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STATE OF ALASKA

William A. Egan, Governor

ANNUAL REPORT OF PROGRESS, 1969 - 1970

FEDERAL AID IN FISH RESTORATION PROJECT F-9-2

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME

Wallace H. Noerenberg, Commissioner

DIVISION OF SPORT FISH

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INTRODUCTION

This report of progress consists of Job Segment Reports from the State of Alaska, Federal Aid In Fish Restoration, Project F-9-2, "Sport Fish Investigations of Alaska".

The studies reported herein are investigations evaluating the sport fish resources of the state. Recreational and other impacts on the fishery resources necessitates a continuous endeavor of ascertaining facts and knowledge of the fisheries. The 24 jobs reported on are of a continuing nature. The investigations are composed of 11 projects involved with the inventory and cataloging of the sport fish waters of the state, sport fishery creel censuses, and access. Fish species that received special investigational effort include: Dolly Varden, anadromous fish, grayling, sheefish, whitefish, pike, char, and salmon. The information gathered from the combined studies provides necessary background data for a better understanding of management problems and constitutes a basis for necessary future investigations.

The subject matter contained in these reports is incomplete, and the findings and interpretations subject to re-evaluation as work progresses.

RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-2 *Name:* Sport Fish Investigations of Alaska.

Job No.: 11-A *Title:* **Inventory, Cataloging and Population Sampling of the Sport Fish and Sport Fish Waters of the Cook Inlet Drainage.**

Period Covered: July 1, 1969 to June 30, 1970.

ABSTRACT

Net population sampling data is presented for 22 stocked lakes sampled from April, 1969 through January, 1970.

An evaluation of silver salmon, Oncorhynchus kisutch, stocking in Matanuska Valley lakes is continued from the prior report segment. A series of observations relating to management of stocked silver salmon in area lakes is included.

Managed lakes within the area stocked with rainbow trout, Salmo gairdneri; grayling, Thymallus arcticus; and Dolly Varden, Salvelinus malma, are also discussed and recommendations for future management presented.

Four additional lakes were inventoried, with only Conners Lake warranting further evaluation.

Dissolved oxygen data collected from 32 lakes during late winter is presented. Dolly Varden successfully overwintered in Sliver Lake despite a dissolved oxygen level of only 0.25 ppm.

Two hundred ninety king salmon, O. tshawytscha, were enumerated on Willow Creek and 150 in Montana Creek by streambank and aerial surveys.

Repeated streambank surveys of spawning silver salmon were made over established index areas in five streams. A summary of count totals is presented. Index counts in Meadow and Fish creeks are related to the total escapement of 4,250 silver salmon into the Fish Creek complex.

Critically low stream flows throughout upper Cook Inlet resulting from the current drought conditions may have caused extensive egg loss during the 1969-70 winter.

RECOMMENDATIONS

1. A limited study of the rainbow trout stocks of the Talachulitna River should be initiated.
2. Survival of stocked rainbow trout should be evaluated in Johnson Lake.
3. Surveys of lakes located in Townships 15N and 16N, Ranges 3W and 4W, and lakes located on the east side of the Talkeetna Spur Highway should be initiated as time and manpower permit.

4. Enumeration of spawning silver salmon should be continued within established index areas.

5. A weir on Fish Creek should be operated during August, 1970, to provide an index of silver salmon escapement into upper Cook Inlet streams and to assist in evaluating the use of index areas to enumerate spawning silver salmon.

6. Enumeration of king salmon stocks should be continued in Willow and Montana creeks and initiated in Little Willow Creek.

OBJECTIVES

1. To determine and record the environmental characteristics of the existing and potential fishery waters of the job area; and to evaluate and develop plans for the enhancement of anadromous fish stocks.

2. To determine 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 selection of sites for segregation.

4. To evaluate multiple-use, water development projects (public and private) and their effects on the area's streams and lakes for the proper protection of the sport fish resources.

5. To make recommendations for the proper management of the sport fish resources in the area, and to direct future studies.

TECHNIQUES USED

Lakes were sampled with 125' x 6', variable mesh (3/4- to 2-inch bar measure) monofilament gill nets. Usually two nets were fished approximately 24 hours each.

Depths were established with a Ross P-100 fathometer.

Water samples for dissolved oxygen determinations were collected with a Kemmerer water sampler. Dissolved oxygen levels were determined by titration with PAO.

King salmon were enumerated by aerial, boat, and streambank surveys.

Silver salmon were enumerated within index areas established in 1968. Only foot surveys were conducted.

A temporary weir was constructed on Fish Creek approximately 200 yards downstream from the Goose Bay Road. The 60' diagonal fence used 1" diameter pipe as pickets. Salmon were identified by species and enumerated as they passed through a 3' x 3' x 6' trap built into the weir fence.

FINDINGS

Sampling of Managed Lakes

In past years, most managed lakes in the Matanuska Valley have been sampled annually during some part of the spring or summer. Due to peak workloads during summer months, sampling has been extremely variable. In addition, samples collected from various lakes during the growing season are not directly comparable. Beginning in 1969, some stocked lakes were sampled during the 1969-70 winter season.

In the future, managed lakes will be sampled annually during mid-winter by gill nets. Winter sampling allows lake sampling to be accomplished when workloads are reduced and produces data which may be more comparable since it is being collected while fish growth is at a minimum. Due to this change in sampling time, some lakes were sampled twice in 1969. A summary of sampling data is presented in Table 1.

Lower Bonnie Lake was sampled once to evaluate stocking success of the 1968 plant of 20,000 rainbow trout fry. A total of 76 rainbow trout were taken, with 19 being age II or older. These fish originated from natural reproduction and/or stocking prior to 1967 as no rainbow trout were stocked in 1967. Fifty-seven age I rainbow trout were captured. These fish could be divided into two groupings by length frequency. The smaller group ranged from 140 - 182 mm and averaged 168 mm. Since Lower Bonnie Lake was stocked with two different sizes of fry in 1968 (10,000 at 379/lb. and 10,000 at 137/lb.), these size groups could represent both groups of stocked trout, or either group could be the result of natural reproduction in the creek between Lower and Upper Bonnie lakes. The origin of these trout could not be determined by scale analysis. After the scheduled 1970 planting is accomplished, it is recommended that stocking of Lower Bonnie Lake be discontinued until the relative contribution of natural reproduction can be determined.

