Volume 15 Study No. G-I

STATE OF ALASKA

William A. Egan, Governor

Annual Report of Performance for

INVENTORY AND CATALOGING

Inventory and Cataloging of the Sport Fish and Sport Fish Waters in Southeast Alaska

by

Artwin E. Schmidt

ALASKA DEPARTMENT OF FISH AND GAME

James W. Brooks, Commissioner

Alaska. DIVISION OF SPORT FISH

Rupert E. Andrews, Director

Howard E. Metsker, Chief, Sport Fish Research

TABLE OF CONTENTS

RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska.

Project No.: F - 9 - 6

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

Job No.: G - I - A Job Title: Inventory and Cataloging of the Sport Fish and Sport Fish Waters in Southeast Alaska.

Period Covered: July 1, 1973 to June 30, 1974.

ABSTRACT

The sport fishery potential of six lakes and 45 streams on West Chichagof and Yakobi Islands was evaluated. Recreational inventories were completed for major streams and lakes studied.

A limnological investigation including physical, chemical, and biological aspects was conducted on Redoubt Lake, Baranof Island.

The effects of chlorinated sewage effluent on survival of coho, Oncorhynchus kisutch, and Dolly Varden, Salvelinus malma, in the Mendenhall River were evaluated. No mortality was observed among Dolly Varden. Mortality for coho was 16 percent at both 0.5 and 1.0 parts ber million (ppm) chlorine residual.

An estimated 2,591 king, O. tshawytscha, 2,577 coho, 758 pink, O. gorbuscha, and 67 chum, O. keta, salmon were taken by Juneau area saltwater sport fishermen from May 14 through September 3. The salmon catch per angler hour was 0.029 for king, 0.029 for coho, 0.009 for pink, and 0.001 for chum salmon. During the 1973 Golden North Salmon Derby 637 king, 449 coho, 278 pink, and 34 chum salmon were entered for prizes.

An estimated 919 sockeye, O. nerka, 543 pink, 196 Dolly Varden char, 48 coho, 30 cutthroat, Salmo clarki, 10 king, and 5 chum were caught in

Auke Creek during the period of June 20-September 2, 1973. In the Echo Cove area of Berner's Bay an estimated 777 pink, 267 cutthroat, 51 Dolly Varden, 6 chum, 6 coho, and 6 king salmon were caught by anglers.

Nonresident anglers made up the greater percentage of participation in the North Behm Canal area with an estimated 1,665 (88.7 percent) anglers as compared to 224 (11.3 percent) resident anglers. Creel census workers observed 1,776 king, 261 coho, 87 pink, and 1 chum salmon.

An estimated 3,585 king, 1,075 coho, 1,072 pink, 102 chum and 13 sockeye salmon were taken from May 14 through September 2 in the Ketchikan area.

The estimated halibut, Hippoglossus stenolepis, catch for Juneau was 2,500, North Behm Canal was 23, and Ketchikan was 1,284 for the census period.

Limnological investigations were conducted on 13 streams and five lakes on Prince of Wales Island. Recreation inventories were developed for the major streams and lakes in close proximity to the road system.

A survey was conducted to appraise the net expense of saltwater sport-caught salmon and the saltwater anglers contribution to the greater Juneau area. Cost of expendable commodity items were applied to obtain a cost of $83.00 per salmon.

A survey of Peterson Lake and inlet streams (location 58°26'45" north latitude and 134°44'00" west longitude) was conducted to determine success of previous rehabilitation and potential for future rehabilitation and enhancement. Survey work included analysis of water chemistry, plankton, insect populations, and fish age and growth.

A bioassay experiment kit was obtained from Ayerst Laboratories, New York, to determine the feasibility of using Fintrol (active ingredient - Antimycin A) for rehabilitating low pH, soft-water lakes. A toxicant level of 1.00 part per billion (ppb) was lethal to all Dolly Varden after an exposure time of 69 hours.

Information on 75 streams, 13 lakes, and 5 saltwater bays were added to existing catalog and inventory files.

RECOMMENDATIONS

Research

1. Effort should be made to conduct more comprehensive limnological investigations to determine the relationships of physical, chemical and biological characteristics of selected lakes to fish production. Numerous investigators including Hayes (1964), Northcote and Larkin (1956), Ball (1948), Carlander (1955), Turner (1960), Moyle (1956), and others have shown the importance of understanding these relationships. The importance of quantifying food availability and food habits of various species of fish cannot be overemphasized.

2. A better method for indexing fish populations and determining fish distribution in lakes should be developed. A method which shows promise is hydro acoustic evaluation of fish stocks.

3. An inventory of fish streams and lakes accessible from the Sitka road system should be conducted similar to the survey conducted by Reed and Armstrong in the Juneau area (1971). This information is needed to develop a management plan.

4. Creel census programs should be directed more toward evaluation of a specific fishery or evaluation of the contribution of a returning marked population to the sport fishery in an area.

Management

1. The feasibility of providing more public access to fishing areas along the Prince of Wales Island road system should be determined. Suggested improvements are as follows: 1) A boat launching site could be constructed to Klawak Lake at mile 14.2 Hollis Road; 2) The three access roads from Hollis Road to Harris River should be maintained; 3) The trail from the Staney Creek Road to the United States Forest Service cabin at the mouth of Staney Creek should be cleared of logging slash.

2. Further attempts to eradicate the Dolly Varden population of Peterson Lake near Juneau should be abandoned. An analysis of fish populations in the lake shows abundant stunted Dolly Varden population and a small population of slow growing rainbow. A survey of the lake's two main tributary streams shows 6.4 miles of unblocked mainstream. Several muskeg backwater areas make a complete fish kill with rotenone impossible. Chemical characteristics of the lake may limit productivity of the lake. It is probable that cutthroat would be better adapted to this system than are rainbow.

OBJECTIVES

1. To determine the physical, chemical, and biological characteristics of existing and potential sport fishing streams and lakes in the West Chichagof-Yakobi area.

2. To develop a plan for the management of the sport fish resource of Redoubt Lake.

3. To determine effects of chlorinated sewage effluent on fish in the Mendenhall River.

4. To determine angler success, fish size, abundance, and distribution of fish caught in the saltwater sport fishery, Juneau area.

5. To determine a plan for the management of the sport fish resources along existing and proposed roads on Prince of Wales Island.

6. To conduct a study on the economic contribution of the saltwater sport fishery in the Juneau area.

7. To determine physical, chemical, and biological characteristics of existing or potential sport fishing areas proposed for enhancement, rehabilitation, of development by other agencies or by other divisions of the Fish and Game Department.

8. To continue collection, analysis, and organization of all available and new information on sport fish resources of Southeastern Alaska.

TECHNIQUES USED

West Chichagof-Yakobi Area

The sport fishery potential of 6 lakes and 45 streams on West Chichagof and Yakobi Islands was evaluated to provide input to the West Chichagof-Yakobi Land Use Study sponsored by the U.S. Forest Service. Recreational inventories were completed for major streams and lakes studied.

Stream and lake surveys were conducted on the major systems within the area as time permitted. Thorough studies of all aquatic systems was not possible during the limited study period.

Surveys were conducted according to the Lake and Stream Survey Manual (Andrews, 1971). In addition to items mentioned in the survey manual, an analysis of water chemistry and plankton populations was conducted on selected aquatic systems. Plankton populations were sampled by hauling a 50 cm diameter, number 20 Nitex plankton net vertically through the water column at the rate of one meter per second. Samples were preserved in 4 percent formalin until laboratory analysis was conducted.

Redoubt Lake Investigation

A biological investigation of Redoubt Lake on Baranof Island was conducted during the period May-August, 1973. The lake supports runs of sockeye, silver, pink, and chum salmon. A substantial subsistence and snag fishery for sockeye exists at the lake outlet. Subsistence fishing records (unpublished) show that 500, 765, and 616 sockeye were taken in 1971, 1972, and 1973, respectively. Dolly Varden char provide a good sport fishery in the inlet stream.

Investigation of the lake and main inlet stream included construction of a bathymetric map, determination of temperature profiles, analyses of water chemistry, evaluation of benthos and plankton, and sampling of fish populations.

Effects of Chlorinated Sewage on Survival of Coho and Dolly Varden in the Mendenhall River

The study was conducted in the intertidal portion of the Mendenhall River. One secondary sewage treatment plant discharges chlorinated effluent into the river about one-half mile below the bridge crossing of State Highway 7 (Figure 1).

Five study stations were chosen for varying exposure to effluent after the effluent plume was located with Rhodamine B dye. Station 1 was upstream so received effluent only at high tide. The remaining four stations were located to receive influence of effluent even at low tide. Station 2 was immediately below the effluent discharge. Stations 3, 4, and 5 were about 150, 300, and 450 yards below the discharge and were centered in the effluent plume at low tide.

At each station two steel fence posts were driven into the substrate. One test cage was fastened to each post. Tops of the cages were exposed during low water, but were underwater at high tide. The test cages, constructed of 3/4 inch plywood, each held a volume of nearly one cubic foot. Galvanized 1/4 inch screen openings allowed limited water circulation.

Two species of test fish, coho salmon and Dolly Varden char were captured from nearby Switzer Creek. Fish ranged in length from about 2 to 3 inches. At the beginning of each phase, fish were transported to the test cages, acclimated and placed into the cages.

During the first phase of the study, ten coho were placed in each cage and monitored for four days. Residual chloring of the effluent entering the river was kept at 0.5 ppm. Observations of test animals and water temperatures were made daily when low tide exposed the top of the cages.

Phase two and three were similar to phase one with the following exceptions. Five test fish of each species were placed in each cage. Phase two was conducted with 1.0 ppm chlorine residual in effluent, and phase three was

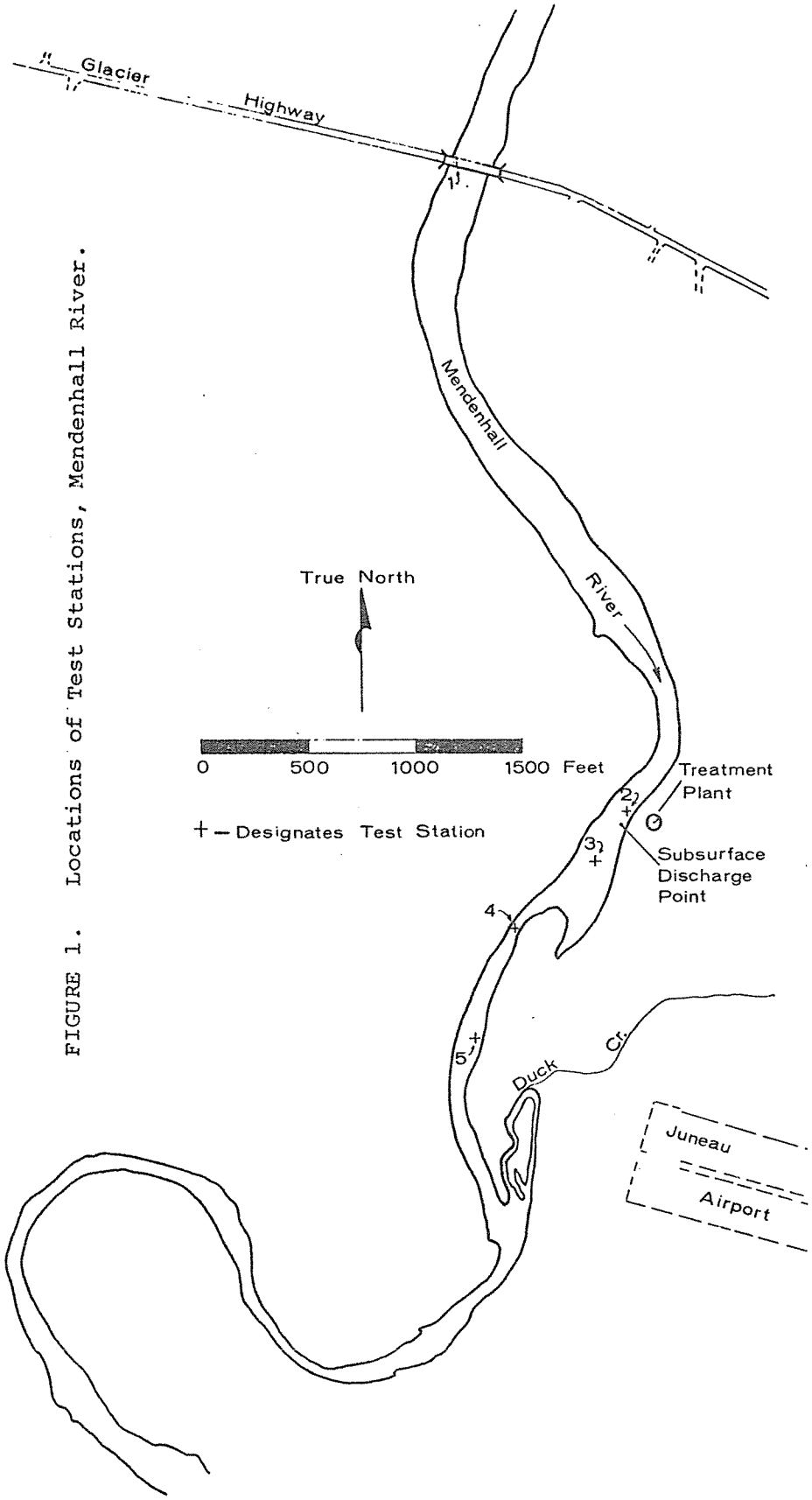


FIGURE 1. Locations of Test Stations, Mendenhall River.

conducted with 0.0 ppm chlorine residual.

Juneau Area Saltwater Creel Census

The saltwater creel census was conducted from May 14 through September 2, 1973, by a crew of four census workers. The saltwater census was conducted on 96 (86 percent) of the 112 days in the sample period. The Golden North Salmon Derby data were excluded from the sample period and considered separately.

Sample days were selected to provide equal coverage of all weekdays, Sunday through Saturday, throughout the sample period. All weekend days and 64 of 80 weekdays (80 percent) were sampled during the summer season.

The census was conducted between 3:00 p.m. and 11:00 p.m. of each sampling day. Intensive day sampling was deleted from the previous year's sampling scheme (Schmidt and Robards, 1973) for the 1973 season. The sampling scheme was further altered to weekly periods from biweekly periods.

Census workers stationed at three local boat harbors conducted angler interviews to obtain catch and effort information. Scale and ovary samples were collected only from king salmon. A tally was kept of sport as well as sport-commercial boats leaving and returning to the harbors so the ratio of sport to sport-commercial boats could be applied to the aerial surveys.

Aerial surveys, used in estimates of total catch and effort, were flown at peak fishing times. This was usually from 1-3:00 p.m. on weekends and from 6-8:00 p.m. on weekdays. If bad weather prevented flying, flights were made the next available census day during the biweekly periods. Counts were made of all boats, both potentially sport and sport-commercial, but did not include vessels that were obviously only commercial, e.g., large trollers, gillnetters and seiners.

The catch and effort data collected by creel census workers and expanded by ratios using aerial and dockside boat counts were used to provide estimates of total catch and effort. Sport-commercial catch was not included.

The expansion factors were derived from the fraction of the aerial count (C_a), divided by dock count (C_d), multiplied by the number of days in the weekday period (D_w) or weekend period (D_e), divided by the number of days censused (D_c). The expansion factors for weekdays (F_w) and weekend days (F_e) were computed separately as shown below.

$$\frac{C_a}{C_d}\,\frac{D_w}{D_c} = F_w \qquad \frac{C_a}{C_d}\,\frac{D_e}{D_c} = F_e$$

Estimates of salmon caught and fishermen participation during the Golden North Salmon Derby were obtained from the derby sponsors and staff observations. Biological samples were collected from king salmon entered in the derby and forwarded to the king salmon project leader for his analysis.

North Behm Canal Creel Census

An angler census was conducted of the saltwater sport fishery in the Yes Bay and Bell Island areas. Angler effort was highly concentrated and sampling effort was devoted to obtain a total census of the effort and catch in the area. The area was covered by two census workers. One was stationed at Bell Island and the other at Yes Bay.

Ketchikan Area Creel Census

The 1973 Ketchikan area creel census was conducted similar to previous year's design (Schmidt and Robards, 1973). The saltwater census was conducted on 78 (71 percent) of the 110 days in the sampling period. All weekend days and 60 percent of weekdays were sampled during the period.

Juneau Roadside Area Creel Census

Sampling effort was directed to assess the angler impact on Auke Creek and Echo Cove during the census period.

Evaluation of Sport Fishing Resources Along the Prince of Wales Island Road System

Limnological investigations were conducted on 13 streams and five lakes on Prince of Wales Island. These aquatic systems will be subject to increased public use in the summer of 1974 (Schmidt and Robards, 1973). Recreation inventories were developed for the major streams and lakes in close proximity to the road system.

Economic Contribution of the Saltwater Sport Fishery to the Juneau Area

A survey was conducted to estimate the saltwater angler's contribution to the economy of the greater Juneau area. Two questionnaires were designed for this study.

The first questionnaire (Figure 2) was designed to obtain estimates of equipment expenditures and was mailed to 1,291 (20 percent) of the 6,455, 1972 sport fishing license holders in the Juneau area. Equipment was defined as those items which would be used for more than one season and would probably be used for other recreational activities. Anglers were asked to list equipment on hand and how much had been purchased in the last year. Purchases within the last year were designated as Juneau area or outside and catalog purchase.

The second questionnaire (Figure 3) listing commodity items was handed to anglers by workers. This questionnaire covered a specific calendar month and itemized a household's purchases of these expendible items (e.g. fuel, bait, food). Numbers of salmon caught, fishing effort, and fishermen per

Dear Alaskan Angler:

You nave been selected to participate in a survey which is presently being conducted on the 1973 saltwater sport fishery in the Greater Juneau area. The area covered is that area within the Juneau Borough and to include that area south to Taku Inlet and Grand Island, west to Admiralty Island, and north to Sullivan Island. The survey is designed to provide information on the significance and economic impact of the salmon sport fishery in the area's economy. This information will be useful to the Department of Fish and Game when determining and defending resource allocations. The best information can be supplied only by you, the individual sport fisherman.

The information requested will become public information but all identifying characteristics will be held in confidence by the researchers.

Please take time to estimate the expenditures you made during the past month toward salmon sport fishing. When you have completed the survey, cut along the dotted line, fold the questionnaire in half, staple or tape it closed, and mail it to the Department.

Thank you and Good Fishing!

Sport Fish Division

ALASKA DEPARTMENT OF FISH AND GAME

SPORT FISH DIVISION

This is a confidential statement. Please complete as fully as possible.

Do you have a 1973 sport fishing license _____Yes _____No

Is your license _____Resident _____Non-Resident _____Non-Resident (10 Day)

Number of licensed saltwater sport fishermen in your household _____

Total saltwater sport fishermen in your household _____

	Household Equipment on Hand		Amount Your Household Spent in the Last 12 Months	
	Quantity	Total Cost	Juneau Area Purchases	Outside/Catalogue Purchases
Tackle				
Rod	_____	$_____	$_____	$_____
Reel	_____	_____	_____	_____
Line	_____	_____	_____	_____
Tackle Box	_____	_____	_____	_____
Landing Net	_____	_____	_____	_____
Other Tackle	_____	_____	_____	_____
Boating Equipment				
Boat	_____	_____	_____	_____
Boat Trailer	_____	_____	_____	_____
Engine	_____	_____	_____	_____
Accessories	_____	_____	_____	_____
Personal Equipment				
Rainwear	_____	_____	_____	_____
Rubber Boots	_____	_____	_____	_____
Heavy Clothing	_____	_____	_____	_____
Food Containers	_____	_____	_____	_____
Stove	_____	_____	_____	_____
Other	_____	_____	_____	_____

Figure 2. Angler Equipment Expenditure Questionnaire.

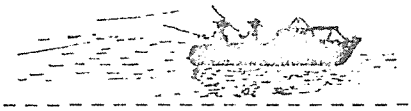
Dear Alaskan Angler:

You have been selected to participate in a survey which is presently being conducted on the 1973 saltwater sport fishery in the Greater Juneau area. The area covered is that area within the Juneau Borough and to include that area south to Taku Inlet and Grand Island, west to Admiralty Island, and north to Sullivan Island. The survey is designed to provide information on the significance and economic impact of the salmon sport fishery in the area's economy. This information will be useful to the Department of Fish and Game when determining and defending resource allocations. The best information can be supplied only by you, the individual sport fisherman.

The information requested will become public information but all identifying characteristics will be held in confidence by the researchers.

Please take time to estimate the expenditures you made during the past month toward salmon sport fishing. When you have completed the survey cut along the dotted line, fold the questionnaire in half, staple or tape it closed, and mail it to the Department.

Thank you and Good Fishing!



Sport Fish Division

ALASKA DEPARTMENT OF FISH AND GAME

SPORT FISH DIVISION

AUGUST QUESTIONNAIRE

This is a confidential statement. Please complete as fully as possible.

1. Is your license ____Resident ____Non-Resident ____Non-Resident (ten day)
2. If visiting, where is your home? _____
3. How many trips did you make to fish for Alaska salmon in August _____
4. How many salmon did you catch ____King ____Silver ____Pink ____Chum ____Sockeye
5. Average number of hours per fishing trip _____
6. Average number of saltwater fishermen in your party _____
7. How many saltwater fishermen in your party were under 16 years of age _____
8. During the last few years, has your interest in fishing for salmon ____Increased ____Remained the same ____Decreased
9. Please estimate the expenditures you made relative to salmon fishing in August.

Bait _____	Food & Beverage _____
Boat Rental _____	Moorage Fee _____
Additional Tackle _____	Other Expenses _____
Engine Fuel & Oil _____	Maintenance _____
(Boat, Car & Airplane)	Lodging _____

10. Please indicate in order of preference, the species of salmon you prefer to catch.

King _____ Silver _____ Pink _____ Chum _____ Sockeye _____

11. Your comments:

Figure 3. Angler Commodity Expenditure Questionnaire.

household were also recorded.

Study of Aquatic Systems Proposed for Enhancement

A survey of Peterson Lake and inlet streams (location 58°26'45" north latitude and 134°44'00" west longitude) was conducted to determine success of previous rehabilitation and potential for future rehabilitation and enhancement. Survey work included analysis of water chemistry, plankton, insect populations and fish age and growth.

A bioassay experiment kit was obtained from Ayerst Laboratories, New York, to determine the feasibility of using Fintrol (active ingredient-Antimycin A) for rehabilitating low pH, soft-water lakes.

A bioassay was conducted to determine toxicity of Fintrol to Dolly Varden char in Peterson Lake.

Dolly Varden char were collected by minnow traps one day prior to testing. On October 17, each of five plastic bags was filled with twenty gallons of water from Peterson Lake. The desired amounts of Fintrol to produce toxicity levels of 0.5, 1.0, 1.5, and 3.0 ppb were added to each of four bags. The fifth bag was used as a control with no Fintrol. Five Dolly Varden were placed in each test bag. The loading level of any bag did not exceed 110 grams. The bags were then sealed and placed in shallow water so they were surrounded by lake water.

The bags were opened at 24, 49, and 69 hours for observation of mortality. At these times dead fish were removed, pH and dissolved oxygen were measured, and the bags were resealed.

Catalog and Inventory Files

New and additional information was filed under the system described by Schmidt and Robards (1973).

FINDINGS

West Chichagof-Yakobi Stream and Lake Surveys

The United States Forest Service began an assessment of the natural resources and land use potential of West Chichagof and Yakobi Islands in 1973. The Alaska Department of Fish and Game as a cooperating agency was responsible for assessment of fishery and game values of the 398,000 acre area. An evaluation of sport fishing values of major streams and lakes (Figure 4) is described below.

Table 1 lists all streams surveyed during the investigation. Unnamed streams are identified by Anadromous Stream Number and by latitude and

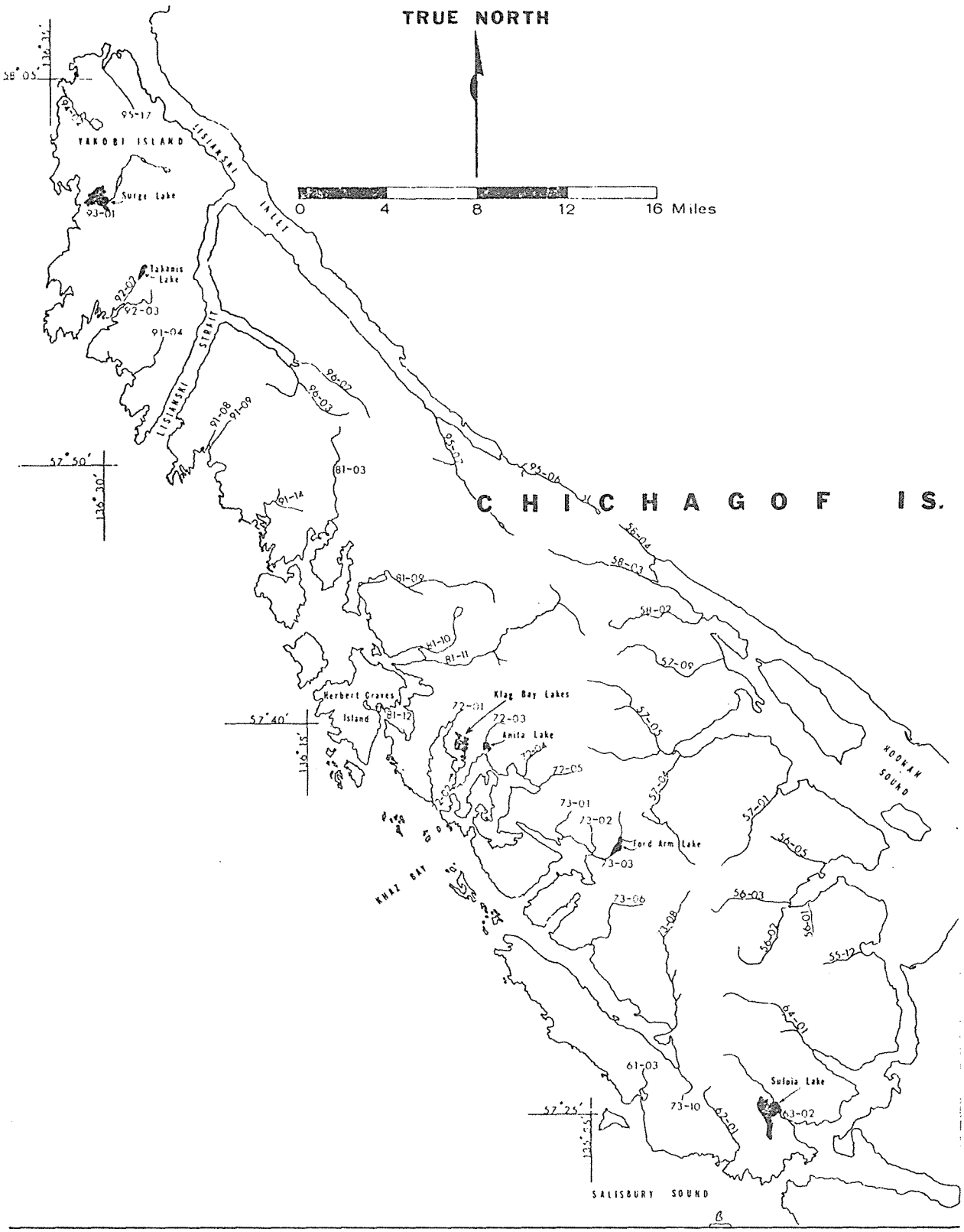


Figure 4. Location of Study Sites, West Chichagof-Yakobi Island.

TABLE 1. Streams Surveyed West Chichagof-Yakobi Area, 1973.

Anadromous Stream No.	Name	Latitude	Longitude
113-55-12	Unnamed	57°31'N	135°36'W
113-56-01	Unnamed	57°32'	135°39'
113-56-02	Unnamed	57°32 1/2'	135°40 1/2'
113-56-03	Unnamed	57°33'	135°41'
113-56-05	Unnamed	57°35'	135°38'
113-57-01	Unnamed	57°37'	135°42'
113-57-04	Patterson Creek	57°39'	135°48'
113-57-05	Unnamed	57°38'	135°49'
113-57-09	Unnamed	57°42'	135°46'
113-58-02	Unnamed	57°44'	135°47'
113-58-03	Granite Creek	57°46'	135°51'
113-58-04	Unnamed	57°46'	135°50'
113-61-03	Unnamed	57°25'	135°51'
113-62-01	Unnamed	57°23'	135°45'
113-63-02	Suloia Creek	57°24'	135°41'
113-64-01	Deep Bay	57°27	135°39'
113-72-01	Chichagof Creek	57°40'	136°05'
113-72-02	Unnamed	57°40'	136°03'
113-72-03	Unnamed	57°39'	136°03'
113-72-04	Rust Creek	57°38'	135°58'
113-72-05	Unnamed	57°37'	135°58'
113-73-01	Unnamed	57°36'	135°57'
113-73-02	Unnamed	57°35'	135°54'

TABLE 1.(Cont) Streams Surveyed West Chichagof-Yakobi Area, 1973.

