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EVALUATION OF POPULATION SIZE, STATUS OF FISH POPULATIONS, AND THE LAKE CHARACTERISTICS FOR THREE LAKES IN THE VICINITY OF KETCHIKAN, ALASKA[1]

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Three lakes in the Ketchikan area were examined to estimate the population size of sport fish species, general lake characteristics, and the current condition of fish populations present. Second Waterfall Lake contained a stocked population of rainbow trout *Salmo gairdneri*. The population estimate was 257 trout (±14 for a 95 percent confidence interval range). The fish in the population were in good condition (average condition factor = 1.17). Lower Wolf Lake contained a natural population of cutthroat trout *Salmo clarki*. The population estimate was 196 fish (with 95 percent confidence interval limits of 125-287) and some Dolly Varden char *Salvelinus malma* (total catch was 39, with insufficient recaptures to estimate population size). The Lower Wolf Lake cutthroat trout were in average condition (average condition factor = 1.02). Harriett Hunt Lake contained the remnants of a stocked population of rainbow trout (total catch was 26, with insufficient recaptures to estimate population size) that were in good condition (average condition factor = 1.28).

KEY WORDS: Southeast Alaska, lake, rainbow trout, *Salmo gairdneri*, cutthroat trout, *Salmo clarki*, Dolly Varden char, *Salvelinus malma*, Ketchikan, Revillagigado Island, Second Waterfall Lake, Lower Wolf Lake, Harriett Hunt Lake, enhancement opportunities, lake surface area, lake volume, mean depth, total dissolved solids, conductivity, Maximum Sustainable Yield, Morphoedaphic Index, condition factor, capture-recapture population estimation, catch per unit effort, Zippin population estimator, Jolly-Seber population estimator, Anderson-Darling *K*-sample goodness-of-fit test, closure test, probability of capture, CAPTURE computer program, RECAP computer program, bootstrap confidence intervals.

INTRODUCTION

Several Ketchikan area lakes have become, or will soon become, more accessible to the public due to expansion of road systems associated with logging and other private enterprises. This report evaluates the existing opportunities for recreational freshwater fishing in three lakes in the Ketchikan area on Revillagigado Island: Second Waterfall Lake, Lower Wolf Lake, and Harriett Hunt Lake.

The impetus for the project came from meetings of a task force comprised of local recreational anglers and Alaska Department of Fish and Game (ADF&G) staff. The task force was appointed by the Commissioner of the ADF&G to assist in the development of strategic plans regarding sport fishing in the Ketchikan area. During the planning process several lakes were identified as being the most likely to provide freshwater fishing opportunities if public access could be improved. Local sport fishing groups have expressed their willingness to donate time, labor, and materials to establish good trails to some of the lakes, and, hopefully, this report will help to ensure that such efforts are not wasted.

Development of new freshwater fishing opportunities for the general public in the Ketchikan area is the overall goal of this research project, and the objective of this report is to describe the three lakes by examining the size and status of fish populations, and by examining several physical aspects of the lakes and comparing them to other lakes in southeast Alaska.

The specific objectives of the project were to:

1. estimate the population size of species of sport fish in selected lakes in the Ketchikan area;
2. estimate the potential productivity of selected lakes in the Ketchikan area;
3. assess the status of current populations of sport fish species in selected lakes in the Ketchikan area; and
4. provide summary information regarding the lakes and sport fish populations examined to local sport fishing groups and to the U.S. Department of Agriculture's Forest Service, and coordinate efforts to provide trail access to suitable lakes.

METHODS

Population Estimates

Trout and char were captured, marked, and recaptured in Second Waterfall Lake, Lower Wolf Lake, and Harriett Hunt Lake in the Ketchikan area (Figure 1). Three 5-day sampling periods were spent on Second Waterfall Lake and Lower Wolf Lake, and two 5-day sampling periods were spent on Harriett Hunt Lake. Fish were captured by using Gee minnow traps (small traps), a larger version of the Gee minnow trap constructed of Vexar and aluminum (large traps), and hook and line. Unique marks were used for each sampling period. A lower caudal punch was used during period one, an upper caudal punch was used during period two, and an anal fin clip was used