Bradley, Kepler, Irene, and Long lakes are all located close together in the Kepler-Bradley lakes complex. Bradley and Kepler lakes are connected by a small channel. All four lakes are managed for rainbow trout production. Stickleback are present only in Long Lake. A small plant of 3,000 silver salmon fry was mistakenly made in Kepler Lake in 1968. Due to their roadside locations, Kepler and Bradley lakes are fished far more intensely than either Long or Irene lakes, resulting in a greater reduction in fish density, particularly during the first year after stocking. Table 1 shows that rainbow fry stocked in 1968 averaged between 300 and 338 mm by December, 1969 in each of the four lakes. By December, 1969, fry stocked in August, 1969 averaged from a maximum of 157 mm in Kepler Lake to a minimum of 126 mm in Bradley Lake. Long Lake was not stocked in 1969. Past data indicates that fish in Bradley Lake typically grow slower than in the inter-connected Kepler Lake. Fry stocked in Irene Lake in 1969, at a density of 400/acre, are growing at approximately the same rate as fry stocked at 250/acre in Kepler and Bradley lakes. Therefore, it appears that growth is independent of stocking density at the densities now being used in these four lakes. Therefore, it is recommended that stocking densities be raised in Kepler and Bradley lakes on a planned schedule to determine the maximum rate which can be used before growth is sharply reduced. Stocking density in Irene Lake should remain at 400 fry/acre as a comparison. Long Lake has not been stocked since 1968 and no further stocking is planned until chemical rehabilitation is completed to remove an indigenous stickleback population.

The 3,000 silver salmon fry planted in error in Kepler Lake were found in near equal densities in both Kepler and Bradley lakes during 1969 samplings, indicating that stocked fish move freely through the small channel between the lakes, at least during their initial period of lake residency. However, since rainbow trout and silver salmon fry stocked in the summer of 1968 were 22 mm and 12 mm longer, respectively, in Kepler Lake than in Bradley Lake by May 7, 1969, movement between the lakes was primarily restricted for a period of time prior to that date.

It is noteworthy that the 3,000 silver salmon which made up only 17% of the plant contributed 25% of the sample of age group I fish taken in Bradley Lake and 35% of the Kepler Lake sample. This apparently higher survival of silver salmon fry was accomplished despite a stocking size of 1,030 silver salmon fry per pound compared to rainbow trout fry stocked at 279 fry per pound. This data supports prior observations that silver salmon fry will demonstrate a considerably higher percentage survival than rainbow trout fry.

Ravine Lake sampling captured seven trout from the 1965 and 1966 stockings. This lake was treated with liquid Rotenone on October 3, 1969, and a heavy kill of stickleback resulted. It is recommended that Ravine Lake be stocked in 1970 with 5,000 rainbow trout fry (400 fry/acre).

Triangle and Echo lakes, both located in the Kepler-Bradley lakes complex, were both stocked with equal numbers of silver salmon and rainbow trout fry in 1968 to determine if both species could be raised successfully in the same lake. Such stocking, if successful, would provide both a summer fishery for rainbow

TABLE 1 Population Characteristics of Managed Matanuska Valley Lakes as Defined by Variable-Mesh Gill Nets, 1969-70.

Lake & Location	Sampling Date	Species* Stocked	No. Caught	Age Class	Length Range (mm)	Mean Length (mm)	Stocking History				Catch/ Net Hour
							Total No.	Per Lb.	Per Acre	Date Stocked	
Bonnie (Lower)	5/28/69	RT	19	II & older	208-444	302	Uncertain				0.39
T20N R6E Sec. 19-20		RT	57	I	93-182	137	Uncertain				1.19
Bradley	5/7/69	RT	2	III		450	18,000**	315	300***	8/15/66	0.09
T17N R1E		RT	53	I	109-232	161	18,000**	379	300***	8/2/68	2.66
Sec. 24		SS	27	I	140-204	165	3,000***	1,030	50***	6/20/68	1.14
	12/18/69	RT	11	I	271-346	300	18,000**	379	300***	8/2/68	0.46
		RT	14	0	93-161	126	15,000**	258	250***	8/6/69	0.58
		SS	8	I	222-317	252	3,000**	1,030	50***	6/20/68	0.33
Kepler	5/7/69	RT	1	III	450		18,000**	315	300***	8/15/66	0.02
T17N R1E		RT	59	I	103-277	183	18,000**	379	300***	8/2/68	1.23
Sec. 24		SS	17	I	136-227	177	3,000**	1,030	50***	6/20/68	0.35
	12/18/69	RT	4	I	319-372	338	18,000**	315	300***	8/15/66	0.16
		RT	2	0+	150-163	157	15,000**	258	250***	8/6/69	0.08
		SS	4	I	274-298	287	3,000**	1,030	50***	6/20/68	0.16
Irene	5/7/69	RT	3	III	503-520	510	4,700	315	224	8/15/66	0.14
T17N R1E		RT	46	I	155-218	184	6,300	379	300	8/2/68	2.19
Sec. 13	2/4/70	RT	1	III	505		4,700	315	224	8/15/66	0.05
		RT	6	I	288-376	315	6,300	379	300	8/2/68	0.28
		RT	29	0+	97-170	145	8,400	258	400	8/6/69	1.35
Long	5/7/69	RT	46	I	95-172	117	22,600	137	300	10/4/68	1.06
T17N R1E	2/4/70	RT	1	III	660		20,000	336	270	8/31/66	0.02
Sec. 13-14		RT	8	I	271-431	322	22,600	137	300	10/4/68	0.16

TABLE 1 (Cont) Population Characteristics of Managed Matanuska Valley Lakes as Defined by Variable-Mesh Gill Nets, 1969-70.

Lake & Location	Sampling Date	Species* Stocked	No. Caught	Age Class	Length Range (mm)	Mean Length (mm)	Stocking History				
							Total No.	Per Lb.	Per Acre	Date Stocked	Catch/ Net Hour
Ravine	5/28/69	RT	7	III-IV	377-453	416	2,700	---	216	1965	0.14
T20N R6E				(mixed)			2,700	336	216	8/3/66	
Sec. 19											
Triangle	12/18/69	RT	0		No catch		3,000	984	200	7/3/68	0.00
(Klaire)		RT	4	0+	144-167	154	6,000	258	400	8/6/69	0.17
T17N R1E		SS	8	0+	320-340	337	3,000	855	200	7/3/68	0.33
Sec. 13-14											
Echo	5/7/69	RT	2	III	496		9,200	450	400	8/15/66	0.04
T17N R1E		RT	11	I	188-235	211	3,500	1,675	152	6/20/68	0.28
Sec. 24		SS	37	I	127-196	169	3,500	1,030	152	6/26/68	0.77
		LNS	2	---	420-428	424			wild		0.04
	12/11/69	SS	25	I	197-262	223	3,500	1,030	152	6/20/68	0.60
Long	6/7/69	GR	5	mixed	175-405	322	Uncertain				0.09
T20N R7E											
Sec. 20-21											
Gooding	5/9/69	GR	0	No catch			20,000	---	400	6/13/68	0.00
T18N R1E	10/15/69	GR	159	0+	135-172	159	20,000	---	400	6/13/69	4.33
Sec. 22-23											
Gen (Victor)	12/10/69	GR	119	0+	158-184	173	2,000	---	225	6/10/69	5.17
T17N R1E											
Sec. 14											
Harriet	12/10/69	GR	52	0+	183-207	194	4,000	----	800	6/13/69	0.90
T17N R1E											
Sec. 24											

TABLE 1 (Cont) Population Characteristics of Managed Matanuska Valley Lakes as Defined by Variable-Mesh Gill Nets, 1969-70.

