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JAMES W. BROOKS, COMMISSIONER

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Study G-I-A: Inventory and Cataloging of Sport Fish and Sport Fish Waters in Southeast Alaska

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STUDY G-I-A

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF THE SPORT FISH AND SPORT FISH WATERS IN SOUTHEAST ALASKA

by

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ALASKA DEPARTMENT OF FISH AND GAME
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RESEARCH PROJECT SEGMENT

State:	Alaska	Name:	Sport Fish Investigations of Alaska
Project No.:	F-9-7		
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, 1974 through June 30, 1975.

ABSTRACT

Limnological investigations of eight lakes revealed: 1) all lakes studied have very limited production due to lack of nutrients and limited shoal areas; 2) conductivity of all lakes studied, except Redoubt, is less than 50 micromhos; 3) Redoubt Lake is meromictic with an anerobic, saline, monomolimnion which acts as a nutrient trap. The standing crop of No. 20 net plankton was determined to compare trophic status of lakes. All lakes are oligotrophic. Descending order of productivity according to this plankton index follows: 1) Swan, 2) Blue, 3) Osprey, 4) Auke, 5) De Boer, 6) Spurt, 7) Redoubt, and 8) Green. Bottom fauna of lakes is dominated by Chironomidae and Oligochaeta. Fish growth appears to be correlated with the above factors e.g. 1) growth of Dolly Varden, Salvelinus malma (Walbaum) is greater in Osprey than Spurt Lake: 2) Rainbow trout Salmo gairdneri (Richardson) populations are more successful in Swan than in Spurt or De Boer lakes.

Attempts to develop methods of indexing Dolly Varden and cutthroat S. clarki (Richardson) populations in Auke Lake met with little success as not enough fish were caught in any one type of gear. The Dolly Varden population in Osprey Lake was reliably estimated using large minnow traps.

A Ross 400A echosounder was used to demonstrate the distribution of fish in Auke and Swan lakes. Rainbow trout were found to be concentrated near the inlets of Swan Lake.

An estimated 126 king, Oncorhynchus tshawytscha (Walbaum); 55 coho, O. kisutch (Walbaum); and 80 Pacific Halibut, Hippoglossus stenolephis were taken during the census period of May 27 through September 2, 1974 in the Sitka area. No coho checked in the sport fishery carried the marking pattern utilized by the Starrigavan saltwater rearing pens facility. The Salmon catch per angler hour was 0.15 for king and 0.06 for coho. During the Sitka Salmon Derby, which was conducted on June 22, 23, 29 and 30, 985 anglers participated to

turn in 186 king; 15 coho; 3 chum; O. keta (Walbaum); 15 halibut, and 35 lingcod, Ophiodon elongatus (Girard) for prizes.

An estimated 1,714 angler hours were spent to catch 309 sockeye, O. nerka (Walbaum); 324 pink, O. gorbuscha (Walbaum); 114 Dolly Varden; 24 cutthroat; 21 coho; and 4 chum during 731 angler trips to Auke Creek. During the census period, July 1 through August 25, the abundance of pink salmon in the sport catch was supplemented by an estimated 55 pinks from the Auke Creek Hatchery facility.

During the census period of May 6 through September 2, an estimated 5,622 coho, 2,301 king, 1,110 pink, 32 sockeye and 7,366 halibut were taken in the Juneau area. The salmon catch per angler hour was 0.74 for coho, 0.30 for king, 0.15 for pink, 0.01 for chum, and 0.001 for sockeye.

The Golden North Salmon Derby was conducted during July 26 through 28. Officials recorded that 7,714 anglers participated in the derby to turn in 1,526 coho, 291 king, 226 pink and 24 chum salmon for prizes.

Information on 16 streams and 12 lakes were added to existing catalog and inventory files.

RECOMMENDATIONS

Research

1. Comprehensive limnological investigations should be conducted on the more productive lake systems so the relationship of physical, chemical, and biological indices can be related to fish production.

2. High quality recreational fishing waters in Southeast Alaska should be identified. Upon review of available information and research data, systems suitable for a type of classification should be submitted to the proper management agency for that classification.

3. An effort should be made to determine the effectiveness of hydroacoustic equipment in the estimation of fish abundance, distribution, and size in lakes.

4. Continue to evaluate the contribution of king and coho salmon reared at the Starrigavan Bay rearing pens facility to the Sitka area sport fishery. Intensify census effort by including a shoreline creel census at Starrigavan Bay in addition to the saltwater boat creel census.

5. Conduct a study to determine the impact of different flow levels from the Blue Lake reservoir on the downstream sport fishery of Sawmill Creek.

6. Further study of Blue Lake reservoir is recommended to evaluate its present level of production of rainbow trout for Sitka area anglers.

Management

The following measures are recommended to enhance present productive systems in the Sitka area.

1. All sewage lines should be removed from the Swan Lake system and rerouted into the Sitka municipal sewage disposal system.

2. All debris should be removed from Wrinkleneck Creek to enhance its aesthetic quality.

3. Better procedures should be used in removing gravel from the barrow pit in Granite Creek to maintain the clear stream waters for rearing and spawning.

4. All construction materials and other debris should be removed from Thimbleberry Creek to facilitate passage of rearing salmonids.

OBJECTIVES

1. Determine the realtionship of physical, chemical, and biological characteristics of selected lakes to fish production.

2. Develop methods of estimating or indexing fish populations in lakes.

3. Develop methods of estimating fish distribution in lakes.

4. Determine distribution and catchability of Dolly Varden and cutthroat trout in Auke Lake.

5. Inventory and develop a plan for the management of fish streams and lakes accessible from the Sitka road system.

6. Determine the recreation potential of the Sarkar Lakes area of Prince of Wales Island.

7. Determine the contribution of coho produced from the saltwater rearing pens at Sitka to the Sitka area coho sport fishery.

8. Determine the sport catch of pink salmon returning from the Auke Creek Hatchery and fish marked from the natural run.

9. Determine the sport catch of king salmon in the Juneau area.

10. Continue collection, analysis, and organization of all available and new information on sport fish resources in Southeast Alaska.

TECHNIQUES USED

Relationship of Limnological Characteristics to Fish Production

Limnological relationships existing in eight lakes were investigated. These included Auke Lake near Juneau; Green, Blue, Redoubt, and Osprey near Sitka; and Swan, Spurt, and De Boer near Petersburg.

Bathymetric maps were prepared for all lakes not previously mapped. Personnel from the Department of Fish and Game and the U.S. Geological Survey made two data collection trips to all lakes except De Boer. These collection trips were timed to coincide as nearly as possible with spring turnover and summer stagnation periods. Sampling stations were established on each lake at approximately the deepest portion of each lake.

Vertical profiles of pH, temperature, specific conductance, and dissolved oxygen concentrations were recorded at each station using a Martex Mark II water quality monitoring system. Samples for chlorophyll analysis were filtered through a milliport filter having a pore size of 0.45

microns. These were desiccated, frozen, and later analyzed using a Turner Fluorometer (Strickland and Parsons, 1968). All chemical samples were collected and analyzed in accordance with standard methods of the U.S. Geological Survey (Brown, Skougstad, and Fishman, 1970). Zooplankton were collected by making vertical tows from 100 meters or bottom, whichever was shallower. Nets used were 0.5 meters in diameter, and 3 meters long with aperture of 243 microns and 45% open area (No. 6 Nitex), or 80 microns and 35% open area (No. 20 Nitex). Number 6 Nitex was used on Osprey Lake; all other samples were collected with number 20 Nitex nets. Plankton were identified and counted. Dry and ash weight of plankton were determined gravimetrically. Efficiency of nets was not accounted for in calculations.

Bottom fauna were collected by dredging with an Ekman 6 inch dredge. Bottom samples were washed through three screens, the finest having 28 meshes per inch. Organisms were preserved in 70% ethyl alcohol or frozen until laboratory analysis.

Stream drift organisms were collected by placing two nets in the main inlets. Nets used were 12 inches square, 3 feet long, made of Nitex with pore size of 280 microns and 45% open area. Benthos were preserved and later identified and enumerated in the laboratory.

Age, growth, and food habits of fish in the lakes were determined from fish collected throughout the study period.

A population estimate of Dolly Varden in Osprey Lake was conducted between June 26 and September 20. The Dolly Varden population in Osprey Lake is nonanadromous so should remain fairly constant. A constant population with no difference in mortality between marked and unmarked individuals is a requirement for using the Schnabel method of population estimation (Schnabel, 1938).

Fish samples were taken using standard commercial minnow traps and modified minnow traps 36 inches long, 16 inches diameter with entrance funnels with aperture of 2 inches on either end. Minnow traps were fished randomly about the lake bottom.

Data were analyzed using the shortened Schnabel estimate. The reciprocal of Schnabel was used to determine variance, standard error, and confidence interval. As a comparison, the data were also analyzed using a formula proposed by Schumacher and Eschmeyer (1943). This formula is weighted to help account for any non-random mixing of marked and unmarked fish. All formulas used were taken from Ricker (1958).

Estimation of Fish Population in Lakes

Dolly Varden char and cutthroat trout were marked and released as they passed through the Auke Creek weir into Auke Lake. All fish were measured (fork length) and marked by punching the caudal fin. Several types of baited traps, a trap net, and gill nets were used to recapture fish in the lake after the inmigration. Fish recaptured were re-marked so they could be identified as recaptures. Various gear types were fished concurrently so selectivity of gear could be compared. Types of gear used included: 1) sinking gill nets eight feet deep and 125 feet long with five 50 foot panels of different size mesh net, varying from 1/2 inch to 2 1/2 inch bar measurements; 2) a trap net of 1/4 inch mesh netting with pot 3 foot x 3 foot x 4 1/2 foot, a 60 foot lead, and 30 foot wings; 3) a cylindrical shrimp pot of 1/4 inch mesh, 22 inch diameter, 14 inches high, with two entrance funnels; 4) a cylindrical minnow trap 17 inches long and 9 inch diameter with entrance funnels on either end; 5) a modified cylindrical minnow trap, 3 feet long, 16 inch diameter, with an entrance funnel on either end; 6) a triangular minnow trap 3 feet long and 16 inches on each side with a funnel entrance on each end and 7) a square minnow trap, 3 feet long, with 14 inch side, and an entrance funnel on each end.

To compare efficiency between: 1) day and night sets and 2) various lengths of time sets, three separate study sites were chosen on Auke Lake. These sites were less than 40 feet deep with gradual sloping bottoms so all types of gear could be fished.

All types of gear were fished on each site during a three-day period. During any given day all gear was fished in one of the three sites. All three types of gear were set at 0900, pulled and reset at 1500, and pulled at 0900 the following morning. In addition, the minnow traps were pulled and reset at 1200 hours. Upon completion of a day's fishing at one site the gear was moved to the next so that all sites were fished during a three-day period. Completion of fishing at all three sites constituted one replicate.

Three sampling replicates were fished during Monday through Thursday of three consecutive weeks. Gear locations at any given site were varied with each replicate so that at the completion of the experiment each type of gear had fished each location.

A population estimate of fish in Auke Lake was prepared using the Peterson method.

Methods of Estimating Fish Distribution in Lakes

A literature search was made to determine the applicability of using hydro-accoustic techniques to locate fish in lakes. A Ross 400A echosounder was purchased and used to detect fish in Auke Lake. Experimentation with anesthetized fish was conducted to determine size of detectable fish.

Distribution and Catchability of Fish in Auke Lake

The determination of fish distribution in Auke Lake was attempted by sounding a number of transects across Auke Lake and recording the indicated depth and location of fish on a chart recorded. Substantiation of indicated fish distribution was attempted using gill nets, minnow traps, and a 2-meter otter trawl.

Evaluation of Sport Fishing Resources along the Sitka Area Road System

Limnological investigations were conducted on lakes and streams accessible along the Sitka area road system. Surveys were conducted by walking each stream and sampling with minnow traps. During these surveys each stream was described with particular emphasis upon noting spawning and rearing areas and any blocks to fish passage.

Recreation Survey of Sarkar Lakes

This objective was not accomplished due to lack of time and manpower.

Sitka Area Saltwater Creel Census

A saltwater creel census was conducted in the Sitka area from June 1 through September 2 to determine the contribution of returning coho produced from the saltwater rearing pens at Starrigavan Bay near Sitka. The saltwater boat census was conducted on 67 (71%) of 94 days in the sampling season. The Sitka Salmon Derby was excluded from the sample design and considered separately due to its characteristic intensive angler effort.

Sample days were selected to provide coverage of all weekdays, Sunday through Saturday, throughout the sample period. All weekend days and 51 (60%) of 85 weekdays were sampled during the field season. Census interviews were conducted between 1500 and 2300 hours of each day sampled. The sampling period was divided into weekly periods similar to the 1974 census (Schmidt and Robards, 1974).

Census workers stationed at two local boat harbors conducted angler interviews to obtain catch and effort data. Scale and ovary samples were collected only from king salmon, and forwarded to the king salmon project leader for his analysis. A tally was kept of the sport and sport-geared commercial boats leaving and returning to the harbors, so the ratio of sport to commercial boats could be correlated to the aerial surveys. Aerial survey, used in estimates of total catch and effort, were flown at peak fishing times. This was usually 1400-1600 hours on weekends and 1800-2000 hours on weekdays. If bad weather prevented flying, the aerial survey was made on the next available census day during the census period. Counts were made of all boats, both potential sport and sport-geared commercial, but did not include vessels that were solely commercial, e.g., large troller, gillnetters, and seiners.

The catch and effort data collected by creel census technicians was expanded by ratios and calculated from dockside boat counts and aerial boat counts. These ratios were derived from fractions of the aerial count (C_a) divided by the 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.

$$\frac{C_a}{C_d}\frac{D_w}{D_c} = Fw \qquad \frac{C_a}{C_d}\frac{D_e}{D_c} = Fe$$

Estimates of salmon caught and fishermen participation during the Golden North Salmon Derby were obtained from staff observations and derby records. Biological samples were collected from king salmon entered in the derby and forwarded to the king salmon project leader for his analysis. Each coho was checked for an adipose clip and an inverted T brand. Bone tissue was taken from fish exhibiting these characteristics and examined under ultraviolet light for traces of oxytetracycline.

Auke Creek Creel Census

A shoreline saltwater creel census was conducted in the Auke Creek area from July 1 through August 25, 1974. Anglers were interviewed to determine catch success and species composition of their catch. Interviews were scheduled to coincide with angler preference for fishing the area at high tide periods.

All pink salmon observed during the census were examined for a clipped adipose fin and either a clipped left or right ventral fin to verify it had been released from the Auke Creek Hatchery.

Juneau Area Saltwater Creel Census

A shoreline saltwater creel census was conducted in the Juneau area from May 6 through September 2, 1974, by a staff of three census workers. The saltwater boat census was conducted on 86 (71%) of the 120 days in the sample season. The Golden North Salmon Derby was excluded from the sample design and considered separately due to its characteristic intensive angler effort. All other details of the sample design and analysis of data are identical to the Sitka area creel census described above.

Catalog and Inventory Files

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

FINDINGS

Relationship of Limnological Characteristics to Fish Production

Morphometry:

The depth, size, and shape of lakes strongly influence physical and chemical conditions which prevail within them. Since physical and chemical parameters limit species composition and abundance of organisms it is essential to study the morphometric features of lakes. Bathymetric maps were prepared for all lakes which had not been mapped previous to this study. Depth contours from Blue Lake (Figure 1) were taken from U.S. Department of Interior, Bureau of Reclamation records. Bathymetric maps of De Boer Lake (Figure 2), Green Lake (Figure 3), Ludvik Lake (Figure 4), Osprey Lake (Figure 5), Redoubt Lake (Figure 6), Spurt Lake (Figure 7), and Swan Lake (Figure 8), were prepared from Department of Fish and Game data. Morphometric data for Blue, De Boer, Green, Ludvik, Osprey, and Swan Lakes are presented in Tables 1 through 6 respectively.

All lakes studied had steep sides with few shoal areas. This limited littoral area results in limited production of benthos required in the food chain of higher aquatic organisms.

Physical and Chemical Conditions:

Observations of temperature, dissolved oxygen, pH, and transparency were made on each lake throughout the study period. Dissolved oxygen and hydrogen ion concentration of each lake are presented in Tables 7 and 8. Thermal profiles of Auke, De Boer, Green, Osprey, Redoubt, Spurt, and Swan Lakes are presented in Figures 9 through 16 respectively. All lakes studied were holomictic except Redoubt. Holomictic lakes can go through freely circulating periods (Hutchinson, 1957). Redoubt is defined as a meromictic lake in which part of the deep water, the monomolimnion of Findenegg (1935) is stabilized by dissolved substances.

All holomictic lakes were second or third order temperate lakes as defined in Welch (1952). Temperature of the bottom waters of second order lakes varies, but not far from 4°C. These lakes have two circulation periods per year (dimictic). Most lakes studied were second order lakes with pronounced thermal stratification occuring between 3 and 12 meters.

Third order lakes should be more productive than second order lakes with similar edaphic, climatic, and nutrient characteristics, as continued circulation of the water column keeps nutrients available to plankton populations.

Redoubt, a meromictic lake, will have reduced productivity as the monomolimnion acts as a nutrient trap. Once organic materials settle into this layer, the nutrients contained are never recycled to the upper trophogenic layer. An inverse temperature gradient occurs deep in Redoubt Lake. This might be attributed to anaerobic decomposition and/or geothermal heating.

The effect of pH values on fish has been investigated since the 1920's. Dahl (1927) and Creaser (1930) showed that pH values were correlated with fish survival. Dahl found that when he raised the pH of hatchery water from 5.2 to 6.0 fish mortality practically ceased. Lloyd and Jordan (1964) found that resistance of fish to acids increases with hardness of water. Kwain (1975) demonstrates that mortality of rainbow trout embryos and fingerlings at a given pH is temperature dependent. Kwain gives a median lethal pH value of 5.52 for 50% hatching of rainbow trout eggs at 5°C.

Beamish and Harvey (1972) and Oden (1968) have shown that accumulation of fallouts, namely SO_2, has sharply decreased pH levels in nearby waters. A gradual disappearance of trout populations in southern Norway can be correlated with lowering of pH.

Many of Southeast Alaska's lakes with low temperatures, soft water, and acid bog conditions are probably not suited to production of rainbow trout. The limiting factor is lack of reproduction in inlet streams due to the synergistic effects of the above mentioned factors. This is proposed as the reason for lack of success in the attempts which have been made to establish a rainbow trout population in Peterson Lake (Schmidt, 1974). More information is needed concerning pH tolerance of other salmonid species. Cutthroat trout appear more tolerant of acidic conditions than do rainbow trout. Phillips (1959) found that fish transferred from hard water hatcheries to soft natural water may have a survival problem associated with the hardness and pH level in the water.

Those areas of Southeast Alaska with SO_2 producing industries might expect a decline in trout populations in mountain lakes due to acidification of stream and lake waters during periods of snow melt. Failures in recruitment are normally accompanied by increased size and growth of remaining individuals. Continuous failures in recruitment would lead to a few good-sized trout. A period of good fishing would occur followed by a disappearance of trout in the lake.

Transparency of lakes as Secchi disc visibility is presented in Figure 17. Yoshimura (1938) concluded that the Secchi disc disappears at about the level of penetration of 5% solar radiation. The range of Secchi disc transparencies recorded is from a few centimeters in very turbid lakes to 41.6 meters in the Japanese caldera Masyuko. The range observed in this study varied from about 2 meters in highly colored Auke Lake to over 20 meters in De Boer.

Specific conductance of lakes surveyed are presented in Table 9. Specific conductance is a measure of a water's capacity to carry an electric current. This measure may be correlated with salinity or total dissolved solids expressed as the total concentration of the ionic components. Rawson (1951) and Northcote and Larkin (1956) attributed much of the difference in plankton, bottom fauna, and fish production between lakes to differences in total dissolved solid concentration of between 100 and 200 ppm (Reid, 1969).

All lakes surveyed to date in Southeast Alaska, except Redoubt, have conductance of less than 50 micromhos. This low conductivity is indicative of low productivity lakes. The conductivity of De Boer (13 micromhos) and Spurt (16 micromhos) approximates that of distilled waters.

The conductivity of Redoubt Lake is much higher than any of the other lakes. This is attributed to the fact that the monomolimnion is full strength salt water. Limited circulation in the epilimnion increases conductivity during turnover periods.

Table 1. Morphometry of Blue Lake.

Water Area

Hectares	538.17
Acres	1,329.83

Percent of Depth Zone Areas

0-50 (ft.)	13.1 (%)	250-300 (ft.)	3.3 (%)
50-100	23.5	300-350	3.6
100-150	25.3	350-400	12.3
150-200	38.1	400-450	2.0
200-250	6.1	450 +	5.5

Water Volume

Cubic Meters x 10^8	2.81
Acre Feet x 10^5	2.28

Percent Volume of Depth Strata

0-50 (ft.)	27.3 (%)	250-300 (ft.)	7.4 (%)
50-100	21.9	00-350	6.9
100-150	11.4	350-400	3.9
150-200	10.4	400-450	1.9
200-250	8.7	450 +	0.3

Maximum Depth - 468 ft. Mean Depth = 171 ft.

Shoreline Development = 1.7

Shoreline Length = 45,750 ft.

Development of Volume = 1.1

Table 2. Morphometry of De Boer Lake.

Water Area			
Hectares	50.9		
Acres	125.59		
Percent of Depth Zone Areas			
0-10 m	21.9	30-40 m	15.0
10-20 m	20.7	40-50 m	12.2
20-30 m	26.7	50+ m	3.5
Water Volume			
Cubic Meters x 10^7	1.18		
Acre Feet x 10^3	9.53		
Percent Volume of Depth Strata			
0-10 m	38.4	30-40 m	9.9
10-20 m	29.2	40-50 m	3.8
20-30 m	18.7		

Maximum Depth = 50 m   Mean Depth = 23 m

Shoreline Development = 10.06

Development of Volume = 1.38

Shoreline Length = 4,998 m

Table 3. Morphometry of Green Lake.

Water Area

Hectares	70.2
Acres	173.4

Percent of Depth Zone Areas

0- 5 m	31.3	15-20 m	33.3
5-10 m	11.3	20-25 m	11.7
10-15 m	6.3	25+ m	6.1

Water Volume

Cubic Meters x 10^6	8.62
Acre Feet x 10^3	6.99

Percent Volume of Depth Strata

0- 5 m	34.1	15-20 m	13.4
5-10 m	25.6	20-25 m	4.7
10-15 m	22.1	25+	0.1

Maximum Depth = 26.2 m

Mean Depth = 12.3 m

Shoreline Development = 0.5

Development of Volume = 1.41

Shoreline Length = 19,600 ft.

Table 4. Morphometry of Ludvik Lake.

Water Area

Hectares	9.7
Acres	23.95

Percent of Depth Zone Areas

0- 5 m	9.4	20-25 m	15.7
5-10 m	8.3	25-30 m	10.8
10-15 m	12.6	30-35 m	24.5
15-20 m	10.8	35+ m	7.9

Water Volume

Cubic Meters x 10^6	2.03
Acre Feet x 10^3	1.65

Percent Volume of Depth Strata

0- 5 m	22.7	20-25 m	9.2
5-10 m	20.6	25-30 m	9.0
10-15 m	18.1	30-35 m	4.5
15-20 m	15.3	35+ m	0.6

Maximum Depth = 39 m Mean Depth = 21 m

Shoreline Development = 1.43

Development of Volume = 1.62

Shoreline Length = 1,582 m

Table 5. Morphometry of Osprey Lake.

Water Area

Hectares	75.15
Acres	185.72

Percent of Depth Zone Areas

0-10 m	9.7	60- 70 m	11.6
10-20 m	8.8	70- 80 m	5.0
20-30 m	7.8	80- 90 m	4.8
30-40 m	8.5	90-100 m	4.3
40-50 m	7.5	100-110 m	8.3
50-60 m	9.3	110-120 m	12.4

Water Volume

Cubic Meters x 10^7	4.5
Acre Feet x 10^4	3.65

Percent Volume of Depth Strata

0-10 m	15.9	60- 70 m	7.1
10-20 m	14.3	70- 80 m	5.7
20-30 m	12.9	80- 90 m	4.9
30-40 m	11.6	90-100 m	4.1
40-50 m	10.3	100-110 m	3.1
50-60 m	8.8	110-120 m	1.2

Maximum Depth = 120 m

Mean Depth = 60 m

Shoreline Development = 1.58

Development of Volume = 1.5

Shoreline Length = 4,848 m

Table 6. Morphometry of Swan Lake.

Water Area

Hectares	208.2
Acres	514.07

Percent of Depth Zone Areas

0- 20 m	12.2	100-120 m	15.4
20- 40 m	8.5	120-140 m	6.5
40- 60 m	10.5	140-160 m	5.8
60- 80 m	11.2	160+ m	14.0
80-100 m	15.9		

Water Volume

Cubic Meters x 10^8	1.9
Acre Feet x 10^5	1.54

Percent Volume of Depth Strata

0- 20 m	20.5	100-120 m	7.4
20- 40 m	18.3	120-140 m	5.0
40- 60 m	16.2	140-160 m	3.7
60- 80 m	15.2	160+ m	2.9
80-100 m	10.8		

Maximum Depth = 174 m   Mean Depth = 91.4 m

Shoreline Development = 1.63

Development of Volume = 1.58

Shoreline Length = 27,300 ft.

Table 7. Dissolved Oxygen Concentrations From Lakes Studied, 1974.

Dissolved Oxygen Concentrations mg/l
[illegible] Lake, 1974

Depth (m)	7/12	7/23	8/7	8/20	9/4
Surface	11.0	11.0	10.0	9.0	9.0
10					10.0
20				11.0	
40	9.0	10.0			
50			11.0	11.0	9.0

Dissolved Oxygen Concentrations mg/l
Green Lake, 1974

Depth (m)	West End 5/18	8/22	Depth (m)	East End 5/18	8/22
0	12.5		0	12.8	
1	12.4		1	13.0	12.2
3	12.4	11.6	3	12.8	12.4
5	12.4	11.8	5	12.7	12.1
9	12.4	11.6	9	12.6	12.2
10	12.4		10	12.5	11.9
12	12.4	11.7	12	12.4	12.1
14	12.3	11.6	14	12.3	12.3
16	12.3	9.7	16	12.3	12.1

Dissolved Oxygen Concentrations mg/l,
Osprey Lake, 1974

Depth (m)	5/30	6/12	6/27	7/24	8/6	8/24
0	12.5	13.0	13.0	13.0	12.0	10.3
1	12.5					10.3
3	12.3					10.4
5	12.4					11.5
10	12.3					12.5
15	12.3					12.3
20	12.2					12.2
30	12.2					12.1
50	12.2					12.3
70	12.1					11.7
80	11.5					10.7
90	10.5					10.3
Bottom	10.2	12.0	12.0	12.0	12.0	10.2

Dissolved Oxygen Consentrations mg/l
Swan Lake, 1974

Depth (m)	7/2	7/11	7/17	7/31	8/14	9/29
0	12.0	11.5	10.0	11.0	9.0	11.6
1		11.5				11.8
3		11.5				12.0
5		11.6				12.0
10	11.0	11.7				12.0
20		11.5				11.7
30		11.5				12.0
50	8.0	9.8	9.0	10.0	9.0	10.4
70		8.4				9.2
100		7.0	7.0			7.6
140	7.0			6.0	6.0	

Dissolved Oxygen Concentrations mg/l
Redoubt Lake, 1974

Depth (m)	5/16	6/6	6/19	7/2	7/17	8/19	9/10
0	13.2	13.0	13.0	14.0	13.0	10.3	12.0
1	13.2					10.3	
3	13.0					10.4	
5	12.9					10.6	
10	12.9					11.2	
20	12.9					12.1	
30	13.0					12.5	
50	12.9					12.2	
70	12.9	13.0		14.0		12.3	
90	10.2			12.0	10.0	9.9	14.0
100	0.0		0.0	0.0	0.0	1.2	8.0
105						0.0	0.0

Dissolved Oxygen Concentration mg/l
Spurt Lake, 1974

Depth (m)	6/21	7/9	7/14	7/26	8/9	8/23	9/27
0	11.0	10.5	9.0	10.0	9.0	9.0	10.8
1		10.3					10.8
3		12.1					11.1
5		12.1					11.3
10	11.0	12.1	11.0	11.0	11.0	10.0	12.0
15		11.9					12.3
20		11.8					12.1
30		11.7					11.7
40	9.0	11.5	10.0	11.0	9.0	9.0	10.1

Dissolved Oxygen Concentrations, mg/l, Auke Lake, 1974

Depth (m)	5/22	6/5	6/19	7/3	7/18	7/31	8/14	8/28	9/11	10/8
0.0	10.8	11.0	14.0	11.5	11.0	11.0	12.5	10.0	12.5	11.0
2.0	11.6		12.0							
2.5	11.5	12.0					11.5	10.0	10.0	
3.2	11.1			12.5	11.0	11.7				
8.0	9.6					9.0	9.5	8.0		
15.0	8.5					9.0		7.0	7.0	7.5
20.0	7.2					6.5	6.5			
25.0	6.8									
30.0	2.8	3.0	4.5	4.0	4.0	4.0	3.8	4.0	2.5	4.0

Dissolved Oxygen
Concentrations, mg/l
Blue Lake, 1974

Depth (m)	5/17	8/21
0	13.2	10.6
2	13.2	10.6
3	13.2	10.8
5	13.2	10.9
9	13.0	11.5
10	13.0	11.7
15	12.9	11.6
20	12.9	11.5
25	12.9	11.2
30	12.8	11.4
50	12.8	11.1
60	12.8	10.9
70	12.7	

Table 8. Hydrogen Ion Concentration of Lakes Studied, 1974.

