/08-8/14); 9 (8/15-8/21); 10 (8/22-9/01); 11 (9/02-9/15).

[b] Daily periods for temporal components 1-6: A (0630-1029); B (1030-1429); C (1430-1829); D (1830-2230).

Daily periods for temporal components 7-11: A (0800-1159); B (1200-1559); C (1600-2000).

Appendix C6. Summary of daily angler effort (angler-hours), catch, and harvest for rainbow trout in the sport fishery in the lower Naknek River, 1991.

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
01	910601	B	1	5.00	5	20.0	0.00	0.00	0.00	0.00	0.00
01	910601	D	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	A	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910603	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910605	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
01	910607	A	4	3.50	0	14.0	45.33	0.00	0.00	0.00	0.00
01	910607	C	4	9.25	0	37.0	76.00	0.00	0.00	0.00	0.00
01	910608	A	1	3.00	0	12.0	0.00	0.00	0.00	0.00	0.00
01	910608	C	1	36.00	24	144.0	0.00	6.15	21.08	4.11	8.38
01	910610	C	1	9.00	5	36.0	0.00	0.00	0.00	0.00	0.00
01	910610	D	1	1.00	4	4.0	0.00	0.00	0.00	0.00	0.00
01	910611	A	4	0.75	0	3.0	6.00	0.00	0.00	0.00	0.00
01	910611	B	4	6.25	0	25.0	44.00	0.00	0.00	0.00	0.00
01	910612	B	1	3.00	7	12.0	0.00	0.00	0.00	0.00	0.00
01	910612	C	1	11.00	10	44.0	0.00	2.22	5.01	0.00	0.00
01	910616	B	1	9.00	10	36.0	0.00	0.00	0.00	0.00	0.00
01	910616	D	1	4.00	8	16.0	0.00	0.77	0.65	0.00	0.00
01	910618	B	1	19.00	9	76.0	0.00	0.00	0.00	0.00	0.00
01	910618	C	1	13.00	13	52.0	0.00	0.00	0.00	0.00	0.00
01	910619	B	4	10.75	0	43.0	195.33	0.00	0.00	0.00	0.00
01	910619	D	4	22.50	0	90.0	60.00	0.00	0.00	0.00	0.00
01	910621	C	1	33.00	24	132.0	0.00	0.00	0.00	0.00	0.00
01	910621	D	1	11.00	15	44.0	0.00	13.74	61.18	0.63	0.51
02	910622	A	1	50.00	2	200.0	0.00	0.00	0.00	0.00	0.00
02	910622	D	1	14.00	7	56.0	0.00	0.00	0.00	0.00	0.00
02	910624	C	4	42.75	27	171.0	590.00	4.35	11.22	0.00	0.00
02	910624	D	4	21.00	24	84.0	124.00	0.00	0.00	0.00	0.00
02	910625	B	1	54.00	23	216.0	0.00	0.00	0.00	0.00	0.00
02	910625	C	1	73.00	43	292.0	0.00	6.21	8.60	4.65	6.75
02	910626	B	4	51.25	41	205.0	836.00	1.47	2.15	0.00	0.00
02	910626	D	4	36.00	36	144.0	247.33	2.90	2.91	0.00	0.00
02	910628	A	1	4.00	7	16.0	0.00	0.00	0.00	0.00	0.00
02	910628	B	1	35.00	24	140.0	0.00	0.00	0.00	0.00	0.00
02	910630	B	4	86.25	78	345.0	3387.33	1.19	1.44	0.00	0.00
02	910630	D	4	70.75	41	283.0	1678.00	0.00	0.00	0.00	0.00
03	910701	A	1	116.00	9	464.0	0.00	0.00	0.00	0.00	0.00
03	910701	C	1	129.00	60	516.0	0.00	1.54	2.39	1.54	2.39
03	910702	A	4	55.00	6	220.0	1586.00	0.00	0.00	0.00	0.00
03	910702	D	4	45.25	44	181.0	944.67	0.00	0.00	0.00	0.00
03	910704	B	4	76.00	59	304.0	2306.00	0.00	0.00	0.00	0.00
03	910704	D	4	36.00	46	144.0	38.67	0.00	0.00	0.00	0.00