Lake & Location	Sampling Date	Species* Stocked	No. Caught	Age Class	Length Range (mm)	Mean Length (mm)	Stocking History				Catch/ Net Hour
							Total No.	Per Lb.	Per Acre	Date Stocked	
Delong	12/4/69	RT	6	I	267-311	280	2,500	4	104	6/19/69	0.13
T12N R4W		GR	1	0+		163	12,000	---	500	6/9/69	0.02
Sec. 3											
Sliver	12/19/69	DV	18	I	322-395	356	3,700	2,880	462	5/23/68	0.80
T17N R1E		GR	0		No catch		2,000	---	250	6/10/69	0.00
Sec. 14											
Canoe	5/5/69	DV	3	II or	395-450	431	91 Fingerling		4	1966	0.07
T17N R1E	6/16/69	DV	11	older	240-293	420	91 Fingerling		4	1966	0.04
Sec. 13		DV		No catch			700	4,500	214	5/23/67	0.00

*RT - Rainbow trout; SS - Silver salmon; LNS - Longnose sucker; GR - Grayling; DV - Dolly Varden.

**Represents total plant which was distributed into both Bradley and Kepler lakes.

***Density computed on total acreage of Bradley and Kepler lakes.

trout and a winter fishery for silver salmon. A summary of the stocking information is given in Table 2 from Redick (1969).

TABLE 2 A Summary of Fish Stocked in Echo and Triangle Lakes, 1968.

Lake	Date	Species	Size	Number	Fry/ Surface Acre
Echo	6/20/68	SS	1,030	3,500	150
	6/20/68	RT	1,675	3,500	150
Triangle	7/3/68	SS	855	3,000	200
	7/3/68	RT	984	3,000	200

Sampling during the 1968-69 winter indicated very little survival of rainbow fry in Echo Lake and relatively poor survival in Triangle Lake (Redick, 1969). Sampling during the current reporting period failed to produce any rainbow trout in Triangle Lake from the 1968 plant. In Echo Lake, only two rainbow trout were taken from the 1968 plant. Therefore, it is recommended that rainbow trout not be stocked in competition with silver salmon, with the possible exception of when rainbow trout fry are significantly larger than silver salmon fry.

Silver salmon fry from the 1968 planting were very successful in Triangle Lake. By December, 1969, the average length of these fish exceeded that of any other landlocked silver salmon population stocked in 1967 in the Matanuska Valley, with the exception of Knik Lake.

Long Lake (86-Mile) produced a catch of five grayling of uncertain origin. Some natural reproduction occurs and stocking of 50,000 fry in 1966 and 40,000 fry in 1969 were made. This lake should be sampled intensively in 1970 to evaluate the effects of the 1969 planting.

Gooding Lake, which demonstrated no survival of grayling fry from the 1968 plant, was restocked in 1969. On October 15, 1969, only four months after planting, two overnight gill-net sets produced 159 grayling averaging 159 mm. All of these fish were from the 1969 plant. The reason for failure of the 1968 plant is unknown, but may have been associated with the stocking procedure as all fish from the 1968 planting were believed to have died prior to gill-net sampling on January 29, 1969.

Gen and Harriet lakes are both small lakes in the Kepler-Bradley lakes complex. Both lakes are characterized by low oxygen levels in the winter. Neither had been stocked prior to 1969. As in Gooding Lake, growth of grayling in both lakes was exceedingly rapid, with samples averaging 173 mm in Gen Lake and 194 mm in Harriet Lake on December 19, 1969, with apparently high percentage survival.

Grayling fry were stocked in Delong and Jewel lakes in Anchorage prior to the introduction of military reared "catchable-sized" rainbow trout. It was hoped that if the catchable rainbow trout were removed rapidly by the intense fishery, grayling might survive in high enough numbers to provide an alternate fishery within the same lake. Sampling in Delong Lake produced only one grayling. Due to nearly constant recreational use other than angling, no sampling was conducted in Jewel Lake.

Grayling were stocked in Reed Lake, and despite a significant population of silver salmon, a moderate survival of grayling fry was attained (Table 3). On October 10, 1969, ten grayling averaging 157 mm were captured with variable mesh gill nets.

Sliver Lake, another small lake in the Kepler-Bradley lakes complex, was experimentally stocked in May,

