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Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF KENAI PENINSULA,
AND COOK INLET DRAINAGES AND FISH STOCKS

by

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations
of Alaska.

Project: F-9-12

Study No.: G-I Study Title: INVENTORY & CATALOGING

Job No.: G-I-C Job Title: Inventory and Cataloging of
Kenai Peninsula, and Cook
Inlet Drainages and Fish
Stocks.

Period Covered: July 1, 1979 to June 30, 1980

ABSTRACT

Relative growth and survival rates, determined by fall gill-netting, are presented for the rainbow trout, Salmo gairdneri Richardson, and coho salmon, Oncorhynchus kisutch (Walbaum), stocked in area lakes. Pertinent historical data regarding stocking, size, time, densities and catch rates are examined for various managed lakes.

Creel census activities on 64.4 kilometers (40 miles) of the Kenai River resulted in an estimated harvest of 39,545 fish in 126,585 man-days of effort. Harvest estimates for coho salmon, sockeye salmon, Oncorhynchus nerka (Walbaum), rainbow trout, and Dolly Varden, Salvalinus malma (Walbaum), are also presented. Angler effort during June and July was directed primarily toward chinook salmon, Oncorhynchus tshawytscha (Walbaum), although other species are harvested incidentally. After August 1, effort was directed towards coho salmon. High water prevailed during August and September which is felt to have curtailed effort during the late run coho salmon fishery, even though commercial fishing on that run had been closed.

Creel census activities during the spring (March through May) on the section of the Kenai River immediately downstream from Skilak Lake resulted in a harvest estimate of 384 rainbow trout in 929 man-days of effort.

An estimated 3,500 angler days were spent on the Anchor River during the period April 13 - April 30, 1979, and an additional 18,267 angler days during the period July 14 - November 4, 1979. Estimated harvest during the spring period was 5,700 Dolly Varden and 100 steelhead trout, Salmo gairdneri Richardson. During the fall fishery the estimated harvest was: 15,205 Dolly Varden; 177 pink salmon, Oncorhynchus gorbuscha (Walbaum);

2,248 coho salmon; 611 steelhead trout; 35 rainbow trout; and 330 fish of other species. Twenty-three steelhead and 357 coho salmon in Anchor River were tagged and released. Tagged to untagged ratios of coho salmon indicated a total population of 5,306 in the spawning migration, and a catch to escapement ratio of 1:2.36. Tag recovery data for steelhead were inadequate to make a population estimate.

BACKGROUND

A vicinity map showing location of the study area is presented in Figures 1 and 2, and a list of species of fish is presented in Table 1.

Stocked Lake Evaluation

Since statehood, an ongoing program to provide angling opportunities in easily accessible lake waters has utilized artificially reared or transplanted fish. Survey data have been analyzed with regard to: need for additional angling opportunity; potential of a given water to sustain desired species; status, condition and composition of existing populations; and, requirements for rehabilitation or enhancement.

Historically, rainbow trout and coho salmon have been the predominant species used for stocking. Sockeye salmon and Arctic grayling have also been used when these species were available.

During the last few years, the state has been attempting to establish its own native brood stock of rainbow trout. Fish from the Swanson River were selected after testing against two other stocks. There have been difficulties with the program and, as a result, rainbow trout have not been available for stocking and coho salmon have been substituted in a number of lakes. No lakes were stocked with rainbow trout in 1979 and only one in 1978.

Stocked populations are sampled each fall and the data obtained are used to determine relative survival, growth rates, and future stocking densities.

Skilak Lake Creek Census

For a number of years a small number of anglers have successfully harvested rainbow trout from that portion of the Kenai River immediately downstream from the outlet of Skilak Lake during the early spring. This fishery was not generally known to the majority of anglers in southcentral Alaska. This fact, coupled with adverse weather conditions in March and April effectively minimized angler participation until recent years.

In 1978 and 1979, "word of mouth" attracted anglers to this area in increasing numbers. Some concerned anglers feel this increased participation

