

## RESEARCH PROJECT SEGMENT

*State:* Alaska

*Project No.:* F-9-3

*Name:* Sport Fish Investigations of Alaska.

*Study No.:* G-11

*Study Title:* Sport Fish Studies.

*Job No.:* G-11-G

*Job Title:* Studies on the Russian River Red Salmon Sport Fishery.

*Period Covered:* July 1, 1970 to June 30, 1971.

## ABSTRACT

A creel census on the Russian River during a fly-only season revealed an estimated 6,350 red salmon, Oncorhynchus nerka, were harvested by 10,700 man-days of effort. Early and late runs contributed 5,750 and 600 red salmon, respectively, to the catch. The seasonal rate of success was 0.12 red salmon per hour.

Early- and late-run escapements were 5,450 and 28,200 red salmon, respectively. Sampling at the Lower Russian Lake weir revealed that age class 2.3 dominated the early run and age 2.2 the late run.

A tag-and-recovery experiment to assess mortality associated with an anti-snagging regulation suggested that most red salmon survive after being hooked and released. The sport fishery recaptured 34.3% of the tagged early-run fish and 5.8% of the late-run fish. Salmon tagged during the early run migrated through the sport fishery slower (14 days) than late fish (6 days).

## RECOMMENDATIONS

Retain present objectives of the study with emphasis directed toward the following:

1. Initiate a tagging study at the weir to determine the spawning distribution of early- and late-run red salmon in the Russian River drainage.
2. Determine the spawning area of Upper Russian Creek.

## OBJECTIVES

1. To collect and analyze biological data concerning abundance of adult red salmon in the Russian River drainages.
2. To investigate racial characteristics and age composition of adult and juvenile red salmon.
3. To determine the sport and commercial harvest of Russian River red salmon.
4. To determine the magnitude of delayed mortality resulting from an anti-snagging (hook and release) regulation.
5. To evaluate current regulations on the sport fishery and to provide recommendations for future management and research.

## TECHNIQUES USED

The 1970 Russian River creel census was a modification of the method described by Neuhold and Lu (1957). Sampling procedures were identical to those outlined by Engel (1965), except fisherman counts were increased to include four of five weekdays.

Escapements were enumerated at a temporary weir located approximately 100 yards downstream from Lower Russian Lake. The weir was constructed of wooden picket panels anchored in position by weighted tripods. A 10' x 12' cabin of tongue and groove cedar construction was erected adjacent to the weir to quarter weir attendants.

A Floy tag applicator utilizing FD-67F internal anchor tags was used in the tagging experiment. All tags were inserted in the left-side musculature immediately below the dorsal fin. The T-bar of the 2 1/2-inch long tag was positioned beyond the interneural bones of the dorsal fin. The adipose fin was excised from each tagged salmon.

Creel census clerks examined sport-caught salmon whenever possible for evidence of tag loss. A substantial portion of the catch was not examined because angler traffic past creel census check points was frequently of such a magnitude that complete observation of the catch was not possible. No attempt was made to assess tag loss at the Lower Russian Lake weir.

## FINDINGS

Russian River red salmon, *Oncorhynchus nerka*, fishery studies have been presented in Alaska Department of Fish and Game, Federal Aid In Fish Restoration, Annual Reports of Progress by Lawler (1963; 1964) and Engel (1965 through 1970). Research activities during recent years have been directed toward developing and evaluating regulatory measures to eliminate snagging, a common angling practice since the inception of the fishery. A single-hook restriction in 1965 and a fly-only regulation in 1966 were transitional attempts toward establishing an aesthetically acceptable fishery. In 1967, the fly-only requirement was supplemented with a foul-hook regulation which required that any fish hooked elsewhere than in the head, mouth or gills be immediately released.

### Creel Census

In accordance with the anti-snagging philosophy, both the fly-only and foul-hook provisions remained mandatory in 1970. A creel census to evaluate these regulations and measure harvest and effort was active from June 11 through July 3, 1970, and from July 24 through July 27, 1970. The census sampled the entire red salmon fishing effort. Projected fisherman counts yielded estimates of 10,700 man-days of effort, or a total of 51,310 angler-hours. Based on interviews with 7,259 fishermen who caught 4,286 salmon, the seasonal harvest was estimated to be 6,350 red salmon. The early and late runs contributed 5,750 and 600 salmon, respectively, to this catch. The mean rate of success was 0.12 red salmon per hour. Table 1 summarizes fishing effort, harvest, and rate of success since 1962.

TABLE 1 Red Salmon Sport Harvest, Effort, and Rate of Success, Russian River, 1962-1970.

