

FISHERY DATA SERIES NO.7

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**CATCH AND EFFORT STATISTICS FOR THE  
SOCKEYE SALMON (*Oncorhynchus nerka*) SPORT  
FISHERY IN THE RUSSIAN RIVER WITH  
ESTIMATES OF ESCAPEMENT, 1986**

By: David E. Athons and  
Douglas N. McBride



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**JUNE 1987**

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## ABSTRACT

A creel survey was conducted during the 1986 Russian River sockeye salmon (*Oncorhynchus nerka* Walbaum) sport fishery to determine harvest and angler effort. Anglers expended 126,720 hours to harvest 35,099 sockeye salmon during the early run (14 June to 21 July) and 89,780 hours to harvest 30,813 sockeye salmon during the late run (22 July to 20 August). Spawning escapements of 36,195 early and 40,422 late run sockeye salmon were counted through a weir at the outlet of Lower Russian Lake. Early run sockeye salmon were predominantly age 2.3 (43.7%) while late run fish were predominantly age 2.2 (60.5%). Ground counts of spawning sockeye indicated a peak escapement of 15,230 fish in the Russian River below the weir. These fish, in contrast to those migrating above the weir, were predominantly age 1.3 (62.7%).

KEY WORDS: Russian River, sockeye salmon, *Oncorhynchus nerka*, creel survey, harvest, effort, weir, escapement.

## INTRODUCTION

The Russian River (Figure 1) supports the largest sport fishery for sockeye salmon (*Oncorhynchus nerka* Walbaum) in Alaska. Maximum annual effort expended by recreational fishermen has approximated 295,000 angler-hours and annual harvests have exceeded 70,000 fish.

The Russian River sport fishery includes the "fly-fishing-only" areas on both the Russian and the Kenai Rivers (Figure 2). Prior information pertaining to this fishery has been presented by Lawler (1963-1964), Engel (1965-1972), Nelson (1975-1985) and Nelson et al. (1986). Unknown numbers of Russian River sockeye salmon are also harvested in the mainstem Kenai River sport and Upper Cook Inlet commercial fisheries. Total mainstem Kenai River sport harvests have been reported annually since 1977 by Mills (1979-1986). Commercial catch and total returns of sockeye salmon to the Kenai River have been reported by Cross et al. (1983, 1985, 1986).

The sockeye salmon run to the Russian River is recognized as having two distinct temporal components (Figure 3) and are referred to as early and late runs. The early run typically enters the Russian River during June and early July; is bound for spawning sites in Upper Russian Creek (Nelson 1973-1974; and is primarily composed of 3-ocean fish (Nelson et al. 1986). The late run typically enters the Russian River during July and August, is primarily bound for spawning sites tributary to Upper Russian Lake, and is primarily composed of 2-ocean fish. The Sport Fish Division of the Alaska Department of Fish and Game regulates the sport fishery to ensure a predetermined number of spawners<sup>1</sup>, i.e. escapement goal, pass the counting weir located at the outlet of Lower Russian Lake (Figure 2).

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<sup>1</sup> Current escapement goals for the early and late runs are 9,000 and 30,000 fish, respectively.

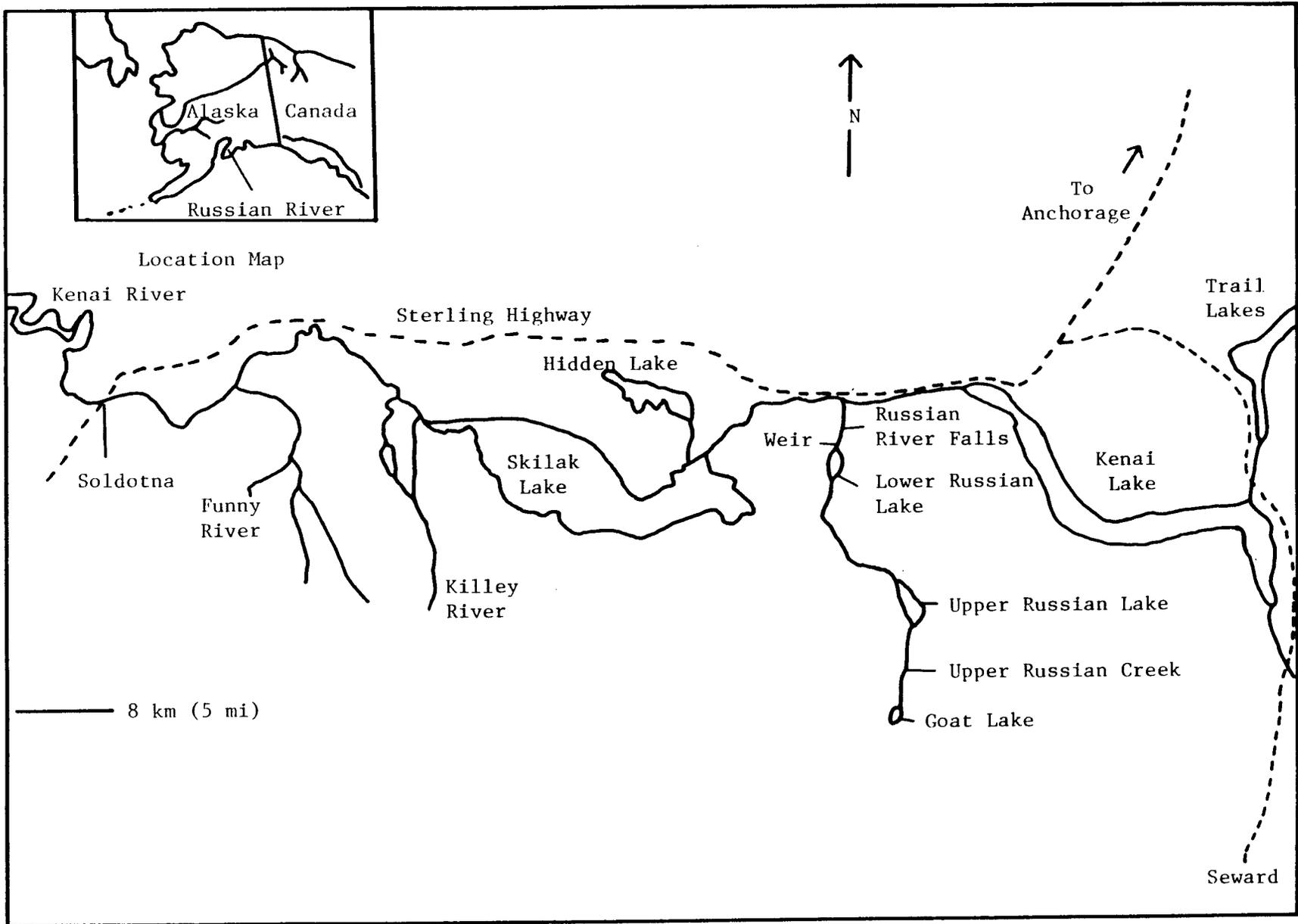


Figure 1. Schematic diagram of the Kenai River drainage.

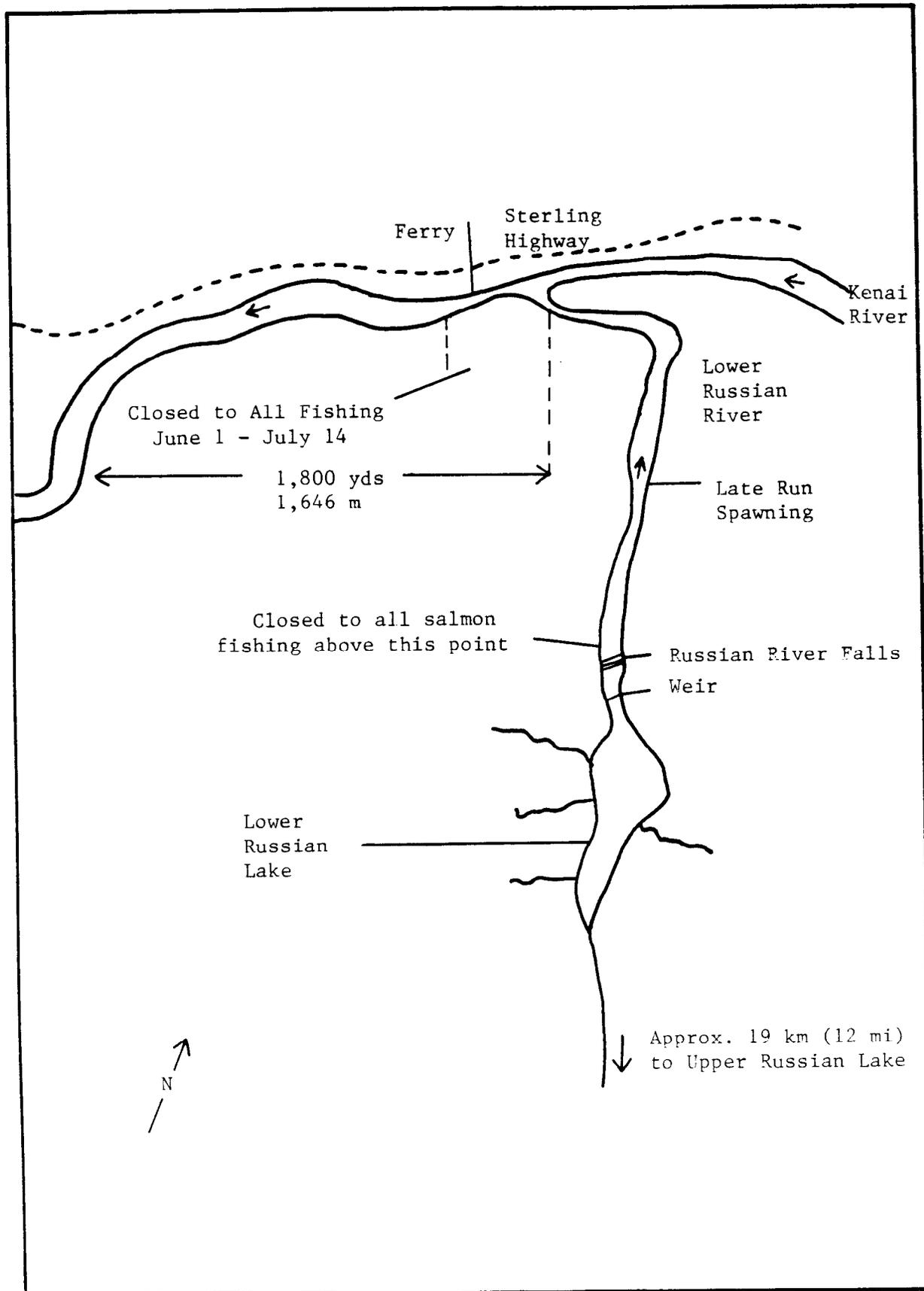


Figure 2. Schematic diagram of the lower Russian River and the Kenai and Russian River confluence.