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Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
03	910706	A	4	39.50	8	158.0	1026.00	0.00	0.00	0.00	0.00
03	910706	D	4	26.25	22	105.0	51.33	0.00	0.00	0.00	0.00
03	910707	C	1	88.00	43	352.0	0.00	2.00	3.98	0.00	0.00
03	910707	D	1	31.00	35	124.0	0.00	1.68	2.99	0.00	0.00
04	910708	B	4	52.00	31	208.0	1240.67	0.00	0.00	0.00	0.00
04	910708	D	4	17.25	27	69.0	65.33	0.00	0.00	0.00	0.00
04	910710	A	1	17.00	6	68.0	0.00	0.00	0.00	0.00	0.00
04	910710	B	1	32.00	11	128.0	0.00	0.00	0.00	0.00	0.00
04	910711	A	1	27.00	4	108.0	0.00	0.00	0.00	0.00	0.00
04	910711	B	1	39.00	15	156.0	0.00	0.00	0.00	0.00	0.00
04	910713	A	4	34.50	9	138.0	804.00	0.00	0.00	0.00	0.00
04	910713	C	4	56.75	39	227.0	585.33	1.32	1.74	0.00	0.00
04	910714	B	4	40.50	21	162.0	442.67	2.00	4.01	0.00	0.00
04	910714	D	4	42.00	17	168.0	241.33	0.00	0.00	0.00	0.00
05	910716	A	4	10.75	0	43.0	153.33	0.00	0.00	0.00	0.00
05	910716	D	4	2.75	0	11.0	49.33	0.00	0.00	0.00	0.00
05	910718	A	4	12.00	2	48.0	158.00	0.00	0.00	0.00	0.00
05	910718	C	4	42.75	27	171.0	92.00	0.00	0.00	0.00	0.00
05	910719	B	1	37.00	3	148.0	0.00	0.00	0.00	0.00	0.00
05	910719	D	1	21.00	7	84.0	0.00	0.00	0.00	0.00	0.00
05	910720	A	1	50.00	1	200.0	0.00	0.00	0.00	0.00	0.00
05	910720	C	1	93.00	29	372.0	0.00	0.00	0.00	0.00	0.00
05	910721	B	4	52.00	45	208.0	1061.33	1.50	2.34	0.00	0.00
05	910721	D	4	17.25	18	69.0	35.33	1.01	1.17	1.01	1.17
06	910722	A	1	31.00	2	124.0	0.00	0.00	0.00	0.00	0.00
06	910722	D	1	25.00	6	100.0	0.00	0.00	0.00	0.00	0.00
06	910723	B	4	25.75	28	103.0	177.33	1.02	1.03	0.00	0.00
06	910723	C	4	23.75	20	95.0	147.33	0.85	0.77	0.00	0.00
06	910724	B	1	41.00	23	164.0	0.00	0.00	0.00	0.00	0.00
06	910724	D	1	30.00	30	120.0	0.00	2.89	3.90	1.44	0.97
06	910725	C	4	48.50	37	194.0	2896.00	1.05	1.16	0.00	0.00
06	910725	D	4	38.50	33	154.0	237.33	2.34	5.66	0.00	0.00
06	910726	A	1	17.00	4	68.0	0.00	0.00	0.00	0.00	0.00
06	910726	D	1	14.00	17	56.0	0.00	0.83	0.71	0.83	0.71
06	910727	C	1	52.00	17	208.0	0.00	8.33	47.22	0.00	0.00
06	910727	D	1	23.00	15	92.0	0.00	0.00	0.00	0.00	0.00
06	910728	C	1	24.00	14	96.0	0.00	5.89	11.56	4.43	10.42
06	910728	D	1	16.00	22	64.0	0.00	0.00	0.00	0.00	0.00
06	910730	B	4	32.00	33	128.0	482.67	0.00	0.00	0.00	0.00
06	910730	D	4	11.50	29	46.0	198.00	0.00	0.00	0.00	0.00
06	910731	A	4	20.50	3	82.0	389.33	0.00	0.00	0.00	0.00
06	910731	B	4	24.50	22	98.0	348.67	0.00	0.00	0.00	0.00
07	910801	A	4	14.75	9	59.0	70.00	0.00	0.00	0.00	0.00
07	910801	B	4	24.25	10	97.0	81.33	20.18	384.00	0.00	0.00