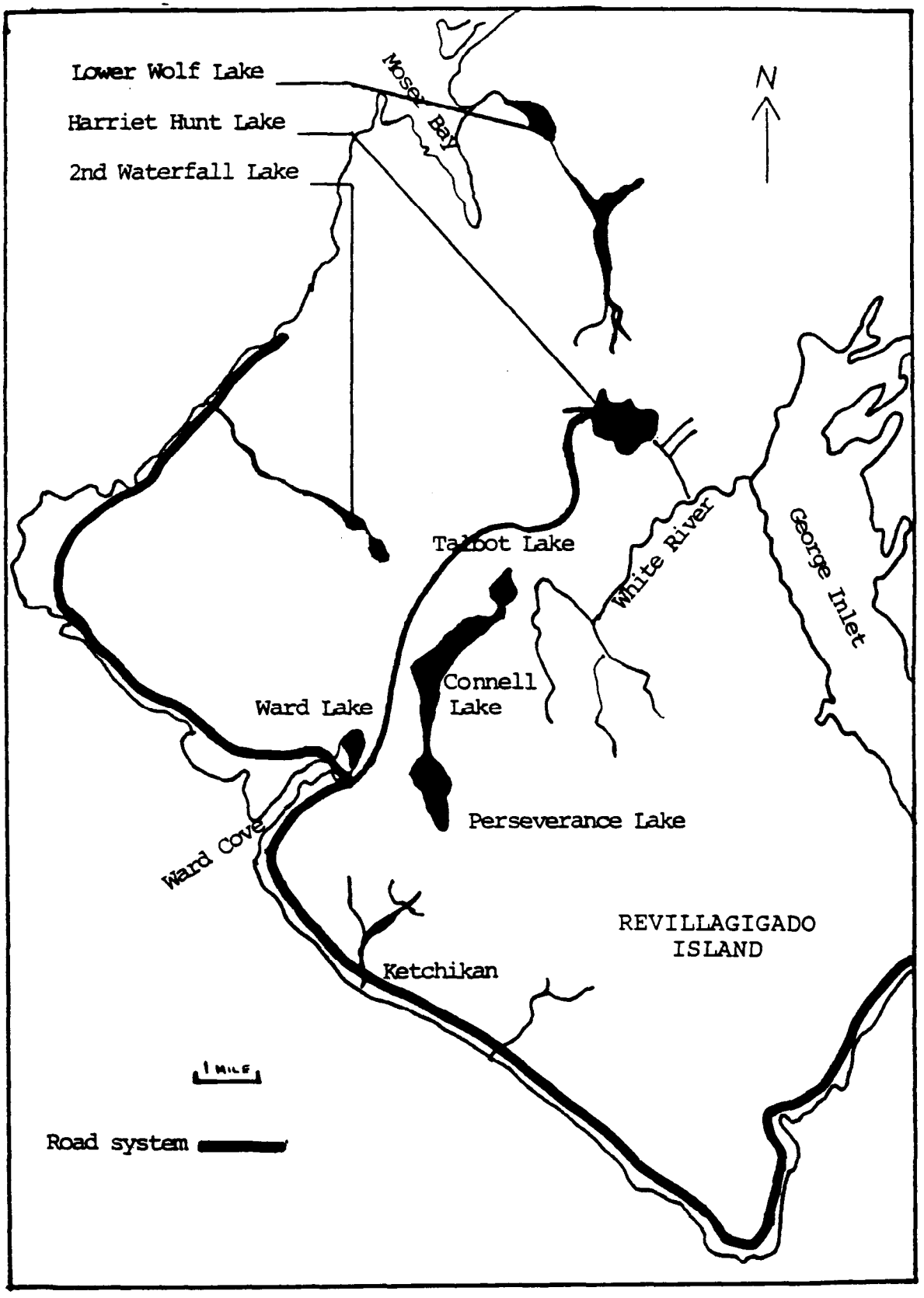

Figure 1. Lakes examined.

during period three. All fish captured were examined for marks. The total number captured and initially marked, the total number recaptured with marks, and the total number recaptured without marks were recorded by species and by mark during each sample period.

During each sampling period, all captured fish were anesthetized with tricaine methanesulfonate (MS-222), identified as to species, counted (marked and unmarked fish were recorded separately by species by mark and by gear type), measured from the tip of the snout to the fork of the tail (fork length to the nearest millimeter), weighed to the nearest 0.1 gram on a triple-beam balance, allowed to recover, and released. All mortalities were recorded. The total fishing time (to the nearest hour) for each gear unit, and the number of gear units for each gear type (small minnow traps, large traps, and hook and line) were also recorded for each sampling period.

The closed population capture-recapture computer program called CAPTURE was used to evaluate the capture history data from each lake for each species of fish (White et al. 1982). The program automatically selected the appropriate estimator (e.g., jackknife, Zippin, generalized removal) for the best fit model (i.e., M_o: constant capture probabilities across time and animals; M_b: behavioral response affect after first capture; M_t: capture probabilities vary by occasion; M_h: capture probabilities vary by animal; and their combinations: M_{tb}, M_{bh}, M_{th}, M_{tbh}). Additionally the program was used to test for closure, that is whether the population is subject to death, immigration, emigration, birth, or recruitment. Refer to White et al. (1982) and Otis et al. (1978) for details on testing procedures and estimation formulae. In addition to evaluating the closure hypothesis and selecting the appropriate model via the CAPTURE program, we tested the hypothesis that our mixture of the gear deployed was size selective. This test was performed by comparing the empirical density distribution of the length of fish captured on the first sampling occasion with the density distribution of fish lengths recaptured on the second occasion. A *K*-sample Anderson-Darling test was used to test the null hypothesis of no difference between the distributions (Scholz and Stephens 1987). All tests (both for closure and for size-selective capture probabilities) were conducted at an $\alpha = 0.05$.

If the closure test was rejected, indicating that the population was open, then we used the Jolly-Seber type estimator as provided in the program RECAP. This program implements a modified Jolly-Seber estimator and uses the bootstrap approach to obtain non-parametric confidence intervals (Buckland 1980, 1982).

Catch per unit effort (CPUE) by sampling period by species by gear type was calculated using standard methods (Ricker 1975).

Lake Characteristics

Bathymetric maps were constructed by using an outline map constructed from aerial photographs and a Simrad EYM fathometer to record continuous depths along selected transects crossing each lake (see Dodge et al. 1981). Four transects were used in mapping Second Waterfall Lake, and six transects were used in mapping Lower Wolf Lake. A bathymetric map was already available for Harriett Hunt Lake (ADF&G 1978).

General water chemistry measurements (water temperature profile, dissolved oxygen, pH, alkalinity, and conductivity) were collected from single stations on Second Waterfall Lake and Lower Wolf Lake during the first sampling period. This information was already available for Harriett Hunt Lake (ADF&G 1978).