Year	Harvest			Effort (Man-Days)	Catch/ Hr.	Census Period
	Early Run	Late Run	Total			
1962	3,410	1,290	4,700	6,595	0.22	6/15-8/12
1963	3,670	1,390	5,060	7,880	0.19	6/ 8-8/15
1964	4,970	1,885	6,855	4,940	0.31	6/20-8/16

TABLE 1 (Cont.) Red Salmon Sport Harvest, Effort, and Rate of Success, Russian River, 1962-1970.

Year	Harvest			Effort (Man-Days)	Catch/ Hr.	Census Period
	Early Run	Late Run	Total			
1965	7,760	2,940	10,700	8,320	0.25	6/15-8/15
1966	16,360	5,460	21,820	17,890	0.21	6/15-8/15
1967	8,500	3,640	12,140	16,470	0.13	6/10-8/15
1968	8,250	4,480	12,730	17,300	0.13	6/10-8/15
1969	5,430	1,100	6,530	13,970	0.09	6/ 7-8/15
1970	5,750	600	6,350	10,700	0.12	6/11-7/27*

\*Census was active from June 11 through July 3 and from July 24 through July 27.

During the 1970 census an estimated 175 Dolly Varden, Salvelinus malma, 37 rainbow trout, Salmo gairdneri, 12 round whitefish, Prosopium cylindraceum, 2 silver salmon, O. kisutch, and 2 Arctic grayling, Thymallus arcticus, were caught incidental to red salmon.

Differences between weekday and weekend fishing pressures and success rates were consistent with past information collected at the Russian River. Fifteen weekday and 16 weekend counts averaged 88.7 and 110.1 anglers, respectively. Anglers fished an average of 4.8 hours on weekdays and 4.7 hours on weekend days. The mean catch per hour was higher on weekdays (0.14) than weekends (0.10). A comparison of fishery statistics for recent years is presented in Table 2.

TABLE 2 Differences between Weekday and Weekend Day Fishing Pressures and Success Rates, Russian River, 1964-1970.

Year	Fisherman Counts		Catch/Hr.		Hrs. Fished	
	Weekdays	Weekend	Weekdays	Weekend	Weekdays	Weekend
		Days		Days		Days
1964	12.1	26.7	0.46	0.25	3.3	4.8
1965	19.6	64.3	0.32	0.22	4.3	5.4
1966	56.2	112.7	0.30	0.17	4.8	5.5
1967	56.8	87.9	0.17	0.09	5.3	5.6
1968	58.7	101.5	0.16	0.10	5.3	5.8
1969	53.6	87.5	0.10	0.07	4.9	5.1
1970	88.7	110.1	0.14	0.10	4.8	4.7

## Escapement

Red salmon escapements have been enumerated since 1960 by tower or weir at the outlet of Lower Russian Lake by the Commercial Fisheries Division of the Alaska Department of Fish and Game. The Lower Russian Lake site permits assessment of the runs after they have been harvested by the Cook Inlet commercial and Russian River sport fisheries. Escapements prior to 1970 averaged 50,093 and ranged from 26,470 - 65,500 red salmon (Table 3).

TABLE 3 Russian River Red Salmon Escapement Estimates and Harvest Rates, Early and Late Runs, 1960-1970.

Year	Escapement			% of Run Caught** by Sport Fishery	
	Early Run*	Late Run	Total	Early Run	Late Run
1960	9,120	34,850	43,970	--	--
1961	7,790	18,680	26,470	--	--
1962	33,300	22,370	55,670	9.3	5.5
1963	14,380	51,120	65,500	20.3	2.6
1964	12,700	46,930	59,630	28.1	3.9
1965	21,510	21,820	43,330	26.5	11.9
1966	16,660	34,430	51,090	49.5	13.7
1967	13,710	49,480	63,190	38.3	6.9
1968	9,200	48,880	58,080	47.3	8.4
1969	5,000***	28,920	34,000	52.1	3.7
1970	5,450	28,200	33,650	51.3	2.1

\*July 15 was used as the termination date for the early run.

\*\*Based on run to the Russian River, commercial harvest not considered.

\*\*\*Estimated escapement determined by foot survey of Upper Russian Creek.

In 1970, the Russian River weir operated from June 14 through August 23. The first red salmon was counted on June 17 and 271 fish passed the weir during the last day of operation. Approximately 2,000 additional red salmon were observed downstream from the weir (in the falls area) when the structure was dismantled.

