

STATE OF ALASKA

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Annual Progress Report for

STUDIES ON THE RUSSIAN RIVER
RED SALMON SPORT FISHERY

by

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RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-4 *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, 1971 to June 30, 1972.

ABSTRACT

A creel census on the Russian River during a fly-only fishery revealed an estimated 13,450 red salmon, Oncorhynchus nerka, were harvested by 15,100 man-days of effort. Early and late runs contributed 2,750 and 10,700 red salmon, respectively, to the catch. The mean rate of success was 0.08 fish per hour during the early run and 0.29 salmon per hour for the late run.

Mortalities attributed to a velocity barrier in the Russian River Falls are discussed.

Examination of escapements after they had passed through the sport fishery revealed that 63.3% of the early fish incurred hook injuries whereas 11.6% of the late run displayed similar wounds. A tagging experiment suggested that many severely wounded fish perished before spawning.

RECOMMENDATIONS

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

1. Continue tagging experiment to assess mortalities associated with an anti-snagging regulation.
2. Close the confluence of the Kenai-Russian rivers from June 1 through June 30 to reduce molestation and harvest of early red salmon.
3. Construct a fishway at the Russian River Falls.

OBJECTIVES

1. To collect and analyze biological data concerning abundance of adult red salmon in the Russian River drainages.
2. To determine 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 Russian River creel census was a modification of the method described by Neuhold and Lu (1957). Sampling procedures followed those outlined by Engel (1965) except that fisherman counts were not conducted during the periods 0200-0600 and 1800-2200. The effort occurring during the eliminated periods, based on past data, was assumed to be 22.2 and 23.4% during the early and late runs, respectively. Fisherman counts in the confluence area were also increased to four daily.

Escapements were enumerated by a temporary weir located approximately 60 yards downstream from Lower Russian Lake. The weir was constructed of wooden picket panels anchored by weighted tripods.

A Floy tag applicator utilizing FD-67F internal anchor tags was used in the tagging experiment at the confluence of the Kenai-Russian rivers. 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.

Petersen disc tags, one inch in diameter, were used for all tagging experiments conducted at the Russian River weir. The numbered tags were attached immediately below the dorsal fin with nickel-plated pins.

Severity of hook wounds was designated as superficial, moderate, or severe. Wound(s) penetrating the dermis but with little damage to muscle tissue were classified as superficial. Injuries that damaged muscle tissue were classified as moderate. Included in this category were fish with damaged eyes, torn jaws, and extensive fin damage. Severely injured fish were those with multiple muscle tissue wounds and/or injuries extending into the body cavity.

FINDINGS

Russian River red salmon, Oncorhynchus nerka, studies have been presented in Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Progress Reports by Lawler (1963; 1964) and Engel (1965 through 1971). Research activities during recent years have been directed toward 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 ethically 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. A historical review of Russian River regulatory requirements has been presented by Engel (1967).

Management

Management of the Russian River sport fishery was hindered in 1971 by unusual water conditions which affected both early and late red salmon runs. A sonar unit operated in the lower Kenai River by the Department's Commercial Fisheries Division provided an initial indication of the magnitude of the early run. Through June 14, the unit indicated that 18,290 salmon had passed upstream. These data suggested a run comparable in size to the 1965 brood year. The salmon did not arrive at the Russian River, however, until June 19, some 10 to 12 days later than normal.

The usual procedure of comparing angler catch rates with data from previous years provided little immediate insight as to relative run size because of the late arrival. As the number of salmon began to build at the confluence of the Kenai-Russian rivers, the usual resting area for early red salmon, accumulated angler catch rates suggested that the run was not as large as predicted by the sonar unit. Extremely high stream flows further complicated an assessment of the run because as the fish began to pass through the sport fishery, they were unable to negotiate a series of falls located about 300 yards downstream from the Department's counting weir.

The small run, coupled with fish passage problems at the falls, necessitated an emergency closure on July 7. The Russian River remained closed to red salmon fishing for 15 days. During this period a fish rescue operation was initiated because of the persisting blockade in the falls. Capturing salmon in the turbulent waters of the falls was a major deterrent to the operation with 531 salmon being manually packed over the obstruction.

After the arrival of the late run, sport fishing reopened for red salmon on July 31. While the run was in progress heavy rains again increased flows to such an extent that velocities within the falls precluded fish passage.

Blocked salmon massed below the obstruction for more than a mile downstream and were extremely vulnerable to capture in the upper portion of the sport fishery.

On August 11 the upper section of the sport fishery from the Homer Electric transmission line crossing to a point 600 yards below the Russian River Falls, was closed to red salmon fishing to protect the concentrated fish. The closure remained in effect throughout the remainder of the season.