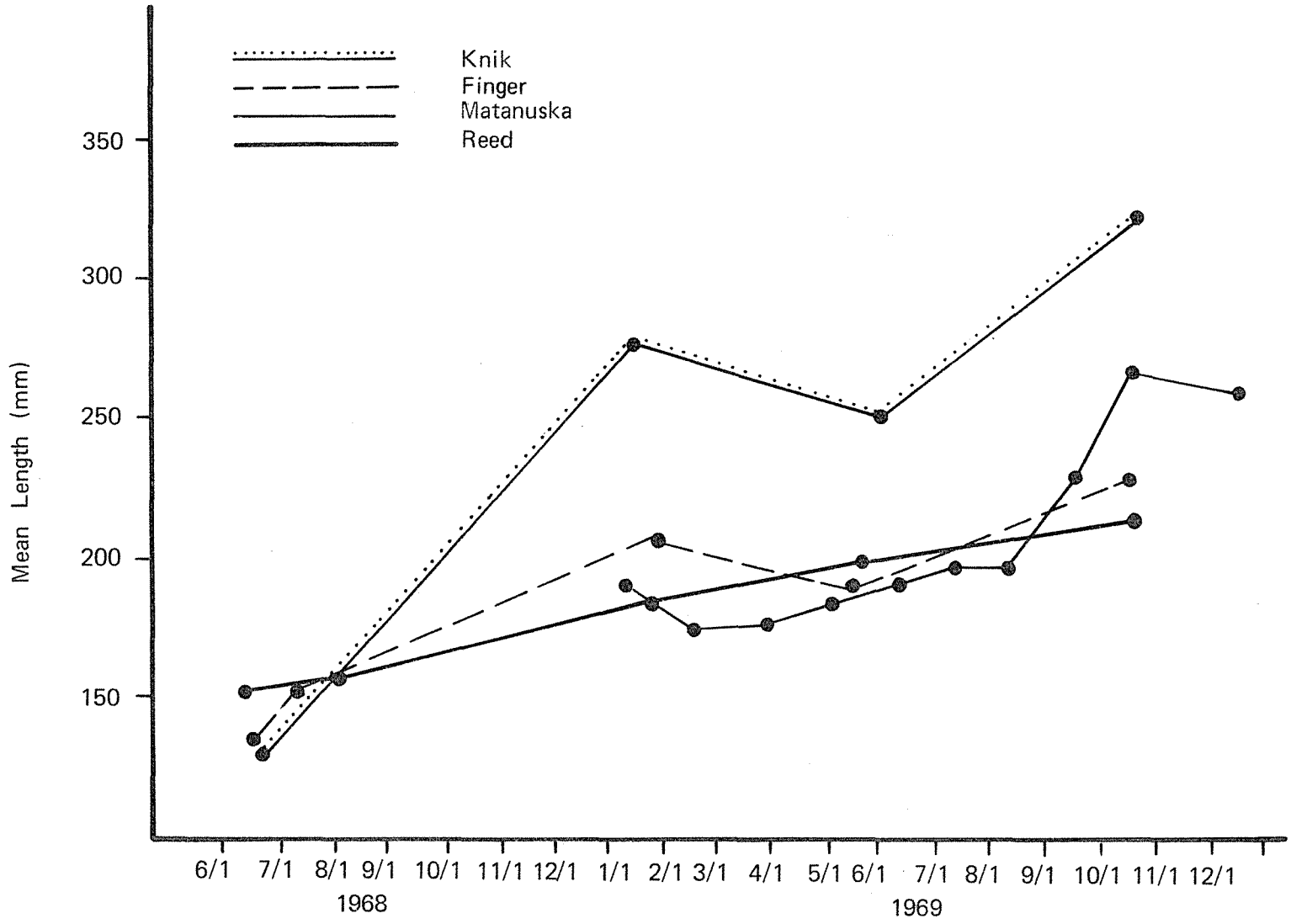

FIGURE 1 MEAN LENGTHS AND SAMPLING DATES FROM FOUR MATANUSKA VALLEY LAKES STOCKED WITH SILVER SALMON, 1968-69.

1968, with Dolly Varden fry at 2,880 fry/pound. Despite a dissolved oxygen level of only 0.25 ppm as recorded on March 6, 1969, eighteen Dolly Varden averaging 356 mm were captured on December 19, 1969. Most individuals in the sample were already sexually mature.

A plant of identical Dolly Varden fry failed to survive in Canoe Lake. Dolly Varden captured by gill-net sampling in May and June, 1969, originated from fingerling transplanted from Fire Creek in 1966 and/or fry stocked in 1967. Due to the apparently very low survival, Canoe Lake was stocked with rainbow trout fry in 1969.

Evaluation of Landlocked Silver Salmon Stocking

A review of the success of silver salmon stockings in the landlocked lakes of the Matanuska Valley was initiated in 1969 (Redick). This report segment is a continuation of that evaluation. Some data reproduced in Figure 1 and Table 3 was collected during the previous report segment. This evaluation is based primarily upon 14 lakes stocked with 505,100 silver salmon fry during 1967. Redick (1969) sampled 11 of the 14 stocked lakes in 1968 and 1969. This report covers subsequent sampling of 7 of the 11 lakes discussed in the prior report segment.

A summary of test-netting data is presented in Table 3. Average size of fish sampled during this and the previous segment is shown in Figure 1.

Beverly Lake:

Sampling in Beverly Lake in 1968 failed to catch any silver salmon from the 1967 planting. A single sample in 1969 produced a total of 13 silver salmon averaging only 126 mm. The reason for this unusually slow growth is unknown. Apparently, these fish were too small during 1968 sampling to be effectively captured by the nets. Beverly Lake should not be considered for future stocking.

Benka Lake:

A single sample was collected from Benka Lake in 1969. This plant survived in moderate numbers despite an indigenous Dolly Varden population. Growth of stocked silver salmon was somewhat slower than most other lakes sampled. Due to the presence of a healthy, indigenous Dolly Varden population, it is recommended that Benka Lake not be stocked in the future.

Mirror Lake:

The small catch made during the single sample collected from Mirror Lake indicates severe mortality occurred sometime between 1968 and 1969 sampling. In 1968 sampling, 223 silver salmon were taken by two nets fishing overnight at a rate of 4.28 fish per net hour. In 1969, two nets captured only two fish from the same plant. Sport fish harvest during the interval was limited. It is believed this mortality was caused by low dissolved oxygen levels which declined to 2.9 ppm during the 1968-69 winter.

New scheduled highway construction will provide a block in the outlet of Mirror Lake to upstream migrating fish. It is recommended that no further stocking be made in Mirror Lake until the outlet is blocked. At that time, the lake should be chemically treated to remove a stickleback population and stocked with grayling.

Reed Lake:

Reed Lake silver salmon were sampled on two occasions. Growth appears to be about average for lakes under consideration. Silver salmon in Reed Lake do not display the wide individual variability in growth demonstrated in all other lakes. Since Reed Lake is the only lake being evaluated in which stickleback are not present, it is assumed that competition from stickleback increases the variability in individual growth rates. This trend was also observed in the 1968 plant of silver salmon in Triangle Lake, where all stickleback had been chemically removed.

Finger Lake:

Finger Lake was also sampled twice during this report segment. Finger Lake was one of three lakes which demonstrated a marked reduction in the average size of fish sampled between January, 1967, and May, 1969. This reduction in size from 207 mm on January 23, 1969, to 191 mm on May 12, 1969, (see Figure 1) indicates either sampling variability or a differential mortality affecting larger members of the age class during the winter months. This reduction in size also occurred in samples collected from Knik and Matanuska lakes.

Knik Lake:

Knik Lake was sampled twice, and as in 1968, silver salmon were much larger than in any other lake in this evaluation. By October 13, captured silver salmon averaged 321 mm. Knik Lake was the only lake in which some female silver salmon from the 1967 plant became sexually mature in 1969. Four of 11 female silver salmon taken in the October 14 sample were approaching sexual maturity. These fish ranged from 391 - 448 mm. The seven immature females ranged from 229 - 275 mm.

Matanuska Lake:

Matanuska Lake was sampled monthly throughout the calendar year of 1969 to better define the growth cycle of stocked silver salmon. Sample data is compiled in Table 3, and mean sizes of fish sampled by date are depicted in Figure 1. A total of 10 samples consisting of 326 silver salmon were collected between January 6 and December 12, 1969. Two samples collected on January 6 and February 14, 1969, are reproduced in Table 3 from Redick (1969).

Of the 326 silver salmon collected, 187 were separated by sex. Ninety-nine (53%) were females. This approximately even sex ratio agrees with samples from other lakes.

As in Finger and Knik lakes, a reduction in mean size appeared after the January sample. The mean length of 194 mm did not exceed the January mean of 191 mm until June 5. Each sample from January through May exceeded 30 fish. The possibility of higher mortality of larger members of the age class during the winter months is supported by observations of the ice fishery on several lakes. Fish (within a given age class) entering the sport fishery averaged significantly smaller than predicted from pre-winter sampling. This discrepancy may also be related to a bias of gill nets toward larger fish. Unfortunately, the data does not clearly define growth rates at various time of the year, nor does the data indicate growth reaching maximum rates in late spring and summer as expected. Rather, this inconclusive data indicates the greatest growth is accomplished in the fall. Additional sampling with less biased equipment would be required to substantiate these findings.