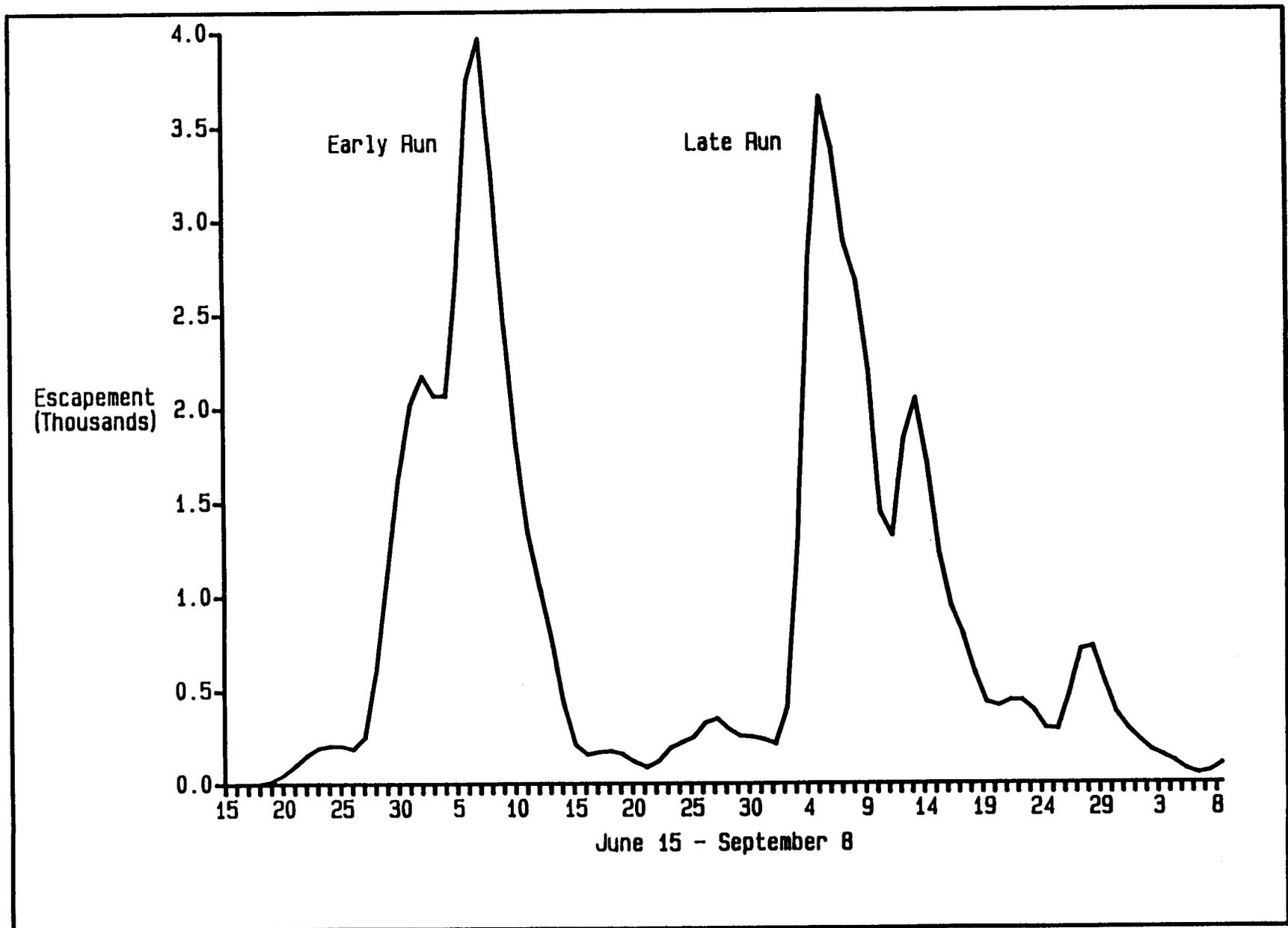


Figure 3. Escapement by day of sockeye salmon past Russian River Weir, 1986.

The sport fishery for Russian River sockeye salmon is intense and has resulted in overharvest in past years. To assure adequate escapement requires precise and timely management decisions. This is accomplished through the use of a creel survey and counting weir to provide timely estimates of abundance which are the basis for inseason alterations of fishing schedules. Estimates of the total inriver return; and the age, sex and size composition of that return; provide information to evaluate production and to estimate optimum spawning escapement levels.

The objectives of the report are to present: (1) base-line population statistics for the 1986 return of sockeye salmon to the Russian River; and (2) detailed information concerning the dynamics of the sport fishery.

## METHODS

### Sport Fishery

A creel survey was conducted during the period 14 June to 20 August.

#### Study Area:

The fishery occurs in two distinct areas (Figure 2). The river fishery is bounded by the upper limit of the fly-fishing-only area and extends downstream to the upper end of a no-fishing sanctuary. A sign marking the upper sanctuary limit is located approximately 137 m (150 yards) upstream from the confluence of the Kenai and Russian Rivers. Primary access to this section is through the U.S. Forest Service campground. The confluence fishery is bounded by the upper limit of the sanctuary area and the lower limit of the fly-fishing-only area. Most anglers that fish this area park in the U.S. Fish and Wildlife Service parking area located adjacent to the Sterling Highway and cross the Kenai River via passenger ferry to the south bank of the Kenai River.

#### Study Design:

Delineation between early and late run was based on inseason subjective observations of harvest rates and external maturation characteristics. Entry of late run fish into the fishery has historically been typified by a surge of ocean-bright fish, which numerically overwhelm the more sexually advanced early run fish. The presence of these ocean-bright fish is usually coupled with dramatic increases in harvest rates.

Effort in angler-hours and sockeye salmon harvest are estimated separately for each run by fishery location. The four major components are: (1) river early run; (2) confluence early run; (3) river late run; and (4) confluence late run. The angler-day is 18 hours long and is defined to be from 0600 to 2400 hours. Weekdays and weekend/holidays are treated as separate strata because effort during weekend/holidays has historically been much greater than during the weekdays. Two time periods are defined for each day: 0600 to 1759 hours (period A) and 1800 to 2400 hours (period B). Since 1965, sampling has only occurred during period A. Period B was sampled in 1986 to determine if significant levels of effort and harvest were occurring during this time.

A two-stage random sample design was followed for making angler counts and collecting angler interviews. Days were considered the primary sample units. The secondary sample units were hours in a day for the angler counts and anglers for the interviews. Days and times to sample were randomly selected without replacement. Each week of the fishery was sampled to provide timely estimates for inseason management. All weekend/holidays and approximately 60% of the weekdays were sampled. Approximately 67% of the sampling effort was expended during period A.

Angler counts were made by a roving creel survey clerk and are considered instantaneous counts (Neuhold and Lu 1957). Angler interviews were collected by monitoring the major access points to each fishery area and interviewing anglers as they departed.

Several assumptions were necessary for this sampling design. They are as follows:

1. Angler counts made during the same day and on consecutive days are assumed to be independent.
2. No significant fishing effort occurs during the hours 0000-0600.
3. Interviewed anglers are representative of the total angler population.
4. The number of anglers interviewed during any day in a stratum is proportional to the effort on that day.
5. Fishing effort does not influence catch per unit effort.

#### Data Collection:

Data on the number of anglers fishing, time expended by anglers, and harvest were collected during each sample period. Angler counts were conducted by quickly walking and/or driving the length of the fishing area at randomly selected times (either the river or confluence) and counting the number of people actively engaged in fishing. A person was considered to be actively engaged in fishing if, in the opinion of the census taker, that person would be actively fishing during the time that the count was being conducted. Interviews were conducted as people exited the fishery and only fishermen who had completed their fishing trip were interviewed. Fishermen were asked to volunteer the amount of time that they had fished (to the nearest 1/2 hour) and the number of sockeye salmon that they had harvested.

#### Analysis:

Effort and harvest rate were computed following a two-stage sampling design with a finite number of primary sample units and an unknown number of secondary sample units (Sukhatme et al. 1984, Von Geldern and Tomlinson 1973). Inadequate sample sizes from the river fishery occurred when fishing effort was low and necessitated grouping weekdays across weeks on three occasions.

Effort. The mean number of anglers per count and total effort in angler-hours was computed by week for weekend/holidays and weekdays during each run and fishery. The following conventions are used for analytical notation:

Subscript  $i$  = days,

subscript  $j$  = sample in day  $i$ ,

$d$  = total number of days on which sampling was conducted,

$D$  = total number of possible days in a week,

$N$  = total number of possible hours of fishing in a week,

$y_{ij}$  = an angler count,

$\bar{Y}_i$  = mean angler count for day  $i$ ,

$\bar{Y}$  = mean angler count for a week,

$m_i$  = number of angler counts on day  $i$ ,

$M$  = total number of angler counts for a week.

Effort in angler-hours,  $\hat{E}$ , was estimated for each week as:

$$\hat{E} = \bar{Y} \times N.$$

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

$$V(\hat{E}) = N^2 V(\bar{Y}), \text{ where}$$

$$V(\bar{Y}) = [1 - (d/D)] s_B^2 / d + \left[ \sum_{i=1}^d (s_{Wi}^2 / m_i) \right] / dD, \text{ and}$$

$$s_B^2 = \left[ \sum_{i=1}^d (Y_i - \bar{Y})^2 \right] / (d-1), \text{ and}$$

$$s_{Wi}^2 = \left[ \sum_{j=1}^{m_i} (y_{ij} - \bar{Y}_i)^2 \right] / (m_i - 1).$$

Harvest Rates. Harvest rates were computed for each sampled day and for each week as determined by analysis of the effort data. For any week, the following conventions are used for analytical notation:

$C$  = total catch by interviewed anglers during a week,

$F$  = total effort (angler-hours) by interviewed anglers in a week,

$\bar{C}$  = mean catch per angler,

$\bar{F}$  = mean effort per angler,

M = number of anglers interviewed in a week,

$s_C^2$  = variance of  $\bar{C}$ ,

$s_F^2$  = variance of  $\bar{F}$ , and

R = correlation coefficient for C and F.

Catch per effort, C/F, was computed for each stratum and its variance,

V(C/F), as:

$$V(C/F) = (C/F)^2 (1/M) [(s_C^2/C) + (s_F^2/F) - (2Rs_Cs_F/\{Cx F\})].$$

The variance for mean catch,  $\bar{C}$ , and mean effort,  $\bar{F}$ , were computed using the two stage random sampling formulae defined for mean angler counts.

The  $y_i$ 's represent the effort or catch of an interviewed angler and  $m_i$ 's represent the total number of anglers interviewed on day i.

Total Harvest. Total harvest,  $\hat{H}$  for any week was computed as:

$$\hat{H} = \hat{E} \times (C/F),$$

and variance,  $V(\hat{H})$ , as (Goodman 1960):

$$V(\hat{H}) = [\hat{E}^2 \times V(C/F)] + [(C/F)^2 \times V(\hat{E})] - [V(\hat{E}) \times V(C/F)].$$

### Escapement

A weir was operated at the outlet of Lower Russian Lake during the period 15 June to 3 August.

### Abundance:

Salmon escapement to the Russian Lakes was counted through the weir located at the outlet of Lower Russian Lake using methods described by Nelson (1976). During the transition period between early and late runs (late July through early August), fish were enumerated separately based on degree of maturation. This procedure began when daily counts dramatically declined in late July (consistently less than 100 fish per day) and the first bright fish (assumed to be of late run origin) appeared at the weir. Both runs were enumerated until daily counts dramatically increased (thousands of fish per day) and fish (assumed to be of early run origin) composed a small fraction of the total (5-10%).