Creel Census

In accordance with the anti-snagging philosophy, both the fly-only and foul-hook requirements remained mandatory during 1971. A creel census to evaluate these regulations, and to measure harvest and effort was active from June 17 through July 7 and from July 31 through August 20. The census sampled the entire red salmon fishing effort. Projected fisherman counts yielded estimates of 15,100 man-days of effort or a total of 70,865 angler-hours. Based on interviews with 3,836 fishermen who caught 2,607 salmon, the combined harvest from both runs was estimated at 13,450 red salmon. The early and late runs contributed 2,750 and 10,700 salmon, respectively, to this catch. The mean rate of success was 0.08 red salmon per hour for the early run and 0.29 salmon per hour during the late run. Table I summarizes fishing effort, harvest, and rate of success since 1962.

During the census an estimated 284 Dolly Varden, Salvelinus malma, 72 rainbow trout, Salmo gairdneri, 8 round whitefish, Prosopium cylindraceum, 42 silver salmon, O. kisutch, and 4 Arctic grayling, Thymallus arcticus, were caught incidental to red salmon.

TABLE 1 Red Salmon Harvest, Effort and Rate of Success on the Russian River, 1962-71.

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
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*
1971	2,750	10,700	13,450	15,100	0.13	6/17-8/20**

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

**Census active from June 17 through July 7, and from July 31 through August 20.

Differences between weekday and weekend fishing pressures and success rates were similar to past information collected at the Russian River. Weekday and weekend fisherman counts averaged 94.8 and 165.4 fishermen, respectively. The counts also indicated that 79.1% of anglers fished the confluence area during the early run whereas only 27.8% of the fishermen occupied this portion of the fishery during the late run. Anglers fished an average of 5.0 hours on weekdays and 5.3 hours on weekend days. The catch per hour averaged higher on weekdays (0.15) than on weekends (0.11) because of the greater weekend congestion on the stream. A comparison of fishing statistics for recent years are presented in Table 2.

TABLE 2 Differences Between Weekday and Weekend Day Fishing Pressures and Rates of Success at the Russian River, 1964-1971.

Year	Fisherman Counts		Catch/Hr.		Hrs. Fished	
	Week- days	Weekend days	Week- days	Weekend days	Week- days	Weekend 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
1971	94.8	165.4	0.15	0.11	5.0	5.3

A total of 134 parties, consisting of 377 anglers and 126 non-anglers, were randomly interviewed throughout the season to provide additional insight on various aspects of the fishery. The average party was composed of 3.7 individuals of which 2.8 were fishermen. Anglers fished an average of 2.3 days per trip.

Seventy-six percent of the interviewees had resident fishing licenses. Military personnel and civilians comprised 55 and 45% of the resident sample, respectively. Of the non-resident license holders, 27% were military personnel living in Alaska, 6% civilians residing in the state and 67% out-of-state visitors. Tourists, therefore, comprised 16% of the anglers utilizing the fishery. Extensive closure of the fishery during July, the peak of the tourist season, undoubtedly reduced participation by out-of-state visitors in 1971.

Ninety-four percent of the anglers living in Alaska listed the Anchorage area as their residence. The types of overnight lodging utilized by participants in the fishery were as follows: pickup camper 31%, personal domicile 31%, camp trailer 21%, tent 15%, and commercial facilities 2%.

Escapement

Red salmon escapements have been enumerated since 1960 by tower or weir at the outlet of Lower Russian Lake. The location of the weir site permits assessment of the runs after they have been harvested by the Cook Inlet commercial and Russian River sport fisheries. Prior to 1971, escapements past the weir averaged 48,598 and ranged from 26,470 - 65,500 red salmon (Table 3).

In 1971, the Russian River weir operated from June 23 through September 7. The first red salmon was counted on July 6 and 17 fish passed the weir during the last day of operation.

The early run escapement of 2,654 salmon was the lowest recorded for the Russian River. The escapement was considerably below the previous 10-year mean of 13,970 and the 1965 parent escapement of 21,510 red salmon.

Racial studies by the Commercial Fisheries Division suggest that relatively few early Russian River red salmon were harvested during the initial commercial fishing periods in 1971. The commercial catch of early salmon between Ninilchik and Boulder Point was estimated to be 1,300 (19% of run). The total early run in 1971 (escapement, commercial and sport catches) of 6,700 red salmon was significantly below the parent run of 29,270.