Anadromous Stream No.	Name	Latitude	Longitude
113-73-03	Cannery Creek	57°53 1/2'	135°57'
113-73-06	Waterfall Cove	57°31'	135°55'
113-73-08	Unnamed	57°28'	135°49'
113-73-10	Unnamed	57°26'	135°48'
113-81-03	Goulding River	57°48'	136°13'
113-81-09	Goon Dip River	57°45 1/2'	136°10'
113-81-10	Unnamed	57°43'	136°07'
113-81-11	Black River	57°43'	136°07'
113-81-12	Unnamed	57°40'45"	136°10'30"
113-91-04	Unnamed	57°53 1/2'	136°27 1/2'
113-91-08	Stranger River	57°50 1/2'	136°23'
113-91-09	Unnamed	57°50 1/2'	136°23'
113-91-14	Falls Creek	57°47 1/2'	136°18'
113-92-02	Takanis Creek	57°55 1/2'	136°28 1/2'
113-92-03	Unnamed	57°55 1/2'	136°28 1/2'
113-93-01	Unnamed	58°00'30"	136°29'
113-94-02	Hoktaheen Creek	57°03'	136°32 1/2'
113-95-06	Lisianski River	57°51'	136°02'30"W
113-95-07	Steelhead River	57°52'	136°06'
113-95-17	Soapstone Creek	58°05'	136°29 1/2'
113-96-02	Saltery River	57°54'	136°16'
113-96-03	Stag River	57°54'	136°16'

longitude of the outlet location. Physical characteristics of streams and fish species observed are given in Table 2.

Chemical characteristics of selected streams and lakes are presented in Table 3. The differences in water chemistry are not great throughout the area. Specific conductance and pH appear to be lowest in the eastern and southeastern areas of the island. These characteristics are dependent upon soil and parent materials. Bishop (1973) describes the geology of this area in detail.

Numerical ratings were assigned to streams using the Aesthetics, Fishery, and Accessibility sections of the rating system described in Table 4. Using this system a numerical score of 15 was possible. Ratings with the corresponding numerical score is as follows: Exceptional, 14-15; Excellent, 11-13; Good, 9-10; Fair, 7-8. Fishing Habitat and Opportunity Ratings for the major streams studied are as follows:

Exceptional	Excellent	Good	Fair
113-63-02	113-57-05	113-56-02	113-57-01
113-72-02	113-58-02	113-56-03	113-57-04
113-81-11	113-62-01	113-57-09	113-72-04
113-73-06	113-64-01	113-58-03	113-73-01
113-81-09	113-72-03	113-58-04	113-73-02
113-81-03	113-72-05	113-95-07	113-73-08
113-92-02	113-73-03	113-96-03	113-73-10
113-93-01	113-91-08		
113-94-02	113-96-02		
113-95-06			

TABLE 2. Physical Characteristics and Fish Species Observed in Anadromous Streams Surveyed, West Chichagof-Yakobi, 1973.

Anadromous Stream No.	Date	Length Miles	Watershed Area Sq. Mile	Feet $\bar{x}$ Width	Inches $\bar{x}$ Depth	Gradient Percent	°C Temp.	pH	Fish Species[1]
58-04	8-15	2.8	11.7	50	12	---	---	---	PS, CS, DV, SS
58-03	5-30	6.5	12.0	35	18	5.0	---	---	PS, CS, DV, SS
58-02	8-16	6.5	12.0	45	12	5.0	7.3	6.3	PS, CS, DV, SS RT
57-09	5-29	4.75	12.5	15	4	4.0	---	---	SS, DV
57-05	8-16	6.75	20.0	75	24	6.0	5.5	6.6	PS, SS, DV
57-04	8-16	3.0	12.0	50	1	11.0	---	---	DV, SS, PS, CS
57-01	5-28	5.0	14.0	18	24	5.0	---	---	PS, CS, DV, SS
56-05	5-28	3.5	7.0	15	24	11.0	---	---	SS, DV
56-03	8-15	4.25	7.0	65	4	2.0	8.4	6.5	PS, CS, DV, SS
56-02	8-15	4.75	7.2	50	8	2.0	---	---	PS, CS, DV, SS
56-01	5-28	2.5	3.0	6	18	10.0	---	---	DV, SS
55-12	8-15	2.0	2.5	45	4	4.0	8.6	6.6	PS, CS, DV
64-01	6-15	6.0	12.35	65	2	2.0-3.0	5.0	6.5	CS, SS
63-02	5-30	0.5	10.0	20	29	17.0	---	---	
62-01	8-16	5.0	7.2	35	6	1.0	6.0	---	SS, DV
61-03	6-13	200 yds	2.4	44	8	3.0	11.5	8.0	SS, TSB
73-10	6-5	2.0	2.1	30	8	3.5	5.0	6.7	PS, CS, SS, RT
73-08	8-15	7.5	16.0	40	24	1.0	7.8	---	PS, CS, SS, DV
73-06	8-14	5.25	5.5	40	10	3.5	8.0	6.95	PS, CS, SS, DV
73-03	6-7	1.0	9.3	45	18	1.0	6.0	6.7	PS, CS, SS, RS CT, DV
73-02	6-8	1.5	0.6	14	6	6.0, 17.0	4.5	6.7	CT
73-01	6-7	2.0	1.8	18	8	8.0	5.0	6.7	DV, SC
72-05	6-9	2.0	6.0	---	---	8.0	5.0	6.7	PS, CS, SS, CT DV

TABLE 2.(Cont) Physical Characteristics and Fish Species Observed in Anadromous Streams Surveyed, West Chichagof-Yakobi, 1973.

Anadromous Stream No.	Date	Length Miles	Watershed Area Sq. Mile	Feet $\bar{x}$ Width	Inches $\bar{x}$ Depth	Gradient Percent	°C Temp.	pH	Fish Species[1]
72-04	6-9	2.0	8.1	---	---	8.6	4.0	7.3	Unknown
72-03	5-23	2.5	1.8	20	12	1.0	6.5	6.8	DV, SS, CT
72-02	7-18	2.0	2.3	12	6	1.0	---	6.7	CT, RT, SS, RS, CS DV, SB, CD, PS
72-01	5-22	1.5	0.8	10	4.6	7.0	---	6.7	
81-12	6-10	0.25	0.5	12	3	---	13.0	6.5	CT, SS, TSB, SC
81-11	6-11	9.0	18.9	50	24	0.5	6.5	6.7	PS, CS, SS, RS CT, DV
81-10	6-11	3.0	4.6	66	8	3.0	4.0	6.7	PS, CS, RS, DV SS, TSB, SC
81-09	6-12	6.5	19.0	35	18	7.6, 2.0	5.5	6.8	Unknown
81-03	5-25	1.5	23.3	50	17	2.0	3.0	6.6	DV, CT, SH
91-14	6-20	2.25	6.54	---	---	5.0	---	---	CT
91-09	6-21	1.75	1.5	16	10	4.5	6.0	---	CT, RT
91-08	6-22	1.0	1.96	12	6	5.0	43.0F	---	CT
96-03	8-21	3.25	7.0	45	---	4.5	6.0	---	Unknown
96-02	5-19	4.5	4.1	20	6.0	3.0	38.0F	6.6	PS, CS
95-07	5-17	7.5	7.3	40-60	20-30	1.5	2.5	6.3	SC, DV
95-06	5-18	6.0	14.3	80	18	1.0	1.0	6.7	*PS, CS, SS, DV
91-04	6-23	1.75	1.05	12	10	1.0	9.0	---	SS, CT, CS
92-02	6-22	1.25 1.0	2.67	9	8	4.5	9.0	---	SS, RT
92-03	6-24	0.25	1.97	9	18	4.5	11.0	6.5	RT
93-01	6-24	0.5	6.2	30	18	4.0	9.0	7.0	RT, DV, CS, RS SS, SC
94-02	6-25	1.0	5.4	12	8	4.0	12.0	7.0	SS, CT, RT, RS
95-17	6-27	2.0	1.8	8	5	7.0	6.0	---	CS

/1 Species Observed During Surveys

TABLE 3. Mineral Analyses from Selected Streams and Klag Lake, 1973.

	113-57-04 Patterson Cr. 5/28/73	113-56-03 Ushk Bay Cr. 8/15/73	113-64-01 Deep Bay Cr. 6/15/73	113-73-06 Waterfall Cove 6/16/73	113-72-02 Klag Bay Cr. 5/23/73	Klag Lake Surface 7/9/73	Klag Lake 12 Meters [1] 7/9/73	Black River 113-81-11 6/11/73	Goulding R. 113-81-03 6/20/73	Saltery R. 113-96-02 5/19/73
pH	6.6	6.6	6.6	7.0	7.2	6.6	6.5	6.8	7.1	7.0
Specific Conductance (micromhos)	20.5	23.5	15.3	35.3	35.7	25.3	23.8	31.4	31.0	31.5
Total Dissolved Solids	66.0	64.0	34.0	26.0	32.0	60.0	42.0	34.0	18.0	22.0
Suspended Solids	22.0	4.0	18.0	2.0	14.0	8.0	2.0	14.0	12.0	14.0
Alkalinity	10.0	8.0	7.0	16.0	13.0	8.0	7.0	7.0	11.0	10.0
Total Hardness	12.0	9.0	7.0	14.0	12.0	13.0	11.0	14.0	8.0	8.0
Calcium (Ca)	3.0	2.0	2.0	5.0	3.0	2.0	2.0	3.0	3.0	3.0
Magnesium (Mg)	2.0	2.0	1.0	2.0	2.0	3.0	2.0	3.0	1.0	1.0
Bicarbonate (HCO_3)	12.0	10.0	8.0	20.0	15.0	10.0	9.0	8.0	13.0	12.0
Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sulfate (SO_4)	3.0	2.0	1.0	3.0	4.0	3.0	3.0	1.0	2.0	3.0
Chloride (Cl)	6.0	3.0	2.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0
Nitrate (NO_3)	0.0	0.0	0.05	0.0	0.09	0.0	0.04	0.03	0.0	0.12
Phosphate (PO_4)	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.03
Turbidity[2]	5.0	10.0	7.0	7.0	16.0	8.0	10.0	2.0	10.0	7.0

1/ 57°39'N 136°04'W
2/ Jackson Turbidity Units

TABLE 4. Numerical Rating for Freshwater and Anadromous Fishing Habitat and Opportunity.

I. WATER QUALITY

A. POLLUTION

1. Water is free of domestic, industrial (including thermal), agricultural pollution.	6
2. Some form of pollution present, no noticeable effect.	4
3. Water pollution or changed from its natural state as evidenced by changes in plankton or benthos populations or conditions present which may be detrimental to fish eggs, insect larvae, etc.	2
4. Water pollution to extent that fish kills are likely; i.e. heat wastes, acids, resins, oxygen blocks, etc.	0

B. LIMNOLOGY

1. Physical, chemical, and biological conditions such that water is or has potential of being productive throughout the year. (Good pool riffle complex in streams or productive littoral area in lakes. Chemical paramenters remain within tolerances of cold water fishes. Plankton and benthos present or support healthy fish populations	6
2. Above conditions not optimum.	4
3. Limnological conditions limiting during some period of the year, but support special use of fish (overwintering, seasonal rearing, spawning, etc.)	3
4. Limnology conditions limiting so area not capable of supporting fish life (acid bog lakes, sterile waters, etc.). . .	0

II. AESTHETICS

A. ENVIRONMENT

1. Environment (land, water, wildlife) is spectacular, inspirational, very scenic, has some unique environment condition (geological, historical, archaeological).	6
2. Environment is very scenic, inspirational but nothing unique in the area	5
3. Environment pleasing, stimulating, relaxing	4
4. Environment is not as above, but drab, uninteresting, spoiled or artificial	1

TABLE 4.(cont) Numerical Rating for Freshwater and Anadromous Fishing Habitat and Opportunity.

III. FISHERY

A. SIZE AND NUMBER

1. Supports a high population of one or more species of cold water game/fish or supports a population of an unusual sporting fish or provides critical habitat for. Some species, i.e. wintering area for Dolly Varden 5
2. Supports a moderate fish population of game fish or has potential of supporting high population of game fish. 4
3. Supports a low population of game fish. 2
4. Supports no fish. 0

IV. ACCESSIBILITY

A. TO AREA

1. Access to area is appropriate (if by boat-good anchorage, by vehicle-turnouts present, if aircraft-adequate landing and take off area, if foot-passable trails, etc. 2
2. Access difficult but possible 1
3. Inaccessible. 0

B. WITHIN AREA

1. Shoreline or stream banks can be walked 2
2. Perimeter of area difficult to negotiate or boat needed . . . 1
3. Inaccessible. 0

TOTAL OF SUB-ITEMS ____

ANITA LAKE

Anita Lake (unofficial name) is located on the west coast of Chichagof Island at 57°39' north latitude and 136°02'30" west longitude. Depths and bottom contours are presented in Figure 5.

The lake is a collecting basin for a muskeg system with a drainage area of about 2.9 square miles. The main tributary enters the lake from the north and provides large stretches of suitable gravel for spawning. Abundant pools along the stream bank provide suitable rearing area. Table 5 enumerates aquatic invertebrates found in this stream. Subsurface flow and other small streams contribute the remainder of the inflow. The outlet stream is approximately 300 yards long with large rubble and boulder. Width of outlet stream varies from 10 to 30 feet, and depth varies from 3 inches to 3 feet. A small falls forms the lake outlet but is not a barrier to fish passage.

Water color in the lake and tributaries is a brown muskeg color. Water is slightly acid with a pH of 6.8. Total hardness and alkalinity are low. The dominant forms of zooplankton found in the lake are listed in Table 6.

Fish species known to utilize the lake and stream are coho, sockeye, pink, and chum salmon; cutthroat trout; and Dolly Varden char. The catch from two minnow traps set for 30 minutes in the outlet stream on May 23, 1973, was 3 Dolly Varden (92-112 mm), 2 cutthroat (122 and 145 mm), and 5 coho (60-92 mm). The larger cutthroat was a mature male.

Recreational use of the lake is limited at present. Large vessels can be brought into Lake Anna. Abundant bear trails provide access to the southeast arm of the lake from Lake Anna. A small float plane can be landed on Anita Lake; and old power line to Chichagof mine and the small size of the lake present aviation hazards.

No facilities are present, but suitable areas for camping are located near the inlet stream or on a gravel beach along the north shore.

The lake is difficult to fish from the banks due to dense alder and spruce growing close to shore. A narrow beach fringe of sedges extends into the lake. The lake is deep so an inflatable boat or canoe is recommended to facilitate movement. The main tributary stream has bank areas suitable for casting.

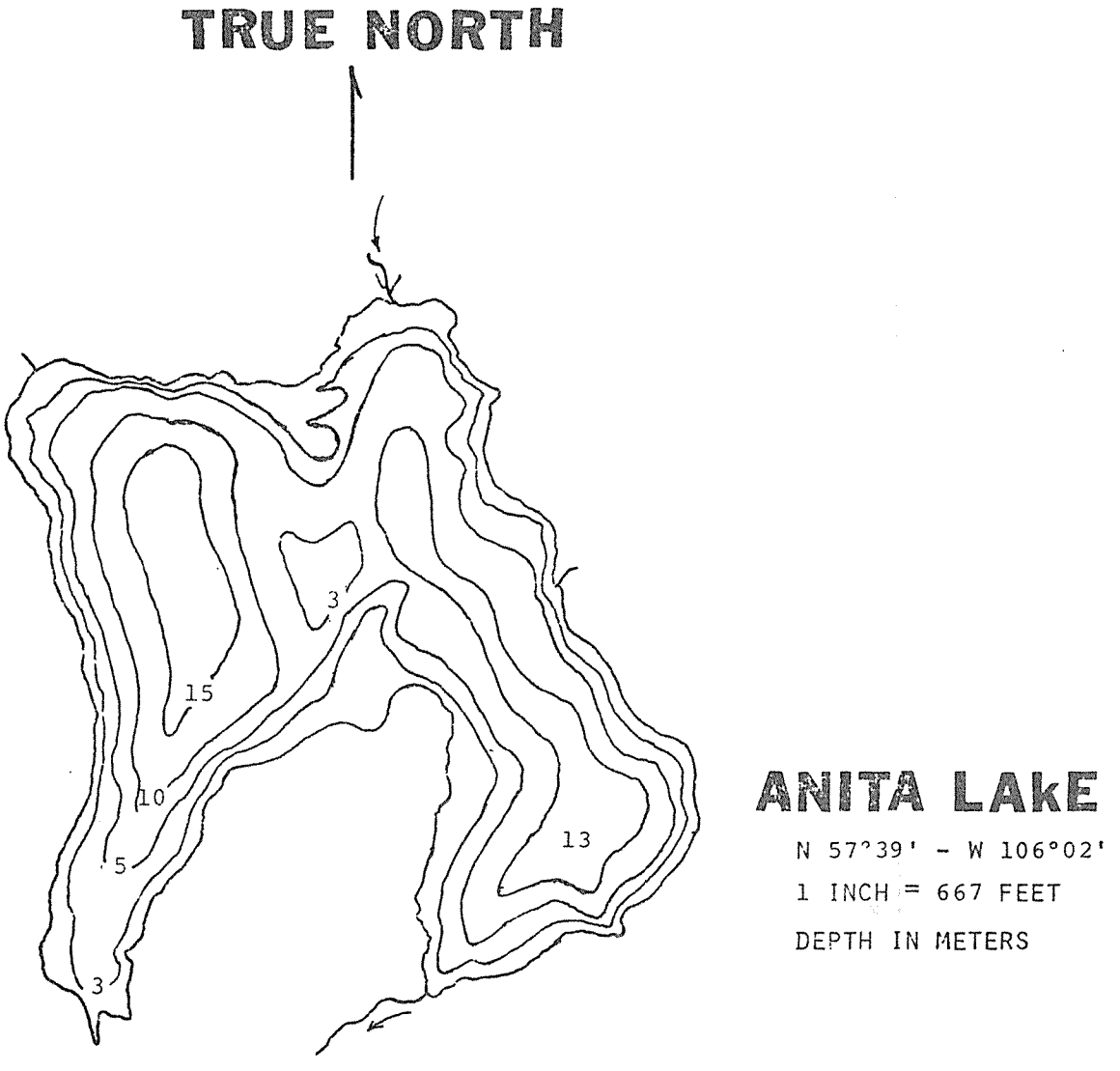


Figure 5. Bathymetric Map of Anita Lake, N57°39' W106°02'.

TABLE 5. Aquatic Invertebrates Found in Tributary Stream to Anita Lake, August 1, 1973.

Order	Family	Genus & Species	No.
Ephemeroptera	Heptageniidae	Epeorus iron albertae	2
		Cinygmula sp.	4
		Rhithrogena undulata	1
Trichoptera	Limnephilidae	Dicosmoecus	1
Diptera	Chironomidae		1
Oligochaeta			2
Turbellaria			1

12/ft²

TABLE 6. Zooplankton Composition of West Chichagof-Yakobi Lakes, 1973.

	Anita 8/1/73	Ford Arm 7/31/73	Goon Dip 7/25/73	Klag Bay 7/10/73	Suloia 7/20/73	Surge 8/24/73	Takanis 8/9/73
Copopoda							
Cyclapoida	X		X	X	X	X	X
Calenoida	X				X	X	
Nauplii	X	X	X	X	X	X	
Cladocera							
Bosminidae	X	X	X	X	X	X	
Daphnidae				X			
Holopedidae	X						
Rotaforia							
Conochilus	X			X		X	
Filinia	X	X					
Keratella			X			X	X
Kellicottia	X		X	X		X	
Polyarthra		X		X			X
Asplancha							X

FORD ARM LAKE

Ford Arm Lake (unofficial name) is located at 57°36'N and 135°53'W. Morphometric data are presented in Figure 6 and Table 7. This mountain valley lake has a drainage area of about 9.3 square miles.

Three tributaries enter the lake. The largest is about 15 feet wide and 1 1/2 to 3 feet deep. All had light brown water color and good spawning gravel. Undercut banks and pools are numerous providing rearing habitat. Aquatic invertebrates collected from a 1 square foot surber sample in this stream included Turbellaria,4; Ephemeroptera, 2; and Trichoptera, 4.

The outlet stream (113-73-03) from Ford Arm Lake runs 3/4 mile to Ford Arm. Average width is about 50 feet and average depth about 2 feet. The color of the water was a light brown. The outlet stream splits into two braided channels 1/4 mile below the outlet and the same two channels rejoin 1/2 mile further downstream. The lower 1/4 mile of stream is characterized by large slippery boulders, large gravel, and open banks. The upper section has good spawning gravel, deep pools, and numerous windfalls. There are no barriers to fish passage. Banks are partly shaded with alder, devils club and salmonberry. A spruce forest with open understory and numerous bear trails provides easy access in portions of the river valley. The upper 1/8 mile is difficult to walk because of steep mountainsides and windfalls.

Water color of the lake is light brown. Secchi disc visibility was 4.2 meters below the surface on July 31. Lake water was slightly acid with a pH of 6.7. Total hardness and alkakinity are low. Dredging with a 6" Ekman dredge produced 27 Chironomidae per sample. Predominant zooplankton forms are listed in Table 6.

Fish species known to utilize the lake are coho, sockeye, pink, and chum salmon; cutthroat trout; and Dolly Varden char. Commercial fishermen report this is a favorite steelhead system but the presence of steelhead was not confirmed.

Recommended mode of transportation to Ford Arm Lake is by aircraft. Hiking the outlet stream to the lake itself is possible with use of a large boat, which would have to be left anchored in Ford Arm. The lake is of sufficient size to permit the landing of a loaded beaver aircraft and to takeoff with a good margin of safety.

The lake is difficult to fish from shore. A small boat, preferably inflatable, would be desirable. Shallow areas extend into the lake from the mouth of tributary streams. The lake's shore is steep, and the lake is deep. Shoreline vegetation is dense making movement difficult.

Ford Arm is in a very scenic valley created by past glacial action. The lake is surrounded by steep mountains.

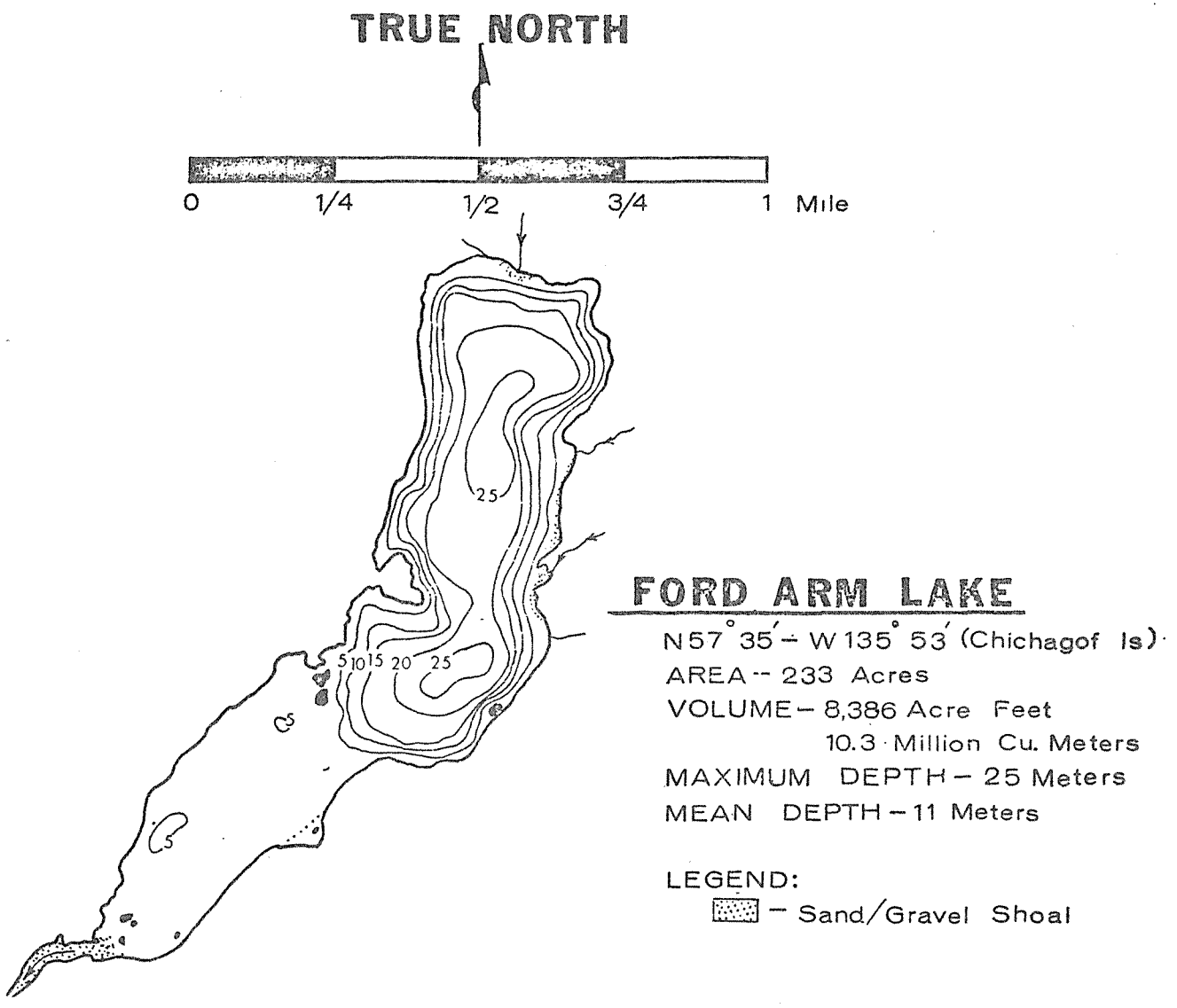


Figure 6. Bathymetric Map of Ford Arm Lake, N57°39' W135°53'.

TABLE 7. Morphometry of Ford Arm Lake.

Water Area

Hectares	94.3
Acres	233

Percent of Depth Zone Areas

0- 5 m	42.5
5-10 m	10.3
10-15 m	8.6
15-20 m	15.0
20-25 m	17.6
25+ m	6.0

Water Volume

Cubic Meters x 10^7	1.03
Acre Feet x 10^4	8.39

Percent Volume of Depth Strata

0- 5 m	35.4
5-10 m	23.8
10-15 m	19.6
15-20 m	14.0
20-25 m	6.3
25+ m	0.9

Maximum Depth = 25 m Mean Depth = 11.0 m

GOON DIP LAKE

Goon Dip Lake, located at 57°45'30" N, 136°10' W, is a large, deep, steep-sided lake, Figure 7, Table 8. The lake is bordered by steep cliffs except in the inlet area where a mature stand of large spruce and hemlock exists. The largest shoal area is adjacent to this inlet. Access to the lake is by plane or a 1-mile walk from Didrickson Bay past the first lake. Game trails provide fairly easy access.

The inlet stream (113-81-09) is about 6 miles long and drains a watershed of approximately 19 square miles. Average width is 35 feet and average depth, 18 inches. The stream is composed of coarse to fine gravels in the lower 1/8 mile to the first tributary stream.

Upstream of the first tributary, the substrate is primarily coarse gravel and boulders for 1/2 mile where it exits from a gorge (fault line) that extends for three-fourths of a mile.

The gorge botton is composed of boulders and bedrock. A greater volume of water flows here than downstream indicating a subsurface drainage flow. Some pools 5 feet deep between rapids were seen from above, but only occasional glimpses of the stream could be seen. No barriers were observed. Those places where water flow sounds were most intense were checked.

At the upper end of the gorge the stream was about 25 feet wide and 1 1/2 to 2 feet deep. Coarse gravel continues upstream for 1/4 mile above this point. One tributary, 8 feet wide x 6 inches deep with rapid flow, entered this section from the southeast. Upstream of the tributary, a series of pools were formed between bedrock walls, the deepest estimated to be 12 feet deep. This section was about 200-300 yards long.

Above the bedrock walls the valley floor widened to 1/4 mile, and the river bottom contained intermediate sized gravels about 4 inches in size for 3/8 mile, gradually coarsening in size and percentage of large boulders. At this point and for 1/4 mile the river flows through a bedrock area with several short steep falls. Near its upper end is a cataract about 10 feet high, which was not considered to be a barrier to salmonids. No fish were seen above this point. For the next 2 1/2 miles, the river bottom is predominantly intermediate gravels with a uniform gradient. Bank cover in the form of overhanging alder increases in density. Several small tributaries enter from both sides, and the valley floor broadens to 3/8 to 3/4 mile.

The stream is easily walked through open stands of spruce, hemlock, and open muskeg. It is the opinion of the survey team that this system has excellent potential as a salmon rearing area or for a resident trout population.

No fish were taken other than cottids; although numerous pools, backwaters, and tributaries were checked in a 5-mile walk upstream.