Data obtained from bathymetric mapping, a polar planimeter, and the following formulae were used to estimate the surface area (A), volume (V), and mean depth (Z) for each lake:

$$A = (VR)\ (CF_1)\ (CF_2) \quad [1]$$

VR - vernier reading of the lake perimeter from a polar planimeter

CF_1 - conversion factor to convert the vernier reading to the map scale

CF_2 - conversion factor to convert the map scale to acres or hectares

$$V = \sum_{i=1}^{n} \{ [h_i + 3] [A_i + A_{i+1} + (A_i A_{i+1})^{\frac{1}{2}}] \} \quad [2]$$

i - subscript denoting horizontal stratum

n - number of horizontal strata

h_i - vertical distance between A_i and A_{i+1}

A_i - area of the ith horizontal stratum

$$Z = V + A \quad [3]$$

Total dissolved solids (TDS) was estimated using conductivity measurements and the following formula:

$$TDS = 0.65\ C \quad [4]$$

C - conductivity (μmhos/cm)

The TDS was then divided by the mean depth to obtain the morphoedaphic index (MEI) for each lake (Ryder 1964, 1965). The maximum sustained yield (MSY) was estimated using the following regression equation from Schlesinger and Regier (1982):

$$\log_{10} MSY = 0.044(TEMP) + 0.482(\log_{10}(MEI_{25}) + 0.021 \quad [5]$$

MSY - maximum sustainable yield in (kg/hectare-year)

TEMP - mean annual air temperature (°C)

MEI_{25} - total dissolved solids/mean depth for lakes with mean depths < 25 m measured in mg/l

MEI and MSY were then compared with similar information from other lakes in southeast Alaska (Schmidt 1983).

Population Status

Paired length and weight samples were obtained from all newly captured fish (see Population Estimates section above) to estimate the relative condition of populations at the time of sampling as measured by the condition factor (K) using the following formula: $K = 100 \times \text{Weight (gm)} / \text{Fork Length (cm)}^3$. The mean and standard deviation of condition factors were calculated using standard statistical procedures.

RESULTS

Population Estimates

Second Waterfall Lake:

A total of 241 rainbow trout *Salmo gairdneri* were captured, marked, and released during three sampling periods at Second Waterfall Lake (Table 1). No other species were captured. During the first sample period (7 September through 11 September 1987), 181 rainbow trout were captured. There were two mortalities, 25 of these trout were recaptures, and one fish was released without being marked; so the total number of marked fish in the lake at the end of sample period one was 153 (Table 2).

A total of 116 rainbow trout were captured during sampling period two (28 September through 2 October 1987). There were two mortalities, 19 recaptures had been marked during period two, and 34 were recaptures of fish marked during the first sampling period. The total number of marked fish in the lake at the end of sampling period two was 214 (Table 2).

During the third sampling period (19 October through 23 October 1987), a total of 91 rainbow trout were captured. There were no mortalities, 17 recaptures had been marked during period three, 24 recaptures had marks from the second sampling period only, 9 had marks from the first sampling period only, and 14 had marks from both sampling period one and sampling period two (Table 2). The total number of marked fish in the lake at the end of sampling period three was 241 (assuming no mortality of marked fish that were released alive).

The *K*-sample Anderson-Darling test comparing lengths of rainbow trout captured on the first sampling occasion with the recaptured trout from the second occasion indicated no size selectivity (with $A^2_{akN} = 1.40$, $\sigma^2_N = 0.5697$, and $T_{akN} = 0.524$, with the critical value of 1.96 for T_{akN}). The CAPTURE program indicated that the closure hypothesis was rejected, indicating an open population ($z = -2.45$). However, the CAPTURE program also indicated that the best model for the data was M_b, in which case the closure test does not work properly (White et al. 1982). Accordingly, considering the short overall duration between the first and third sampling occasions, we continued to accept the closure assumption. The estimator for the M_b is the Zippin removal estimator. CAPTURE calculated a population

Table 1. Summary of catch, effort, and catch per unit effort (CPUE) by gear type, sample period, species, and lake.

Lake	Species[1]	Period	Gear	Catch	Effort	CPUE
Waterfall	RT	1	Large Traps	133	440.0	0.30
Waterfall	RT	1	Small Traps	20	976.0	0.02
Waterfall	RT	1	Hook and Line	28	21.0	1.33
Waterfall	RT	1	ALL GEAR	181	1437.0	0.13
Waterfall	RT	2	Large Traps	102	440.0	0.23
Waterfall	RT	2	Small Traps	2	222.0	0.01
Waterfall	RT	2	Hook and Line	12	7.0	1.71
Waterfall	RT	2	ALL GEAR	116	669.0	0.17
Waterfall	RT	3	Large Traps	78	440.0	0.18
Waterfall	RT	3	Small Traps	2	616.0	0.01
Waterfall	RT	3	Hook and Line	11	16.0	0.69
Waterfall	RT	3	ALL GEAR	91	1072.0	0.08
Wolf	CT	1	Large Traps	59	450.0	0.13
Wolf	CT	1	Small Traps	7	462.0	0.02
Wolf	CT	1	Hook and Line	19	15.0	1.27
Wolf	CT	1	ALL GEAR	85	927.0	0.09
Wolf	CT	2	Large Traps	118	452.5	0.26
Wolf	CT	2	Small Traps	9	633.5	0.01
Wolf	CT	2	Hook and Line	18	20.0	0.90
Wolf	CT	2	ALL GEAR	145	1106.0	0.13
Wolf	CT	3	Large Traps	91	335.0	0.27
Wolf	CT	3	Small Traps	2	315.0	0.01
Wolf	CT	3	Hook and Line	13	9.0	1.44
Wolf	CT	3	ALL GEAR	106	659.0	0.16
Wolf	DV	1	Large Traps	3	450.0	0.01
Wolf	DV	1	Small Traps	2	462.0	0.01
Wolf	DV	1	Hook and Line	0	15.0	0
Wolf	DV	1	ALL GEAR	5	927.0	0.01
Wolf	DV	2	Large Traps	17	452.5	0.04
Wolf	DV	2	Small Traps	5	633.5	0.01
Wolf	DV	2	Hook and Line	0	20.0	0
Wolf	DV	2	ALL GEAR	22	1106.0	0.02
Wolf	DV	3	Large Traps	10	335.0	0.03
Wolf	DV	3	Small Traps	0	315.0	0
Wolf	DV	3	Hook and Line	0	9.0	0
Wolf	DV	3	ALL GEAR	10	659.0	0.02
Harriett Hunt	RT	1	Large Traps	9	360.0	0.03
Harriett Hunt	RT	1	Small Traps	2	336.0	0.01
Harriett Hunt	RT	1	Hook and Line	3	3.0	1.00
Harriett Hunt	RT	1	ALL GEAR	14	699.0	0.02
Harriett Hunt	RT	2	Large Traps	10	480.0	0.02
Harriett Hunt	RT	2	Small Traps	4	168.0	0.02
Harriett Hunt	RT	2	Hook and Line	0	9.6	0
Harriett Hunt	RT	2	ALL GEAR	14	647.6	0.02