Salmon spawning from the weir downstream to the confluence of the Kenai and Russian Rivers were enumerated by foot survey. These data are considered indices of relative annual abundance and do not represent a complete enumeration of season escapement.

#### Age, Sex, and Length Composition:

Fish were sampled for scales, sex, and length. Scales were collected on 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 (INPFC 1963). Scales were mounted on gum cards and impressions were made in cellulose acetate (Clutter and Whitesel 1956). Three distinct populations of sockeye salmon were sampled: (1) early run past weir; (2) late run past weir; and (3) late run spawning below Russian River Falls. Live fish were sampled at the weir throughout the migration. Carcasses were sampled as a single time stratum in the population below Russian River Falls.

Examination of scales provided age information. Sex determination was based on examination of external morphometric characteristics. Fish length was measured from middle of eye to fork of tail.

An age and sex composition was estimated for each sockeye salmon population sampled. In addition, escapement by time period for each sex and age class was estimated for both the early and late run populations at the weir. The sum of the strata estimates yielded an escapement value for each sex and age class by run. Sampling goals were to collect enough samples to estimate the proportion of major age classes in the populations to within  $\pm 5$  percentage points nine out of ten times (Bernard 1983). Mean length, by sex and age class, were computed for each sampled escapement. Sample variances were estimated using formulas for the binomial approximation (Cochran 1977). Variance of the number of fish by age class for any time period (t) was estimated as:

$$V(E_a) = E_t^2 \times \frac{P_{at}(1-P_{at})}{N_{t-1}}$$

where:

E = escapement in numbers of fish,

$P_a$  = proportion of an age class, a, and

N = sample size.

## RESULTS

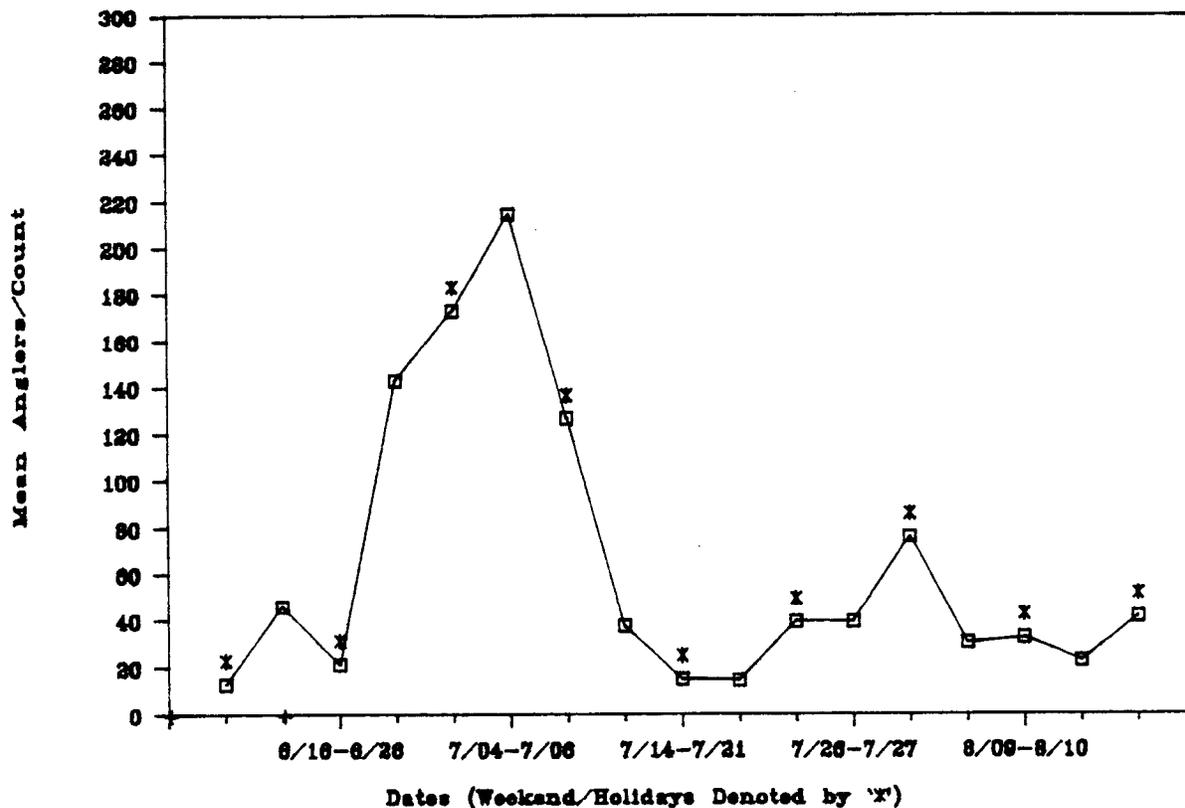
### Sport Fishery

Temporal changes were evident for effort (Table 1 and Figure 4) and harvest rate (Table 2 and Figure 5) data. Both mean number of anglers per count and mean harvest per hour show a bimodal distribution with the

Table 1. Effort (hours) in the Russian River sockeye salmon sport fishery, 1986.

Run	Location	Time Frame	Strata	Number Counts	Number Days Possible	Number Days Sampled	Counts		Effort	
							Mean	Std Err	Total	Std Err
Early	River	Wknd-Hol	6/14-6/15	2	2	2	13.0	10.0	468.0	360.0
Early	River	Wknd-Hol	6/21-6/22	2	2	2	46.0	26.0	1,656.0	936.0
Early	River	Wkday	6/16-6/26	5	9	5	21.2	5.5	3,434.4	889.4
Early	River	Wknd-Hol	6/28-6/29	2	2	2	143.0	14.0	5,148.0	504.0
Early	River	Wkday	6/27-7/03	3	4	3	173.0	62.6	15,570.0	5,629.9
Early	River	Wknd-Hol	7/04-7/06	3	3	3	214.7	38.9	11,592.0	2,098.0
Early	River	Wkday	7/07-7/11	2	5	2	126.5	17.5	11,385.0	1,575.0
Early	River	Wknd-Hol	7/12-7/13	2	2	2	37.5	0.5	1,350.0	18.0
Early	River	Wkday	7/14-7/21	4	6	4	15.0	0.4	1,620.0	44.1
Early	River	Wknd-Hol	7/19-7/20	2	2	2	14.5	6.5	522.0	234.0
Total				27	37	27			52,745.4	6,181.0
Early	Confluence	Wknd-Hol	6/14-6/15	6	2	2	42.5	12.3	1,530.0	442.9
Early	Confluence	Wkday	6/16-6/20	8	5	3	87.4	19.1	7,863.8	1,723.1
Early	Confluence	Wknd-Hol	6/21-6/22	6	2	2	217.2	26.7	7,818.0	959.7
Early	Confluence	Wkday	6/23-6/27	8	5	3	193.5	22.2	17,415.0	1,994.6
Early	Confluence	Wknd-Hol	6/28-6/29	6	2	2	199.3	28.3	7,176.0	1,020.2
Early	Confluence	Wkday	6/30-7/03	5	4	2	163.8	22.3	11,793.6	1,604.7
Early	Confluence	Wknd-Hol	7/04-7/06	9	3	3	171.7	9.5	9,270.0	510.7
Early	Confluence	Wkday	7/07-7/11	6	5	2	99.5	17.8	8,955.0	1,605.2
Early	Confluence	Wknd-Hol	7/12-7/13	6	2	2	27.5	7.7	990.0	275.5
Early	Confluence	Wkday	7/14-7/21	10	5	4	7.5	3.8	810.0	414.6
Early	Confluence	Wknd-Hol	7/19-7/20	6	2	2	9.8	3.3	354.0	117.3
Total				76	37	27			73,975.4	3,504.1
Late	River	Wkday	7/22-8/01	4	9	4	39.5	13.7	6,399.0	2,225.7
Late	River	Wknd-Hol	7/26-7/27	2	2	2	39.5	35.5	1,422.0	1,278.0
Late	River	Wknd-Hol	8/02-8/03	2	2	2	76.0	25.0	2,736.0	900.0
Late	River	Wkday	8/04-8/08	3	5	3	30.3	15.2	2,730.0	1,367.2
Late	River	Wknd-Hol	8/09-8/10	2	2	2	32.5	14.5	1,170.0	522.0
Late	River	Wkday	8/11-8/20	4	8	4	22.8	1.8	3,276.0	257.5
Late	River	Wknd-Hol	8/16-8/17	2	2	2	41.5	19.5	1,494.0	702.0
Total				19	30	19			19,227.0	2,915.6
Late	Confluence	Wkday	7/22-7/25	3	4	1	94.7	8.9	6,816.0	639.0
Late	Confluence	Wknd-Hol	7/26-7/27	6	2	2	186.2	26.4	6,702.0	949.8
Late	Confluence	Wkday	7/28-8/01	8	5	3	201.6	24.5	18,146.3	2,206.3
Late	Confluence	Wknd-Hol	8/02-8/03	6	2	2	224.0	44.7	8,064.0	1,607.5
Late	Confluence	Wkday	8/04-8/08	8	5	3	213.4	14.8	19,203.8	1,328.9
Late	Confluence	Wknd-Hol	8/09-8/10	6	2	2	184.3	14.2	6,636.0	512.2
Late	Confluence	Wkday	8/11-8/15	9	5	3	31.8	13.4	2,860.0	1,209.9
Late	Confluence	Wknd-Hol	8/16-8/17	6	2	2	46.8	7.7	1,686.0	278.0
Late	Confluence	Wkday	8/18-8/20	7	3	3	8.1	3.4	439.7	183.6
Total				59	30	42			70,553.8	3,516.5