The early run escapement of 5,450 red salmon, including 24 precocious males (jacks), was the lowest recorded for the Russian River. The escapement was considerably below both the 10-year mean of 14,337 and the 1964 parent escapement of 12,700 red salmon. The sport fishery, after a harvest of 5,750 red salmon (51.3% of the early run to the stream), was closed on July 4 to allow escapement. The sport fishery remained closed throughout the remainder of the early run.

Racial studies by the Commercial Fisheries Division suggest a substantial number of early Russian River red salmon were harvested during the first three commercial fishing periods in 1970. Scale analysis of set net caught salmon on June 17, 20, and 22 between Ninilchik and Boulder Point revealed approximately 62% were of Russian River origin. The 1970 commercial harvest of early Russian River red salmon, including set and drift gill net catches, was estimated to be 2,600.

The total 1970 early run, including escapement, commercial and sport catches, was estimated to be 13,800 red salmon. This was well below the 1964 escapement and sport catch of 17,670 red salmon. The Cook Inlet commercial fishery did not harvest an appreciable number of early-run Russian River red salmon during the parent year because the season opened on June 25, after the salmon had migrated through the fishery.

The late-run red salmon escapement of 28,200, including 2,542 jacks, was slightly higher than the 1965 parent escapement of 21,820 but below the previous 10-year average of 35,748. From July 24 through July 27, the sport fishery harvested an estimated 600 salmon from the late run. The fishery was closed for the duration of the late run to permit escapement.

The Commercial Fisheries Division's scale analysis revealed that six-year-old fish comprised 87.1% of the early run, whereas 89.0% of the late-run escapement consisted of five-year-old salmon. Both runs were dominated by fish that had migrated to sea after two winters in fresh water. A summary of age classes by sexes is shown in Table 4. The male-to-female sex ratios for 399 early and 720 late red salmon were 1:0.8 and 1:1.0, respectively.

TABLE 4 Age Analysis of Red Salmon Escapements Past the Lower Russian Lake Weir, 1970.

	<u>Age Class</u>	<u>Sample Size</u>	<u>Parent Year</u>	<u>% of Sample</u>
Early Run:	1.2	1	1966	0.4
	2.2	25	1965	8.9
	2.3	243	1964	87.1
	2.4	10	1963	3.6
Late Run:	1.2	5	1966	2.4
	1.3	6	1965	2.9
	2.1	3	1966	1.4
	2.2	179	1965	86.1
	2.3	15	1964	7.2

A total of 957 silver salmon and 240 king salmon, O. tshawytscha, were also enumerated at the weir. The period of weir operation permitted total enumeration of king salmon and a partial silver salmon count. During the last day of operation 101 silver salmon passed the weir.

### Tagging Studies

Approximately 42.5% (4,690) of the salmon landed in 1970 were reported released because they were illegally hooked. This is slightly greater than in 1967, 1968, and 1969 when snagged salmon comprised 40.5, 37.9, and 36.2% of the respective catches. In 1970, flies were attached to 241 (0.7% of the escapement) salmon passing the weir. Eighty percent of the flies were imbedded in locations other than in the head, mouth, or gills. The anti-snagging regulation, because it substantially affects the fishery, has remained controversial since its adoption in 1967. Delayed mortality is a prime concern of those opposed to the regulation.

A tag-and-recovery experiment initiated in 1969 was continued in 1970 to determine the existence of mortality factors associated with hooking and releasing red salmon. The 1969 investigation provided little insight on hook-and-release mortality because most of the early run passed undetected through the weir at Lower Russian Lake.

All 1970 tagging was confined to the confluence of the Kenai-Russian rivers from June 14 through July 3 and from July 24 through July 26. The junction of the two rivers was the only site where a substantial number of salmon could be tagged. Eighty-two percent of the fishing effort was recorded at this location. Tagging at the confluence, however, injected an unavoidable unknown into the data because red salmon not of Russian River origin pass through this section of the fishery. The vastness of the upper Kenai River drainage and the glacial condition of much of the water precluded a meaningful tag-recovery program to assess the magnitude of stock mixture at the tagging site.

Tags were applied to 554 early-run salmon snagged, landed, and released by fishery participants. Sixty-four percent of these fish were recovered: 190 were estimated recaptured in the sport fishery; 157 passed through the Russian River weir; 2 were found dead; 2 were known to have lost their tags; and 1 fish was found in Quartz Creek, located 11 miles east of the Russian River.

Fifty-two red salmon were tagged during the late run. Seventy-seven percent of these fish were recovered: 37 at the weir and 3 by the sport fishery.

Despite deficiencies, the study indicated most red salmon survive after being foul-hooked. Whether snagged salmon spawn normally after reaching their natal stream is a question requiring further investigation.

