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STATE OF ALASKA

William A. Egan, Governor

ANNUAL REPORT OF PROGRESS, 1964 - 1965

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-6

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
Walter Kirkness, Commissioner

E. S. Marvich, Deputy Commissioner

Alex H. McRea, Director
Sport Fish Division

Louis S. Bandirola, Coordinator

INTRODUCTION

This report of progress consists of Job Segment Reports from the State of Alaska Federal Aid in Fish Restoration Project F-5-R-6, "Sport Fish Investigations of Alaska."

The project during this report period is composed of 23 separate studies designed to evaluate the various aspects of the State's recreational fishery resources. Of these, eight jobs are designed to pursue the cataloging and inventory of the numerous State waters in an attempt to index the potential recreational fisheries. Four jobs are designed for collection of specific sport fisheries creel census while the remainder of the jobs are more specific in nature. These include independent studies on king salmon, silver salmon, grayling, Dolly Varden, a statewide access evaluation program and an egg take program.

A report concerning the residual effects of toxaphene accumulates the findings of a three-year study. The report presented here terminates this segment and is a final report. The information gathered from the combined studies will provide the necessary background data for a better understanding of local management problems and will assist in the development of future investigational studies.

The subject matter contained within these reports is often fragmentary in nature. The findings may not be conclusive and the interpretations contained therein are subject to re-evaluation as the work progresses.

Volume 6 Report No. 14-A

JOB COMPLETION REPORT

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.

Project No.: F-5-R-6 Title: Inventory and Cataloging of Sport Fish and Sport Fish Waters of the Copper River and Prince William Sound Drainage, and Upper Susitna River Drainage.

Job No.: 14-A

Period Covered: April 1, 1964 to March 31, 1965.

ABSTRACT

During the course of field investigations, 36 lakes were test netted. Of these, 21 had been checked previously, but were test netted again to obtain trends in fish populations. The remaining 15 lakes had never been checked.

Eight of the new lakes were along the Lake Louise Road. Six of these support fine populations of grayling.

Hatchery plants of silver salmon and grayling were found to be progressing satisfactorily in Moose, Tolsona and Dick Lakes.

Subsistence fishermen were checked during the summer to determine composition of their catches and to determine the times of maximum numbers of the salmon and steelhead trout. Red and king salmon runs were at their peak during the first week in July in the Copper Center area. Steelhead trout and silver salmon were taken during early September. The number of subsistence permits, 994, tripled since 1961 but there was no increase in numbers of fish harvested.

Creel census data from military recreation camps was analyzed. There was a significant drop in the number of returns from the Lake Louise camp, although fishing pressure was actually higher. The rate of catch remained the same as in 1963. Almost 330,000 eggs were taken from an experimental spawning operation conducted on Moose Creek; 1,034 grayling were captured for this purpose.

Investigations were made of five highway construction projects to determine effects on the fisheries and to make recommendations.

The program of winter oxygen determinations was continued and 21 lakes were checked.

RECOMMENDATIONS

In consideration of the findings made during 1964-1965 the following recommendations are made:

1. It is recommended that creel census takers at the Valdez and Lake Louise Military Recreation Camps be briefed thoroughly on procedures and that the camps be visited periodically during the summer to collect creel census sheets and correct errors.

2. It is recommended that cataloging and inventory of lakes and streams in the Copper River and Upper Susitna Drainages be continued. Emphasis should be placed on those waters adjacent to the highway system.

3. It is recommended that preliminary surveys be carried out on some of the larger "fly-in" lakes in the area. This would include Susitna, Tyone, Rat, Crosswind, Ewan and Tanada Lakes.

4. It is recommended that the preliminary investigations of the whitefish be continued and include length-weight, age-growth and distribution.

5. It is recommended that additional fisheries investigations be carried out on Klutina Lake and its tributaries. By midsummer of 1965 the access road into this lake will be completed and sportsmen will be attracted to the area.

6. It is recommended that efforts be made to determine the extent of steelhead trout runs in the Gulkana River Drainage. This should include creel checks at access points along the river during the summer.