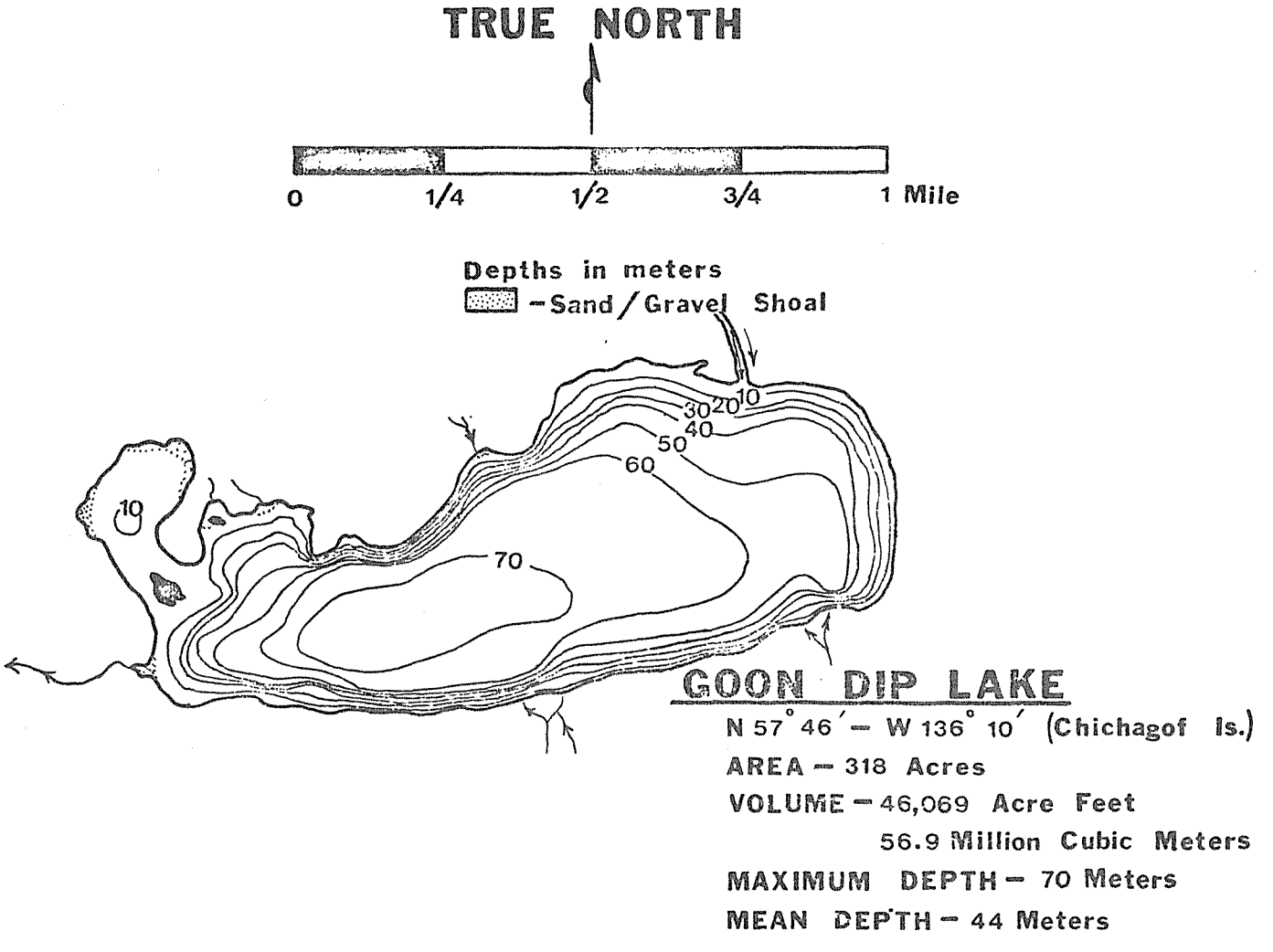


Figure 7. Bathymetric Map of Goon Dip Lake.

TABLE 8. Morphometry of Goon Dip Lake.

Water Area

Hectares	128.7
Acres	318

Percent of Depth Zone Areas

0-10 m	16.0	40-50 m	11.6
10-20 m	7.5	50-60 m	16.0
20-30 m	5.0	60-70 m	25.5
30-40 m	7.2	70+ m	11.0

Water Volume

Cubic Meters x 10^7	5.69
Acre Feet x 10^4	4.61

Percent Volume by Depth Strata

0-10 m	20.8	40-50 m	13.2
10-20 m	18.1	50-60 m	10.0
20-30 m	16.7	60-70 m	5.1
30-40 m	15.3	70+ m	0.8

Maximum Depth = 70+ m Mean Depth = 44 m

The outlet stream is boulder strewn with 1 to 3 inches of water, swift rapids, and deep runs. Gradient to the lower lake is about 2 percent and below the lower lake to Didrickson Bay about 8 percent. Stream bottom type below the lower lake is 90 percent boulder and 10 percent rubble. A mature spruce forest with semi-open understory borders the creek. A waterfall 100 yards from the ocean forms a complete fish block. No fish were caught in the stream or lake by minnow trapping.

Water of Goon Dip Lake was neutral with a pH of 7.0. Secchi disc visibility was 13 meters below the surface. Plankton identified are listed in Table 6.

The only fish taken in the lake were cottids collected with a plankton net. Eighty net hours of fishing with a variable mesh gill net produced nothing.

KLAG BAY LAKE

Klag Bay Lake is located at 57°30' north latitude and 136°04' west longitude. Depth contours and morphometric data are presented in Figure 8 and Table 9. The lake is surrounded by 200-500 foot high hills with a thin rocky soil mantle. Vegetation is primarily yellow cedar and lodgepole pine. The lake drains 1.1 miles to Klag Bay through a series of small ponds.

The lake's main inlet is about 2 miles long, 12 feet wide, and 6 inches deep. Drainage area is about 2.3 square miles. Water has a very faint muskeg color. The stream bottom is composed of 30 percent boulder, 50 percent coarse gravel, 20 percent intermediate gravel and fine material. Two series of rapids 3/8 and 1/2 mile upstream may form a partial block to stickleback. The stream banks are partly shaded with a 30 foot to 80 foot wide spruce and hemlock stand. Open area through muskegs cover about 30 percent of length. Sport fishing produced several 8 to 13 inch cutthroat. The inlet stream was surveyed to about 5/8 mile above the main lake where a small lake exists.

The outlet stream has an average width of 20 feet and depth of 6 inches. The stream bottom is primarily boulder and rubble with very little sand or silt. No barriers to fish were found. Bank cover is partly shaded by alder, but open pools with grass shoreline are common. Submergent vegetation is abundant in the stream. This stream seemed to have abnormally warm temperatures. The temperature was 9°C May 25 while other streams in the area were 5° to 6°C. Additional data and fish species present are shown in Table 2. Two cutthroat caught on sport gear were 32 and 34 mm at ages IV and V, respectively.

Analysis of water quality (Table 3) showed the lake and outlet stream to be higher in total dissolved solids than surrounding waters. This increased nutrient base with warmer temperature should contribute to a more productive aquatic system.

This system contains cutthroat, rainbow, Dolly Varden, pink salmon, chum salmon, and supports substantial runs of sockeye and coho. Stickleback are numerous. An 18 hour variable mesh gill net set in the main lake produced 20 cutthroat, 6 Dolly Varden, and 1 rainbow.

This system contains excellent potential for recreational angling. A Fish and Game cabin at the mouth of the creek provides shelter. Potential for a canoe route was described by the survey crew as follows:

> Area has possibilities for canoe/portage camp trips. A trail along powerline for access to N.W. end of main lake is possible with a small amount of brushing. Access to the first lake below the largest is a 25 feet lift out over a few boulders. Access to second lake is a portage of 200 feet along the creek bottom. Access to the third lake is more difficult. Stream bottom has logs in it and

bank foliage is thick. Third lake to ocean is even more difficult. Brush becomes considerably thicker. Ocean access from second lake can be made from a shallow N.W. bay of that lake across a muskeg to a small inlet of Klag Bay. This survey party made the portages from the largest lake to the first below, and from the first below to the second with a 10 feet Avon rubber dinghy. The remainder of the portage routes mentioned were walked.

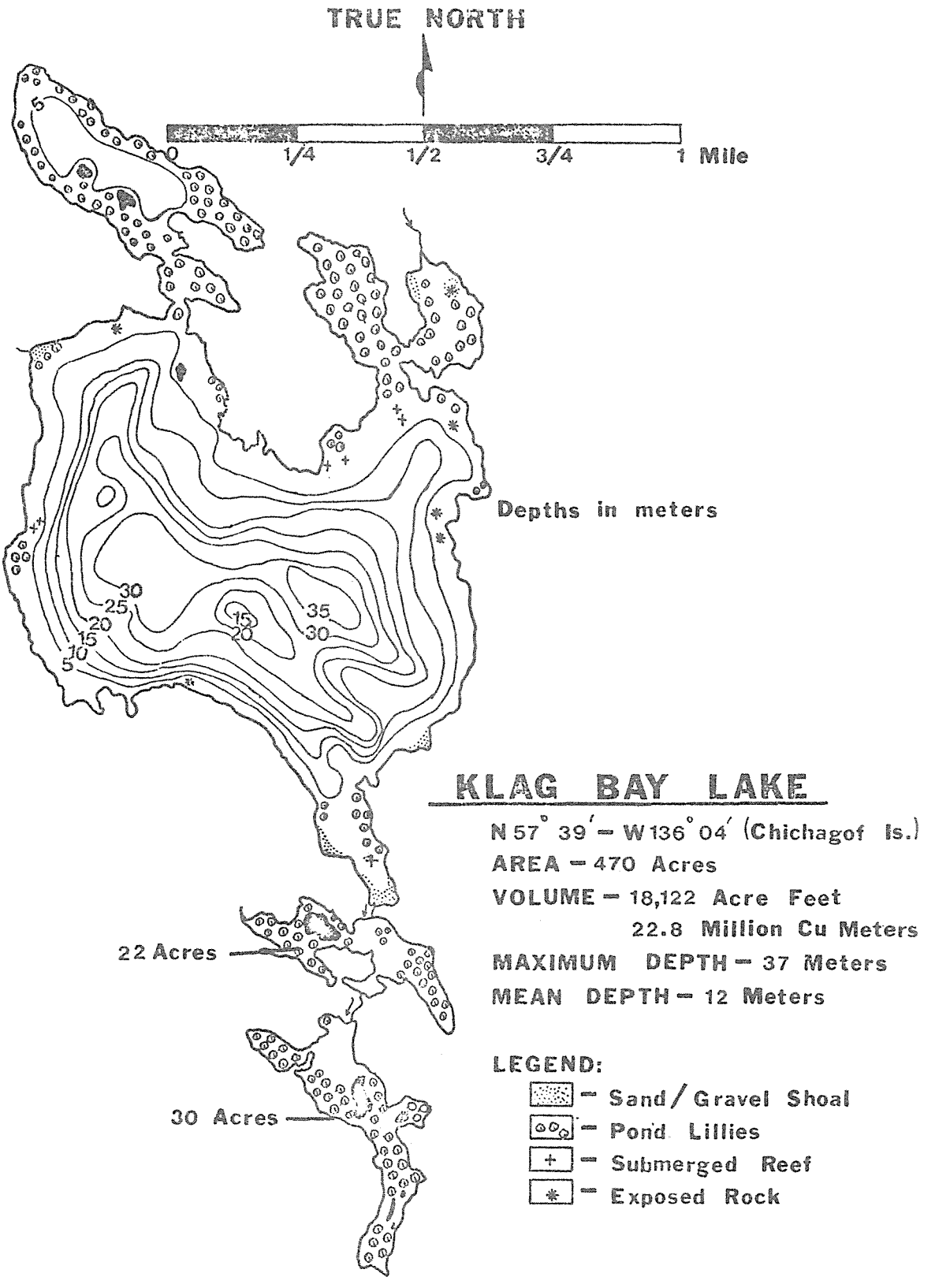


Figure 8. Bathymetric Map of Klag Bay Lake, N57°39' W136°04'.

TABLE 9. Morphometry of Klag Bay Lake.

Water Area

Hectares	190
Acres	470

Percent of Depth Zone Areas

0- 5 m	41.3	20-25 m	9.1
5-10 m	12.8	25-30 m	9.1
10-15 m	10.6	30-35 m	6.4
15-20 m	9.4	35+ m	1.3

Water Volume

Cubic Meters x 10^7	2.277
Acre Feet x 10^4	1.81

Percent Volume of Depth Strata

0- 5 m	33.4	20-25 m	9.0
5-10 m	22.2	25-30 m	5.1
10-15 m	17.2	30-35 m	0.2
15-20 m	12.9	35+ m	---

Maximum Depth = 37 m Mean Depth = 12 m

SULOIA LAKE

Suloia Lake is located at 57°25' north latitude and 135°42' west longitude. Depth contours and morphometric data are presented in Figure 9 and Table 10.

The inlet stream is about 5 miles long with excellent spawning gravel. Inlet flow was 42 cfs on July 21. The lake drainage area is about 20 square miles.

The lake outlet is about 1/2 mile long and drains into Suloia Bay. Gradient is steep and three impassable falls block fish movement. The outlet water is clear. Volume of outlet stream at time of survey was estimated to be 58 cfs.

Limited water quality analyses were conducted. Visibility of secchi disc was 11 meters below the surface. The temperature of the lake water was 13°C at the surface and 5.5°C at 30 meters below the surface. A strong thermocline existed at 8 meters depth. The water was slightly acid with a pH of 6.55.

Suloia Lake was investigated by Wilding (1939) who reported an abundant and heavily parasitized population of Dolly Varden. Rainbow trout were introduced into the system in 1965. Test netting in 1973 produced 1 rainbow (155 mm) and 26 Dolly Varden (127-215 mm).

This system is readily accessible from Sitka by skiff or aircraft. A 1-mile trail from Suloia Bay provides access to an 8 foot x 12 foot Forest Service cabin containing a stove and two bunks. The sport fishery is poor as small Dolly Varden predominate.

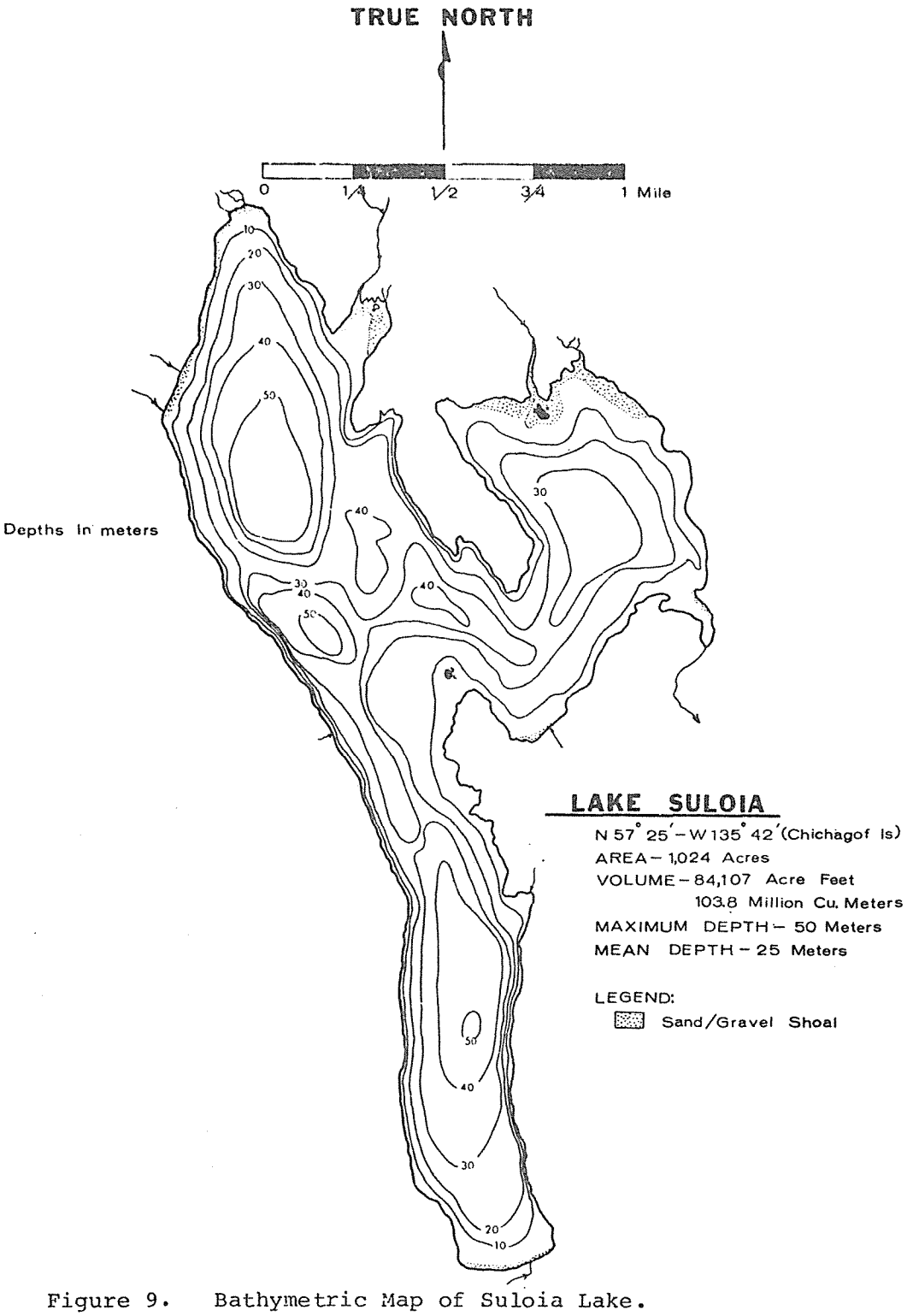


Figure 9. Bathymetric Map of Suloia Lake.

TABLE 10. Morphometry of Suloia Lake.

Water Area

Hectares	414.6
Acres	1024

Percent of Depth Zone Areas

0-10 m	18.0
10-20 m	19.9
20-30 m	25.4
30-40 m	19.1
40-50 m	12.5
50+ m	5.1

Water Volume

Cubic Meters x 10^7	10.04
Acre Feet x 10^4	8.41

Percent Volume of Depth Strata

0-10 m	36.3
10-20 m	28.7
20-30 m	19.5
30-40 m	10.6
40-50 m	4.2
50+ m	17

Maximum Depth = 50 m Mean Depth = 25 m

Number of Islands = 2

SURGE LAKE

Surge Lake is located at 58° north latitude, 136°31' west longitude. Depth contours and morphometric data are presented in Figure 10 and Table 11.

Table 2 presents physical data and fish species found in the main inlet stream (113-93-01). This inlet has excellent spawning area and frequent pools. Aquatic invertebrates sampled from Surge Lake Inlet are listed in Table 12. No barriers exist in the 1 1/4 mile length to a second lake. Two minnow traps set for 6 1/2 hours caught 89 coho fry, 22 Dolly Varden, 8 rainbow, and 41 stickleback. At the time of survey (late August), a large run of sockeye (5,000 estimated) were spawning. Coho salmon were also entering the lake at this time. No estimate of number was attempted.

The lake level is about 1 foot above high tide mark. It is possible saltwater enters the lake on high tides.

The limited data collected shows a decrease of pH from 7.05 at lake surface to 5.9, 200 feet below the surface. Hardness and alkalinity showed increased concentrations proportional to increased depth. Salinity measurements were not taken.

This lake is readily accessible from tidewater or via an 80-mile air charter from Sitka. No facilities are available on the lake, but good tent sites are abundant along the shore. Although no maintained trails are present, the shoreline is open with well-established game trails. The forest has an open understory.

The lake is very picturesque with small islands. It would be ideal for canoeing; canoe portage area exists from salt water to the lake. Rugged peaks are in view from the lake.

Fishing history is unknown but should be good considering the species diversity available.

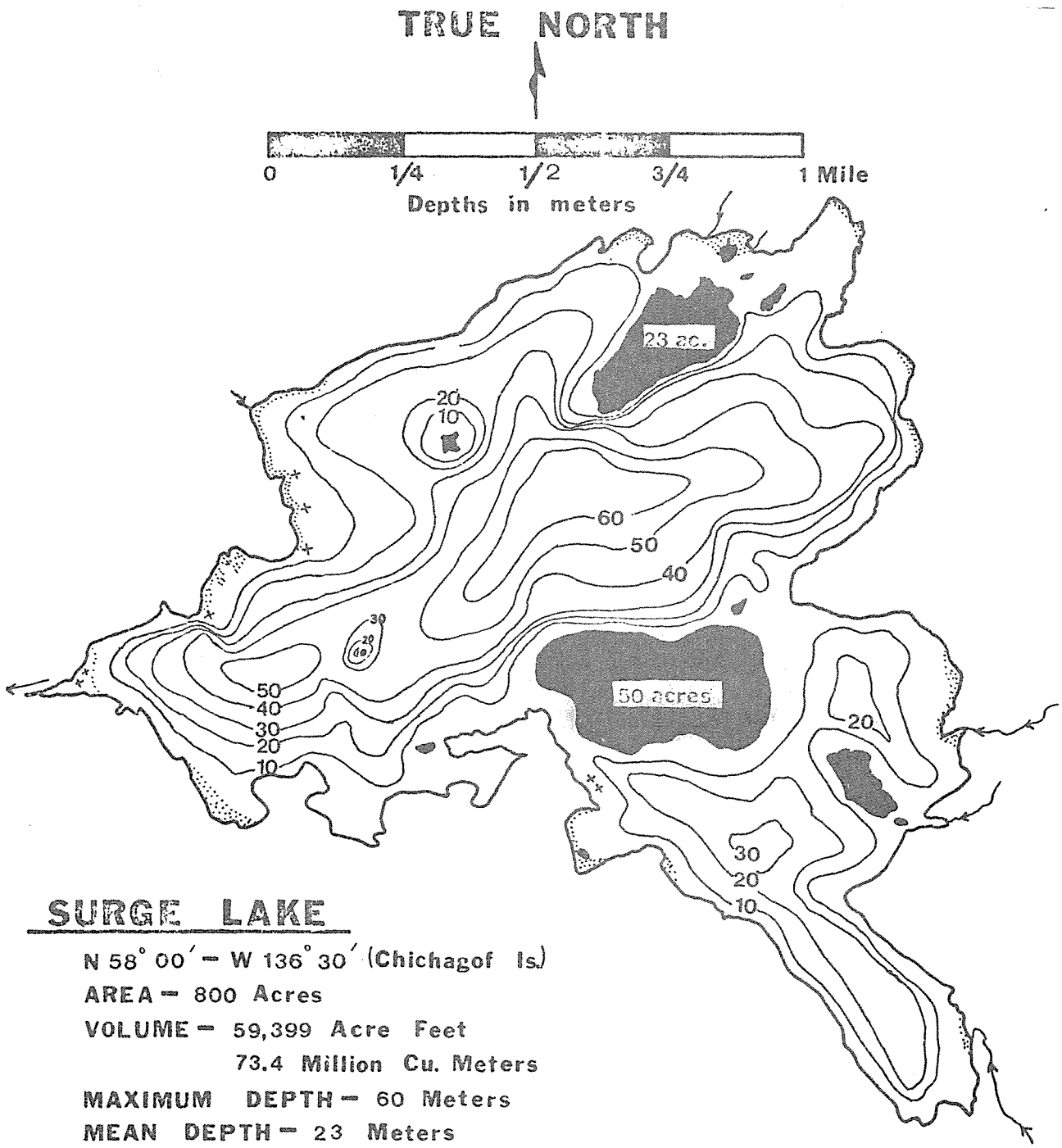


Figure 10. Bathymetric Map of Surge Lake.

TABLE 11. Morphometry of Surge Lake.

Water Area		Island Area	
Hectares	323.9	Hectares	20.2
Acres	800	Acres	50

Percent of Depth Zone Areas

0-10 m	31.0	40-50 m	11.5
10-20 m	20.5	50-60 m	5.5
20-30 m	18.5	60+ m	3.0
30-40 m	10.0		

Water Volume

Cubic Meters x 10^7	7.34
Acre Feet x 10^4	5.94

Percent Volume of Depth Strata

0-10 m	37.1	40-50 m	6.1
10-20 m	25.7	50-60 m	2.4
20-30 m	17.2	60+ m	0.4
30-40 m	11.0		

Maximum Depth = 63.0 m Mean Depth = 22.6 m

Number of Islands = 1

TABLE 12. Aquatic Invertebrates Sampled, Surge Lake Inlet.

Surber Sample (1 square foot), June 23, 1973

Order	Family	Genus & Species	No.
Ephemeroptera	Ephemerellidae	Ephemerella (Drunella) doddsi	1
		Ephemerella (D.) grandis flavitineta	2
	Baetidae	Baetis tricaudatus	1
Plecoptera	Chloroperlidae	Alloperla sp.	1
Trichoptera	Limnephilidae	Dicosmoecus sp.	1
Diptera	Chironomidae		1
			7

Grab Sample, August 24, 1973

Order	Family	Genus & Species	No.
Ephemeroptera	Ephemerellidae	Ephemerella (Drunella) coloradensis	1
		Ephemerella (Serratella) tibialis	2
	Heptageniidae	Cinygmula sp.	6
Trichoptera	Limnephilidae	Dicosmoecus sp.	1
Diptera	Chironomidae		24
Acarina			1

Surber Sample (1 square foot), August 25, 1973

Order	Family	Genus & Species	No.
Turbellaria			5
Ephemeroptera	Baetidae	Baetis tricaudatus	3
	Ephemerellidae	Ephemerella (Serratella) tibialis	1
	Heptageniidae	Cinygmula sp.	1

10

TAKANIS LAKE

Takanis Lake is located on Yakobi Island at 57°57'30" north latitude, 136°27'30" west longitude. Depth contours and morphometric data are presented in Figure 11 and Table 13.

Upper Takanis Creek is the major tributary to the lake. Numerous salmon smolt were observed in small pools formed by exposed tree roots. The stream bottom is composed of rubble and medium rock. Aquatic invertebrates were abundant on rock (Table 14).

The outlet flows 1 1/4 miles to a saltchuck. See Table 2 for physical characteristics of stream 113-92-02. The upper intertidal area has excellent spawning gravels. The spawning gravel area above tide line is primarily bedrock and boulder with a small percentage of smaller size gravel. Stream banks showed a wide fluctuation in ouflow levels. Sockeye, coho, and pink salmon; Dolly Varden; and rainbow trout were observed in the stream. The stream is easily fished, pools are infrequent, and the stream is narrow with an average width of 9 feet. No barriers to fish passage were found.

Water of Takanis Lake is clear with an apparent blue-green color. Secchi disc visibility was 7.4 meters below the surface.

Takanis Lake is primarily accessible by floatplane. It is also possible to pack in from Takanis Bay along an overgrown steep trail.

The prime fishing areas in the lake are at the inlet of the upper Takanis Creek and in the lake outlet. Accessibility around the lake is difficult because of dense spruce and alder and the steep mountains. It is recommended anglers use a collapsible or inflatable boat on the lake.

Takanis Lake is located close to other productive salmonid areas. No established recreation facilities exist in the area. Inspirational Development Mining Company has an exploratory camp nearby, and the lake receives some angling pressure from this source.

Takanis Lake is located in a very appealing setting with steep mountains rising on both sides of the valley. The area is unique in its terrain and location on Yakobi Island.

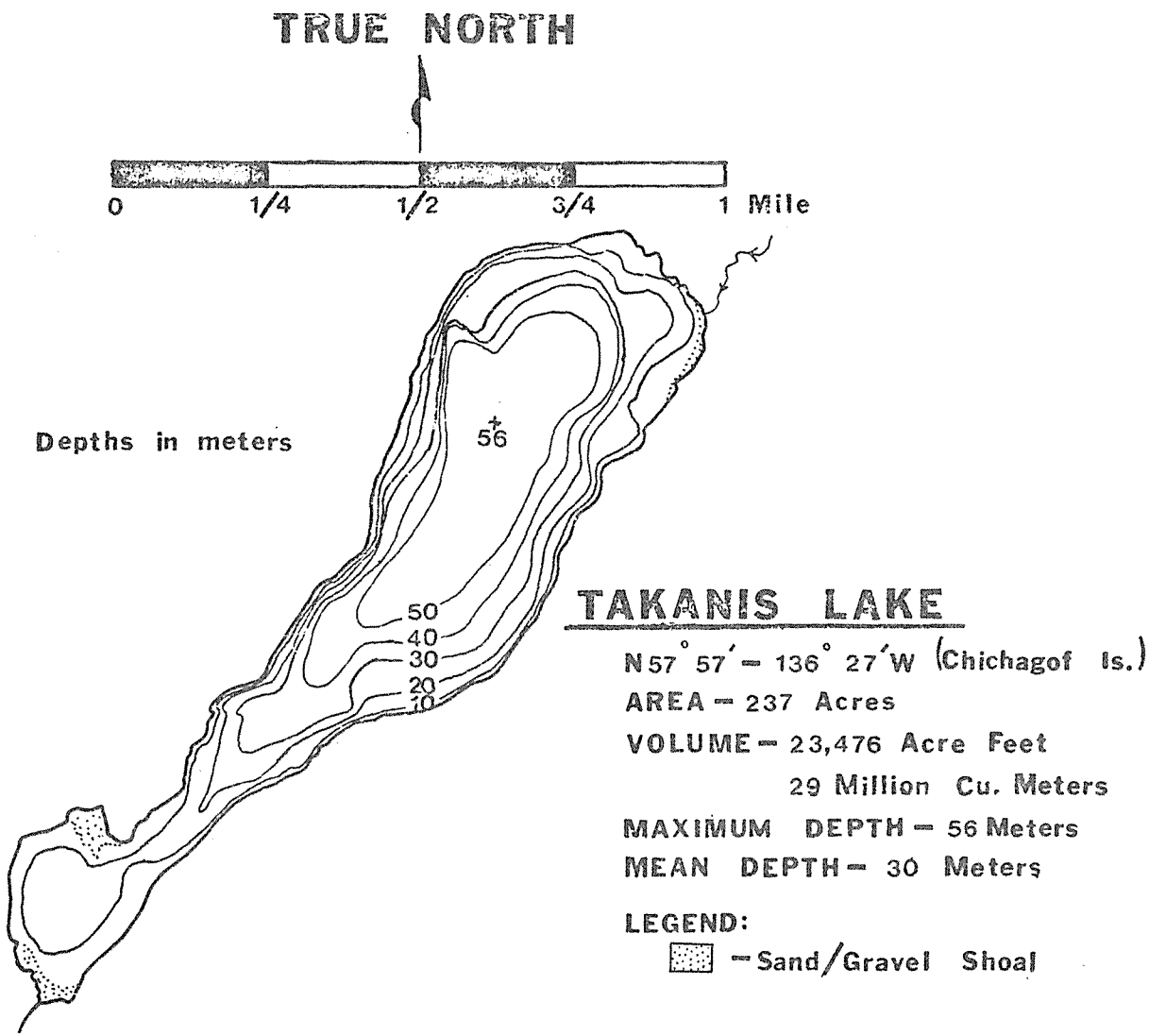


Figure 11. Bathymetric Map of Takanis Lake.