[1] Species codes are: RT = rainbow trout; CT = cutthroat trout; and DV = Dolly Varden.

Table 2. Summary of marks, recaptures, and population estimates with 95% confidence intervals (CI) by sample period, species, and lake.

	Second Waterfall Lake - Rainbow Trout			Lower Wolf Lake - Cutthroat Trout		
	Period			Period		
	1	2	3	1	2	3
Captured, marked, and released						
Newly marked fish	153	61	27	78	107	40
Recaptures						
from period 1	25	34	9	7	18	4
from period 2	---	19	24	---	20	35
from periods 1 & 2	---	---	14	---	---	14
from period 3	---	---	17	---	---	12
Captured and died						
Newly captured fish	2	1	---	---	---	---
Recaptures						
from period 1	---	1	---	---	---	---
from period 2	---	---	---	---	---	---
from periods 1 & 2	---	---	---	---	---	1
from period 3	---	---	---	---	---	---
Captured and released unmarked	1	---	---	---	---	---
Total Catch	181	116	91	85	145	106
Population estimate	257	---	---	---	196	---
95% CI limits	243-271	---	---	---	125-287	---

estimate of 257, with 95% confidence interval (CI) limits of 243 to 271, with the Zippin estimator (Table 2).

Lower Wolf Lake:

A total of 225 cutthroat trout *Salmo clarki*, 30 Dolly Varden *Salvelinus malma*, 245 stickleback *Gasterosteus* species, and 23 sculpins *Cottus* species, were captured during three sampling periods at Lower Wolf Lake. During the first sample period (14 September through 18 September 1987), 85 cutthroat trout were captured (Table 1). There were no mortalities and 7 of these trout were recaptures, so the total number of marked cutthroat trout in the lake at the end of sample period one was 78 (Table 2).

A total of 145 cutthroat trout were captured during sampling period two (12 October through 16 October 1987). There were no mortalities, 20 recaptures had been marked during period two, and 18 were recaptures of fish marked during the first sampling period. The total number of marked fish in the lake at the end of sampling period two was 185 (Table 2).

During the third sampling period (26 October through 30 October 1987), 106 cutthroat trout were captured (Table 1). There was one mortality, 12 recaptures had been marked during period three, 35 recaptures had marks from the second sampling period only, 4 had marks from the first sampling period only, and 14 had marks from both sampling periods (Table 2). The total number of marked fish in the lake at the end of sampling period three was 225 (assuming no mortality of marked fish that were released alive).

The *K*-sample Anderson-Darling test comparing lengths of cutthroat trout captured on the first sampling occasion with the recaptured trout from the second occasion indicated no size selectivity (with $A^2_{akN} = 1.19$, $\sigma^2_N = 0.5597$, and $T_{akN} = 0.255$, with the critical value of 1.96 for T_{akN}). The CAPTURE program indicated that the closure hypothesis was rejected, indicating an open population ($z = -3.34$). The test is most likely valid in that the CAPTURE program also indicated that the best model for the data was M_t, which is one of the models for which the closure test works properly (White et al. 1982). Accordingly, we used the RECAP program to estimate a Jolly-Seber population estimate at the start of sampling period two. The estimate was 196 trout, with 95% CI limits of 125 to 287 (Table 2).

Harriett Hunt Lake:

A total of 28 rainbow trout were captured during two sampling periods at Harriett Hunt Lake. No other species were seen. During the first sample period (21 September through 25 September 1987), 14 rainbow trout were captured (Table 1). There was one mortality and none of these trout were recaptures, so the total number of marked fish in the lake at the end of sample period one was 13.

A total of 14 trout were captured during sampling period two (5 October through 9 October 1987), (Table 1). There were no mortalities, one recapture had been marked during the same period, and one was a recaptured fish marked during the first sampling period. The total number of marked fish in the lake at the end of sampling period two was 25. Because of the small numbers of fish that were captured and marked during two sampling

periods, no further sampling was conducted, and population estimates were not calculated.

Lake Characteristics

Second Waterfall Lake:

Second Waterfall Lake is a small mountain lake located approximately 8 miles (13.5 kilometers) north of Ketchikan. Currently, it is accessible via a 3-mile (4.8 km) undeveloped trail leaving the North Tongass Highway at Mile 17.5 (28.2 km).

Construction of the contour map (Figure 2) and the use of a polar planimeter allowed calculation of surface area, volume, and mean depth. The surface area of the lake is 13.4 acres (5.4 hectares) and the elevation is approximately 1,100 feet (340 meters) (Table 3). The volume of the lake is 65.5 acre-feet (10.3 hectare-meter) and the mean depth is 4.9 feet (1.9 meters).