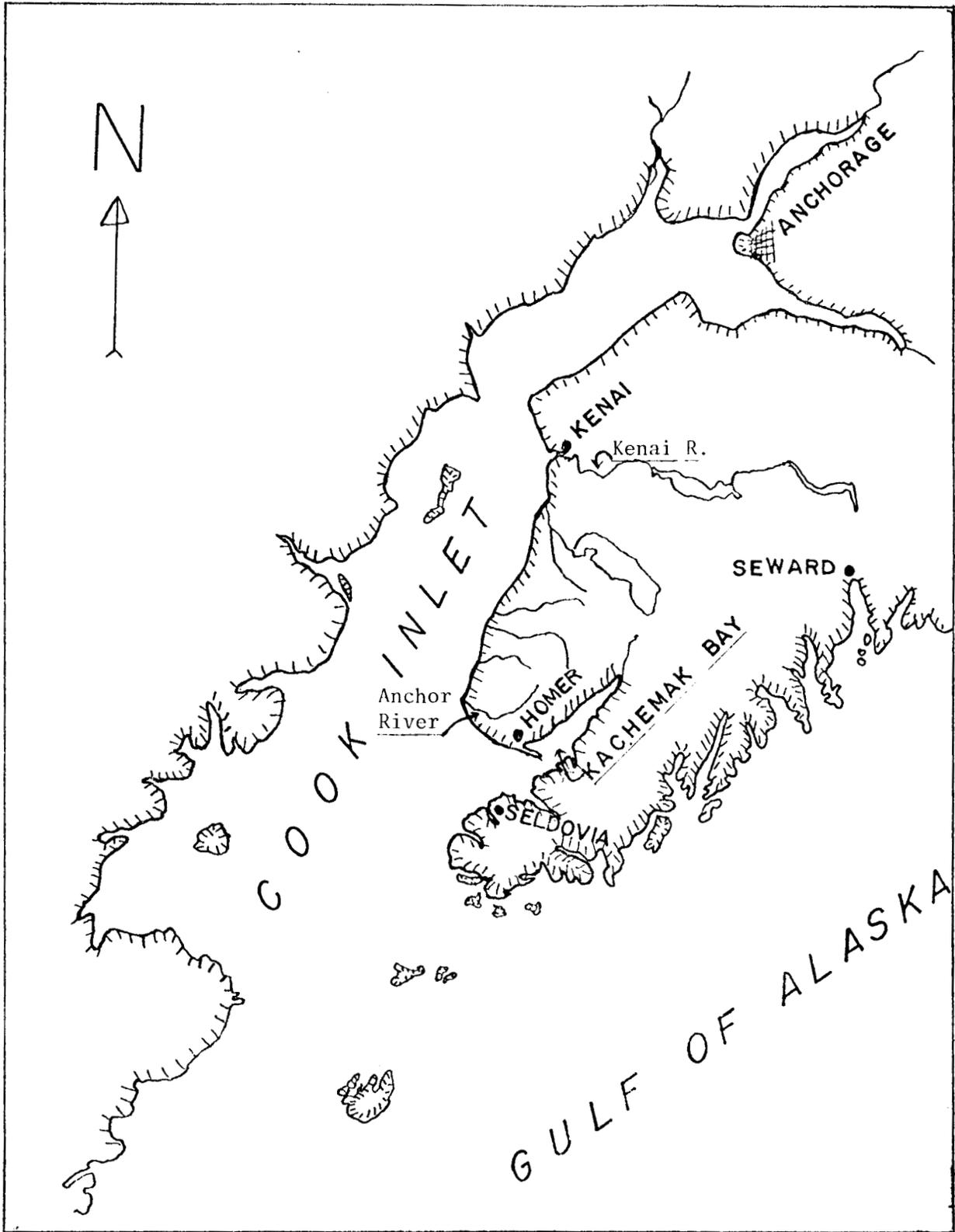


Fig. 1. Vicinity map showing location of the study area.

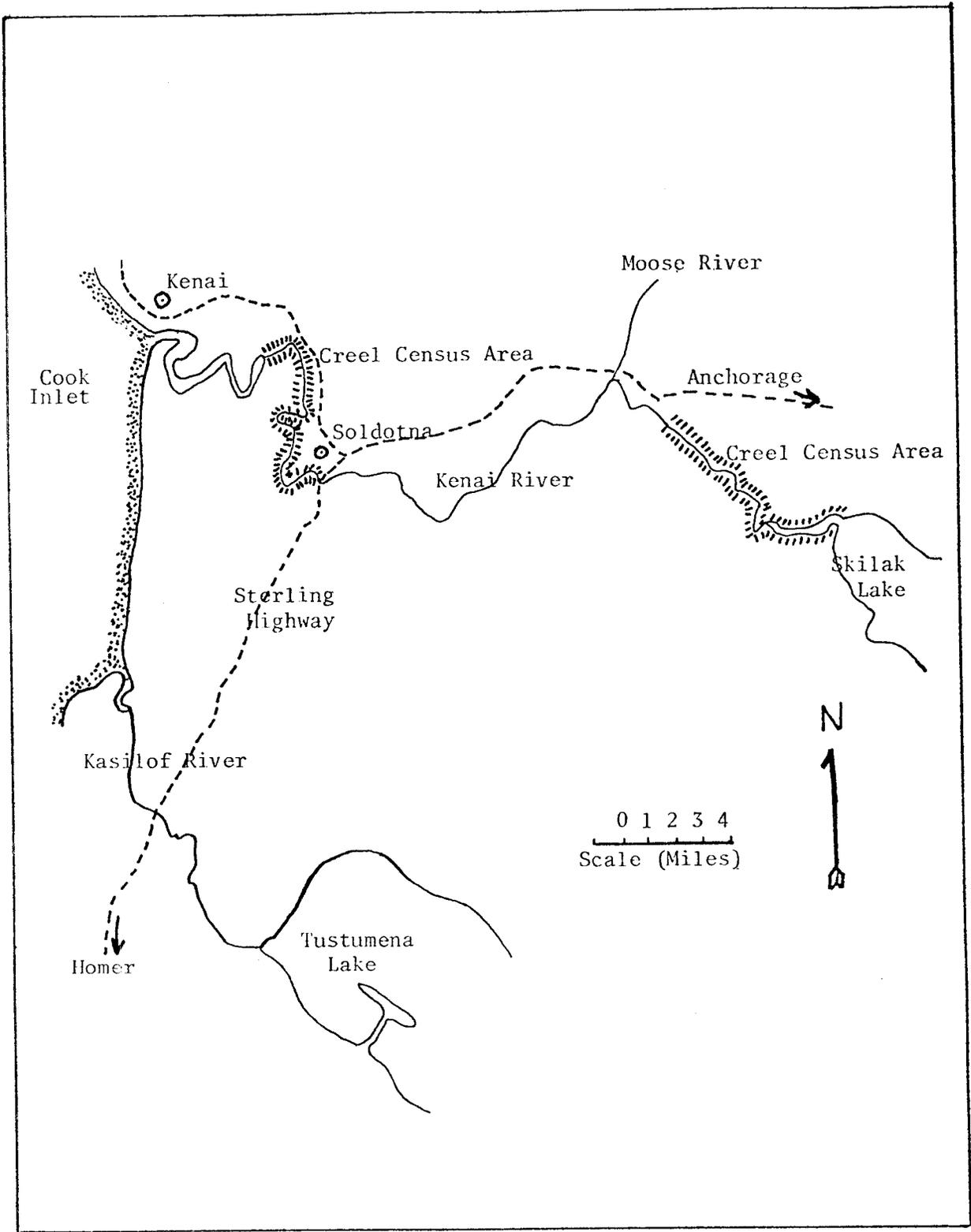


Fig. 2. Map Depicting Creel Census Areas on the Kenai River.

Table 1. List of common names, scientific names and abbreviations.

Common Name	Scientific Name & Author	Abbreviation
Pink salmon	<i>Oncorhynchus gorbuscha</i> (Walbaum)	PS
Chinook salmon	<i>Oncorhynchus tshawytscha</i> (Walbaum)	KS
Chum salmon	<i>Oncorhynchus keta</i> (Walbaum)	CS
Coho salmon	<i>Oncorhynchus kisutch</i> (Walbaum)	SS
Sockeye salmon	<i>Oncorhynchus nerka</i> (Walbaum)	RS
Dolly Varden	<i>Salvelinus malma</i> (Walbaum)	DV
Lake trout	<i>Salvelinus namaycush</i> (Walbaum)	LT
Rainbow trout	<i>Salmo gairdneri</i> Richardson	RT
Steelhead trout	<i>Salmo gairdneri</i> Richardson	SH
Arctic grayling	<i>Thymallus arcticus</i> (Pallas)	GR
Threespine stickleback	<i>Gasterosteus aculeatus</i> Linnaeus	TST

is resulting in an excessive harvest of relatively large rainbow trout which are present in this area from approximately early March through late May. Although no data are presently available, it is likely these fish drop out of Skilak Lake during this period and spawn in the slackwater area where the fishery occurs. In response to increasing angling pressure in the area, a creel census was initiated in 1979.

Kenai River Creel Census

A creel census was initiated in 1974 with chinook salmon the target species. Information gathered the first year revealed that anglers direct their efforts toward coho salmon after the chinook salmon season closes (July 31). The fishing technique changes from drifting for chinook salmon to still fishing with bait or casting artificial lures for coho salmon. Fishing continues through September unless weather conditions or high water levels prevail.