The late red salmon weir count of 54,430, including 1,429 jacks, was the largest recorded at the Russian River. The return was substantially higher than either the 1965 or 1966 escapements of 21,820 and 34,430 red salmon.

TABLE 3 Russian River Red Salmon Escapement Estimates and Harvest Rates for Early and Late Runs, 1960-71.

Year	Escapement			Percentage 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
1971	2,650	54,430	57,080	50.1	16.4

*Based on escapements passed the weir; commercial harvest and fish spawning downstream from the weir were not considered.

**Escapement determined by foot survey of Upper Russian Creek.

Foot surveys indicated that about 10,000 additional salmon utilized Lower Russian River spawning areas. This is comparable to the number of late fish that spawned downstream from the weir in 1966. In addition, an estimated 10,000-12,000 red salmon perished below the falls during the high water period.

The total late run into the Russian River system, including sport catch, escapement and mortality at the falls, was approximately 85,000 red salmon. Data are not available regarding the late run's contribution to the Cook Inlet commercial fishery.

Scale analysis by the Commercial Fisheries Division revealed that six-year-old fish comprised 89.3% of the early run, whereas, 66.1% of the late-run consisted of five-year-old salmon. Both runs were dominated by fish that had migrated seaward after two winters in freshwater. A summary of age classes is shown in Table 4. The male-to-female sex ratios for 400 early and 1,274 late red salmon were 1:1.1 and 1:0.9.

TABLE 4 Age Analysis of Red Salmon Escapements Past the Lower Russian Lake Weir, 1971.

	<u>Age Class</u>	<u>Sample Size</u>	<u>Parent Year</u>	<u>% Sample</u>
Early Run	1.2	2	1967	1.1
	1.3	6	1966	3.2
	2.2	12	1966	6.4
	2.3	168	1965	89.3
Late Run	1.2	4	1967	1.9
	1.3	11	1966	5.2
	2.1	2	1967	1.0
	2.2	128	1966	60.9
	2.3	63	1965	30.0
	3.3	2	1964	1.0

A total of 839 silver salmon and 21 king salmon, *O. tshawytscha*, were also enumerated at the weir. The period of weir operation permitted total king salmon enumeration and a partial silver salmon count. During the last two days of operation 201 silvers passed the weir.

Russian River Falls

The Russian River, after leaving Lower Russian Lake, passes through a rocky canyon of considerable gradient. The restricted river channel and the rapid rate of descent creates extreme currents at several locations within the canyon. Passage through the area, commonly called the Russian River Falls, is difficult for salmon at all water stages.

During the past decade early Russian River red salmon have been delayed in the canyon on several occasions. Annual discharge records show that peak flows normally occur during the early migration. cursory observations have suggested, in some years, that the early fish have been detained for more than a week. Significant mortalities, however, have never been recorded below the obstruction. Late fish migrate through the falls during late July and early August when stream flows are usually low and passage easier.

In 1971, a late spring breakup coupled with unusually heavy summer precipitation increased flows to such an extent that velocities within the canyon blocked or partially impeded fish passage during much of the summer. Late passage of the 1971 runs is compared to normal migration patterns in Figure 1.

The blockage had a profound effect on both runs. Although the majority of the salmon eventually negotiated the obstruction considerable mortality occurred below the canyon. As each run progressed, many fish became too feeble to maintain position in the strong current and were forced downstream to quieter waters. Physiological changes, associated with advanced sexual development, accompanied their retirement to the quieter eddies. Many quiescent fish were marked with abrasive injuries.

Although a portion of the early run was known to have perished below the obstruction quantitative data are not available regarding the loss. Numerous observations during the latter stage of the blockage suggested that the mortality was probably less than the total that negotiated the barrier.

Mortalities associated with the late blockade were assessed with a carcass weir, and by visual counts downstream from the canyon. Data from both sources indicate 10,000-12,000 red salmon died below the obstruction without spawning. The data further suggests that females suffered greater mortality than males. Of 494 carcasses examined during foot surveys, 59.5% were unspawned females. Examination of 1,368 unspawned red salmon at the carcass fence revealed that 62.7% were females.

Observations at the Lower Russian Lake weir revealed that many salmon that negotiated the falls sustained abrasive injuries, and had assumed nuptial coloration during the delay. The poor condition of these fish cast doubt on their ability to spawn successfully.

Surveys on Upper Russian Lake spawning areas on September 8 and 9 confirmed that a substantial portion of the late run died before spawning. Of 286 female carcasses examined 64.4% had not spawned. Hundreds of salmon were noted listlessly swimming in shoal areas of the lake. The quiescent fish, many with extensive injuries, were less vividly colored than normal spawning red salmon.