7. It is recommended that increased efforts be made to secure a minimum of one million grayling eggs. This will possibly entail seeking more than one source and require additional help for a short time.

OBJECTIVES

1. To continue the inventory and cataloging of lakes and streams in this area with emphasis on those adjacent to the Alaska Highway System.

2. To evaluate the present and potential use of fishing waters in this area.

3. To investigate those fisheries which have potential egg-taking sites for trout, char and grayling and to secure eggs wherever possible and practical.

4. To determine trends in fish populations in the more exploited waters and to formulate management plans for these fisheries.

5. To evaluate multiple water use development projects for the proper protection of the sport fish resources.

6. To maintain a check on the harvest of fish by fish wheels, dip nets and other forms of subsistence fishing gear.

TECHNIQUES USED

To sample fish populations, 125-foot experimental gill nets with 5 mesh sizes ranging from 1 inch to 3-1/2 inches were used. These nets were all six feet deep and rigged to dive. With a few exceptions, all nets were set from the shoreline out.

Backpack equipment was used on those waters close to a road while airplane transportation was utilized to reach waters inaccessible by foot travel.

Aerial surveys were conducted to check for salmon and steelhead migrations.

Winter oxygen determinations were accomplished through the use of a Hach Colorimeter, and a hand-operated ice-auger was employed for penetrating ice cover.

Temperatures and depths were taken with battery-powered electronic gear. Fish were captured for spawn by trapping, seining and angling. The plastic impression method was used for scale reading.

FINDINGS

The Copper River, Prince William Sound and Upper Susitna River drainages comprise a vast complex of lakes and streams which support, or have the potential for supporting, sport fish populations. The Copper River Drainage alone has an estimated area of 21,000 square miles with an annual runoff of approximately 24,000,000 acre feet of water. Unfortunately, most of the waters in this area are not adjacent to the road system and, therefore, are not readily available to the average angler.

In keeping with the philosophy of providing angling for the largest number of fishermen, the emphasis of effort has been on those waters adjacent to access roads. Projects F-5-R-2, -3, -4 and -5 have been largely concerned with the inventory and cataloging of these waters. This project is a continuation of these efforts, since there are still many waters

which must be surveyed. In addition, surveys have been initiated on larger waters that are quite distant from the road and are generally considered fly-in lakes. The nationwide steady increase in anglers is reflected here in Alaska and continuing efforts must be made to stay ahead of this pressure.

The sport fish in the Copper River drainage consist primarily of grayling, Thymallus arcticus (Cope), lake trout, Salvelinus namaycush (Walbaum), rainbow trout, Salmo gairdneri (Richardson), Dolly Varden, Salvelinus malma (Walbaum), and cutthroat trout, Salmo clarki (Richardson).

Burbot, Lota lota (Linnaeus), round whitefish, Prosopium cylindraceum (Pallas), and lake whitefish, Coregonus clupeaformis (Mitchill), are found in the waters of this area but are infrequently taken by sport fishermen.

Grayling Spawning

The annual spawning migration of grayling in this area was delayed somewhat by the late spring breakup. On May 18, 1961, (Project F-5-R-2), a trap was installed in Bear Creek, Mile 127 Richardson Highway, and 191 grayling were taken. In 1964, the first grayling in Bear Creek were not observed until June 1.

Planting requests throughout the state made it imperative that grayling eggs be secured. Among the streams in this area that were checked for spawning populations are Sourdough, Moose, Bear, Dry, Mae West, Popular Grove, Gillespie and Trail.

Moose Creek, Mile 187 Glennallen Highway, was the only stream in which a concentration of fish was located. Limited time and personnel prevented additional observations on the other streams. The first grayling were noted in Moose Creek on June 1. At this time the annual runoff was approaching the peak and the water temperature was 36° F. On June 1 and 2, 1,034 grayling were collected by seining and angling; 479 were females and 555 were males. Other fish were taken but only those that appeared to be mature were retained.

On June 3, 165 females were stripped. These eggs measured 800 per ounce and 253,110 were delivered to the Fire Lake Hatchery that afternoon by airplane. During the day, the water temperature varied from 47° F. at 10:00 a.m. to 50° F. at 3:00 p.m. The following day, the 10:00 a.m. water temperature was 48° F.