The coho salmon run into the Kenai River is comprised of two segments, early and late. The early run enters the river in late July and is present until early September. The late run enters in late August and is present until freeze-up.

Prior to 1978 both runs were also harvested commercially but a decision by the Board of Fisheries to close the east side of Cook Inlet on August 15, effectively eliminated any commercial harvest of the late run.

Anchor River Creel Census

Anchor River has long been recognized as one of the most popular sport fishing streams on the Kenai Peninsula. The river supports good populations of Dolly Varden and chinook and coho salmon and has the largest steelhead trout population of the five Kenai Peninsula streams that produce this species.

Observations indicated a great increase in angler effort and harvest on the river, and in 1978 we initiated a creel census of the summer-fall fishery to obtain current data on harvest levels of Dolly Varden, coho salmon and steelhead trout.

RECOMMENDATIONS

1. Adult lake trout from Skilak Lake should be captured using electro-fishing gear and transplanted to Upper Summit Lake in an attempt to establish a self-sustaining population.
2. Creel census activities on the spring rainbow trout fishing on Skilak Lake should be discontinued.

3. Additional rainbow trout should be transplanted from China Poot Lake into Hazel Lake and Upper China Poot Lake.
4. A creel census of the recreational fishery in Kachemak Bay should be conducted in 1981.

OBJECTIVES

1. To determine the environmental characteristics of the existing recreational fishery waters of the job area and to obtain estimates of existing and/or potential angler use of sport fish harvest.
2. To evaluate application of fishery restoration measures and availability of sport fish egg sources.
3. To assist as required in the investigation of public access status to the area's fishing waters and to make specific recommendations for segregation of public fishing access sites.
4. To investigate, evaluate and develop plans for enhancement of anadromous and resident fish stocks.
5. To provide recommendations for the management of sport fish resources in these waters and direct the course of future studies.

TECHNIQUES USED

Stocked Lake Evaluation and Lake Survey

The techniques for stocked lake evaluation were the same as those described by the Lake and Stream Manual, ADF&G (1971), Engel (1973) and Hammarstrom (1974).

Rainbow trout were captured in China Poot Lake using fyke nets, a gill net and hook and line. They were transported in cans provided with bottled oxygen and hauled by chartered aircraft.

Kenai River Creel Census

The creel census employed on the Kenai River was based on those described by Neuhold and Lu (1957) and described in detail by Hammarstrom (1977). Effort estimates are based on two randomly selected instantaneous angler counts per day. Every weekend-holiday and 3 of 5 weekdays were sampled. Because of changing daylight hours the fishing day ranged from 20 hours to

12 hours as follows: June and July, 20 hours; August, 16 hours; September, 12 hours. During the interview periods, the following information was collected: hours fished; catch by number and species; and specific biological data from chinook salmon, coho salmon and large rainbow trout.

The Kenai River coho run is comprised of two distinct segments, early-run fish and late-run fish. Certain Alaska Board of Fisheries policies pertain to these run segments; therefore, effort and harvest were calculated separately for early-run and late-run fish in upstream and downstream sections of the river. Previous unpublished data have shown that the uncensused sections of the river account for 9.1% as much effort as the two census areas; therefore, estimates from the upstream and downstream sections were expanded by that factor to arrive at a total estimate of effort and harvest. Timing of the runs was determined by changes in angler catch rate.

Skilak Lake Creel Census

The creel census employed on the Kenai River downstream from Skilak Lake was essentially the same as that described for the coho fishery. The length of the angler day was adjusted to account for the daylight conditions. Interviews were conducted on both completed and uncompleted anglers and once it became obvious that the catch rates declined substantially, the intensity of the creel census was reduced from 5 days per week to 4 days and eventually 3 days per week during the last 3 weeks of the fishery.

Scale samples were collected from as many fish as possible while the interviews were conducted. Additional data such as fork length and sex were also recorded.

Anchor River Creel Census

The Anchor River creel census was conducted during the periods April 13-30 and July 14 - November 4, 1978. Methods employed were described in detail by Wallis and Hammarstrom (1979).

Coho and steelhead were captured with a beach seine and tagged with serially numbered Floy anchor tags. Tags were recovered during the creel census and by voluntary returns. Tagged to untagged ratios were used to make a population estimate of steelhead, based upon Schaefer's formula as outlined by Ricker (1975). Biological data (fork length to nearest 5 mm and scales) were collected from samples of coho salmon and steelhead.

FINDINGS

Stocked Lake Evaluation

Fourteen stocked lakes in the area were sampled with variable mesh gill nets. Eight of the lakes had been treated with emulsified rotenone to

eliminate competing species, usually threespine stickleback. Sticklebacks have become re-established in five of the lakes; two instances are believed to have resulted from insufficient concentrations of rotenone at time of rehabilitation, and three are suspected to have been due to illegal plants of sticklebacks.

Currently only six of the lakes contain rainbow trout, and all but three have been stocked with coho salmon. The only rainbow trout available during the past 2 years were 8,550 stocked in Sport Lake in 1978. Sockeye salmon were available in 1977, and large numbers of very small fry were planted in three lakes. One of these, Island Lake, was not sampled in 1979.

An experimental plant of rainbow trout from two different sources was attempted in Joseph Lake. In October of 1977, 2,000 Alaska Ennis fish, at an average weight of 4.4 gm each with a right ventral fin clip and 4,000 Swanson River fish at 3.6 gm each with a left ventral fin clip, were stocked. The lake had not been rehabilitated so it had a natural population of stickleback.

Sampling in October, 1978, resulted in capturing 34 fish in 44.5 net hours. Four fish had Alaska Ennis marks and 30 had Swanson River marks. Apparent survival was 3.75 times higher for Swanson River fish than Alaska Ennis fish. The sampled Alaska Ennis fish increased their weight from 4.4 gms to 418 gms while the Swanson River fish increased from 3.6 gms to 100 gms.

Sampling in late September, 1979 resulted in capturing 22 rainbow trout in 52 net hours, all of which contained Swanson River marks. Apparent survival, as estimated by catch rates, has decreased by only 37% for Swanson River fish. No Alaska Ennis fish were captured. Average weight has increased from 3.6 gms at stocking to 236 gms in 2 years.

Personal conversation with Al Havens, a Department biologist evaluating Swanson River rainbow trout planted in Matanuska Valley lakes, has indicated similar results; slower growth but far superior survival as compared to Alaska Ennis fish. Monitoring will continue next fall.

Pertinent historical data for the Kenai area lakes sampled with gill nets are presented in Tables 2 and 3.

During the period August 27-30, 1979, rainbow trout were captured in China Poot Lake and transplanted into Hazel Lake. A total of 118 fish were captured, 18 died upon capture or during holding, and the remaining 100 fish were transplanted on August 30. Dead fish ranged from 96 to 353 mm with a mean fork length of 240 mm; observation indicated this sample was representative of the fish transplanted.