TABLE 13. Morphometry of Takanis Lake.

Water Area

Hectares	95.9
Acres	237

Percent of Depth Zone Areas

0-10 m	16.4
10-20 m	18.1
20-30 m	16.4
30-40 m	13.5
40-50 m	11.8
50+ m	23.6

Water Volume

Cubic Meters x 10^7	2.89
Acre Feet x 10^4	2.35

Percent Volume of Depth Strata

0-10 m	30.4
10-20 m	24.6
20-30 m	18.9
30-40 m	13.9
40-50 m	9.7
50+ m	2.6

Maximum Depth = 56 m Mean Depth = 30.2 m

TABLE 14. Aquatic Invertebrates Sampled, Takanis River System, 1973.

Main River, Surber Sample (1 square foot), June 22, 1973

Order	Family	Genus & Species	No.
Ephemeroptera	Baetidae	Baetis tricaudatus	13
		Baetis bicaudatus	2
	Ephemerellidae	Ephemerella s.s. inermis	1
Diptera	Simulidae	Simulium sp.	2
	Chironomidae		2
			20

Tributary, Surber Sample (1 square foot), June 22, 1973

Order	Family	Genus & Species	No.
Ephemeroptera	Siphlonuridae	Ameletus sparsatus	1
	Baetidae	Baetis bicaudatus	1
	Leptophlebidae	Paraleptophlebia debilis	1
	Heptageniidae	Cinygmula	1
	Ephemerellidae	Ephemerella (Drunella) coloradensis	1
			5

Takanis Creek, Above Lake, Grab Sample, August 9, 1973

Order	Family	Genus & Species	No.
Turbellaria			2
Ephemeroptera	Baetidae	Baetis bicaudatus	8
	Heptageniidae	Cinygmula sp.	2
	Leptophlebidae	Paraleptophlebia memorialis	1
	Heptageniidae	Epeorus iron longimus	2
		Epeorus iron albertae	3
Ephemeroptera	Ephemerellidae	Ephemerella (Drunella) doddsi	1
Trichoptera	Hydropsychidae	Arctopsyche	1
Diptera	Simulidae	Simulium (Eusimulium)	1

Redoubt Lake Investigation

The Sitka Fish and Game Advisory Board in January requested that the Department of Fish and Game "undertake immediately a comprehensive study of Redoubt Lake near Sitka to determine the reasons for the constant decline of the sockeye salmon run in this lake." An understanding of limnological relationships including physical, chemical, and biological aspects is essential to understanding fish production.

Hayes (1964) found that area and depth of lakes affect standing crop. The level of total dissolved solids is important in determining lake productivity (Northcote and Larkin, 1956). Ball (1948), Carlander (1955), and Turner (1960) reported that standing crop of fishes are directly related to levels of alkalinity in lakes and ponds. Moyle (1956) showed that the type of biological community is influenced by concentrations of chemical nutrients.

The depth, size and shape of lakes strongly influence the physical and chemical conditions which prevail within them. Redoubt Lake is very deep with steep sides (Figure 12). Shallow areas are limited to a few inlet stream deltas and to the south end. The lack of shoal area has severly limited the productive rearing area.

Thermal profiles of the lake taken throughout the summer (Figure 13) show that very little warming occurs below 15 meters. Secchi disc readings taken with a 20 cm plate on July 6 showed the level of penetration of 5 percent solar radiation to be about 8 meters.

Water samples for mineral analyses were collected from the inlet stream, lake surface, 50 meter and 84 meter depths. Water analyses were made by the Alaska Department of Health and Social Services. Samples were taken on May 2, when the water column was nearly homothermous and showing no indication of an overturn. Specific conductance, total dissolved solids, total hardness, and those ions comprising the main constituents of seawater increased markedly with increased depth (Table 15). Hydrogen ion concentration was slightly acid with pH of 6.9 at all depths sampled. Dissolved oxygen was at near saturation at all depths analyzed.

The presence of chemical stratification indicates that the lake has or had influence from the ocean. No overturn or mixing of the water column was evident during the period when the water was homothermous.

In lakes which do not undergo an annual overturn, the organic nutrients governing biological productivity, nitrogen and phosphorous, settle to the lake bottom with dead organisms and are lost from the energy cycle. Since nitrogen can be fixed from the atmosphere, it may be concluded that phosphorous is the key element in fertilization of natural bodies of water.

Plankton are important in lakes as primary and secondary producers. In lakes with sparse rooted vegetation, production is limited by the amount

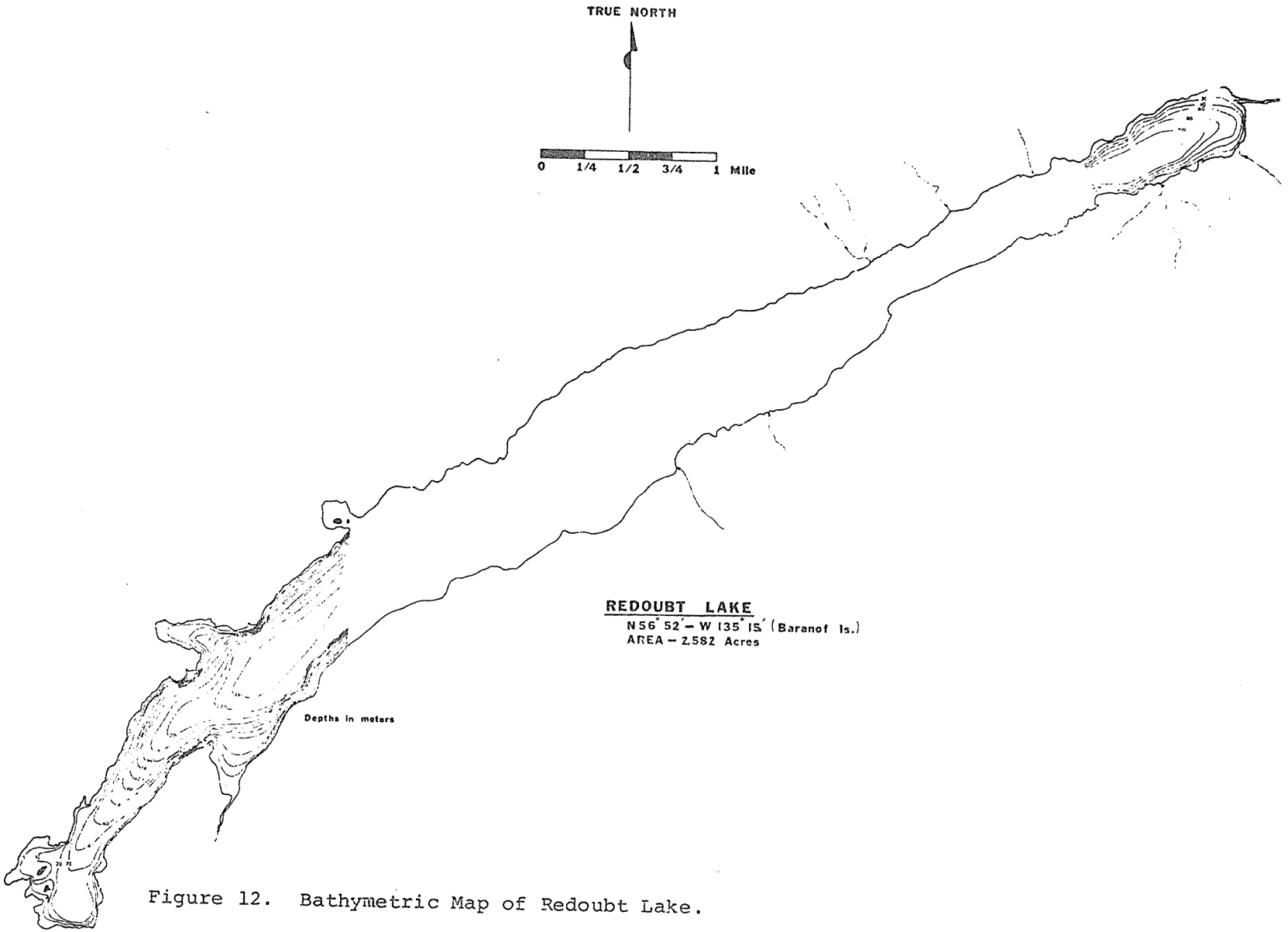


Figure 12. Bathymetric Map of Redoubt Lake.

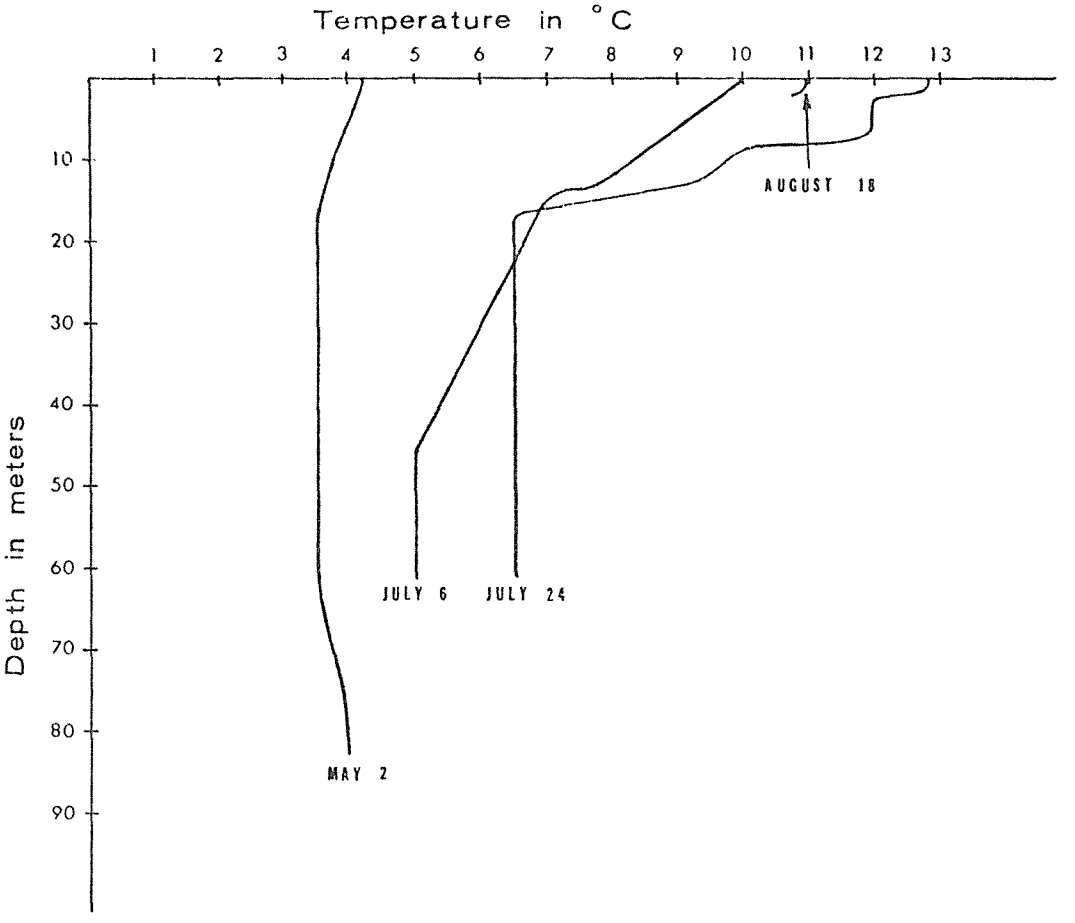


Figure 13. Thermal Profile of Redoubt Lake, 1973.

TABLE 15. Mineral Analyses as Parts per Million, Redoubt Lake and Inlet Stream, May 2, 1973.

	Inlet	Surface	50 Meters	84 Meters
pH	6.7	6.9	6.9	6.9
Specific Conductance (micromhos)	31.2	164	230	404
Total Dissolved Solids	42	96	132	216
Suspended Solids	2	14	32	12
Alkalinity	11	10	9	10
Total Hardness	12	23	27	43
Calcium (Ca)	3	5	5	5
Magnesium (Mg)	2	4	5	9
Bicarbonate (HCO_3)	13	12	11	12
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	2	11	12	20
Chloride (Cl)	2	48	64	104
Nitrate (NO_3)	0.04	---[1]	---	---
Phosphate (PO_4)	0.05	---	---	---
Turbidity[2]	7	10	7	10

[1] Not analyzed

[2] Jackson Turbidity Units

of phytoplankton and zooplankton present.

Although standing crops of plankton are not measured production, net plankton samples show some distinction between oligotrophic and eutrophic lakes. Rawson (1953) states that the standing crop of No. 20 net plankton measured by total vertical hauls exhibits this distinction in western Canada.

Phytoplankton populations in Redoubt Lake appear very scarce. The only diatoms found were in early May when Tabellaria reached densities of about 500 colonies per square meter. The blue-green algae, Caelospherium, increased in density from early May to early July when it reached concentrations of about 5,000 organisms per square meter. By late July it disappeared and did not reappear for the remainder of the study period.

Zooplankton populations were scarce during the spring and early summer (Table 16). The most abundant organisms were the Cladocera and Rotifera. The Cladocera Bosmina reached its greatest density in mid-September.

The pronounced lack of phytoplankton in Redoubt Lake may indicate the absence of some required nutrient. Development of fair populations of Rotifera and Cladocera late in the season could be attributed to their feeding on suspended and/or colloidal organic material. Suspended organic material was found in fair quantity upon microscopic examination.

Aquatic invertebrates were sampled in the lake and main inlet (Table 17).

The extent of salmon runs in Redoubt Lake in past years is poorly documented. The U.S. Department of the Interior, Fish and Wildlife Service, maintained a weir at the outlet of the lake in 1953, 1954, and 1955. In 1953, the escapement counts into the lake were 22,942 sockeye and 6,466 coho. Escapement counts in 1954 were 21,145 sockeye and 2,932 coho. Total counts of sockeye and coho in 1955 were 22,828 and 1,534, respectively. Escapement counts of coho were probably incomplete in 1954 and 1955 as the weir was removed on September 3 each year.

Escapement counts taken in 1963 from an Alaska Department of Fish and Game counting tower indicate a minimum of 16,733 sockeye entered the lake. Reliable counts of pink and chum salmon and Dolly Varden are not available.

A substantial subsistence fishery for sockeye salmon exists at the outlet of Redoubt Lake. Subsistence fishing records show that 216 permits were issued in 1973 with a reported 616 sockeye taken. The number of sockeye taken by sportsmen is unknown.

TABLE 16. Zooplankton Composition and Density, Organisms per Square Meter, Redoubt Lake, May 2 - September 8, 1973.

	Rotifera							
	Polyarthra	Keratella	Kellicottia	Filinia	Total	Cladorera Bosmina	Copepoda Cyclopoida	Immature Forms
5/2	---	1527	---	509	2036	1018	509	509
6/11	---	509	---	---	509	509	---	1018
7/2	3563	---	---	1018	4581	---	---	1018
7/24	60571	2036	1018	---	63652	7126	509	28504
8/17	5599	1527	---	---	7125	116561	2036	26977
9/18	56499	65152	---	1018	122669	233122	---	35630

TABLE 17. Aquatic Invertebrates Sampled, Redoubt Lake and Main Inlet, 1973.

Date	Location	Type of Sample	Organisms and Number	
5/2	Inlet stream delta	Ekman 6"	Order Oligochaeta	22
			Order Amphipoda	
			Family Gammaridae	
			Gammarus	3
			Order Ephemeroptera	
			Family Siphlonuridae	
			Ameletus sparsatus	2
			Order Plecoptera	
			Family Nemouridae	
			Capnia	1
			Order Diptera	
			Family Chironomidae	
			Smittia	1
			Chironomus (Tribelos)	4
			Polypedilum	8
6/12	Inlet stream delta	Ekman 6"	Order Oligochaeta	1
			Order Diptera	
			Family Chironemidae	43
6/6	1/4 mile up main inlet	Grab sample	Order Ephemeroptera	
			Family Baetidae	
			Baetis bicaudatus	3
			Family Leptophlebidae	
			Paraleptophlebia memorialis	1
			Family Heptageniidae	
			Cinygma	4
			Order Plecoptera	
			Family Chloroperlidae	
			Alloperla	3
			Order Trichoptera	
			Family Rhyacophilidae	
			Rhyacophila	2
			Family Limnephilidae	
			Dicosmoecus	2
			Order Ephemerella	
			Family Ephemerellidae	
			Ephemerella grandis flavitineta	8
			Family Baetidae	
			Baetis bicaudatus	8
			Order Plecoptera	
			Family Chloroperlidae	
			Alloperla	1
			Order Trichoptera	
			Family Rhyacophilidae	
			Rhyacophila	4

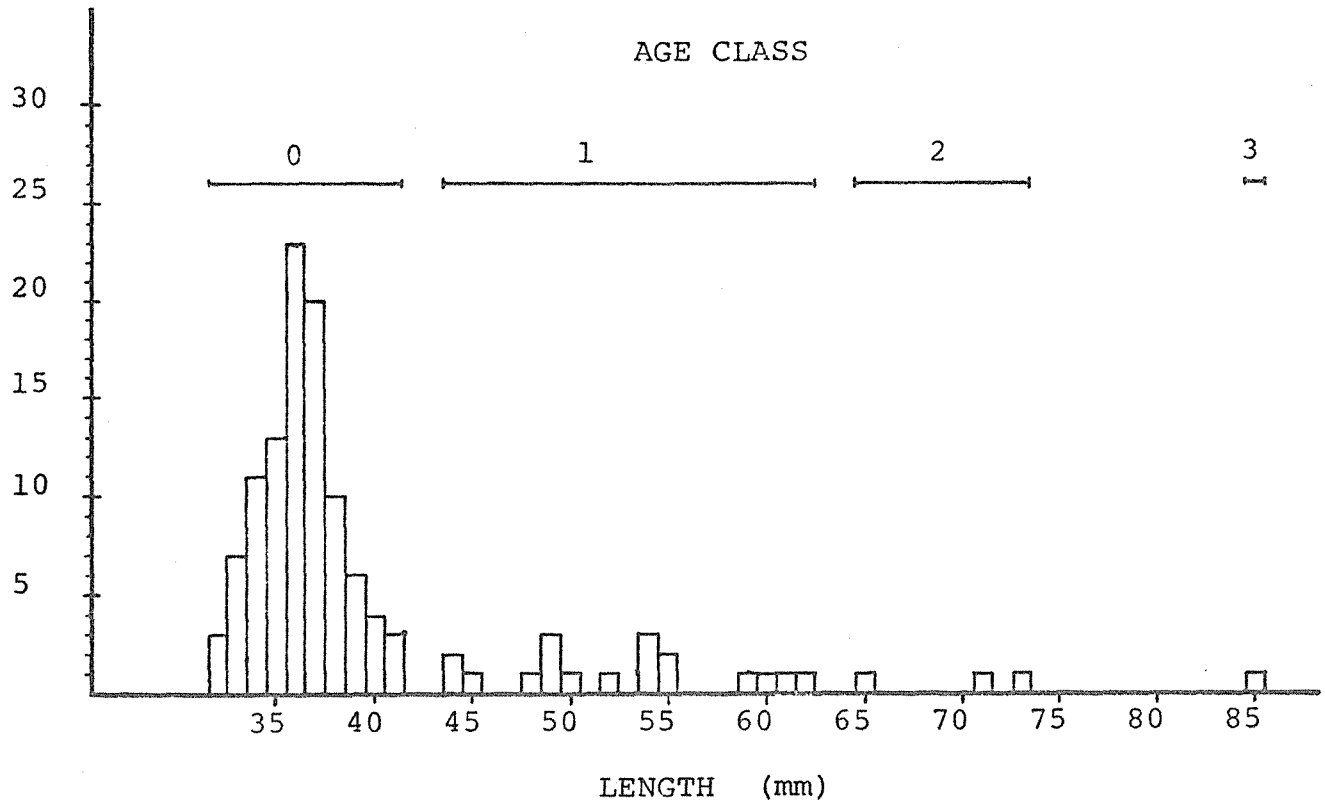
Fish collections made with variable mesh gill net throughout the study period are summarized below:

Date	Species*	Age Class	Number in Sample	Hours of Effort	Length Range mm	Mean Length mm	Weight Range (grams)	Mean Weight
4/12/73	DV	---	5	4	267-381	334	156-481	308
4/12/73	DV	---	9	4	114-527	280	35-1217	304
6/12/73	DV	---	2	10	---	---	---	---
7/24/73	DV	---	25	17	325-550	422	367-1814	934
	RS	1.2	1	17	---	---	766	---
7/26/73	DV	---	35	25	---	---	---	---
	DV	---	1	25	720	---	4110	---
	RS	1.3(2)** 2.2(1) 2.3(3)	6	25	585-650	599	2136-3112	2517

* Fish species are DV, Dolly Varden; RS, red salmon.
** ( ) = number of fish.

Several attempts were made to collect sockeye smolt with no results. Sockeye fry captured June 6 in a slough near the main inlet ranged from 30-38 mm. Size and age of rearing coho are presented in Figure 14.

Figure 14. Size and Age of Rearing Coho, Redoubt Lake Inlet, June 6, 1973.



REDOUBT MAIN INLET
STREAM SURVEY & RECREATION INVENTORY

Survey Date: June 15, 1973.

Location: Lat. 57°55'N, Long. 137°7'W.

Length: 5.2 mi.

Watershed Area: 12.4 sq. mi.

Flow Range: a) Mouth to 1/8 mi. upstream; W = 150', D = 4-6' (shallow bar 1-2" at terminus of delta), V = sluggish. b) 1/8 mi. to 1/4 mi. upstream; W = 75-100', D = 2-3', V = rapid. c) 1/4 to 3/8 mi.; W = 75', D = 1-12', V = rapid. d) 3/8 to 1/2 mi.; W = 50-75', D = 2-3', V = rapid.

Color/Turbidity: Clear.

Accessibility: a) Via 5-mile trail from Silver Bay passing Salmon Lake. Trail cleared and marked in 1972 by U.S. Forest Service. b) Via water craft from Sitka, small craft only in stable weather. Mechanical life device for skiffs to portage falls at outlet (best at high tide). c) Via air charter 15 minutes one way from Sitka. d) Forest Service cabin located at mouth of stream inlet--excellent condition. Fish and Wildlife cabin at lake outlet in fair condition but not maintained.

Access to Fishing: First 1/2 mile has open timbered banks with well-used deer and bear trails. From 1/2 mile to 1 1/4 mile the banks have heavy growths of devils club, but game trails 50-100 yds. wide are usable. Large pool 1/4 mile from mouth has large logs across, otherwise wading across is possible only in a few places.

Tributaries: Numerous small interconnecting 10-20' pools (water table very near surface). Main tributary 4' wide and 6" deep entering from the south about 1/2 mile from mouth of main inlet. A spectacular falls is located where the tributary enters the flat valley floor. Temperature of the tributary is 44°F (4° above the main flow). Good spawning gravels and runs up to the base of the torrential flow about 3/8 to 1/2 mile from its confluence with the main inlet stream. Beaver dam off branch of tributary.

Bottom Type: a) Mouth overlain by silt and fine organic debris. b) Mouth to 1/8 mi. is sandy with occasional boulders. c) 1/8 to 1/4 mi.; boulders and gravel (good spawning area). d) 1/4 to 3/8 mi.; pools with sand and fine gravel bottom. e) 3/8 to 1/2 mi.; boulder and coarse gravel (good spawning bottom). f) 1 1/2 mi. to 5 mi.; stream braided into several channels with numerous gravel bars. Very little bank cover.

Pools: Same width as stream, mostly shallow pools without aquatic vegetation, frequency 50 percent. Largest pool about 1/4 mile upstream is 12' deep. John Vallie reportedly saw 3 steelhead here during a

survey in 1968.

Barriers: None.

Spawning Area: 30-50 percent.

Bank Cover: a) Mouth to 1/2 mi.; partly shaded. b) 1/2 to 1 1/2 mi.; intensely shaded. c) 1 1/2 to 5 mi.; sparsely shaded.

Watershed: Mountainous, wooded.

Fish Species: Dolly Varden char; steelhead trout and stickleback; and sockeye, coho, pink, and chum salmon. Observed coho fry in all areas.

Fishing History: Dolly Varden fished in mouth of inlet, good for large Dolly Varden when sockeye run in July. Coho reported taken at mouth of inlet in October-November.

Fishing Intensity: Light.

Invertebrates: See Table 17.

Aquatic Vegetation: Mosses and filamentous green algae sparse.

Water Use: None.

Pollution: None.

Remarks: Slough 100 yards northwest of mouth has the highest density of rearing fry. Fry were observed for about 600'. Lower reaches (up to 300' from mouth) are 1"-18" deep and 25' to 100' wide, sluggish in flow, and mainly choked with sedges, horsetails, moss and skunk cabbage. Temperature was 42°F at mouth and 40°F one-half mile upstream.

Effects of Chlorinated Sewage Effluent on Survival of Coho, *Oncorhynchus kisutch*, and Dolly Varden, *Salvelinus malma*, in the Mendenhall River

Recent studies of residual chlorine toxicity in aquatic systems have emphasized the need for close scrutiny of present water treatment procedures for disinfection. Recent investigations, including life cycle studies with aquatic organisms, have greatly clarified the level of significance of chlorine toxicity. Doudoroff and Katz (1950) and Merkens (1958) stated that toxicity of free chloring is apparently in the same order as that of chloramines, and a measure of residual chlorine is generally adequate to define chlorine toxicity. Holland et. al. (1960) determined that chloramines were more toxic than chlorine to salmon in seawater. Tsai (1971) found no fish in water with a chlorine residual above 0.37 mg/l, and the species diversity index went to zero at 0.25 mg/l. Esvelt et. al. (1971) and Krock and Mason (1971) concluded that chlorination may be the largest single source of toxicity in San Francisco Bay.

Phase one, which was conducted with 0.5 ppm chlorine residual in effluent, showed mortality (Table 18). Observations throughout this study period revealed that all fish at station one remained very active. Fish at the four remaining stations were less active and all sustained some mortality. Before death the fish appeared distressed. Symptoms observed were loss of equilibrium, swimming with body oriented horizontally rather than vertically, and gasping for air at the water's surface. The highest mortality (30 percent) occurred at station two.

Coho and Dolly Varden were observed four days in water receiving effluent with 1.0 ppm chlorine residual. No mortality occurred among the Dolly Varden. The highest mortality among coho occurred at station three with 33 percent in one cage and 60 percent in the other (Table 19). Six of the eight coho which died were small and would not smolt until the following year. Two were smolt-size fish.

After the four-day period, surviving test animals were held seven days in water not influenced by effluent discharge. No delayed mortality occurred during the seven-day period.

A control phase was conducted from 9:45 a.m. April 16 to 9:45 a.m. April 20 with no chlorine in effluent discharge. Water temperature ranged from 38°F to 42°F. Five coho and five Dolly Varden were placed in each test cage at the beginning of the experiment. The only mortalities occured at station one where one coho died after 48 hours and one after 72 hours.

Juneau Area Creel Census

An estimated 2,591 king, 2,577 coho, 758 pink, and 67 chum salmon were taken from May 14 through September 3 (Table 20). The salmon catch per angler hour was 0.029 for king, 0.029 for coho, 0.009 for pink, and 0.001 for chum (Table 21).

TABLE 18. Observations from Phase 1 of Study, Mendenhall River, April 4-8, 1973.

DATE	TIME	WATER TEMP	OBSERVATION OF TEST ANIMALS BY STATION									
			1		2**		3**		4		5	
			A	B	A	B	A	B	A	B	A	B
4/4/73	11:30 am	36°F	Ten coho put in each test cage									
4/5/73	12:00 nn	36°F	active	active	OK	Ok	1 in distress	1 dead	OK	Ok	2 in distress	2 dead
4/6/73	11:00 am	36°F	active	active	1 dead	OK	2 in distress, 1 dead	1 dead	OK	OK	1 in distress	OK
4/7/73	11:30 am	37°F	active	active	OK	OK	1 in distress	OK	OK	OK	1 in distress	OK
4/8/73	12:10 pm	36°F	active	active	2 dead	3 dead	2 dead	OK	OK	1 dead	1 dead	OK
MORTALITY			0.0	0.0	30	30	30	20	0	10	20	20

* 0.5 ppm chlorine residual in effluent
** Stations 2 and 3 on edge of effluent plume

TABLE 19. Observations from Phase 2 of Study, Mendenhall River, April 9-13, 1973.