Hydrogen Ion Concentrations pH
Spurt Lake, 1974

Depth (m)	6/21	7/9	7/14	7/28	8/9	8/23	9/27
0	6.5	6.3	6.6	6.6	6.8	6.8	6.3
1							
5		6.3					6.1
10		6.0	6.5	6.5	6.5	6.7	6.0
20		5.5					5.5
40	6.5		6.5	6.5	6.4	6.5	

Hydrogen Ion Concentrations pH,
Redoubt Lake, 1974

Depth (m)	5/16	6/6	6/19	7/2	7/17	8/19	9/10
0	7.0	6.9	6.7	6.9	6.8	7.2	6.9
5	7.0					7.2	
10	7.0					7.1	
20	7.0					7.0	
50	7.0					7.0	
70	7.0					7.0	
80	6.9	6.9		7.0		6.9	
90	6.7			6.7	6.5	6.8	6.7
100	7.0		7.0	7.3	7.9		7.0

Hydrogen Ion Concentration pH,
Osprey Lake, 1974

Depth (m)	5/30	6/12	6/27	7/25	8/6	8/24
0		6.5	6.5	6.5	6.7	6.4
1	5.9					6.4
3	6.0					6.4
5	6.0					6.4
10	6.0					6.2
20	6.0					6.1
50	6.1					6.0
70	6.1					6.0
80	6.0					6.0
90	5.9					6.0
Bottom	6.1	6.4	6.2	6.4	6.2	5.9

Hydrogen Ion Concentrations pH,
Green Lake, 1974

West End Depth (m)	5/18	8/22	East End Depth (m)	5/18	8/22
1	7.0		1	6.9	6.7
3	7.0	6.7	3	6.9	6.6
5	7.0	6.7	5	6.9	6.7
10	7.0	6.7	10	6.9	6.7
14	6.9	6.7	14	6.9	6.7
16	6.9	6.7	16	6.9	6.9

Hydrogen Ion Concentration, pH
Swan Lake, 1974

Depth (m)	7/2	7/11	7/17	7/31	8/14	9/29
0	6.5		6.8	7.0	7.0	6.5
1		6.6				
5		6.5				6.3
10		6.4				
15		6.4				6.0
50				6.7	6.7	
140	6.5		6.5	6.5	6.5	

Hydrogen Ion Concentrations pH
De Boer Lake, 1974

Depth (m)	7/12	7/23	8/7	8/20	9/4
Surface	6.5	6.5	6.6	6.7	6.8
10					6.6
20				6.5	
40	6.3	6.4			
50			6.4	6.3	6.3

Hydrogen Ion Concentrations, pH, Auke Lake, 1974

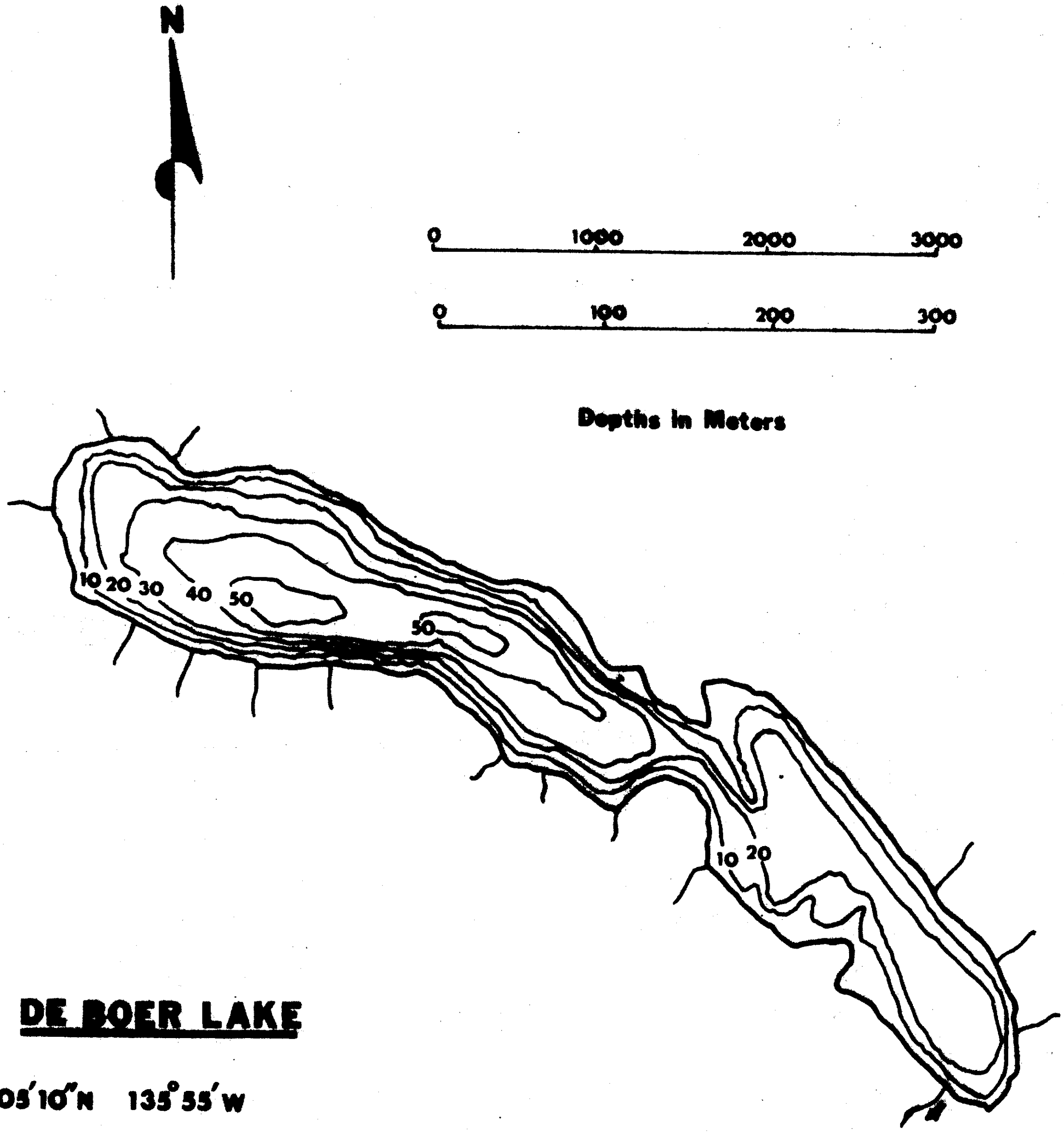
Depth (m)	5/22	6/5	6/19	7/3	7/18	7/31	8/14	8/28	9/11	10/8
0.0	6.9	6.9	7.0	7.2	6.9	6.7	6.7	6.7	6.8	6.8
2.0			6.6							
2.5	6.9	6.9					6.7	7.0	6.6	
3.2				6.8	6.7	6.8				
8.0						6.5	6.5	6.5		
15.0	6.6							6.3	6.3	6.8
20.0							6.4			
25.0										
30.0	6.3	6.4	6.3	6.2	6.1	6.2	6.2	5.8	6.0	4.7

Hydrogen Ion
Concentrations, pH
Blue Lake, 1974

Depth (m)	5/17	8/21
0	7.0	6.9
2	7.0	6.8
3	7.0	6.8
5	7.0	
9	6.9	6.7
10	6.9	6.7
15	6.9	6.6
20	6.9	6.5
25	6.9	6.5
30	7.0	6.5
50	7.0	6.5
60	7.0	6.5
70	7.0	
87	7.0	

Table 9. Specific Conductance (Micromhos) of Lakes Surveyed, 1974.

Depth (m)	Auke 5/22	Blue 5/17	Blue 8/21	Green 5/18	Green 8/22	Osprey 5/30	Osprey 8/24	Redoubt 5/16	Spurt 7/9	Spurt 9/27	Swan 7/11	Swan 9/29
0.2	29	43	32	49	29	22	12	283	16	14	24	17
1		43	32								25	
2	34		30				16					
3			30									
4			30				16	283			25	
5								289			24	
6			31	49			18					
7			31									
8			26	48			18					
9			28									
10			28				20	289			24	
12												
14			28				21					
15	38		27	48				292			22	
16					29							
17												17
19												18
20			27				21				22	
21												19
25			30					292			24	21
30	43		30				19	286				
38									16	14		21
40			34								24	22
44												
50			36								26	23
60			38								26	24
70								286			27	26
80								321			29	
81								382				
83								420				
84								480				
85								510				
89		43						593				
90								687				
92								841				
94								1,056				
95						22		1,245				
97								1,800+				
100							19	1,800+			29	26
150								20,000+				



DE BOER LAKE

57°05'10"N 135°55'W

AREA – 125.59 Acres

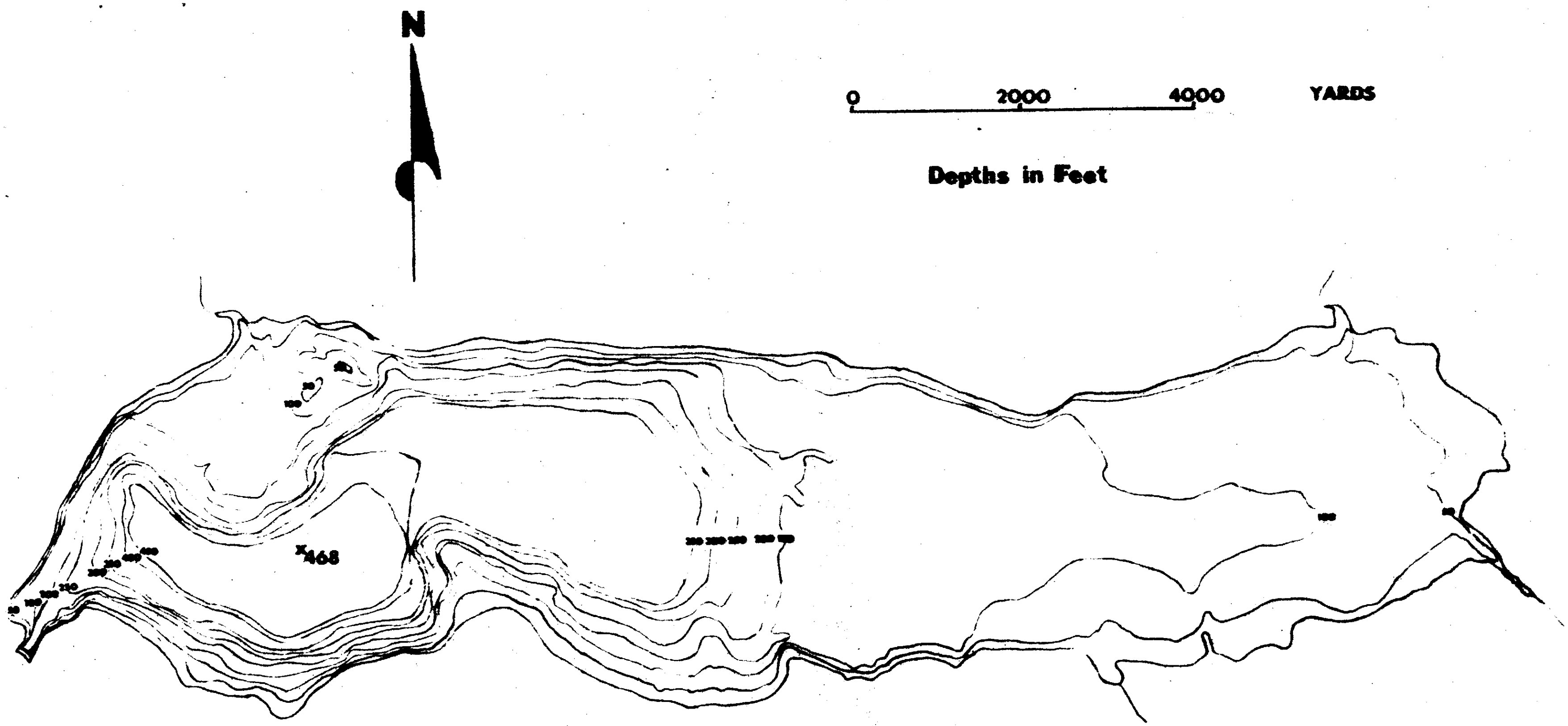
VOLUME – 9528.32 Acre Feet

11.75×10^6 Cu Meters

MAXIMUM DEPTH – 50 Meters

MEAN DEPTH – 23 Meters

Figure 2. Bathymetric Map of De Boer Lake.



BLUE LAKE

57°04'30"N 135°10'W

AREA - 1329.83 Acres

VOLUME - 2.28x10^5 Acre Feet

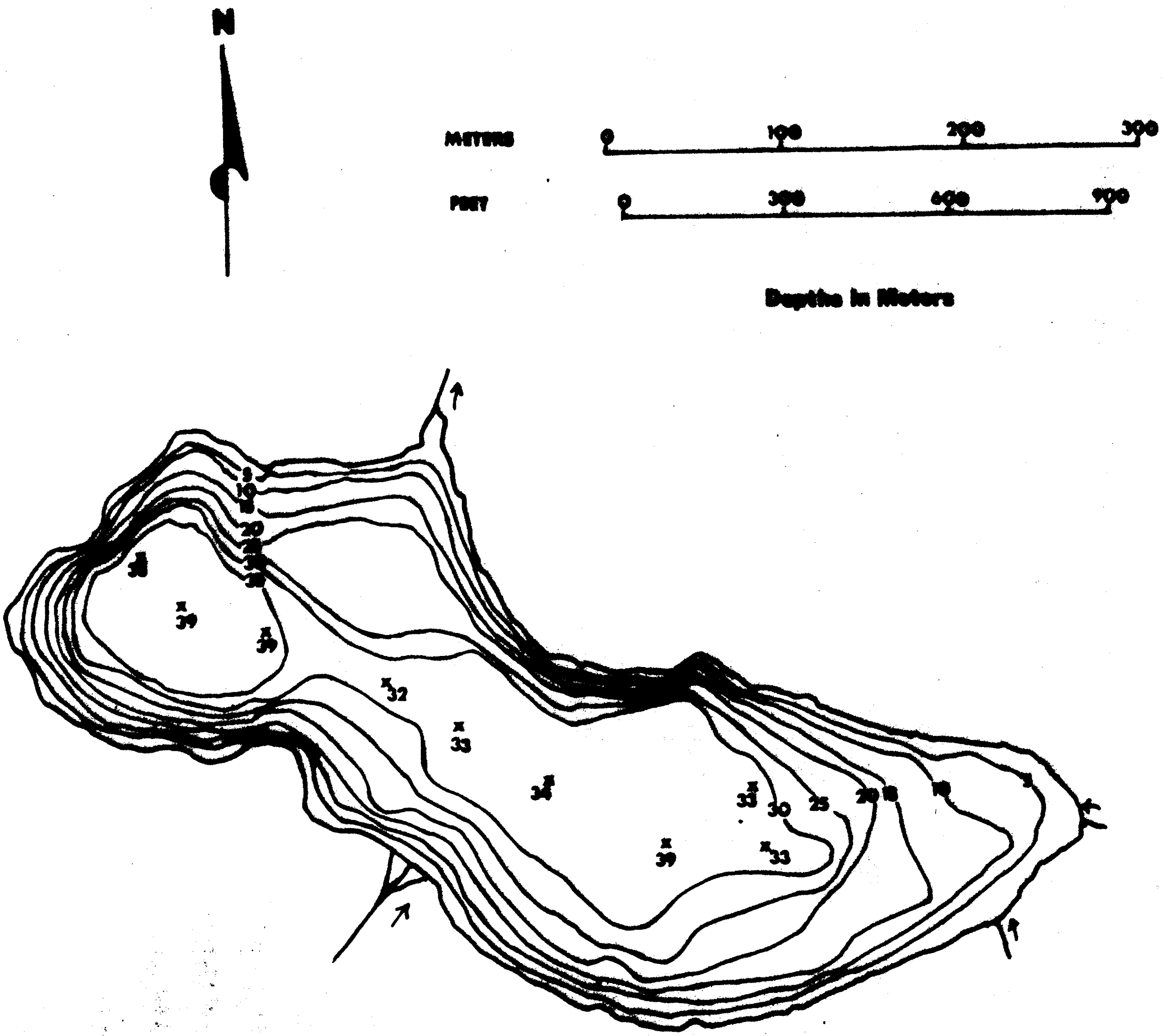
2.81x10^8 Cu. Meters

MAXIMUM DEPTH - 468 Feet

MEAN DEPTH - 171 Feet

Traced from Bureau of Reclamation Map of Blue Lake Project.

Figure 1. Bathymetric Map of Blue Lake.



LUDVIK LAKE

56°22'40"N 134°42'00"W

AREA - 23.95 Acres

VOLUME - 1646.26 Acre Feet

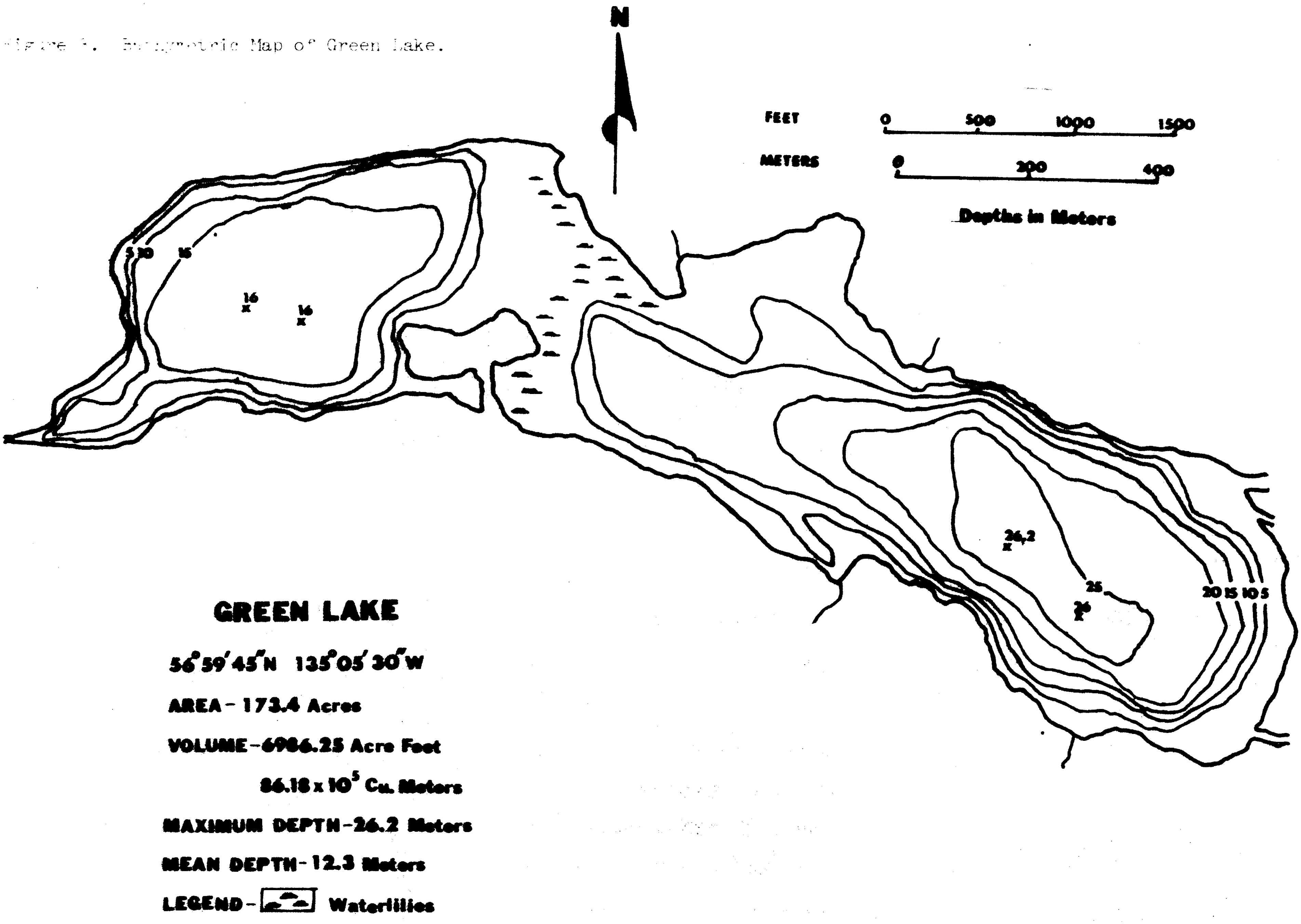
20.3×10^5 Cu Meters

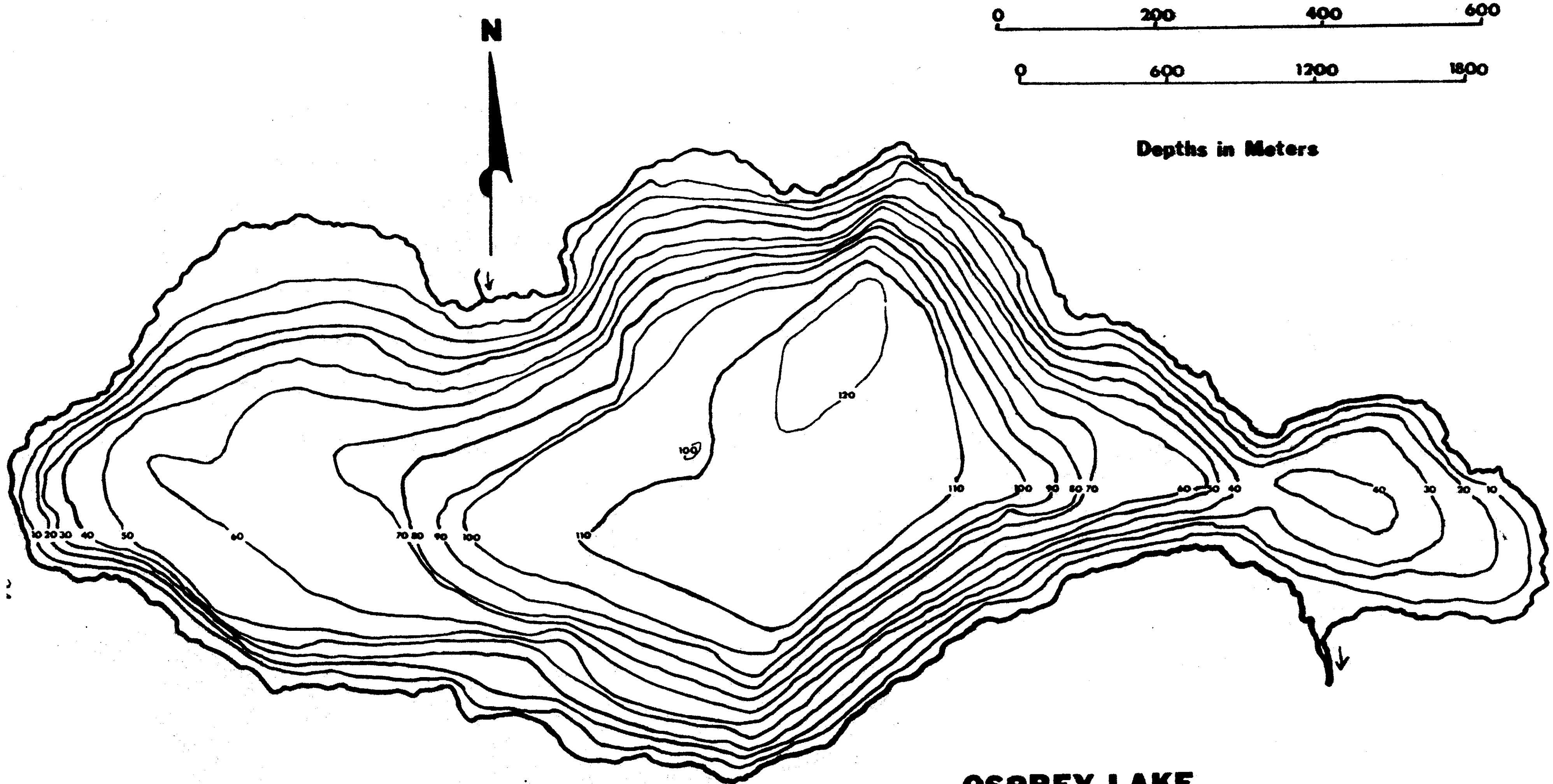
MAXIMUM DEPTH - 39 Meters

MEAN DEPTH - 21 Meters

Figure 4. Bathymetric Map of Ludvik Lake.

Figure [illegible]. Bathymetric Map of Green Lake.





OSPREY LAKE

56°24′N 134°40′W

AREA – 185.72 Acres

VOLUME – 3.65×10^4 Acre Feet

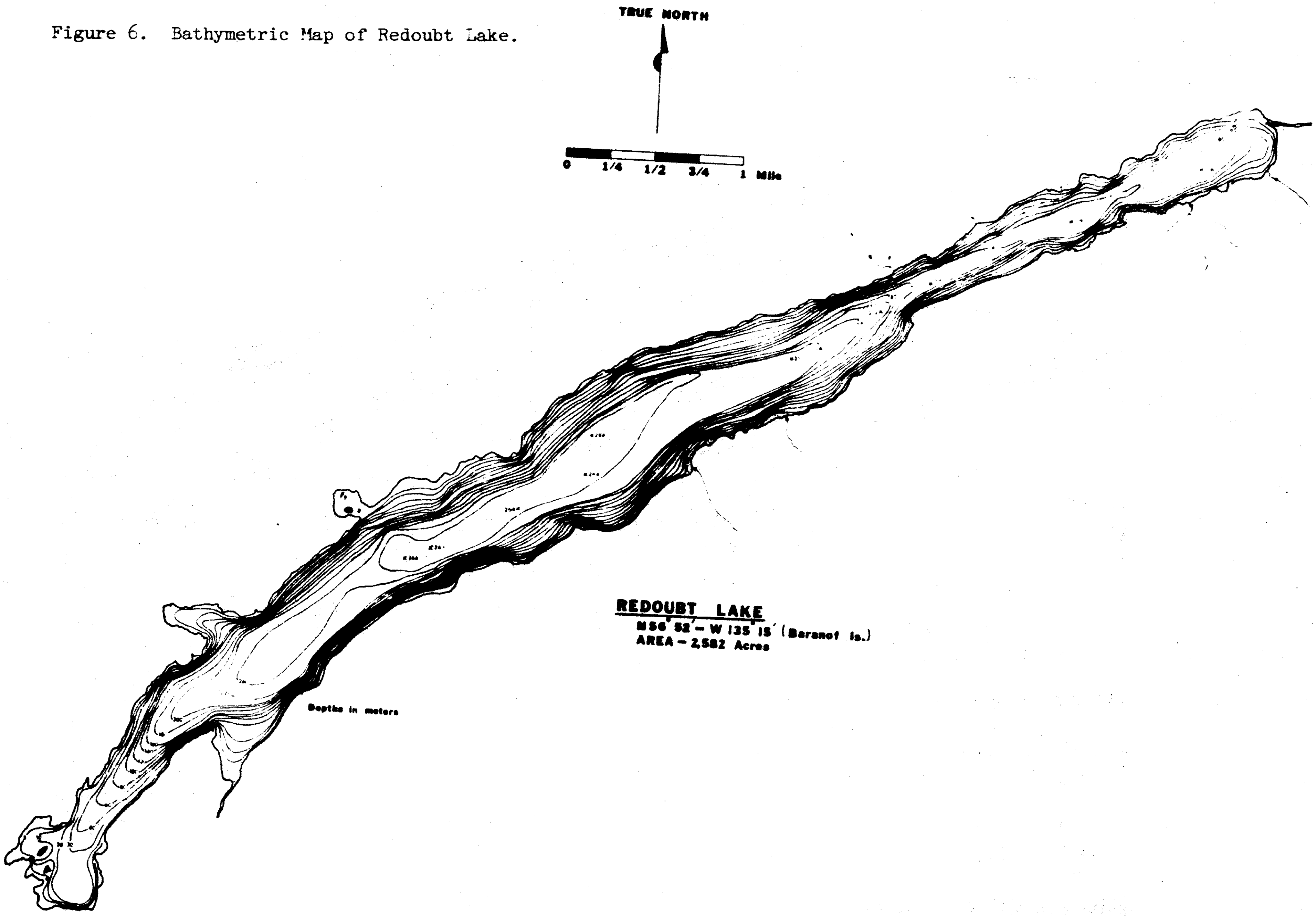
4.5×10^7 Cu. Meters

MAXIMUM DEPTH – 120 Meters

MEAN DEPTH – 60 Meters

Figure 5. Bathymetric Map of Osprey Lake.

Figure 6. Bathymetric Map of Redoubt Lake.



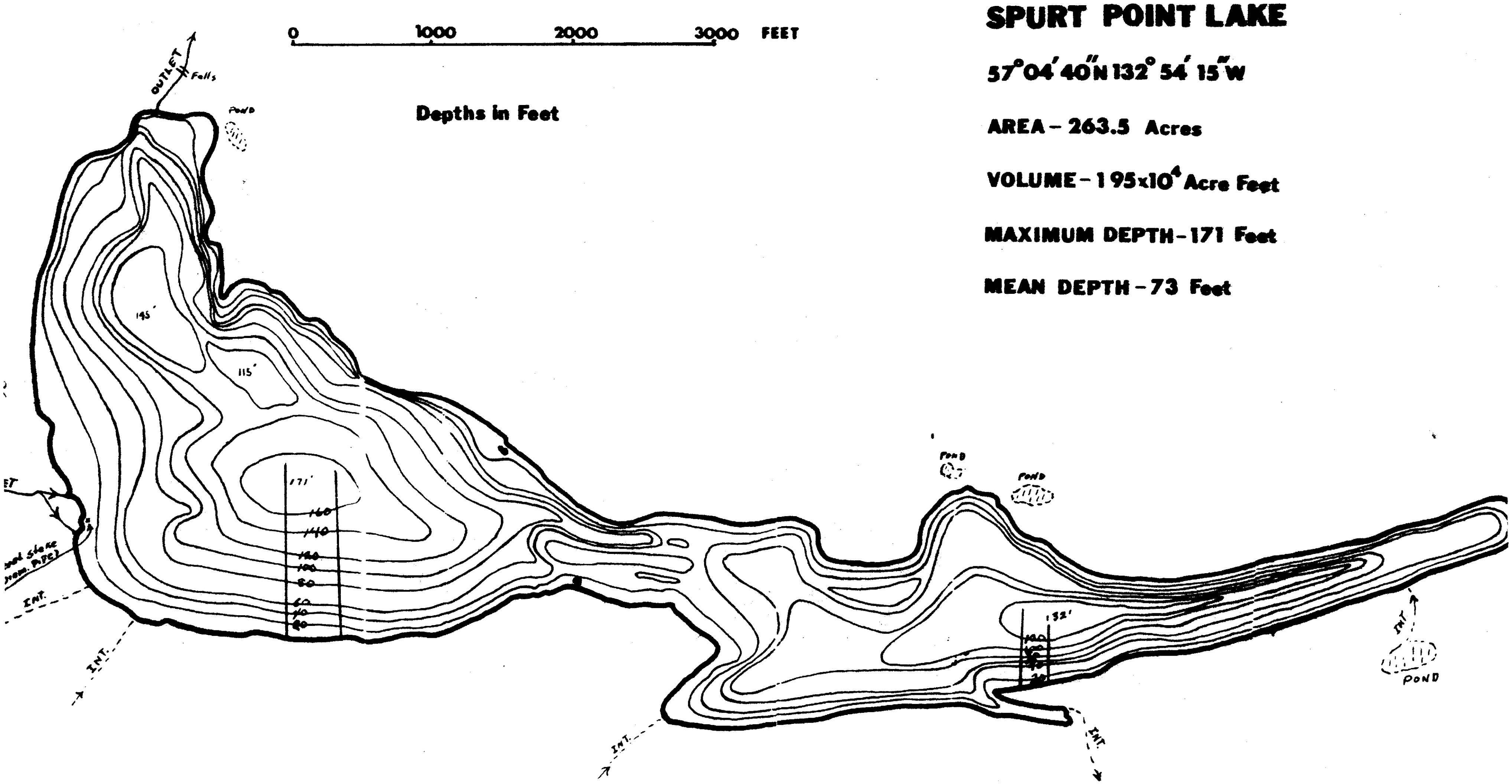


Figure 7. Bathymetric Map of Spurt Lake.

Photoreduced from Bathymetric Map
Drawn by Herbart and Andrews (1965).

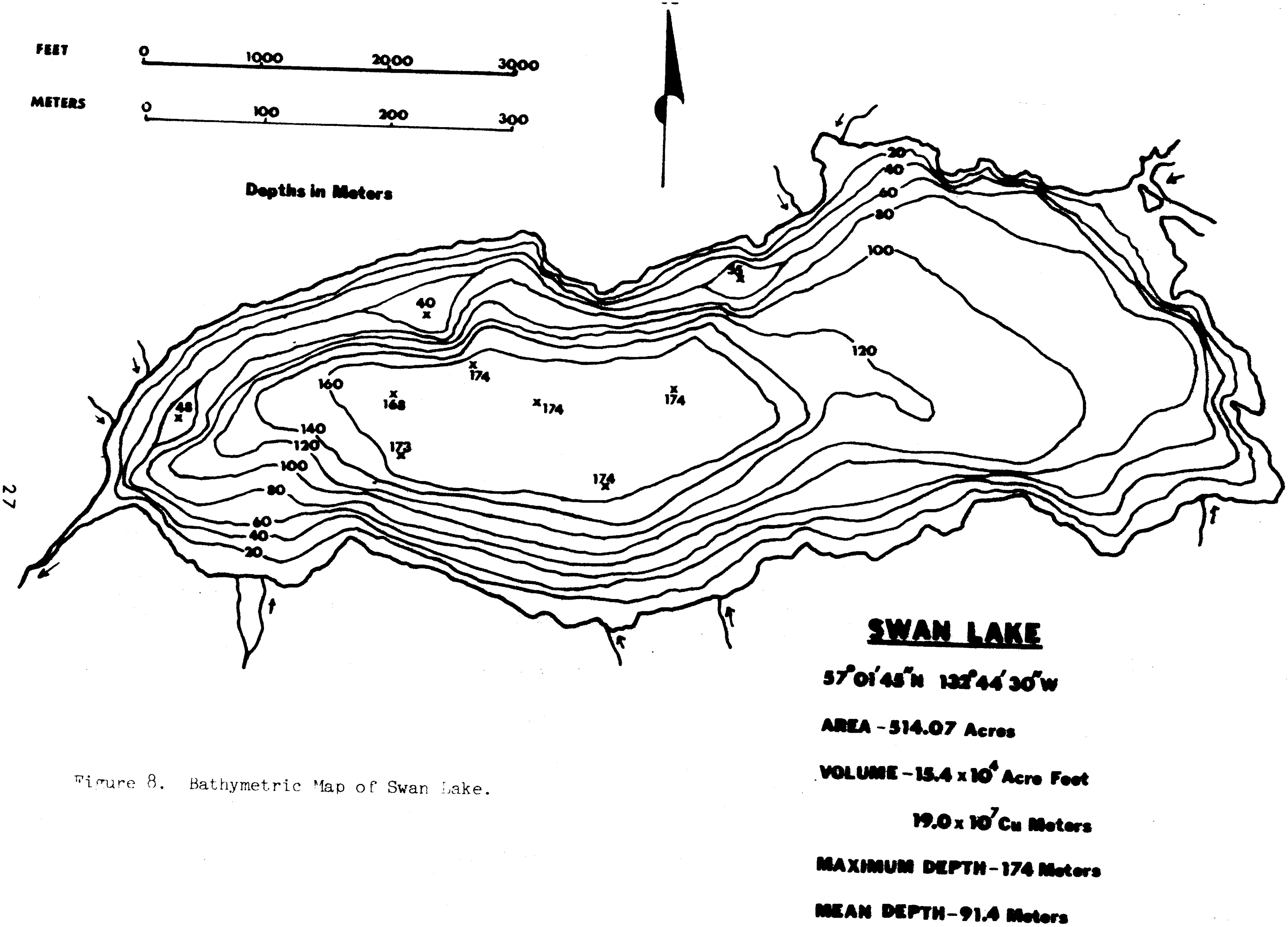


Figure 8. Bathymetric Map of Swan Lake.