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Appendix C6. (Page 3 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
07	910803	A	4	42.00	18	168.0	1475.33	0.00	0.00	0.00	0.00
07	910803	C	4	26.00	19	104.0	530.00	0.00	0.00	0.00	0.00
07	910805	A	4	23.25	6	93.0	315.33	0.00	0.00	0.00	0.00
07	910805	C	4	30.75	18	123.0	30.00	0.00	0.00	0.00	0.00
07	910806	A	1	21.00	2	84.0	0.00	0.00	0.00	0.00	0.00
07	910806	B	1	26.00	18	104.0	0.00	0.00	0.00	0.00	0.00
07	910807	A	1	3.00	2	12.0	0.00	0.00	0.00	0.00	0.00
07	910807	B	1	20.00	2	80.0	0.00	0.00	0.00	0.00	0.00
08	910808	A	1	16.00	6	64.0	0.00	0.00	0.00	0.00	0.00
08	910808	B	1	20.00	13	80.0	0.00	0.00	0.00	0.00	0.00
08	910809	B	4	21.25	36	85.0	16.67	0.00	0.00	0.00	0.00
08	910809	C	4	21.75	19	87.0	91.33	0.00	0.00	0.00	0.00
08	910812	B	1	29.00	16	116.0	0.00	0.00	0.00	0.00	0.00
08	910812	C	1	33.00	36	132.0	0.00	0.00	0.00	0.00	0.00
08	910813	B	4	24.50	17	98.0	162.00	0.00	0.00	0.00	0.00
08	910813	C	4	30.00	30	120.0	222.00	0.00	0.00	0.00	0.00
08	910814	A	4	22.00	3	88.0	71.33	0.00	0.00	0.00	0.00
08	910814	B	4	32.00	22	128.0	60.67	0.00	0.00	0.00	0.00
09	910815	A	1	21.00	4	84.0	0.00	0.00	0.00	0.00	0.00
09	910815	C	1	31.00	15	124.0	0.00	0.00	0.00	0.00	0.00
09	910816	A	4	42.00	9	168.0	456.67	0.00	0.00	0.00	0.00
09	910816	C	4	33.50	15	134.0	377.33	0.00	0.00	0.00	0.00
09	910817	B	4	30.00	28	120.0	104.67	1.81	3.24	0.00	0.00
09	910817	C	4	50.25	35	201.0	262.00	0.00	0.00	0.00	0.00
09	910818	B	4	40.00	53	160.0	739.33	5.56	23.79	0.92	0.90
09	910818	C	4	25.00	28	100.0	228.00	0.00	0.00	0.00	0.00
09	910821	B	1	34.00	16	136.0	0.00	0.00	0.00	0.00	0.00
09	910821	C	1	31.00	31	124.0	0.00	2.85	7.80	2.85	7.80
10	910822	A	1	29.00	11	116.0	0.00	0.00	0.00	0.00	0.00
10	910822	C	1	31.00	25	124.0	0.00	1.65	1.26	1.65	1.26
10	910823	B	1	48.00	11	192.0	0.00	0.00	0.00	0.00	0.00
10	910823	C	1	37.00	39	148.0	0.00	0.00	0.00	0.00	0.00
10	910825	A	1	14.00	14	56.0	0.00	0.00	0.00	0.00	0.00
10	910825	B	1	23.00	7	92.0	0.00	0.00	0.00	0.00	0.00
10	910826	A	4	27.00	4	108.0	19.33	0.00	0.00	0.00	0.00
10	910826	B	4	12.25	15	49.0	14.67	0.00	0.00	0.00	0.00
10	910827	A	1	20.00	8	80.0	0.00	0.00	0.00	0.00	0.00
10	910827	C	1	3.00	21	12.0	0.00	0.00	0.00	0.00	0.00
10	910829	A	4	17.25	11	69.0	60.00	0.00	0.00	0.00	0.00
10	910829	B	4	17.00	17	68.0	34.00	10.02	29.25	0.00	0.00
10	910831	A	4	11.25	9	45.0	36.00	0.00	0.00	0.00	0.00
10	910831	B	4	11.00	12	44.0	51.33	15.76	69.00	0.00	0.00
10	910901	A	1	17.00	7	68.0	0.00	0.00	0.00	0.00	0.00
10	910901	B	1	6.00	14	24.0	0.00	6.15	31.61	0.00	0.00

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Appendix C6. (Page 4 of 4).