OBSERVATIONS OF TEST ANIMALS BY STATION

			1		2		3		4		5	
			A	B	A	B	A	B	A	B	A	B
4/9/73	2:45 pm	38°F	5 coho 5 DV	5 coho 5 DV	6 coho 4 DV	5 coho 5 DV	6 coho 5 DV	5 coho 5 DV	5 coho 5 DV	5 coho 5 DV	5 coho 5 DV	5 coho 5 DV
4/10/73	2:45 pm	36°F	OK	OK	NOT CHECKED	NOT CHECKED	NOT CHECKED	NOT CHECKED	NOT CHECKED	NOT CHECKED	NOT CHECKED	NOT CHECKED
4/11/73	2:40 pm	38°F	OK	2 coho dead	OK	OK	2 coho distress	1 coho dead, 2 distress	OK	OK	OK	OK
4/12/73	4:00 pm	39°F	OK	OK	OK	1 coho dead	2 coho dead	2 coho dead	OK	OK	OK	OK
4/13/73	3:30 pm	39°F	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
% Mortality			0.0	40.0 coho	0.0	20.0 coho	33.3 coho	60.0 coho	0.0	0.0	0.0	0.0

* 1.0 ppm chlorine residual in effluent.

TABLE 20. Estimate of Angler Effort and Salmon Catch in the Juneau Area Sport Fishery, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22*	7/23-8/5	8/6-8/19	8/20-9/2	MEAN
King/Boat	0.278	0.326	0.361	0.432	0.559	0.316	0.119	0.127	0.322
/Angler Trip	0.106	0.139	0.127	0.177	0.231	0.124	0.048	0.053	0.121
/Angler Hour	0.026	0.040	0.033	0.043	0.058	0.027	0.010	0.012	0.029
Coho/Boat	0.000	0.035	0.091	0.217	0.283	0.340	0.653	0.773	0.320
/Angler Trip	0.000	0.015	0.032	0.089	0.117	0.134	0.262	0.325	0.120
/Angler Hour	0.000	0.004	0.008	0.021	0.030	0.029	0.056	0.075	0.029
Pinks/Boat	0.000	0.000	0.013	0.327	0.302	0.048	0.046	0.014	0.094
/Angler Trip	0.000	0.000	0.005	0.134	0.125	0.019	0.018	0.006	0.035
/Angler Hour	0.000	0.000	0.001	0.032	0.031	0.004	0.004	0.003	0.009
Chums/Boat	0.000	0.000	0.000	0.018	0.020	0.003	0.017	0.007	0.008
/Angler Trip	0.000	0.000	0.000	0.007	0.008	0.001	0.007	0.003	0.003
/Angler Hour	0.000	0.000	0.000	0.002	0.002	0.000	0.001	0.001	0.001
Total Salmon/ Boat	0.278	0.362	0.466	0.995	1.127	0.706	0.837	0.912	0.740
/Angler Trip	0.106	0.154	0.164	0.408	0.466	0.278	0.336	0.383	0.277
/Angler Hour	0.026	0.044	0.042	0.098	0.117	0.060	0.072	0.089	0.068

*Excludes Catch Data for Golden North Salmon Derby, July 20-22, 1973

TABLE 21. Juneau Area Sport Caught Salmon Catch per Unit Effort by Species, May 14 - September 2, 1973.

	5/19-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22*	7/23-8/5	8/6-8/19	8/20-9/2	TOTAL
Boats	1151	1017	1148	1103	922	773	1064	1266	8044
Angler Trips	3014	2388	3261	2690	2231	1961	2652	3013	21480
Angler Hours	12374	8362	12684	11218	8847	9065	12457	12978	87985
King	320	332	415	477	515	244	127	161	2591
Coho	0	36	105	239	261	263	695	978	2577
Pink	0	0	15	361	278	37	49	18	758
Chum	0	0	0	20	18	2	18	9	67
Total Salmon	320	368	535	1097	1039	546	891	1155	5951

*Excludes Catch Data for Golden North Salmon Derby, July 20-22, 1973

During the 1973 Golden North Salmon Derby, 637 king, 449 coho, 278 pink, and 34 chum salmon were entered for prizes.

Juneau Area Roadside Creel Census

The roadside area creel census was limited to a cursory surveillance of the Auke Creek and Echo Cove areas. An estimated 919 sockeye, 543 pink, 196 Dolly Varden char, 48 coho, 30 cutthroat, 10 king and 5 chum were caught near the mouth of Auke Creek during the period of June 20-September 2, 1973 (Table 22). The catch per angler hour was 0.260 for sockeye, 0.154 for pink, 0.555 for Dolly Varden, 0.014 for coho 0.008 for cutthroat, 0.002 for king, and 0.001 for chum salmon.

In the Echo Cove area of Berner's Bay, an estimated 777 pink, 267 cutthroat, 51 Dolly Varden, 6 chum, 6 coho, and 6 king salmon were caught by anglers (Table 23). The catch per angler hour was 0.334 for pink, 0.115 for cutthroat, 0.022 for Dolly Varden, 0.002 for chum, 0.002 for coho and 0.002 for king.

North Behm Canal Area Creel Census

Nonresident anglers made up the greater percentage of participation in the North Behm Canal area with an estimated 1,665 (88.7 percent) anglers as compared to 224 (11.3 percent) resident anglers. Creel census workers observed 1,776 king, 261 coho, 87 pink and 1 chum salmon (Table 24). The salmon catch per angler hour was estimated to be 0.108 for king, 0.016 for coho, 0.005 for pink and 0.000+ for chum salmon (Table 25).

Ketchikan Area Creel Census

An estimated 3,585 king, 1,075 coho, 1,072 pink, 102 chum, and 13 sockeye salmon were taken from May 14 through September 2 (Table 26). Catch per angler hour was 0.054 for king, 0.027 for coho, 0.030 for pink, 0.002 for chum, and 0.001 for sockeye (Table 27). These data include salmon derby catch.

Pacific Halibut Catch

The estimated halibut catch for Juneau was 2,500, North Behm Canal was 23, and Ketchikan was 1,284 for the census period (Table 28).

The mean length for halibut was 73 cm and mean weight was 25 lbs. During the season there was some variation in size, as illustrated in Table 29.

TABLE 22. Estimate of Angler Effort and Salmon Catch in Auke Creek, Auke Bay, June 29 - September 2, 1973.

	6/29-7/1	7/2-7/15	7/16-7/29	7/30-8/12	8/13-8/26	8/27-9/2	TOTAL
Angler Trips	461	721	133	38	10	34	1397
Angler Hours	1192	1505	513	115	41	168	3534
Sockeye	254	653	0	0	0	12	919
Pink	0	399	9	0	80	55	543
Dolly Varden	39	65	0	31	0	61	196
Coho	0	5	0	0	0	43	48
Cutthroat	0	0	0	0	12	18	30
King	0	10	0	0	0	0	10
Chum	0	5	0	0	0	0	5
Total Salmon	293	1137	9	31	92	189	1751

TABLE 23. Estimate of Angler Effort and Salmon Catch in the Echo Cove Area, Berner's Bay, June 29 - September 2, 1973.

	6/29-7/1	7/2-7/15	7/16-7/29	7/30-8/12	8/13-8/26	8/27-9/2	TOTAL
Angler Trips	16	86	486	99	51	63	801
Angler Hours	127	739	684	326	259	189	2324
Pink	54	450	230	43	0	0	777
Cutthroat	0	12	200	0	55	0	267
Dolly Varden	9	39	0	0	3	0	51
Chum	2	4	0	0	0	0	6
Coho	2	4	0	0	0	0	6
King	2	4	0	0	0	0	6
Total Salmon	68	526	430	43	58	0	1126

TABLE 24. Estimate of Angler Effort and Salmon Catch, North Behm Canal Sport Fishery, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22	7/23-8/5	8/6-8/19	8/20-9/2	TOTAL
Boats	18	103	131	118	83	124	113	62	752
Resident Angler Trips	4	14	33	39	20	56	51	7	224
Nonresident Angler Trips	33	204	314	385	196	187	215	131	1665
Total Angler Trips	37	218	347	424	216	343	266	138	1989
Angler Hours	98	3100	2486	2491	2903	2323	2114	998	16513
King	33	221	262	290	186	404	286	94	1776
Coho	0	0	0	1	53	53	58	96	261
Pink	0	0	0	3	49	17	11	7	87
Chum	0	0	0	0	0	1	0	0	1
Total Salmon	33	221	262	294	288	475	355	197	2125

TABLE 25. North Behm Canal Sport Caught Salmon Catch per Unit Effort by Species, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22	7/23-8/5	8/6-8/19	8/20-9/2	MEAN
Kings/Boat	1.833	2.146	2.000	2.458	2.241	3.258	2.531	1.516	2.362
/Angler Trip	0.892	1.014	0.755	0.684	0.861	1.178	1.075	0.681	0.893
/Angler Hour	0.337	0.071	0.105	0.116	0.064	0.174	0.135	0.094	0.108
Cohos/Boat	0.000	0.000	0.000	0.008	0.639	0.427	0.513	1.548	0.347
/Angler Trip	0.000	0.000	0.000	0.002	0.245	0.155	0.218	0.696	0.131
/Angler Hour	0.000	0.000	0.000	0.000+	0.018	0.023	0.027	0.096	0.016
Pinks/Boat	0.000	0.000	0.000	0.025	0.590	0.137	0.097	0.113	0.116
/Angler Trip	0.000	0.000	0.000	0.007	0.227	0.050	0.041	0.051	0.044
/Angler Hour	0.000	0.000	0.000	0.001	0.017	0.007	0.051	0.007	0.005
Chums/Boat	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.001
/Angler Trip	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.001
/Angler Hour	0.000	0.000	0.000	0.000	0.000	0.000+	0.000	0.000	0.000+
Total Salmon/ Boat	1.833	2.146	2.000	2.492	3.470	3.831	3.142	3.177	2.826
/Angler Trip	0.892	1.014	0.755	0.693	1.333	1.385	1.335	1.428	1.068
/Angler Hour	0.337	0.071	0.105	0.118	0.099	0.204	0.168	0.198	0.129

TABLE 26. Estimate of Angler Effort and Salmon Catch in the Ketchikan Area Sport Fishery, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22	7/23-8/5	8/6-8/19	8/20-9/2	TOTAL
Boats	2791	2786	577	334	328	399	525	184	7924
Angler Trips	6025	8207	1452	865	851	865	1293	387	19925
Angler Hours	21779	1574	7271	4010	4307	4802	6921	2213	52877
King	1138	1378	613	87	222	97	50	0	3585
Coho	30	10	31	138	524	158	148	36	1075
Pink	0	0	92	72	464	240	204	0	1072
Chum	13	23	53	0	13	0	0	0	102
Sockeye	0	0	0	0	13	0	0	0	13
Total Salmon	43	33	789	297	1236	495	402	36	5847

TABLE 27. Ketchikan Area Sport Caught Salmon Catch per Hour of Effort by Species, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22	7/23-8/5	8/6-8/19	8/20-9/2	MEAN
Kings/Boat	0.411	0.543	1.058	0.250	0.690	0.235	0.267	0.000	0.432
/Angler Trip	0.190	0.182	0.420	0.097	0.263	0.108	0.109	0.000	0.171
/Angler Hour	0.053	0.029	0.083	0.021	0.054	0.186	0.002	0.000	0.054
Coho/Boat	0.011	0.004	0.058	0.393	1.379	0.353	0.288	0.188	0.334
/Angler Trip	0.005	0.001	0.023	0.153	0.526	0.162	0.118	0.083	0.134
/Angler Hour	0.001	0.000+	0.005	0.033	0.109	0.028	0.022	0.016	0.027
Pinks/Boat	0.000	0.000	0.173	0.214	1.517	0.676	0.400	0.000	0.372
/Angler Trip	0.000	0.000	0.069	0.083	0.579	0.311	0.164	0.000	0.151
/Angler Hour	0.000	0.000	0.014	0.018	0.120	0.054	0.030	0.000	0.030
Chums/Boat	0.004	0.008	0.096	0.000	0.034	0.000	0.022	0.000	0.021
/Angler Trip	0.002	0.003	0.038	0.000	0.013	0.000	0.009	0.000	0.007
/Angler Hour	0.000+	0.000+	0.008	0.000	0.003	0.000	0.002	0.000	0.002
Sockeye/Boat	0.000	0.000	0.000	0.000	0.068	0.000	0.000	0.000	0.009
/Angler Trip	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.003
/Angler Hour	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.001
Total Salmon/ Boat	0.426	0.556	1.327	0.500	3.690	1.265	0.978	0.188	1.116
/Angler Trip	0.197	0.186	0.527	0.333	1.408	0.581	0.400	0.083	0.464
/Angler Hour	0.054	0.030	0.104	0.072	0.291	0.100	0.073	0.016	0.093

TABLE 28. Estimate of Pacific Halibut Catch in the Juneau, North Behm Canal, and Ketchikan Sport Fisheries, May 14 - September 2, 1973.

	5/14-5/27	5/28-6/10	6/11-6/24	6/25-7/8	7/9-7/22	7/23-8/5	8/6-8/19	8/20-9/2	TOTAL
Juneau	181	230	319	434	256	203	643	234	2500
North Behm Canal	1	0	2	3	6	8	3	0	23
Ketchikan	134	201	103	427	240	79	100	0	1284
Biweekly Total	316	431	424	864	502	290	746	234	3807

TABLE 29. Pacific Halibut Length and Weight Range by Month for Juneau, North Behm Canal, and Ketchikan Area, 1973.

Month	Length Range (cm)	Mean Length (cm)	Weight Range (lbs)	Mean Weight (lbs)
June	56 -120	72	3- 43	10.5
July	55.5-167	76	2-200	15.5
August	55 -100	70	3- 39	37

BLACK BEAR LAKE

Black Bear Lake is located on Prince of Wales Island at 55°33' north latitude and 132°52' west longitude. The system was named after the heavy black bear activity on spawning salmon by E. I. Jones in 1914 (Orth, 1971).

An outline map was prepared from an aerial photograph. Depth contours and bottom features were measured by use of a recording echo sounder, and representative depth contours were plotted on the outline map (Figure 15). Morphometric data, areas of depth zones and values of depth strata are presented in Table 30.

Black Bear Lake is a cirque mountain lake located at the northwest foothills of Pin Peak, northwest of Klawak Lake, and west of Salmon Lake. It collects the runoff from the mountain walls above and empties into Black Bear Creek. Two miles downstream the creek widens to form Black Bear Lake and then narrows to flow north to empty into Big Salt Lake estuary.

Black Bear Lake is 1.4 miles long and varies in width from 1/8 to 3/8 mile. Six streams drain into the head of the lake.

The mountain runoff streams that flow into the lake are narrow and steep. They were 1 to 3 feet wide and 1 to 2 inches deep at the time of survey.

Black Bear Lake spills into Black Bear Creek, which descends through a steep draw to empty into Big Salt Lake. The creek flow is rapid at the lake's outlet and varies down to a sluggish movement near the estuarine zone. It varies in depth from 3 feet upstream to 9 inches downstream. The width is about 80 feet. Throughout its course small muskeg tributaries enter to contribute to its light muskeg coloration.

The stream was found to contain abundant pools with bank cover. Substrate is comprised of rubble, gravel, and sand.

Temperature profiles were recorded during the one-day survey. A gradual thermocline was recorded in the 7-15 meter zone (Figure 16).

Surface and bottom water samples were tested for dissolved oxygen and carbon dioxide and found to be 12 mg/l and 15 mg/l, respectively. The pH fluctuated only slightly from 6.5 on the surface to 6.6 at the bottom.

Zooplankton at the time of sampling was composed primarily of large copepods (Table 31).

Rainbow trout introduced to the lake have established a good trout sport fishery. Length-age of rainbow caught August 30 was as follows: 24 cm, 3+; 32 cm, 4+; 39.5 cm, 5+.

Black Bear Lake is only accessible by float plane. Charters may be made from Ketchikan for those persons outside Prince of Wales Island or from Klawock for parties already located on the island.

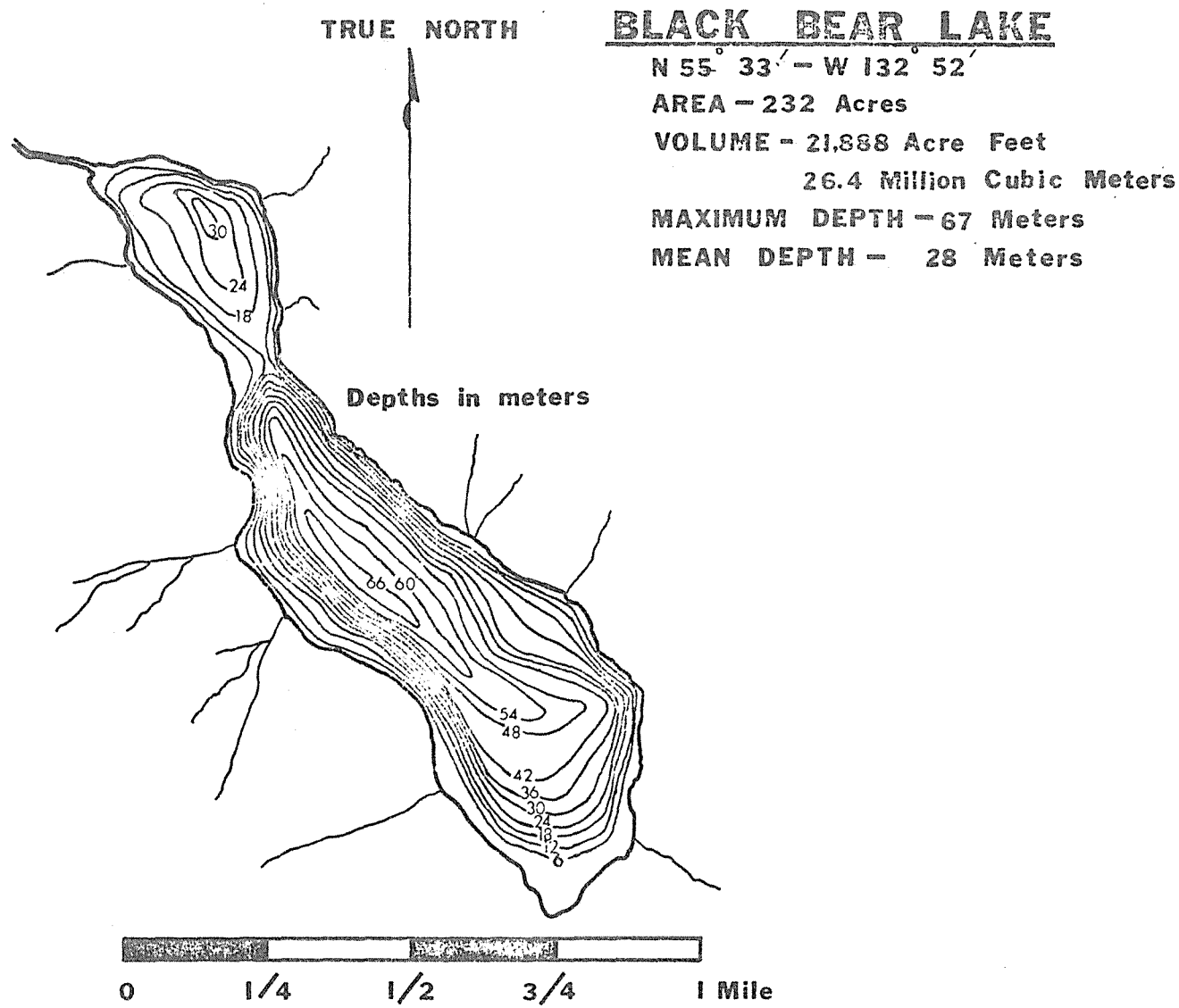


Figure 15. Bathymetric Map of Black Bear Lake.

TABLE 30. Morphometry of Black Bear Lake.

Water Area

Hectares	93.9
Acres	232

Percent of Depth Zone Areas

0- 6 (m)	17.2 (%)	36-42 (m)	6.5 (%)
6-12	8.6	42-48	9.0
12-18	11.6	48-54	6.0
18-24	10.8	54-60	5.2
24-30	9.5	60-66	1.7
30-36	7.8		

Water Volume

Cubic meters x 10^6	26.4
Acre feet x 10^3	21.9

Percent Volume of Depth Strata

0- 6 (m)	19.0 (%)	36-42 (m)	9.0 (%)
6-12	16.4	42-48	5.2
12-18	14.2	48-54	3.6
18-24	11.8	54-60	2.0
24-30	9.8	60-66	0.8
30-36	8.0		

Maximum Depth = 66m

Mean Depth = 4.7m

Lake Perimeter = 3.435m

TABLE 31. Zooplankton Composition and Density, Black Bear Lake, August 31, 1973.

Rotifera	
Kellicottia	= 27.2
Conochilus	= 50.3
Cladocera	
Bosmina	= 5.3
Copepoda	
Calanoida	= 20.7
Cyclopoida	= 2.9
Nauplii	= 1.2

TABLE 31. Zooplankton Composition and Density, Black Bear Lake, August 31, 1973.

Rotifera	
Kellicottia	= 27.2
Conochilus	= 50.3
Cladocera	
Bosmina	= 5.3
Copepoda	
Calanoida	= 20.7
Cyclopoida	= 2.9
Nauplii	= 1.2

Most of the lake shore can be walked but not without some labor. Large boulders along the shore line make a rapid straight course impossible. The rocky bank is limited to the eastern shore line. Fishing from any given spot along the shore was generally good. Deep waters immediately adjacent to shore make fishing from land easy. Perhaps the best spots for fishing from shore are located in the southeastern section of the lake where rock slides have provided large boulders to fish from.

Black Bear Lake exists as a photographer's delight. The lake sits in a spectacular setting with the westerly shore having steep mountainous sloped to the water's edge. The peaks supply a constant source of melting snow that produces streamlets that end in a series of waterfalls to the lake.

The National Forest Service maintains a cabin for public use at the northeast end of the lake. A boat, of questionable safety, was available.

Fishing can be slow at times but persistence should produce some fine rainbow, the only species present.

Hunting and hiking are other activites available in proximity to the lake. Behind the Forest Service cabin a trail leads to an easily climbed ridge, which gives access to other high country.

RECREATIONAL SURVEY OF BLACK BEAR CREEK

Black Bear Creek may be reached by skiff of any size from Klawock; waters are protected but caution should by taken to enter Big Salt Lake at high or low water slack via the south entrance. Strong tidal currents may prove hazardous at any other time of entry to the lake. Big Salt Lake high and low water is two hours after outside water.

The creek is accessible via Big Salt Lake logging road. The road will be passable by most any vehicle. Big Salt Lake road crosses the creek approximately 8 miles from Klawock.

Charter flights can be made from Ketchikan to Big Salt Lake or "Coastal Air" daily flights to Klawock or Craig.

The creek can be fished from the banks, but bank cover of salmonberry, devils club and blueberry may restrict fishing in parts of the lower 2 miles. Within the section of stream surveyed, certain areas are distinctive as being good fishing spots: 1) The mouth of the stream enters an estuary habitat, an open area of grasses with no trees or shrubs to impede fishing; 2) Within 200 yards south of bridge crossing; 3) Approximately 1 1/2 miles from mouth of the creek a large marshy meadow exists for a half mile. This spot provides good fishing its entire length. The stream channel here is wide and deep allowing for a variety of fishing methods.

The first mile of stream is composed of wide shallows, primarily with gravel and rubble bottom, which can be forded easily. In the second mile, the velocity of stream increases and a more irregular and slippery bottom exists. In this section the western bank provides the best walking. The marshy area can be walked from either side of the stream. The walking is difficult due to overgrown vegetation over the stream channel and holes.

From the marshy lowlands, 1 mile south of the bridge, one gains a good view of Pin Peak and the mountains to the south making for a pleasurable fishing spot.

The Forest Service maintains a public cabin on Big Salt Lake, which might provide shelter for fishermen in the area. Access to other nearby fishing sites, Thorne River and Steelhead Creek, is provided.

Species present include silver, pink, red, and chum salmon; Dolly Varden; and cutthroat. In the first week in August, pink and chum salmon were seen in the stream. Four major pools in the first 2 miles had salmon. An estimated 75 salmon were seen in the first pool below the bridge. Rod and reel survey proved successful in taking cutthroat trout on streamer flies in three of the major pools.

CONTROL LAKE

Control Lake is located in the headwaters of the Thorne River system on Prince of Wales Island at 55°41'30" north latitude and 132°51'55" west longitude. Its name was reported by the U.S. Forest Service in 1963 (Orth, 1967).

An outline map was prepared from an aerial photograph. Depth contours and bottom features were measured by use of a recording echo sounder, and representative depth contours were plotted on the outline map (Figure 17).

Control Lake is an upland, muskeg lake located in the Thorne River system. It collects runoff from three tributary streams which enter from the northwest, southwest, and southeast shores of the lake. The lake is drained to the northeast by Control Creek.

The alpine muskeg streams that enter the lake are small and shallow. Stream dimensions varied from 6 to 12 feet in width and 1/2 to 3 feet in depth at the time of survey.

Control Creek flows to the northeast to enter Thorne River. During the survey it was noted to average 30 feet in width and 16 inches in depth at the lake outlet.

A temperature profile was recorded during the one-day survey (Figure 18). A thermocline was detected at the 5-10 meter depth strata.

Lake waters were tested for dissolved oxygen and carbon dioxide and found to be 11 mg/l and 5 mg/l, respectively. The pH value was 6.7. Secchi disc visibility was 2.5 meters.

Plankton sampling was conducted on August 14 at the recording station. Sample findings are presented in Table 32. Benthic samples are pending analysis.

Control Lake could be reached only by float plane at the time of this survey, a distance of 60 air miles from Ketchikan. Air taxi service may be obtained from Klawock at a considerable savings to those parties already on Prince of Wales Island.

Vehicle usage is impossible at this date as logging roads in proximity are closed to public use. When these roads open to public use, Control Lake may be reached via the Big Salt road from Klawock or the Staney Creek road out of Thorne Bay.

The lake is situated amongst rolling hills covered by Sitka spruce and lodgepole pine. The periphery of the lake can be walked without great difficulty providing you stay close to shore. The western shore line is poorly drained muskeg with a considerable amount of shoal area and soft bottom covered with lily pads.

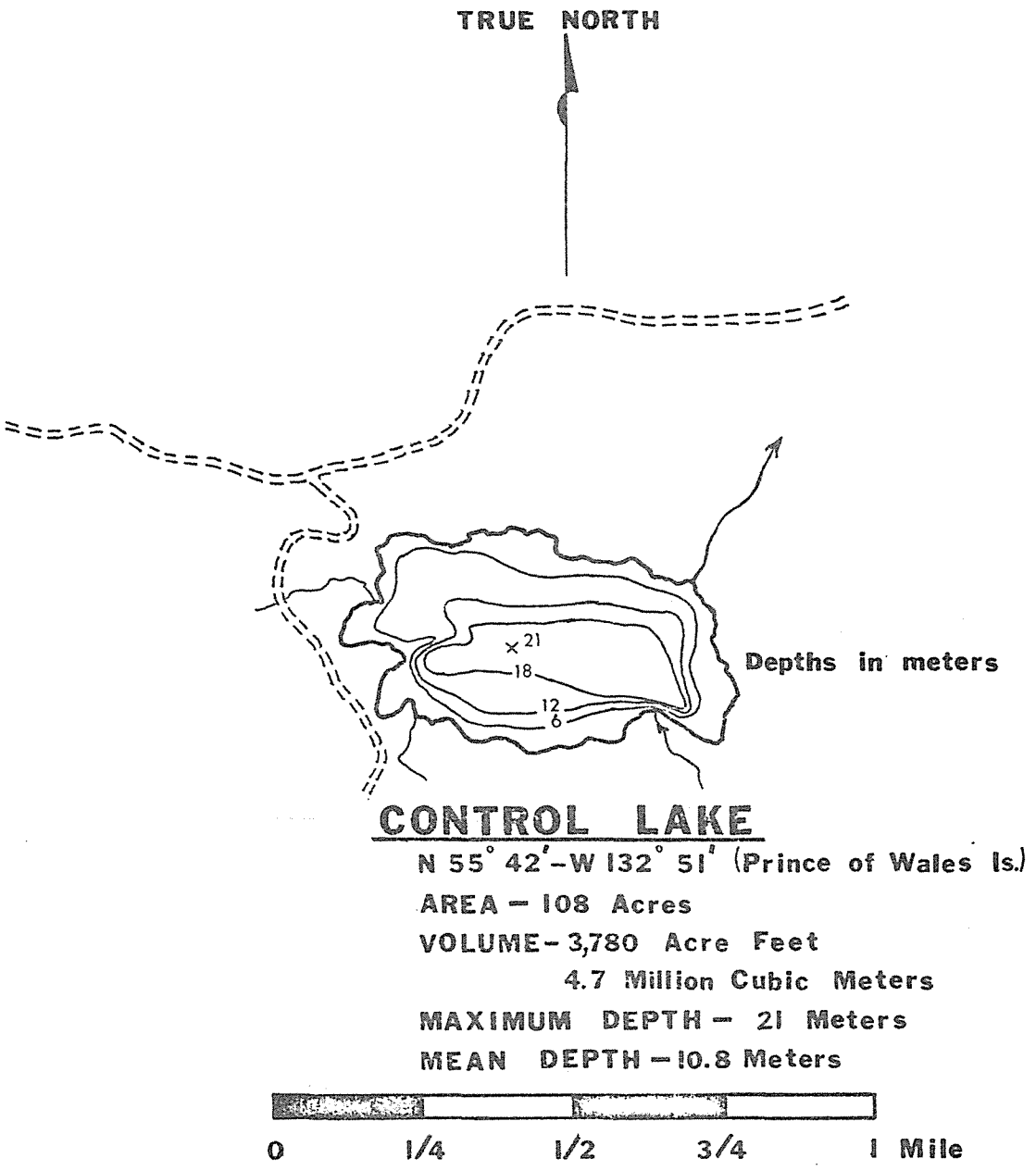


Figure 17. Bathymetric Map of Control Lake.