The 10:00 a.m. water temperature on June 5 was 50° F. and the final egg take was made. Fifty-two female grayling were stripped and 79,716 eggs were sent to Fire Lake. This made a total of 332,826 grayling eggs shipped to Fire Lake Hatchery. Some of the eggs were packed in glass jars and shipped by airplane in ice-filled camp coolers. The remainder were packed in

insulated boxes containing egg trays and melting ice. According to Fire Lake Hatchery personnel, both methods were satisfactory.

During the Moose Creek egg-take, only 45 percent of the females were used. The remainder were green, immature, had bloody eggs, or egg plugs. Ordinarily it would be expected that grayling would not have been ripe so soon after capture. However, the runoff was delayed abnormally and the fish remained at the mouth of Moose Creek for a longer period of time before moving upstream. During this time, maturation of the eggs advanced rapidly. A trap was placed in Gillespie Creek, Mile 167 Richardson Highway, on June 10. During the next 24 hours, only 5 grayling were taken. The water temperature was 41° F. and it was felt that the run had just started. Other commitments prevented leaving the trap in longer.

It is desirable to take grayling eggs from areas seldom used by anglers; however, during the spring breakup which coincides with grayling spawning, it is virtually impossible to reach most of the remote areas. Ice and snow conditions prevent most boat and airplane travel.

A "V" type trap would be a much better means of securing grayling from the streams in this area but unfortunately the annual spring runoff is generally quite high and large amounts of debris are carried by the waters at this time. Installation and maintenance of a trap might prove to be too expensive.

Scales and fork length measurements were taken from 100 grayling, chosen at random, from Moose Creek. Scale readings indicated that 58.5 percent were 4 years old, 38.5 percent were 3, and 3 percent were 5 years old. The fish ranged in length from 8.9 inches to 13.7 inches and averaged 11.5 inches. No significant difference was noted between males and females.

Gill Netting

Test netting was conducted on 36 lakes during the report period (Table 1). Fifteen of these had not previously been checked. Twenty-one lakes were netted to determine survival of hatchery plants and other trends in the fish populations.

Thirteen lakes were checked in the Lake Louise area. Eight of these are located along the Lake Louise road and the remainder are accessible by boat and walking. The predominant fish present was the grayling, with whitefish, lake trout, burbot and suckers also being taken. It is interesting to note that six of the lakes adjacent to the Lake Louise road have good populations of grayling. However, on numerous trips up and down this road during two summers, only one fishing party has been observed. Anglers using that road are generally headed for Lake Louise and also may not be aware that fish are present in the small, roadside lakes. Signs indicating these fisheries will be installed.

TABLE 1. - Test Netting Summaries, 1964

Name	Number Of Fish	Species*	Length Range	Length Mean	Frequency**	% Composition
Caribou Lake	9	GR	4.0-14.1	9.7	.56	75
(Lk. Louise Rd.)	3	BB	16.0-24.0	19.0	.19	25
Crater Lake (Lk. Louise Rd.)		No Fish				
Elbow Lake (Lk. Louise Rd.)	7	GR	9.1-14.8	11.2	.43	100
Spruce Lake	10	GR	7.5-14.0	11.6	.55	71.4
(Lk. Louise Rd.)	3	LNS	11.0-19.0	14.0	.16	21.4
	1	BB	18.0	18.0	.05	7.2
Peter Lake	9	GR	9.0-15.0	12.3	.50	69.3
(Lk. Louise Rd.)	2	BB	9.0-10.8	9.9	.11	15.4
	2	LNS	15.0-19.8	17.4	.11	15.4
Paul Lake (Lk. Louise Rd.)	11	GR	6.4-13.2	10.3	.65	100.0
Crosswind Lake	80	WF	7.4-17.5	13.0	1.66	75.5
	16	LNS	17.0-19.5	18.0	.36	15.0
	10	LT	18.0-35.8	29.3	.21	9.5
Dick Lake	17	GR	11.8-14.5	13.5	.50	100.0