Specific conductance was measured as 15 micromhos at all depths (Table 4). Total dissolved solids (TDS) is 10.5 mg/l, the morphoedaphic index is 7.20, and the MSY is 2.59.

Lower Wolf Lake:

Lower Wolf Lake is the lowest of two lakes located approximately 14 miles (22.5 kilometers) north of Ketchikan. Currently, it is accessible from saltwater at Moser Bay via a 1.5-mile undeveloped trail (2.4 km).

Construction of the contour map (Figure 3) and the use of a polar planimeter allowed calculation of surface area, volume, and mean depth. The surface area of the lake is 61.4 acres (24.8 hectares) and the elevation is approximately 350 feet (560 meters) (Table 3). The volume of the lake is 2,659.9 acre-feet (328.1 hectare-meter) and the mean depth is 43.4 feet (13.2 meters).

Unfortunately, specific conductance measurements were found to be erroneous, hence TDS, MEI, and MSY could not be calculated.

A temperature profile and pH, alkalinity, and dissolved oxygen measurements are presented in Table 5.

Harriett Hunt Lake:

Harriett Hunt Lake is about 10.5 miles (17 km) NNE of Ketchikan. It is accessible by driving 7.5 miles (14 km) to the end of the Ward Creek road.

Bathymetric mapping by the Fisheries Rehabilitation, Enhancement, and Development (FRED) Division (Figure 4) yielded a surface area of 193.5 acres (78.3 hectares), a volume of 15,551.4 acre-feet (1,919 hectare-meters), a mean depth of 81 feet (24.7 meters), and a maximum depth of 225 feet (68.6 meters) (Table 3). The elevation of the lake is 640 feet (195 meters). Specific conductance was measured as 20 micromhos. TDS was calculated to be 13.0 mg/l, the MEI was 0.53, and MSY was 0.70.

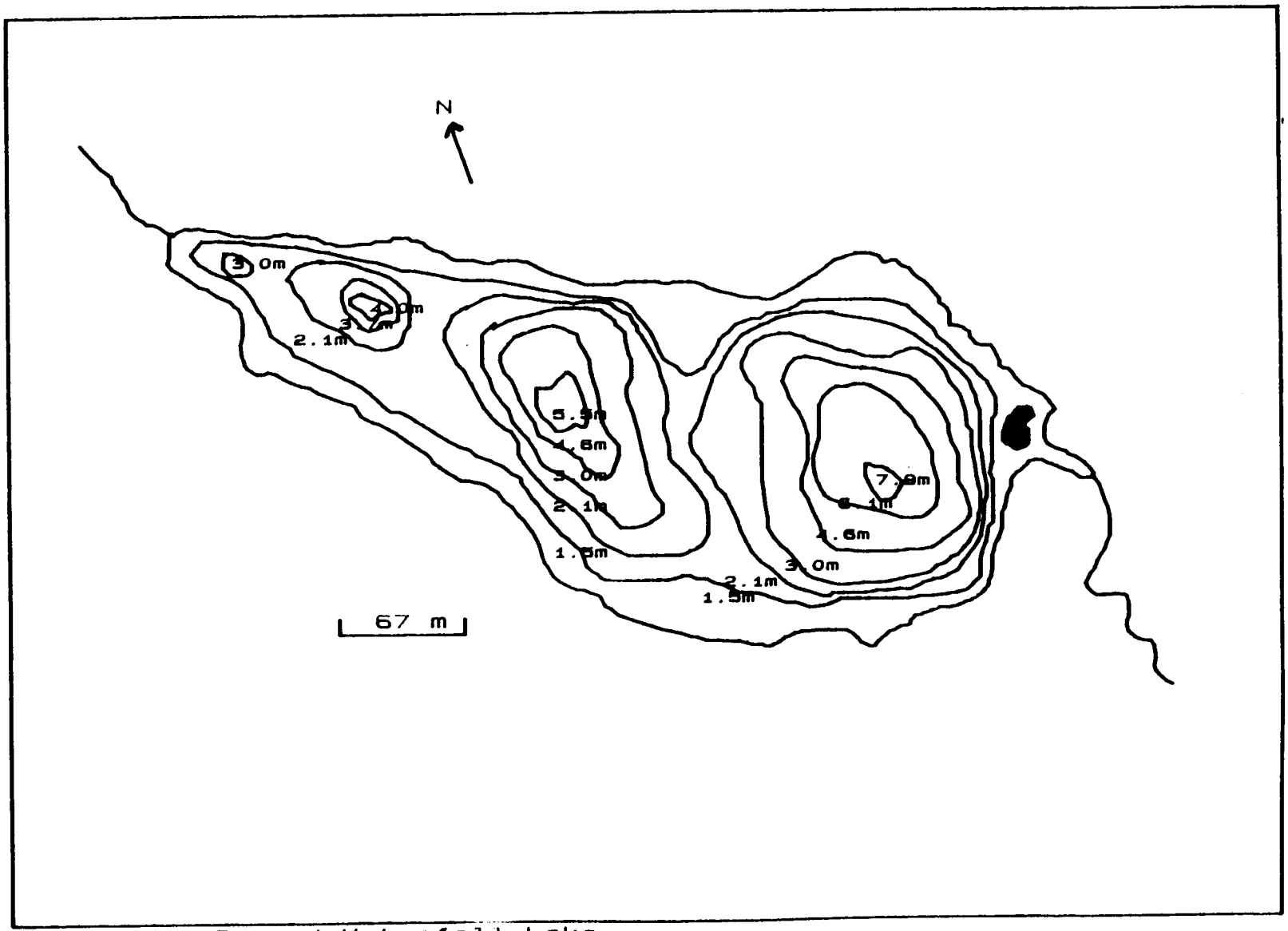

Figure 2. Second Waterfall Lake.