Table 2. Summary of recent stocking history of Kenai Peninsula area lakes sampled with gill nets in 1979.

Lake	Stocked	Species	Origin	Fish/ kg(lb)	Fish/Hectare (/acre)	Total Stocked
Arc	6/15/78	SS	Seward, Ak.	652(295)	630(255)	4,000
Cabin	5/24/77	RB	Ennis, Mt. Ak.	297(135)	303(122)	7,000
	7/24/79	SS	Seward, Ak.	267(121)	650(263)	15,000
Centennial	7/13/77	SS	Seward, Ak.	882(400)	1,421(575)	14,400
	6/08/79	SS	Seward, Ak.	785(357)	610(244)	6,100
Engineer	7/07/77	SS	Seward, Ak.	919(417)	370(150)	34,350
	6/08/79	SS	Seward, Ak.	785(357)	370(150)	34,250
Johnson	7/16/75	RB	Ennis, Mt.	255(116)	494(200)	17,000
	7/24/79	SS	Seward, Ak.	267(121)	580(235)	20,000
Longmare	8/16/78	SS	Seward, Ak.	323(147)	283(115)	19,698
Joseph	10/4/77	RB	Swanson River	350(159)	447(181)	4,000
Portage	7/13/77	SS	Seward, Ak.	919(417)	502(203)	5,600
	7/24/79	SS	Seward, Ak.	267(121)	449(182)	5,000
Rainbow	7/03/74	RB	Winthrop, Wa.	728(331)	1,254(508)	7,600
Scout	6/02/76	SS	Blind Slough, Ak.	656(298)	866(351)	33,300
	6/15/78	SS	Seward, Ak.	652(285)	494(200)	19,000
Sport	9/15/78	RB	Talarick Cr., Ak.	319(145)	293(119)	8,550
Sunken Island	6/06/77	RS	Tustumena Lk., Ak.	8,435(3,834)	3,971(1,608)	225,055
	6/08/79	SS	Seward, Ak.	785(357)	534(216)	30,250
Tirmore	7/16/75	RB	Ennis, Mt.	365(165)	494(200)	10,400
Upper Jean	6/10/77	RS	Tustumena Lk., Ak.	9,198(4,181)	4,027(1,630)	75,000
	6/08/79	SS	Seward, Ak.	785(357)	486(197)	9,060

Table 3. Summary of Results of Gill Net Sampling of Kenai Peninsula Stocked Lakes, 1979

Lake	Date Sampled	Species	Number in Sample	Catch/ Hour	Length in mm		S.V.	Weight in grams		Year Planted
					Range	Mean		Range	Mean	
Arc	Sept. 20	SS	59	1.31	110-202	176.4	9.1	41- 68	50	1978
Cabin	Sept. 24	SS	128	7.21	102-131	115.0	6.8	-	18	1979
Centennial	Sept. 25	SS	9	0.23	242-314	279.0	18.8	154- 372	249	1977
	Sept. 25	SS	263	6.58	103-125	115.8	5.6	-	18	1979
Engineer	Oct. 4	SS	38	0.76	320-445	374.4	34.9	417-1161	730	1977
	Oct. 4	SS	26	0.55	100-168	144.8	23.9	-	38	1979
Jerome	Sept. 17	SS*	11	0.24	215-486	264.4	79.9	109-1461	277	Unknown
	Sept. 17	DV	10	0.22	204-450	304.5	86.8	82- 975	376	Unknown
Johnson	Sept. 26	RB	4	0.09	436-480	468.5	23.5	1506-1774	1624	1975
	Sept. 26	SS	8	0.17	97-114	104.9	5.9	-	14	1979
Longiare	Sept. 20	SS	35	0.78	110-254	172.2	35.6	14- 191	60	1978
North Joseph	Sept. 26	RB	22	0.42	239-338	282.8	26.4	136- 376	236	1977
Portage	Oct. 1	SS	16	0.67	187-245	227.6	15.3	73- 154	127	1977
	Oct. 1	SS	14	0.58	93-106	98.9	4.7	-	13	1979
Rainbow	Sept. 17	RB	7	0.15	450-545	496.4	38.5	1429-2341	1865	1974
Scout	Sept. 19	SS	3	0.08	292-310	300.7	9.0	218- 308	263	1976
	Sept. 19	SS	38	1.00	179-229	198.8	12.5	54- 127	77	1978
Sport	Oct. 23	RB	61	1.36	160-319	239.4	32.5	415-354	186	1978
Sunken Island	Oct. 1	RS	8	0.16	206-244	228.4	12.8	100- 186	150	1977
	Oct. 1	SS	102	2.08	98-123	110.2	4.9	-	16	1979
Timore	Sept. 24	RB	2	0.04	575-611	593.0	25.5	2699-3230	2967	1975
Upper Jean	Sept. 18	RS	7	0.14	175-241	197.0	24.5	36- 172	81	1977
	Sept. 18	SS	34	0.60	96-112	104.9	4.3	-	13	1979

* Plant of unknown origin.

Kenai River Creel Census

The Kenai River creel census commenced June 1 and was continuous through September 30. Until July 31, the primary species captured was chinook salmon. Other species harvested incidental to chinook salmon were coho salmon, Dolly Varden, rainbow trout, sockeye salmon and pink salmon. Data regarding chinook salmon are presented in the G-II-L Report of Progress, Hammarstrom (1980).

The most important species harvested in the recreational fishery, other than chinook salmon, is coho salmon, although when a large sockeye salmon escapement is present, as occurred in 1978, interest in this species is more apparent. The first coho salmon was reported caught on July 19 but substantial catches were not reported until July 26. For practical purposes, all coho salmon harvested prior to August 1 are incidental to the chinook salmon fishery.

Early run coho were present in the lower section (Beaver Creek to Soldotna Bridge) until August 17. Catch rates rose sharply August 1, not due to increased numbers of fish present, but to a change in angling techniques when the chinook season closed and anglers targeted on coho salmon. Early-run fish were reported in the upper section (Naptowne Rapids to Skilak Lake) beginning August 1 and continued through August 26.

The separation point between early and late run coho was determined by both catch rates (Figure 3) and size of fish present (Table 4), with late-run fish being significantly larger.

It is believed that elimination of the commercial harvest of late-run coho resulted in a successful sport fishery in 1979. If two or three 12-hour commercial fishing periods per week had been allowed, catch rates on late-run coho salmon in the Kenai River would have fallen below acceptable levels (0.100 fish per hour).