TABLE 1 (Cont.) - Test Netting Summaries, 1964

Name	Number Of Fish	Species*	Length Range	Length Mean	Frequency**	% Composition
Tazlina Lake	41	WF	8.1-16.0	12.2	.57	.55
	15	LNS	8.8-17.8	13.6	.21	.20
	10	LT	14.4-19.5	16.0	.14	.13
	3	GR	10.3-12.0	11.2	.04	.04
	3	DV	11.7-13.0	12.4	.04	.04
	2	BB	22.0-22.5	22.2	.02	.03
	1	RS	19.6	19.6	.01	.01
Klutina Lake	30	WF			1.36	.55
	14	RS			.63	.25
	6	LNS			.27	.11
	4	DV			.18	.07
	1	GR			.05	.02
Arizona Lake	No fish taken					
Beaver Lake	27	WF	8.0-11.0	9.6	.67	.58
(Lk. Louise Rd.)	10	LNS	11.0-17.0	14.0	.25	.21
	9	LT	22.5-29.0	26.6	.22	.19
	1	BB	25.0	25.0	.02	.02
Burnt Lake	30	WF	7.2-13.8	11.1	.63	.71
(Lk. Louise Rd.)	9	LNS	6.4-15.2	9.0	.20	.22
	3	GR	6.6-12.0	8.5	.06	.07
Dog Lake	33	WF	8.0-15.3	10.8	.52	.56
(Lk. Louise Rd.)	17	LNS	8.5-20.1	14.6	.27	.30
	5	LT	14.5-27.0	21.4	.08	.08
	3	GR	7.0- 8.5	7.6	.05	.05
	1	BB	13.5	13.5	.02	.01

TABLE 1 (Cont.) - Test Netting Summaries, 1964

Name	Number Of Fish	Species*	Length Range	Length Mean	Frequency**	% Composition
June Lake	12	WF	6.8-12.0	8.8	.66	75.0
	3	LNS	9.0-16.5	12.8	.16	19.0
	1	GR	13.3	13.3	.06	6.0
Nita Lake	30	LNS	10.5-17.8	12.6	.83	51.0
	24	WF	7.0-12.8	8.8	.67	41.0
	5	GR	9.5-11.3	10.0	.27	8.0
Moose Lake	100	GR	6.2-12.3	9.3	2.80	65.0
	46	LNS	8.1-13.6	9.7	1.30	30.0
	8	SS	8.3-17.1	14.4	.22	5.0
Pippin Lake	No Fish					
Dinty Lake	86	WF	8.8-20.1	14.3	1.86	98.0
(Lk. Louise Rd.)	2	LNS	7.8-10.1	9.0	.04	2.0
Swan Lake	8	WF	10.2-12.0	11.1	2.70	80.0
(Lk. Louise Rd.)	1	LNS	16.5	16.5	.33	10.0
	1	LT	26.0	26.0	.33	10.0
Lake #9	26	LNS	6.7-17.5	13.2	2.60	76.0
(Lk. Louise area)	8	WF	8.4-12.6	9.1	.80	24.0
Blueberry Lake	28	RB	5.8-12.5	8.4	1.75	100.0
Summit Lake #1	15	RB	6.0-12.8	7.7	.93	100.0
Summit Lake #2	13	RB	7.0-10.2	9.0	.81	100.0

TABLE 1 (Cont.) - Test Netting Summaries, 1964

Name	Number Of Fish	Species*	Length Range	Length Mean	Frequency**	% Composition
Upper Beaver Lake	8	DV	7.7-10.2	8.9	.40	73.0
(Cordova)	3	CT	8.2-10.0	8.9	.15	27.0
Lower Beaver Lake	11	CT	7.0-11.5	8.6	.55	79.0
(Cordova)	3	DV	7.0- 9.8	7.9	.15	21.0
Cabin Lake (Cordova)	4	CT	7.0- 9.0	8.2	.23	100.0
Corser Lake (Cordova)	10	CT	9.0-13.2	12.4	.45	100.0
Cordova Water Supply Res. #1	4	RB	13.0-15.3	14.4	.25	100.0
Hartney Lake (Cordova)	1	CT	15.0	15.0	.33	100.0
Island Lake (Cordova)	7	CT	7.8-11.0	9.8	.39	100.0
Pipeline Lake	6	CT	7.5-11.8	10.1	.30	75.0
(Cordova)	2	DV	10.5-15.0	12.7	.10	25.0