Figure 9. Thermal Profile, Auke Lake, May 22 - October 8, 1974

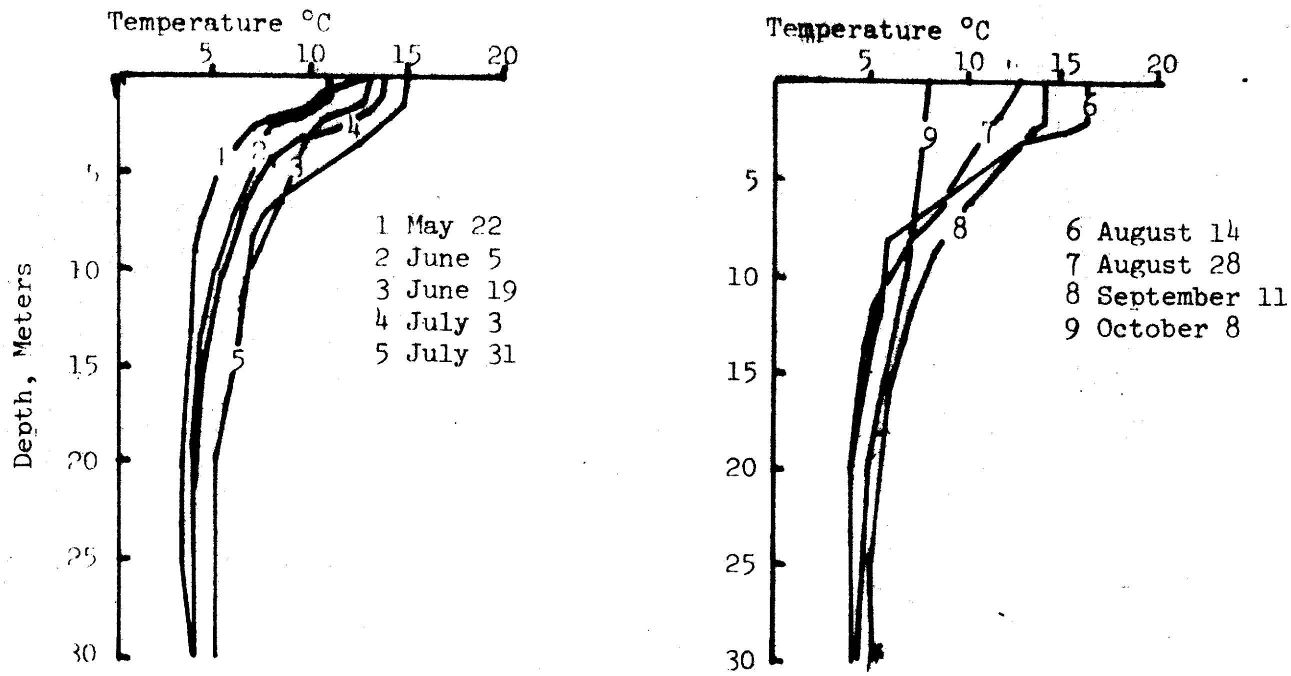


Figure 10. Thermal Profile, Blue Lake, May 22 - October 8, 1974.

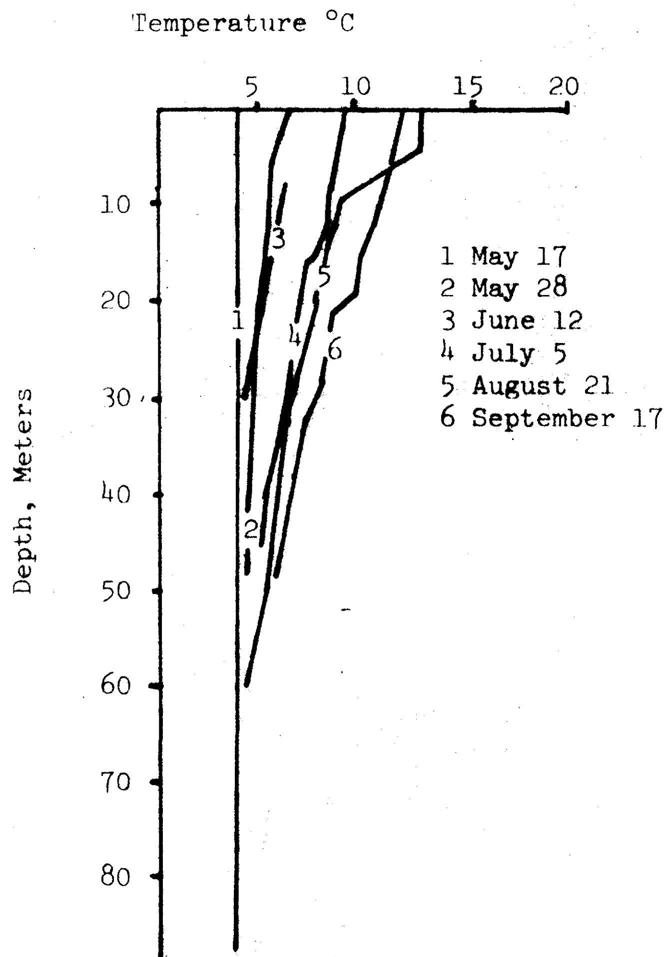


Figure 11. Thermal Profile De Boer Lake, July 12 - September 9, 1974

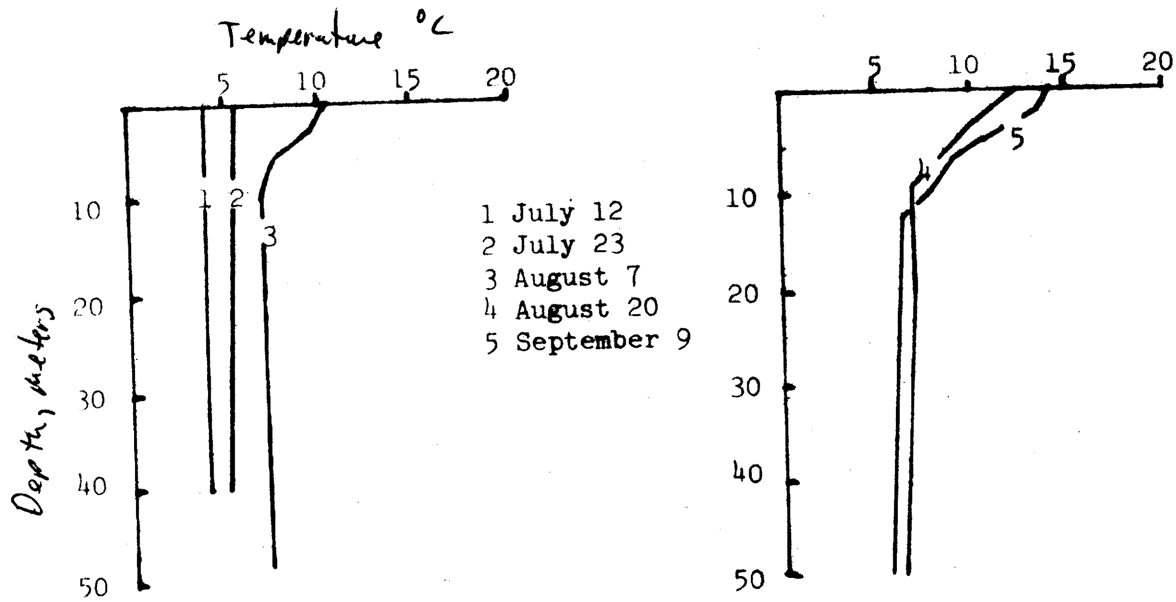


Figure 12. Thermal Profile, Green Lake, May 15 - August 22, 1974.

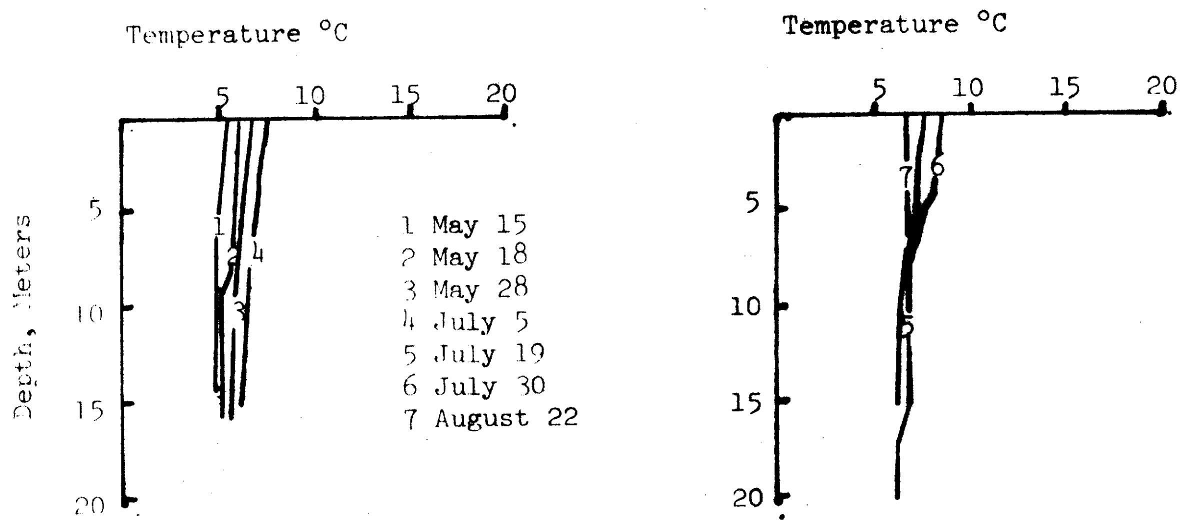


Figure 13. Thermal Profile, Osprey Lake, May 30 - September 4, 1974.

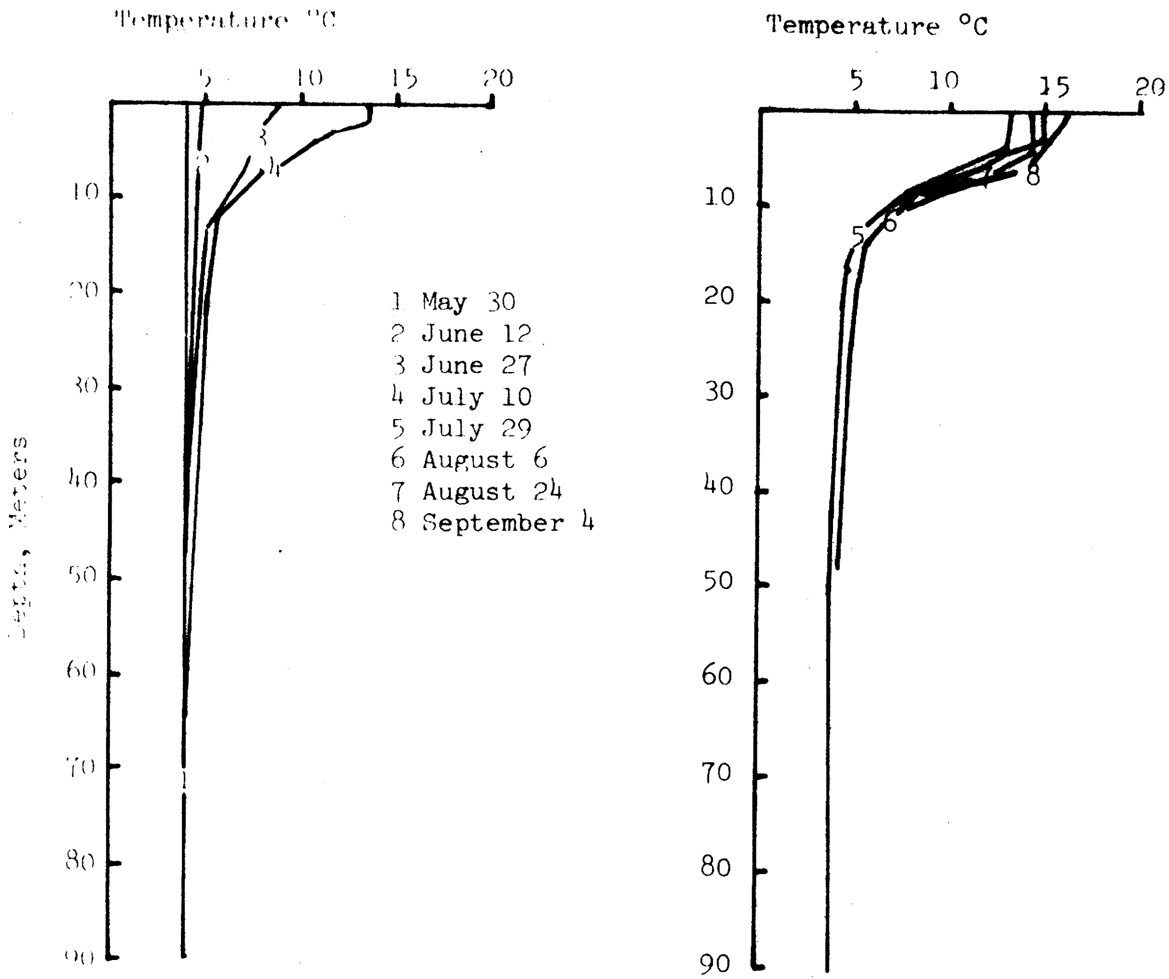


Figure 14. Thermal Profile, Redoubt Lake, April 8 - September 17, 1974.

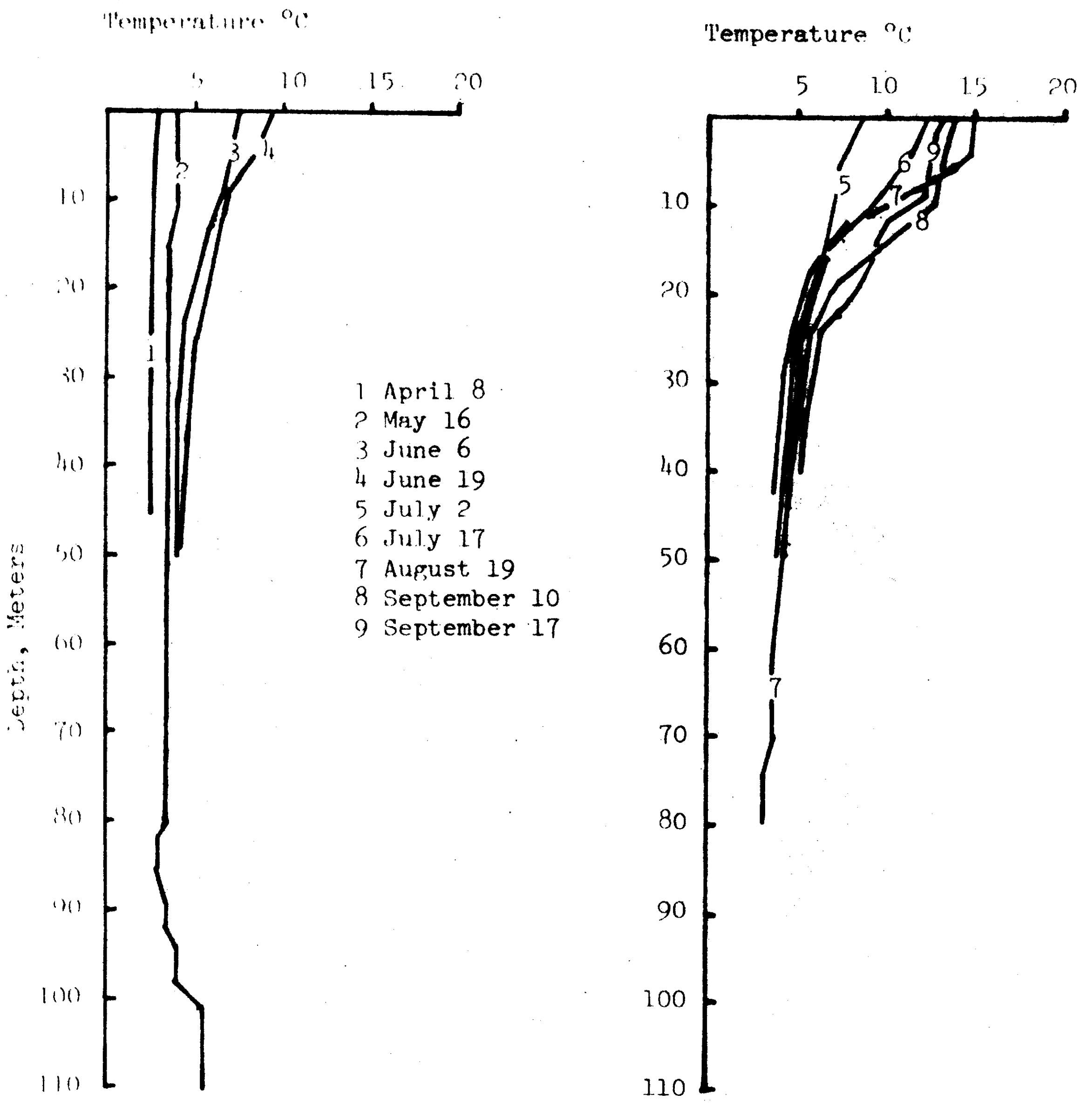


Figure 15. Thermal Profile, Spurt Lake, June 22 - September 27, 1974.

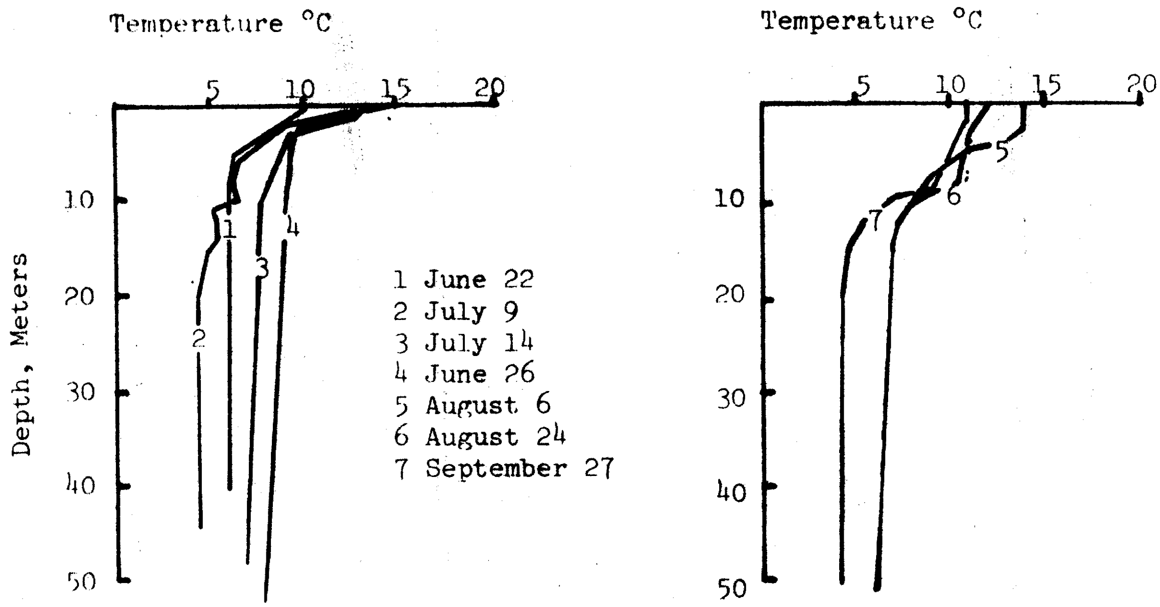


Figure 16. Thermal Profile, Swan Lake, July 2 - September 29, 1974.

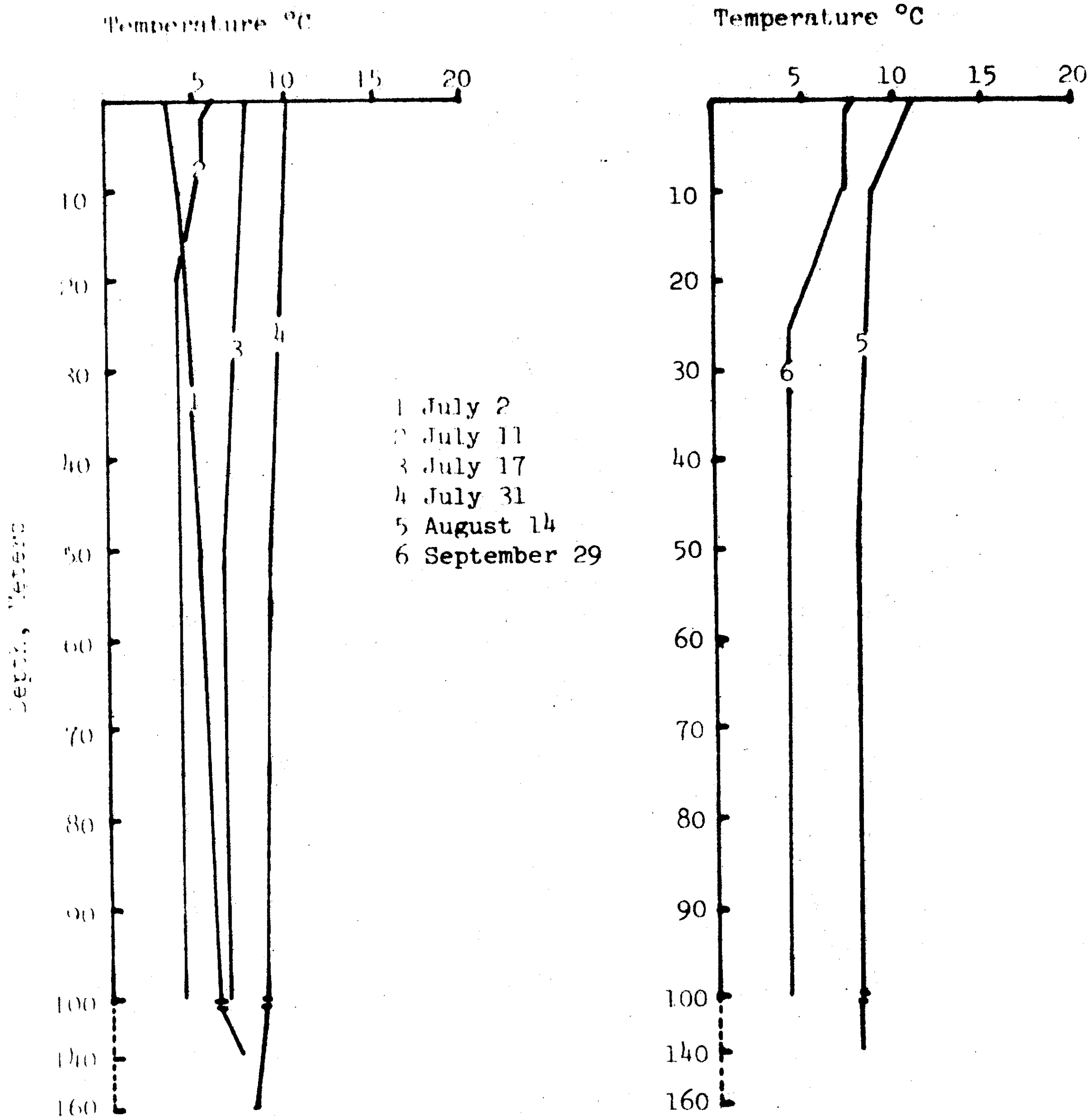


Figure 17. Secchi Disc Visibility of Lakes Studied, 1974. (in part)

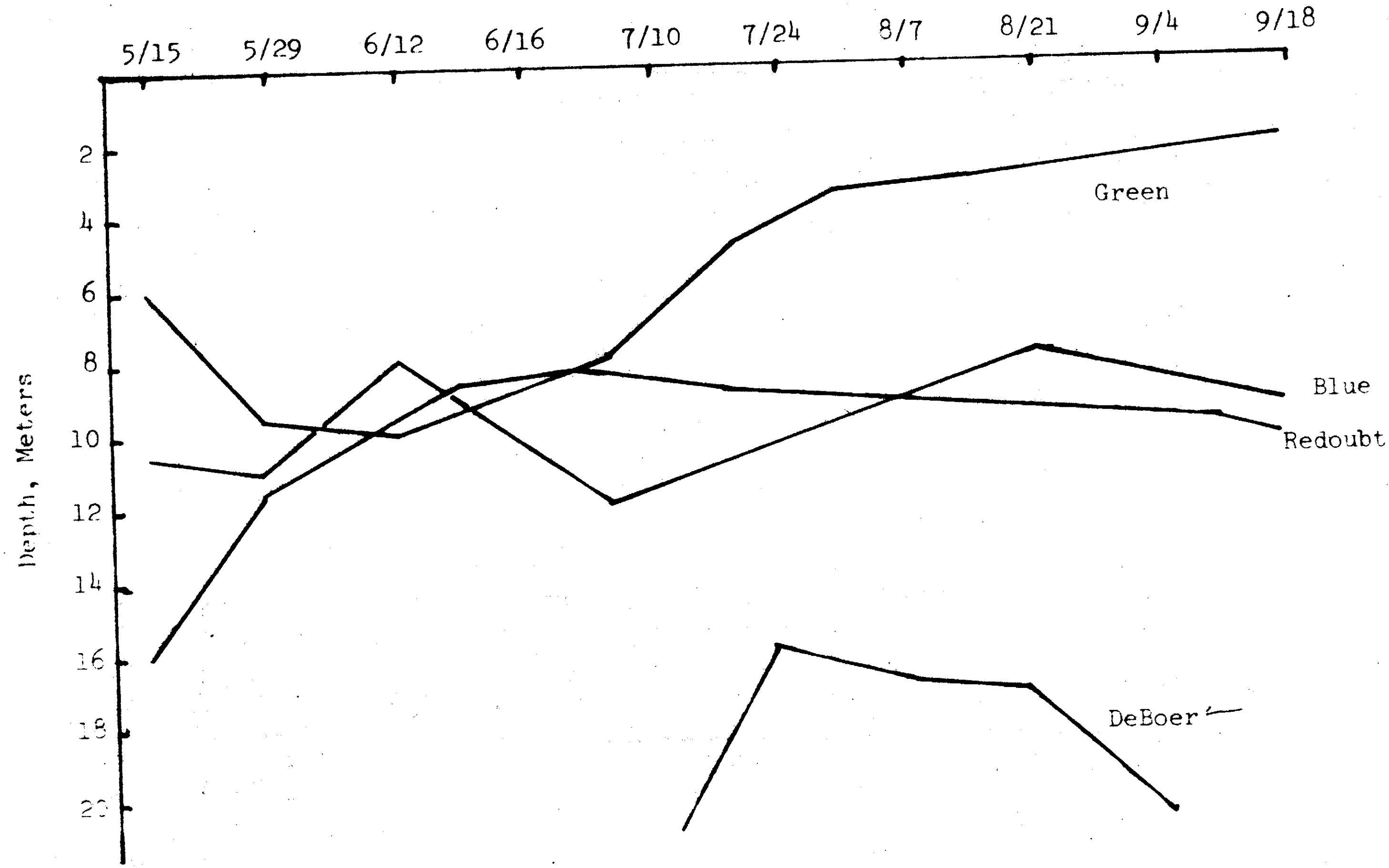
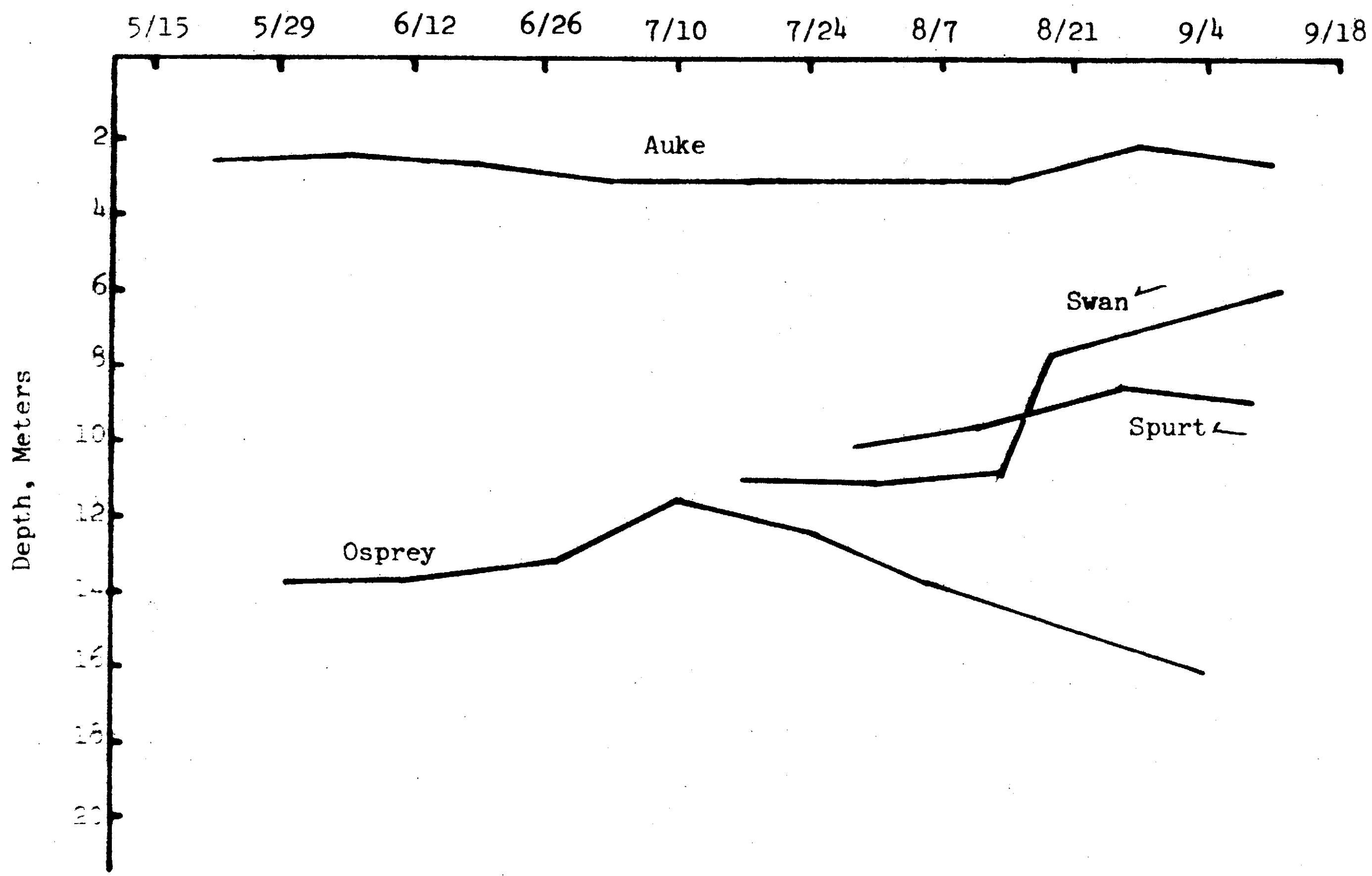


Figure 17. (Cont.) Secchi Disc Visibility of Lakes Studied, 1974.



Recent geologic uplift has probably transformed Redoubt from a fiord to a large meromictic lake. The extreme depth of Redoubt (264 m) is nearly identical to that of the fiord-like inlets nearby. The surface of Redoubt is now about 4 feet above high tide.

Changes which Redoubt has probably gone through include a period of existence as a productive estuary with a fresh water lens. This would have been ideal for rearing sockeye and coho salmon. The lake is no longer influenced by tidal action, and the density barrier between fresh and salt water has strengthened. The lower portion of the lake is now an anaerobic nutrient trap which has limited the productive capacity of the lakes. Plankton populations are sparce, as are indigenous fish populations.

This same sequence of events appears to be occuring in other lakes along the outer coast. Surge Lake on Yakobi Island (Schmidt, 1974), now has a significant run of sockeye salmon, estimated 20,000, and is open to influence of extreme high tides. Stagnation is developing in the lower end of the lake at this time.