Temporal Component[a]	Date	Period[b]	Number of Counts	Mean Angler Count	Anglers Interviewed	Estimates by Period: Effort Estimate	Effort Variance	Catch Estimate	Catch Variance	Harvest Estimate	Harvest Variance
11	910907	A	4	1.50	0	6.0	6.00	0.00	0.00	0.00	0.00
11	910907	B	4	3.00	0	12.0	13.33	0.00	0.00	0.00	0.00
11	910908	A	1	0.00	2	0.0	0.00	0.00	0.00	0.00	0.00
11	910908	C	1	0.00	7	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910910	C	1	0.00	4	0.0	0.00	0.00	0.00	0.00	0.00
11	910912	B	1	2.00	0	8.0	0.00	0.00	0.00	0.00	0.00
11	910912	C	1	0.00	6	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	B	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910913	C	1	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910914	B	4	0.50	0	2.0	2.67	0.00	0.00	0.00	0.00
11	910915	A	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00
11	910915	C	4	0.00	0	0.0	0.00	0.00	0.00	0.00	0.00

[a] Temporal Components: 1 (6/01-6/21); 2 (6/22-6-30); 3 (7/01-7/07); 4 (7/08-7/14); 5 (7/15-7/21); 6 (7/22-7/31); 7 (8/01-8/07); 8 (8/08-8/14); 9 (8/15-8/21); 10 (8/22-9/01); 11 (9/02-9/15).

[b] Daily periods for temporal components 1-6: A (0630-1029); B (1030-1429); C (1430-1829); D (1830-2230).

Daily periods for temporal components 7-11: A (0800-1159); B (1200-1559); C (1600-2000).

APPENDIX D

Computer Files

Appendix D. Computer files used to produce this report.

Data Files

R007AIZ1.DTA	Naknek R. angler interviews 1 June-15 September 1991.
R007ACZ1.DTA	Naknek R. angler counts 1 June-15 September 1991.
R007ABB1.DTA	Naknek R. chinook salmon harvest biological data.
R007ABC1.DTA	Naknek R. chum salmon harvest biological data.
R007ABD1.DTA	Naknek R. coho salmon harvest biological data.
R1960BA1.DTA	Big Creek chinook salmon escapement biological data.

Analysis Programs

UCSP91	Universal creel survey program: effort, catch, and harvest estimate program.
R007AC01.DTD	UCSP91 interview data control file.
R007AI01.DTD	UCSP91 count data control file.
BRA31NAK.RD	UCSP91 report table 1 descriptive file.
BRA32NAK.RD	UCSP91 report table 2 descriptive file.
BRA33NAK.RD	UCSP91 report table 3 descriptive file.
BRA31NAK.DB	UCSP91 table 1 data descriptive file.
BRA32NAK.DB	UCSP91 table 2 data descriptive file.
BRA33NAK.DB	UCSP91 table 3 data descriptive file.
R007AC01.STB	UCSP91 count data header file.
R007AI01.STB	UCSP91 interview data header file.
BBXPEXE	A series of programs that uses biological data files to produce tables of mean lengths and weights by sex and age group for a species.
CC91	A program which produces frequency reports from raw data.
NAK91CPU.SAS	CPUE as estimator of abundance program for Naknek River 1991.
NAK91CHD.SAS	Distribution of angler catch and harvest program for Naknek River 1991.
AGEKS91.WK1	A Lotus 1-2-3 (tm) worksheet which weights chinook salmon age data by temporal component.
AGESS91.WK1	A Lotus 1-2-3 (tm) worksheet which weights coho salmon age data by temporal component.

These data files are archived with the Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Unit, 333 Raspberry Road, Anchorage, Alaska 99518-1519. Contact Gail Heineman or Donna Buchholz (267-2369) for copies of the files and descriptions of the file formats.