* GR-grayling; CT-cutthroat; DV-Dolly Varden; BB-Burbot; RD-rainbow; SS-silver salmon; RS-red salmon; WF-whitefish; LNS-longnose sucker; LT-lake trout

** No. of fish per hour in 125 foot experimental gill net.

Dick Lake was checked for the survival of previous plants of grayling and rainbow. No trout were taken but the grayling are well established. Gill netting was done on Crosswind Lake as part of a preliminary survey. A good population of mature lake trout was present. In addition, whitefish and suckers were taken. The average fork length of the whitefish was 13.0 inches. This corresponds to the average fork length (13.9 inches) of whitefish taken by a commercial gill-netter during the winter of 1964-1965 at the lake.

Gill nets were used to check the survival of hatchery plants in Arizona, June, Nita, Pippin and Moose Lakes in the Glennallen area. Evidence of these plants was found only in Moose Lake where the silver salmon had attained a fork length of over 17 inches. Good catches were made by sportsmen during the summer of 1964. Twelve lakes in the Cordova area were checked as part of the regular management plan. As a result of this gill netting, recommendations were submitted for stocking six of the lakes.

Preliminary Surveys

Preliminary survey work was initiated on Susitna Lake, located in the Tyone River drainage near Lake Louise. Access is possible only by airplane or boat. Susitna Lake is situated between Lake Louise and Tyone Lake and is separated from these two waters by short, 100-yard sections of the Tyone River.

The long axis of the lake lies north and south and it is divided into two distinct parts. Two-thirds of this 8,600-acre lake lies within the west part. Soundings made during 1964 revealed depths in excess of 120 feet, although the major portion is less than 75 feet deep.

The east portion of Susitna Lake has four main inlets. The largest of these is Beaver Creek, which flows approximately 35 cfs during July and August. This stream connects Beaver and Susitna Lakes and is about 300 yards long. All of the inlet streams have good spawning facilities and support summer populations of grayling and whitefish.

The Tyone River is the largest of the six inlets flowing into the west portion of Susitna Lake. Boats have no trouble negotiating the short section of stream that connects Susitna Lake with Lake Louise.

Spawning areas for lake trout are scattered throughout the lake. Limited observations indicated the west and south-west shoreline to be the best spawning areas. Numerous lake trout were seen in these areas on September 6.

Susitna Lake is not utilized as heavily by anglers as is Lake Louise, but pressure is expected to increase annually.

TABLE 2. - Creel Census Data from Military Recreation Camp, Valdez

Year	Anglers	Hours	Hours Per Angler	Fish Per Angler	Fish Per Hour	FISH* Dog Salmon	Pink Salmon	Silver Salmon	Dolly Varden**	Total
1963	21	123	5.9	13.8	2.3	80	193	3	13	289
1964	47	246	5.2	7.7	1.5	140	189	29	5	363

* Since only two creel forms were submitted which showed no fish caught there is a possibility that successful anglers were favored by recorders.
** The Dolly Varden were taken from the Robe River. All other fish came from Valdez Bay.

The lake has an irregular shoreline and is dotted with nine islands, the largest being approximately 25 acres in size. Almost all of the cabin sites established by the Bureau of Land Management have been taken up by private parties and at the present there are approximately 35 cabins erected. This lake also serves as an aquatic highway for caribou hunters during the fall months.