## River Fishery



## Confluence Fishery

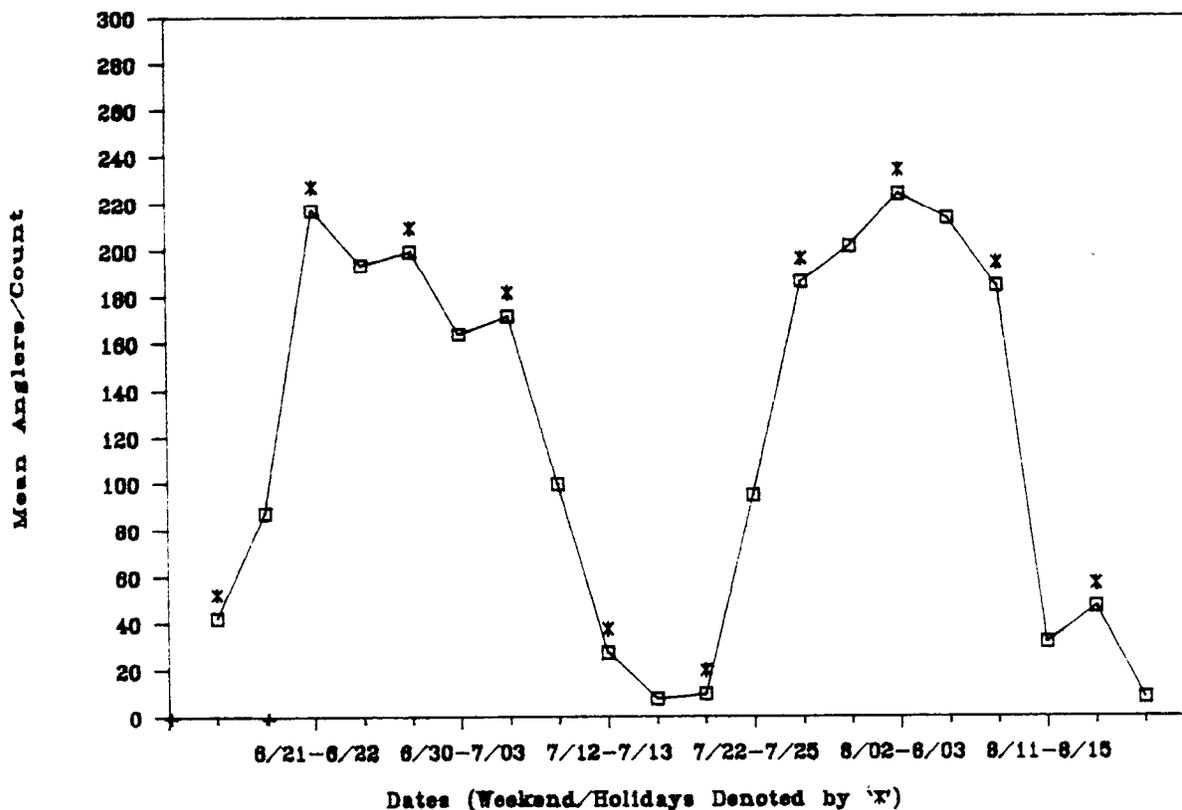


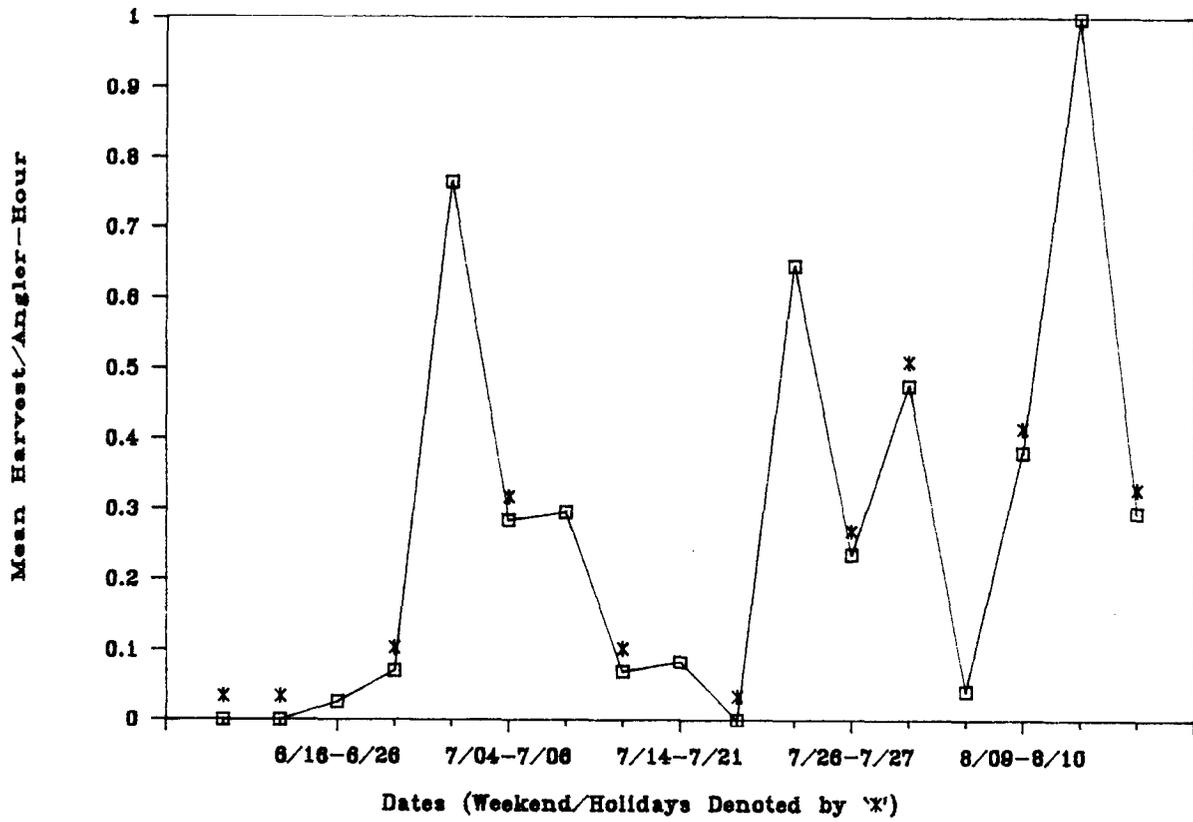
Figure 4. Mean number of anglers per count, Russian River fishery, 1986.

Table 2. Harvest rates (per hour) in the Russian River sockeye salmon sport fishery, 1986.

Run	Location	Time Frame	Strata	Number Intv's	Number Days Possible	Number Days Sampled	Effort		Sockeye Harvest				
							Mean	Std Err	Mean	Std Err	Corr <sup>1</sup>	CPUE	Std Err
Early	River	Wknd-Hol	6/14-6/15	13	2	1	1.6085	3.39E-01	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
Early	River	Wknd-Hol	6/21-6/22	15	2	1	3.4667	4.18E-01	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
Early	River	Wkday	6/16-6/26	30	9	3	3.8833	4.59E-01	0.1000	7.92E-02	0.3500	0.0258	3.57E-03
Early	River	Wknd-Hol	6/28-6/29	57	2	2	3.2544	2.39E-01	0.2281	8.64E-02	0.3108	0.0701	3.37E-03
Early	River	Wkday	6/27-7/03	64	4	3	3.0391	6.30E-01	2.3810	2.29E-01	0.2095	0.7661	2.01E-02
Early	River	Wknd-Hol	7/04-7/06	84	3	3	5.2619	7.08E-02	1.5000	1.41E-01	0.3894	0.2851	2.73E-03
Early	River	Wkday	7/07-7/11	37	5	2	4.5676	5.40E-01	1.3514	4.92E-01	0.3738	0.2959	1.64E-02
Early	River	Wknd-Hol	7/12-7/13	10	2	1	2.9000	3.68E-01	0.2000	9.43E-02	0.1921	0.0690	1.01E-02
Early	River	Wkday	7/14-7/21	14	6	3	1.7143	4.87E-01	0.1429	1.12E-01	(0.1678)	0.0833	1.95E-02
Early	River	Wknd-Hol	7/19-7/20	2	2	1	1.0000	3.54E-01	0.0000	0.00E+00	0.0000	0.0000	0.00E+00
Early	Confluence	Wknd-Hol	6/14-6/15	71	2	2	3.4063	3.42E-01	0.0704	3.72E-02	0.4308	0.0207	1.21E-03
Early	Confluence	Wkday	6/16-6/20	103	5	3	4.0995	3.83E-01	1.1650	2.94E-01	0.2312	0.2842	6.93E-03
Early	Confluence	Wknd-Hol	6/21-6/22	179	2	2	4.3953	1.94E-01	0.7765	8.14E-02	0.2956	0.1767	1.34E-03
Early	Confluence	Wkday	6/23-6/27	197	5	3	4.4569	3.73E-01	1.1015	1.33E-01	0.1184	0.2472	2.43E-03
Early	Confluence	Wknd-Hol	6/28-6/29	181	2	2	4.3591	1.72E-01	0.9337	8.43E-02	0.2831	0.2142	1.40E-03
Early	Confluence	Wkday	6/30-7/03	121	4	2	4.6157	1.88E-01	1.3471	8.06E-02	0.1709	0.2919	1.88E-03
Early	Confluence	Wknd-Hol	7/04-7/06	249	3	3	4.6687	1.57E-01	0.7912	6.84E-02	0.0608	0.1695	9.75E-04
Early	Confluence	Wkday	7/07-7/11	108	5	2	3.8194	3.89E-01	0.4907	1.19E-01	0.2776	0.1285	2.92E-03
Early	Confluence	Wknd-Hol	7/12-7/13	41	2	2	2.9146	1.83E-01	0.1951	7.09E-02	0.1870	0.0669	3.73E-03
Early	Confluence	Wkday	7/14-7/21	41	5	2	2.9146	1.83E-01	0.1951	7.09E-02	0.1870	0.0669	3.73E-03
Early	Confluence	Wknd-Hol	7/19-7/20	9	2	2	1.7778	3.50E-01	0.2222	1.05E-01	0.1184	0.1250	2.05E-02
Late	River	Wkday	7/22-8/01	23	9	3	3.0870	3.22E-01	2.0000	2.09E-01	0.2364	0.6479	1.74E-02
Late	River	Wknd-Hol	7/26-7/27	6	2	1	2.8333	7.45E-02	0.6667	1.49E-01	0.2500	0.2353	2.10E-02
Late	River	Wknd-Hol	8/02-8/03	33	2	2	4.5758	2.94E-01	2.1818	2.23E-01	0.0755	0.4768	9.68E-03
Late	River	Wkday	8/04-8/08	8	5	1	3.0000	7.32E-02	0.1250	5.59E-02	0.0000	0.0417	6.59E-03
Late	River	Wknd-Hol	8/09-8/10	10	2	2	3.4000	2.45E-01	1.3000	1.48E-01	(0.1474)	0.3824	1.73E-02
Late	River	Wkday	8/11-8/20	6	8	2	2.1667	4.81E-01	2.1667	2.92E-01	0.6278	1.0000	7.07E-02
Late	River	Wknd-Hol	8/16-8/17	6	2	1	4.5000	4.56E-01	1.3333	3.94E-01	0.2315	0.2963	3.50E-02
Late	Confluence	Wkday	7/22-7/25	36	4	1	4.4167	3.86E-01	0.3333	8.91E-02	0.7267	0.0755	2.67E-03
Late	Confluence	Wknd-Hol	7/26-7/27	137	2	2	4.8832	1.93E-01	1.1095	1.03E-01	0.4024	0.2272	1.65E-03
Late	Confluence	Wkday	7/28-8/01	157	5	3	4.5318	2.47E-01	1.7389	1.52E-01	0.0337	0.3837	3.10E-03
Late	Confluence	Wknd-Hol	8/02-8/03	192	2	2	5.1641	3.58E-01	2.0781	8.06E-02	(0.0912)	0.4024	2.39E-03
Late	Confluence	Wkday	8/04-8/08	150	5	3	4.7567	3.42E-01	1.5533	1.38E-01	0.2819	0.3266	2.60E-03
Late	Confluence	Wknd-Hol	8/09-8/10	150	2	2	4.7533	1.60E-01	0.7533	6.83E-02	0.2176	0.1585	1.16E-03
Late	Confluence	Wkday	8/11-8/15	46	5	3	4.0870	5.89E-01	0.8478	1.78E-01	0.3850	0.2074	6.23E-03
Late	Confluence	Wknd-Hol	8/16-8/17	63	2	2	3.7619	2.52E-01	1.1429	1.45E-01	0.2076	0.3038	5.00E-03
Late	Confluence	Wkday	8/18-8/20	32	3	2	4.3906	3.09E-01	0.7188	1.45E-01	0.1329	0.1637	5.93E-03

<sup>1</sup> Correlation between effort and harvest. Values in ( ) are negative.