Quantitative analyses of ions present and concentrations of nutrients for each lake surveyed are summarized in Table 10.

Alkalinity:

Alkalinity is usually imparted by hydroxide, carbonate, and bicarbonate. Hydroxide and carbonate alkalinity were not found in any of the lakes studied. Bicarbonate alkalinity occurred in small quantities.

Ball (1948), Carlander (1955), and Turner (1960) found that lakes with high alkalinities usually have higher standing crops of fish than do lakes with low alkalinities. Moyle (1946) states that where alkalinity is above 40 mg/l there seems to be no relationship between increased carbonate and yield. All lakes investigated during this study had less than 15 mg/l alkalinity, again suggesting limited productivity.

Hardness:

Total hardness measures the divalent cations capable of reacting with soap to form precipitates. The principal divalent cations are calcium and magnesium. Temporary hardness or alkalinity are indicators of the carbonate and bicarbonate content of waters expressed as calcium carbonate. Since alkalinity is an indicator of productivity in aquatic ecosystems, it has been discussed separately. Non-carbonate hardness (total hardness - alkalinity) is considered to be primarily due to sulfates, chlorides, and nitrates of the metallic ions causing hardness.

Calcium and Magnesium:

These two elements usually constitute the most abundant ions in fresh waters. Calcium is usually the most abundant of these two ions. Reid (1961) stated that in soft waters calcium makes up, on the average, about 48% and magnesium about 14% of the total cations present. In average hard waters the proportion of magnesium to calcium increases, giving approximately 53% calcium and 34% magnesium.

Moyle (1946) indicated that calcium is not a critical factor in the productivity of waters having a total alkalinity greater than 15 ppm. Gerloff, Fitzgerald, and Skoog (1950) found that calcium concentrations of 9.8 ppm and magnesium concentrations of 0.13 ppm allowed for optimum growth of *Coccochloris peniocystis*.

Sodium and Potassium:

Sodium and potassium concentrations usually follow calcium and magnesium in waters of open river systems. Reid (1961) stated that where sodium and potassium occur in low concentrations the proportion of sodium is only slightly greater than that of potassium. As the total content of both increases, the concentration of sodium greatly exceeds that of potassium. The only lake with a significant amount of these elements is Redoubt.

Chloride and Sulfate:

Moyle (1946) stated that high concentrations of sulfates and chlorides usually occur together. It has long been known that high concentrations of chlorides are related to plant distribution. This may be an osmotic effect since Gerloff, et al. (1950) demonstrated that there are optimum osmotic concentrations for plants.

Sulfate is important in natural waters in many ways. Sulfur is an essential component of protoplasm and is necessary for plant growth. Lack of sulfate can inhibit development of phytoplankton populations thus limiting production. (Reid, 1961). Moyle (1945) pointed out that there is a noticeable biological relationship between concentration of sulfates and distribution of aquatic plants in Minnesota.

Nitrogen and Phosphorous:

Nitrogen and phosphorous are essential to living organisms due to their role in protein metabolism and energy transfer. Of all the elements present in living organisms, phosphorous is likely to be the most important ecologically; it is more likely to limit production than any other element. Sawyer (1945) stated that nitrogen is often considered the element which determines the extent of biological productivity, and phosphorous is often considered the governor of the "biological machine" which controls the rate of changes. Combined nitrogen in water exists as inorganic compounds (ammonia, nitrate, and nitrite) and organic compounds. Phosphorous is known to occur in several forms. Those of greater concern in natural waters are soluble phosphate phosphorous, soluble organic phosphorous (Reid, 1961).

Sawyer (1944) concluded that any lake showing concentrations in excess of 0.01 ppm of inorganic phosphorous and 0.30 ppm of inorganic nitrogen at the time of spring turnover could be expected to produce algal blooms of such density as to cause nuisance.

Table 10. Water Quality and Nutrient Analysis of Selected Southeast Alaska Lakes, 1974. (in part)

leave off

LAKE AND DATE	Depth (m)	Oxygen Diss. (mg/l)	pH (units)	Phosphate (mg/l) Ortho Diss. AS P	Ortho Diss.	Total AS P	Potassium Diss. (mg/l)	Dis Calc Sum (mg/l)	Residue Dis. Ton/Aft	Dis. 180C (mg/l)	S A R	Seston ASH WT (mg/l)	DRY WT (mg/l)	Silica Diss. (mg/l)	Sodium Diss. (mg/l)	Sodium Percent	Sulfate Diss. (mg/l)	Turbidity Total (JTU)	Vanadium Total (ug/l)	Temp. (°C)	Zinc Total (ug/l)
Auke																					
May 22, 1974	0.3*	11.4	6.9	0.10	0.30	0.01	0.2	21	0.03	21	0.1	1.2	1.3	2.2	1.1	16	3.6	0.9	0.9	10.5	20
	2.4	11.5	6.8	0.10	0.30	0.01	0.2	19	0.02	18	0.1	1.8	2.2	2.2	1.1	17	2.9	0.9	0.9	7.0	30
Blue																					
May 17, 1974	11.9	12.9	6.9	0.00	0.00	0.01	0.5	25	0.04	27	0.2	0.7	0.7	1.8	1.6	15	3.4	0	5.7	4.0	50
August 21, 1974	3.0	10.8	6.8	0.00	0.00	0.00	0.4	21	0.03	20	0.2	0.7	1.2	1.4	1.5	21	4.6	0	ND	13.5	ND
	14.9	11.6	6.6	0.00	0.00	0.01	0.4	19	0.02	13	0.2	1.0	1.0	1.3	1.5	22	3.2	0	ND	8.0	ND
DeBoer																					
July 9, 1974	0.2*	10.2	6.4	0.00	0.00	0.00	0.3	13	0.01	8	0.1	ND	ND	1.5	0.4	9	1.6	1	ND	4.0	30
Green																					
May 18, 1974	0.6*	12.4	6.9	0.00	0.00	0.01	0.8	28	0.04	29	0.2	0.4	0.6	2.6	1.9	19	3.9	0	5.9	6.0	230
	7.9	12.6	6.9	0.00	0.00	0.01	0.6	28	0.04	27	0.2	0.4	0.6	2.5	1.8	19	4.8	0	5.2	5.0	90
August 22, 1974	0.3*	12.0	6.5	0.00	0.00	0.00	0.5	16	0.02	12	0.2	1.2	1.6	1.5	1.5	26	2.6	0	ND	8.0	ND
	4.9	12.1	6.7	0.00	0.00	0.00	0.4	17	0.01	10	0.1	1.2	1.4	1.5	0.8	14	2.8	0	ND	7.0	ND
Osprey																					
May 30, 1974	0.2	12.5	5.8	0.01	0.03	0.00	0.3	12	0.02	16	0.6	0.0	0.2	1.1	2.6	58	1.4	0.2	ND	4.1	30
	0.5*	12.5	5.8	0.00	0.00	0.00	0.3	12	0.02	15	0.5	ND	ND	1.1	2.2	54	1.6	0.2	ND	4.2	10
August 23, 1974	0.3*	10.1	6.3	0.00	0.00	0.00	0.6	18	0.01	7	1.1	0.1	0.5	0.7	4.6	70	0.9	0	ND	15.5	ND
	4.0	10.4	6.4	0.00	0.00	0.00	0.2	10	0.00	3	0.3	0.0	0.3	0.6	1.8	40	1.0	0	ND	14.5	ND
	14.5	12.3	6.1	0.00	0.00	0.19	0.2	16	0.01	7	0.2	0.1	0.4	0.8	1.9	23	2.5	0	ND	5.0	ND
Redoubt																					
May 16, 1974	0.2*	13.2	7.0	0.00	0.00	0.01	1.7	126	0.18	135	3.0	ND	ND	2.1	35.0	73	9.0	0	2.0	4.0	10
	16.4	13.0	7.0	0.01	0.03	0.01	1.8	127	0.25	184	3.0	0.1	0.3	2.2	36.0	73	11.0	0	2.0	3.5	0
	99.1	0.0	7.0	0.01	0.03	0.01	9.4	1380	1.78	1310	19.0	ND	ND	3.0	530.0	88	82.0	0	4.5	5.0	1000
August 19, 1974	0.3*	10.5	6.7	0.00	0.00	0.06	1.3	84	0.12	91	2.3	0.2	0.6	1.7	22.0	71	6.3	ND	ND	15.0	ND
August 20, 1974	5.8	10.6	7.2	0.00	0.00	0.06	1.2	79	0.11	83	2.0	0.2	0.5	1.7	20.0	68	6.1	0	ND	14.0	ND
	29.9	10.5	7.0	0.00	0.00	0.07	1.8	121	0.17	126	2.8	0.2	0.6	2.1	33.0	72	8.4	0	ND	5.0	ND
	99.1	0.0	7.3	0.37	1.10	0.35	200.0	19500	27.70	20400	44.0	ND	ND	16.0	6000.0	77	1000.0	62	ND	4.0	ND
	109.1	0.0	7.3	0.68	2.10	0.90	240.0	22800	32.60	24000	47.0			19.0	6900.0	77	1200.0	55		8.0	
	123.7	0.0	7.3	1.00	3.10	1.40	250.0	22800	34.10	25100	48.0	ND	ND	20.0	7000.0	78	1100.0	1		9.0	
Spurt																					
July 9, 1974	0.3*	11.4	6.3	0.00	0.00	0.00	0.5	13	0.02	14	0.1	0.2	0.8	1.6	0.4	12	1.8	1	ND	12.0	30
	0.9	10.5	6.3	0.00	0.00	0.00	0.3	11	0.02	13	0.1	0.0	0.0	1.6	0.4	12	1.9	1	ND	14.5	30
	10.0	12.1	6.1	0.00	0.00	0.01	0.3	12	0.00	1	0.1	0.0	0.0	1.8	0.5	14	1.8	1	ND	5.5	30
September 26, 1974	0.6*	10.8	6.4	0.01	0.03	0.10	0.1	17	0.02	18	0.3	0.4	0.6	1.9	2.1	28	5.4	ND	ND	12.0	20
September 27, 1974	7.9	12.0	6.0	0.01	0.03	0.06	0.1	15	0.02	15	0.3	0.2	2.4	1.7	1.9	30	3.5	ND	ND	9.9	20
Swan																					
July 11, 1974	0.9	11.5	6.6	0.00	0.00	0.00	0.4	17	0.02	17	0.1	0.3	0.5	2.0	1.0	13	1.5	1	ND	6.5	20
	0.9*	11.5	6.7	0.01	0.03	0.00	0.3	15	0.02	17	0.1	0.4	0.7	2.1	0.5	9	1.6	1	ND	5.5	10
September 28, 1974	0.6*	11.6	6.5	0.00	0.00	0.01	0.1	16	0.01	9	0.3	1.9	2.1	1.4	1.9	27	4.5	ND	ND	6.9	10
	4.0	12.0	6.3	0.00	0.00	0.01	0.0	16	0.02	13	0.2	0.9	1.1	1.3	1.8	26	4.5	ND	ND	7.2	70

* Sample taken at lake outlet.
** ND - Not Determined.

Table 10. (Cont) Water Quality and Nutrient Analysis of Selected Southeast Alaska Lakes, 1974.

LAKE AND DATE	Depth (m)	Alkalinity ($CaCO_3$) (mg/l)	Aluminum Total (ug/l)	Bicarbonate HCO_3 (mg/l)	Boron Total (ug/l)	Calcium Diss. (mg/l)	CO_2 (mg/l)	Carbon Total Org. (mg/l)	Chloride Diss. (mg/l)	Cobalt Total (mg/l)	Color	Conductivity (micromhos)	Copper Total (ug/l)	Fluoride (mg/l)	Hardness (mg/l) Total (Mg/l)	Hardness (mg/l) Noncarbonate	Iron Diss. (ug/l)	Magnesium Diss. (mg/l)	Manganese Diss. (mg/l)	Molybdenum Total (ug/l)	Nitrogen (mg/l) NH_4 AS N Total	Nitrogen (mg/l) Total AS N	Nitrogen (mg/l) Total AS NO_3	Nitrogen (mg/l) Total ORG N	Nitrogen (mg/l) Total KJD AS N	Nitrogen (mg/l) NO_2+NO_3 AS N Total
Auke																										
May 22, 1974	0.3*	11	100	14	70	4.1	4.5	4.2	1.7	50	40	28	20	0.0	13	1	200	0.6	80	0	0.08	0.40	1.80	0.30	0.38	0.2
	2.4	11	100	13	20	3.6	4.2	4.2	1.8	50	40	28	4	0.0	11	0	240	0.5	100	0	0.08	0.35	1.60	0.26	0.34	0.1
Blue																										
May 17, 1974	11.9	12	100	11	110	6.9	3.0	2.1	2.6	50	3	43	10	0.0	18	6	30	0.3	40	0	0.03	0.24	1.10	0.03	0.06	0.18
August 21, 1974	3.0	ND**	ND	8	4	4.2	ND	ND	2.4	ND	1	30	10	0.0	12	2	20	0.4	10	ND	0.06	0.13	0.58	0.00	0.06	0.07
	14.9	ND	ND	10	4	4.0	ND	ND	2.0	ND	2	27	10	0.0	11	0	20	0.2	10	ND	0.07	0.15	0.66	0.00	0.07	0.08
DeBoer																										
July 9, 1974	0.2*	9	300	11	5	2.2	7.0	2.3	1.1	50	2	13	10	0.0	8	0	20	0.6	0	0	0.05	0.12	0.53	0.03	0.08	0.04
Green																										
May 18, 1974	0.6*	14	100	13	110	5.9	3.4	1.6	3.0	50	7	49	10	0.0	17	3	80	0.5	10	1	0.02	0.20	0.89	0.02	0.04	0.16
	7.9	14	100	16	120	5.7	3.4	2.0	3.4	50	8	47	100	0.0	16	2	80	0.5	0	0	0.06	0.24	1.10	0.00	0.06	0.18
August 22, 1974	0.3*	ND	ND	10	3	3.5	ND	ND	1.7	ND	2	31	10	0.0	9	1	20	0.0	0	ND	0.02	0.07	0.31	0.02	0.04	0.03
	4.9	ND	ND	10	4	3.6	ND	ND	1.5	ND	2	29	10	0.0	11	1	40	0.4	0	ND	0.02	0.09	0.40	0.00	0.02	0.07
Osprey																										
May 30, 1974	0.2	3	0	2	30	1.0	1.0	ND	3.2	50	8	22	10	0.0	4	0	50	0.3	20	0	0.04	0.26	1.20	0.16	0.20	0.06
	0.5*	3	0	3	60	1.0	0.4	1.5	3.2	50	8	21	10	0.0	4	0	30	0.3	30	0	0.05	0.27	1.2	0.16	0.21	0.06
August 23, 1974	0.3*	ND	ND	4	4	1.4	ND	5.4	3.2	ND	2	18	10	0.0	4	0	60	0.0	0	ND	0.03	0.11	0.49	0.01	0.04	0.07
	4.0	ND	ND	4	20	1.9	ND	5.6	1.9	ND	4	16	10	0.0	6	2	30	0.2	0	ND	0.03	0.09	0.40	0.03	0.06	0.03
	14.5	ND	ND	4	4	5.2	ND	1.4	3.6	ND	3	21	10	0.0	13	10	20	0.1	0	ND	0.03	0.13	0.58	0.05	0.08	0.05
Redoubt																										
May 16, 1974	0.2*	8	100	7	120	3.3	4.0	2.6	65	50	5	283	10	0.1	26	18	20	4.4	0	1	0.04	0.12	0.53	0.02	0.06	0.06
	16.4	8	100	7	220	3.2	1.6	1.8	63	50	7	292	20	0.0	27	18	10	4.5	0	0	0.04	0.31	1.40	0.20	0.24	0.07
	99.1	33	100	37	410	11.0	6.4	2.4	690	50	8	3,160	30	0.2	150	110	50	29.0	490	1	0.34	0.38	1.70	0.00	0.34	0.04
August 19, 1974	0.3*	ND	ND	7	30	2.7	ND	ND	42	ND	2	172	10	0.0	17	9	50	2.6	0	ND	0.29	0.31	1.40	0.00	0.30	0.01
August 20, 1974	5.8	ND	ND	13	230	3.0	ND	2.2	38	ND	3	162	10	0.0	19	9	20	2.9	0	ND	0.10	0.15	0.66	0.03	0.13	0.02
	29.9	ND	ND	10	50	3.3	ND	1.4	63	ND	6	237	10	0.0	26	18	20	4.3	0	ND	0.45	0.54	2.4	0.02	0.47	0.07
	99.1	ND	ND	635	550	240	ND	9.8	11,000	ND	50	27,000	10	0.5	3600	3000	50	72.0	730	ND	0.10	8.90	39.0	8.80	8.90	0.02
	109.1	ND	ND	734	3,400	280	ND	8.9	13,000	ND	90	32,200	20	0.7	4200	3600	40	84.0	300	ND	0.32	7.10	32.0	6.80	7.10	0.04
	123.7	ND	ND	764	3,600	270	ND	ND	13,000	ND	200	32,200	20	0.7	4100	3400	10	82.0	90	ND	0.34	1.90	8.4	1.60	1.90	0.00
urt																										
July 9, 1974	0.3*	8	400	6	7	1.6	8.0	2.1	1.1	50	5	16	10	0.0	6	0	40	0.3	10	0	0.24	0.25	1.10	0.19	0.23	0.02
	0.9	6	300	5	7	2.1	5.6	1.4	1.0	50	5	16	10	0.0	6	0	40	0.2	10	0	0.07	0.29	1.30	0.20	0.27	0.02
	10.0	6	300	5	10	2.1	11.0	ND	1.3	50	7	16	10	0.0	6	0	40	0.2	0	0	0.16	0.20	0.89	0.00	0.15	0.05
September 26, 1974	0.6*	ND	300	7	70	2.3	ND	3.3	0.3	50	20	16	10	0.0	12	6	70	1.5	0	0	0.03	0.23	1.00	0.18	0.21	0.02
September 27, 1974	7.9	ND	100	7	70	2.3	ND	2.2	0.7	50	20	13	10	0.0	9	4	40	0.9	20	0	0.10	0.62	2.70	0.44	0.54	0.08
un																										
July 11, 1974	0.9	10	200	12	10	3.7	4.8	8.0	0.7	50	2	23	10	0.0	14	4	40	0.2	0	0	0.00	0.14	0.62	0.10	0.10	0.04
	0.9*	10	200	12	5	4.0	3.8	4.5	0.6	50	2	24	10	0.0	11	1	30	0.2	0	0	0.00	0.17	0.75	0.09	0.09	0.08
September 28, 1974	0.6*	ND	200	9	110	1.7	ND	1.8	0.1	50	3	16	10	0.0	11	3	10	1.6	10	0	0.02	0.19	0.84	0.16	0.18	0.01
	4.0	ND	200	9	100	2.0	ND	1.6	0.1	50	5	16	10	0.0	11	4	200	1.5	40	0	0.01	0.17	0.75	0.09	0.10	0.07

* Sample taken at lake outlet.
** ND - Not Determined.

Chu (1942) investigated the requirements of algae. Using pure chemicals he found that phosphorous concentrations below 0.05 ppm limited growth. He also found that the nitrogen and phosphorous requirements for different planktonic algae were approximately the same.

The total fish production of Minnesota lakes was shown to rise linearly from 100 to 400 pounds per acre as the phosphorous increased from 0.2 to 1.4 mg/l (Moyle, 1956).

Lackey (1945) has related the production of algal blooms in Wisconsin lakes to the concentrations of nutrients in the water and hence to the amount of sewage entering the lake. Lackey and Sawyer (1945) stated that some of these lakes receive annual dosages of saline nitrogen as high as 422 pounds per acre.

Iron and Manganese:

Iron and manganese may be highly important in certain lakes since most lakes contain relatively small amounts of these elements. Both iron and manganese form the active site of many enzymes and are involved in the photosynthetic process. Manganese is also essential for nitrate assimilation.

Silicon:

Silicon is almost universally present in some form in all natural waters. It is a major nutrient for diatoms and may be a limiting factor since it is normally found in low concentrations in available form.

Plankton:

Concentration of chlorophyll is commonly used as a measure of standing crop of phytoplankton. Since photosynthesis is dependent upon chlorophyll it would seem that primary production could be calculated from chlorophyll content. Steel and Baird (1961) and Ryther (1956) have pointed out many limitations of this method. The more important of these limitations are as follows: 1) chlorophyll measured in water is partly inactive; 2) assimilation numbers (mg carbon assimilated per mg chlorophyll *a* per hour) vary with light intensity, turbidity, and total dissolved solids; 3) there is a diurnal fluctuation in chlorophyll content; 4) the ratio of the chlorophyll components *a*, *b*, and *c* varies in different organisms; and 5) photosynthesis is light adaptive. Consequently, knowledge of chlorophyll content alone cannot provide a basis for productivity estimates. Data concerning chlorophyll *a* concentrations (Table 11) are used as general indices of standing crop of phytoplankton.

Zooplankton populations were monitored throughout the season. Plankton composition, density, and weight are presented for Auke, Blue, De Boer, Green, Osprey (2 basins), Redoubt, Spurt (2 basins), and Swan lakes in Tables 12 through 21 respectively. A comparison of plankton net tows made with number 6 and number 20 Nitex is shown in Table 22.

Table 11. Pigment Concentrations (mg/l) From Lakes Surveyed, 1974.

Pigment Concentrations From Auke Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
May 29	0.3*	3.06	1.73
May 29	2.6	3.79	2.06

Pigment Concentrations From Blue Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
May 17	12.0	0.27	0.12
June 12	8.0	1.15	0.51
July 5	12.0	0.16	0.18
July 11	10.0	0.50	0.22
August 21	0.3	0.55	0.29
	1.0	1.21	0.50
	5.0	0.97	0.44
	10.0	0.53	0.26
	15.0	0.39	0.18
	40.0	0.29	0.17
September 17	9.5	1.26	0.54

Pigment Concentrations From De Boer Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
July 9	0.3*	0.23	0.11
July 11	11.0	0.19	0.10
July 25	14.0	0.37	0.20
August 9	17.0	0.61	0.22
August 20	17.4	0.28	0.22
September 5	20.0	0.26	0.14

Pigment Concentrations From Green Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
May 18	8.0	0.59	0.35
	0.3*	0.74	0.31
June 12	10.0	0.09	0.04
July 5	4.5	0.07	0.04
July 19	13.0	0.13	0.06
July 30	4.5	0.14	0.07
August 22	0.3*	0.17	0.09
	0.3	0.11	0.07
	1.0	0.24	0.14
	5.0	0.19	0.09
	7.5	0.18	0.10
	10.0	0.18	0.10
	15.0	0.16	0.10
September 27	2.5	0.09	0.05

Pigment Concentrations From Redoubt Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
May 16	0.3*	0.48	0.17
June 11	11.0	0.48	0.21
June 30	8.75	70	0.31
July 7	8.0	0.68	0.32
July 18	4.0	0.65	0.32
July 30	4.25	1.22	0.56
August 19	0.3*	0.50	0.29
August 20	0	0.81	0.36
	5	0.59	0.28
	10	0.61	0.31
	15	0.76	0.33
	20	0.48	0.23
	30	0.30	0.15
September 10	10	0.72	0.33

Pigment Concentrations From [illegible] Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
May 30	15.5	0.15	0.07
	0.3*	0.17	0.09
June 11	14.0	0.23	0.10
June 27	14.0	0.30	0.17
July 5	12.5	0.65	0.38
July 11	11.5	0.37	0.17
August 6	14.0	0.52	0.25
August 21	14.0	0.54	0.27
August 23	0.3*	0.26	0.13
	0	0.23	0.13
	5	0.32	0.18
	10	0.33	0.17
	15	0.16	0.07
	15	0.18	0.07
	20	0.13	0.09
	30	0.14	0.08
September 4	14	0.38	0.20

Pigment Concentrations From Swan Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
July 11	0.3*	0.50	0.27
	0.0	0.30	0.14
	1.0	0.32	0.15
	5.0	0.31	0.15
	10.0	0.43	0.20
	15.0	0.41	0.19
July 17	11.0	0.47	0.26
August 1	11.2	0.27	0.14
August 16	10.9	0.26	0.13
August 29	7.0	0.30	0.18
September 12	6.1	0.54	0.31
September 20	0.0	0.65	0.36
	2.0	0.70	0.37
	4.0	0.79	0.37
	6.0	0.79	0.40
	9.0	0.70	0.37
	12.0	0.67	0.36

Pigment Concentrations From Spurt Lake, 1974

Date	Depth (m)	Chlorophyll a (mg/m³)	Phaeopigment
Basin I - North End			
July 9	0.3*	0.46	0.25
	0.0	0.13	0.06
	1.0	0.14	0.07
	4.0	0.28	0.14
	7.0	0.36	0.18
	10.0	0.30	0.15
	15.0	0.06	0.04
July 29	9.4	0.36	0.18
August 11	9.75	0.26	0.13
August 26	8.0	0.26	0.12
September 9	9.75	0.43	0.22
September 26	0.3*	0.46	0.25
	0.0	0.52	0.25
	3.0	0.47	0.23
	6.0	0.40	0.22
	7.0	0.15	0.08
	9.0	0.71	0.30
	17.0	0.08	0.06
	23.0	0.05	0.03
Basin II			
July 29	10.25	0.29	0.15
August 11	9.7	0.20	0.11
September 9	9.1	0.38	0.20
September 26	8.9	0.70	0.36

Table 12. Plankton Composition Density (Organisms Per Square Meter of Furface Area) and Weight (milligrams Per Square Meter) Auke Lake. May 22-- September 25, 1974.

Date	5/22	6/5	6/19	7/3	7/26	8/28	9/25
Depth of Tow (m)	30	30	30	30	30	30	30
Rotatoria							
Keratella	509	1,018		509	2,546	3,565	4,584
Kellicottia	32,085	78,940	180,290	257,703	230,201	80,469	17,825
Asplancha			24,955	22,918	14,769	1,018	3,056
Cladocera							
Daphnia	8,658	12,732	4,074	7,130	16,297	21,900	12,223
Bosmina	509			509	17,316	54,494	31,067
Copepoda							
Calanoida				1,529	509	8,658	6,621
Cyclopoida	74,866	183,346	11,357	26,993	92,691	87,089	44,818
Nauplii	205,245	83,015	28,520	51,439	181,818	126,814	165,011
Dry Weight	267.9	322.9	407.9	252.1	350.9	307.6	287.2
Organic Weight	195.6	286.2	359.0	227.1	286.2	274.0	256.2
Ash Weight	72.3	36.7	48.9	24.9	64.7	33.6	31.0

Table 13. Plankton Composition, Density (organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Blur Lake, May 15 - September 7, 1974

Date Depth of Tow (m)	5/15 80	5/28 80	6/12 80	7/5 85	8/19 80	9/17 90
Rotatoria						
Keratella	0	0	0	509	1528	2037
Kellicottia	7639	16807	2546	3546	61115	22409
Polyarthra	0	0	0	0	2546	0
Conochilus	0	0	0	1018	4074	1018
Cladocera						
Holopedium	0	5092	15279	33613	7130	1528
Daphnia	0	1018	0	509	33613	4074
Bosmina	0	0	0	0	43290	7130
Copepoda						
Calanoida	0	0	2546	4074	1018	509
Cyclopoida	18844	13242	7130	16297	19353	3565
Nauplii	52457	55004	19353	41762	30048	10695
Miscellaneous						
Tabellaria	0	0	0	0	509	0
Coelospherium	0	0	4584	0	509	0
Fragillaria	0	0	0	509	0	0
Dry Weight	62.6		519.5	691.6	375.4	220.5
Organic Weight	47.9		401.3	641.7	336.6	206.3
Ash Weight	14.7		118.2	49.9	38.7	14.3

Table 14. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Deboer Lake, July 12 - September 4, 1974.

Date Depth of Tow (m)	7/12 50	7/23 49	8/8 43	8/20 52	9/4 50
Rotatoria					
Keratella	17825	17825	14260	15278	13743
Kellicottia	7639	15278	11204	6111	8653
Polyarthra	3565	6621	1018	2037	0
Conochilus	12732	26483	16807	56022	6617
Cladocera					
Daphnia	5093	2546	3055	6111	10180
Bosmina	509	0	0	0	0
Holopedium	0	13234	2037	4584	9162
Copepoda					
Calanoida	6620	7639	19353	12732	13234
Nauplii	10695	14769	5093	6621	7635
Miscellaneous					
Coelospherium	1018	0	0	0	0
Tabellaria	1018	0	0	0	0
Fragillaria	0	0	0	509	0
Dry Weight	153.8	140.6	225.5	333.6	461.4
Organic Weight	124.8	114.6	227.6	306.1	425.3
Ash Weight	29.0	26.0	47.9	27.5	36.1

Table 15. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Green Lake, May 15 - September 17, 1974.

Date Depth of tow (m)	5/15 15	5/29 13	6/12 13	7/5 13	7/17 13	7/30 13	8/19 13	9/17 13
Rotatoria								
Keratella	1528	509	1528	2037	2037	5484	0	130888
Kellicottia	2037	0	1528	509	1018	3056	16806	1528
Polyarthra	0	0	0	0	0	1018	0	16297
Conochilus	0	0	0	0	0	0	0	1018
Filinia	0	0	0	0	0	0	0	3565
Cladocera								
Bosmina	1018	0	1018	0	0	0	1018	509
Holopedium	0	0	0	0	0	0	1018	0
Copepoda								
Cyclopoida	0	0	0	0	0	509	509	0
Calanoida	1018	2546	509	0	0	0	0	0
Nauplii	0	509	1018	0	0	509	1508	0
Miscellaneous								
Coelospherium	509	0	15788	0	0	509	0	1018
Tabellaria	3565	0	0	0	0	0	0	0
Fragellaria	0	0	1018	1528	2546	0	1528	2037
Dry Weight	80.5	56.5	22.4	10.2	11.2	28.0	19.4	36.7
Organic Weight	66.2	48.9	14.3	8.6	5.1	19.4	15.3	26.5
Ash Weight	14.3	7.6	8.1	1.5	6.1	8.6	4.1	10.2

Table 16. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Osprey Lake, Basin I, May 31 - September 4, 1974.

Date	5/31	6/12	6/27	7/10	7/25	8/6	8/21	9/4
Depth of Tow (m)	36	36	31	30	30		30	30
Cladocera								
<u>Daphnia</u>	1018		3054	1527	5090		15799	14252
<u>Holopedium</u>				509	509		2036	509
<u>Bosmina</u>		509	1018	1018			3054	1527
Copepoda								
Calanoida	5599	0	39702	36139	20869		24432	12216
Cyclopoida	1018	2545	3565	3563	2036		2545	2545
Nauplii	3563	1527	5599	5090	2036		2545	509
Dry Weight	33.6	16.3	201.2	309.6	397.8		397.8	222.6
Organic Weight	24.9	10.7	187.4	266.4	369.2		369.2	203.2
Ash Weight	8.6	5.6	13.8	43.3	28.5		28.5	19.4

Table 17. Plankton Composition, Density (Organisma Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Osprey Lake, Basin II, May 31 - September 4, 1974.

Date Depth of Tow (m)	5/31 100	6/12 100	6/27 100	7/10 100	7/25 100	8/6 90	8/21 100	9/4 100
Rotatoria								
<u>Kellicottia</u>							1018	1018
Cladocera								
<u>Daphnia</u>	509	1018	3563	2036	4072	6108	14761	16288
<u>Holopedium</u>					2036	5599	2545	2036
<u>Bosmina</u>		1018			8653	5090	7635	4581
Copepoda								
Calanoida	3054	2545	28504	37666	52936	40720	38684	20869
Cyclopodia	3653	5090	509	5090	8144	1527	5090	2545
Nauplii	1018	14761	21887	7635	5090	5599	1527	1018
Dry Weight	37.2	69.8	302.0	319.8	492.0	515.9	550.0	338.6
Organic Weight	33.1	61.1	277.6	301.0	466.0	479.8	512.8	312.7
Ash Weight	4.1	8.7	24.4	18.8	26.0	36.1	37.2	25.9

Table 18. Zooplankton Composition, Density (Organisms X 10^2 Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Redoubt Lake, April 9 - September 17, 1974.