Initial soundings and other observations were made on Crosswind Lake during 1964. This lake has an area of approximately 8,000 surface areas and drains into the West Fork, Gulkana River. Its depth exceeds 100 feet, but most of the lake is much shallower. There is one outlet and one main inlet. Both have good spawning areas and support populations of whitefish, grayling and, occasionally, lake trout. The whitefish is one of the more numerous species of fish found in Crosswind Lake. This lake is also noted for its large lake trout and burbot. Scale samples were collected from gill-netted whitefish as part of a study to be initiated in conjunction with commercial fishing activities. During the winter of 1964-1965, one commercial gill-netter operated on the lake. The operation is small, taking about 50 fish daily when in operation. Measurements of 150 whitefish taken in the nets showed a fork length range of 12.0 inches to 16.6 inches with the average being 13.9 inches. The fish are cleaned and frozen at the lake and then hauled by snow vehicle to the highway for the market. This lake is not accessible by automobile but is only about 15 minutes flying time from the road system. At present, there are about 15 private cabins located on Crosswind Lake.

Creel Census

During the 1964 fishing season, creel census was taken by military personnel at military recreation camps located at Valdez (Table 2) and Lake Louise (Table 3). This information is given in comparison with past records.

TABLE 3. - A Comparison of Lake Louise Creel Census Data for 1956, 1963 and 1964

All Fishermen	1956	1963	1964
Total Anglers	695	1,489	188
Total Hours	3,939	4,647	756
Total Fish *	540	1,259	198
Total Grayling		600	94
Catch Per Hour	.14	.27	.26
Hours Per Angler	5.7	3.1	4.0
Total Lake Trout	530	609	103
Lake Trout Catch Per Hour	.13	.13	.14

TABLE 3. (Cont.) - A Comparison of Lake Louise Creel Census Data for 1956, 1963 and 1964

Successful Fishermen	1956	1963	1964
Total Anglers	284	595	87
Total Hours	1,684	1,747	318
Catch Per Hour	.32	.72	.62
Lake Trout Catch Per Hour	.31	.35	.32
Hours Per Angler	6.0	2.9	3.7

* This includes lake trout, grayling, whitefish and burbot.

Data collected from Valdez indicates a decrease in fishing success accompanied by the increase in fishing pressure. This may not necessarily be so since there is reason to believe that only successful fishermen were contacted in 1963. This was also partly true in 1964. This data also falls short of recording the actual number of military personnel that fished from these camps. Although the system was explained very carefully to the personnel and the camp was visited periodically, there was still a failure to record each angler. Efforts will have to be intensified next year to secure as much accurate data as possible.

Needless to say, the Valdez information does indicate that fishing was very good there. Most of it is restricted to the Valdez Bay area since all of the inlet streams are closed to salmon fishing. The silver salmon is the most popular fish in that area, but the data does not verify this. There is good reason to believe that identification of the different species is not entirely accurate.

A similar breakdown in creel census work occurred at Lake Louise. Again, as at Valdez, personnel were briefed as to procedures, etc. One reason given for the fewer anglers is the March 27 earthquake. If anything, the March 27 earthquake should have increased anglers at Lake Louise since some of the fishing areas outside of Anchorage were inaccessible because of damaged roads. In addition, the Air Force Recreation Camp, located at Lake Louise, was closed in 1963 and their anglers used the Army Recreation Camp. In spite of the reduction of creel census data collected, it does appear to be valid. There is no major difference from 1963 in catch or species composition. The only distinct change has been an increase in fishing time. This may be a reflection of better weather conditions and is not considered too significant at this time.

Fisheries personnel definitely believe that fishing pressure at Lake Louise is steadily increasing, and it is gratifying to note that fishing success has remained good. As expected, the grayling and lake trout make up the majority of the catch.

Subsistence Fishing

The number of subsistence fishing permits in 1964 was triple that of 1961 (Table 4). This has not resulted in a larger catch. The biggest increase in permits has been in dip netting. The number of people who can dipnet for salmon at any one time is limited since there are only one or two spots on the Copper River where this is feasible. Therefore, even if there is an increase in dipnet fishermen in 1965, which is expected, the total harvest is not expected to rise significantly. Many people have a tendency to apply for and receive a dipnet permit simply because it is free. Observations have shown that many dipnetters show up without the proper equipment and generally go home with few fish. The number of fish wheels in operation in 1964 diminished somewhat because only the main Copper River was opened to subsistence fishing. This apparently caused no great hardship on the fish wheel permittees.