## River Fishery



## Confluence Fishery

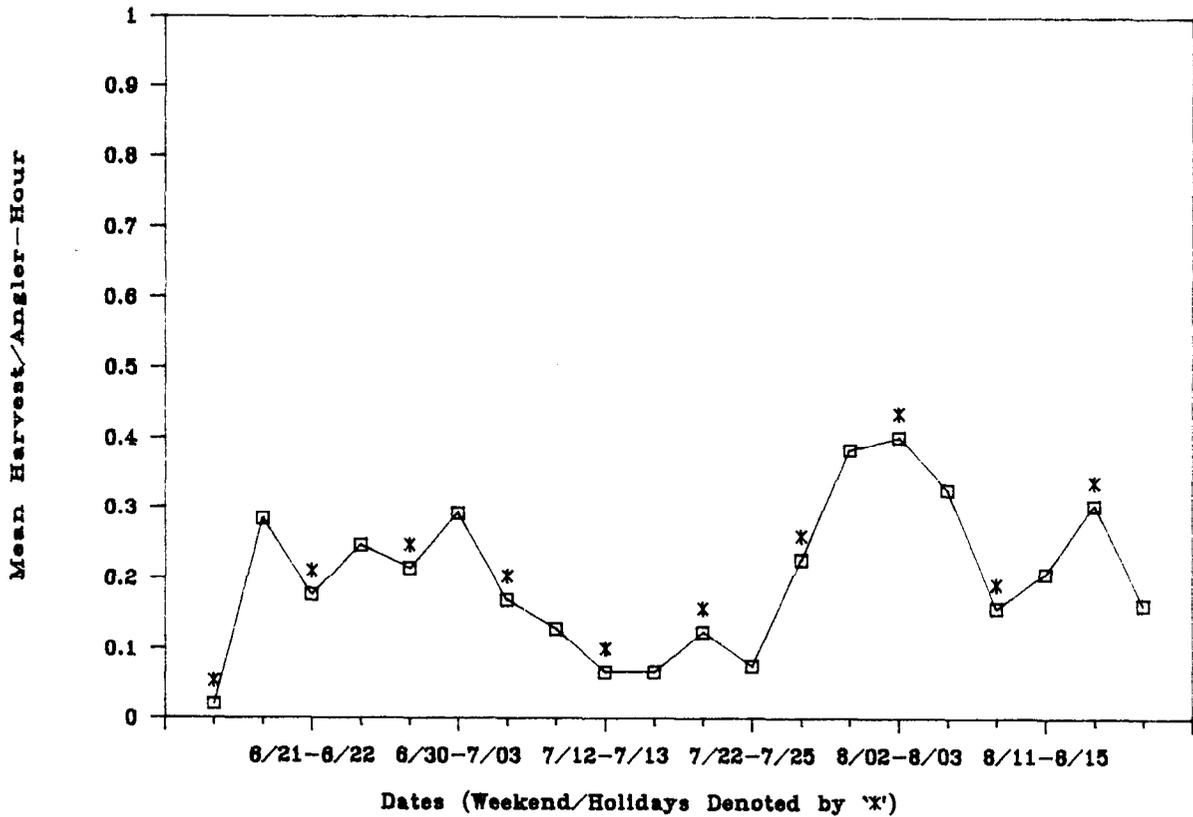


Figure 5. Mean CPUE (harvest of sockeye salmon per angler-hour), Russian River fishery, 1986.

trough between modes occurring during the period of overlap between early and late runs. Daily summaries of angler counts by fishery and daily period are presented in Appendix Table A1. Daily summaries of angler interviews are presented in Appendix Table A2.

Temporal changes in harvest were also evident (Table 3) Effort and harvest were slightly greater during the early run (126,720 hours and 35,099 fish) than during the late run (89,780 hours and 30,813 fish, Table 4). The distribution of effort and harvest between the river and confluence fisheries were different between the early and late runs. During the early run, the river fishery accounted for approximately 42% (52,745 hours) of the effort and 55% of the harvest (19,280 fish). During the late run, the river accounted for only 21% (19,277 hours) and 32% (10,066 fish) of the effort and harvest, respectively.

The estimates of effort and harvest from the river fishery had the largest variances (Table 4) and are primarily a result of smaller sample sizes. Although not addressed in this analysis, a cursory examination of confluence angler counts (Appendix Table A1) indicates that stratification by daily periods could explain some of the variation in these data.

A cursory examination of angler counts also indicates that fishing effort during period B (1800 to 2400 hours) is significant for both the river and confluence fisheries and, in most cases, is nearly equal to or exceeds fishing effort expended during comparable time frames of period A. Engel (1965) determined that approximately 78% of the early and 72% of the late run were caught between 0600 and 1800 hours. Since 1965, sampling has been restricted to the hours of 0600 to 1800 hours. Based on our analysis, sampling should be conducted at least during the hours of 0600 to 2400 hours.

### Escapement

Early and late run escapements past the weir were 36,195 and 40,422 fish, respectively (Appendix Table B1 and Table 5). Transition between runs occurred during the period 22 July to 3 August. The weir was removed 9 September when the sockeye salmon and chinook salmon runs were virtually complete. The coho salmon migration, however, was still in progress and only a partial count was obtained.

Temporal changes in age composition were evident within both the early and late runs (Appendix Tables C1, C2 and Figure 6). Three-ocean fish (age 1.3 and 2.3)<sup>1</sup> comprised a high proportion of the first strata than did 2-ocean (age 1.2 and 2.2) fish (68.0% vs. 32.1%, respectively). Conversely, in the second strata, 2-ocean fish were more abundant than 3-ocean fish (56.3% and 43.7%, respectively). The late run showed a similar temporal trend in that 3-ocean fish again declined over time

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<sup>1</sup> European Formula: The first numeral refers to the number of years of freshwater residence after emergence. The second number refers to the number of years of marine residence. Total age is the summation of these two numbers plus one.

Table 3. Total effort and harvest of sockeye salmon in the Russian River sockeye salmon sport fishery over time, 1986.

Run	Location	Time Frame	Strata	Effort		Sockeye Harvest Rate		Sockeye Harvest		
				Total	Rel Pre <sup>1</sup>	Mean	Rel Pre <sup>1</sup>	Total	Std Err	Rel Pre <sup>1</sup>
Early	River	Wknd-Hol	6/14-6/15	468.0	150.8%	0.0000	NA <sup>2</sup>	0	0.0	NA <sup>2</sup>
		Wknd-Hol	6/21-6/22	1,656.0	110.8%	0.0000	NA <sup>2</sup>	0	0.0	NA <sup>2</sup>
		Wkday	6/16-6/26	3,434.4	50.8%	0.0258	27.1%	89	25.8	56.9%
		Wknd-Hol	6/28-6/29	5,148.0	19.2%	0.0701	9.4%	361	39.3	21.3%
		Wkday	6/27-7/03	15,570.0	70.9%	0.7661	5.1%	11,928	4,322.9	71.0%
		Wknd-Hol	7/04-7/06	11,592.0	35.5%	0.2851	1.9%	3,305	599.0	35.5%
		Wkday	7/07-7/11	11,385.0	27.1%	0.2959	10.9%	3,369	501.5	29.2%
		Wknd-Hol	7/12-7/13	1,350.0	2.6%	0.0690	28.7%	93	13.7	28.9%
		Wkday	7/14-7/21	1,620.0	5.3%	0.0833	46.0%	135	31.9	46.3%
		Wknd-Hol	7/19-7/20	522.0	87.9%	0.0000	NA <sup>2</sup>	0	0.0	NA <sup>2</sup>
		Total				52,745.4	23.0%			19,280
Early	Confluence	Wknd-Hol	6/14-6/15	1,530.0	56.7%	0.0207	11.5%	32	9.3	57.2%
		Wkday	6/16-6/20	7,863.8	42.9%	0.2842	4.8%	2,235	492.6	43.2%
		Wknd-Hol	6/21-6/22	7,818.0	24.1%	0.1767	1.5%	1,381	169.9	24.1%
		Wkday	6/23-6/27	17,415.0	22.4%	0.2472	1.9%	4,305	494.9	22.5%
		Wknd-Hol	6/28-6/29	7,176.0	27.9%	0.2142	1.3%	1,537	218.8	27.9%
		Wkday	6/30-7/03	11,793.6	26.7%	0.2919	1.3%	3,443	468.9	26.7%
		Wknd-Hol	7/04-7/06	9,270.0	10.8%	0.1695	1.1%	1,571	87.0	10.9%
		Wkday	7/07-7/11	8,955.0	35.1%	0.1285	4.5%	1,151	207.9	35.4%
		Wknd-Hol	7/12-7/13	990.0	54.5%	0.0669	10.9%	66	18.8	55.7%
		Wkday	7/14-7/21	810.0	100.3%	0.0669	10.9%	54	27.9	101.1%
		Wknd-Hol	7/19-7/20	354.0	64.9%	0.1250	32.1%	44	16.2	72.1%
Total				73,975.4	9.3%			15,819	890.8	11.0%
Late	River	Wkday	7/22-8/01	6,399.0	68.2%	0.6479	5.3%	4,146	1,445.8	68.3%
		Wknd-Hol	7/26-7/27	1,422.0	176.2%	0.2353	17.5%	335	301.0	176.1%
		Wknd-Hol	8/02-8/03	2,736.0	64.5%	0.4768	4.0%	1,305	429.8	64.6%
		Wkday	8/04-8/08	2,730.0	98.2%	0.0417	31.0%	114	59.1	101.6%
		Wknd-Hol	8/09-8/10	1,170.0	87.4%	0.3824	8.9%	447	200.4	87.9%
		Wkday	8/11-8/20	3,276.0	15.4%	1.0000	13.8%	3,276	345.7	20.7%
		Wknd-Hol	8/16-8/17	1,494.0	92.1%	0.2963	23.2%	443	213.1	94.3%
Total				19,227.0	29.7%			10,066	1,615.8	31.5%
Late	Confluence	Wkday	7/22-7/25	6,816.0	18.4%	0.0755	6.9%	515	51.5	19.6%
		Wknd-Hol	7/26-7/27	6,702.0	27.8%	0.2272	1.4%	1,523	216.1	27.8%
		Wkday	7/28-8/01	18,146.3	23.8%	0.3837	1.6%	6,963	848.4	23.9%
		Wknd-Hol	8/02-8/03	8,064.0	39.1%	0.4024	1.2%	3,245	647.2	39.1%
		Wkday	8/04-8/08	19,203.8	13.6%	0.3266	1.6%	6,272	436.9	13.7%
		Wknd-Hol	8/09-8/10	6,636.0	15.1%	0.1585	1.4%	1,052	81.5	15.2%
		Wkday	8/11-8/15	2,860.0	82.9%	0.2074	5.9%	593	251.4	83.1%
		Wknd-Hol	8/16-8/17	1,686.0	32.3%	0.3038	3.2%	512	84.9	32.5%
Wkday	8/18-8/20	439.7	81.8%	0.1637	7.1%	72	30.1	82.1%		
Total				70,553.8	9.8%			20,747	1,207.0	11.4%

<sup>1</sup> Relative precision at  $\alpha = .05$ .