Date Depth of Tow (m)	4/9 30	5/15 100	5/28 100	6/12 100	7/2 100	7/17 90	7/30 100	8/19 80	9/17 90
Rotatoria									
Keratella	534	2057	2301	1502	5505	1950	3774	6534	7175
Polyarthra	0	0	0	0	0	448	1304	2505	1660
Kellicottia	5	0	0	25	25	0	0	61	0
Filinia	10	260	0	36	204	0	102	158	143
Conochilus	5	0	0	71	71	25	71	0	0
Cladocera									
Bosmina	15	15	10	46	25	36	311	336	606
Daphnia	0	0	30	71	0	0	0	0	0
Copepoda									
Cyclopoida	0	0	0	0	0	0	46	0	10
Immature Forms*	0	0	0	0	25	46	163	117	20
Dry Weight	32.1	62.6	92.2	64.7	73.3	59.1	100.3	91.2	220.5
Organic Weight	29.0	47.9	77.9	47.9	52.4	42.3	79.4	78.4	206.3
Ash Weight	3.1	14.8	14.3	16.8	20.9	16.8	20.9	12.7	14.3

* Eggs not counted

Table 19. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Spurt Lake, Basin I, July 14 - September 7, 1974.

Date Depth of Tow (m)	7/14 52	7/27 52	8/10 53	8/24 51	9/7 49
Rotatoria					
<u>Keratella</u>	4581	3054	2545	1018	0
<u>Kellicottia</u>	1527	509	1018	3059	732
<u>Polyarthra</u>	12725	2036	2545	3054	4390
<u>Conochilus</u>	100782	90602	62098	37157	45365
Cladocera					
<u>Daphnia</u>	13234	45810	45301	16288	8048
<u>Holopedium</u>	18324	26468	11198	10180	6585
<u>Bosmina</u>	0	0	509	509	2195
Copepoda					
Calanoida	4581	3054	2545	1527	732
Cyclopoida	5090	11707	8653	6617	4390
Nauplii	29522	9162	17306	22905	10975
Miscellaneous					
<u>Coelospherium</u>	1527	0	509	509	0
Dry Weight	292.3	325.9	150.8	248.5	107.9
Organic Weight	196.1	267.4	126.8	208.3	92.7
Ash Weight	96.2	58.6	23.9	40.2	15.3

Table 20. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Spurt Lake, Basin II, July 14 - September 7, 1974.

Date	7/14	7/27	8/10	8/24	9/7
Depth of Tow (m)	43		42	41	44
Rotatoria					
Keratella	4072	5090	2545	2545	0
Kellicottia	509	0	1018	509	1018
Polyarthra	6617	0	4581	4581	4581
Conochilus	130304	104854	70242	40720	91111
Cladocera					
Daphnia	21887	44283	42247	19851	11198
Holopedium	19342	17306	14761	8653	7635
Bosmina	0	509	0	0	1527
Copepoda					
Calanoida	2545	4581	1527	2036	1018
Cyclopoida	7126	10689	6108	7126	9671
Nauplii	24941	10180	19342	19342	18833
Miscellaneous					
Coelospherium	2036	509	509	509	1527
Dry Weight	255.7		254.6	218.0	156.9
Organic Weight	234.3		229.7	198.1	141.1
Ash Weight	21.4		24.9	19.9	15.8

Table 21. Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter), Swan Lake, July 17 - September 11, 1974.

Date	7/17	7/31	8/14	8/29	9/11
Depth of Tow (m)	78	100	100	100	100
Rotatoria					
Keratella	509	0	0	0	0
Fragillaria	0	509	0	0	0
Conochilus	0	0	509	8653	15270
Polyarthra	0	0	0	509	1018
Cladocera					
Holopedium	4581	2036	18324	41738	18833
Copepoda					
Calanoida	38175	29702	32067	36648	26977
Cyclopoida	509	509	4072	0	0
Nauplii	19851	12725	20360	14761	26977
Dry Weight	480.3	582.1	721.2	1474.4	578.5
Organic Weight	347.8	423.2	666.7	878.0	498.6
Ash Weight	132.4	158.9	54.5	586.2	79.5

Table 22. Comparison of Plankton Composition, Density (Organisms Per Square Meter of Surface Area) and Weight (Milligrams Per Square Meter) of Plankton Net Tows made with Number 20 and Number 6 Plankton Nets, Osprey Lake, July 10, 1974.

	No. 6 Nitex 100m Vertical Tow	No. 20 Nitex 100m Vertical Tow
Rotatoria		
Kellicottia		10,180
Conochilus		509
Cladocera		
Bosmina		5,599
Daphnia	2,036	4,072
Copopoda		
Calanoid	37,666	29,522
Cyclopoid	5,090	4,072
Nauplii	7,635	39,702
Dry Weight	319.8	261.3
Organic Weight	301.0	236.8
Ash Weight	18.8	24.4

Table 23. Identification and Abundance (Organisms/m^2) of Benthic Organisms From Lakes Studied, 1974.

No. Samples	44	15	12	12	25	14
Depth Range (m)	1-33	1-45	3-81	10-83	1-31	0-147
Lake	Auke	De Boer	Osprey	Redoubt	Spurt	Swan
Amphipoda	8.8		118.4			
Gammaridae	7.8		118.4			
Pelecypoda	10.8	51.7	204.5	3.6	94.7	86.1
Gastropoda	1.9		50.2			
Oligochaeta	26.4	120.5	305.0	28.7	134.3	64.6
Hydracarina		20.1	14.3		3.4	
Nematoda					1.7	
Hirudinia					1.7	
Ephemeroptera			7.2			33.8
Tricoptera	12.7		14.4	3.6	1.7	
Odonata	36.2					
Diptera	481.4	352.9	1,772.4	434.1	136.0	664.3
Chironomidae	479.5	350.0	1,772.4	434.1	132.6	665.1
Empididae					1.7	
Ceratopogonidae	1.9					
Tipulidae		2.9			1.7	9.2
Plecoptera					1.7	

Table 24. Identification and Enumeration of Drift Organisms, Auke Lake, 1974.

Date	6/7		6/21		7/3		6/19		9/17	
Net	I	II	I	II	I	II	I	II	I	II
Insecta										
Ephemeroptera	56	142	41	79	17	36	3	5	5	20
Siphlonuridae										
Ameletus										
Baetidae	46	127	20	70	15	35	2	3	1	
Baetis	46	127	20	70	15	35	2	3	1	
Heptageniidae	3	4	10	6	1	1	1		4	18
Cinygmula		2	2	3	1		1		1	18
Epeorus	3	2	6	3		1			3	
Rithrogena			2							
Leptohlebiidae	6	11	7	3						2
Paraleptophlebia	6	11	7	3						2
Ephemerellidae	1		4		1			2		
Ephemerella	1		4		1			2		
Plecoptera	5	7	6	4	2				16	7
Nemouridae	2	3	6	2	2				5	1
Nemoura	2	3	1	2	2				5	1
Leuctra			4							
Capnia			1							
Chloroperlidae	3	4		2					11	6
Kathroperla	1	1								
Alloperla	2	3		2					11	6
Coleoptera	5	9	2		1	2		4		4
Tricoptera	4	3	4	5		1		1	5	2
Rhyacophilidae	1	1		1				1	5	
Rhyacophila	1	1		1				1	5	
Hydropsychidae										
Arctopsyche										
Limnephilidae	2	2	4	4		1				2
Dicosmoecus										
Philopotamidae										
Dolophilus										
Diptera	9	7	4		8	1		6	16	41
Tipulidae	5	5	2							
Dicranota	5	5	2							
Ceratopogonidae										
Chironomidae	1	1	1	1	4			1	10	5
Larvae									4	
Pupae									1	
Adults					4			1	5	5
Simuliidae	1									
Prosimulium	1									
Rhagionidae	2	1	1			1			3	1
Atherix	2	1	1			1			3	1
Empididae					4			5	3	68
Amphipoda										
Miscidae										
Gammaridae										
Araneae										
Hydracarina										
Collembola					1	1		2		
Hymenoptera										3
Gastropoda										
Pelecypoda										
Copepoda										
Miscellaneous										
Aquatics									17	
Terrestrials	9	10	6	5			5	1	4	

Table 25. **Identification and Enumeration of Drift Organisms, DeBoer Lake, 1974.**

Date	7/13	7/23		8/9		8/22		9/5	
Net	I&II	I	II	I	II	I	II	I	II
Insecta									
Ephemeroptera	256	9	70	3	41		57	345	378
Siphlonuridae		4	12		6		54	336	348
Ameletus	22	4	12		6		54	336	348
Baetidae	192	3	44		27		2	6	11
Baetis	192	3	44		27		2	6	11
Heptageniidae	24				3			2	12
Cinygmula	1				1				
Epeorus	21				2			2	12
Rithrogena	2								
Leptohlebiidae	5	1	6	1	3		1	1	6
Paraleptophlebia	5	1	6	1	3		1	1	6
Ephemerellidae	13	1	8	2	2				1
Ephemerella	13	1	8	2	2				1
Plecoptera	75	10	36	36	32		38	58	231
Nemouridae	51	8	27	29	22		34	55	230
Nemoura	41	7	27	29	22		34	55	220
Leuctra	10	1							10
Capnia									
Chloroperlidae	24	2	9	7	10		4	3	1
Kathroperla									
Alloperla	24	2	9	7	10		4	3	1
Coleoptera			1	5	3				3
Tricoptera	13		7		1		25	4	4
Rhyacophilidae									
Rhyacophila									
Hydropsychidae									
Arctopsyche									
Limnephilidae	13		7		1		25	4	3
Dicosmoecus									
Philopotamidae									
Dolophilus									
Diptera	62	12	64	30	128		20	5	23
Tipulidae	5	2	10	2	5		4		
Dicranota									
Ceratopogonidae	2		1						
Chironomidae	47	10	40	12	79		14	3	17
Larvae	44	9	36	2	6		9	1	1
Pupae	1	1	1	2	2		2		
Adults	2		3	8	71		3	2	16
Simuliidae				11	32				3
Prosimulium	7		1		2		1	2	3
Rhagionidae	7		1		2		1	2	3
Atherix			1						
Empididae			1						
Amphipoda									
Miscidae									
Gammaridae									
Araneae					2		7		
Hydracarina	9				5			6	7
Collembola			3		1				
Hymenoptera					5				
Gastropoda									
Pelecypoda									
Copepoda									
Miscellaneous									
Aquatics									
Terrestrials									

Table 26. **Identification and Enumeration of Drift Organisms, Osprey Lake, 1974.**

Date	Inlet 5/31	Inlet 6/12	Inlet 6/28	Inlet 7/11	Inlet 7/11	Inlet 7/26	Inlet 8/7	Inlet 8/7	Inlet 8/23	Inlet 8/23	Inlet 4/5	Inlet 4/5	Outlet 5/31	Outlet 6/12	Outlet 6/28	Outlet 7/11	Outlet 7/27	Outlet 8/7	Outlet 8/23
Net	I	I	I	I	II	I&II	I	II	I	II	I	II	I	I	II	I&II	I&II	I	I
Ephemeroptera	89	8	144	124	74	203	128	81	13	5	13	60				1	5		3
Siphlonuridae	19	1	6	11	5			1											
Ameletus	19	1	6	11	5			1											
Baetidae	45	3	108	74	37	153	76	40	3	3		19							
Baetis	45	3	108	74	37	153	76	40	3	3		19							
Heptageniidae	11		25	29	22	26	35	23	9	2	13	38							
Cinygmula	6		14	11	9	4	11	5	1	2	13	38							
Epeorus	3		10	17	9	18	16	4	2			3							
Rithrogena	2		1	1	4	4	8	14	6										
Leptohlebiidae	14	4	5	10	10	24	17	15								1	5		1
Paraleptophlebia	14	4	5	10	10	24	17	15								1	5		1
Ephemerellidae								2	1										
Ephemerella								2	1										
Plecoptera	219	12	47	20	23	17	12	12	8	12	13	25	1		3	1			
Nemouridae	130	5	6		1	1	3	7	8	11	12	25			3	1			
Nemoura	68	3	6		1	1	3	7	6	11	2	25			3				
Leuctra	62	2							2		10								
Capnia																			
Chloroperlidae	89	7	41	20	22	16	9	5		1	1		1						
Kathroperla																			
Alloperla	89	7	41	20	22	16	9	5		1	1		1						
Coleoptera		2			1	3		1							24				
Tricoptera	2	3	12	19	4	11	84	92	3	10	3	6			2		3	1	
Rhyacophilidae	2	2	7	17	3	3	1			1		1			1				
Rhyacophila	2	2	7	17	3	3	1			1		1			1				
Hydropsychidae																			
Arctopsyche																			
Limnephilidae		1	5	2	1		12	3	2	6	3				1		1	1	
Dicosmoecus							12			6					1				
Philopotamidae						8	71	89		3									
Dolophilus						8	71	89		3									
Diptera	21	9	12			24	62	26	5	2	25	113	21	33	181	30	27	1	
Tipulidae	5	5	2						2		1	1			2	1			
Dicranota	5	5	2						2		1				2				
Ceratopogonidae						1									7				
Chironomidae	15	2	3			6	32	11	3		20	93	21	31	108	26	26		
Larvae		1				5	4				1	13	1	2	97	10	15		
Pupae		1						1	3		3	2	12	4	7	2	7		
Adults	15					1	28	10			16	78	8	25	4	14	4		
Simuliidae			7			9	2	7			1	1			1				
Prosimulium			7				2	7				1							
Rhagionidae	1	2																	
Atherix	1	2																	
Empididae						8		8		2	3	13		2	52	3	1	1	
Amphipoda		1	1				1					1							
Miscidae																			
Gammaridae		1	1				1					1							
Araneae		2				1								2				2	
Hydracarina	3		2		2	1	9	2				6				1	1		
Collembola	1																		
Hymenoptera																			
Gastropoda																			
Pelecypoda																			
Copepoda																			
Miscellaneous																			
Aquatics			36	7	7		6							1	1				1
Terrestrials	4	2	14	14	11		6		2	6	3				5		1	1	

Table 27. Identification and Enumeration of Drift Organisms, Redoubt Lake, 1974.

	Inlet								Outlet					
Date	5/25		7/5	7/19	8/2	8/17	8/30	9/12	5/22	5/24	7/5	7/19	8/17	9/13
Net	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Ephemeroptera	149	124	63	48	84	187	42	12	1	5		1	4	10
Siphlonuridae	88	60	2		5	1	1							
Ameletus	88	60	2		5	1	1							
Baetidae	58	60	55	38	74	157	28	5	1	5				3
Baetis	58	60	55	38	74	157	28	5	1	5				3
Heptageniidae	1	3	6	8	5	18	10	7						5
Cinygmula	1	2	3	6	3	4	1	5						5
Epeorus			3		2	8	7	2						
Rithrogena		1		2		6	2							
Leptohlebiidae		1		1		10						1	4	2
Paraleptophlebia		1		1		10						1	4	2
Ephemerellidae	2			1		1	2							
Ephemerella	2			1		1	2							
Plecoptera	17	44	10	5	4	51	15	40						
Nemouridae	15	39	10	3		19	9	40						
Nemoura	15	33	10	3		19	9	40						
Leuctra		6												
Capnia														
Chloroperlidae	2	5		2	4	32	6							
Kathroperla														
Alloperla	2	5		2	4	32	6							
Coleoptera			3	2								4	1	
Tricoptera	12	9	19	7	2	7	9		4	1		1	1	1
Rhyacophilidae				1	1									
Rhyacophila			2	1	1									
Hydropsychidae														
Arctopsyche														
Limnephilidae	12	9	16	1	1	4	7		4	1		1		1
Dicosmoecus				1		4	4		1	1		1		
Philopotamidae							1							
Dolophilus							1							
Diptera		2	247	88	15	102	7	7	23	69	211	139	232	28
Tipulidae														
Dicranota														
Ceratopogonidae														
Chironomidae			3	19	6	4	5	3	6	10	69	28	226	16
Larvae			2	16	1	3	2	1	4	6	1	22	1	1
Pupae				1	5					1	2	6	9	1
Adults			1	2		1	3	2	2	3	60		216	14
Simuliidae		2	1	1	2				17	35	109	78	1	
Prosimulium		2	1	1	2				17	35	109	78	1	
Rhagionidae			1							23		1		
Atherix			1							23		1		
Empididae			242	68	7	98	2	4		1	33	32	5	12
Amphipoda									11	30	1	33	4	24
Miscidae										3				
Gammaridae										4	1			24
Araneae							1							
Hydracarina	2	1	1			6	2	1				5		1
Collembola				1	1	1								
Hymenoptera														
Gastropoda										18	5	8		3
Pelecypoda										9				
Copepoda														
Miscellaneous														
Aquatics	5	12				2			115			2		
Terrestrials		4	1	6	2				8					

Table 28. Identification and Enumeration of Drift Organisms, Spurt Lake, 1974.

Date	7/14	7/28		8/11		8/25		9/8	
Net	II	I	II	I	II	I	II	I	II
Insecta									
Ephemeroptera	193	73	111	22	22		94	34	217
Siphlonuridae	5		6				1	26	30
<u>**Ameletus**</u>	5		6				1	26	30
Baetidae	164	10	94	18	22		80	6	142
<u>**Baetis**</u>	164	10	94	18	22		80	6	142
Heptageniidae	14	1	5	1			12	2	37
<u>Cinygmula</u>	12						2		
<u>Epeorus</u>	2		5	1			10	2	36
<u>Rithrogena</u>		1							
Leptohlebiidae	10	2	5	3			1		
<u>Paraleptophlebia</u>	10	2	5	3			1		
Ephemerellidae			1						8
<u>Ephemerella</u>			1						8
Plecoptera	33			6	3		29	4	
Nemouridae	14		7	5	3		27	3	62
<u>Nemoura</u>	8		5	5	2		22	2	62
<u>Leuctra</u>	6		2		1		5	1	
<u>Capnia</u>									
Chloroperlidae	19			1			2	1	
<u>Kathroperla</u>	1								
<u>Alloperla</u>	18			1			2	1	
Coleoptera	2		3		3		3		1
Tricoptera	2	1			1		4	2	12
Rhyacophilidae		1							1
<u>Rhyacophila</u>		1							1
Hydropsychidae									
<u>Arctopsyche</u>									
Limnephilidae	1				1		4	2	10
<u>Dicosmoecus</u>									2
Philopotamidae									
<u>Dolophilus</u>									
Diptera	21	8	25	4	6		23	8	28
Tipulidae	9		12				5	2	1
<u>Dicranota</u>									
Ceratopogonidae									
Chironomidae	7	6	3		6			1	12
Larvae	6	6			2	1			5
Pupae					1	13			
Adults	1				3	9		1	7
Simuliidae	1	2	10				11	1	6
<u>Prosimulium</u>	1	1	10				9		5
Rhagionidae									1
<u>Atherix</u>									
Empididae	4			4			7	1	7
Amphipoda									
Miscidae									
Gammaridae									
Araneae									
Hydracarina	4	3		13	1		6	13	
Collembola								6	1
Hymenoptera								2	
Gastropoda									
Pelecypoda									
Copepoda									
Miscellaneous									
Aquatics					2		1		
Terrestrials				11	1			1	6

Table 29. Identification and Enumeration of Drift Organisms, Swan Lake, 1974.

Date	7/18		8/1		8/15		8/29		9/11	
Net	I	II	I	II	I	II	I	II	I	II
Insecta										
Ephemeroptera	55	67	30	48	6	8	5	4	8	2
Siphlonuridae	34	51	10	19	2		2		5	
Ameletus	34	51	10	19	2		2		5	
Baetidae	19	13	16	28	2	4	3	2		1
Baetis	19	13	16	28	2	4	3	2		1
Heptageniidae	2	3	4		1	2		2	3	1
Cinygmula		1	1							1
Epeorus	2	2			1			1	1	
Rithrogena			3			2		1	2	
Leptohlebiidae				1		2				
Paraleptophlebia				1		2				
Ephemerellidae										
Ephemerella										
Plecoptera	15	17	5	8	3	5			2	
Nemouridae	5	1		1	2	1				
Nemoura	4	1		1	2					
Leuctra						1				
Capnia	1									
Chloroperlidae	10	16	5	7	1	4			2	
Kathroperla										
Alloperla	10	16	5	7	1	4			2	
Coleoptera			3		2	3				
Tricoptera	1		1			1	4	1		
Rhyacophilidae			1			1	4	1		
Rhyacophila			1			1	4	1		
Hydropsychidae										
Arctopsyche										
Limnephilidae	1									
Dicosmoecus										
Philopotamidae										
Dolophilus										
Diptera	44	45	102	140	54	68	47	30	25	60
Tipulidae			1	2		1			1	
Dicranota										
Ceratopogonidae				1						
Chironomidae	41	41	98	134	42	64	29	29	22	
Larvae	39	41	95	132	41	41	18	22	19	59
Pupae			2	1		4		1	1	
Adults	2		1	1	1	19		4	2	
Simuliidae	3	2	3	2						
Prosimulium		2	2	2						
Rhagionidae										
Atherix										
Empididae		2			4	2		1	2	
Amphipoda										
Miscidae										
Gammaridae										
Araneae			1							
Hydracarina	1	8	9	3	2		1	1	4	2
Collembola			1		1				1	
Hymenoptera							9			
Gastropoda										
Pelecypoda										
Copepoda										
Miscellaneous										
Aquatics				5	1	3				
Terrestrials			1	1	1	1				

Figure 19. Length Age of Dolly Varden, Osprey Lake, May - October, 1974.

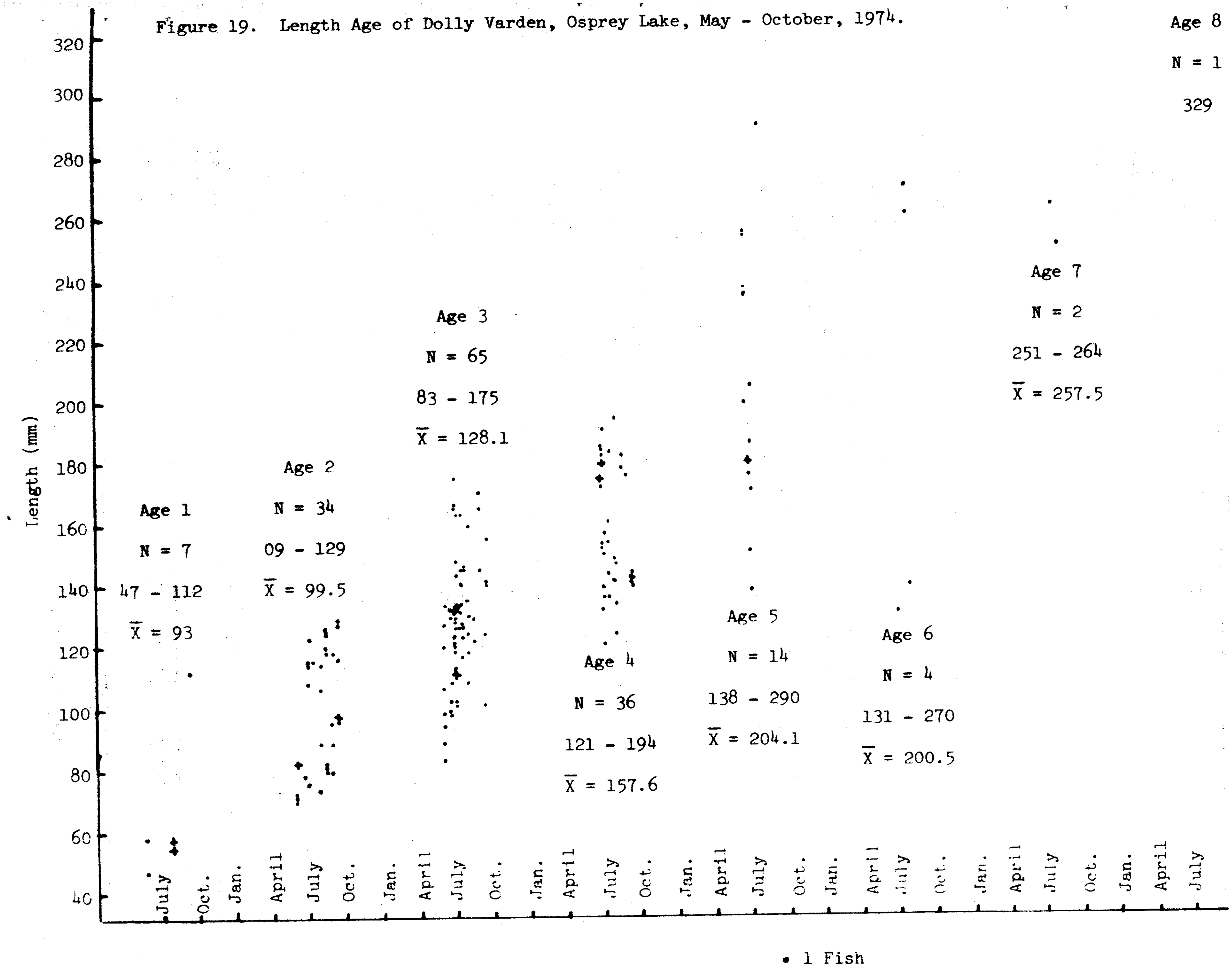


Table 30. Mean Lengths (mm) of Rainbow Trout By Age Class From De Boer, Spurt and Swan Lakes, 1974.

	De Boer		Spurt		Swan	
Age Class	Length	No.	Length	No.	Length	No.
Age 1		-	116	5		-
2		-	127	12		-
3		-	146	13	187	5
4	217	2	250	4	239	5
5	234	9	303	3	260	23
6	283	1		-	305	11
7	401	4	412	2	354	6
8					354	1

Table 31. Stomach Content From 34 Dolly Varden (69-210 mm Fork Length), Spurt Lake, June 23 - September 9, 1974.

Taxa	No. of Organisms	Taxa	No. of Organisms
BENTHOS		STREAM	
Pelecepoda	26	Hydracarina	1
Coleoptera	8	Ephemeroptera	50
Dytiscidae	6	Leptophlebidae	5
Agabus sp	5	*Paraleptophlebia* sp	5
Tricoptera	53	Heptageniidae	4
Limnephilidae	53	Ephemerellidae	1
Diptera	689	*Ephemerella doddsi*	1
Ceratopognidae	1	Siphlouridae	11
Chironomidae (larvae)	686	*Siphlonurus* sp	9
Tanypodinae	2	*Ameletus* sp	2
Rhagionidae	1	Beatdae	29
Atherix sp	1	*Beatis bicaudatus*	29
Empididae	1	Plecoptera	42
Collembola	1	Nemouridae	35
		Leuctra sp	1
PLEUSTON-BIONEKTON		*Capnia* sp	16
Diptera (terrestial)	14	*Nemoura* sp	18
Chironomidae		Chloroperlidae	4
(pupae & adults)	281	*Kathoperla* sp	2
Tipulidae	6	*Alloperla* sp	2
Dicranota sp	2	Perlodidae	1
Hymenoptera	21	Tricoptera	7
Formicidae	19	Rhyacophilidae	4
Homoptera	8	*Rhyacophila* sp	2
Araneae	2	*Rhyacophila fuscula*	2
Plankton	72	Brachycentridae	3
		Micrasema sp	3
		MISCELLANEOUS	
		Exuvia	2

Table 32. Stomach Content Analysis of Dolly Varden by Location and Method of Capture, Osprey Lake, 1974.

Food Items by Origin	Near Outlet		Near Inlet				Benthic - Pelagic				All Locations	
	Floating Gillnet		Traps		Gillnet		Traps		Gillnet		All Methods	
	No. of fish = 22		No. of Fish = 38		No. of fish = 6		No. of fish = 34		No. of fish = 13		Total fish = 113	
	% Occurrence	No. Organisms	% Occurrence	No. Organisms	% Occurrence	No. Organisms	% Occurrence	No. Organisms	% Occurrence	No. Organisms	% Occurrence	No. Organisms
LAKE BENTHOS												
Amphipoda												
Gammarus	-	-	23.7	12	-	-	5.9	6	-	-	9.7	18
Gastropoda	9.1	2	34.2	37	33.3	2	11.8	4	-	-	18.6	45
Pelecypoda	4.5	1	5.3	2	-	-	11.8	4	-	-	6.2	7
Oligochaeta	4.5	75	-	-	-	-	-	-	-	-	0.9	75
Libellulidae	-	-	2.6	1	-	-	-	-	-	-	0.9	1
Dytiscidae	-	-	2.6	1	16.7	1	2.9	1	-	-	2.6	3
Trichoptera	40.9	25	47.4	47	16.7	1	32.4	45	30.8	14	38.0	132
Leptoceridae	22.7	14	10.5	9	-	-	17.6	19	17.8	6	15.0	48
Limnephilidae	13.6	8	34.2	30	-	-	20.6	24	30.8	8	23.9	70
Psychomyiidae	9.1	2	5.3	6	-	-	2.9	1	-	-	4.4	9
Diptera	-	-	-	-	-	-	-	-	-	-	-	-
Chironomidae (larvae)	45.4	263	60.5	283	66.7	178	55.9	366	30.8	15	53.1	1105
PLEUSTON-BIOSESTON												
Chironomidae (Pupae & Adults)	95.4	1066	63.2	1721	83.3	824	82.4	997	84.6	1112	78.8	5740
Spiders (Aranea)	13.6	3	-	-	33.3	5	-	-	-	-	4.4	8
Collembola	-	-	2.6	5	50.0	3	-	-	-	-	3.5	8
Thysanoptera	-	-	-	-	16.7	1	-	-	-	-	0.9	1
Coleoptera	13.6	11	2.6	1	100.0	80	5.9	3	-	-	10.6	95
Lepidoptera	9.1	2	-	-	33.3	6	-	-	-	-	3.5	8
Hymenoptera	22.7	8	-	-	66.7	11	-	-	-	-	8.0	19
Diptera	54.5	123	5.3	2	83.3	429	2.9	3	15.4	3	19.5	560
Tipulidae	4.5	8	-	-	-	-	-	-	7.7	1	1.8	9
Bibionidae	13.6	5	-	-	50.0	327	-	-	7.1	1	6.2	333
Empididae	4.5	58	-	-	-	-	-	-	-	-	0.9	58
Sryphidae	-	-	-	-	16.7	1	-	-	-	-	0.9	1
Anthomyiidae	-	-	-	-	16.7	3	2.9	3	-	-	1.8	6
Other	4.5	1	-	-	16.7	9	0	0	7.7	1	2.6	11
Plankton												
Copepoda & Cladocera	40.9	10057	15.8	702	66.7	187	14.7	4875	-	-	21.2	15821
STREAM BENTHOS												
Acarina (Hydracarina)	-	-	2.6	1	-	-	2.9	1	-	-	1.8	2
Ephemeroptera	9.1	2	47.4	37	-	-	2.9	1	-	-	18.6	40
Plecoptera	-	-	15.8	10	16.7	1	-	-	-	-	6.2	11
Rhyacophilidae	-	-	5.3	2	-	-	-	-	-	-	1.8	2
Tipulidae	9.1	2	2.6	38	-	-	-	-	7.7	1	3.5	41
Empididae	-	-	-	-	-	-	-	-	-	-	-	-
Hemerodroma sp	-	-	5.3	3	-	-	-	-	-	-	1.8	3

Table 33. Stomach Content Analysis of Rainbow Trout from De Boer, Spurt and Swan Lakes, 1974, (in part)

	De Boer L., 9 Fish (222-454 mm)		Spurt L., 27 Fish (116-433 mm)		Swan L., 35 Fish (153-364 mm)	
	No. Orga- nisms	Orga- nisms /Fish	No. Orga- nisms	Orga- nisms /Fish	No. Orga- nisms	Orga- nisms /Fish
BENTHOS						
Annelida					6	0.2
Oligochaeta					6	0.2
Amphipoda					27	0.8
Gammarus					27	0.8
Odonata			1	0.0		
Aechnidae			1	0.0		
Tricoptera	3	0.3	43	1.6	183	5.2
Limnephilidae	3	0.3	35	1.3	182	5.2
Caborius					1	0.0
Psychomyiidae			1	0.0		
Coleoptera	12	1.3	8	0.3		
Dytiscidae	12	1.3	8	0.3		
Diptera	777	86.2	138	5.1	6,412	183.2
Chironomidae (larvae)	776	86.2	128	4.7	6,381	182.3
Pseudodiamesa	2	2.2			1,773	50.7
Chironomus	752	83.6			4,381	125.2
Diamesa					114	3.3
Procladius	22	2.4				
Simuliidae	1	0.1			11	0.3
Prosimulium	1	0.1				
Empididae			2	0.1	20	0.6
Hemerodromia					1	0.0
PLEUSTON - BIONECTON						
Copepoda			12,555	465.0	5,729	163.7
Araneae			27	1.0	3	0.1
Collembola			5	0.2	2	0.1
Lepidoptera	19	2.1	4	0.1	1	0.0
Coleoptera	6	0.7	61	2.3	15	0.4
Staphylinidae	6	0.7	20	0.7	3	0.1
Diptera	325	36.1	870	32.2	3,890	111.1
Chironomidae (pupae & adults)	313	34.8	187	6.9	3,676	105.0
Anthomyiidae					17	0.5
Empididae					21	0.6
Dolichopodidae					2	0.1
Bibionidae			265	9.8	3	0.1
Tipulidae					7	0.2
Dicranota	2	0.2			4	0.1
Homoptera			452	16.7	2	0.1
Aphididae			101	3.7	2	0.1

Table 33. (Cont) Stomach Content Analysis of Rainbow Trout from De Boer, Spurt and Swan Lakes, 1974.