Most sockeye salmon are harvested by shore anglers, whereas, most chinook salmon are harvested by boat anglers. The creel census was designed to measure the take of boat anglers, thus, data regarding total harvest of sockeye salmon may be biased and somewhat misleading. It is felt that the actual harvest is substantially greater than creel census estimates. Estimates for other species are considered accurate.

Pink salmon were not abundant in 1979 and the recreational harvest reflects this "odd" year occurrence. Probably less than 100 fish were harvested.

Angling pressure exhibited a similar pattern to that of 1977 (Hammarstrom, 1978) due to chronic flooding throughout late August and September. Water levels remained high through November which is unusual in the Kenai River. High water levels seem to curtail angling effort.

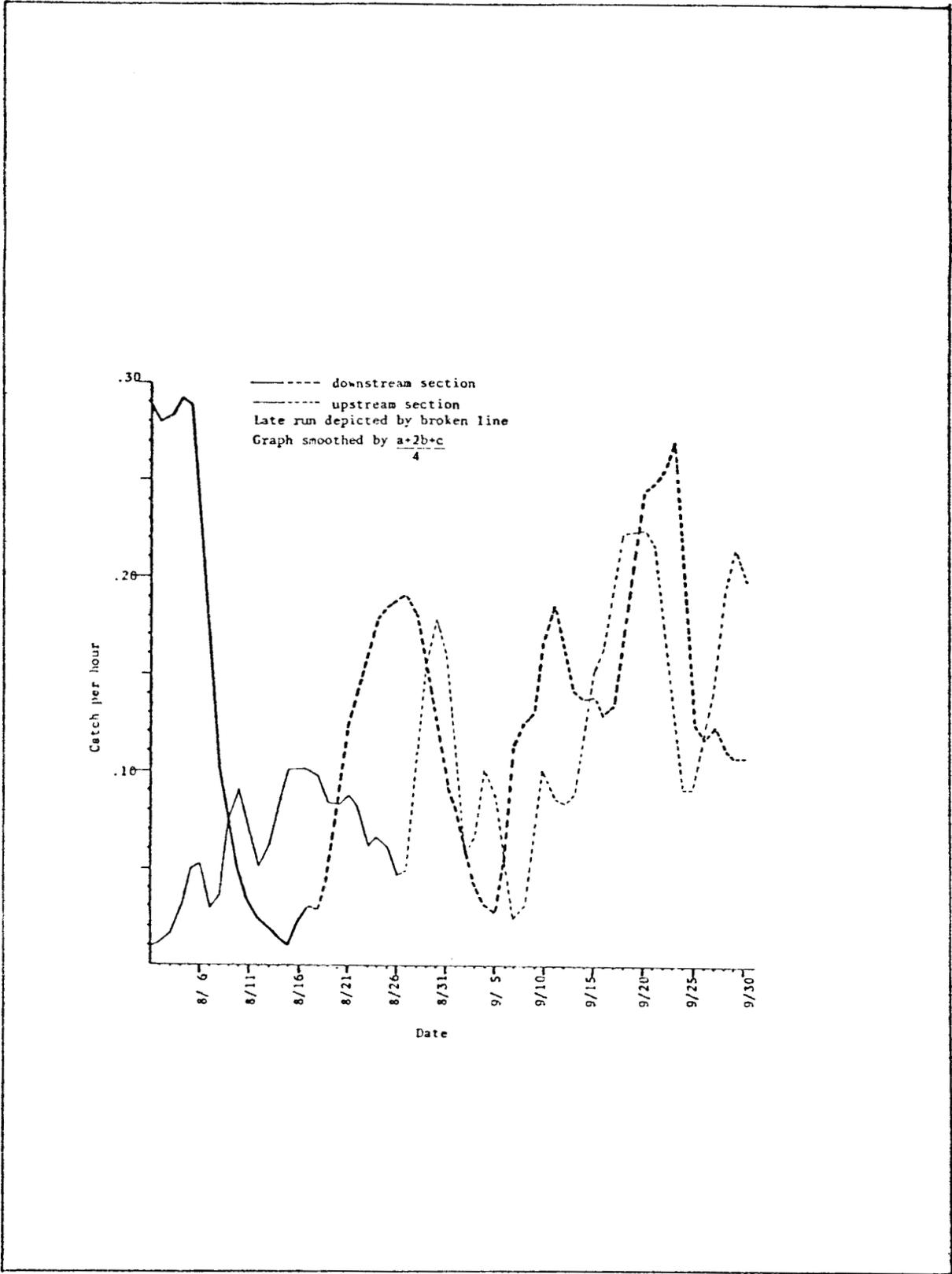


Fig. 3. Catch Rates for the Kenai River Coho Salmon Fishery, 1979.

Table 4. Summary of length-weight data from coho salmon samples captured in the Kenai River recreational fishery, 1979.

	<u>Early Run</u>		<u>Late Run</u>	
	<u>Length(mm)</u>	<u>Weight(kg)</u>	<u>Length(mm)</u>	<u>Weight(kg)</u>
Number in Sample	162	162	144	144
Range	430-710	1.4-5.5	460-710	1.1-6.6
Mean	598	3.5	633	4.2
Standard Deviation	43.3	0.79	39.3	.86

During August and September of 1979, 170 instantaneous angler counts were made, 7,293 anglers were interviewed, 1,628 fish were creel checked and 14,135 hours were reported. These data resulted in the following estimates: harvest - 14,479 coho salmon (8,795 from the early-run and 5,684 from the late-run), effort - 28,025 man-days (15,700 man-days from the early-run and 12,325 man-days from the late run). A man-day averaged 3.4 hours during the early-run and 3.6 hours during the late-run. Catch per hour during the early-run was 0.101 and 0.123 during the late-run. A historical summary of the fishery from 1975-1979 is presented in Table 5.

Harvest during the early run increased by 68% over 1978 estimates, from 5,225 in 1978 to 8,795 in 1979; the catch rate increased from 0.058 (1978) to 0.101 (1979). Effort was decreased by 21% from 19,965 man-days in 1978 to 15,700 man-days in 1979.

Harvest during the late-run decreased by 10.6% from 6,360 in 1978 to 5,684 in 1979, and effort dropped by 32%. The catch rate increased from 0.100 in 1978 to 0.123 in 1979.

In addition to the 14,479 coho salmon harvested, the following harvest estimates were made: Dolly Varden, 11,764; rainbow trout, 3,100; sockeye salmon, 1,907; pink salmon, <100 (Table 6). Historical data are presented in Table 7.

Skilak Lake Creel Census

In response to increasing angling pressure in the area, the Sport Fish Division initiated a creel census in 1979. The census was in effect from March 18 through May 20 and sampled both shore and boat anglers. During the census 342 angler interviews were conducted and 99 rainbow trout were creel checked. These data were expanded by standard statistical methods to estimate a total catch of 384 rainbow trout harvested in 929 man-days of effort.