Table 3. Comparison of parameters associated with three Ketchikan lakes (in CAPS) and with other lakes in southeast Alaska.

Lake	Conductance (μmhos)	TDS[1] (mg/l)	Area (ha)	Mean Depth (m)	MEI[2]	Yield[3] (kg/ha)
WATERFALL	15	11[4]	5.7	2.0	5.26	2.21
WOLF	...	...[4]	24.8	13.2	...	...
HARRIETT HUNT	20	14[4]	78.3	24.7	0.57	0.70
Helen	50	35[4]	14.5	3.7	9.46	2.97
Red	93	65[4]	166.0	10.4	6.25	2.41
Mountain	100	59	83.0	20.5	2.88	1.64
Situk	105	60	408.0	27.3	2.20	1.43
Streets	30	21	60.7	11.0	1.91	1.34
Finger	28	20[4]	347.0	10.7	1.87	1.32
Tammy	25	18[4]	134.0	10.0	1.80	1.30
Green	39	22	70.0	12.3	1.79	1.29
Salmon	26	18	41.1	10.4	1.75	1.28
Bear	29	21[4]	30.7	12.2	1.66	1.24
Klawak	39	24	1177.0	17.7	1.36	1.13
Hofstad	17	12[4]	60.3	9.8	1.22	1.07
Auke	28	20	46.0	19.0	1.05	0.99
Virginia	18	13[4]	258.0	13.0	1.00	0.97
Manzanita	60	42[4]	625.0	49.0	0.86	0.89
Salmon Bay	30	21[4]	388.0	26.7	0.79	0.86
Sitkoh	39	27[4]	209.5	35.2	0.77	0.85
Heckman	17	14	163.0	19.7	0.71	0.81
Spurt	16	14	107.0	22.2	0.63	0.77
Karta	26	16	508.0	27.6	0.58	0.74
Bugge	20	14[4]	66.8	24.0	0.58	0.74
Akwe	48	28	216.0	50.1	0.56	0.72
De Boer	13	13	51.0	23.0	0.56	0.72
Wilson	51	36[4]	468.0	54.0	0.67	0.69
Ella	47	33[4]	710.0	70.0	0.47	0.66
Patching	17	14	207.0	30.2	0.46	0.66
Blue	33	22	538.0	52.0	0.42	0.63
Turner	15	10[4]	1270.0	30.0	0.33	0.55
Plotnikof	14	10	320.4	37.4	0.27	0.50
Osprey	20	14	109.0	60.0	0.23	0.46
Baranof	22	8[4]	323.6	39.0	0.20	0.43
Swan	20	16	208.0	91.4	0.18	0.41
Avoss	21	8[4]	123.7	45.8	0.18	0.41
Davidof	12	8	140.8	52.5	0.15	0.38
Lonieof	5	4[4]	179.0	55.1	0.07	0.25
Rezanof	3	2[4]	354.0	71.2	0.03	0.17

1 TDS = Total Dissolved Solids

2 MEI = Morphoedaphic Index = TDS/Z.

3 Ryder (1965) described the equation $y \approx 2(x)^{\frac{1}{3}}$; where y = yield in pounds per acre (with Z in feet). The metric expression is therefore $y \approx 0.966(x)^{\frac{1}{3}}$ where yield is fish yield as kg/ha and x = MEI.

4 Calculated as 0.70 x specific conductance.

Table 4. Temperature profile, pH, alkalinity, and dissolved oxygen measurements from Second Waterfall Lake.

Lake Characteristics		
Temperature Profile 9/8/87 (4:45p.m.)		9/9/87 Water Chemistry
Surface	0′ - 16.0°C	Surface
	3′ - 15.0°C	
	6′ - 13.3°C	pH = 6.0
	9′ - 12.5°C	Alkalinity = 28 mg/l $CaCO_3$
	12′ - 12.0°C	D.O. = 10.25 mg/l
	15′ - 11.2°C	
	18′ - 9.0°C	
	21′ - 7.7°C	Mid-Depth (12′)
Bottom	24′ - 7.1°C	
		pH = 6.0
		Alkalinity = 26 mg/l $CaCO_3$
		D.O. = 9.99 mg/l
		Bottom (≈20′)
		pH = 6.0
		Alkalinity = 45 mg/l $CaCO_3$
		D.O. = 7.48 mg/l