Figure 18. Temperature Profile of Control and Karta Lakes, 1973.

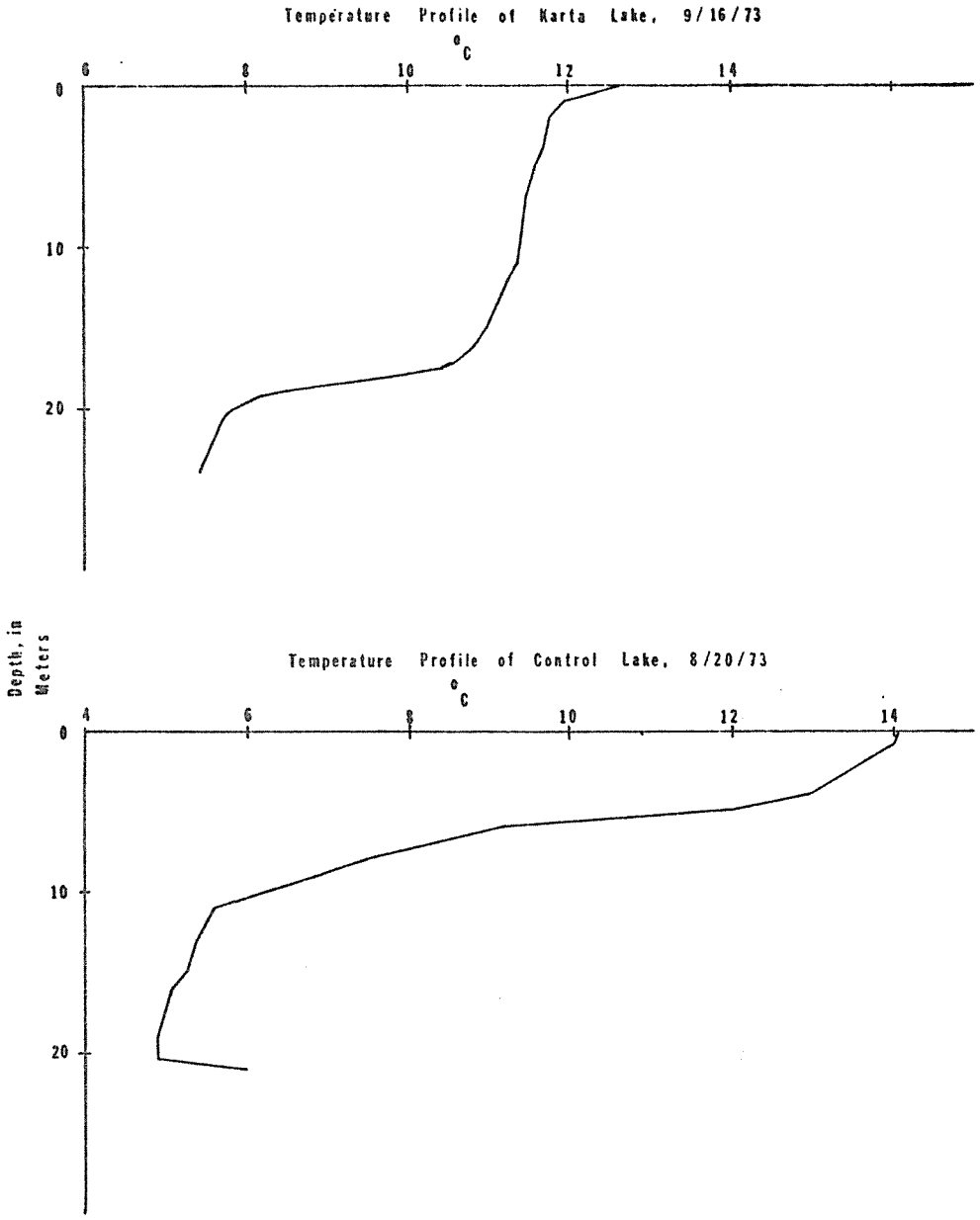


TABLE 32. Zooplankton Composition and Density, Control Lake, August 14, 1973.

Copepoda	
Cyclopoida	23.7
Nauplii	146.8
Cladocera	
Bosminidae	23.7
Daphnidae	42.6
Rotifera	
Conochilus	132.6
Kellicottia	9.5
Polyarthra	7.1

With the advent of Big Salt and Staney Creek roads open to the public, Control Lake will be favorably located near other creeks which presently receive fishing pressure (Steelhead Creek, Black Bear Creek, Thorne River, and Staney Creek). All of these can be reached from Control Lake in a half-hour drive.

Control Lake, to date, has probably experienced only light fishing activity due to the inaccessibility by road and a lack of sport fishing potential to attract float plane traffic. Red, pink, and silver salmon; cutthroat and Dolly Varden are present.

Trolling the lake with spoons proved only moderately successful for Dolly Varden and cutthroat. None larger than 12 inches were caught. Pink and red salmon were observed at the mouth of the creek along the south-eastern end of the lake in mid-August. Salmon fishing there proved to be good.

The Forest Service has a large cabin on the lake, formerly used as a survey base camp. The future use of the building has not been determined.

KARTA-SALMON LAKES SYSTEM

The Salmon and Karta lakes are located on the east coast of Prince of Wales Island at the head of Kasaan Bay. Salmon Lake is located 15 miles east of Klawock at 55°34'30" north latitude and 132°40'30" west longitude. Karta or Little Salmon Lake is located downstream of Salmon Lake in the course of the Karta River at 55°34' north latitude and 132°38' west longitude (Figure 19), (Orth, 1967).

An outline map was prepared from aerial photographs for each lake. Depth contours and bottom features were measured by use of a recording echo sounder, and representative depth contours were plotted on the outline map for Salmon (Figure 20) and Karta (Figure 21) lakes.

The Karta-Salmon Lakes system drains the valley bordered by Rush Peak to the north, Pin Peak to the southwest, and Granite Mountain to the south.

Salmon Lake is formed by the runoff from Andersen and McGilvery creeks and receives runoff from several other small tributaries.

Andersen Creek originates as a long muskeg lake at the foothills of Pin Peak. Numerous small tributaries enter its course before it flows into the west shore of Salmon Lake. Its substrate varies from gravel and sand at the outflow area to bedrock and large rock 1 1/2 miles upstream. A partial barrier exists 1/2 mile upstream in the form of a steep 12 foot falls.

McGilvery Creek originates on the eastern slope of Pin Peak and flows northeast 7.2 miles to enter the southwest shore of Salmon Lake. The stream's substrate varies from predominately gravel and some sand downstream to coarse gravel and larger rubble 1 1/2 miles upstream.

Karta Lake receives runoff from the Karta River and Flagstaff Creek with some additional flow from small unnamed tributaries. Flagstaff Creek flows north to enter the southern shore of Karta Lake (Figure 19).

Aquatic invertebrates sampled from Andersen, Karta and McGilvery creeks are listed in Table 33.

The Karta River receives stream flow from Salmon and Karta lakes. The upstream section receives runoff from Salmon Lake and enters Karta Lake and resumes in the downstream section to flow into Karta Bay. Throughout its course, its banks are populated by an open canopy spruce-hemlock forest with a moderate understory of alders and berry bushes. The downstream section follows through low hills to the tidal flats of Karta Bay.

The temperature profile of each lake is shown in Figure 18. Additional measurements were made of dissolved oxygen and carbon dioxide, which were found to be 12 mg/l and 5 mg/l, respectively. Total alkalinity and hardness tests both indicated 17 mg/l of calcium carbonate.

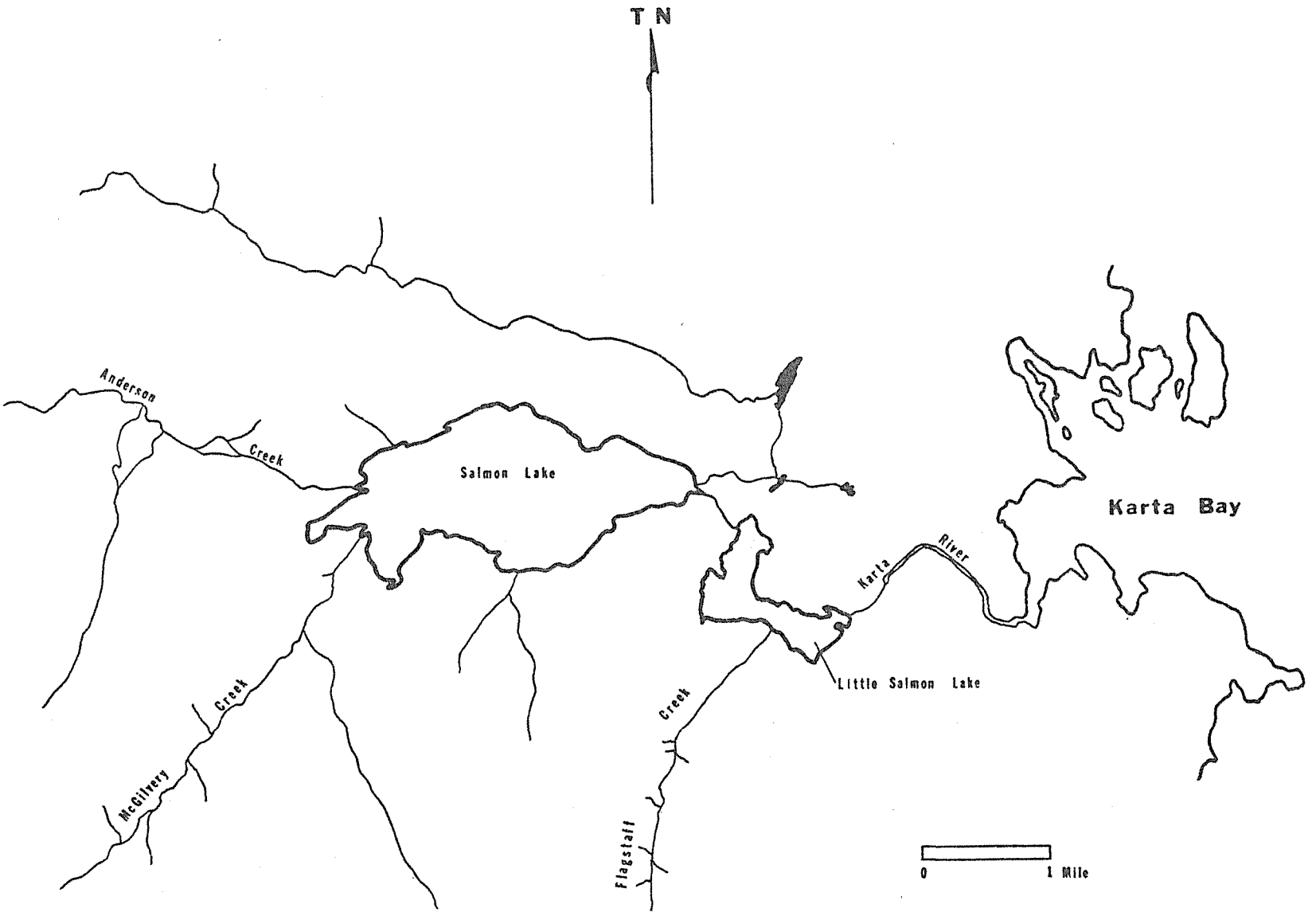


Figure 19. Location Map of Salmon and Karta Lakes.

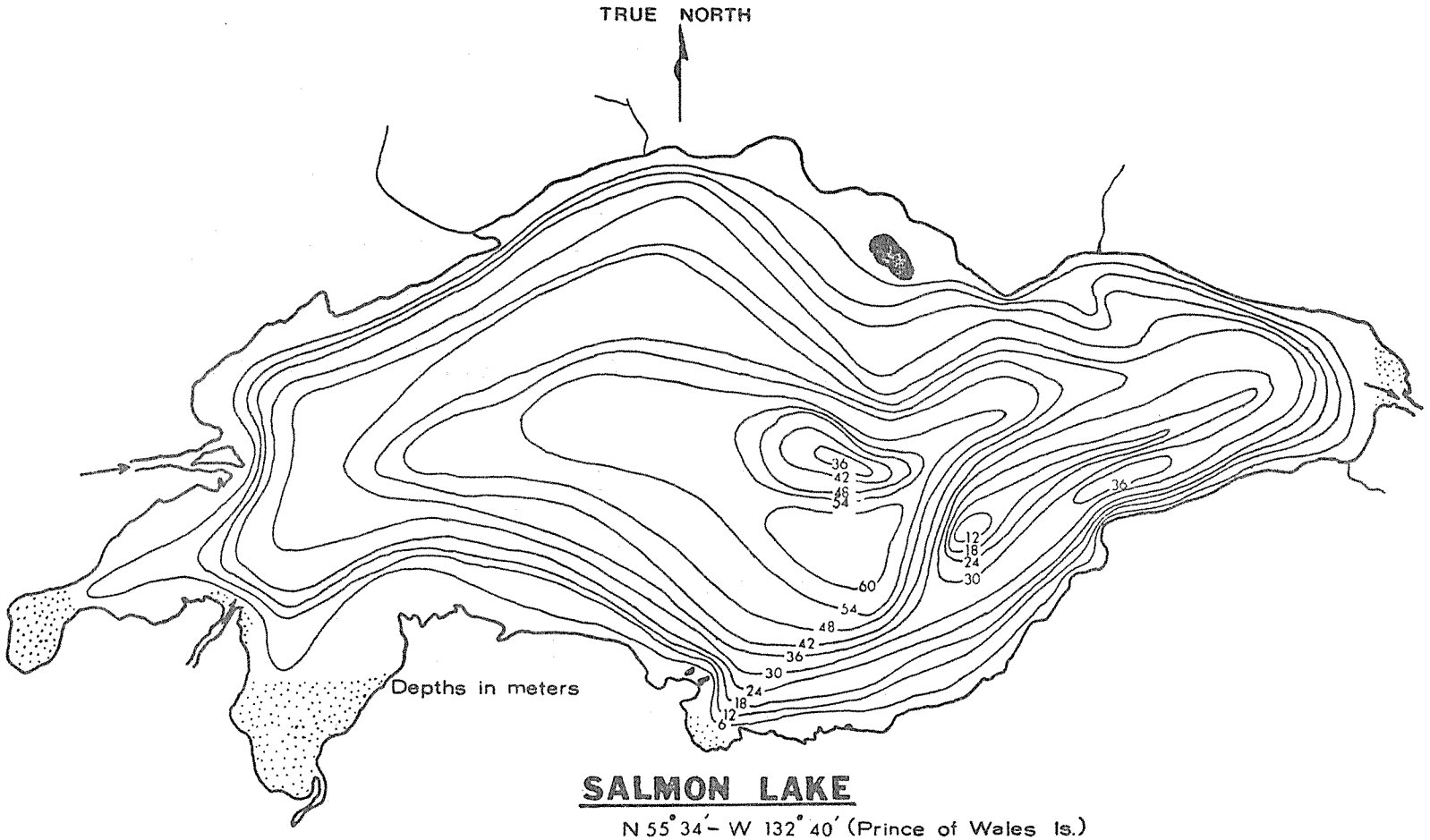


Figure 20. Bathymetric Map of Salmon Lake.

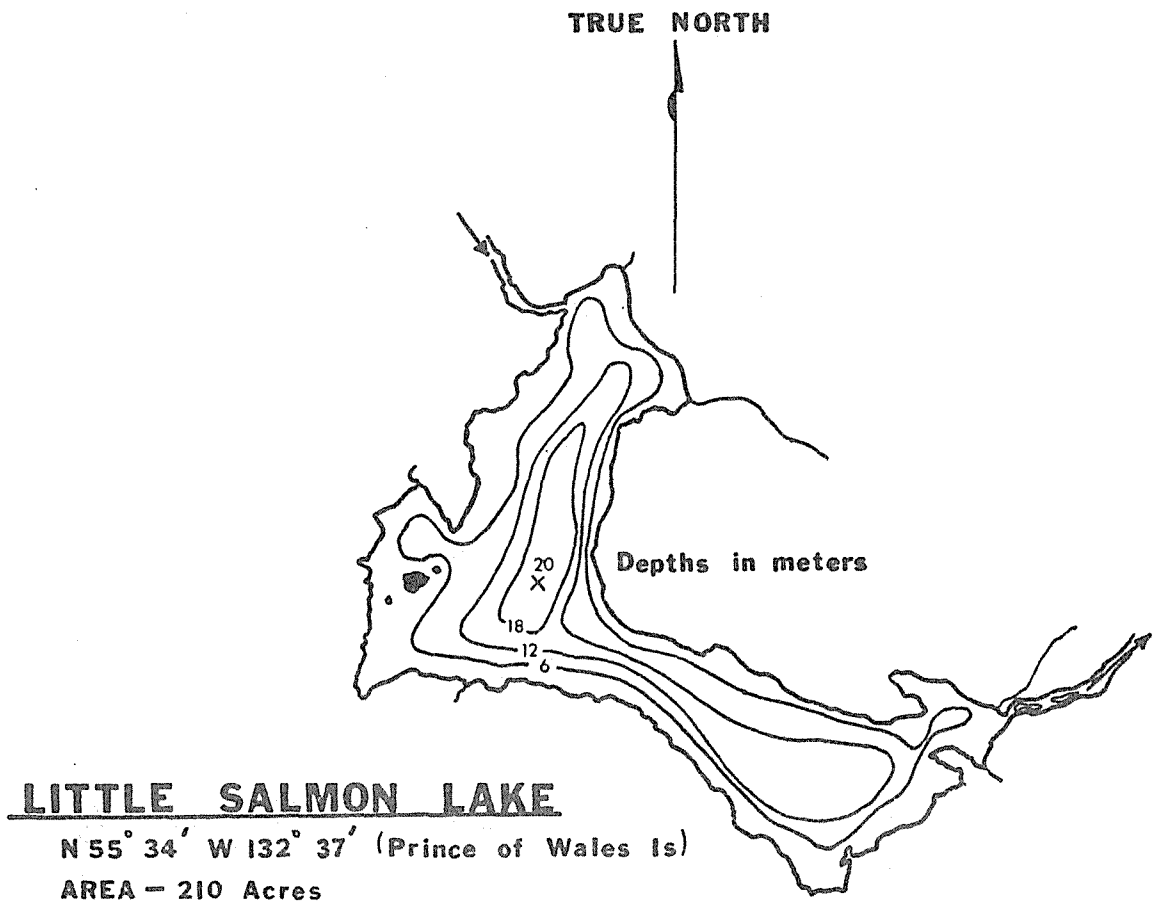


Figure 21. Bathymetric Map of Little Salmon (Karta) Lake.

TABLE 33. Aquatic Organisms Collected from Streams in the Karta River Watershed, September, 1973.

	Anderson Creek	Karta River	McGilvery Creek
Turbellaria	4	1	1
Oligochaeta	1	1	
Hirudinea		2	
Amphipoda		1	
Insecta			
Ephemeroptera			
Baetidae			
Baetis bicaudatus	1	5	
Baetis parvus ?		2	
Heptageniidae			
Cinygmula sp.	1		
Epeorus (Iron) longimanus group			1
Epeorus (I.) albertae	1		
Rithrogena sp.	3		10
Ephemerellidae			
Ephemerella (Drunella) grandis		2	
Ephemerella (Serratella) sp.			1
Plecoptera			
Nemouridae			
Nemoura sp.	1		
Chloroperlidae			
Alloperta sp.	2	9	1
Trichoptera			
Hydropsychidae			
Cheumatopsyche sp.		1	
Limnephilidae			3
Pycnopsyche sp.		28	
Diptera			
Tipulidae			
Eriocera spinosa	1		
Chironomidae	1	1	
Pelecypoda		27	
No. Samples	N = 2	N = 2	N = 2
Density organisms/square ft.	8	35.5	8.5
No. of Species	10+	12+	6+

Plankton was sampled at station 1 (Figure 22) on Karta Lake. Zooplankton composition and density are presented in Table 34.

Aquatic invertebrates were sampled at selected locations (Figure 22). Aquatic organisms by depth zone from Big Salmon and Karta lakes are presented in Table 35.

Coho, chum, pink, and sockeye salmon were found to be abundant throughout the Salmon-Karta Lakes system. Cutthroat and Dolly Varden are present in large numbers as is a well-known spring-run steelhead population.

The Karta watershed is only accessible by float plane, via charter from Ketchikan, approximately 55 miles, or air taxi from Klawock. Depending upon location desired, float landings are possible on Salmon Lake, Karta Lake, and Karta Bay.

The Karta system provides excellent fishing throughout with a variety of different fishing waters all connected. Most noted is Salmon Lake, the northern shore of which can be walked via a Forest Service trail extending from the outlet to Andersen Creek. The water close to shore is deep enough to allow spin casting. The mouths of both Andersen and McGilvery creeks may provide good cutthroat and Dolly Varden fishing. Observations of McGilvery Creek showed good size cutthroat and Dollys approximately 1/2 mile upstream. The outlet of Salmon Lake proved to be another spot where fishing success was assured. At the time of our survey (September 15, 1973) silver salmon were present.

From Salmon Lake the outlet may be traveled by boat to gain passage to Karta Lake. The connecting river level may vary considerably. At times of low water one may have to wade the boat through shallows.

Karta Lake in contrast to Salmon Lake is a much shallower body of water with a greater percentage of surface water covered by lily pads. The north shore of Karta Lake has an excellent Forest Service trail. Lily pads will make shore fishing difficult.

Karta River is paralleled its entire length by an excellent trail, which leads to a limited number of fishing holes. The first 1/4 mile of river from the outlet of Karta Lake is a series of falls and rapids. The stream flow for most of its length is swift becoming torrential. One of the best pools in the entire course of the river is located at the base of the falls. Over 50 salmon were observed in this pool. Other excellent pools exist near the mouth of the river.

Nearby mountains add to the visual quality of Salmon Lake. The Karta River when containing salmon, abounds with hundreds of screaming gulls, and mixed with an occasional bear it becomes an impressive sight.

The Forest Service has strategically located cabins at McGilvery Creek, the northern shore of Salmon Lake, at the outlet of Karta Lake, and at the mouth of the Karta River. Such locationing helps provide shelter in proximity to good fihing spots and helps to utilize the Karta system as

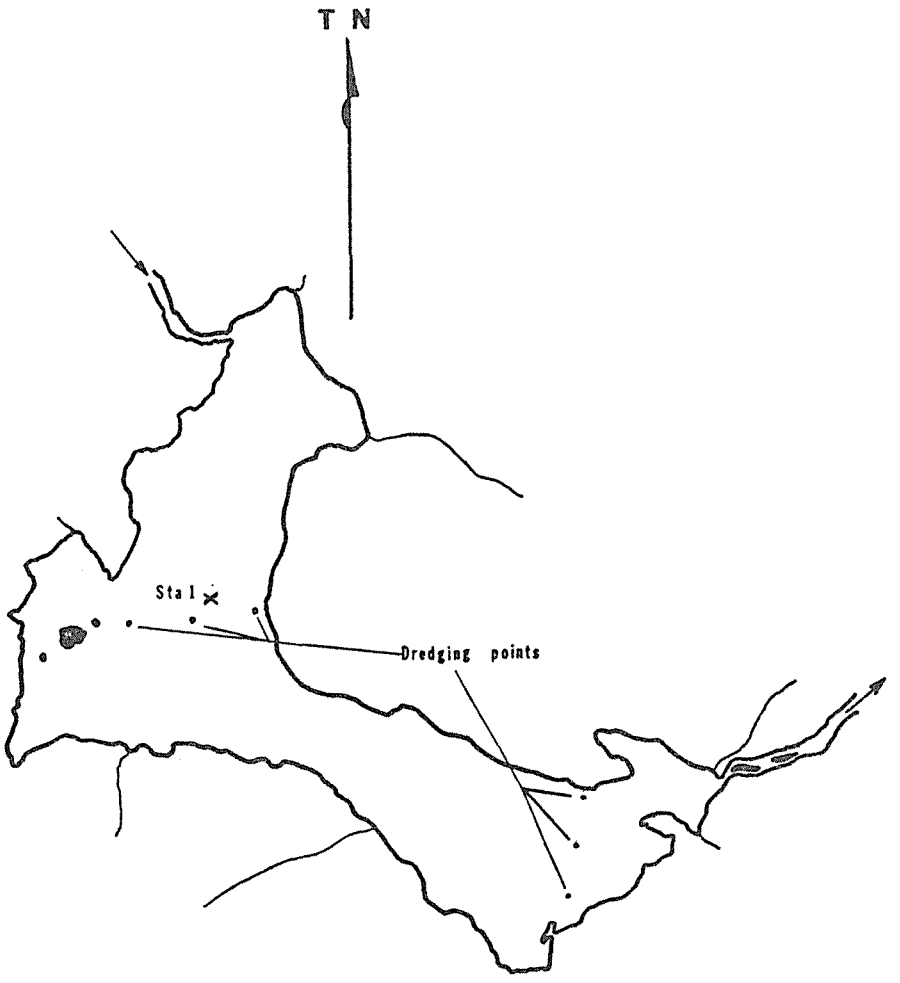


Figure 22. Dredging and Limnology Stations, Little Salmon Lake.

TABLE 34. Zooplankton Composition and Density, Karta Lake, September 15, 1973.

Copepoda	
Cyclopoida	26.0
Nauplii	21.9
Cladocera	
Bosminidae	62.7
Daphnidae	4.1
Rotifera	
Kellicottia	6.5
Keratella	1.2
Polyarthra	.6

TABLE 35. Aquatic Organisms Collected by Depth Zone, Big Salmon and Karta Lakes, September, 1973.

	Big Salmon Lake			Little Salmon Lake	
	0 - 10 m	11 - 20 m	20 - 30 m	0 - 10 m	11 - 21 m
Oligochaeta	8	5	14	11	23
Hirudinea	1	-	-	2	-
Amphipoda	11	-	-	10	-
Acarina	3	-	-	1	-
Insecta					
Trichoptera					
Rhyacophila sp.	1	-	-	-	-
Oecetis sp.	2	-	-	-	-
Diptera					
Chironomidae	9	13	30	6	11
Hemerodromia sp.	-	-	-	2	-
Gastrapoda	18	-	2	4	-
Pelecypoda	15	3	4	22	7
No. Dredge Samples	N = 3	N = 2	N = 3	N = 4	N = 2
Density of organisms/sq. foot (expanded)	90.6	42.0	66.4	58.0	82.0
No. of Species	9+	3+	4+	8+	4+

a unit.

The trail from Karta Bay to the Salmon Lake cabin is in excellent condition; from there to Andersen Creek the trail is fair.

KLAWAK LAKE

Klawak Lake is located on the west coast of Prince of Wales Island at 55°32' north latitude and 133°00' west longitude. Its name is derived from the community of Klawock located 1 mile away.

An outline map was prepared from aerial photographs. Depths and bottom features were measured by use of a recording echo sounder and representative depth contours were plotted on the outline map (Figure 23). Morphometric data, areas of depth zones and volumes of depth strata are presented in Table 36.

Klawak Lake is a large muskeg system forming the collecting basin for the 26,899 acre drainfield to the west of Pin Peak, north of the St. Nicholas and Harris Rivers. Halfmile, Threemile and Hatchery Creeks, and ten other unnamed streams all flow into Klawak Lake. Its waters in turn flow out through Klawak River into Klawak Inlet.

The lake's tributary streams are characterized by shallow depths of 3-10 inches and average widths of 28-35 feet. Aquatic invertebrates were sampled at random in Klawak's tributaries and results are presented in Table 37.

Klawak River originates at the outlet of Klawak Lake, which spills at an elevation of 30 feet and descends to a level with the inlet tidal zone 1 mile downstream. The stream bottom is primarily gravel with interspersed larger gravel and some large boulders. Aquatic invertebrates sampled are presented in Table 38. The river is deep along its route, and three pools were found well suited for year-round use by salmonids. There are no barriers to migratory fish species.

Temperature observations were made at stations 1, 2, and 3 (Figure 23) on July 9 and continued until September 5. The three locations were selected to represent overall conditions in Klawak Lake.

