

RECONNAISSANCE REPORT
(Fisheries Assessment and Improvement)

PROJECT: CROWSTON LAKE ASSESSMENT REGION: 2
LOCATION: 6 km east of Halfmoon Bay MANAGEMENT UNIT: 2-5
MAP REFERENCE NO: 92-G-12 AIR PHOTO REFERENCE NO: BC 85015
DATE SURVEYED: July 4, 1987 REPORT DATE: April 19, 1988
PERSONS PRESENT: R.P. Griffith, J.R.L. Russell (Ptolemy)
REPORT PREPARED BY: J.R.L. Russell

PURPOSE: To assess fisheries enhancement potential and evaluate the
condition of stocked hatchery cutthroat.

OBSERVATIONS: (See attached.)

PROPOSED ACTION: (See attached.)

PHOTOGRAPHS ATTACHED: YES ___ NO X AVAILABLE: YES X NO ___

CIRCULATE TO: Ross Neuman, Rob Knight, C.D. Tredger, G.D. Taylor

SUGGESTED CONTACTS: Author/C.D. Tredger

COMMENTS BY:

SEE ATTACHED SHEETS: YES X NO ___

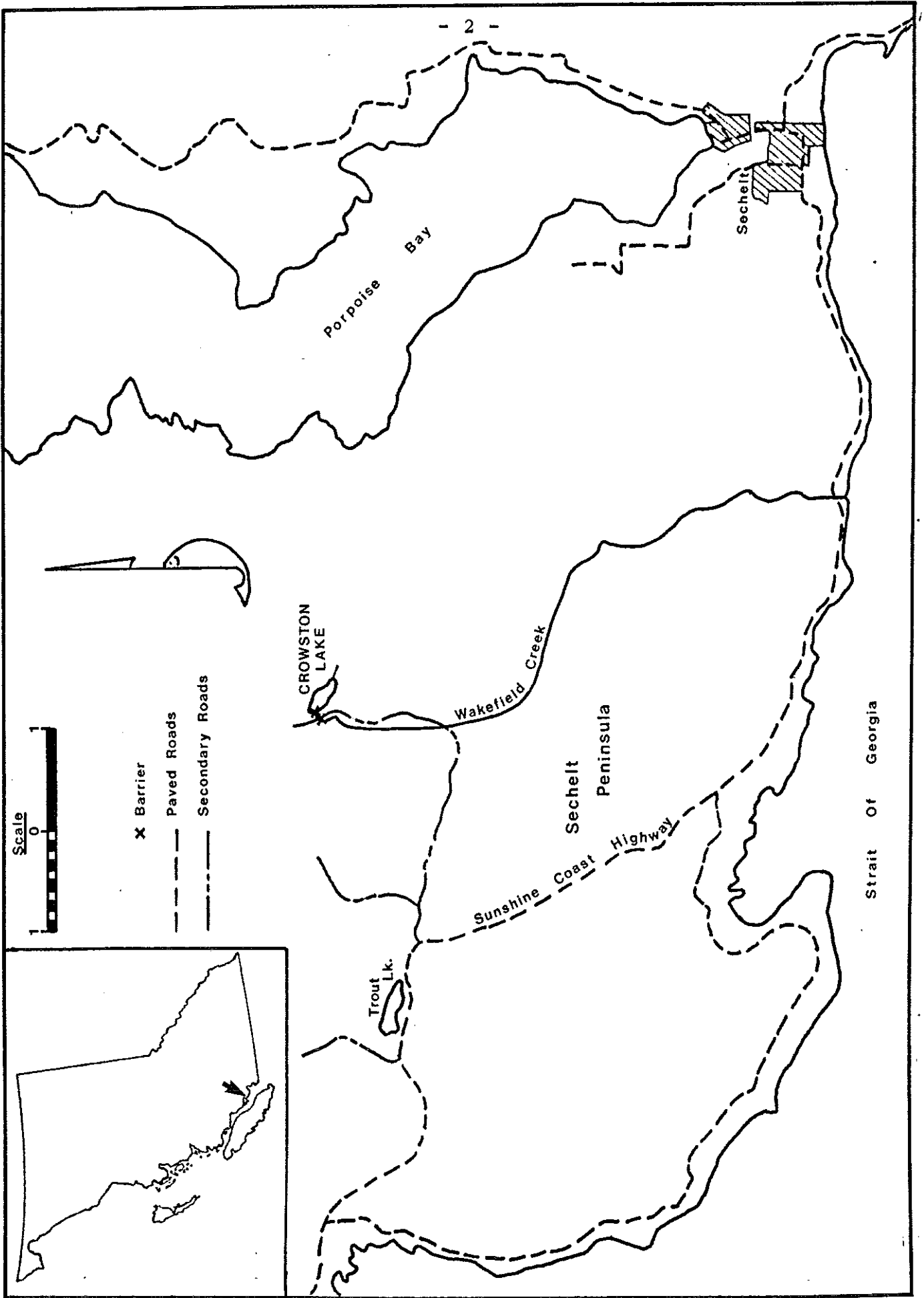