The census indicated angler effort and success rates for this fishery were relatively low. The average daily effort was only 14.3 man-days with an average daily harvest of 5.9 rainbow trout. It therefore required 2.5 man-days of fishing effort to harvest one fish during the 1979 season.

Of the estimated 384 rainbow trout harvested, 199 or 51.8% were larger than 508 mm (20 inches). Scale analysis revealed one of the fish taken during this early fishery may have been a steelhead. If this is true, it will be the first documented observation of steelhead in the Kenai River system. A total of 46 readable scales were collected. Fish ranged in size from 0.7 kg (1.5 lbs.) to 8.2 kg (18.0 lbs.). The largest age class was 5.0 (brood year 1973), which represented 30.3% of the harvest, followed by age class 4.0 (brood year 1974) representing 26.1% of the harvest.

Table 5, Summary of Kenai River coho salmon sport harvest and effort, 1975-1979.

Year	Early Run			Late Run			Catch	Effort
	Catch	Effort	C/H	Catch	Effort	C/H		
1975	5,715	9,725	0.091	Not censused			-	-
1976	6,365	18,620	0.085	7,445	17,430	0.122	15,810	36,050
1977	6,780	12,520	0.123	3,280	6,630*	0.105	10,060	19,150
1978	5,225	19,965	0.058	6,360	18,140	0.100	11,585	38,105
1975-78 Mean	6,021	15,208	0.089	5,695	14,067	0.109	-	-
1979	8,795	15,700	0.101	5,685	12,325*	0.123	14,480	28,025

* Angling effort reduced due to chronic flooding conditions.

C/H = catch per hour

Table 6. Harvest and effort, by month, by species, for the Kenai River 1979.

Month	Effort Man-days	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Rainbow Trout	Dolly Varden	Total Harvest	Total Catch/Hour
<u>Downstream Section</u>									
June&July	74,060	7,270	125	-	1,632	509	1,703	11,239	.043
August	11,200	-	0	-	6,752	0	0	6,752	.172
September	3,000	-	0	-	1,217	0	0	1,217	.116
Total	88,260	7,270	125	-	9,601	509	1,703	19,208	.062
<u>Midstream Section</u>									
June&July	8,155	682	95	-	167	186	415	1,545	.054
August	1,615	-	60	-	749	32	363	1,204	.213
September	700	-	1	-	279	38	193	511	.209
Total	10,470	682	156	-	1,195	256	971	3,260	.089
<u>Upstream Section</u>									
June&July	16,345	343	945	-	226	1,559	2,910	5,983	.105
August	6,730	-	670	-	1,575	358	4,029	6,632	.282
September	4,780	-	10	-	1,882	418	2,151	4,461	.267
Total	27,855	343	1,625	-	3,683	2,335	9,090	17,076	.175
<u>Total</u>									
June&July	98,560	8,295	1,165	-	2,025	2,254	5,028	18,767	.054
August	19,545	-	731	-	9,076	390	4,392	14,589	.213
September	8,480	-	11	-	3,378	456	2,344	6,189	.209
Total	126,585	8,295	1,907	-	14,479	3,100	11,764	39,545	.089

Table 7. Kenai River historical sport harvest (excluding chinook salmon) and effort data for 1976-1978.

Year	Effort Man-days	Sockeye Salmon	Coho Salmon	Pink Salmon	Rainbow Trout	Dolly Varden	Total Harvest
1976	80,506	719	13,808	21,443	1,797	4,957	42,724
1977	102,203	1,436	10,056	100	2,474	8,058	22,124
1978	118,307	2,180	11,585	17,011	3,118	11,695	45,589
1979	126,585	1,907	14,479	-	3,100	11,764	39,545
Mean	106,900	1,560	12,482	Not Applicable	2,622	9,119	37,495

A harvest of 384 rainbow trout from this area does not appear to be excessive at this time. However, as this is the first spring fishery on the Kenai Peninsula and, as increasing numbers of anglers become aware of the angling opportunity, effort will undoubtedly increase. Although the Department presently is unable to fund further investigations in this area, the possibility of a cooperative project with the United States Fish and Wildlife Service is being explored.

Anchor River Creel Census

Anchor River began flowing enough in mid-April to permit fishing, and a limited creel census was conducted from April 13 until the river was closed to fishing on April 30. A total of 349 anglers were interviewed and effort was estimated to be 3,500 man-days with a harvest of 5,700 Dolly Varden and 100 steelhead trout.

Dolly Varden caught during this spring fishery were very thin and highly colored. All of the fish examined had spawned, presumably in the fall of 1978, and apparently spent the winter in Anchor River. A total of 24 steelhead were also examined for degree of sexual maturity. None of those examined had spawned; eggs in females filled the body cavity, but none were loose; a small quantity of milt could be extruded from some of the males, but the testes were not fully mature.

A creel census of the summer-fall fishery was started on July 14 and terminated on November 4. A summary of estimated angler effort and harvest during this period is presented in Tables 8 and 9. A total of 2,993 anglers were interviewed, and completed anglers fished an average of 3.38 hours per day.

A summary of creel census data since 1954 from the summer-fall fishery in Anchor River is presented in Table 10. Angler effort in 1979 was comparable to that of the previous 2 years. Harvest of Dolly Varden and steelhead during April, 1979 was of fish which entered the river in the fall of 1978. Harvest of both Dolly Varden and steelhead in the fall of 1979 was good in comparison to most years, even though it was reduced from the exceptionally high harvest in 1978. The coho salmon harvest in 1979 was the greatest for those years on record.

Beginning August 2 and continuing once a week until September 27, coho salmon and steelhead trout were captured with a beach seine and tagged with serially numbered Floy anchor tags before release. No fish were captured on September 5. Summaries of the pertinent tagging and recovery data are presented in Tables 11 and 12.

Tags recovered from coho salmon during the random creel census interviews were used to establish tagged-to-untagged ratios and a population estimate based upon the method of Schaefer. The estimated coho population in Anchor

Table 8. Estimated total angler effort and harvest on Anchor River,
July 14 - November 4, 1979, by weekly intervals.

Week Ending	Total Effort Angler Hours	Catch Per Hour	Total Estimated Harvest
7/15	1,648	0.56	923
7/22	5,720	0.62	3,546
7/29	5,680	0.73	4,146
8/5	6,576	0.20	1,315
8/12	4,720	0.16	755
8/19	7,504	0.18	1,351
8/26	6,132	0.14	858
9/2	5,807	0.11	639
9/9	3,384	0.16	541
9/16	2,584	0.16	413
9/23	2,562	0.28	717
9/30	2,364	0.17	402
10/7	2,308	0.30	692
10/14	1,624	0.39	633
10/21	1,560	0.67	1,045
10/28	840	0.55	462
11/4	<u>730</u>	0.23	<u>168</u>
Total	61,743		18,606

$$\text{Total Angler Days} = \frac{61,743 \text{ Angler Hours}}{3.38 \text{ Hours/Angler}} = 18,267$$

Table 9. Estimated sport fish harvest from Anchor River, by species and weekly intervals, July 14 - November 4, 1979.