	De Boer L. 9 Fish (222-454 mm)		Spurt L. 27 Fish (116-433 mm)		Swan L. 35 Fish (153-364 mm)	
	No. Organisms	Organisms /Fish	No. Organisms	Organisms /Fish	No. Organisms	Organisms /Fish
Hymenoptera			14	0.5	96	2.7
Formicidae					62	1.8
Inchneumonidae					13	0.4
Other Terrestrials			3	0.1	6	0.2
STREAM						
Plecoptera	12	1.3	7	0.3	94	2.7
Nemouridae	5	0.5	5	0.2	11	0.3
Capnia			2	0.1	6	0.2
Namoura	4	0.4	3	0.1	3	0.1
Isocapnia	1	0.1				
Chloroperlidae	7	0.8	2	0.1	81	2.3
Alloperla	6	0.7	2	0.1	80	2.3
Kathoperla	1	0.1				
Setipalpa					1	0.0
Ephemeroptera	129	14.3	7	0.3	1,333	38.1
Heptigeniidae	77	8.6	11	0.4	52	1.5
Rithrogena	75	8.3			35	1.0
Epeorus longimanus			9	0.3	1	0.0
Cinygmula	2	0.2			5	0.1
Ephemerellidae	2	0.2	2	0.1	6	0.2
Ephemerella doddsi	2	0.2			6	0.2
Siphlonuridae	16	1.8	121	4.5	47	1.3
Ameletus	16	1.8	16	0.6	45	1.3
Baetidae	34	3.8	2	0.1	1,228	35.1
Baetis bicaudatus	34	3.8	6	0.2	1,158	33.1
Tricoptera					10	0.3
Rhyacophilidae					10	0.3
Rhyacophila					6	0.2
Rhyacophila fuscula					1	0.0
Brachycentridae						
Micrasema						

Table 34. Estimation of Dolly Varden Population by Schnabel Method, Osprey Lake, 1974.

Date	C_t	R_t	M	M_t	R	C_tM_t	$\Sigma(C_tM_t)$	$\hat{N} = \frac{\Sigma(C_tM_t)}{R}$
6/26	23	0	23	0	0	0	0	
6/27	4	1	3	23	1	92	92	92
6/28	3	1	2	26	2	78	170	85
7/11	28	0	28	28	2	784	954	477
7/16	40	1	33	56	3	2,240	3,194	1,064
7/26	1	0	1	88	3	88	3,282	1,094
7/27	38	3	35	89	6	3,382	6,664	1,110
8/7	94	2	92	124	8	11,656	18,320	2,290
8/8	60	4	56	216	12	12,960	31,280	2,607
8/9	12	1	10	272	13	3,264	34,544	2,657
8/12	0	0	0	282	13	0	34,544	2,657
8/17	135	9	126	282	22	38,070	72,614	3,300
8/19	121	5	116	408	27	49,368	121,982	4,518
8/21	143	21	118	524	48	74,932	196,914	4,102
8/22	22	7	15	662	55	14,564	211,478	3,845
8/23	171	6	161	677	61	115,767	327,245	5,365
8/26	105	15	90	838	76	87,990	415,235	5,464
8/29	278	29	248	928	105	257,984	673,219	6,412
8/31	121	15	105	1,176	120	142,296	815,515	6,796
9/3	64	10	51	1,281	130	81,984	897,499	6,904
9/4	110	20	87	1,332	150	146,520	1,044,019	6,960
9/5	48	4	41	1,419	154	68,112	2,112,131	7,222
9/11	47	13	34	1,460	167	68,620	1,180,751	7,070
9/20	78	13	65	1,494	180	116,532	1,297,283	7,207

C_t the total sample taken on day t
R_t the number of recaptures in the sample C_t
M the number of fish marked from the sample C_t
M_t the number of marked fish in the lake when the t^{th} sample is drawn
R ΣR_t, the total of recaptures in the experiment
N the population present throughout the experiment
m the number of samples

Although standing crop of plankton does not measure production, net plankton samples may show some distinction between oligotrophic and eutrophic lakes. Rawson (1953) stated that the standing crop of No. 20 net plankton measured by total vertical hauls exhibits this distinction in western Canada. He gives this range as 10 - 40 kg/ha dry weight for alpine and large oligotrophic lakes, while mesotrophic and moderately eutrophic lakes have up to 100 kg/ha.

The standing crop of No. 20 net plankton was calculated using an assumed net efficiency of 25%. All lakes studied fall into the oligotrophic category. Lakes studied are listed in descending order of productivity according to this plankton index: 1) Swan - 30.8 kg/ha; 2) Blue - 14.8 kg/ha; 3) Osprey - 13.2 kg/ha; 4) Auke - 12.6 kg/ha; 5) De Boer - 10.4 kg/ha; 6) Spurt - 8.8 kg/ha; 7) Redoubt - 3.6 kg/ha; and 8) Green - 1.2 kg/ha. Klawak Lake on Prince of Wales Island is the most productive lake studied to date. (Schmidt, 1974). The average standing crop of No. 20 net plankton for Klawak Lake was estimated to be 43.1 kg/ha.

Bottom Fauna:

Bottom fauna collected by dredging and screening benthic materials are identified and enumerated for Auke, De Boer, Osprey, Redoubt, Spurt, and Swan lakes in Table 23. Analysis of drift net samples collected from inlets and outlets of these lakes are presented in Tables 24 through 29.

Fish:

Age, growth, and food habits of fish were examined in selected lakes where more detailed information was desired. Length-age information is available for Dolly Varden from Spurt Lake (Figure 18) and Osprey Lake (Figure 19). Growth rate in Osprey Lake was consistently greater than that in Spurt Lake. Length-age of rainbow trout for De Boer, Spurt, and Swan lakes is presented in Table 30.

Stomach content analysis of Dolly Varden is presented for Spurt Lake (Table 31) and Osprey Lake (Table 32). Stomach content analyses of rainbow trout from De Boer, Spurt, and Swan lakes are presented in Table 33.

A population estimate of Dolly Varden in Osprey Lake conducted by the Schnabel and Schumacher methods estimated 7,210 and 7,891 fish respectively. A comparison of estimated population parameters for the Schnabel and Schumacher-Eschmeyer population census is given below:

Parameter		Schnabel	Schumacher-Eschmeyer
Population Inverse	$(\hat{\frac{1}{N}})$	$\frac{R}{\Sigma(C_t M_t)} = 1.3870 \times 10^{-4}$	$\frac{\Sigma(M_t R_t)}{\Sigma(C_t M_t^2)} = 1.267 \times 10^{-4}$
Variance Inverse	$(\frac{1}{s^2})$	$\frac{R}{\Sigma(C_t M_t)^2} = 1.0696 \times 10^{-10}$	$\frac{\Sigma(R_t^2/C_t) - (\Sigma R_t M_t)^2/\Sigma C_t M_t^2}{m-1} = 0.1789$
Standard Error Inverse	$\frac{1}{SE}$	$\frac{\sqrt{R}}{\Sigma(C_t M_t)} = 1.0342 \times 10^{-5}$	$\frac{S}{\sqrt{\Sigma C_t M_t^2}} = 1.18 \times 10^{-5}$

Parameter	Schnabel	Schumacher-Eschmeyer (cont.)
95% Confidence Inverval	6,246 - 8,525	6,618 - 9,776

Data from the Schnabel method of population estimation at Osprey Lake are presented in Table 34. The data from the last five samples shows a stabilization of the population estimate.

A possible bias of fishing gear toward fish under 200 mm does not appear to be significant. Fish captured in large minnow traps show a length frequency of 78 to 229 mm with mean of 148 and median of 143. Numbers of fish larger than 200 mm is probably small. Forty fish captured with variable mesh gill net had a length frequency range of 112-329 mm with mean of 180 mm.

Recreation Survey of De Boer Lake

De Boer Lake is a small alpine lake snuggled in a basin at an elevation of 1,420 feet. There are no roads or trails; access is restricted to float-plane. The vegetation is of alpine character, and the lake is surrounded by ridges which are frequented by mountain goat.

De Boer Lake does not thaw until early July, and use is then light. Some people fly in to hike in the back country. In August goat hunters establish a camp at the U.S. Forest Service cabin. The cabin is an A-Frame style cabin with oil stove for heat. Campers must supply their own stove oil. A valid U.S. Forest Service permit must be obtained at the U.S. Forest Service office in Petersburg.

The cabin is located near the inlet stream. Hiking in the upland region is pleasant, but it is impossible to walk the shoreline of the lake. Grizzly bear are in the basin, and hikers should be aware of this fact. The inlet stream is small, about 26 feet wide near the entrance to the lake. The first 400 yards of stream appears to be suitable spawning ground for rainbow, but beyond this point the gravel bed disappears and is replaced by bedrock. At the head of this stretch of stream, De Boer Creek consists of five or six small tributaries which drain the head of the basin. This locality is very pleasant to hike through.

The outlet stream is a sheer drop from the southeast end of the lake, falling 1,000 feet in two-thirds of a mile.

Fishing in De Boer is poor, but a few large rainbow are caught. Productivity of this lake is very low, and fish growth and survival from planting has been poor.

Recreation Survey of Spurt Lake

Spurt Lake, or Lower De Boer Lake, seems to offer very little in the way of recreational activities which are popular among many people of Southeast Alaska. No small part of this evaluation stems from the fact that fishing is very poor in Spurt Lake, despite efforts of the Department of Fish and Game to turn the waters of this lake into a good rainbow trout sport fishery.

Spurt Lake is accessible by float plane, or by a two and one-half mile trail from the tidewaters of Thomas Bay, 15 miles north of Petersburg, Alaska. The lake is 415 feet above sea level, and is surrounded by muskeg and spruce-hemlock vegetation. The lake is approximately two miles long and relatively narrow with an extreme mid-lake constriction forming two separate lake basins.

There are no trails around the lake, and the vegetation makes foot travel very difficult. There is a nice cabin at the south end of the lake where the trail to Thomas Bay begins. The hike is not hard and takes about one-half hour. The U.S. Forest Service cabin can accommodate four people. The cabin has an oil stove.

The lake has an indigenous population of Dolly Varden. Rainbow introductions have not been very successful. Poor hiking restricts activities to the lake. At present, the lake is used very lightly. It would be an excellent spot for someone to go to just "unwind" and experience the cabin style of life. The cabin is cozy and bright and is set so that the view is very picturesque. One of the attractions is the presence of Common and Red Throated Loons. There is little noise at the cabin (the inlet and outlet are at the other end of the lake), and the howls and cries of the loons make for a soothing, and at times haunting narration.

The inlet stream, De Boer Creek, has a barrier fall approximately one-quarter mile upstream. Natural barriers prevent anadromous fish species from reaching the lake through the outlet stream.

Recreation Survey of Swan Lake

Swan Lake is an extremely scenic lake, offering a fine rainbow trout sport fishery. The lake is located approximately two and one-half miles from the tidewaters of Thomas Bay. Aircraft is essentially the only means of access to Swan Lake, although a crude trail does lead from the outlet along Cascade Creek down to sea level. This trail is used only as an emergency exit from the lake in cases of prolonged periods of fog which would preclude departure by airplane.

Fine fishing, majestic scenery, goat hunting, prospecting, and close proximity to Petersburg make Swan Lake a popular place from spring thaw until freeze-up. Because the lake is 1520 feet above sea level, the lake is not usually free of ice until early July. Freeze-up occurs sometime in late October.

A U.S. Forest Service A-frame cabin, equipped with an outhouse, incinerator, and boat are present. The cabin has two bunks on the main level and a loft which would easily accomodate four or five people. The cabin is equipped with an oil stove.

The lake is situated in a deep canyon basin rimmed by peaks topping 5,000 feet. It is impossible to walk the shoreline of the lake as some portions of the shoreline are vertical walls. An outboard motor is not necessary due to the cabin's location in relation to the inlet area which offers the best fishing. Swan Lake has no native fish species. Several rainbow trout introductions have been quite successful and natural reproduction appears to be good.

Cascade Creek varies in width from about 10 to 80 feet with shallow riffles and pools, some as deep as 10 feet. The stream provides fair fishing, but the inlet shoals of the lake provide the best fishing. Fishing reports say fish to 4 pounds can be caught. In recent years the average size of fish has decreased. Now, fish over 2 pounds might be considered exceptional.

Swan Lake is in close proximity to Thomas Bay. The countryside surrounding Thomas Bay has long been of interest to people of Alaska because of strange stories brought back by prospectors. The "curses" talked about regarding the locality may be unfounded, yet some people from Petersburg and other communities of Southeast Alaska consider the region a place never to trespass upon.

Scenery Lake lies just on the other side of the ridge to the north of Swan Lake. The name is very appropriate. This spot is a starting point for hikers and climbers venturing into the high country. Devil's Thumb, an impressive granite spire over 9,000 feet high, is considered an extreme test for serious technical climbers.

Estimation of Fish Populations in Lakes

The weir at Auke Creek was fitted with 5/16 inch hardware cloth screens on June 17th. Between that time and September 15, 781 Dolly Varden were marked at the weir site. An additional 374 fish were marked in Auke Lake. Lake marked fish were thought to be lake resident. During the period June 17th to September 15th, 1,612 Dolly Varden and 35 cutthroat immigrated into Auke Lake. A total immigration count was not obtainable as fish moved into the system before and after the weir was operational.

Population estimation of marked fish had to be made from catch data of all gear combined, as not enough fish were caught by any one type of gear to produce a reliable estimate. A population estimate of Dolly Varden in Auke Lake was attempted from September 9 to 13, 1974. At the beginning of this period there were 753 weir marked (caudal punch) and 275 lake marked (anal punch) fish in the lake. Four days fishing with several types of minnow traps produced 126 Dolly Varden of which 24 were recaptures (8 weir, 16 lake).

Application of the simple Peterson formula $N = MC/R$ yields an estimate of total population of 5,397. Another population estimate was attempted during the period September 23 to October 11, 1974. At the beginning of this period 1,155 marked fish were in the lake (781 weir and 374 lake marks). Fishing for nine days with several gear types produced 418 Dolly Varden of which 39 were recaptures (19 weir and 20 lake). An expansion of these data give an estimated population of 12,390 Dolly Varden. A record of captures is given below:

Date	Captures	Recaptures Lake	Recaptures Weir
9/23	23	5	2
9/24	12	1	1
9/25	49	2	2
10/01	20	1	1
10/02	53	2	3
10/03	87	2	2
10/09	45	4	2
10/10	58	1	1
10/11	62	2	5
TOTALS	418	19	39

A comparison of overnight catches by species for different types of gear is presented in Table 35. The most efficient type of gear for catching Dolly Varden was the variable mesh gill net. The most efficient gear for use in population estimation was the modified minnow trap (3 feet long, 16 inch diameter with entrance funnel on each end).

A comparison of day sets shows the gill net to be more efficient than the trap net.

Gear	No. Sets	Average Time Set	Average Catch DV	Average Catch CT
Trap Net	8	4 hr. 44 min.	1.9	0
Gill Net	7	5 hr. 4 min.	10.1	0.1

A comparison of catches by time period for the different style minnow traps (Table 36) shows the modified minnow trap to be the most efficient overall.

Methods of Estimating Fish Distribution In Lakes

The first systematic use of acoustics to detect fish was in 1933 when an echosounder was used to locate herring in the North Sea (Balls, 1948). Some of the first echograms of fish schools were published in 1935 (Sund, 1935) but the first regular echo surveys of a fish stock were those of spawning cod in the North Sea in 1938 by Sund. From 1940 to 1960 acoustic observations were made of fish distribution, abundance, and behavioral traits, such as diurnal movements, seasonal changes in abundance and migration routes (Cushing, et. al., 1952: Hodgson and Fredricksson, 1955). During these years fish abundance was assessed by counting fish detections or by estimating the darkness of amount of overlap from individual fish echoes in schools as recorded on echograms, or by counting the detections on an oscilloscope while the vessel was underway.

Table 35. Average Overnight Catch by Species for Different Types of Gear, Auke Lake, September 23 - October 11, 1974

Gear	Nets		Minnow Traps				
Type	Gill	Trap	Commercial	Modified	Shrimp Pot	Triangle	Rectangle
No. of Sets	6	8	8	8	8	8	8
$\bar{X}$ Time Set (Hr. Min.)	18:27	18:40	18:37	18:37	18:37	18:37	18:37
Species							
Stickleback		74.5	3.3		18.3		
Coho Fry		1.6	2.5	.9	3.5	2.1	0.1
Dolly Varden	14.2	0	.3	2.1	2.0	1.8	0.1
Cutthroat	1.0	0				0.1	
Sockeye Fry		4.0					
Sculpin				0.8	0.9	0.1	0.1

Table 36. Average Catch of Dolly Varden and Cutthroat by Time Period for Different Style Minnow Traps, Auke Lake, 1974.

Gear	Time Period	Average Time Set	No. Sets	Average Catch	
				DV	CT
Minnow Trap	Morning	2 Hr. 9 Min.	8	0.1	0
	Afternoon	2 Hr. 49 Min.	8	0.2	0
	Overnight	18 Hr. 37 Min.	8	0.2	0
Modified Minnow Trap	Morning	2 Hr. 9 Min.	8	1.4	0
	Afternoon	2 Hr. 49 Min.	8	3.1	0.5
	Overnight	18 Hr. 37 Min.	8	2.1	0
Shrimp Pot	Morning	2 Hr. 9 Min.	8	1.6	0
	Afternoon	2 Hr. 49 Min.	8	1.6	0
	Overnight	18 Hr. 37 Min.	8	2.0	0
Triangular Minnow Trap	Morning	2 Hr. 9 Min.	8	1.2	0
	Afternoon	2 Hr. 49 Min.	8	3.5	0
	Overnight	18 Hr. 37 Min.	8	1.8	0.1
Square Minnow Trap	Morning	2 Hr. 9 Min.	8	0.5	0
	Afternoon	2 Hr. 49 Min.	8	0.2	0
	Overnight	18 Hr. 37 Min.	8	0.1	0

In the 1960's an echo pulse counter was built that could indicate numbers of fish detections whose amplitudes were greater than a predetermined voltage threshold (Mitson and Wood, 1961). This system was workable for single fish detections but was inadequate for multiple target situations. A cycle counter was developed later, but it was also inadequate for multiple target situations (Dowd, 1967). An echo integrator was then developed whereby all echo returns from within any predetermined depth stratum were summed and fish biomass was reflected proportionally by the integration rate of increase in integration voltage per unit of time (Dragesund and Olsen, 1965). Calibration of this integrator has been made both by calculations using target strengths and by comparison of echo integration voltages with catches over a stratum fished simultaneously with a trawl. In a similar echo integrator designed by Dragesund and Olsen, the major limitations were circuit instability and inadequate dynamic range.

In the summer of 1971, a digital integrator was completed at the University of Washington which could process acoustic data from two echosounders simultaneously and integrate over any nine contiguous depth strata (Moose, Ehrenberg, and Green, 1971). Collection and analyses of acoustic data by the use of a data acquisition unit and the digital integrator, respectively have been described by Thorne (1972), Dawson (1972), Ehrenberg (1972), and Croker (1973).

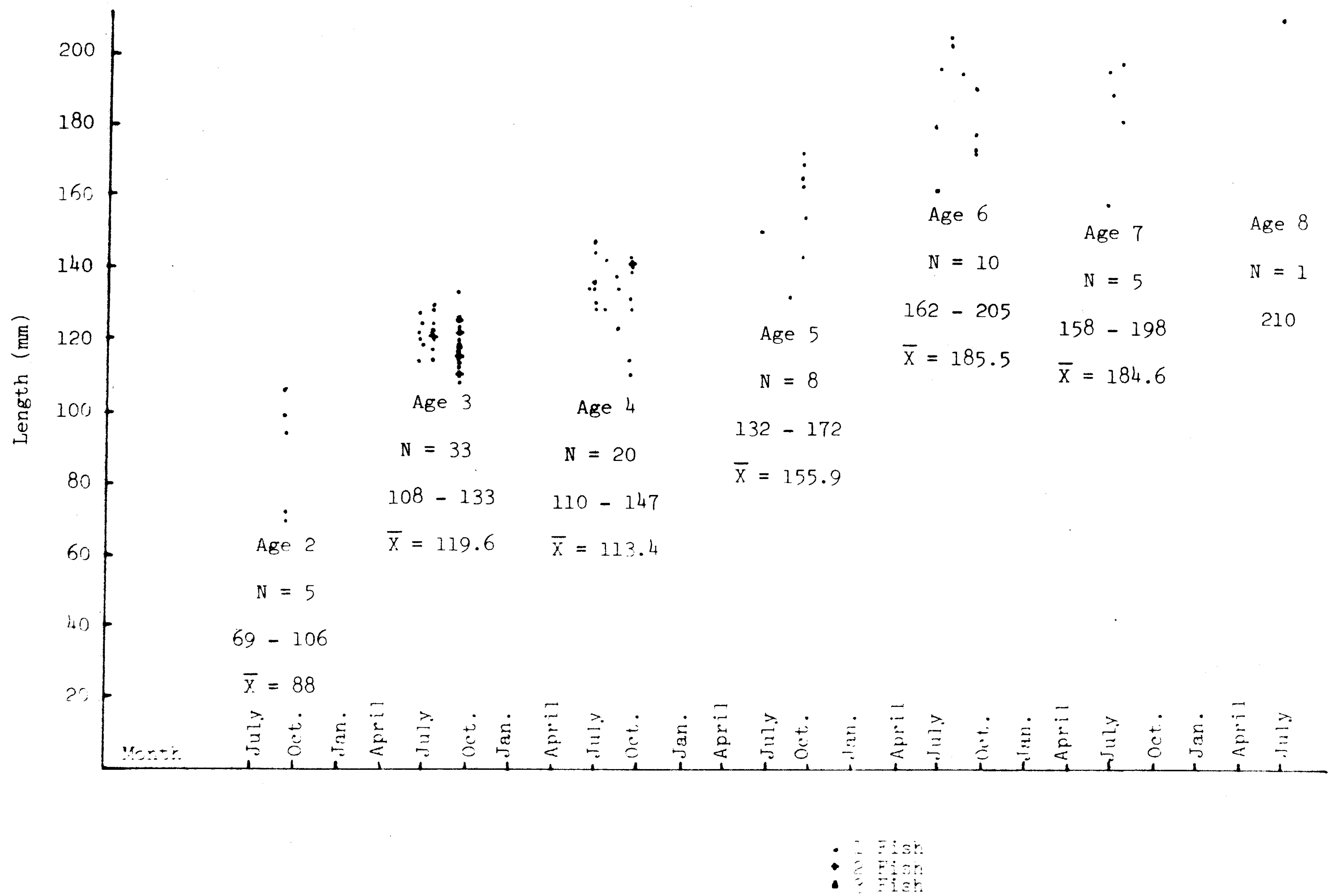
Nannallee (1973) compiled publications relating to the acoustic data acquisition system developed at the University of Washington and described the various components and their operations in language understandable to fishery biologists. In this paper he presented a users manual describing the workings of the data acquisition system and its set up and operation in the field.

For a more complete understanding of the use of acoustics the reader is referred to "The Use of Acoustic Instruments for Fish Detection and Abundance Estimation" (FAO Man, Fish Sci., 1941).

An analysis of the literature available clearly demonstrates the applicability of using hydroacoustic techniques to locate fish in lakes. An acoustic survey of Lake Chelan, Washington (Croker and Mathisen, 1972) was conducted for the purpose of estimating fish distribution as a function of depth and light. Another survey on Lake Wanatchee, an oligotrophic lake on the eastern side of the Cascade Mountain Range was conducted for the purpose of estimating the number of juvenile sockeye salmon and their distribution (Nannallee and Mathisen, 1972). Yet another sample of the usefullness of this acoustic system is described by Lemberg (1975) in a hydroacoustic assessment of the 1973 sockeye salmon escapement into Lake Quinault, Washington.

A Ross 400A echosounder was purchased through the Applied Physics Laboratory, University of Washington, and an attempt was made to detect fish in Auke Lake. Experimentation with anesthetized fish showed that the chart recorder of the sounder could not be used to determine target size. A stickleback 65 mm long appeared the same on the chart recorder as did a Dolly Varden 300 mm long.

Figure 18. Length-Age of Dolly Varden, Spurt Lake, June - September, 1974.



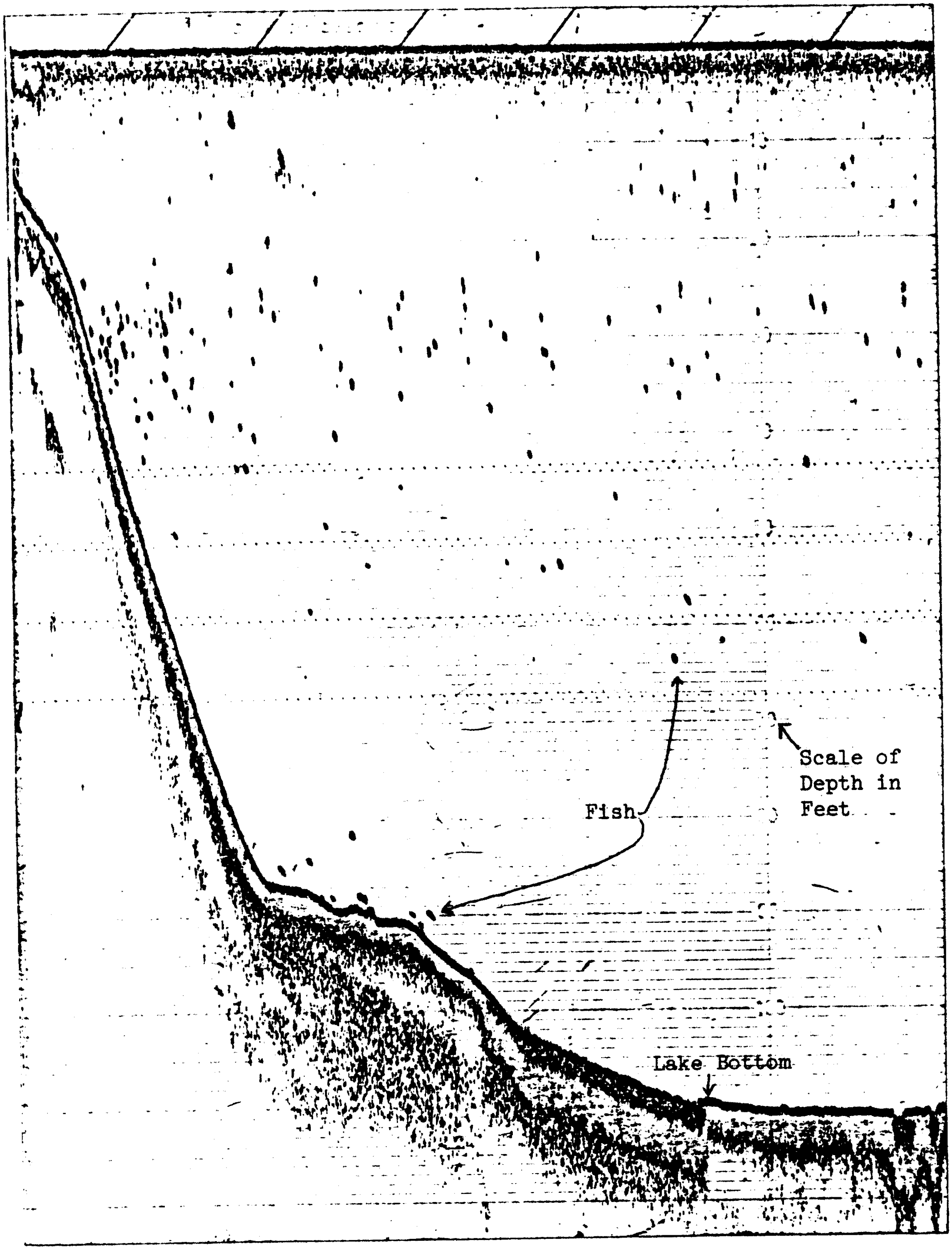


Figure 20. Echogram Showing Spatial Distribution of Fish in Auke Lake, July 25, 1974.

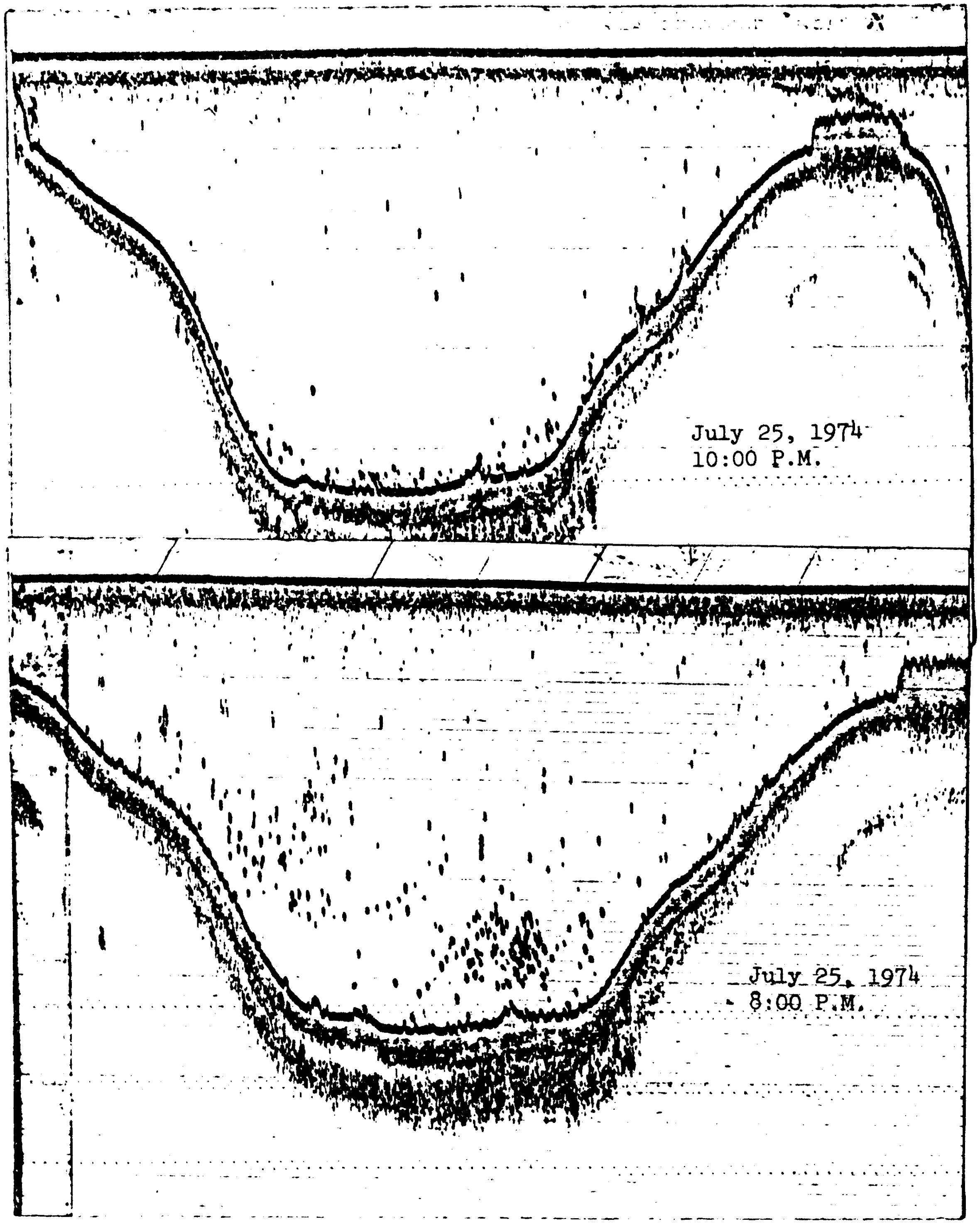


Figure 21. Echogram Showing Diurnal Movement of Fish in Auke Lake, July 25, 1974.

Distribution and Catchability of Fish in Auke Lake

The distribution of echo strength from a fish population is a fundamental factor in making quantitative assessments of that population. All methods of fish stock assessment require some knowledge of echo strength. The more information available the more accurate the assessment will be.