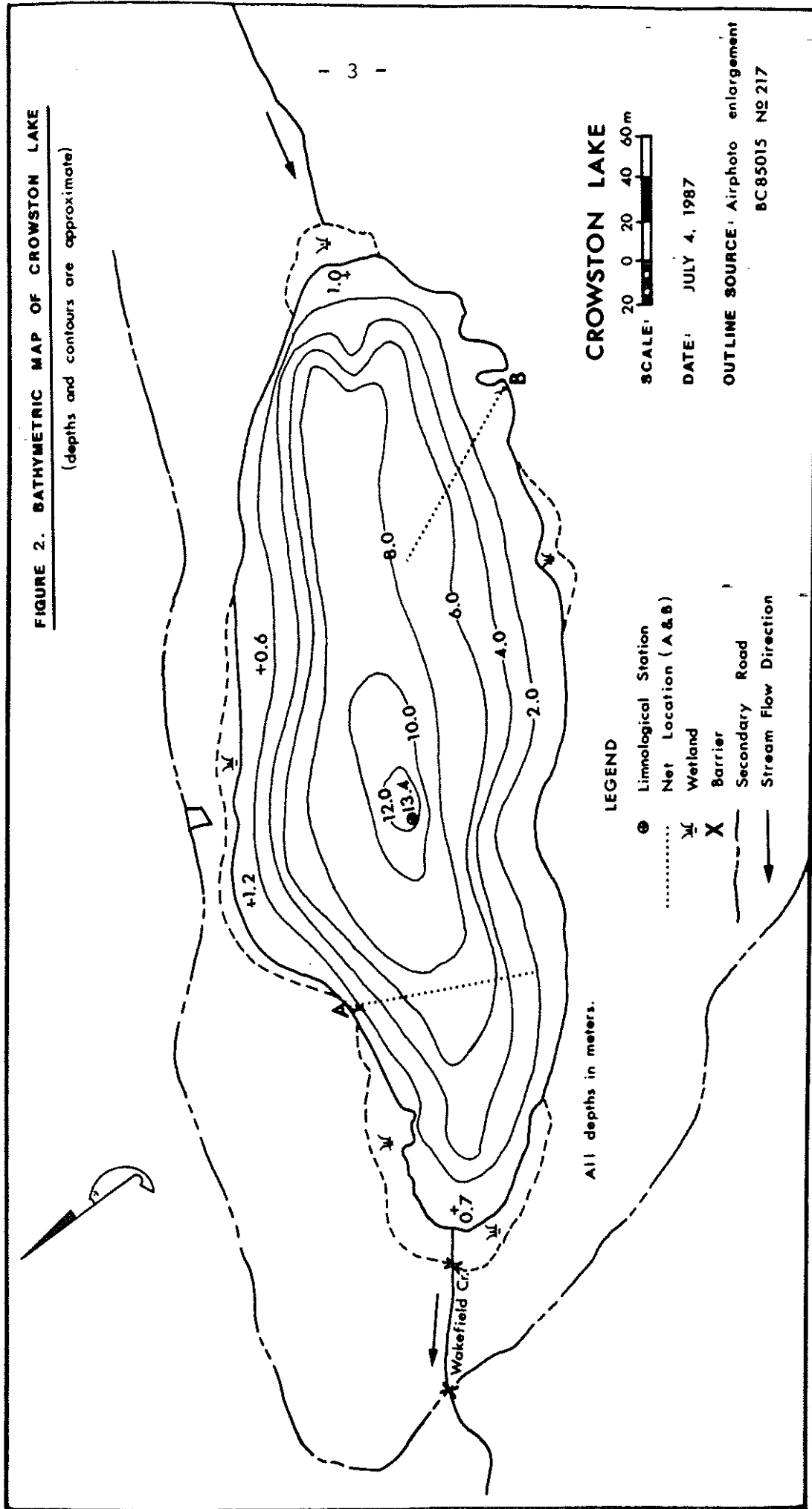


Figure 1: Relative location of Crowston Lake.

FIGURE 2. BATHYMETRIC MAP OF CROWSTON LAKE
 (depths and contours are approximate)



CROWSTON LAKE

SCALE: 20 0 20 40 60m

DATE: JULY 4, 1987

OUTLINE SOURCE: Airphoto enlargement
 BC85015 N2217

LEGEND

- ⊗ Limnological Station
- Net Location (A & B)
- ⌘ Wetland
- X Barrier
- - - Secondary Road
- Stream Flow Direction

INTRODUCTION

At the request of Regional Fisheries Section (Surrey), the Fisheries Assessment and Improvement Unit undertook an assessment of 5 lakes in the Sechelt area during July, 1987. Crowston lake was surveyed along with Sakinaw, Ruby, Klein and Richardson Lakes. The purpose of the Crowston Lake assessment was to evaluate the condition of stocked hatchery fish and determine the potential for cutthroat enhancement.