<sup>2</sup> Not applicable.

Table 4. Total effort and harvest of sockeye salmon in the Russian River sockeye salmon sport fishery by location, 1986.

Run	Location	Effort		Harvest		
		Total	Rel Pre <sup>1</sup>	Total	95% CI	Rel Pre <sup>1</sup>
Early	River	52,745.4	23.0%	19,280	10,725 - 27,835	44.4%
	Confluence	73,975.4	9.3%	15,819	14,073 - 17,565	11.0%
	Total	126,720.8	11.0%	35,099	26,368 - 43,830	24.9%
Late	River	19,227.0	29.7%	10,066	6,899 - 13,233	31.5%
	Confluence	70,553.8	9.8%	20,747	18,381 - 23,113	11.4%
	Total	89,780.8	10.0%	30,813	26,860 - 34,766	12.8%
Total Fishery		216,501.6	7.6%	65,912	56,328 - 75,496	14.5%

<sup>1</sup> Relative precision at  $\alpha = .05$ .

Table 5. Russian River salmon escapements, 1986.

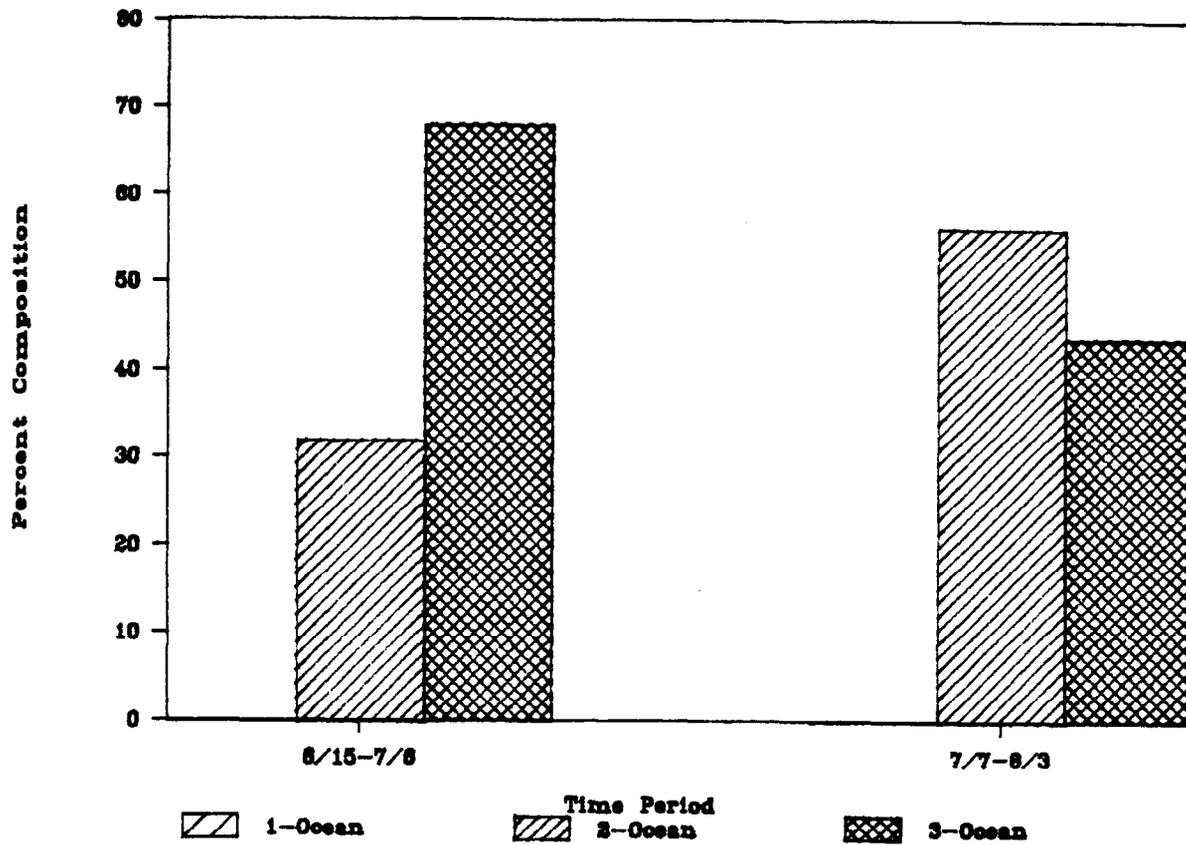
Area	Dates	Sockeye			Coho	Chinook		
		Live	Dead	Total		Live	Dead	Total
Early Run Past Russian River Weir	06/15-08/03 <sup>1</sup>	36,195						
Late Run Past Russian River Weir	07/22-09/08 <sup>1</sup>	40,422			1814 <sup>2</sup>	52		
Downstream From Russian River Weir <sup>3</sup>	08/21	15,150	80	15,230		99	6	105
	09/03	2,130	3,870	6,000		36	71	107

<sup>1</sup> From 7/22 through 8/03, early run fish were enumerated separately from late run fish based on degree of maturation (color).

<sup>2</sup> Coho escapement represents an unknown percentage of the total return as the weir was removed prior to the end of the run.

<sup>3</sup> Escapements downstream from Russian River Weir are peak counts done by foot survey.

# Early Run



# Late Run

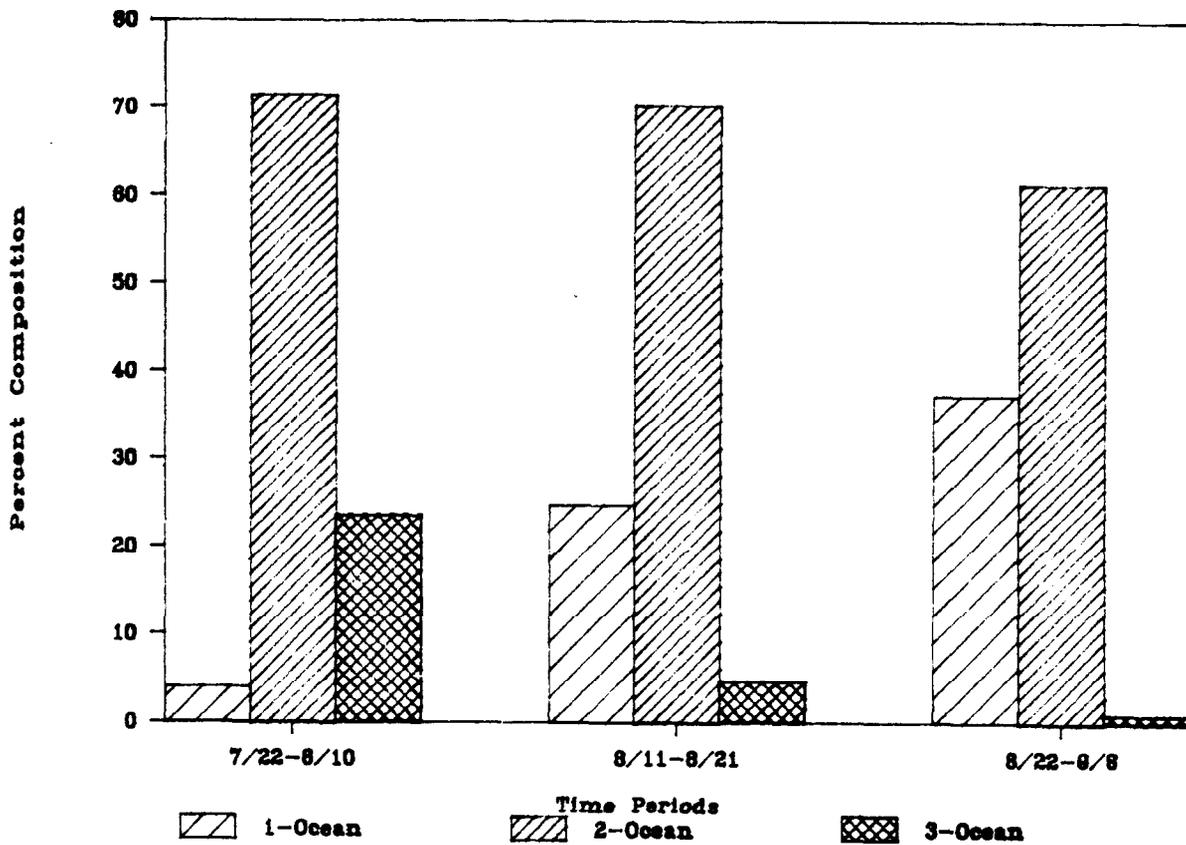


Figure 6. Ocean age composition of early and late run Russian River sockeye salmon escapements, 1986.

(23.6%, 4.7%, and 1.0%, respectively) while 2-ocean fish remained relatively constant (71.6%, 70.4%, and 61.5%, respectively). However, late run 1-ocean fish increased over time (4.1%, 24.8%, and 37.5%, respectively).

Differences in age composition were evident between the early and late runs (Appendix Table C1 to C3 and Table 6). Both the early and late runs, which spawned upstream from the weir, were comprised primarily of fish which spent the first 2 years of their lives in fresh water. The early run was comprised primarily of age 2.3 fish (43.7%) while the late run was comprised primarily of age 2.2 fish (60.5%). Late run escapement downstream from the weir were predominantly 1-freshwater fish (62.7% age 1.3 and 18.9% age 1.2). One-ocean fish, commonly referred to as "jacks", were found only in the late run escapement past the weir (14.8%).

Mean lengths by sex and age class of the three populations sampled are presented in Appendix Table C4.

#### CONCLUSIONS AND RECOMMENDATIONS

Harvest, effort, spawning escapement, and total return for the early run were all greater than the recent 10-year mean (Table 7). Harvest was 76% greater and spawning escapement was 33% greater than the mean. Total return was the third largest during the past 11 years. The late run harvest of 30,813 was 20% greater than the historic mean, however, effort, weir escapement, and total return were all below average. The weir escapement of 40,422 was 35% greater than the escapement goal but 32% less than the historic mean.

The following changes are recommended for the 1987 field program:

1. Increase overall precision of the harvest estimates by increasing the number of river effort counts. Treat the river fishery as a single stratum.
2. Reduce within-day variances by stratifying the confluence fishery into three 6-hour time periods.
3. Estimate fishing effort during the period 0000 to 0600 hours.
4. Sample the confluence sport harvest for age, sex, and size data.
5. Account for temporal variations by stratifying sampling at the weir for age, sex, and size data.

#### ACKNOWLEDGEMENTS

Andrea Meyer collected creel census data and provided on-site fishery observations, Deric Marcorelle operated Russian River Weir and collected age, sex, and size data. The Research and Technical Services (RTS) staff in Anchorage and Jay Carlon with Sport Fish Division in Soldotna provided assistance with data compilation and analysis. Betty Mishou formatted and

Table 6. Age composition of sockeye salmon escapements in the Russian River, 1986.

			Percent Composition by Brood Year and Age Class							
			1980			1981		1982		1983
Escapement	Sample Size	Total Escapement	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1
-----										
Weir										
Early Run	469	36,193	0.0	43.7	0.0	13.1	32.1	11.1	0.0	0.0
Late Run	454	40,422	0.3	7.9	0.3	7.2	60.5	9.0	14.6	0.2
Downstream <sup>1</sup>	440	15,200	0.2	12.0	0.0	62.7	6.1	18.9	0.0	0.0

<sup>1</sup> Peak count, foot survey.