Failure to account for all tags could be attributed to any or all of the following: mortality due to hooking and releasing, tag loss, creel census error, a lack of detection at the weir, and tagging fish not of Russian River origin.

The intense fishing pressure on the early run is reflected by a significant recapture of tagged fish. The sport fishery recovered 23.6 and 1.6% of the tagged early fish in 1969 and 1970, respectively. This differed sharply from the 5.8% recovery of late-run fish in 1970. The disparity in early- and late-run harvest rates may, in part, be explained by less angling effort on the late run because of a shorter season. However, the tagging study also suggested the late fish were less vulnerable to capture because they migrated through the fishery more rapidly than early fish. Most late fish arrived at the weir within six days after being tagged, whereas, 14 days lapsed before the majority of the early fish passed the weir.

### Collaneous Studies

In recent years effort and catch have varied with the abundance of red salmon returning to the Russian River system. Emergency fishing closures, promulgated when runs were deficient, have provided additional escapement or complete elimination of angling participation. Weak runs in 1970 necessitated curtailment of the Russian River fishery during nearly 60% of the season.

Closure of the fishery, while at times unavoidable, is a management measure that should be used with discretion because of its drastic impact on recreational opportunity. Creel census data was examined from 1967 to 1970 to evaluate alternate methods of assuring escapement during low runs. With the exception of closures in 1969 and 1970, regulations governing the fishery have remained unchanged during the past four years. Run size and catch have varied considerably during this period (Tables 1 and 3).

Prior creel census data indicates 7.2 - 12.8% of the fishermen catch the three fish daily limit, whereas 7.1 - 10.1% of the anglers catch two or more salmon. Anglers catching one salmon per day comprise approximately 11.0% of the seasonal effort. The majority of the fishermen, 55.8 - 65.0%, fail to catch one salmon per man-day of effort. A summary of the catch distribution by runs and years are presented in Table 5.

TABLE 5 Distribution of Red Salmon Catch, Russian River, 1967-1970.

Year	No. Anglers Interviewed	% of Effort				
		No Salmon	One Salmon	Two Salmon	Three Salmon	
1967	Early run	730	62.0	21.0	7.8	9.2
	Late run	295	48.1	21.0	12.6	18.3
	Combined	1,025	58.0	21.0	9.2	11.8

TABLE 5 (Cont.) Distribution of Red Salmon Catch, Russian River, 1967-1970.

Year		No. Anglers Interviewed	% of Effort			
			No Salmon	One Salmon	Two Salmon	Three Salmon
1968	Early run	1,101	62.3	20.0	8.4	9.3
	Late run	617	44.2	23.7	13.3	18.8
	Combined	1,718	55.8	21.3	10.1	12.8
1969	Early run	966	64.4	21.0	7.1	7.5
	Late run	198	68.2	18.7	7.1	6.0
	Combined	1,164	65.0	20.7	7.1	7.2
1970	Early run	1,313	61.0	19.5	8.8	10.7
	Late run	117	59.0	24.8	7.7	8.5
	Combined	1,430	60.8	19.9	8.7	10.6
Mean	Early run		62.4	20.4	8.0	9.2
	Late run		54.9	22.0	10.2	12.9
	Combined		59.9	20.7	8.8	10.6

Creel census analysis suggest that daily limits of one and two red salmon would have reduced past seasonal harvests about 43 and 15% respectively. Approximately 80% of the fishery participants would not have been affected if the limit was reduced to one salmon. The theoretical reduction in harvest by runs and years are shown in Table 6.

TABLE 6 Theoretical Percent Reduction of Harvest if Daily Limits were Reduced to One and Two Red Salmon.

Year		% Reduction of Catch	
		Two Fish Limit	One Fish Limit
1967	Early run	14.3	40.8
	Late run	18.1	48.7
	Combined	15.8	43.9
1968	Early run	14.4	41.8
	Late run	17.6	47.7
	Combined	16.0	44.6
1969	Early run	12.9	38.2
	Late run	11.9	37.6
	Combined	12.8	38.1

TABLE 6 (Cont.) Theoretical Percent Reduction of Harvest if Daily Limits were Reduced to One and Two Red Salmon.

<u>Year</u>		<u>% Reduction of Catch</u>	
		<u>Two Fish Limit</u>	<u>One Fish Limit</u>
1970	Early run	15.4	44.1
	Late run	13.0	37.7
	Combined	15.2	43.6
Mean	Early run	14.3	41.2
	Late run	15.2	42.9
	Combined	15.0	42.6

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