Beginning with the August sample, the approaching sexual maturity of some males became evident. The two males in the August 8 sample which were approaching maturity were significantly larger than the remaining

immature males. This size difference became progressively greater as sexual maturity approached. Table 4 describes growth rates of mature males, immature males, and females which all remained immature. Probably, larger males were more likely to mature in 1969. However, extremely rapid growth of maturing males in the several months before maturity is indicated. In samples collected prior to July, males and females averaged approximately the same length. If most of the males which were significantly larger than the mean had matured, the remaining immature males would be expected to average significantly smaller than females. The mean length of immature males remained approximately equal to the females, indicating the difference in length between mature and immature males was caused principally by rapid growth of those males approaching maturity. As noted earlier, the length of maturing females greatly exceeded immature females in a small sample from Knik Lake.

Summary:

It is recommended that future sampling of the 1967 plantings of silver salmon be discontinued except as coincides with annual sampling of managed lakes.

The following observations seem pertinent regarding the stocking and management of landlocked silver salmon in Matanuska Valley lakes:

1. Due to relatively slow growth, most stocked populations do not significantly contribute to the sport fish harvest until the winter of the year following stocking (approximately 18 months after stocking). At this time, they will range from 150 - 250 mm.

2. Silver salmon grow too slowly to appeal to most summer anglers. Few silver salmon over 300 mm are harvested.

3. Silver salmon bite voraciously during the period of ice cover and are the most successful fish for the winter fishery. Winter anglers are satisfied with smaller fish than summer anglers, but do desire a higher catch rate.

4. Lakes stocked with silver salmon, primarily for use in the winter fishery, should be accessible to car travel on the ice, and if possible, located where wind periodically clears the snow from the ice to facilitate car travel.

5. Stocked silver salmon maintain an even sex ratio before maturation.

6. A significant portion of males mature (and die) one year earlier than females.

7. Both sexes undergo a period of extremely rapid growth just before sexual maturation.

8. Males do not die immediately after ripening in September and October. Ripe males will still be entering the sport fishery the following March.

9. Silver salmon exhibit a greater size variability between members of the same age class when competing with stickleback than when stocked in a lake without stickleback.

10. A selective mortality against larger members of the age class may operate during their second winter after stocking.

11. Gill-net sampling at various depths indicates silver salmon predominantly use the uppermost 10 - 12 feet of water. Regardless of high surface water temperatures, nets set deeper than 12 feet caught very few silver salmon.

TABLE 3 Stocking History and Growth Rates of Landlocked Silver Salmon Stocked in Matanuska Valley Lakes During 1967 as Defined by Gill-Net Sampling, 1968-69.

Lake & Location	Date of Sample	Species*	No. Caught	Length Range (mm)	Mean Length (mm)	Catch/ Net Hour	% of Total Catch	Stocking History		
								Number	Size	Fry/ Surface Acre
Sec. 24	5/22/69	SS	8	193-325	251	0.16	89			
		SS**	1	157	----	0.02	11	9,000	625	180
	10/14/69	SS	15	229-448	321	0.32	60	12,500	352	250
		SS**	10	148-208	183	0.21	40	9,000	625	180
Matanuska	1/6/69	SS	43	140-263	191	1.26	100	13,000	352	224
T17N R1E	2/14/69	SS	41	143-267	177	0.85	100			
Sec. 23	3/21/69	SS	40	152-237	179	0.93	98			
		RT	1	451	----	0.02	2	Mixed with SS at hatchery		
	5/2/69	SS	32	163-262	185	0.70	100			
	6/5/69	SS	15	165-228	194	0.74	100			
	7/8/69	SS	50	157-291	197	1.04	100			
	8/6/69	SS	31	163-259	198	0.60	100			
	9/16/69	SS	52	193-299	231	1.18	100			
	10/10/69	SS	9	211-345	268	0.38	100			
	12/12/69	SS	12	211-289	260	0.26	100			

TABLE 3 (Cont) Stocking History and Growth Rates of Landlocked Silver Salmon Stocked in Matanuska Valley Lakes During 1967 as Defined by Gill-Net Summaries, 1968-69.

Lake & Location	Date of Sample	Species*	No. Caught	Length Range (mm)	Mean Length (mm)	Catch/ Net Hour	% of Total Catch	Stocking History		
								Number	Size	Fry/ Surface Acre
Beverly	6/2/69	SS	13	97-166	126	0.26	27	12,000	352	218
T18N R2W		RT	15	123-506	278	0.30	33		wild	
Sec. 35-36		LNS	18	148-434	----	0.36	40		wild	
Big (Benka)	10/20/69	SS	14	202-261	226	0.30	22	124,000	352	108
T24N R4W		DV	51	193-460	299	1.11	78		wild	
Sec. 9-10										
Mirror	10/16/69	SS	2	151-179	165	0.04	2	40,000	646	500
T15N R1W		SS**	4	110-128	121	0.09	3	20,000	1,030	250
Sec. 1		RT	61	138-274	224	1.33	95	17,300	4	216
Reed	6/6/68	SS	107	132-170	152	2.23	81	5,200	352	281
T18N R1E		SS	10	173-204	185	0.45	95			
Sec. 8		SS	45	163-222	197	1.12	83			
		RT	9	348-404	390	0.22	17	1,075	---	60
	10/10/69	SS	23	217-257	239	0.49	68	5,200	352	281
		RT	1	410	----	0.02	3	1,075	----	60
		GR	10	144-167	157	0.21	29	8,000	----	432
Finger	6/21/68	SS	180	118-145	131	3.91	93	210,700	460	432
T17N R1E	7/27/68	SS	33	139-165	157	0.79	72			
Sec. 33	1/23/69	SS	13	165-245	207	0.29	93			
	5/12/69	SS	32	168-254	191	0.80	91			
		SS**	3	117-132	122	0.08	9	25,000	1,030	58
	10/9/69	SS	12	204-246	229	0.26	80	210,000	460	482
		SS**	3	116-218	190	0.08	20	25,000	1,030	58
Knik	6/21/68	SS	11	110-172	127	0.22	100	12,500	352	250
T16N R3W	1/17/69	SS	9	216-310	279	0.10	45			

TABLE 4 Numbers and Mean Lengths of Mature and Immature Male and Female Silver Salmon, Matanuska Lake, 1969.

	Mature Males			Immature Males			Immature Females			Combined		
Date	No. Sampled	Length Range (mm)	Mean Length (mm)	No. Sampled	Length Range (mm)	Mean Length (mm)	No. Sampled	Length Range (mm)	Mean Length (mm)	No. Sampled	Length Range (mm)	Mean Length (mm)
5/2/69	None			(15)	167-262	183	(17)	163-237	188	(32)	163-262	185
6/5/69		*			*			*		(15)	165-228	194
7/8/69	None			(25)	157-230	195	(26)	158-221	199	(51)	157-230	197
8/6/69	(2)	217-259	238	(12)	163-224	192	(17)	170-248	197	(31)	163-259	198
9/16/69	(9)	241-299	262	(14)	199-248	223	(29)	193-268	224	(52)	193-299	231
10/10/69	(3)	294-345	315	(2)	232-240	236	(4)	211-283	249	(9)	211-345	249
12/11/69	None			(6)	211-284	258	(6)	243-289	261	(12)	211-289	260

*Sample not separated by sex.