Table 7. Early and late run Russian River sockeye salmon harvest, effort, spawning escapement, and total return, 1976-1986.<sup>1</sup>

Year	Early Run				Late Run				
	Effort <sup>2</sup>	Harvest	Weir Escapement	Total Return	Effort <sup>2</sup>	Harvest	Weir Escapement	Downstream Escapement	Total Return
1976	28,900	3,380	14,700	18,080	74,000	13,700	31,950	3,470	49,120
1977	138,600	20,400	16,070	36,470	115,100	27,440	21,410	17,090	65,940
1978	196,600	37,720	34,150	71,870	98,800	24,530	34,230	18,330	77,090
1979	96,300	8,400	19,700	28,100	114,400	26,830	87,920	3,920	118,670
1980	130,800	27,220	28,670	55,890	70,500	33,500	83,980	3,220	120,700
1981	101,600	10,720	21,140	31,860	107,600	23,720	44,530	4,160	72,410
1982	163,100	34,500	56,080	90,580	59,100	10,320	30,630	45,000	85,950
1983	78,500	8,360	21,200	29,560	66,600	16,000	34,000	44,000	94,000
1984	114,800	35,880	28,910	64,790	94,900	21,970	92,660	3,000	117,630
1985	71,300	12,300	30,610	42,910	155,000	58,410	136,970	8,650	204,030
Mean	112,050	19,890	27,120	47,010	95,600	25,640	59,830	15,080	100,550
1986	126,720	35,099	36,195	71,294	89,780	30,813	40,422	15,230	86,465

<sup>1</sup> Fish harvested in the commercial fishery or by sport anglers downstream from the survey area are not included. These factors are insignificant to the early run.

<sup>2</sup> Angler-hours.

typed the report. We also thank Dave Nelson and Steve Elliot for their review of this manuscript.

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APPENDIX A

Creel survey data from the Russian River sport fishery.

Appendix Table A1. Angler counts in the Russian River sockeye salmon fishery, 1986.

Date	Wknd-Hol (* )	Counts by Period <sup>1 2</sup>				
		River Fishery		Confluence Fishery		
		A	B	A1	A2	B
14-Jun	*	23		8	37	28
15-Jun	*		3	73	93	16
16-Jun		13		32	41	54
17-Jun		24		77	124	84
18-Jun			40	141	146	
19-Jun						
20-Jun						
21-Jun	*	72		175	264	245
22-Jun	*		20	125	284	210
23-Jun				152	272	
24-Jun				128	253	235
25-Jun			8	135	238	135
26-Jun		21				
27-Jun		115				
28-Jun	*		129	170	317	260
29-Jun	*	157		113	224	112
30-Jun		106		132	181	128
01-Jul		298		232	146	
02-Jul						
03-Jul						
04-Jul	*		278	129	158	151
05-Jul	*		222	264	259	209
06-Jul	*	144		160	126	89
07-Jul		109		127	141	91
08-Jul		144		106	98	34
09-Jul						
10-Jul						
11-Jul						
12-Jul	*	38		57	33	8
13-Jul	*		37	17	34	16
14-Jul						
15-Jul		15		0	2	1
16-Jul						
17-Jul		17		1	10	1
18-Jul			14	4	8	
19-Jul	*		8	24	19	5
20-Jul	*	21		0	10	1
21-Jul		14		13	35	
22-Jul						
23-Jul						
24-Jul		87		102	105	77
25-Jul						
26-Jul	*	75		145	245	181
27-Jul	*		4	108	260	178
28-Jul		2		146	230	221
29-Jul						
30-Jul						
31-Jul		48		75	222	200
01-Aug			21	220	299	
02-Aug	*	51		141	404	258
03-Aug	*		101	155	271	115
04-Aug			0	167	240	
05-Aug		47		185	276	223
06-Aug						
07-Aug		44		172	264	180
08-Aug						
09-Aug	*	47		284	226	201
10-Aug	*		18	152	139	104
11-Aug		20		24	122	54
12-Aug						
13-Aug						
14-Aug				8	25	17
15-Aug				8	18	10
16-Aug	*	61		47	64	58
17-Aug	*		22	42	60	10
18-Aug		27		11	0	
19-Aug		17		2	26	0
20-Aug			27	7	11	

<sup>1</sup> Period A: 0600 to 1759 hrs.  
Period B: 1800 to 2400 hrs.

<sup>2</sup> Two counts were usually conducted during period A. The counts are presented in the order that they were conducted.

Appendix Table A2. Angler interviews in the Russian River sockeye salmon sport fishery, 1986.

Date	Wknd-Hol (*)	River Fishery						Confluence Fishery					
		Sample Size	Effort		Sockeye Harvest			Sample Size	Effort		Sockeye Harvest		
			Mean	Std Err	Mean	Std Err	CPUE		Mean	Std Err	Mean	Std Err	CPUE
14-Jun	*	13	1.6080	0.4789	0.0000	0.0000	0.0000	24	3.9800	0.6270	0.0833	0.0576	0.0209
15-Jun	*							47	3.1140	0.2740	0.0638	0.0472	0.0205
16-Jun		5	4.8000	1.2000	0.0000	0.0000	0.0000	23	2.9130	0.2909	0.1739	0.0808	0.0597
17-Jun								32	4.1170	0.5431	1.5938	0.2283	0.3871
18-Jun													
19-Jun		11	3.7730	0.7959	0.2727	0.1408	0.0723	48	4.6560	0.3141	1.3542	0.1799	0.2908
20-Jun													
21-Jun	*	15	3.4670	0.5905	0.0000	0.0000	0.0000	77	3.7560	0.2956	0.6623	0.1193	0.1763
22-Jun	*							102	4.8770	0.2522	0.8627	0.1115	0.1787
23-Jun													
24-Jun													
25-Jun		14	3.6430	0.9397	0.0000	0.0000	0.0000	56	3.2860	0.2221	0.9107	0.1657	0.2772
26-Jun								66	4.7650	0.3592	0.8788	0.1323	0.1844
27-Jun		8	0.9380	0.1752	2.5000	0.3273	2.6667	75	5.0600	0.2862	1.4400	0.1346	0.2846
28-Jun	*	36	3.4720	0.3785	0.2222	0.1062	0.0640	103	4.4850	0.2102	0.9223	0.1057	0.2056
29-Jun	*	21	2.8810	0.2926	0.2381	0.1364	0.0826	78	4.1920	0.2725	0.9487	0.1315	0.2263
30-Jun		23	2.3480	0.1585	1.6957	0.2772	0.7222	72	4.4650	0.2370	1.3750	0.1486	0.3079
01-Jul		33	4.0300	0.1740	2.7273	0.1174	0.6767	49	4.8370	0.2873	1.3061	0.1872	0.2700
02-Jul													
03-Jul													
04-Jul	*	30	6.7500	0.6278	1.4333	0.2284	0.2123	81	4.8700	0.3567	0.7901	0.1251	0.1622
05-Jul	*	28	4.9460	0.3068	1.6071	0.2431	0.3249	92	5.0540	0.1959	1.0109	0.1270	0.2000
06-Jul	*	26	3.8850	0.3856	1.4615	0.2615	0.3762	76	3.9870	0.2349	0.5263	0.1017	0.1320
07-Jul		31	4.7420	0.3094	1.1935	0.2292	0.2517	38	3.2240	0.3057	0.6579	0.1656	0.2041
08-Jul		6	3.6670	0.5426	2.1667	0.5426	0.5909	70	4.1430	0.2404	0.4000	0.0824	0.0966
09-Jul													
10-Jul													
11-Jul													
12-Jul	*							31	3.2420	0.2732	0.2258	0.1006	0.0697
13-Jul	*	10	2.9000	0.5207	2.0000	0.1333	0.0690	10	1.9000	0.2450	0.1000	0.1000	0.0526
14-Jul													
15-Jul		3	0.8330	0.1667	0.3333	0.3333	0.4000	3	1.3330	0.3333	0.3333	0.3333	0.2500
16-Jul													
17-Jul		7	1.2140	0.2857	0.1429	0.1429	0.1176	4	2.5000	0.2887	0.0000	0.0000	0.0000
18-Jul		4	3.2500	0.2500	0.0000	0.0000	0.0000						
19-Jul	*							6	1.9170	0.4902	0.3333	0.2108	0.1739
20-Jul	*	2	1.0000	0.5000	0.0000	0.0000	0.0000	3	1.5000	0.5000	0.0000	0.0000	0.0000
21-Jul								9	2.1670	0.5000	0.1111	0.1111	0.0513
22-Jul													
23-Jul													
24-Jul		11	2.5450	0.1575	1.8182	0.4004	0.7143	36	4.4170	0.5461	0.3333	0.1260	0.0755
25-Jul													
26-Jul	*	6	2.8330	0.1054	0.6667	0.2108	0.2353	70	4.8140	0.2729	1.0571	0.1437	0.2196
27-Jul	*							67	4.9550	0.2721	1.1642	0.1483	0.2349
28-Jul								53	5.0570	0.3751	1.3585	0.1748	0.2687
29-Jul													
30-Jul													
31-Jul		8	3.8750	0.0818	2.1250	0.3504	0.5484	62	4.5000	0.2370	1.8387	0.1476	0.4086

-Continued-

Appendix Table A2. Angler interviews in the Russian River sockeye salmon sport fishery, 1986 (continued).

Date	Wknd-Hol (* )	River Fishery						Confluence Fishery					
		Sample Size	Effort		Sockeye Harvest			Sample Size	Effort		Sockeye Harvest		
			Mean	Std Err	Mean	Std Err	CPUE		Mean	Std Err	Mean	Std Err	CPUE
01-Aug		4	3.0000	0.0000	2.2500	0.7500	0.7500	42	3.9170	0.2481	2.0714	0.1683	0.5289
02-Aug	*	6	2.4170	0.4549	1.1667	0.4014	0.4828	109	5.4360	0.6786	1.9908	0.1110	0.3662
03-Aug	*	27	5.0560	0.3740	2.4074	0.1944	0.4762	83	4.8070	0.2274	2.1928	0.1168	0.4561
04-Aug		8	3.0000	0.1637	0.1250	0.1250	0.0417	39	4.4230	0.2971	1.6923	0.1768	0.3826
05-Aug								64	4.2110	0.2979	1.2500	0.1652	0.2968
06-Aug													
07-Aug								47	5.7770	0.3507	1.8511	0.1693	0.3204
08-Aug													
09-Aug	*	2	2.0000	0.0000	3.0000	0.0000	1.5000	95	5.4320	0.2299	0.9158	0.1065	0.1686
10-Aug	*	8	3.7500	0.4910	0.8750	0.2951	0.2333	55	3.5820	0.2227	0.4727	0.0855	0.1320
11-Aug		2	1.5000	0.0000	2.5000	0.5000	1.6667	31	4.5160	0.3821	0.8710	0.1781	0.1929
12-Aug													
13-Aug													
14-Aug								3	2.1670	0.6009	1.0000	0.5774	0.4615
15-Aug								12	3.4580	0.6527	0.7500	0.2787	0.2169
16-Aug	*							42	3.9290	0.1683	1.2619	0.2047	0.3212
17-Aug	*	6	4.5000	0.6455	1.3333	0.5578	0.2963	21	3.4290	0.4760	0.9048	0.2059	0.2639
18-Aug		4	2.5000	0.6124	2.0000	0.5774	0.8000	11	3.8640	0.2868	0.7273	0.3042	0.1882
19-Aug								21	4.6670	0.3673	0.7143	0.1844	0.1531
20-Aug													

APPENDIX B  
Escapement data.