Difficulties encountered in the Russian River Falls illustrate the need for correcting passage problems, not only during unusual years such as 1971, but during ordinary years with shorter periods of delay. The falls, because of seasonal discharge patterns, undoubtedly has its greatest influence on the early salmon. Although problematic, the obstruction may explain disparity in age structure, relative magnitudes, and bimodal characteristics of the Upper Russian River stocks.

Tagging Studies

Approximately 39.3% of the salmon landed in 1971 were reported released because they were illegally hooked. This is similar to 1967-70 mean of 38.5% foul-hooked fish. The anti-snagging regulation, because it substantially affects the fishery, has remained controversial since its adoption in

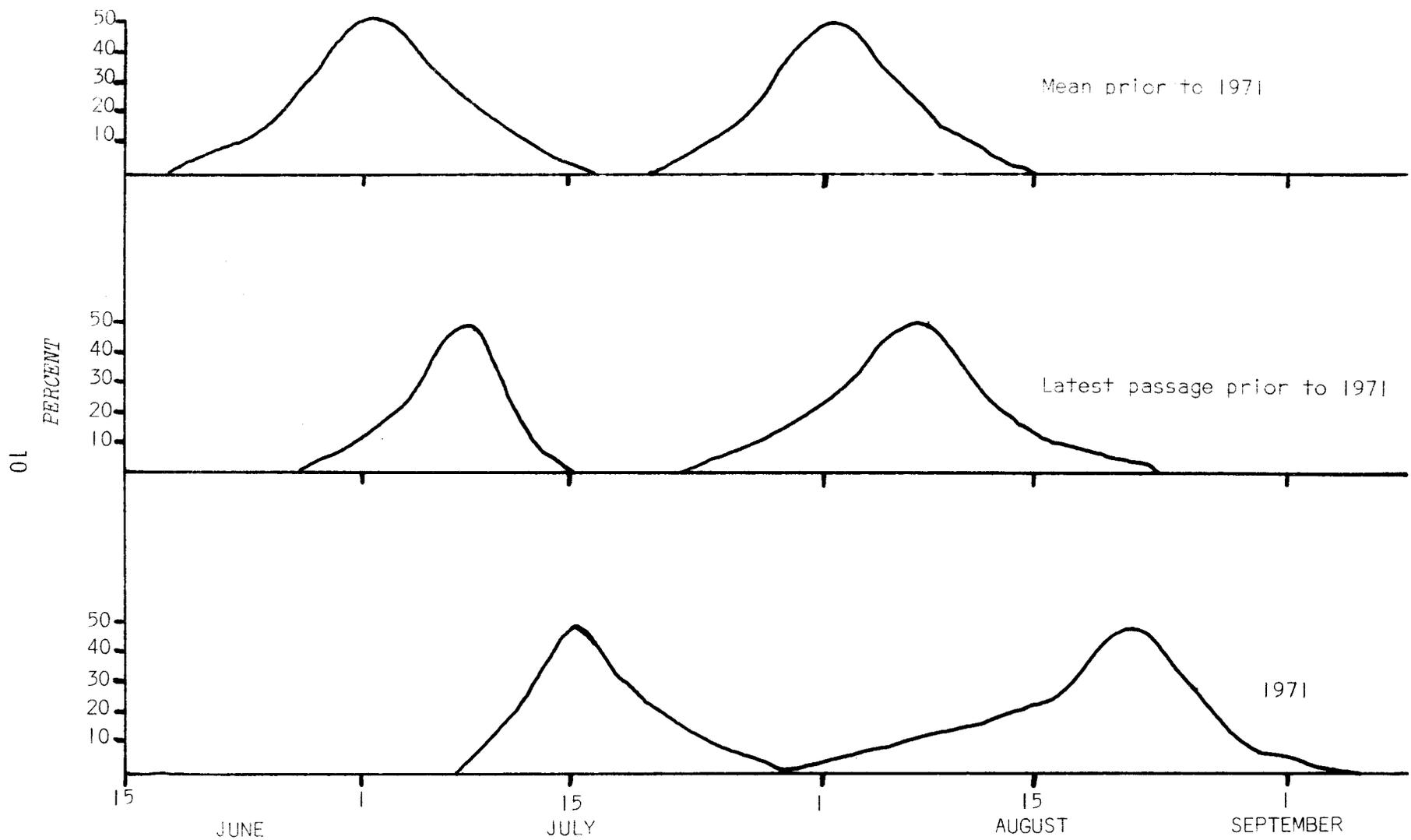


FIGURE 1 Time of Passage for Early and Late Red Salmon Runs Past the Russian River Weir, 1960-1971.