Although fewer salmon are taken now as compared to years past, there appears to be less demand by the fish wheel operators. According to a U. S. Fish and Wildlife Service Report (The Red Salmon Oncorhynchus nerka of Copper River, Alaska, 1964, Seton H. Thompson), an estimated 50,000 red salmon were taken in 1931 with 45 fish wheels. This is considerably more than the 19,000 taken in 1964. In the past, many of the salmon were used for dog feed, but this practice is decreasing each year with the use of more modern means of transportation.

The peak of the king and red salmon run at Copper Center occurred during the early part of July. Fish wheel operations were delayed somewhat by late high water. Steelhead trout and silver salmon were taken by operators early in September. Efforts were made to explain the difference between the two species to the operators, but this met with little success.

Multiple Water Use and Construction

During 1964, Alaska Department of Highways construction projects involving fish habitat were investigated at Valdez, Mile 57 Richardson Highway, Paxson, Mile 14 Richardson Highway and on the Chitina Road. At Mile 14 Richardson Highway, 100,000 yards of excess material was dumped into the Copper River. Turbidity checks above and below the area showed that there was no difference in the amount of silt in the river.

All other projects that were investigated involved moving and/or inundating sections of streams and lakes. Two of these involved anadromous species of fish. Recommendations were made which would minimize damage to the fisheries and agreements were made with the Department of Highways.

TABLE 4. - Subsistence Permits and Subsistence Catch in the Upper Copper River from 1961 through 1964

	1961	1962	1963	1964*
Number of permits issued	321	448	624	994
Number of catch records returned	200 or 62%	420 or 94%	344 or 55%	682 or 68.6%**
Number of salmon recorded on catch records	15,991	16,273	15,200	12,743
Average number of salmon taken per person	80	38.7	44.2	21.2
Percent of red salmon in catch	96	93	93	94
Percent of king salmon in catch	2	5	3	5.5
Percent of silver salmon in catch	2	2	4	.5
Estimated total salmon catch	25,680	17,338	27,580	19,377

* This data includes 80% dip net permits, 16% fishwheel permits and 4% dip net and/or fishwheel permits.

** 82 permits were returned unused. They were not used in computing the average and estimated catch.

TABLE 5. - Winter Oxygen Determinations from Waters in the Copper River Drainage

Date	Lake	Location	Depth of Sample	PPM Oxygen	Max. Depth of Lake	Fish Present	Ice
4/14/64	Junction	Mi. 160 Glenn. Hwy.	8 ft.	3.1	19 ft.	none	36 inches
2/17/65	Junction	Mi. 160 Glenn. Hwy.	10 ft.	4.0	19 ft.	none	27 inches
2/17/65	Junction	Mi. 160 Glenn. Hwy.	7 ft.	2.9	19 ft.	none	30 inches
1/13/65	Tex Smith	Mi. 161 Glenn. Hwy.	10 ft.	7.6	25 ft.	Rb	27 inches
1/13/65	Tex Smith	Mi. 161 Glenn. Hwy.	5 ft.	8.1	25 ft.	Rb	27 inches
1/15/65	Moose	Mi. 170 Glenn. Hwy.	12 ft.	3.9	30 ft.	SS,GR	26 inches
1/15/65	Moose	Mi. 170 Glenn. Hwy.	6 ft.	9.8	30 ft.	SS,GR	26 inches
2/25/65	Moose	Mi. 170 Glenn. Hwy.	6 ft.	5.8	30 ft.	SS,GR	33 inches
1/15/65	Tolsona	Mi. 170 Glenn. Hwy.	7 ft.	6.3	14 ft.	SS,GR,Rb	28 inches
2/25/65	Tolsona	Mi. 170 Glenn. Hwy.	7 ft.	4.0	14 ft.	SS,GR,Rb	34 inches
2/25/65	Tolsona	Mi. 170 Glenn. Hwy.	5 ft.	4.2	14 ft.	SS,GR,Rb	34 inches
1/18/65	Mirror	Mi. 149 Glenn. Hwy.	6 ft.	2.8	12 ft.	unknown	24 inches
1/18/65	Mile 14	Lake Louise Road	4 ft.	5.6	8 ft.	unknown	26 inches
1/18/65	Paul	Lake Louise Road	5 ft.	3.4	16 ft.	GR,BR	26 inches
1/18/65	Mary	Lake Louise Road	4 ft.	7.8	9 ft.	GR	25 inches
1/20/65	Mae West	Mi. 169 Glenn. Hwy.	5 ft.	2.4	9 ft.	GR	25 inches
3/23/65	Mae West	Mi. 169 Glenn. Hwy.	5 ft.	1.2	9 ft.	GR	33 inches
1/20/65	Crater	Lake Louise Road	7 ft.	6.3	17 ft.	none	26 inches
1/20/65	Elbow	Lake Louise Road	7 ft.	5.5	17 ft.	GR	27 inches
1/20/65	Caribou	Lake Louise Road	7 ft.	7.1	25 ft.	GR,BR	26 inches
1/26/65	Fish	12 Mi. West of Mile 148 Rich. Hwy.	8 ft.	7.0	unknown	BR,WF,LT	28 inches
1/26/65	Rat	10 Mi. West of Mile 146 Rich. Hwy.	4 ft.	3.0	unknown	BR,WF,LT	28 inches
1/26/65	Ewan	12 Mi. West of Mile 140 Rich. Hwy.	7 ft.	8.0	unknown	BR,WF,LT	28 inches
1/29/65	Kenny	Chitina cutoff	6 ft.	3.0	10 ft.	none	33 inches
3/15/65	Kenny	Chitina cutoff	6 ft.	2.3	10 ft.	none	35 inches