The lake's temperature gradient was gradual, and no noticeable stratification was observed. Observations were recorded for the surface and bottom zones and illustrated in Figure 24.

Surface and bottom water samples were tested for their content of dissolved oxygen. These findings are presented in Figure 25.

The pH values were found to fluctuate from 6.7 to 6.9 at the surface and 6.3 to 6.8 at the bottom of Klawak Lake during the sampling period. The pH values of the three sampling stations are presented in Figure 26. Light penetration through the lake's water column was measured by a 20 cm Secchi disc as 5-6 meters.

Zooplankton were sampled biweekly at station 1 and 3 during the study period. These levels of plankton production were of significant size and diversity throughout the summer season (Table 39). The presence of

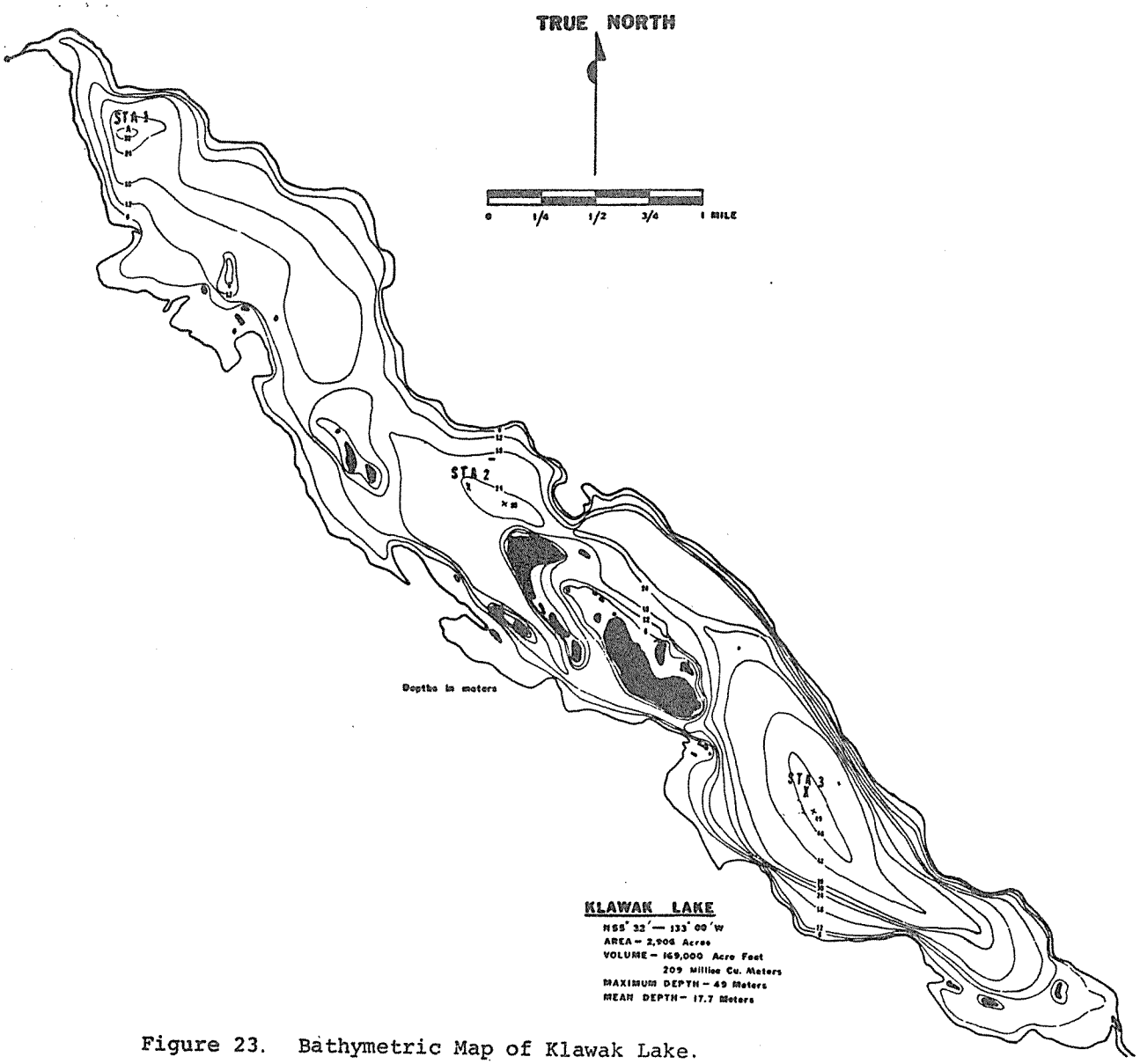


Figure 23. Bathymetric Map of Klawak Lake.

TABLE 36. Morphometry of Klawak Lake.

Water Area		Island Area	
Hectares	1176.7	Hectares	36.6
Acres	2906.4	Acres	90.4

Percent of Depth Zone Areas

0-12 m	34.7
12-24 m	44.0
24-36 m	9.1
36-49 m	11.1

Water Volume

Cubic Meters x 10^7	20.9
Acre Feet x 10^4	16.9

Present Volume of Depth Strata

0-12 m	55.7
12-24 m	29.2
24-36	10.9
36-49	4.1

Maximum Depth = 49 m Mean Depth = 17.7 m

Lake Perimeter = 12,159 m

Island Perimeter = 2,144 m

Number of Islands = 19

TABLE 37. Aquatic Invertebrates Collected from Tributaries of Klawak Lake, July, 1973.

	3-Mile Creek	Unnamed Stream At SE End Lake	Hatchery Creek
Turbellaria	--	20	--
Insecta			
Ephemeroptera			
Ephemerellidae			
Ephemerella (Serratella) tibialis	--	--	6[a]
Heptageniidae			
Cinygmula sp.	3	14	1
Epeorus (Iron) albertae	4	1	--
Epeorus (Iron) longimanus (group)	1	2	--
Baetidae			
Baetis tricaudatus	--	1	--
Plecoptera			
Chloroperlidae			
Alloperla sp.	--	2	1
Trichoptera			
Limnephilidae			
Dicosmoecus sp.	--	--	3
Diptera			
Chironomidae	--	1	--
Simulidae	--	1	1
[a] Tentative Identification Pending Consultation	8	42	12

TABLE 38. Aquatic Invertebrates Collected from Klawak River, June 24 - September 5, 1973.

	June[b]	July				August				September
	24	1	8	15	22	1	8	22	29	5
Turbellaria	21	26	6	16	26	18	26	38	3	13
Oligochaeta	8	9	3	14	9	2	6	5	2	3
Hirudinea	12	24	17	5	6	56	27	27	5	9
Pelecypoda	8	1	45	--	28	43	48	26	2	2
Gastropoda	5	--	--	1	2	1	7	5	3	2
Amphipoda		--	--	--	--	--	1	--	--	1
Arachnida										
Acarina spp.	5	1	8	1	9	10	5	9	2	--
Insecta										
Ephemeroptera										
Ephemerellidae										
Ephemerella grandis flavitincta	1	--	1	--	--	--	4	5	--	1
Ephemerella (*Serratella*) *teresa*	3	--	--	--	--	--	--	--	--	--
Ephemerella (*Serratella*) *tibialis*		15	8	1	2	--	--	1	--	--
Ephemerella inermis	1[c]	--	--	--	--	--	--	--	--	--
Heptageniidae										
Cinygmula sp.	5	7	--	--	--	--	--	--	--	--
Epeorus (*Iron*) *longimanus* (group)	2	1	--	--	--	--	--	--	--	--
Leptophlebidae										
Paraleptophlebia debilis		--	--	1	--	--	--	1	--	--
Siphlonuridae										
Ameletus sparsatus		--	--	2	--	--	1	--	--	--
Baetidae										
Baetis tricaudatus	6[c]	--	--	7	--	3	1	31[c]	1	2
Baetis parvus		--	--	--	--	--	--	2[c]	--	--
Baetis bicaudatus	23[c]	--	--	--	--	1	--	--	--	--
Baetis spp.		17	34	5	21	--	--	--	--	--

TABLE 38.(cont) Aquatic Invertebrates Collected from Klawak River, June 24 - September 5, 1973.

	June[b]	July				August				September
	24	1	8	15	22	1	8	22	29	5
Insecta										
Plecoptera										
Chloroperlidae										
Alloperla sp.	8	--	--	--	1	1	--	3	1	--
Trichoptera										
Hydropsychidae										
Hydropsyche sp.	6	--	34	--	--	--	--	1	--	--
Hydropsyche slossonae	5	5	8	--	1	1	--	--	--	--
Cheumatopsyche sp.	19	1	6	--	--	1	2	3	1	5
Hydroptilidae										
Ochratrichia tarsalis		--	--	1	2	--	--	1	--	--
Rhyacophilidae										
Rhyacophila sp.	1	--	--	--	--	--	--	--	--	--
Limnephilidae										
Dicosmoecus sp.		7	1	--	--	--	--	--	186	178
Unidentified		--	1	1	51	18	159	290	--	--
Diptera										
Tipulidae										
Antocha sp.	21	1	4	--	--	1	--	1	--	--
Empididae										
Roederiodes sp.	3	1	--	1	2	--	2	1	--	--
Chironomidae										
Tanytarsus cf. *exiguus*	1	--	--	--	--	--	--	--	--	--
Unidentified	21	19	46	23	44	72	175	65	24	5
Simuliidae										
Simulium decorum	1	3	--	--	--	--	--	--	--	--

a 2 Surber Samples Taken per Sampling Day

b 2 Surber Samples and One Grab Sample Taken

c Tentative Identification Pending Consultation

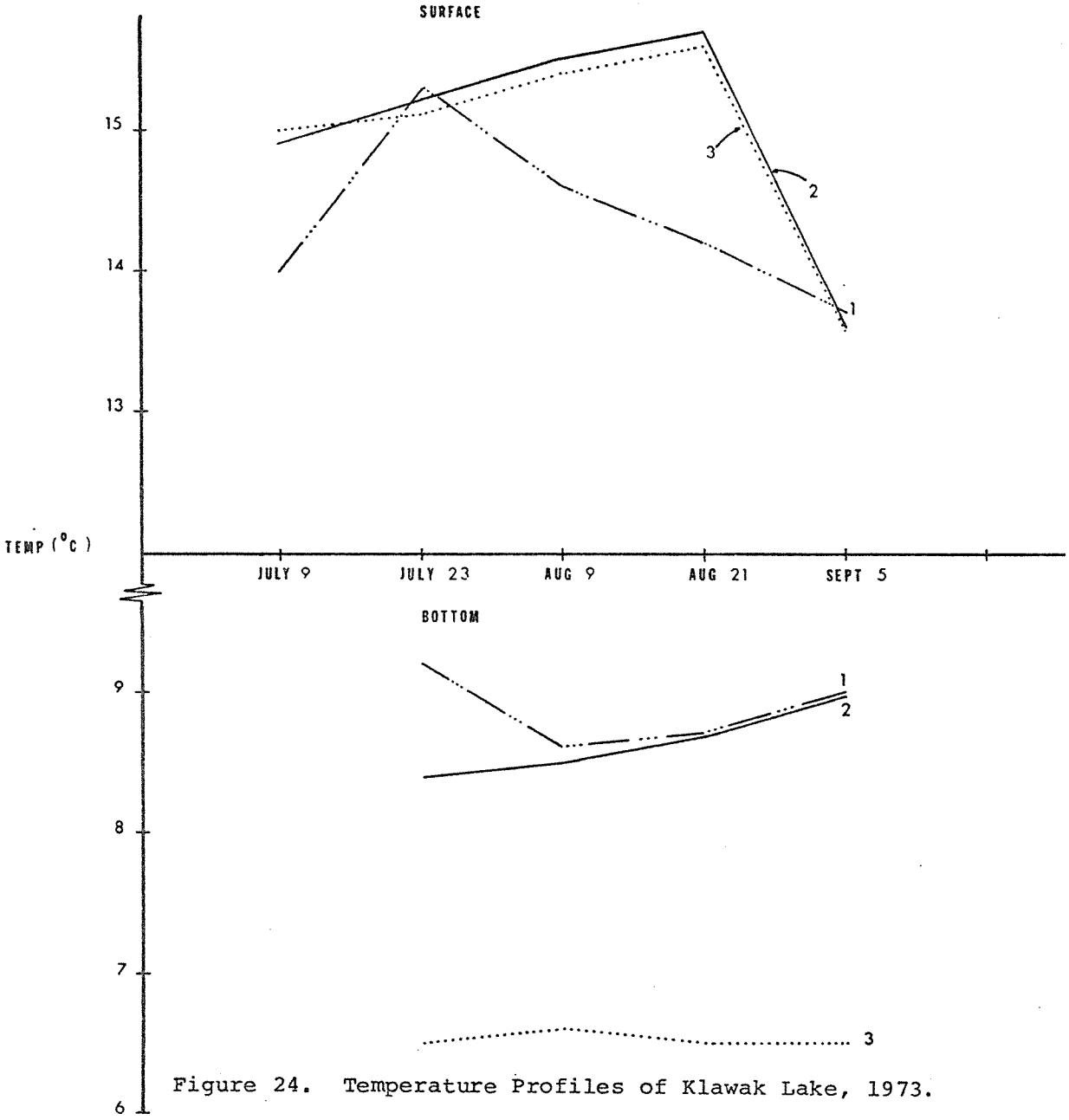


Figure 24. Temperature Profiles of Klawak Lake, 1973.

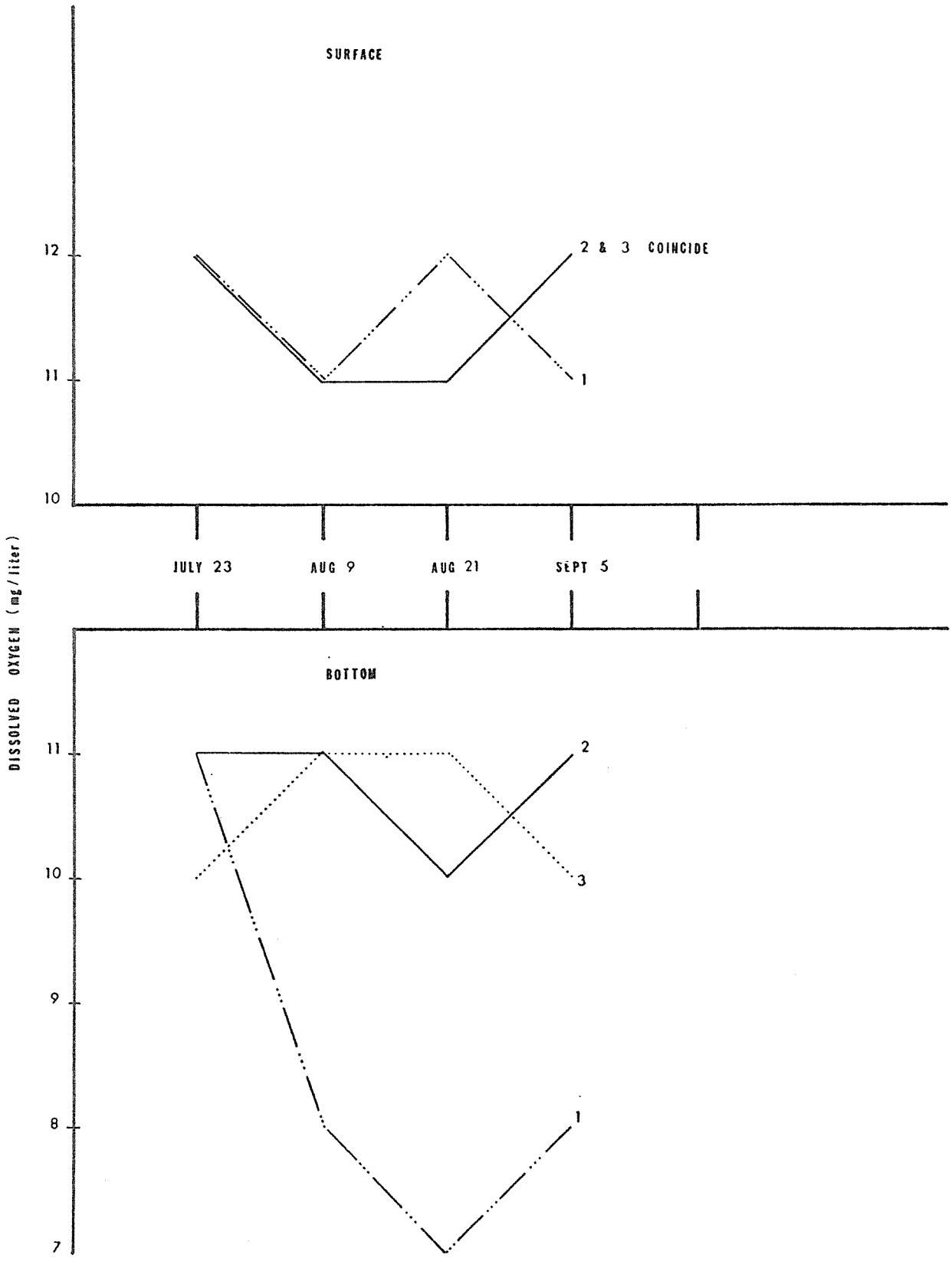


Figure 25. Dissolved Oxygen Profiles of Klawak Lake, 1973.

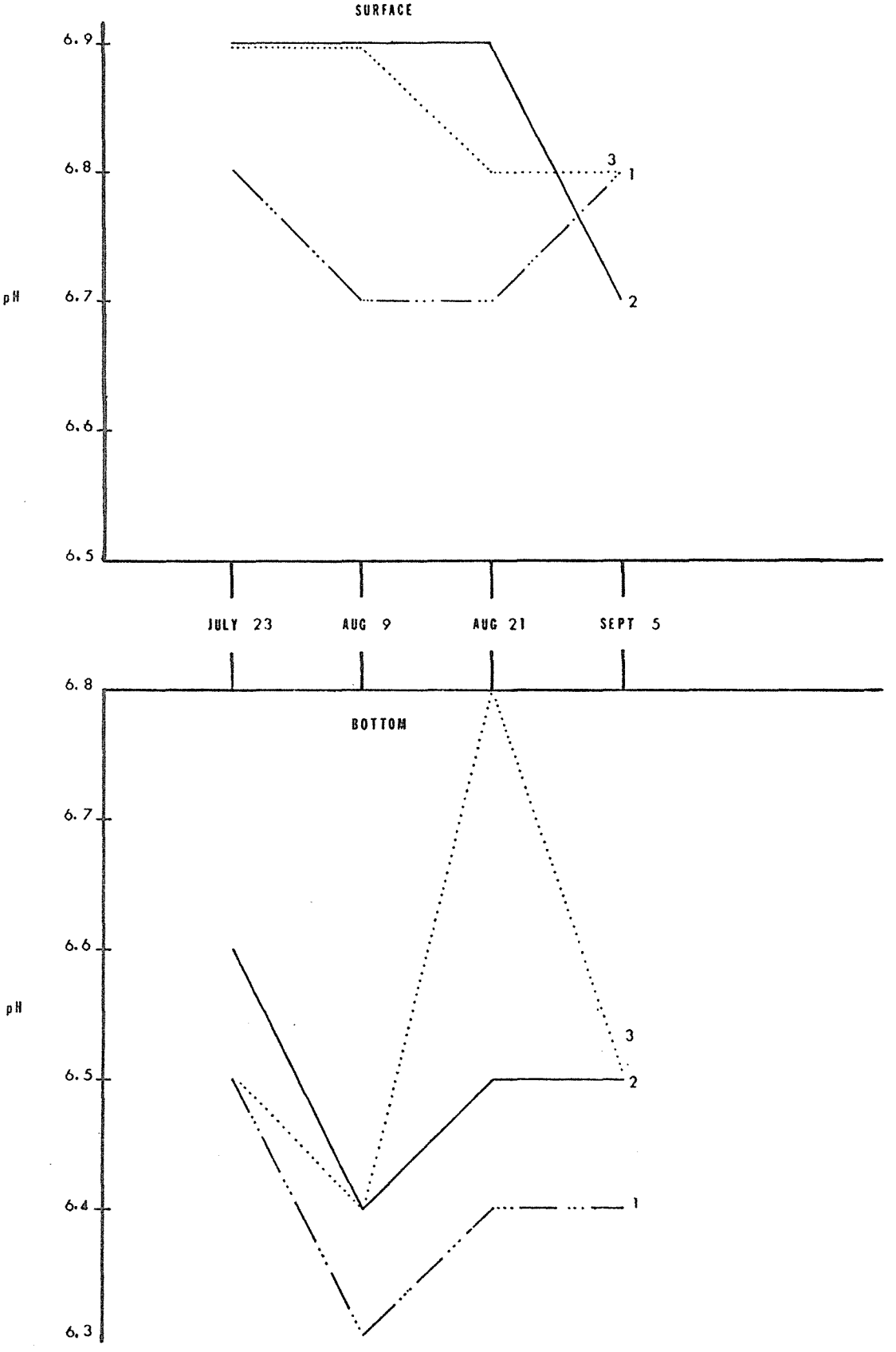


Figure 26. Hydrogen Ion Concentration, Klawak Lake, 1973.

Neomysis meriedis was confirmed in several net tows.

Occurrence of phytoplankton in samples was rare and appears to be only supplemental to the abundance of suitable detritus for use as food by zooplankton. The abundance of Tabellaria sp. varied slightly throughout the samples from 800 to 1,900 organisms per square meter. Spriogryra spp. were observed in several samples but no pattern of abundance was evident. Other Chlorophyta spp. were observed but had been altered physically by formalin and further identification was not possible.

The benthos zone of Klawak Lake was sampled during the three-day period in July 12-14. Samples were taken by use of a 6" Ekman dredge at selected locations in the lake. These findings are illustrated in Table 40.

The principal bottom type found in Klawak Lake was brown ooze (Table 41). This type was found in 43 percent of samples taken. Other substrates found were brown-black ooze, black ooze, woody debris, sand and gravel.

Known fish species utilizing the Klawak system include pink, chum, silver and sockeye salmon; cutthroat and rainbow (steelhead) trout; Dolly Varden char; three spine stickleback and cottids. The species composition and relative abundance was studied further by use of variable sized mesh gill nets and minnow traps. Subsequent sampling efforts confirmed the presence of a large population of resident cutthroat trout and rearing coho salmon. The cutthroat exhibited good growth and substantial size, as shown in Figure 27.

TABLE 40. Mean Number of Benthic Organisms by Depth Zone, Klawak Lake, July 12-14, 1973.

Depth Zones (Meters)	Number of Dredgings	Oligochaeta	Hirudinea	Pelecypoda	Gastropoda	Amphipoda	Plecoptera Chloroperlidae *Alloperla exquisita*	Trichoptera Leptoceridae	Diptera Tipulidae *Dicranota* sp.	Chironomidae	Rhagionidae	Centipeda	Colembola
0-12	12	328	12	116	44	140	92	8	12	312	4	4	4
12-24	8	140	--	28	--	16	--	--	--	444	--	--	--
24-36	1	4	--	--	--	--	--	--	--	16	--	--	--
36-48	3	20	--	24	--	--	--	--	--	80	--	--	--
Mean		123	3	42	11	39	23	2	3	213	1	1	1
Percent		26.6	0.6	9.1	2.4	8.4	5.0	0.4	0.6	46.1	0.2	0.2	0.2

TABLE 41. Composition of Bottom Materials in Dredgings of Klawak Lake, 1973.

Depth Zone Meters	Brown/Black Ooze	Black Ooze	Brown Ooze	Woody Debris	Sand	Gravel
0-12	1	1	9	3	1	1
12-24	3	1	3	1	-	-
24-36	-	1	-	-	-	-
36-48	3	-	-	-	-	-
Total	7	3	12	4	1	1

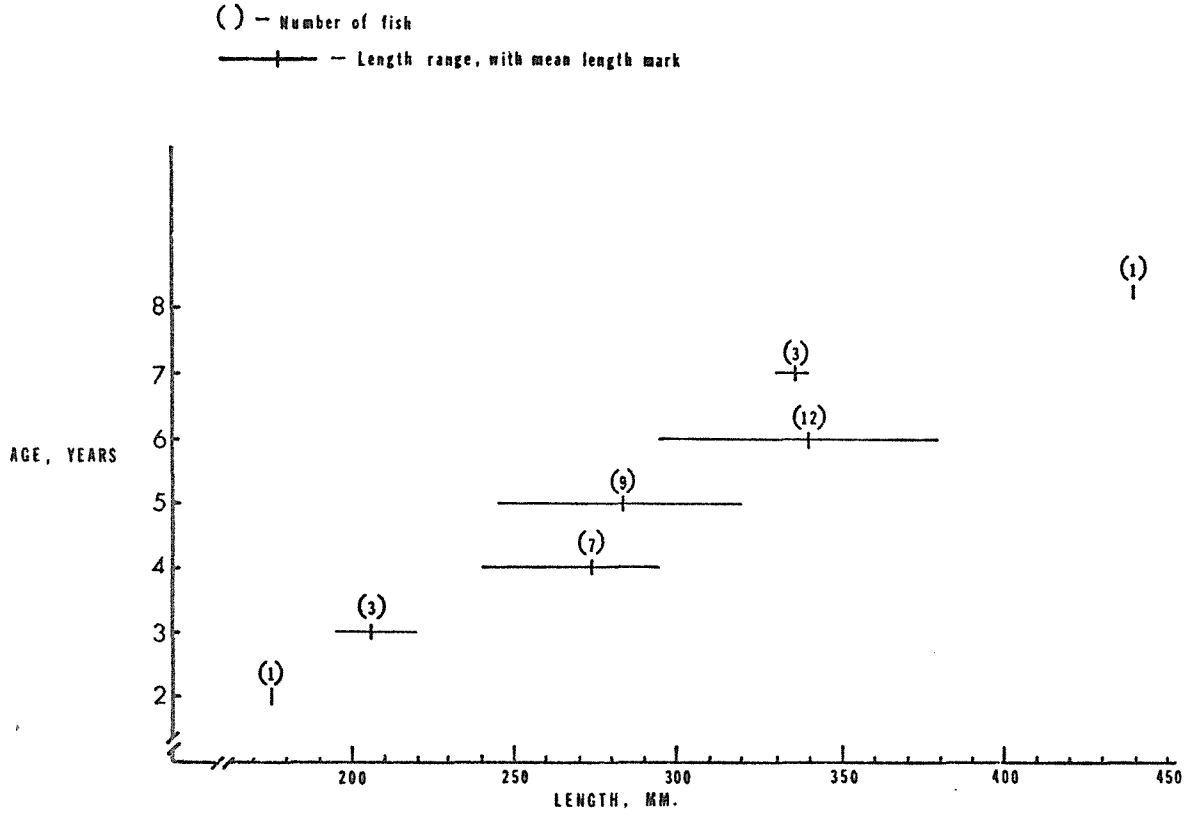


Figure 27. Length and Age of Cutthroat Trout, Klawak Lake, 1973.

HARRIS RIVER

The Harris River flows south and east 14 miles to enter Harris River Bay. It is located near the center of Prince of Wales Island at 55°27'40" north latitude and 132°41'30" west longitude.

Extensive long-term studies were conducted on this stream assessing the impact of logging practices on salmonid habitat (Meehan et. al., 1969, and Sheridan and McNeil, 1968).

Points on the Harris River are accessible from the Hollis Road. At mile 19.4 Hollis Road a bridge crosses the Harris River, and at miles 24.6 and 26.4 access is made available to the north bank of Harris River via logging roads. Charter flights may be made from Ketchikan, an approximate distance of 40 miles, to the Kasaan Bay area, or a daily flight may be taken from Ketchikan to Klawock or Craig.

The upper waters of the Harris cannot be fished from the banks without great difficulty. Numerous windfalls and the remains of logging debris have diverted stream flow making banks unstable and undercut.

The middle waters of the Harris are lined with large gravel beds and shallows that can be easily waded; this combination allows walking for at least 3 miles.

The lower section of river is accessible via old logging roads. Good fishing holes are available in the lower mile.

No developed recreational facilities exist in the immediate area. Sport fishing is also available in Maybeso Creek and Indian Creek, which are located nearby.

Coho, pink, and chum salmon; Dolly Varden; steelhead and cutthroat are available to sport fishermen. Local residents report that Dolly Varden had started to run the second week in July. A local fisherman caught 3 Dolly Varden the first weekend in July and 30 the second weekend. On July 20 Dolly Varden were present in every pool. Pink salmon enter the system the third week in July.

MAYBESO CREEK

Maybeso Creek is located immediately northwest of Harris River on Prince of Wales Island at 55°29'10" north latitude and 132°39'55" west longitude. It flows 6.4 miles from its source to enter salt water at Hollis anchorage.

Meehan et. al. (1969) conducted extensive studies on Maybeso Creek to assess the impact of logging practices on salmonid habitat.

Maybeso Creek flows through a large glacial valley with steep slopes on both sides. The valley was cleared during logging operations conducted in 1953 through 1957. The area's vegetation now shows a slow recovery from the effects of these operations.

No developed recreational facilities exist in the Maybeso Creek valley except for an administrative cabin at Hollis maintained by the Forest Service. Sport fishing is also available at Harris and Indian creeks.

Vehicular transportation to the area is available from the Hollis ferry terminal.