Appendix Table B1. Escapement of salmon by day through Russian River Weir, 1986.<sup>1</sup>

Date	Early Run Sockeye	Late Run Sockeye	Coho	Chinook
6/15	1			
6/16	0			
6/17	5			
6/18	1			
6/19	5			
6/20	27			
6/21	149			
6/22	60			
6/23	365			
6/24	49			
6/25	337			
6/26	124			
6/27	205			
6/28	23			
6/29	1,896			
6/30	922			
7/01	2,854			
7/02	1,770			
7/03	2,613			
7/04	1,362			
7/05	2,002			
7/06	4,684			
7/07	5,010			
7/08	2,557			
7/09	2,515			
7/10	1,958			
7/11	807			
7/12	1,333			
7/13	782			
7/14	333			
7/15	60			
7/16	153			
7/17	206			
7/18	159			
7/19	184			
7/20	133			
7/21	17			
7/22	87	5		
7/23	76	136		
7/24	79	265		
7/25	7	29		1
7/26	64	359		2
7/27	105	430		0
7/28	4	67		0
7/29	30	352		0

-Continued-

Appendix Table B1. Escapement of salmon by day through Russian River Weir, 1986<sup>1</sup> (continued).

Date	Early Run Sockeye	Late Run Sockeye	Coho	Chinook
7/30	22	130		1
7/31	20	321	1	0
8/01	5	100	0	0
8/02	30	272	0	0
8/03	5	38	0	1
8/04		3,884	3	3
8/05		4,619	3	2
8/06		3,328	4	1
8/07		2,359	3	3
8/08		2,753	13	2
8/09		3,368	7	3
8/10		267	0	0
8/11		635	5	2
8/12		2,683	16	8
8/13		2,148	27	5
8/14		1,867	49	8
8/15		1,066	45	0
8/16		582	26	1
8/17		1,325	90	1
8/18		237	1	0
8/19		465	31	0
8/20		337	21	0
8/21		510	36	0
8/22		454	26	0
8/23		426	24	2
8/24		325	15	1
8/25		47	1	0
8/26		416	15	0
8/27		955	61	3
8/28		883	47	2
8/29		480	59	0
8/30		284	39	0
8/31		315	58	0
9/01		275	128	0
9/02		74	35	0
9/03		206	153	0
9/04		115	84	0
9/05		54	63	0
9/06		22	2	0
9/07		51	94	0
9/08		103	529	0
Totals	36,195	40,422	1,814	52

<sup>1</sup> From 7/22 through 8/03, early run fish were enumerated separately from late run fish based on degree of maturation.

APPENDIX C

Age, sex, and length data.

Appendix Table C1. Age and sex composition of early run sockeye salmon through the Russian River Weir, 1986.

-----									
Age Class									
-----									
6/15-7/06	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	Total
-----									
<b>Males</b>									
Sample Number	0	78	0	21	37	10	0	0	146
Percent	0.0	25.2	0.0	6.8	12.0	3.2	0.0	0.0	47.2
Escapement	0	4,911	0	1,322	2,329	630	0	0	9,192
<b>Females</b>									
Sample Number	0	85	0	26	38	14	0	0	163
Percent	0.0	27.5	0.0	8.4	12.3	4.5	0.0	0.0	52.8
Escapement	0	5,351	0	1,637	2,392	881	0	0	10,262
<b>Sexes Combined</b>									
Sample Number	0	163	0	47	75	24	0	0	309
Percent	0.0	52.8	0.0	15.2	24.3	7.8	0.0	0.0	100.0
Escapement	0	10,262	0	2,959	4,722	1,511	0	0	19,454
Standard Error	0	553	0	398	475	297	0	0	
-----									
Age Class									
-----									
7/07--8/03	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	Total
-----									
<b>Males</b>									
Sample Number		24		10	20	7			61
Percent	0.0	15.0	0.0	6.3	12.5	4.4	0.0	0.0	38.1
Escapement	0	2,511	0	1,046	2,093	732	0	0	7,417
<b>Females</b>									
Sample Number		29		7	46	17			99
Percent	0.0	18.1	0.0	4.4	28.8	10.6	0.0	0.0	61.9
Escapement	0	3,034	0	732	4,813	1,779	0	0	12,037
<b>Sexes Combined</b>									
Sample Number	0	53	0	17	66	24	0	0	160
Percent	0.0	33.1	0.0	10.6	41.3	15.0	0.0	0.0	100.0
Escapement	0	5,545	0	1,779	6,906	2,511	0	0	16,741
Standard Error	0	625	0	409	654	474	0	0	
-----									
Age Class									
-----									
Total									Total
Early Run	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	Total
-----									
<b>Males</b>									
Escapement	0	7,422	0	2,368	4,422	1,362	0	0	15,574
Percent	0.0	20.5	0.0	6.5	12.2	3.8	0.0	0.0	43.0
<b>Females</b>									
Escapement	0	8,385	0	2,369	7,205	2,660	0	0	20,619
Percent	0.0	23.2	0.0	6.5	19.9	7.3	0.0	0.0	57.0
<b>Sexes Combined</b>									
Escapement	0	15,807	0	4,737	11,627	4,022	0	0	36,193
Percent	0.0	43.7	0.0	13.1	32.1	11.1	0.0	0.0	100.0
-----									

Appendix Table C2. Age and sex composition of late run sockeye salmon through the Russian River Weir, 1986.

7/22-8/10	Age Class								Total
	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	
<b>Males</b>									
Sample Number	0	10	0	8	42	5	7	0	72
Percent	0.0	5.9	0.0	4.7	24.9	3.0	4.1	0.0	42.6
Escapement	0	1,366	0	1,093	5,736	683	956	0	9,834
<b>Females</b>									
Sample Number	1	11	1	11	67	6	0	0	97
Percent	0.6	6.5	0.6	6.5	39.6	3.6	0.0	0.0	57.4
Escapement	137	1,502	137	1,502	9,151	819	0	0	13,248
<b>Sexes Combined</b>									
Sample Number	1	21	1	19	109	11	7	0	169
Percent	0.6	12.4	0.6	11.2	64.5	6.5	4.1	0.0	100.0
Escapement	137	2,868	137	2,595	14,887	1,502	956	0	23,082
Standard Error	137	587	137	563	852	439	355	0	

8/11-8/21	Age Class								Total
	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	
<b>Males</b>									
Sample Number	0	1	0	2	37	7	46	1	94
Percent	0.0	0.5	0.0	1.1	19.6	3.7	24.3	0.5	49.7
Escapement	0	63	0	125	2,321	439	2,885	63	5,896
<b>Females</b>									
Sample Number	0	4	0	2	72	17	0	0	95
Percent	0.0	2.1	0.0	1.1	38.1	9.0	0.0	0.0	50.3
Escapement	0	251	0	125	4,516	1,066	0	0	5,959
<b>Sexes Combined</b>									
Sample Number	0	5	0	4	109	24	46	1	189
Percent	0.0	2.6	0.0	2.1	57.7	12.7	24.3	0.5	100.0
Escapement	0	314	0	251	6,837	1,505	2,885	63	11,855
Standard Error	0	139	0	124	427	288	371	63	

8/22-9/08	Age Class								Total
	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	
<b>Males</b>									
Sample Number	0	0	0	1	18	1	36	0	56
Percent	0.0	0.0	0.0	1.0	18.8	1.0	37.5	0.0	58.3
Escapement	0	0	0	57	1,028	57	2,057	0	3,200
<b>Females</b>									
Sample Number	0	0	0	0	30	10	0	0	40
Percent	0.0	0.0	0.0	0.0	31.3	10.4	0.0	0.0	41.7
Escapement	0	0	0	0	1,714	571	0	0	2,285
<b>Sexes Combined</b>									
Sample Number	0	0	0	1	48	11	36	0	96
Percent	0.0	0.0	0.0	1.0	50.0	11.5	37.5	0.0	100.0
Escapement	0	0	0	57	2,743	628	2,057	0	5,485
Standard Error	0	0	0	57	281	179	272	0	

Total Late Run	Age Class								Total
	1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1	
<b>Males</b>									
Escapement	0	1,429	0	1,275	9,085	1,179	5,898	63	18,929
Percent	0.0	3.5	0.0	3.2	22.5	2.9	14.6	0.2	46.8
<b>Females</b>									
Escapement	137	1,753	137	1,629	15,381	2,456	0	0	21,493
Percent	0.3	4.3	0.3	4.0	38.1	6.1	0.0	0.0	53.2
<b>Sexes Combined</b>									
Escapement	137	3,182	137	2,904	24,466	3,635	5,898	63	40,422
Percent	0.3	7.9	0.3	7.2	60.5	9.0	14.6	0.2	100.0

Appendix Table C3. Age and sex composition of spawned sockeye salmon sampled downstream from the Russian River Weir, 1986.

	Age Class						Total
	1.4	2.3	1.3	2.2	1.2	2.1	
<b>Males</b>							
Sample Number	0	26	104	13	26	0	169
Percent	0.0	5.9	23.6	3.0	5.9	0.0	38.4
<b>Females</b>							
Sample Number	1	27	172	14	57	0	271
Percent	0.2	6.1	39.1	3.2	13.0	0.0	61.6
<b>Sexes Combined</b>							
Sample Number	1	53	276	27	83	0	440
Percent	0.2	12.0	62.7	6.1	18.9	0.0	100.0
Standard Error	0.2	1.6	2.3	1.1	1.9	0.0	

Appendix Table C4. Mean lengths (mm)<sup>1</sup> by age and sex of Russian River sockeye salmon, 1986.

		Age Class							
		1.4	2.3	3.2	1.3	2.2	1.2	2.1	1.1
-----									
Early Run									
Passed Weir									
Male	Mean Length		595		595	550	540		
	Std Error		1.92		2.44	3.85	5.38		
	Sample Size		102		31	57	17		
Female	Mean Length		590		585	535	525		
	Std Error		1.96		3.71	2.37	4.83		
	Sample Size		114		33	84	31		
-----									
Late Run									
Passed Weir									
Male	Mean Length		605		610	545	535	380	350
	Std Error		6.61		6.11	3.49	9.85	2.59	
	Sample Size		11		11	97	13	89	1
Female	Mean Length	615	580	545	590	535	520		
	Std Error		6.06		4.95	2.22	3.74		
	Sample Size	1	15	1	13	169	33		
-----									
Downstream									
From Weir									
Male	Mean Length		610		600	540	535		
	Std Error		4.34		2.72	7.65	5.11		
	Sample Size		26		104	13	26		
Female	Mean Length	605	565		565	505	505		
	Std Error		3.57		1.52	9.15	3.84		
	Sample Size	1	27		172	14	57		

<sup>1</sup> Mid-eye-to-fork length