TABLE 5 (Cont.) - Winter Oxygen Determinations from Waters in the Copper River Drainage

Date	Lake	Location	Depth of Sample	PPM Oxygen	Max. Depth of Lake	Fish Present	Ice
1/29/65	Pippin	Mi. 83 Rich. Hwy.	5 ft.	3.6	14 ft.	none	35 inches
3/15/65	Pippin	Mi. 83 Rich. Hwy.	6 ft.	1.0	14 ft.	none	36 inches
2/17/65	Elbow	Lake Louise Road	7 ft.	4.5	17 ft.	GR	30 inches
2/ 9/65	Mi. 151	Rich. Hwy.	8 ft.	0.0	14 ft.	none	24 inches
2/ 9/65	Dick	Mi. 173 Rich. Hwy.	5 ft.	7.7	32 ft.	GR	28 inches
3/23/65	Arizona	Mi. 156 Glenn. Hwy.	6 ft.	2.6	19 ft.	none	33 inches
3/23/65	Arizona	Mi. 156 Glenn. Hwy.	12 ft.	.45	19 ft.	none	33 inches

GR - grayling; SS - silver salmon; BR - burbot; WF - whitefish; RB - rainbow; LT - lake trout.

Winter Oxygen Determinations

Winter oxygen determinations were conducted on 20 lakes during 1964 and 1965 (Table 5). Some of the tested lakes support fish populations while others were barren. These tests are conducted for several reasons: (1) to determine if a barren lake contains enough oxygen to make stocking feasible, (2) to set up criteria, based on oxygen content, for the overwinter survival of various species of fish, (3) to determine rate of oxygen depletion as winter progresses, and (4) to determine the influence of snow and ice thickness on oxygen content.

A comparison with the previous winter's data shows snow depths to be greater, ice thickness less, and oxygen content approximately the same in 1964-1965.

Tests are generally continued until the ice cover begins to deteriorate in the spring. However, this was interrupted in 1964 when the March earthquake broke up the ice on most of the lakes in this area.

Information from these oxygen tests can be used to make forecasts of future conditions in the various lakes. For example, a partial winter kill of grayling is expected in Mae West where the latest oxygen determinations show only 1.2 ppm at five feet. Also, the failure of a rainbow plant in Arizona Lake can be attributed to a winter oxygen depletion down to lethal levels.

Prepared by:

Fred T. Williams
Fishery Biologist

Date: April 1, 1965

Approved by:

s/ Louis S. Bandirola
D-J Coordinator

s/ Alex H. McRea, Director
Sport Fish Division