A bridge crossing at mile 28.8 on the Hollis road provides road access to the upstream area of Maybeso Creek. In addition, a road parallels the stream a short distance adjacent to the bridge. A second road is located at mile 28 and extends a short distance upstream.

The bank cover is salmonberry interspersed with scrub spruce and some hemlock in the lower 1/2 mile. Walking is generally good along the streambed and poor on the overgrown banks.

Coho and pink salmon occur seasonally. Cutthroat, steelhead, and Dolly Varden are available to fishermen in Maybeso Creek and its tributary streams.

STANEY CREEK

Staney Creek flows 20 miles northwest to enter Tuxekan Passage on the west coast of Prince of Wales Island. A previous name variation used for Staney Creek was Lester River. Its geographical location is 55°49'15" north latitude and 133°10'00" west longitude.

During the August 27 survey, the field crew found the average stream width to be 80 feet and the average depth to be 9 inches. The stream color was dark muskeg brown. At high tide the stream velocity was slowed to form large pools in the lower mile. Other large pools were found in the east fork, below the lower bridge and one on either side of the entry of West Fork.

The stream's substrate varies from mud and organic ooze in lower sections to rubble and bedrock further upstream. In the lower 2 miles the stream channel cuts through a mud layer, which was previously an old clam bed. Crushed and washed shell pieces are strewn throughout the lower 2 miles of the stream channel. Spawning areas are excellent and quite extensive.

Fish using the stream are pink, chum, and coho salmon; cutthroat; steelhead; rainbow; and Dolly Varden. Staney Creek has long been known as a pink, chum, and coho producer of considerable importance. With the advent of the logging and road access, the stream has received more fishing pressure with reports of large, easy takes of coho and steelhead.

There are no facilities present on Staney Creek. The approximate 50 square mile watershed has been extensively clearcut. Bank cover now consists primarily of broadleaf vegetation.

STEELHEAD CREEK

Steelhead Creek is a local name for Anadromous Stream No. 103-60-29 that flows into the northern end of Big Salt Lake. It is located at 55°38'30" north latitude and 132°57'20" west longitude.

Steelhead Creek flows 8.7 miles to drain 26.5 square miles. During the August 4 survey, the water was muskeg brown and slightly turbid. Several small tributaries were noted in the lower 2 miles of the stream. Average width was 51 feet and average depth, 1 foot.

The stream's substrate varied from predominantly rubble wiht lesser quantities of gravel and sand to occasional bedrock and boulders further upstream. Pools were abundant, covering 50 percent of stream area in the lower 1 3/4 mile; and less numerous, 25 percent of stream area, above the major fork. Pools were largely formed by deadfalls and resulting change in direction of the stream course. Excellent spawning area was noted from 1/2 mile upstream to the fork 1 3/4 mile further upstream.

The creek can be reached by any size skiff through the south entrance to Big Salt Lake. Caution should be taken upon entrance to the lake as strong tidal currents make navigation hazardous. Best times for entering the lake are high and low slack water. High tide in Big Salt is delayed 2 hours from outside waters.

Vehicle access is provided by the Big Salt logging road from Craig, Klawock, or Hollis. The road crosses Steelhead Creek approximately 2 miles from the mouth.

No foot trails are available at this time leading to the stream.

The creek can be fished from the banks but not without some difficulty due to dense patches of salmonberry and devils club. The lower 1/2 mile banks were steep and undercut in places providing poor fishing sites. In the first mile gravel bars were sparse but coincided with good fishing pools.

Shallows in the first mile of the stream were limited. Approximately 1 mile above the mouth, creek wading becomes more possible. Dense patches of salmonberry and devils club interspersed with timber windfalls make walking difficult. Approximately 2 miles from the mouth, the stream passes through a series of ridges covered by spruce providing a high pool canopy, which made fishing quite scenic.

A Forest Service cabin is located on Big Salt Lake less than 2 miles from the creek. The fishing history of this stream is unknown. Alternative good fishing spots eg., Black Bear Creek and Thorne River, are in the near proximity.

Coho, pink, and chum salmon; Dolly Varden; cutthroat; and a reported steelhead run are available to fishermen. During the first week of August, pink and chum salmon and Dolly Varden were observed. Pink salmon were seen in all pools.

THORNE RIVER

Thorne River is located in the central area of Prince of Wales Island at 55°42' north latitude and 132°35' west longitude. Its origin is Thorne Lake and flows 15 miles southeast to enter Thorne Bay. Drainage area is about 150 square miles.

During the August survey observations were confined to the lower 7 miles of the system. The river averaged 125 feet in width and 20 inches in depth. The stream waters were brown in color and exhibited slight turbidity.

The stream bottom composition is primarily rubble with lesser quantities of gravel and some sand interspersed with silt. Occasional bedrock outcroppings were noted throughout the river course. Pools were abundant along the river's course; large pools often a half mile long and 2-3 feet deep were common.

Long stretches of the streambed were excellent spawning habitat, especially in the lower one mile and six miles above. Tributaries contribute greatly to the spawning area.

Thorne Bay can be reached by boat from areas outside Prince of Wales, approximately 45 miles northwest of Ketchikan, with docking facilities available at the town of Thorne Bay.

Presently the Staney Creek road is closed to the public. This road passes within proximity or adjacent to Thorne River from the mouth to about 6 miles upstream. When open to the public, Thorne River may be reached from both Klawock and Thorne Bay communities via Big Salt and Staney Creek roads.

Charter flights may be made from Ketchikan to Thorne River.

This river can be readily fished from the banks above the mouth to the confluence of Goose Creek. Much of this river portion has deep water in near proximity of gravel bars or rock outcrops, which makes either fly fishing or spin casting easy. The understory is light. An exceptionally good pool exists at the entrance of Falls Creek to Thorne River. In this portion of the stream, few, if any, good crossing spots exist. At low water periods, fording may be possible at the confluence of Gravely Creek.

Above the confluence of Goose Creek, shallow areas for wading increase but are still very limited. In the 2 1/2 mile section surveyed above Goose Creek, the fishing potential from the banks decreases. The river contains areas of lily pads, and weed growth.

Game trails and a light undergrowth make for excellent walking from the mouth to the confluence of Falls Creek. Above Falls Creek the road parallels the stream, often with foot trails leading to the pools.

The only camping facilities in the area are at a Forest Service picnic

area, approximately 4 miles up the Staney Creek road.

Sport fishing on the Thorne River is primarily limited to weekend use by the Thorne Bay logging community. Access by private vehicle to the river is prohibited above the Staney Creek road bridge. With the advent of Staney Creek road opening to the public, fishing pressure will increase.

All of the surveyed section on Thorne River appears navigable by canoe, the current is not restricting or formidable even to a novice. Above Goose Creek, shallow waters occasionally will have to be waded depending on water levels.

Sport fish present in Thorne River include sockeye, coho, pink, and chum salmon; cutthroat; rainbow trout; steelhead and Dolly Varden. At the time of our survey, August 16-18, pink salmon were seen in creeks entering Thorne River. We were told that the silver salmon start their run about the 15th of August. Silver salmon were observed in pools approximately 2 miles above the entrance of Goose Creek (August 18).

Economic Contribution of the Saltwater Sport Fishery to the Juneau Area

One hundred fifty-seven questionnaires, 12 percent of the 20 percent population sample, were filled out and returned for analysis. Of those returned, 7 percent were unusable and discarded.

Analysis of the questionnaires indicated that the Juneau area fishery was composed of 93 percent resident, 6.4 percent nonresident, and 0.6 percent nonresident 10-day licenses. An average angler household was composed of 2.7 anglers of which 2.1 were licensed and 0.6 were juveniles. Table 42 illustrates the mean expenditures of equipment by households toward sport fishing for salmon.

Monthly fishing commodity questionnaires were circulated during the last week of June, July and August. Fifty-seven (27 percent) of 211 questionnaires were completed by anglers and returned for analysis. Anglers reported making 4.3 ($\sigma t_{.95}$ = 0.8) trips per month and spent 5.1 ($\sigma t_{.95}$ = 0.6) hours per trip fishing for salmon. The mean composition of an angler party was 2.7 ($\sigma t_{.95}$ = 0.2) anglers of which 0.6 ($\sigma t_{.95}$ = 0.2) were juveniles.

Anglers were asked to record the number of each salmon species caught. This part of the questionnaire was used in comparison with the creel census data to gain a relative measure of the "closeness of fit" between the two sets of data. The mean response from the questionnaires was 1.2 salmon/boat trip as compared to 0.7 salmon/boat trip from the creel census data. The creel census data sample size (1,572) is significantly larger than the economic survey (57) and hence more representative of the population parameters. The greater catch success shown by the economic survey questionnaire is thought to have been affected by the more successful and interested anglers who responded voluntarily to the questionnaire.

Anglers reported a 42 percent (24) increase in interest in salmon fishing over the past few years. Thirty-two percent (18) reported their interest had remained the same, 5 percent (3) indicated a decrease in interest and 21 percent (12) did not comment.

The mean monthly angler expenditures for fishing commodities are illustrated in Table 43. People took exception to answering questions on boat rental and lodging; consequently, this information was deleted.

Species preference is reflected in Table 44. King salmon appear to be the anglers first choice and silvers occupy second place. The ranking of the other three species is somewhat unclear. The relative ranking expressed here seems proportional to the catch of these various species (Tables 20 and 44).

Dividing the commodity costs among the reporting anglers, an angler spends $5.60 for each hour of fishing and $28.70 for his share of each boat trip. In assessing the monetary value of a sport-caught salmon, these commodity costs were applied to obtain a net expense of $83.00 for each salmon caught. Cost per salmon would at least double if the value of equipment

TABLE 42. Mean Fishing Equipment Expenditures by Angler Household, Juneau Area Salmon Sport Fishery, June - August, 1973.

	Number/Household		Cost/Household		
	$\bar{x}$	$\sigma t_{.95}$	$\bar{x}$	$\sigma t_{.95}$	%
License	2.1	0.11	$ 12.6	0.7	0.2
Rods	4.2	0.3	86.2	16.8	1.4
Reels	3.7	0.4	79.5	17.8	1.3
Line	---	---	14.5	2.4	0.2
Tackle boxes	1.3	0.2	15.4	3.6	0.2
Landing net	1.0	0.1	11.4	1.4	0.2
Other tackle	---	---	43.3	17.1	0.7
Boat	0.9	0.2	4906.6	368.1	78.0
Small engine	0.7	0.2	458.7	43.4	7.3
Trailer	0.2	0.07	101.4	55.4	1.6
Boat accessories	---	---	314.3	106.4	5.0
Personal gear	---	---	220.8	44.2	3.5
Other costs	---	---	23.7	7.2	0.4

n = 145

σ = Standard deviation of $\bar{x}$

TABLE 43. Mean Monthly Fishing Commodity Expenditure per Angler, Juneau Area Salmon Sport Fishery, June - August, 1973.

	$\bar{x}$	σt_{95}	%
Bait	$ 7.9	1.5	6.4
Additional tackle	10.8	6.3	8.7
Fuel and Oil	27.6	8.5	22.2
Food and Beverage	20.4	7.8	16.4
Moorage	17.9	4.6	14.4
Maintenance	27.9	23.4	22.4
Other costs	11.8	13.9	9.5

n = 57

σ = Standard deviation of $\bar{x}$

TABLE 44. Salmon Species Preference by Juneau Area Anglers

	1	2	3	4	5
Kings	85% (45)	17% (6)	---	---	---
Silvers	15% (8)	57% (20)	4% (1)	---	---
Pinks	---	11% (4)	52% (14)	26% (6)	26% (5)
Chums	---	11% (4)	15% (4)	57% (13)	26% (5)
Reds	---	3% (1)	67% (8)	17% (4)	47% (9)

could be distributed over fishing trips. However, a method of allocating equipment expenses to the sportman's fishing experience has not been determined.

Expanding monthly commodity costs alone, the sport fishery contributes a net value of $493,900 to $992,700 to the Juneau area's economy, during June, July, and August. This estimate does not include any application of angler cost of equipment; contribution by visiting anglers or the expenditures made by anglers who fish the Juneau highway system. If the previously mentioned contributions were computed to the expenses of fishing during the other months, the total annual value of sport fishing to the Juneau area probably exceeds two million dollars.

Peterson Lake Investigation

Peterson Lake (58°26'45"N., 134°44'W.) was first investigated August 29 and 30, 1939, by James L. Wilding. His report is as follows:

> Peterson Lake was surveyed on August 29 and 30. It is located approximately 25 miles northwest of Juneau and lies in a low valley surrounded by low hills which are moderately covered with spruce, hemlock, huckleberry and shrubs. The lake is about one half mile long and one quarter mile wide, and is divided almost into two areas by the invasion of a bog mat near the upper third. The entire north shore line is covered by a moss and sedge mat. The slope of the bottom is gradual throughout to a maximum depth of 15 meters and, in all areas sampled up to a depth of 10 meters, was covered with a mat of algae.
>
> Seepage and two small streams supply the lake. Neither of the inlets is large enough to support spawners but adequate riffles are found in the outlet a short distance below the lake.
>
> Trout food organisms, Table III were abundant as was shown by the eight dredge samples taken in the numerous weed beds. The vegetation was the most abundant of the ten lakes studied and consisted of Equisetum, sedge, lilies, narrow-bladed grass, Myriophyllum, and dense moss and algae mats. Two vertical plankton hauls showed these organisms, limited to seven species, to be fairly abundant, Table IV, averaging 5.3 cubic centimeters per cubic meter of water.
>
> The fish population of the lake appears to be sparse and consists of a stunted race of Dolly Varden trout. No migratory fish are present because of an impassable falls about one mile below the lake in the outlet stream. Since the food and water conditions are very favorable for trout, the lake should be stocked with a desirable species. Steelhead fingerling are available in Peterson Creek below the first falls about two and one half miles below the lake, and could easily be transported to the lake. The stocking of steelhead has proven successful in Lake Sassion in Baranof Island.

Trout food organisms identified by Wilding were midge larvae, annelids, fingernail clams, shrimp, and caddis cases. Plankton identified included Bosmina, Diaptomus, Cyclops, Nothelca, and nauplii.

Reed and Armstrong (1972) summarized subsequent management and research activities. Rehabilitation of Peterson Lake was attempted in 1961. Since that time 137,800 steelhead have been planted.

Investigation conducted October 18-20, 1973, showed the Secchi disc reading to be 1.0 meters. Water is from a muskeg spruce drainage. Surface to bottom pH readings ranged from 4.8 to 5.4. Dissolved oxygen ranged from 13.0 to 10.0 ppm. Two main inlets and several small muskeg seepages

drain into the lake. The two main inlets have 6.4 miles of unblocked main channel. Good spawning gravel was found in both inlets.

Phytoplankton at the time of survey was limited to a sparse population of the acidophilic desmid Staurastrum. Zooplankton populations are summarized below.

Number of organisms per square meter, Peterson Lake, October 20, 1973:

Rotatoria		Copepoda	
Keratella	17,815	Calanoida	13,743
Kellicottia	509	Cyclopoida	26,468
Cladocera		Nauplii	19,851
Bosmina	3,054		

Aquatic invertebrates identified in the main inlet stream and lake are listed in Table 45. Dredging in the lake was accomplished with a 6" Ekman dredge in approximate relation to depth area of the lake. The average density of organisms in Peterson Lake was 111 organisms per square foot. Larvae of the family Chironomidae were the most abundant (93 per square foot) with Stictochironomus being the most abundant genus. The only organisms identified below 7.5 meters were Oligochaeta and Chironomidae.

Fishing with a variable mesh gill net near the inlet and one near the outlet for 24 and 28 hours respectively captured 56 Dolly Varden and 3 rainbow trout. Twelve minnow traps set for 24 hours produced 209 Dolly Varden and 1 rainbow trout.

Growth of rainbow trout in the lake appears slow. Age and length of net caught rainbow is as follows: 5 years, 155 and 161 mm; 6 years, 205 mm. One 50 mm rainbow was caught in a minnow trap, indicating natural reproduction.

An attempt to analyze growth of Dolly Varden by otoliths was futile. Growth appears normal the first three years followed by a much reduced growth rate. This indicates a stunted population. Length-weight of Dolly Varden and limited age analyses are presented in Figure 28.

TABLE 45. Benthic Organisms Collected from Peterson Lake and Inlet, October 16-17, 1973.

Peterson Lake Faunal Summary X-16-17-73

Main Inlet Stream
- Ephemeroptera
  - Baetidae
    - *Baetis bicaudatus* Dodds
  - Heptageniidae
    - *Cinygmula* sp.
    - *Rithrogena* prob. *robusta* Dodds
  - Ephemerellidae
    - *Ephemerella* (*Drunella*) *doddsi* Needham
    - *Ephemerella* (*Drunella*) *grandis flavitincta* Med.
- Plecoptera
  - Nemouridae
    - *Nemoura* sp.
  - Chloroperlidae
    - *Alloperla* sp.
- Trichoptera
  - Limnephilidae
    - *Hesperophylax* sp.
- Diptera
  - Chironomidae
    - *Micropsectra* sp.

Peterson Lake
- Oligochaeta
- Hirudinea
- Mallacostraca
  - *Gammarus* sp.
- Trichoptera
  - Limnephildae (represented by cases)
- Diptera
  - Chironomidae
  - Tanypodinae
    - *Procladius* sp. A
    - *Procladius* sp. B
  - Chironominae
    - *Chironomus* (*Chironomus*) sp. A
    - *Chironomus* (*Chironomus*) sp. B
    - *Stictochironomus* sp.
    - *Microtendipes* sp.
    - *Micropsectra* sp.
    - Chironomini (unidentifiable)
  - Orthocladiinae
    - *Cardiocladius* sp.
- Mollusca
  - Sphaeridae

( ) - Number of fish

——|—— - Length range, with mean length mark

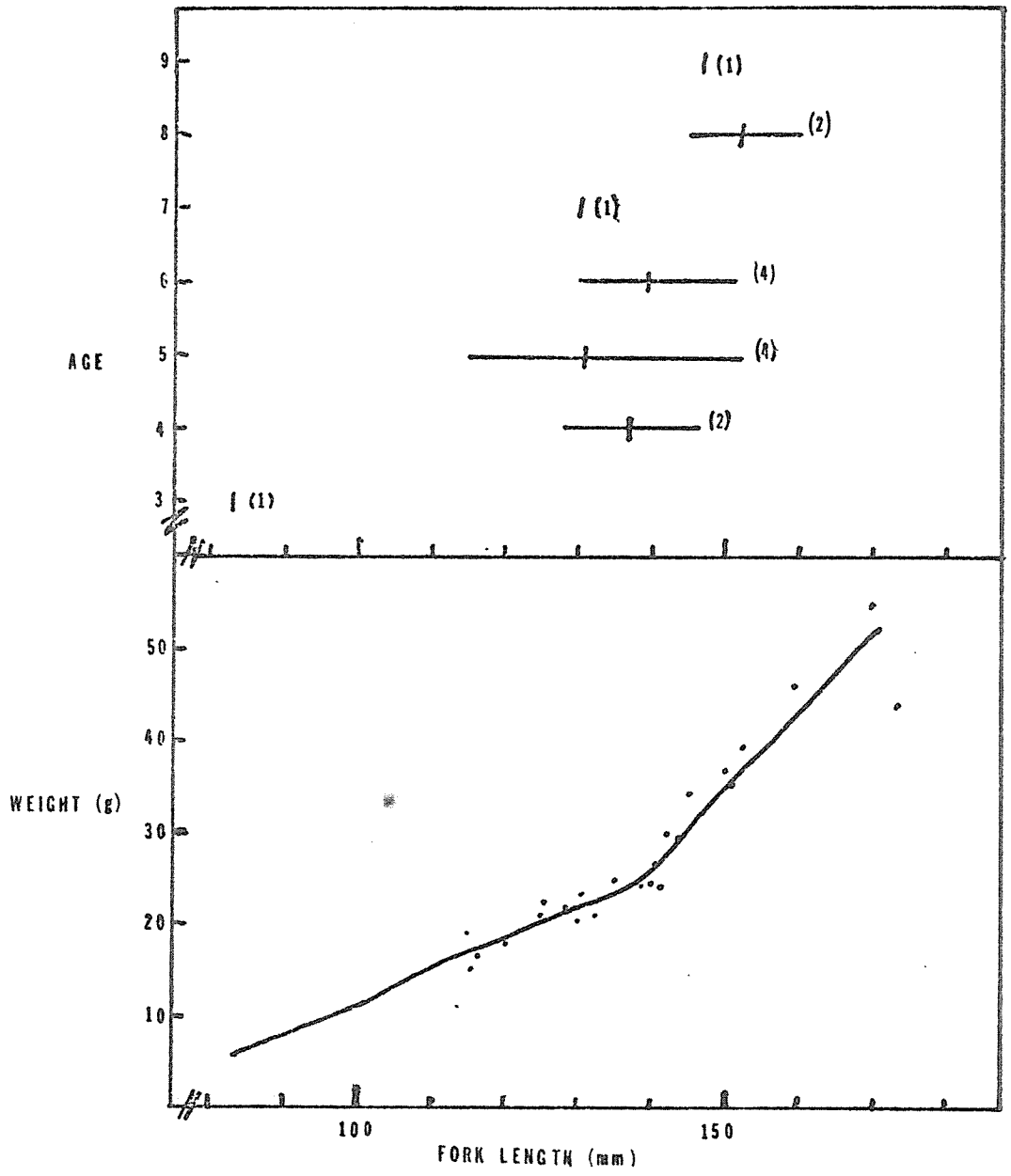


Figure 28. Length, Weight and Age of Dolly Varden Char, Peterson Lake, 1973.

Bioassay Results

Water chemistry analysis showed the lake to be very acetic (pH 5.4). Conductivity of the water was 7.5 micromhos and alkalinity four ppm. Surface water temperature was 4.25°C. These parameters remained constant in the experiment bags during the study period. Dissolved oxygen concentration was 13.0 ppm at the beginning of the bioassay and 8.0 ppm after 69 hours.

Test animals exposed to 3.0 ppb Fintrol were dead before 24 hours (Table 46), while those exposed to 0.5 ppb survived for 69 hours. Fish exposed to 1.5 and 1.0 ppb toxicant were dead within 49 and 69 hours respectively. The control was inadvertently destroyed after 48 hours, but all fish survived at 0.5 ppb toxicant indicating the control fish would also have survived.

TABLE 46. Fintrol Toxicant Levels and Resulting Fish Mortalities, Peterson Lake, October 18-20, 1973.

Fintrol (ml) per 20 Gal. Water	Toxicant Level (ppb)	Percent Kill After Time Period		
		24 hrs.	49 hrs.	69 hrs.
0.0	Control	0.0	0.0	---
0.2	0.50	0.0	0.0	0.0
0.4	1.00	0.0	60.0	100.0
0.6	1.50	40.0	100.0	---
0.8	3.00	100.0	---	---

Fish exposed briefly to 12 ppb toxicant developed stress symptoms in three hours. They appeared to suffer asphyxiation as they gaped at the surface of the water, lost orientation, then lay on their sides gasping. Those fish killed within 24 hours by 3.0 ppb toxicant had their backs arched and mouths open. Fish which were killed by lower concentrations of toxicant over longer periods of time did not show these characteristics but were covered with a heavy coating of mucus.

Aquatic insects exposed to Fintrol showed no mortality after 25 hours (Table 47). The mortalities of the bioassay organisms may be attributed to handling and injuries. The organisms were examined after the experiment, and many were observed to have wounds such as missing legs and punctures.

The Ephemeroptera used in the experiments were stream dwelling animals which require moving water for respiration (Dodds & Hisaw, 1924; Jaag in Hynes, 1970; Feldmoth, 1970) and may have suffered mortality in the enclosed bags due to insufficient oxygen.

TABLE 47. Fintrol Toxicant Level and Insect Mortality, Peterson Lake, October 18-20, 1973.

Toxicant Level (ppb)	Test Organism (No.)	Mortality 25 hrs. 15 min.	No. Escaped	Mortality 48.5 hrs.
Control	Chironomus (Chironomus)sp.(5)	0	3	0
	Cinygmula sp.(2)	0	1	1
0.5	Chironomus (Chironomus)sp.(5)	0	1	2
	Cinygmula sp.(2)	0	1	0
	Hesperophylax sp.(1)	0	0	0
1.0	Chironomus (Chironomus)sp.(5)	0	0	3
	Cinygmula sp.(2)	0	0	0
	Nemoura sp.(1)	0	0	0
1.5	Chironomus (Chironomus)sp.(5)	0	3	2
	Cinygmula sp.(2)	0	0	0
3.0	Chironomus (Chironomus)sp.(5)	0	0	3
	Cinygmula sp.(2)	0	0	2

Taxa

Cinygmula sp. (Heptageniidae: Ephemeroptera)
Nemoura sp. (Nemourida: Plecoptera)
Hesperophylax sp. (Limnephilidae: Trichoptera)
Chironomus (C.) sp. (Chironomidae: Diptera)

Catalog and Inventory Files

Information on 75 streams, 13 lakes, and 5 saltwater bays were added to existing catalog and inventory files.

LITERATURE CITED

Alaska Department of Fisheries. 1953. Annual Report for 1953. 93 p.

Andrews, R.E. 1971. Lake and Stream Survey Manual. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 1954. Annual Report for 1954. 92 p.

_____. 1955. Annual Report for 1955. 152 p.

Ball, R.C. 1948. A summary of experiments in Michigan lakes on elimination of fish populations with rotenone. Trans. Am. Fish. Soc. 75:139-146.

Bishop, D.M. 1973. Waters of West Chichagof-Yakobi. U.S.D.A. Forest Service, Alaska Region. (Processed) 61 p.

Carlander, K.D. 1955. The standing crop of fish in lakes. J. Fish. Res. Bd. Can. 12(4):543-568.

Dodds, G.S. and F.L. Hisaw. 1924. Ecological studies of aquatic insects II. Size of respiratory organs in relation to environmental conditions. Ecol. 5(3):262-271.

Doudoroff, P. and M. Katz. 1950. Critical review of literature on the toxicity of industrial wastes and their components to fish. Sew. & Ind. Wastes. 22:1432.

Esvelt, L.A., et. al. 1971. Toxicity Removal from Municipal Wastewaters. Vol. IV of A Study of Toxicity and Biostimulation in San Francisco Bay-Delta Waters. SERL Report No. 71-7, Sanitary Engineering Research Laboratory, University of California, Berkeley.

Feldmeth, C.R. 1970. Respiratory energetics of two species of stream caddis fly larvae in relation to water flow. Comp. Biochem. Physiol. 32:193-202.

Hayes, R.F. and E.H. Anthony. 1964. Productive capacity of North American lakes as related to the quantity and trophic level of fish, the lake dimensions, and water chemistry. Trans. Am. Fish. Soc. 93(1):53-57.

Holland, G.A., et. al. 1960. Toxic Effects of Organic and Inorganic Pollutants on Young Salmon and Trout. State of Washington, Dept. of Fisheries, Res. Bull. No. 5. 198 p.

Hynes, H.B.N. 1970. The ecology of stream insects. Annual Review of Entomology. 15:25-42.

Krock, H. and D.T. Mason. Bioassays of Lower Trophic Levels. Vol. VI of A Study of Toxicity and Biostimulation in San Francisco Bay-Delta Waters. SERL Report No. 71-8, Sanitary Engineering Research Laboratory, University of California, Berkeley.

Meehan, W.R. et.al. 1969. Some effects of clearcutting on salmon habitat of two Southeast Alaska streams. U.S.D.A. Forest Service Res. Pap. PNW-82, 45 p.

Merkens, J.C. 1958. Studies on the toxicity of chlorine and chloramines to the rainbow trout. Waste & Waste Trt. Jour. 7:150.

Moyle, J.B. 1956. Relationships between the chemistry of Minnesota surface waters and wildlife management. J. Wildl. Mgmt. 20(3):303-320.

Northcote, T.G. and P.A. Larkin. 1956. Indices of productivity in British Columbia lakes. J. Fish. Res. Bd. Can. 13(4):515-540.

Orth, D.J. 1971. Dictionary of Alaska place names. U.S. Geological Survey Professional Paper 567. 1097 p.

Reed, R.D. and R.H. Armstrong. 1971. Dolly Varden sport fishery - Juneau area. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration. Annual Report of Progress 1970-71. 12(R-IV):1-105.

Schmidt, A.E. and F.S. Robards. 1973. Inventory and cataloging of the sport fish and sport fish waters in Southeast Alaska. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress 1972-73.

Sheridan, W.L. and W.J. McNeil. 1968. Some effects of logging on two salmon streams in Alaska. Jour. of Forestry, Feb. 1968:128-133.

Tsai, C. 1971. Water quality and fish life below sewage outfalls. Progress Report, Natural Resources Institute, University of Maryland, College Park.

Turner, W.R. 1960. Standing crop of fishes in Kentucky farm ponds. Trans. Am. Fish. Soc. 89(4):333-337.

Wilding, J.L. 1939. Alaska lake survey, July-August 1939. Dept. of Interior. Bur. of Fish. Washington D.C. 13 p.

Prepared by:

Artwin E. Schmidt
Fishery Biologist

Approved by:

s/Howard E. Metsker
Chief, Sport Fish Research

s/Rupert E. Andrews
Director, Sport Fish Division