Determination of proper sensitivity settings on the Ross 400A to allow detection of fish and mark the recording papers (described previously) allowed the determination of fish distribution in Auke Lake. No quantitative data on fish size or abundance could be determined with the chart recorder.

In the determination of fish distribution in Auke Lake, six transects were made across the lake. These transects showed a concentration of fish throughout the lake at a depth of 20 to 60 feet. These fish appeared to be concentrated near the shore (Figure 20). An attempt to capture fish in the limnetic area with a 2-meter otter trawl failed because the boat used was too slow. Diurnal movements of these fish (Figure 21) indicated they may be rearing sockeye and/or stickleback.

Another group of fish were found near the bottom at a depth of about 90 feet (Figure 20). The larger fish at the 90 foot depth are believed to be Dolly Varden and cutthroat.

Catchability of fish in Auke Lake does not appear to be very good. Fishing with lures at various locations throughout the lake produced no fish in four hours of fishing. Fishing with bait eggs near the inlet and outlet produced three strikes and one Dolly Varden in two hours of fishing.

The distribution of rainbow trout in Swan Lake was shown to be concentrated near the inlet of streams (Figure 22). This distribution was substantiated by hook and line sampling.

Evaluation of Sport Fishing Resources Along the Sitka Area Road System

No Name Creek:

No Name Creek originates on the north slope of Harbor Mountain and flows northwest 2 miles to empty into the Old Sitka National Monument recreational area at Starrigavan Bay (Figure 23). Its geographic location is 57 7' 30" north latitude and 135 22' 30" west longitude (Orth, 1967).

The field crew found on its June 5 survey that the mean stream width was 23 feet and the mean depth was 14 inches at low tide. At higher tides the stream velocity is slower and the intertidal zone extends above the highway bridge. The stream substrate is gravel interspersed with large rock. The water flow is rapid, but there is adequate habitat for rearing salmon and trout in the lower half mile. Stream sampling by minnow traps yielded one coho fingerling from the five traps placed above the highway bridge. Stream temperature on June 5 was noted at 6°C and ambient air temperature was 11°C. The stream was acidic with pH of 6.4.

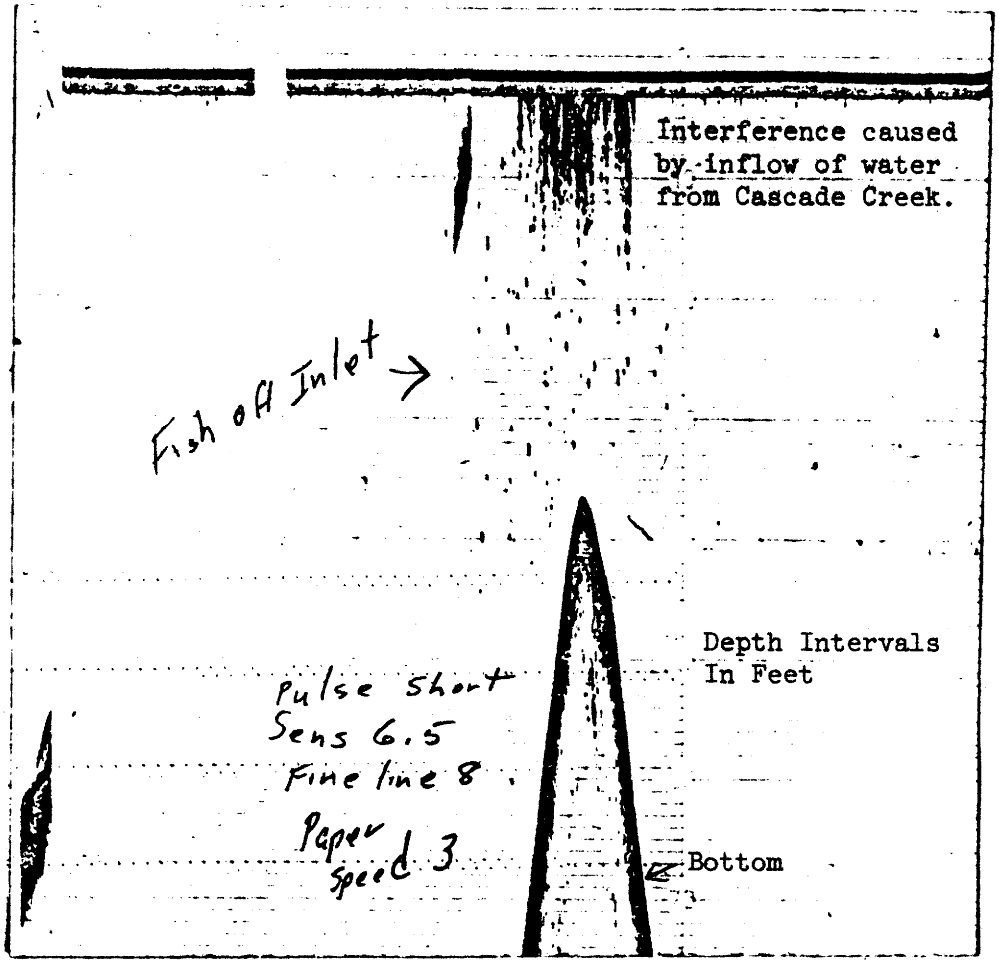
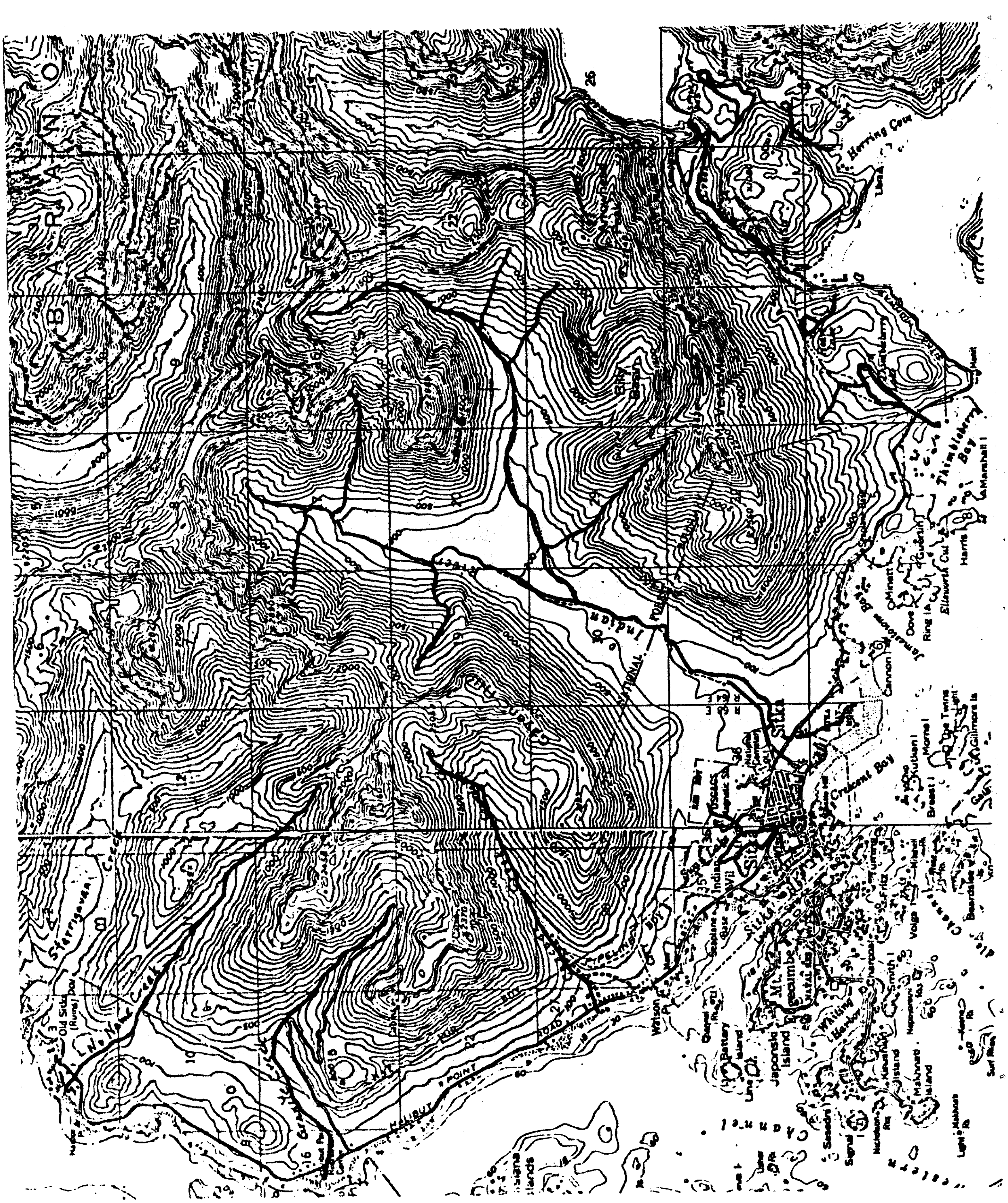


Figure 22. Echogram Showing Concentration of Rainbow Trout Near the Inlet of Cascade Creek, Swan Lake, September 11, 1974.

Figure 23. Map of Sitka Area Road System



Granite Creek:

Granite Creek originates on the western slope of Harbor Mountain and flows three miles into Sitka Sound at Halibut Point (Figure 23). It is located four miles southwest of Sitka at geographic coordinates 57° 06' north latitude and 133° 24' west longitude (Orth, 1967). Its name is derived from a large gravel pit which is extensively used by building contractors throughout the Sitka area. The stream is easily accessible from the gravel pit downstream to the intertidal zone. Mean width is 37 feet and mean depth is 15 inches. High tide has a minimal effect of 3 inches. Large gravel and rock comprise the stream's substrate in the intertidal zone. Above the bridge, substrate is of large rock and boulders. The stream is often muddy and laden with silt due to equipment operation in the gravel pit. Stream temperature on June 5 was 8°C and air temperature was 13°C. The water is acid with pH of 6.3.

Minnow traps were placed above the highway bridge up to the gravel pit. Sixty two Dolly Varden and three sculpin (Cottidae sp.) were captured in the five traps set.

On August 16th, pink salmon were observed in spawning activity in the muddy water. The stream flows through the Halibut Point Recreation Area where numerous interested persons watched the salmon migration.

Cascade Creek:

Cascade Creek flows 2.5 miles from a valley bounded on the north by Harbor Mountain and on the east by Gavan Hill to enter Sitka Sound (Figure 23). Its confluence is located 2.5 miles northwest of Sitka at 57° 4' 25" north latitude and 135° 22' 10" west longitude.

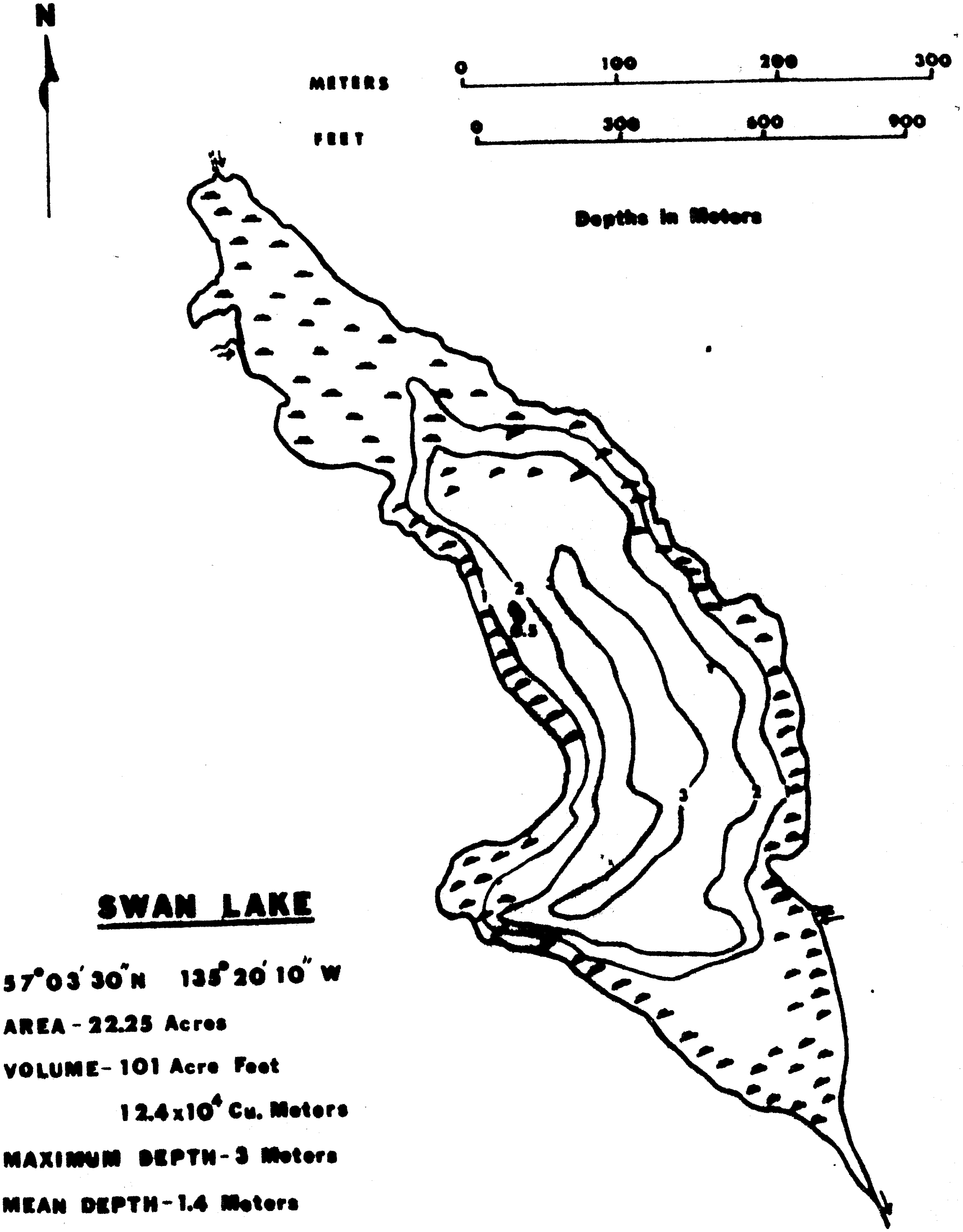
Its name was given by the U.S. Navy in 1880 after the valley and the rapid water flow in the stream (Orth, 1967). The stream is accessible from the bridge and the banks in the intertidal zone. Upstream of the bridge the stream is bordered by moderately steep banks. Its mean width is seven feet and mean depth is 11 inches. High tides create additional intertidal habitat but have little effect above the highway bridge. The stream substrate varies from large gravel to bedrock. Minnow trapping demonstrated that Dolly Varden char were abundant in small pools and riffles in the stream.

Water temperature on June 4 was noted at 5°C and the ambient air temperature was 11°C. Phenol Red pH test indicated a reading of 6.4.

Swan Lake:

Swan Lake is located in Sitka at 57° 03' 50" north latitude and 135° 20' 10" west longitude (Orth, 1967). It collects runoff from the surrounding muskeg and drains through a culvert to empty into Sitka Sound (Figure 23). Representative depth contours were plotted on the outline map (Figure 24). Morphometric data, areas of depth zones, and volumes of depth strata area presented in Table 37.

Figure 24. Bathymetric Map of Swan Lake.



SWAN LAKE

57°03'30"N 135°20'10"W

AREA - 22.25 Acres

VOLUME - 101 Acre Feet

12.4x10^4 Cu. Meters

MAXIMUM DEPTH - 3 Meters

MEAN DEPTH - 1.4 Meters

LEGEND

- Waterlilies

Figure 25. Temperature Profiles of Swan Lake, 1974.

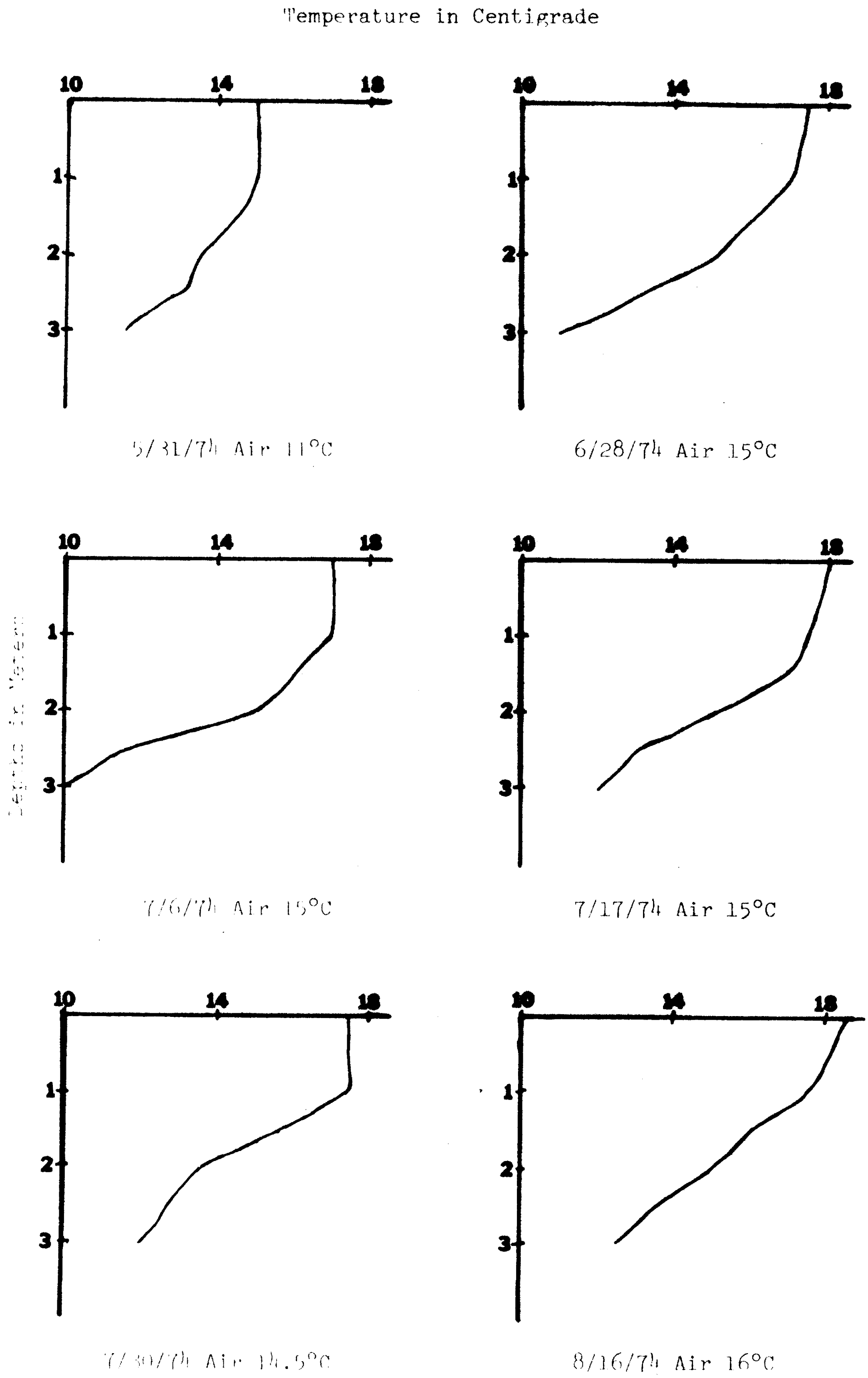


Table 37. Morphometry of Swan Lake.

Water Area

Hectares	9+
Acres	22.25

Percent of Depth Zone Areas

0-1 m	48.0	2-3 m	27.5
1-2 m	17.8	3+ m	6.7

Water Volume

Cubic Meters x 10^5	1.24
Acre Feet x 10^2	1.01

Percent Volume of Depth Strata

0-1 m	54.6	2-3 m	14.0
1-2 m	31.3	3+ m	0.1

Maximum Depth = 3 m   Mean Depth = 1.4 m

Shoreline Development = 1.89

Development of Volume = 1.4

Shoreline Length = 6,600 ft.

Table 38. Plankton Composition and Density (Organisms Per Square Meter of Surface Area), Swan Lake, May 31 - August 16, 1974.

	May 31	July 6	July 30	August 16
Rotatoria				
Keratella		575	946	1,521
Kellicottia	338	4,563	6,354	6,625
Polyarthra	-	507	1,487	2,265
Conochilus	237	406	473	1,048
Cladocera				
Daphnia	4,056	4,529	5,678	5,881
Holopedium	270	575	507	1,453
Bosmina	1,960	2,501	4,200	6,388
Copepoda				
Calanoida	-	-	-	270
Cyclopoida	101	237	608	1,758
Nauplii	270	1,825	2,096	2,400
Miscellaneous				
Fragillaria	169	237	135	338
Tabillaria	-	473	710	1,149
Euglera	338	203	135	203

Thermal profiles (Figure 25) exhibit a noticeable thermocline in the 1 to 2.5 meter range. Surface water temperature was generally higher than the current air temperature.

Tests indicated the hydrogen ion concentration to be fairly constant varying between 6.1 and 6.6 ($\bar{x}$ = 6.3) along the bottom, and between 6.2 and 6.6 ($\bar{x}$ = 6.5) at the surface. Dissolved oxygen varried from 5 to 11 mg/l ($\bar{x}$ = 8) above the bottom and 9 to 11 mg/l ($\bar{x}$ = 10) at the surface. Plankton (Table 38) were sampled at the deepest point of the lake.

Wrinkleneck Creek is now the primary tributary stream to Swan Lake. It originates in an upland muskeg bog. Throughout its course small areas are available for spawning activity. Stream velocity is moderate and suitable for rearing trout. Untreated sewage and solid waste is currently being flushed into the system. Abundant grasses and algae grow as a result of this waste matter and detract from the system's aesthetic quality.

Swan Lake contains a population of rainbow trout. Throughout the summer season the lake is under significant angler use by young anglers, and is a considerable recreational asset to the community of Sitka. During the initial year of the Sitka junior trout derby on Swan Lake, young anglers caught seven rainbow with fork lengths of 255 go 378 mm ($\bar{x}$ = 302 mm) and weight of 149 to 510 grams ($\bar{x}$ = 291 grams). A stunted population of Dolly Varden char are also resident to the lake as is a population of three spine stickleback, Gasterosteus aculeatus. Before municipal development culverted the main outlet stream, this lake supported populations of coho and anadromous cutthroat trout.

Indian River:

Indian River flows five miles from a large valley formed at the foothills of Gavan Hill, The Sisters, Arrowhead Peak, and Mt. Verstovia to the Eastern channel of Sitka Sound (Figure 23). Its geographic location is 57° 02' 45" north latitude and 135° 18' 30" west longitude (Orth, 1967). Its name is derived from the stand the Indians took against the early colonization efforts of the Russians.

This wide, rapid moving stream is utilized by the city of Sitka as a primary water source for domestic consumption. Sheldon Jackson College also draws water through a partial dam and diversion culvert for hydroelectric power generation.

On May 31 the field crew found the stream to have an average width of 53 feet and an average depth of 1.5 to 2 feet. The stream's substrate is primarily composed of large gravel and rubble with some stretches of large rocks and boulders. The water velocity is moderate to rapid. On June 6 the water temperature was 6°C and air temperature was 10°C. Hydrogen ion concentration was found to be 7.1.

Minnow traps were placed near the foot bridge in Totem Park just upstream of the outlet. Additional traps were set upstream to the falls area. Rearing silver salmon, Dolly Varden and sculpin were found throughout the lower section.

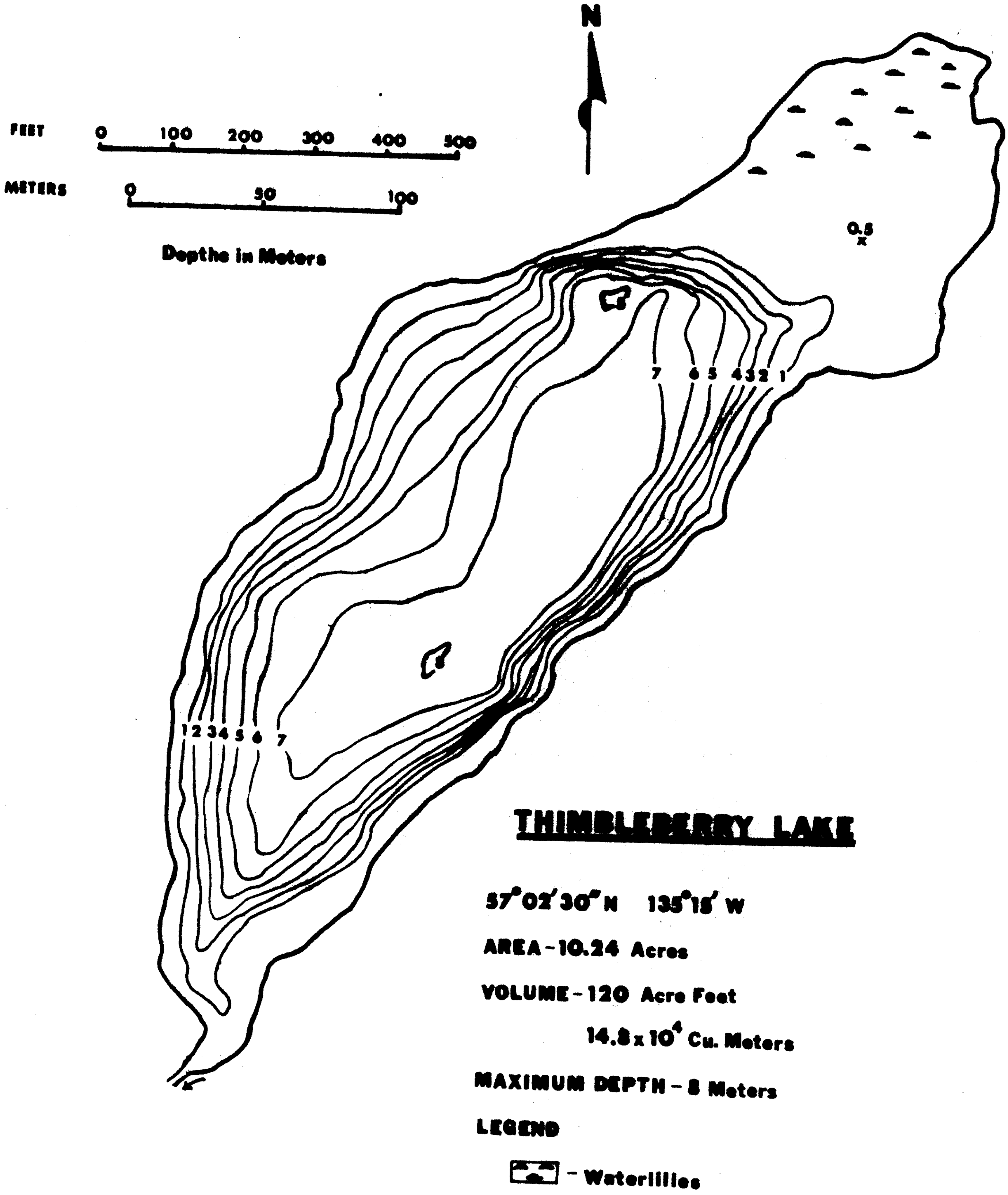


Figure 26. Bathymetric Map of Thimbleberry Lake.

Table 39. Morphometry of Thimbleberry Lake.

Water Area

Hectares	4.14
Acres	10.24

Percent of Depth Zone Areas

0-1 m	33.7	4-5 m	7.3
1-2 m	7.0	5-6 m	8.3
2-3 m	6.9	6-7 m	13.0
3-4 m	6.2	7-8 m	17.4

Water Volume

Cubic Meters x 10^5	1.48
Acre Feet x 10^2	1.20

Percent Volume Depth Strata

0-1 m	23.1	4-5 m	11.9
1-2 m	17.5	5-6 m	9.7
2-3 m	15.6	6-7 m	6.6
3-4 m	13.8	7-8 m	1.8

Maximum Depth = 8 m

Mean Depth = 3.6 m

Figure 27. Temperature Profiles of Thimbleberry Lake, 1974.

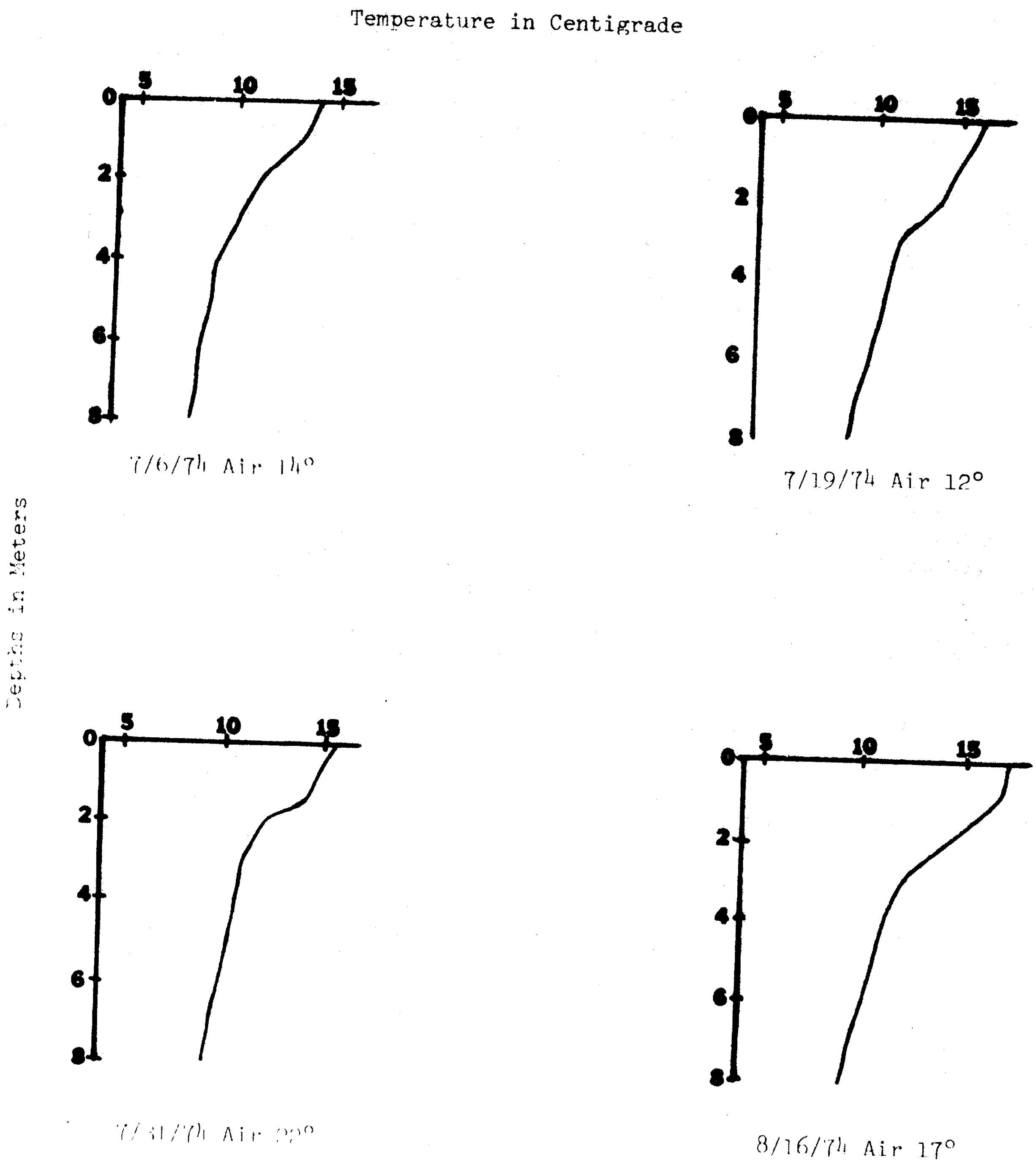


Table 40. Plankton Composition and Desity (Organisms Per Square Meter of Surface Area), Thimbleberry Lake, June 12 - August 16, 1974.

	June 12	August 1	August 16
Rotatoria			
Kellicottia	338	1,622	2,298
Conochilus	1,217	3,042	3,921
Cladocera			
Bosmina	676	4,124	3,177
Copepoda			
Calanoida	68		
Cyclopoida		101	68
Nauplii	135	2,129	946
Miscellaneous			
Fragillaria	203	-	-
Tabellaria	135	-	-
Spirogyra	-	270	-
Synedra	-	338	-

Thimbleberry Lake System:

The Thimbleberry Lake system collects runoff from a small valley at the southern foothills of Mt. Verstovia. It flows southwest through Thimbleberry Creek to enter the eastern channel of Sitka Sound (Figure 23). It is located three miles east of Sitka at Geographical coordinates 57° 02' 30" north latitude and 135° 15' west longitude. Representative depth contours were plotted on the outline map (Figure 26). Morphometric data, areas of depth zones, and volumes of depth strata are presented in Table 39.