Week Ending	DV	PS	SS	SH	RT	Other	Total
7/15	898	11	0	0	0	14	923
7/22	3,510	22	0	0	0	14	3,546
7/29	3,801	23	81	0	0	241	4,146
8/5	1,198	0	90	17	10	0	1,315
8/12	290	49	402	14	0	0	755
8/19	658	55	618	0	20	0	1,351
8/26	447	14	373	24	0	0	858
9/2	248	0	319	68	0	4	639
9/9	196	3	257	56	0	29	541
9/16	235	0	93	85	0	0	413
9/23	551	0	0	146	0	20	717
9/30	359	0	11	32	0	0	402
10/7	660	0	0	32	0	0	692
10/14	581	0	0	44	0	8	633
10/21	986	0	4	50	5	0	1,045
10/28	440	0	0	22	0	0	462
11/4	<u>147</u>	<u>0</u>	<u>0</u>	<u>21</u>	<u>0</u>	<u>0</u>	<u>168</u>
Total	15,205	177	2,248	611	35	330	18,606
Percent of Total	81.7	0.9	12.1	3.3	0.2	1.8	100.0

Table 10. Summary of historical creel census data from Anchor River for harvest of Dolly Varden, coho salmon and steelhead trout.

Year	Period Covered In Census	Effort Man-Days	Dolly Varden		Coho		Steelhead	
			Harvest	Total Run	Harvest	Total Run	Harvest	Total Run
1954	5/29-10/23	3,000	4,000	11,500	395	1,700	247	511
--								
1957	5/1-10/15	5,800	573	7,000	90	801	50	600
--								
1960	5/7-10/2	5,300*	3,300	...	1,000	...	400	...
--								
1968	7/6-10/19	3,045	4,352	...	1,149	...	102	...
--								
1977	5/28-6/19	10,978	NC**	...	NC	...	NC	...
	Bal. of year	<u>20,573</u>	<u>9,222</u>		<u>1,339</u>		<u>1,072</u>	
	Total	<u>31,515</u>	<u>9,222</u>		<u>1,339</u>		<u>1,072</u>	
1978	5/27-6/19	23,748	NC		NC		NC	
	7/15-11/12	<u>20,906</u>	21,141	...	1,433	...	1,462	4,132
	Total	<u>44,654</u>						
1979	4/13-4/30	3,500	5,700	...	0	...	100	...
	5/26-6/18	17,715	NC		NC		NC	
	7/14-11/4	<u>18,267</u>	<u>15,205</u>	...	<u>2,248</u>	5,306	<u>611</u>	...
	Total	<u>39,482</u>	<u>20,905</u>		<u>2,248</u>		<u>711</u>	

* Effort incomplete - covers period 5/7-7/14 only

** NC - not covered in census

Table 11. Summary of tagging and recovery data for Anchor River coho salmon, 1979.

	Date Tagged							Total
	8/2	8/9	8/15	8/22	8/29	9/13	9/19	
Number of fish tagged	3	13	67	85	62	119	8	357
Number of tags returned	0	3	15	18	14	4	0	54
Tags reported but not returned								4
Known harvest of tagged fish								58
Days from tagging to capture								
Mean	...	12.7	4.0	8.1	4.2	1.8	...	
Range	...	4-21	0-19	1-26	0-13	0-3	...	

Table 12. Summary of tagging and recovery data for Anchor River steelhead trout, 1979.

	8/15	8/22	8/29	9/13	9/19	9/27	Total
Number of fish tagged	1	5	1	6	8	2	23
Number of tags returned	0	1	0	0	0	1	2
Tags reported but not returned							3
Number of tagged fish caught & released							3
Known harvest of tagged fish							2
Days from tagging to capture							
Mean	...	1	3	
Range		

River during the fall of 1979 was 5,306 fish. Numbers of steelhead captured and tagged, and numbers of tags recovered (2) in the fall fishery were inadequate to use in estimating total population.

Tags from five steelhead trout tagged during the fall of 1978 were recovered in the spring 1979 fishery. Two males tagged on September 11 and October 20, 1978 were recaptured on April 14 and April 17, 1979, respectively. Neither fish had spawned, but one had some loose milt. Three females tagged on September 11, 1978 were recovered during the period June 2-11, 1979; all three were spent.

Scales were collected from 124 coho salmon taken by anglers for age determination. The length frequency of the sample is listed in Table 13 by age classification and sex. In the sample, 32.3% were Age 1.1, 63.7% were Age 2.1, and 4.0% were Age 3.1. The ratio of males to females was 1:1.14.

Scales were collected from steelhead during tagging operations and creel census interviews. Sixty-four scales were collected and total age determinations could be made from 57. A summary of age composition and lengths from the sample is presented in Table 14 for fish on their first spawning run and repeat spawners.

Mean lengths of the fish tagged and fish checked during census interviews were similar, 685 mm and 688 mm, respectively; however, there were substantial differences in sex ratios between the two samples. Twenty-three fish tagged consisted of six males and 17 females, a male to female ratio of 1:2.83. The sample collected during census consisted of 20 males and 21 females, a male to female ratio of 1:1.05. This difference suggests there was considerable bias in favor of females in the seining operation.

Ten of the 57 steelhead (17.5% of the sample) for which total age determinations could be interpreted had spawned previously; eight had spawned once before and two had spawned twice previously. One individual had spawned twice before in successive years and returned for the third consecutive year. All others had one ocean annulus following a spawning check before returning again. The percentage of repeat spawners is comparable to those reported earlier: Allin (1954) - 26%; Dunn (1960) - 3.5%; Redick (1968) - 24.3%; McHenry (1969) - 16.2%; and Wallis and Hammarstrom (1979) - 17.7%.

Marked Fish Returns

In June 1976, 26,000 chinook salmon smolts, which averaged 20.2 grams each (22.5 fish per pound), were marked with a right ventral fin-clip and planted into Tutka Bay Lagoon Creek. The fish originated from eggs of the 1975 brood year in Ship Creek, and had been reared at the Fort Richardson Hatchery near Anchorage. During 1978, three marked adults of this lot were captured by anglers in Tutka Bay Lagoon. In 1979, it was estimated that

Table 13. Length frequency of coho salmon from Anchor River, by sex and age classification, 1979.