12. Catch rates acceptable to winter anglers have resulted only from plants ranging from 200 - 500 fry per surface acre.

13. Catch rates are highest in early winter as soon as the ice is safe for anglers. The catch rate declines steadily throughout the winter.

14. Due to their extremely competitive nature, silver salmon fry should not be stocked in competition with the fry of other game fish. Also, other species of game fish should not be stocked in the year following a silver salmon fry plant.

Cataloging and Inventory

A total of four small lakes were catalogued.

Conners Lake, T13N, R4W, Sec. 35-36: located within the greater Anchorage area has approximately 37 surface acres and a maximum depth of 19 feet. No fish are present. Dissolved oxygen measurements of 3.2 ppm indicated the lake may offer possibilities for management. Additional dissolved oxygen measurements and more complete volumetric surveys are recommended.

Nunaka Valley Gravel Pit, T13N R3W Sec. 23 and Tudor Gravel Pit, T13N R3W Sec. 32: Both pits are located in the greater Anchorage area and have maximum depths of 14 and 28 feet, respectively. While both pits are believed capable of supporting fish, public access could not be attained to either pit.

Scotty Lake, T26N R6W Sec. 23-26: This 220-acre lake, located north of the Petersville Road, was found to have a maximum depth of only six feet. The lake is covered by emergent vegetation during the late summer. This lake is not deemed suitable for sport fish management. The lake does serve as a rearing site for silver salmon fry.

Dissolved Oxygen Sampling

Thirty-two lakes were tested for dissolved oxygen during March and April, 1969. This data is summarized in Table 5. Samples were collected from 12 lakes in a major lake complex commonly known as the Meadow Lakes. Of these lakes, only School (Luci) Lake had oxygen levels less than 5.0 ppm. School Lake, which contained only 2.4 ppm dissolved oxygen, has a natural population of rainbow trout and stocking is not necessary.

Seven lakes contained 2.0 ppm or less dissolved oxygen. Canoe Lake (2.0 ppm) and Sliver Lake (0.25 ppm) contained Dolly Varden populations which survived over winter. Gen Lake (0.9 ppm) did not contain game fish during the 1968-69 winter. All four lakes have been, or will be, stocked with grayling fry.

Lucile Lake (1.3 ppm) contained a limited population of stocked silver salmon which successfully survived over winter. However, a severe winter kill of stocked silver salmon occurred in Mirror Lake which contained 2.9 ppm dissolved oxygen. Either dissolved oxygen tests are not representative of the entire lake, or some other factor is critical in determining the success of game fish surviving over winter.

Sampling of Salmon Populations

King salmon were enumerated by both aerial and ground surveys on two east-side tributaries of the

TABLE 5 Lakes Tested for Dissolved Oxygen, Matanuska Valley, 1969.

Lake	Date	Location	Snow Depth (in.)	Ice Depth (in.)	Water Depth (ft.)	ppm
Beaver	3/18/69	T17N R3W Sec. 4,9	11	23	5	9.1
					10	9.6
					15	3.3
Canoe	3/11/69	T17N R1E Sec. 13	None	34	5	2.0
					10	1.5
					20	0.4
Conners	3/7/69	T12N/13N R4W Sec. 35,2	8	30	5	3.2
					9	2.3
Frog	3/26/69	T18N R2W Sec. 30,31	8	22	5	7.9
					10	4.9
Gen	3/5/69	T17N R1E Sec. 14	7	29	5	0.2
					10	0.0
Gooding	2/7/69	T18N R1E Sec. 22,23, 26,27	0	40	5	0.5
					5	0.5
Goose	3/7/69	T13N R3W Sec. 21,28	7	34	5	0.9
					9	0.8
Harriet	3/6/69	T17N R1E Sec. 24	7	30	5	0.7
					10	0.3
Irene	3/16/69	T17N R1E Sec. 13	2	34	5	6.4
					10	6.1
					20	3.7
Jean	3/11/69	T19N R4W Sec. 19	24	24	5	10.1
					10	6.8
					20	3.2
Jewel	3/24/69	T12N R4W Sec. 10	9	32	5	4.5
					10	2.7
Johnson	3/21/69	T17N R1E Sec. 14	2	25	5	3.6
					10	2.6
					20	1.6
Knik	3/24/69	T16N R3W Sec. 24	12	28	5	7.6
					10	6.4
					20	0.8
Lalen	3/18/69	T18N R2W Sec. 31,32	7	24	5	5.8
					10	5.6
					13	0.6

TABLE 5 (Cont) Lakes Tested for Dissolved Oxygen, Matanuska Valley, 1969.

Lake	Date	Location	Snow Depth (in.)	Ice Depth (in.)	Water Depth (ft.)	ppm
Loon	3/11/69	T18N R3W Sec. 2	6	23	5	5.7
					7	5.2
Lucile	3/21/69	T17N R1W Sec. 8,9	4	34	5	1.3
					10	1.6
Marlow	3/11/69	T19N R3W Sec. 22,23 26,27	24	24	5	8.0
					10	5.5
					15	4.8
Meirs	3/5/69	T17N R1E Sec. 18	5	32	5	3.2
					10	3.1
					20	2.8
Mirror	3/6/69	T15N R1W Sec. 1	4	34	5	2.9
					8	1.1
Morvro	3/26/69	T18N R3W Sec, 3, 34, 35	4	22	5	11.0
					10	7.0
					15	4.5
Paradise	3/20/69	T18N R1W Sec. 25	0	39	5	9.7
					10	5.2
Patricia	3/26/69	T18N R3W Sec. 26,35	8	22	5	11.3
					10	5.2
					15	4.1
Prator	3/26/69	T18N R3W Sec. 25	11	22	5	12.3
					10	8.8
					20	4.2
Ravine	3/25/69	T20N R6E Sec. 19	1	48	5	10.6
					10	10.3
					20	8.2
Reed	3/20/69	T18N R1E Sec. 8	1	40	5	6.0
					10	3.4
Rocky	3/21/69	T17N R3W Sec. 16,21	11	23	5	7.1
					10	4.4
					20	2.6
School (Luci)	3/26/69	T18N R3W Sec. 36	7	24	5	2.4

TABLE 5 (Cont) Lakes Tested for Dissolved Oxygen, Matanuska Valley, 1969.

Lake	Date	Location	Snow Depth (in.)	Ice Depth (in.)	Water Depth (ft.)	ppm
Seymour	3/11/69	T18N R2W Sec. 28,29 32,33	8	24	5	7.6
Sharon	3/5/69	T17N R3W Sec. 12	12	21	5	3.5
					10	0.5
Sliver	3/6/69	T17N R1E Sec. 13,14	7	32	5	0.3
					10	0.0
Visnaw	3/18/69	T18N R2W Sec. 29,32	8	24	5	7.0
					10	5.0
					15	4.9
West Beaver	3/18/69	T17N R3W Sec. 4,5,8,9	11	24	5	8.6
					10	5.8
					15	1.4

Susitna River. In both Willow and Montana creeks, numbers of king salmon observed by aerial surveys were greater than in any year since statehood.