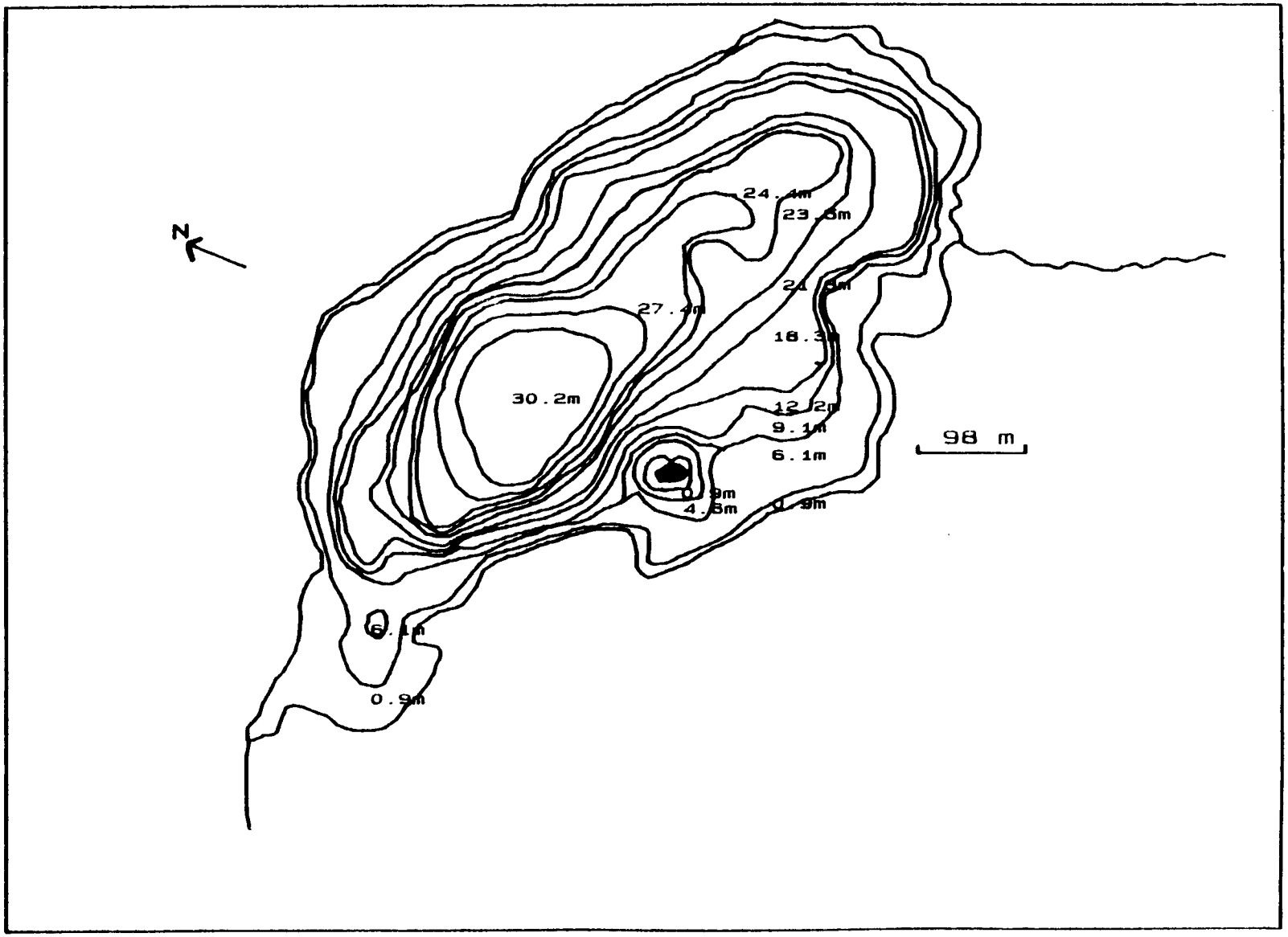

Figure 3. Lower Wolf Lake.

Table 5. Temperature profile, pH, alkalinity, and dissolved oxygen measurements from Lower Wolf Lake.

Lake Characteristics	
Temperature Profile	
9/16/87 11:30 a.m.)	9/17/76 Water Chemistry
Surface 0' - 13.5°C	Surface
3' - 13.0°C	
6' - 13.0°C	pH - 6.0
9' - 13.0°C	Alkalinity - 21.0 mg/l CaCO3
12' - 12.9°C	D.O. - out of solution
15' - 12.9°C	
18' - 12.3°C	
21' - 11.0°C	Mid-Depth (45')
24' - 9.0°C	
27' - 8.5°C	pH - 6.0
30' - 7.5°C	Alkalinity - 21.0 mg/l CaCO3
33' - 7.0°C	D.O. - 11.28 mg/l
36' - 6.5°C	
39' - 6.0°C	
42' - 5.9°C	Bottom (90')
45' - 5.3°C	
48' - 5.0°C	pH - 5.5
51' - 5.0°C	Alkalinity - 19.0 mg/l CaCO3
54' - 5.0°C	D. O. - 8.48 mg/l
57' - 5.0°C	
60' - 4.8°C	
63' - 4.8°C	
66' - 4.8°C	
69' - 4.5°C	
72' - 4.5°C	
75' - 4.5°C	
78' - 4.5°C	
81' - 4.5°C	
84' - 4.5°C	
87' - 4.5°C	