Age Classification	Females			Males	
	1.1	2.1	3.1	1.1	2.1
<u>Length Interval (mm)</u>					
525-549	1				
550-574	2			1	1
575-599		1	1	3	
600-624	2	4			5
625-649	4	6		2	1
650-674	7	12	1	4	9
675-699	3	12		3	6
700-724	2	4	3	5	9
725-749		1			3
750-774	—	<u>1</u>	—	<u>1</u>	<u>5</u>
Number	21	40	5	19	39
Mean Length	643	665	676	666	684
S.D.	44.5	35.0	50.8	53.4	48.1

Table 14. Summary of age composition and lengths of Anchor River steelhead trout; data from scales collected in fall, 1979.

Age Class	Number	Length (mm)		
		Mean	Range	S.D.
<u>First-time spawners</u>				
<u>Males</u>				
2.1	1	620	620	...
3.1	15	613	570-660	25.9
3.2	4	734	700-790	39.4
4.1	1	560	560	...
4.2	<u>1</u>	730	730	...
Total	22			
<u>Females</u>				
3.1	2	600	560-640	56.6
3.2	20	700	640-750	38.6
4.1	2	582	580-585	3.5
4.2	<u>1</u>	720	720	...
Total	25			
<u>Repeat spawners</u>				
<u>Males</u>				
3.1s1	3	810	810	0
<u>Females</u>				
3.1s1	2	768	760-775	10.6
3.2s1	3	813	785-830	24.7
3.2ss	1	780	780	...
3.2s1s1	<u>1</u>	815	815	...
Total	7			

approximately 40 chinook salmon returned to Tutka Bay Lagoon Creek (Mark Dickson, personal communication).

Fourteen fish were captured by hook and line and one was caught by a commercial seiner during one open period for pink salmon. In this sample, five were females and ten were males; they ranged in length from 686 mm to 984 mm and averaged 883 mm; weights ranged from 4.0 kg to 10.7 kg and averaged 8.1 kg.

Beginning in 1974 and continuing to date the Department of Fish and Game has planted coho and chinook salmon smolts into Halibut Cove Lagoon. These fish were reared to smolt size at the Fire Lake-Fort Richardson Hatchery complex, then transported to Halibut Cove and held a short time in salt-water pens before release. Most of the smolts were fin marked and tagged with coded wire tags before release.

During 1979 it was estimated that 600 adult chinook salmon returned to Halibut Cove Lagoon. There was an estimated effort of 416 boats and 1,200 angler days and a harvest of 500 chinook salmon. Chinook salmon which enter the lagoon do not take lures readily and most of the fish are caught by snagging. In earlier years the upper end of the lagoon was designated as freshwater to prevent snagging and protect a segment of the run for spawntaking. There were no plans to spawn any of the fish in 1979 and the upper end of the lagoon was defined as saltwater, thereby making snagging a legal method.

In 1978 coho salmon smolts from the Ship Creek Hatchery were planted into Fritz Creek in the expectation that adult returns would make a greater contribution to existing sport and subsistence fisheries than if they were planted into Halibut Cove Lagoon. Coho "jacks" were observed in Fritz Creek during the fall of 1978. However, during the fall of 1979, no adult coho salmon were observed in Fritz Creek. No marked coho were observed in fish caught in the sport or subsistence fisheries, although one marked coho was later reported by a sport fisherman. We have no defensible explanation for the failure of these fish to return as adults.

Kachemak Bay Feeder Chinook Salmon

Five tagged feeder chinook salmon were recovered in Kachemak Bay during 1979 (Table 15). One fish which originated from Crystal Lake Hatchery in southeastern Alaska was captured in an experimental shrimp trawl. Three fish originated at the South Santiam River Hatchery in Oregon, and the final one recovered was from the Robertson Creek Hatchery, British Columbia.

Further examination of scales from chinook salmon caught in shrimp trawls and in the sport fishery in Kachemak Bay proved inconclusive in determining probably origin of the fish. Most of the commonly defined life history patterns for chinook salmon are represented in the scale samples including:

Table 15. Data for tagged chinook salmon caught in Kachemak Bay sport fishery, 1977-1979.

Date Captured	Length/ Weight	Tag Code	Brood Year	Origin
1977	Size Unknown	2-3-2	1973	Puntledge River Hatchery, British Columbia; hatchery evaluation.
9/26/78	680 mm/ 5.9 kg	9-5-7	1975	South Santiam River, Oregon; hatchery experimental.
9/26/78	575 mm/ 3.7 kg	2-4-11	1975	Nitinat River, British Columbia; wild stock contribution.
9/26/78	570 mm/ 3.6 kg	2-1-10	1975	Atnarko River, British Columbia; wild stock contribution
9/30/78	825 mm/ 6.8 kg	9-5-8	1975	South Santiam River, Oregon; planted in Willamette River at Oregon City.
10/19/78	Lgth Unknown 2.3 kg	63-16-6	1976	Skagit River, Washington; wild stock contribution.
3/5/79 ^{1/}	505 mm	4-16-16	1976	Crystal Lake Hatchery, Petersburg, Alaska.
5/6/79	Lgth Unknown 1.6 kg	9-16-30	1976	South Santiam River, Oregon; planted in Willamette River at Oregon City.
9/9/79	Lgth Unknown 6.8 kg	9-16-30	1976	South Santiam River, Oregon; planted in Willamette River at Oregon City.
10/6/79	760 mm 10 kg	9-5-8	1975	South Santiam River, Oregon; planted in Willamette River at Oregon City.
10/23/79	Lgth Weight Unknown	2-16-30	1976	Robertson Creek Hatchery, British Columbia.

^{1/} This individual was caught in an experimental shrimp trawl.

- (1) "ocean-run" type with a few freshwater circuli, then marine growth and the first annulus in saltwater;
- (2) first annulus in freshwater zone, preceded by 5-8 circuli, the most common pattern of local stocks;
- (3) first annulus in freshwater zone, preceded by 12-16 circuli, and sometimes followed by a few freshwater circuli prior to marine growth;
- (4) similar to (3), but the first annulus followed by what appears to be an extended period of "intermediate" growth before true marine growth rate is apparent; and
- (5) two annuli in freshwater.

Tutka Bay Lagoon Dolly Varden

Fisheries Rehabilitation Enhancement and Development Division personnel continued the program of tagging Dolly Varden in Tutka Bay Lagoon in an attempt to determine the extent of predation upon pink salmon fry. During the period May 22 through August 2, 1979, 98 Dolly Varden were tagged with serially numbered Floy tags. Fourteen tagged fish were recovered, all within the same general area where they had been tagged. Time between date of tagging and time of recapture ranged from 4 to 58 days with a mean of 26 days. Data obtained were not adequate to estimate the Dolly Varden population in the lagoon and no conclusions can be reached as to the extent of predation upon pink salmon fry.

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