The largest number of king salmon enumerated in Willow Creek by aerial and foot surveys was 185 and 290, respectively.

In Montana Creek, 92 king salmon were observed by aerial surveys and 150 by streambank count. Very low streamflows resulted in excellent counting conditions, and it is believed that streambank counts represent nearly complete enumeration of salmon stocks.

Silver salmon spawning in 1969 appeared to be substantially lower in number than in 1968. A total of 14 foot surveys were conducted over established index areas, as defined by Redick (1969), on five separate streams.

In 1969, an extremely warm, dry fall held streamflows at critically low levels. Water temperatures remained high. Silver salmon typically entered spawning streams about ten days later in 1969 than in 1968, and spawning activity was condensed into a relatively brief period. It is believed that a substantially higher percentage of the total run was enumerated during 1969 counts than in 1968. A summary of 1969 silver salmon enumeration data is presented in Table 6.

No silver salmon were observed in Goose Creek during two surveys. In 1968, 147 silver salmon were observed during the peak count in Goose Creek. However, almost all fish observed in 1968 were ripening in a large resting area very near the confluence with the Susitna River. Very few of these fish were later found over spawning redds, and perhaps most of the estimated 200 silver salmon in Goose Creek in 1968 actually re-entered the Susitna River and spawned in a different system. Goose Creek should be critically evaluated in 1970, and if significant numbers of silver salmon are not spawning in this system, then it should be discarded as an index area.

TABLE 6 Estimated Timing and Numbers of Silver Salmon in Escapement Index Areas, Upper Cook Inlet, 1969.

Stream	No. of Counts	Est. Peak of Run	Largest Count Attained	Date of Count	Est. Total Spawning in Index Area
Goose	2	None	0	---	None
Birch	3	9/25-10/5	142	10/1	175
Cottonwood	3	9/20-10/1	9	9/28	20
Meadow	3	9/15-9/25	109	9/18	150
Fish	3	9/25-10/5	852	9/30	1,100

Three counts were made in Birch Creek in 1969 with the largest count being 142 silver salmon. This total compares with a maximum count of 125 fish in 1968, an increase of 14% over the previous year. However, due to the unusual climatic conditions and altered spawning behavior, it is believed the actual run of silver salmon into Birch Creek was smaller than in 1968.

Cottonwood Creek was enumerated on three occasions with the largest count being only nine silver salmon on September 28, 1969. In 1968, counts were not initiated until well past the peak of spawning. However, 22 silver salmon were observed on October 2, 1968. The number of silver salmon in Cottonwood Creek in 1969 was much smaller than in 1968.

Meadow and Fish creeks are part of the same stream-lake complex. Meadow Creek drains a series of lakes and flows into Big Lake. Fish Creek is the outlet to Big Lake and drains into Cook Inlet at Knik Arm.

Index areas in both streams were enumerated on three occasions. In addition, a weir was operated near the mouth of Fish Creek. Index counts are related to a numerically known escapement in this system.

In 1968, spawning in Meadow Creek peaked during the first ten days in September, but spawning extended over a period of several weeks. In 1969, silver salmon entered the stream much later and spawning was compressed into a brief period extending from approximately September 15 - 30.

The peak count of 109 spawning silver salmon was made on September 18, 1969. The peak count of 1968 was only 54 silver salmon. Thus, index area counts in 1969 imply a 100% increase in run size over 1968; however, the change in spawning behavior due to low streamflows and high water temperatures is believed to have resulted in a higher percentage of the total run being enumerated. Whereas approximately 300 silver salmon are believed to have spawned within the Meadow Creek index area in 1968, only about 150 are believed to have used the area in 1969. The peak count of 109 silver salmon represents 2.56% of the total run passing the Fish Creek weir.

Silver salmon also spawned much later in Fish Creek with the maximum count of 852 fish made on September 30. Spawning activity was at or near a peak when the count was made. The peak count of 852 silver salmon represents 20.05% of the total run to the system.

Each year a weir is operated on lower Fish Creek by Commercial Fisheries Division personnel to enumerate red salmon escapement into the Fish Creek - Big Lake - Meadow Creek system. The weir has been removed each year on August 1 as the red salmon migration is essentially complete. In 1969, the Sport Fish Division continued the weir operation through September 2 to provide an index to silver salmon escapement into upper Cook Inlet systems and to assist in the evaluation of using index areas to estimate silver salmon escapements. This weir allows index escapement counts in Fish and Meadow creeks to be evaluated against a numerically known escapement.

In 1969, extremely low streamflows persisted, and salmon runs were late. A summary of red and silver salmon migrations by day is presented in Table 7.

The red salmon run into Fish Creek totaled less than 12,000 fish, the smallest run since counts were initiated in 1938. The run was also late with 47.7% of the run entering the stream after August 1.

The silver salmon run totaled approximately 4,250 fish. Approximately 200 stragglers were still below the weir site when the weir was removed on September 2.

A combination of intense human activity along the streambanks and low streamflows essentially stopped the movement of salmon into Fish Creek in August. To insure adequate salmon escapement, the stream was closed twice, as shown in Table 7, by emergency regulation. The sport fishery operates mostly near the weir site at the mouth of Fish Creek. Very few fish moved past the weir when the sport fishery was operating since almost all migration occurred when the sport fishery was closed. Silver salmon passing the weir site ultimately contributed to the spawning population. The reduced number of silver salmon passing the weir while the sport fishery was open was not caused by an extensive harvest below the weir site. Rather, intense angler activity along the streambanks and in the stream made salmon reluctant to leave the silty, inter-tidal area where large numbers of salmon could be seen at any time rolling at the surface.

The effect that anglers imposed on the migration of salmon in Fish Creek is important in that it points out problems in managing recreational salmon fisheries in small streams accessible to the large population centers of the Cook Inlet area. This problem is compounded in Fish Creek because periods of high streamflows, which assisted and accelerated salmon movement through lower Fish Creek in past years, are now reduced by a water flow regulating device at the outlet of Big Lake.

It should be noted that the drought condition in the Matanuska Valley, which caused extremely low streamflows in 1969, had continued into 1970. Further reduction of streamflows associated with winter freezeup may be causing extensive egg loss in many upper Cook Inlet salmon stocks. It is impossible to investigate this problem. However, management personnel should be aware that progeny of 1969 spawning may be reduced in number.

The creel census scheduled for the east-side tributaries of the Susitna River was almost totally omitted due to manpower limitations. The fragmentary data which was collected does not warrant reporting.

LITERATURE CITED

Redick, R. Russell. 1969. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Cook Inlet Drainage. Alaska Department of Fish and Game. Federal Aid In Fish Restoration, Annual Report of Progress, 1968-1969, Project F-9-1, 10:213-232.