1967. Delayed mortality is a prime concern of those opposed to the regulation.

A tagging experiment was attempted at the confluence of the Kenai-Russian rivers during the early run to provide insight on hook and release mortality, and to determine migration and recapture rates. The study, however, was terminated shortly after it started because of the blockade in the falls.

The junction of the two rivers was chosen as a tagging site because 79% of the fishing effort occurred at this location in 1971. Tagging at the confluence, however, injected an unavoidable unknown into the data because red salmon not of Russian River origin pass through this portion 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.

Before termination of the study, tags were applied to 99 salmon snagged, landed, and released by participants in the fishery. Forty-four percent of these fish were recovered: 26 were estimated recaptured by the sport fishery, 15 passed the Russian River weir and 2 were found dead below the falls. This recovery was substantially lower than what was recorded during a similar study in 1970 when 66% of 554 tagged salmon were accounted for.

The significant recapture of tagged fish again reflected the intense fishing pressure on the early run. The fishery recovered 23.6, 34.6 and 29.8% of the tagged fish in 1969, 1970, and 1971, respectively. Examination of red salmon at the Lower Russian Lake weir also emphasized the heavy fishing pressure on the early run. Of 746 early fish examined 63.3% had wounds that were judged to have been caused by snagging. Twenty-three percent of these wounds were classed as moderate or severe. Of 997 late fish examined 11.6% showed hook injuries. Only 2.8% of the late fish displayed moderate or severe wounds. The reason for the marked difference in frequency of wounds in the two runs is believed related to the early run delaying at the mouth of the Russian River. Prior studies show that early fish, unlike the rapidly migrating late run, remain in the sport fishery for about two weeks. Much of this time the salmon are concentrated at the confluence where angling is intense.

All salmon examined for hook wounds were tagged to determine spawning success and distribution. The delay at the falls, in addition to the hook wounds, also substantially affected survival of all tagged fish. Tagging after the salmon had experienced the stress of the blockage undoubtedly maximized mortality associated with the hook wounds.

Of the 746 fish tagged during the early run, 69 (9.2%) were recovered from spawning areas. Tag recovery was hampered by relatively few recovery surveys, high water, and intense bear predation. Completeness of spawning could not be determined from many carcasses because of predation.

Comparison of wound classifications at the weir and on the spawning grounds suggest that unmarked and superficially wounded fish had a greater survival than moderate and severely injured salmon (Table 5). Based on

these data, a substantial number of the moderate and severely wounded fish died between the weir and the spawning grounds.

TABLE 5 Summary of Hook Injuries for Early Russian River Red Salmon, 1971.

	<u>Class Injury</u>	<u>No. of Fish</u>	<u>Percentage</u>
Weir Observations	Unmarked	274	36.7
	Superficial	300	40.2
	Moderate	123	16.5
	Severe	49	6.6
Spawning Ground Recoveries	Unmarked	30	43.5
	Superficial	30	43.5
	Moderate	6	8.7
	Severe	3	4.3

Fourteen tagged fish were also collected from the upstream face of the weir. Of these fish, 42.1% showed moderate or severe wounds.

Of 997 late fish that were tagged, only 30 were recovered. Unmarked or superficially wounded fish comprised 93.3% of the recoveries, however, 36% of the fish in these classifications had not completed spawning.

Ground, aerial and float surveys conducted in the upper Russian River drainage indicated that early spawning was confined to Upper Russian Creek, located at the south end of Upper Russian Lake. Although only 50% of the fish tagged were observed in the creek, no early salmon were noted using beach or other tributary spawning areas. The tagged-to-untagged ratio in Upper Russian Creek was similar to the tagged-to-untagged ratio at the weir.

The paucity of tag observations may have been caused by any of the following: (1) survey frequency (two week intervals) that did not adequately assess spawning turnover, (2) unrecorded mortalities caused by the blockade and/or snagging wounds, (3) undetected deep beach spawning.

An estimated 1,000 to 1,200 late red salmon utilized Upper Russian Creek concomitant with the later arriving early run. Late run spawning was virtually complete in the tributary before the peak of spawning in other areas.

Surveys during late August and early September indicated that late spawners were concentrated along the north and east beaches of Upper Russian

Lake. The terminal 100 to 200 yards of two small east-side tributaries were also heavily used by late spawners.

The Russian River, from Upper Russian Lake to a series of rapids located approximately 2-1/2 miles downstream, was also an important late run spawning area. No spawning was recorded in the portion of river between the rapids and Lower Russian Lake.

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