Temperature measurements (Figure 27) were made at the deepest point on July 6 and continued periodically until August 16. These profiles show a thermocline in the 1-3 meter depth range.

Hydrogen ion concentration was fairly constant with pH 6.3 at the surface and pH 6.1 just above lake bottom. The concentration of dissolved oxygen varied between 9 and 13 mg/l ($\bar{x}$ = 11) above and 9 to 11 mg/l ($\bar{x}$ = 10) below the thermocline. Plankton was sampled biweekly at the deepest point during the study period. These findings are listed in Table 40.

The lake and shoreline vegetation is largely composed of numerous deadfall trees and snags making fishing from the banks difficult. The soft muddy ooze of the bottom makes movement difficult for an angler. Eastern brook char (Salvelinus fontinalis) were planted on May 25, 1928, and are confined to the lake by rapids and an impassible fall. Only lately are eastern brook char caught downstream. Below the falls and highway bridge the stream is 7 to 9 feet wide and generally 1 to 2 feet deep. Its waters flow at a moderate rate and provide high quality spawning and rearing habitat for anadromous salmonids. Known fish species utilizing the Thimbleberry system include eastern brook char, Dolly Varden, coho salmon, and sculpin. Several barriers which impede fish passage are located downstream. These are composed of discarded building supplies disposed of by local residents.

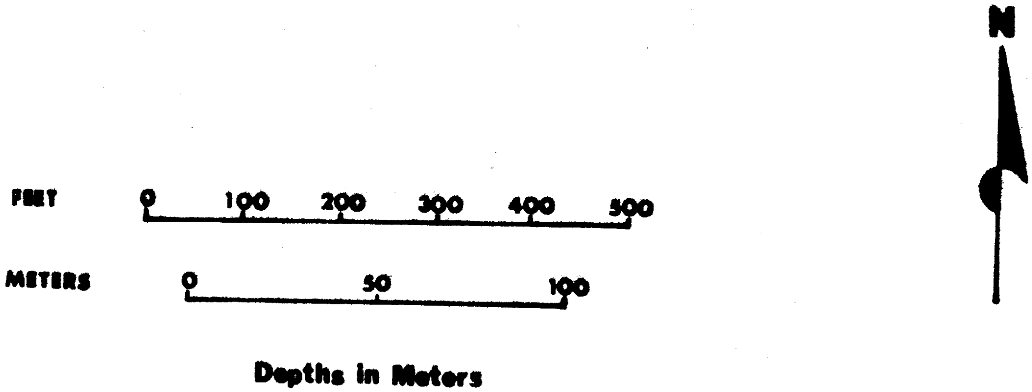
Heart Lake:

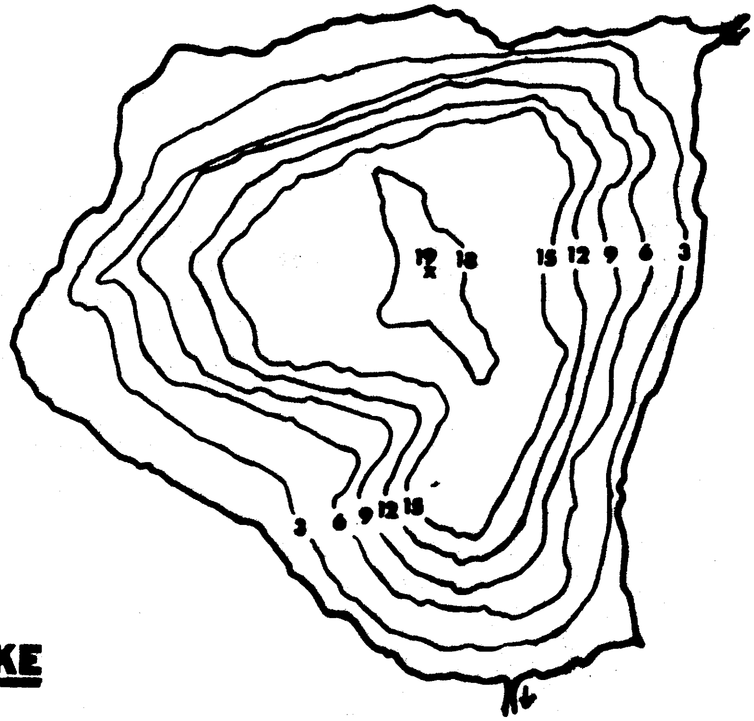
Heart Lake collects runoff from the south slope of Mt. Verstovia and empties through a small stream down a steep hill to enter saltwater at the head of Silver Bay (Figure 23). It is located 3.5 miles east of Sitka at geographical coordinates 57° 03' north latitude and 135° 14' 20" west longitude (Orth, 1967). The lake is accessible by a short trail from the highway or from a longer trail that heads at Thimbleberry Lake. Representative depth contours were plotted on the outline map (Figure 28). Morphometric data, areas of depth zones, and volumes of depth strata are presented in Table 41.

Temperature measurements were made at the deepest point on July 6 and continued biweekly until August 14 (Figure 29). The thermocline was fairly constant in the 3 to 7 meter range throughout the sampling period.

Hydrogen ion concentration at the surface increased constantly throughout the sample period from 6.2 to 6.6 ($\bar{x}$ = 6.4) and changed slightly in the bottom strata 6.2 to 6.4 ($\bar{x}$ = 6.3). Surface waters of the lake were supersaturated with dissolved oxygen (11 to 12 mg/l) while dissolved oxygen below the thermocline varied between 6 and 10 mg/l ($\bar{x}$ = 8 mg/l).

Figure 28. Bathymetric Map of Heart Lake.





HEART LAKE

57°03′N 135°14′20″W

AREA - 5.77 Acres

VOLUME - 51.52 Acre Feet

63.6×10^3 Cu. Meters

MAXIMUM DEPTH - 19 Meters

Table 41. Morphometry of Heart Lake.

Water Area

Hectares	2.3
Acres	5.77

Percent of Depth Zone Areas

0-3 m	23.7	12-15 m	8.8
3-6 m	18.2	15-18 m	22.0
6-9 m	11.9	19 m	3.3
9-12m	11.7		

Water Volume

Cubic Meters x 10^4	6.36
Acre Feet	51.5

Percent Volume of Depth Strata

0-3 m	31.4	12-15 m	10.3
3-6 m	23.1	15-18 m	4.4
6-9 m	16.4	19 m	0.6
9-12m	13.8		

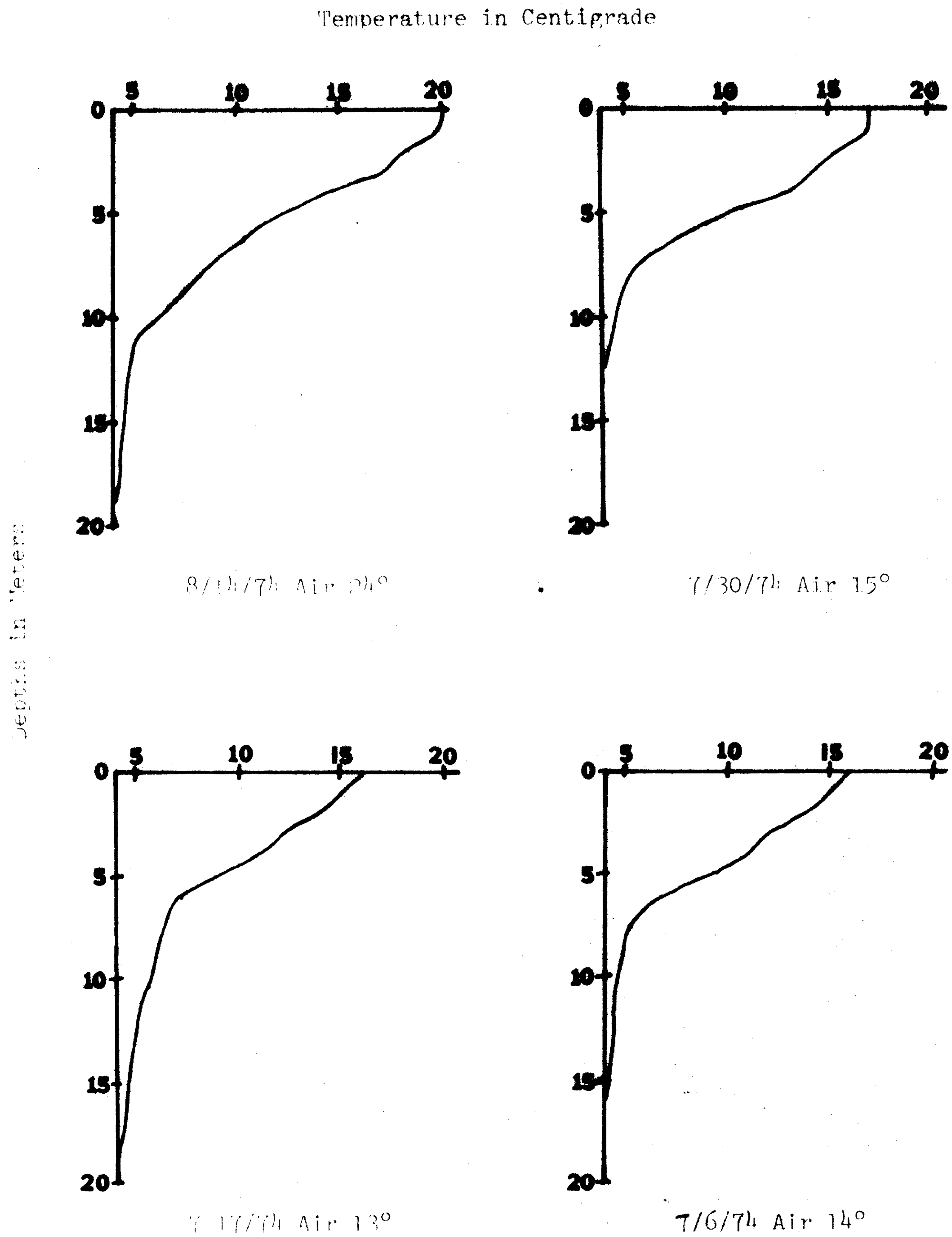
Maximum Depth = 19 m   Mean Depth = 2.7 m

Shoreline Development = 1.13

Development of Volume = 0.43

Shoreline Length = 2,016 ft.

Figure 29. Temperature Profiles of Heart Lake, 1974.



Plankton was sampled biweekly during the sampling period at the deepest point in the lake. These findings are listed in Table 42.

The lake's population of eastern brook char was planted on May 25, 1928 and has been very productive to present day anglers. The lake receives high angler pressure and fishing success is high. Due to the steep trail and heavy brush boardering most of the lake an inflatable boat is recommended.

Beaver Lake:

Beaver Lake is located in a scenic valley at the northwest foothills of Bear Mountain, and flows north to enter Sawmill Creek (Figure 23). It is located 5 miles east of Sitka at 135° 11' 30" west longitude (Orth, 1967). The lake is accessible from the Sawmill Creek campground by a trail that scales a large bluff and follows Beaver Creek upstream to the lake outlet.

Representative depth contours were plotted on the outline map (Figure 30). Morphometric data, areas of depth zones, and volumes of depth strata are presented in Table 43.

Temperature measurements (Figure 31) were made at the deepest point on July 5 through August 15. The thermocline became more defined later in July and August, and stabilized in the 4 to 7 meter depth range.

Hydrogen ion concentration of Beaver Lake varied between 6.3 and 6.6 ($\bar{x}$ = 6.5) at the surface and 6.0 and 6.4 ($\bar{x}$ = 6.2) below the thermocline. Beaver Lake waters remained saturated with dissolved oxygen throughout the study period. The concentration of dissolved oxygen in the surface waters varied between 10 and 14 mg/l ($\bar{x}$ = 12 mg/l) and between 8 and 12 mg/l ($\bar{x}$ = 10 mg/l) below the thermocline.

Limnetic plankton were sampled biweekly at the deepest location on the lake. These findings are listed in Table 44.

Beaver Lake was stocked in 1965 with Arctic grayling in an experiment to determine the success of planting this species in Southeast Alaska. The plant was successful and provides an additional species available to the Sitka angler. To aid the angler the local sportsmen's group has placed an aluminum boat on the lake. The lake shore has a moderate to steep slope. Trees and brush grow close to the water's edge. The lake's edges are generally too deep to wade so that a boat is necessary for a successful trip.

Herring Cove Creek:

Herring Cove Creek is located 5.25 miles east of Sitka and collects runoff from the western slope of Bear Mountain into Herring Cove (Figure 23). This small stream has a substrate of gravel and boulders. Stream waters flow at a moderate rate providing good rearing habitat for anadromous salmonids.

Minnow trappings demonstrated the presence of coho salmon and Dolly Varden char. Stream temperature was 12°C. When tested for hydrogen ion concentration stream waters showed pH 6.7.

Table 42. Plankton Composition and Density (Organisms Per Square Meter of Surface Area), Heart Lake, June 13 - August 14, 1974

	June 13	July 6	July 30	August 14
Rotatoria				
Kertella	2,434	8,923	3,785	4,563
Kellicottia	-	1,082	1,960	5,002
Polyarthra	-	-	135	-
Conochilus	-	-	3,583	7,030
Cladocera				
Daphnia	-	203	135	574
Holopedium	34	68	270	-
Bosmina	36	1,014	203	2,231
Copepoda				
Calaroida	135	338	135	135
Cyclopoida	203	-	2,974	5,442
Nauplii	-	-	3,718	8,585
Miscellaneous				
Fragillaria	-	-	201	-

Figure 30. Bathymetric Map of Beaver Lake.

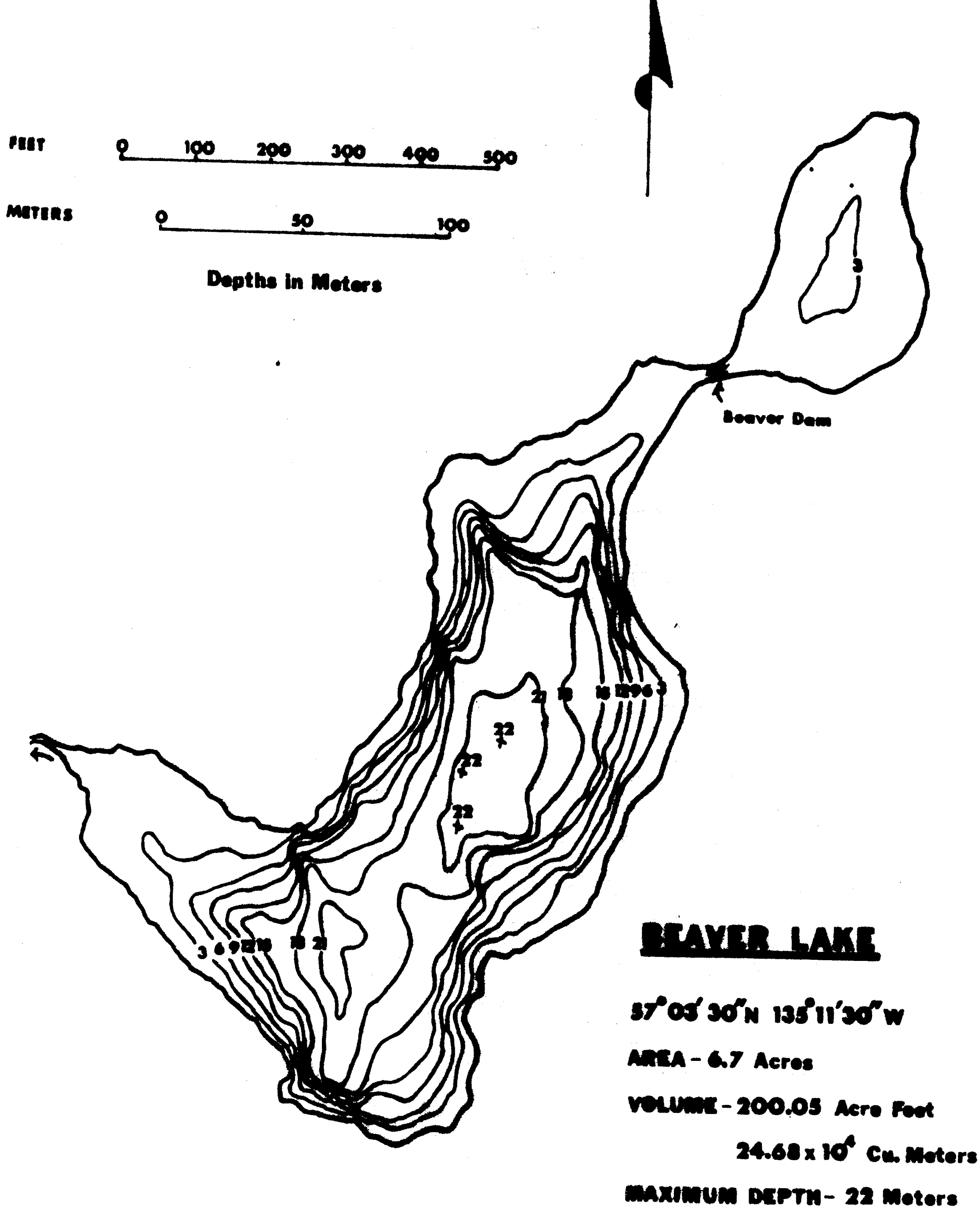


Table 43. Morphometry of Beaver Lake.

Water Area

Hectares	2.7
Acres	6.7

Percent of Depth Zone Areas

0- 3 m	37.5	12-15 m	7.6
3- 6 m	16.2	15-18 m	10.7
6- 9 m	7.5	18-21 m	14.8
9-12 m	7.0	21+ m	---

Water Volume

Cubic Meters x 10^5	2.47
Acre Feet x 10^2	2.0

Percent Volume of Depth Strata

0- 3 m	26.4	12-15 m	11.6
3- 6 m	19.0	15-18 m	8.5
6- 9 m	16.3	18-21 m	4.1
9-12 m	14.0	21+ m	0.1

Maximum Depth = 22 m

Mean Depth = 9 m

Shoreline Development = 2.99

Development of Volume = 1.23

Shoreline Length = 5,730 ft.

Sitka Area Creel Census

An estimated 126 king, 55 coho and 80 halibut were taken during the census period of May 27 through September 2 in the Sitka area (Table 45). The salmon catch per angler hour was 0.15 for king, and 0.06 for coho (Table 46).

No coho checked in the sport fishery carried the marking pattern utilized by the starrigavan saltwater rearing pens facility. From these findings we hypothetize that (1) the actual return of marked coho to the Sitka area was very small and/or (2) the marking combination of cold brand and tetracycline did not function as a permanent mark that could be identified in the field.

The Sitka Salmon Derby was conducted June 22, 23, 29, and 30. Officials estimate that 985 anglers participated in the derby to turn in 186 king, 15 coho, 3 chum, 15 halibut, and 34 lingcod for prizes.

Auke Creek Creel Census

Auke Creek was found to be subject to moderate angler pressure during the census period. During the census period of July 1 through August 25, an estimated 1,714 angler hours were spent catching 309 sockeye, 324 pink, 114 Dolly Varden, 24 cutthroat, 21 coho, and 4 chum during 731 angler trips (Table 47). Of the pink salmon censused, 4 (15%) were noted with adipose and left ventral fin clips indicating they were of Auke Creek Hatchery origin. The abundance of pink salmon in the catch was supplemented by an estimated 55 pinks from the Auke Creek Hatchery facility.

Juneau Area Creel Census

An estimated 5,622 coho, 2,301 king, 1,110 pink, 32 sockeye, and 7,366 halibut were taken during the census period of May 6 through September 2 (Table 48). The salmon catch per angler hour was 0.74 for coho, 0.30 for king, 0.15 for pink, 0.01 for chum, and 0.001 for sockeye (Table 49).

The Golden North Salmon Derby was conducted during July 26 through 28. Officials recorded 7,714 anglers participated in the derby to turn in 291 king, 1,526 coho, 226 pink, and 24 chum salmon for prizes.

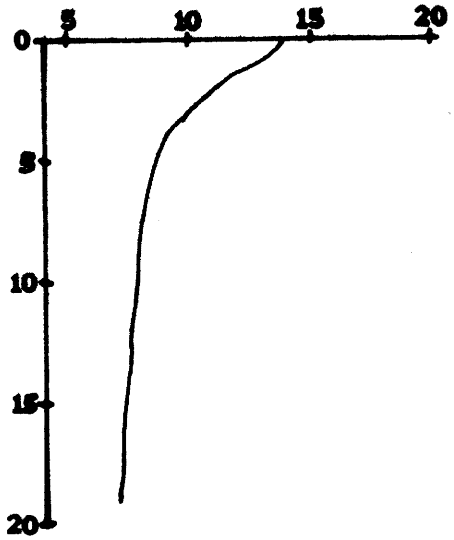
Catalog and Inventory Files

Information on 16 streams and 12 lakes were added to existing catalog and inventory files.

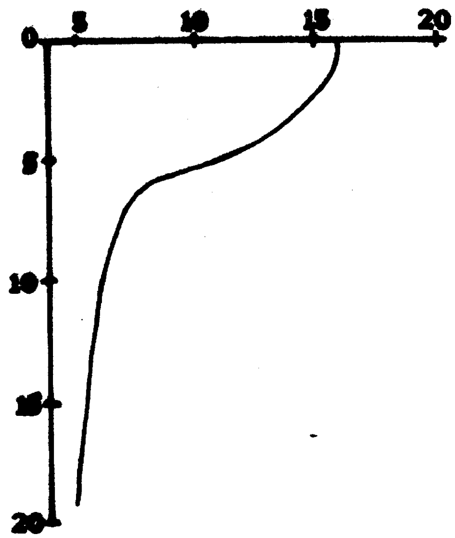
Figure 31. Temperature Profiles of Beaver Lake, 1974.

Temperatires in Centigrade

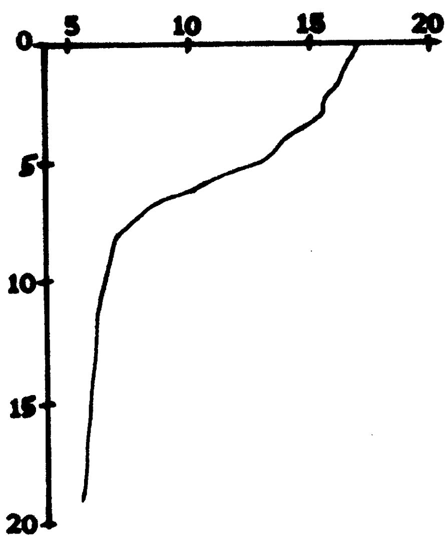
Depths in Meters



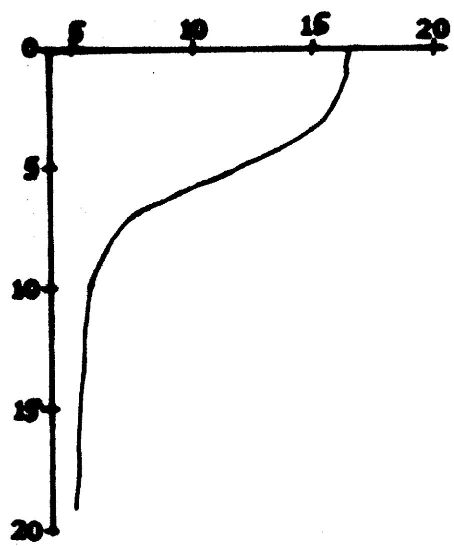
7/5/74 Air 16°



7/19/74 Air 12°



8/1/74 Air 21°



8/15/74 Air 21°

Table 44. Plankton Composition and Density (Organisms Per Square Meter of Surface Area), Beaver Lake, June 5 - August 15, 1974

	June 5	June 14	August 1	August 15
Rotatoria				
Keratella				135
Kellicottia		68	946	1,014
Polyarthra				
Conochilus			1,622	5,814
Cladocera				
Daphnia	676	473	406	1,014
Holopedium	679	648	676	608
Bosmina	237	608	694	270
Copepoda				
Calanoida	439	676	1,420	1,487
Cyclopoida	101	473	203	270
Nauplii	101	135	676	608
Miscellaneous				
Synedra			237	135
Spirogyra			270	270
Fragillaria			1,284	68

Table 45. Estimate of Angler Effort and Salmon and Halibut Catch on the Sitka Area Sport Fishery, May 27 - September 2, 1974

Date	5/27-6/2	6/3-6/9	6/11-6/16	6/17-6/23	6/24-6/30	7/1-7/7	7/8-7/14	7/15-7/21	7/22-7/28	7/29-8/4	8/5-8/11	8/12-8/18	8/19-8/25	8/26-9/1	9/2	Total
Boats	60	139	104	43	35	19	67	49	106	42	53	47	36	62	2	864
Angler Trips	146	347	238	121	82	49	155	112	243	118	114	110	70	139	4	2,048
Angler Hours	660	1,409	1,125	564	640	406	1,401	672	1,635	834	4,629	1,006	587	1,077	43	16,688
Kings	10	21	16	7	7	2	3	3	8	8	6	18	2	15	0	126
Cohos	2	0	0	0	3	0	4	2	2	0	2	12	19	7	2	55
Total Salmon	12	21	16	7	11	2	8	6	10	8	8	30	21	23	2	185
Total Halibut	2	0	7	0	0	0	7	6	51	0	3	0	2	2	0	80

Table 46. Sitka Area Sport Caught Salmon Catch Per Hour of Effort by Species, May 27 - September 2, 1974.

Date	5/27-6/2	6/3-6/9	7/10-6/16	6/17-6/23	6/24-6/30	7/1-7/7	7/8-7/14	7/15-7/21	7/22-7/28	6/29-8/4	8/5-8/11	8/12-8/18	8/19-8/25	8/26-9/1	9/2	Total
Kings/Boat	.18	.17	.19	.18	.22	.11	.05	.06	.09	.27	.13	.39	.09	.20	.00	.15
/Angler Trip	.07	.07	.08	.06	.10	.04	.02	.02	.04	.10	.06	.17	.05	.09	.00	.06
/Angler Hour	.02	.02	.02	.01	.01	.01	.00	.00	.01	.01	.00	.02	.01	.01	.00	.01
Coho/Boat	.04	.00	.00	.00	.11	.00	.10	.06	.03	.00	.06	.22	.45	.10	1.00	.06
/Angler Trip	.01	.00	.00	.00	.05	.00	.04	.02	.01	.00	.03	.10	.23	.05	.50	.03
/Angler Hour	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00	.00	.01	.03	.01	.05	.00
Total Salmon/Boat	.21	.17	.19	.18	.33	.11	.15	.12	.12	.27	.19	.61	.55	.30	.00	.21
/Angler Trip	.09	.07	.08	.06	.14	.04	.07	.05	.05	.10	.09	.26	.27	.14	.50	.09
/Angler Hour	.02	.02	.02	.01	.02	.01	.01	.01	.01	.01	.00	.03	.03	.02	.05	.01

Table 47. Estimate of the Sport Catch at Auke Creek, July 1 - August 25, 1974

	7/1-7/14	7/15-7/28	7/29-8/11	8/12-8/25	Totals
Angler Trips	524	112	41	54	731
Angler Hours	1,006	437	132	139	1,714
Sockeye	277	32	0	15	324
Pink *	265	15	6	83	369
Dolly Varden	63	0	17	34	114
Coho	4	0	3	14	21
Cutthroat	3	7	0	14	24
Chum	0	4	0	0	4
Total Fish	612	58	26	146	842

* 4 pinks (15% of censused pinks) were tagged with adipose and left ventral fin clips were noted in the census.

Table 48. Juneau Area Sport Caught Salmon Catch Per Hour of Effort by Species, May 6 - August 18, 1974.

Date	5/6-5/12	5/13-5/19	5/20-5/26	5/27-6/2	6/3-6/9	6/10-6/16	6/17-6/23	6/24-6/30	7/1-7/7	7/8-7/14	7/15-7/21	7/22-7/28	7/29-8/4	8/5-8/11	8/12-8/18	8/19-8/25	8/26-9/1	9/2	Total
Kings/Boat	.07	.17	.31	.03	.37	.51	.53	.52	.40	.35	.20	.24	.38	.22	.20	.42	.12	.26	.30
/Angler Trip	.04	.07	.11	.01	.15	.19	.20	.19	.15	.12	.07	.07	.13	.08	.07	.15	.04	.09	.11
/Angler Hour	.01	.02	.02	.06	.03	.04	.02	.03	.03	.02	.01	.01	.03	.01	.02	.03	.01	.02	.02
Coho/Boat	.00	.03	.01	.00	.03	.05	.18	.55	.77	.06	1.00	1.52	1.38	1.31	1.39	1.68	1.09	2.04	.74
/Angler Trip	.00	.01	.00	.00	.01	.02	.07	.20	.28	.37	.35	.48	.47	.47	.50	.60	.40	.72	.27
/Angler Hour	.00	.00	.00	.00	.00	.00	.01	.04	.05	.06	.07	.08	.10	.08	.11	.12	.08	.13	.05
Pinks/Boat	.00	.44	.00	.00	.01	.02	.06	.10	.47	.24	.31	.19	.09	.12	.08	.00	.02	.04	.15
/Angler Trip	.00	.18	.00	.00	.00	.01	.02	.04	.17	.08	.11	.06	.03	.04	.03	.00	.01	.02	.05
/Angler Hour	.00	.04	.00	.00	.00	.00	.00	.01	.03	.01	.02	.01	.01	.01	.01	.00	.00	.00	.01
Chums/Boat	.00	.01	.00	.00	.00	.00	.00	.01	.01	.01	.02	.00	.01	.01	.03	.05	.03	.04	.01
/Angler Trip	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.01	.02	.01	.02	.00
/Angler Hour	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Red/Boat	.00	.00	.00	.00	.00	.00	.01	.01	.02	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
/Angler Trip	.00	.00	.00	.00	.00	.00	.01	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
/Angler Hour	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Total Salmon	.07	.65	.32	.03	.41	.58	.79	1.19	1.67	1.61	1.53	1.95	1.86	1.67	1.70	2.16	1.25	2.39	1.21
/Angler Trip	.04	.27	.11	.01	.16	.22	.30	.53	.60	.57	.54	.61	.63	.59	.61	.77	.46	.85	.44
/Angler Hour	.01	.06	.02	.00	.03	.04	.03	.08	.11	.09	.10	.10	.14	.10	.14	.16	.09	.15	.08

Table 49. Estimates of Angler Effort and Salmon and Halibut Catch on the Juneau Area Sport Fishery, May 6 - September 2, 1974.

Date	5/6-5/12	5/13-5/19	5/20-5/26	5/27-6/2	6/3-6/9	6/10-6/16	6/17-7/23	6/24-6/30	7/1-7/7	7/8-7/14	7/15-7/21	7/27-7/28	7/29-8/4	8/5-8/11	8/12-8/18	8/19-8/25	8/26-9/1	9/2	Total
Boats	226	214	226	372	308	582	432	417	931	778	489	82	446	590	674	56	716	49	7,578
Angler Trips	453	511	604	997	776	1,585	1,121	1,167	2,569	2,263	1,384	262	1,328	1,649	1,876	154	1,933	140	20,746
Angler Hours	1,429	1,945	2,811	5,944	3,454	7,862	12,577	6,575	13,669	12,963	7,169	1,515	6,019	9,166	8,216	742	9,524	804	112,142
Kings	17	38	67	10	104	270	238	219	359	275	101	19	191	142	134	22	85	12	2,301
Coho	0	7	2	0	6	29	75	214	663	805	506	125	646	735	814	95	799	101	5,622
Pinks	0	121	0	0	2	10	24	43	398	170	152	15	41	67	52	0	13	2	1,110
Chums	0	3	0	0	0	3	3	0	6	8	13	0	2	8	14	3	24	2	89
Red	0	0	0	0	0	2	6	3	12	3	0	0	0	4	0	0	2	0	32
Other	70	69	97	27	27	137	62	38	44	53	48	23	6	17	4	0	16	0	738
Total Salmon	35	334	135	24	120	313	341	477	2,399	1,290	774	160	3,039	1,082	2,737	120	923	118	9,151
Total Halibut	0	4	4	331	34	92	69	42	93	52	31	15	71	174	175	8	163	8	1,366

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