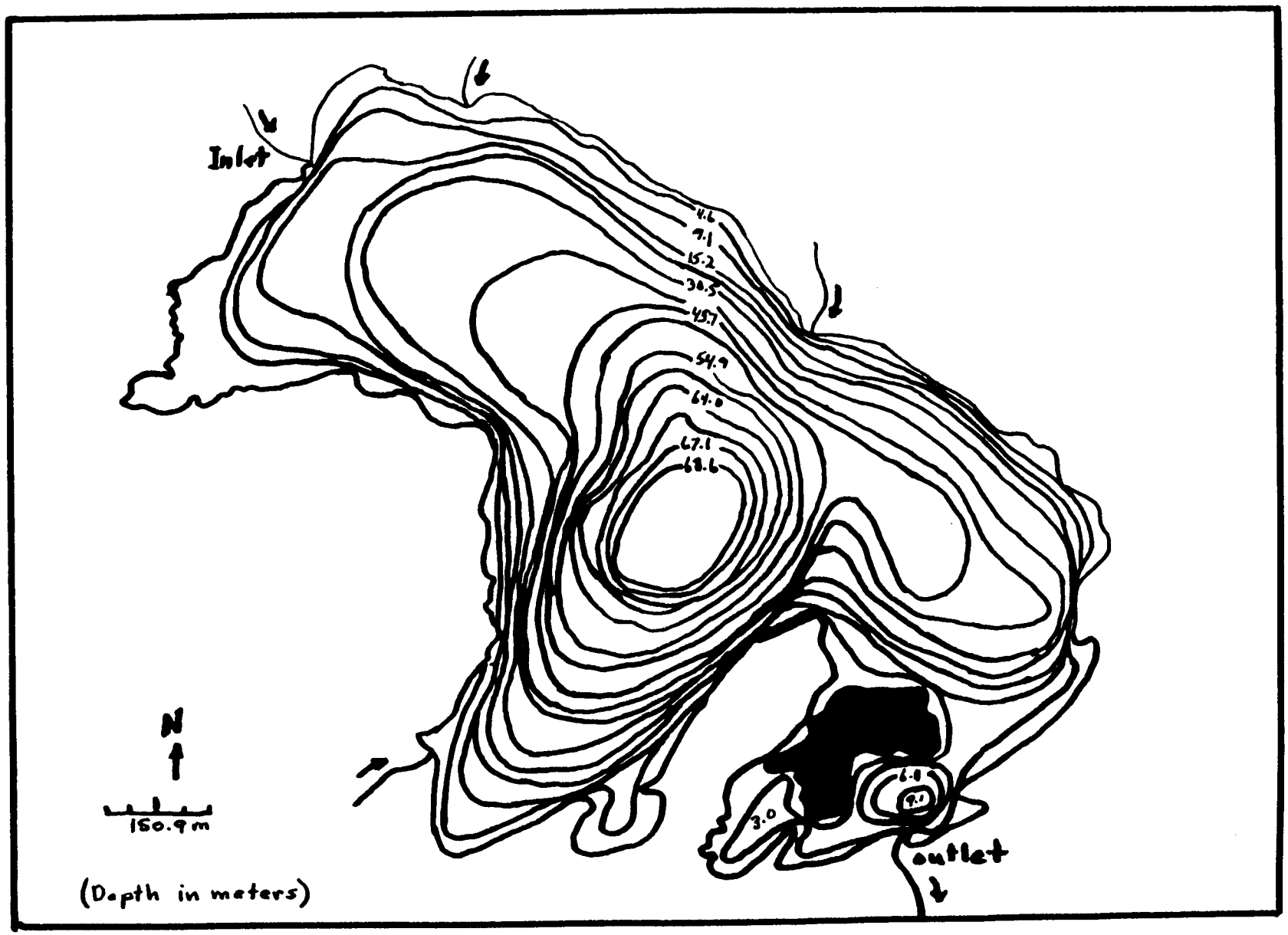

Figure 4. Harriet Hunt Lake.

Population Status

Second Waterfall Lake:

A total of 217 paired lengths and weights were collected from rainbow trout captured in Second Waterfall Lake. Lengths from 244 rainbow trout ranged from 56 mm (2.2 inches) to 433 mm (17 inches), and averaged 203.2 mm (8 inches). Weights from 217 rainbow trout ranged from 1.5 g (0.003 lbs.) to 826.5 g (1.8 lbs.) and averaged 110.2 g (0.24 lbs) The mean condition factor was 1.17 with a standard deviation of 0.32.

Lower Wolf Lake:

A total of 223 paired lengths and weights were collected from cutthroat trout captured in Lower Wolf Lake. Lengths from 223 cutthroat trout ranged from 104 mm (4.1 inches) to 364 mm (14.3 inches) and averaged 209.4 mm (8.3 inches). Weights from 223 cutthroat trout ranged from 9.5 g (0.02 lbs.) to 479.3 g (1.06 lbs) and averaged 114.1 g (0.25 lbs.). The mean condition factor was 1.02 with a standard deviation of 0.19.

Harriett Hunt Lake:

A total of 20 paired lengths and weights were collected from rainbow trout captured in Harriett Hunt Lake. Lengths from 20 rainbow trout ranged from 45 mm (1.8 inches) to 300 mm (11.8 inches) and averaged 141.6 mm (5.6 inches). Weights from 20 rainbow trout ranged from 3.4 g (0.008 lbs) to 306.4 g (0.68 lbs.) and averaged 56.0 g (0.12 lbs.). The mean condition factor was 1.28 with a standard deviation of 0.23.

DISCUSSION

Second Waterfall Lake was stocked via an experimental air drop, with 850 rainbow trout fry in 1965. The present population appears to be in good condition with all size classes represented in the catch (Table 2). The good condition factor and the high MEI and potential yield indicate that the lake's physical attributes are conducive to production of fish biomass (Table 3). The CPUE for hook and line sampling (Table 1) indicates that anglers willing to hike to the lake should experience good fishing.

Lower Wolf Lake contains natural populations of cutthroat trout and Dolly Varden. The estimated size of the cutthroat trout population was rather disappointing, considering that Lower Wolf Lake has a surface area nearly five times greater than that of Second Waterfall Lake. Unfortunately, MEI and potential yield were not estimated because of equipment problems. Accordingly, our evaluation of the physical potential of the lake was limited. However, the condition factor for the cutthroat trout was of average quality, and all size classes were represented in the catch. CPUE for hook and line indicates anglers would receive a respectable, but not an outstanding fishing experience.

Harriett Hunt Lake was planted with 35,000 rainbow trout eyed-eggs in 1954, and stocked with 20,000 rainbow trout fry in 1967. Sport fishing in the lake was reportedly fair until recently. The construction of a road to the

lake in conjunction with logging activities, and the subsequent increased access by the general public may have contributed to the small numbers of fish that we were able to catch. In addition, the low MEI and low potential yield (Table 3) indicate that the physical characteristics of the lake are less than optimum for fish production. An additional problem is that although there are several inlets, they are small and the spawning habitat is limited. In spite of these negative aspects, the large size and beauty of the lake as well as its good accessibility to the public make it a prime candidate for fisheries enhancement. Because of the poor physical conditions in the lake, the best management scheme for this lake would be the establishment of a put-and-take fishery with a regularly scheduled stocking program.

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