TABLE 7 Numbers and Timing of Red and Silver Salmon Passing the Fish Creek Weir, 1969.

Date	Red Salmon	Accumulated Red Salmon	Silver Salmon	Accumulated Silver Salmon
SPORT FISHERY OPEN				
Thru 7/31		6,243		11
8/1	14	6,257	0	11
8/2	75	6,332	11	22
8/3	43	6,375	0	22
8/4	34	6,409	0	22
8/5	368	6,777	17	39
8/6 (a.m.)	12	6,789	0	39
Total	546		28	
SPORT FISHERY CLOSED				
8/6 (p.m.)	1,278	8,067	123	162
8/7	2,431	10,498	860	1,022
8/8	202	10,700	49	1,071
8/9	47	10,747	42	1,113
8/10	95	10,842	67	1,180
8/11	30	10,872	84	1,264
8/12	108	10,980	236	1,500
8/13	180	11,160	254	1,754
8/14	155	11,315	283	2,037
8/15	177	11,492	222	2,259
8/16	37	11,529	124	2,383
8/17 (a.m.)	0	11,529	0	2,383
Total	4,740		2,344	
SPORT FISHERY OPEN				
8/17 (p.m.)	1	11,530	7	2,390
8/18	0	11,530	0	2,390
8/19	2	11,532	6	2,396
8/20	2	11,534	3	2,399
8/21	1	11,535	4	2,403
8/22	1	11,536	1	2,404
8/23	5	11,541	11	2,415
8/24	0	11,541	0	2,415
8/25	1	11,542	0	2,415
8/26	0	11,542	0	2,415
Total	13		32	
SPORT FISHERY CLOSED				
8/27	173	11,715	763	3,178

TABLE 7 (Cont) Numbers and Timing of Red and Silver Salmon Passing the Fish Creek Weir, 1969.

Date	Red Salmon	Accumulated Red Salmon	Silver Salmon	Accumulated Silver Salmon
8/28	176	11,891	457	3,635
8/29	22	11,913	143	3,778
8/30	6	11,919	78	3,856
8/31	22	11,941	164	4,020
9/1	0	11,941	29	4,049
9/2	1	11,942	4	4,053
Total	400		1,638	

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Approved by:

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s/Rupert E. Andrews, Director
Division of Sport Fish

Date: April 15, 1970.

RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-2 *Name:* Sport Fish Investigations of Alaska.

Job No.: 11-D *Title:* **Creel Census of the Sport Fish and Sport Fish Waters of the Cook Inlet Drainage.**

Period Covered: July 1, 1969 to June 30, 1970.

Project inactive. Creel census scheduled for east-side Susitna River tributaries was almost totally omitted due to manpower limitations.

Prepared by:

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Date: April 30, 1970.

Approved by:

s/Howard E. Metsker
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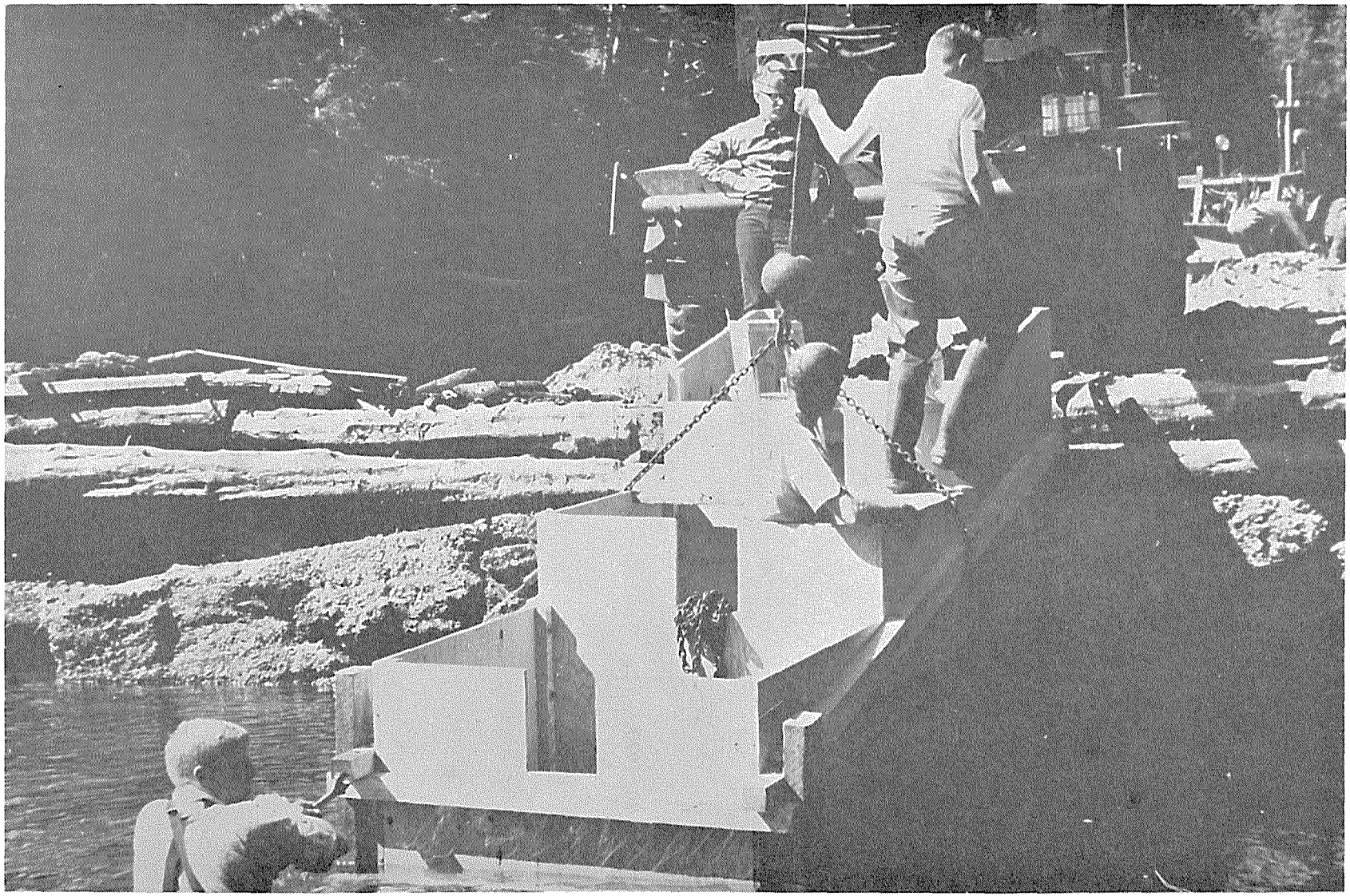

A FISH PASSAGE STRUCTURE BEING SET INTO PLACE. THE THREE-STEP POOL FACILITY ACCOMMODATES FISH LOW BARRIER.