DESCRIPTION OF THE LAKE

Crowston Lake is located on the Sechelt Peninsula approximately 9 km east of Halfmoon Bay (Fig. 1). Lake elevation is between 274 - 305 m. Crowston Lake drains south and east via Wakefield Creek into the Strait of Georgia. Public access is good on a gravel road off the Sunshine Coast Highway just east of Trout Lake. The last hill (<1 km from the lake) limits vehicles to those with adequate clearance. A beaver dam located at the outlet has led to flooding of the lakeshore to a depth of 0.5 to 1.0 m. The lake is surrounded by hills and is sheltered from all except southerly winds.

Morphometric data for Crowston Lake is presented in Table 1 while lake bathymetry is shown in Figure 2.

Table 1. Morphometric data for Crowston Lake, based on July, 1987 hand soundings by Fisheries Assessment and Improvement Unit as well as aerial photography (BC85015).

Surface Area (ha/ac.)	5.5/13.7
Volume (cu. m/ac.ft.)	278,250/226
Mean Depth (m/ft.)	5/16.4
Maximum Depth (m/ft.)	13.4/44
Perimeter (m/ft.)	1123/3685

WATER QUALITY

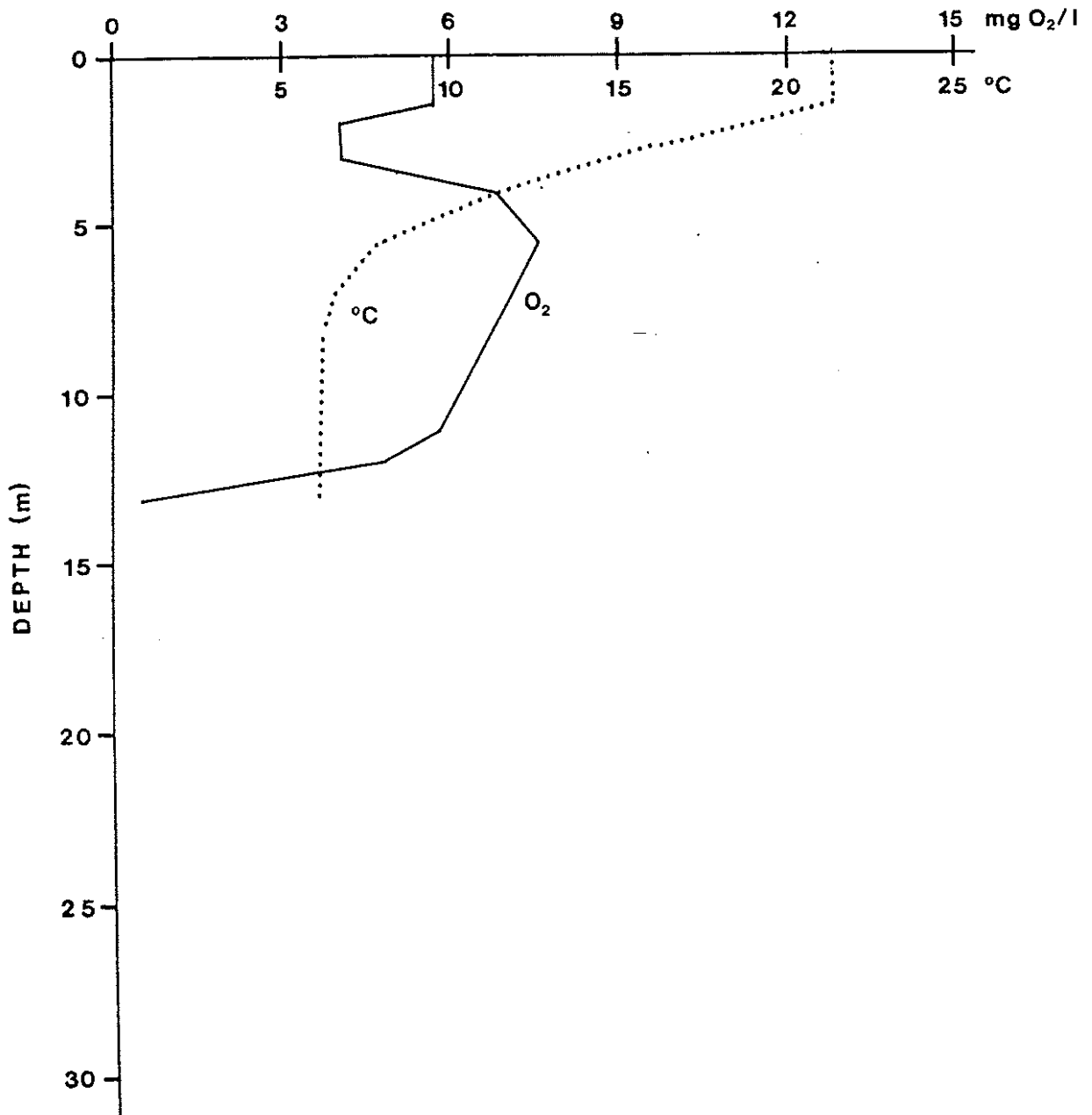
A limnological station was established near the deepest portion of the lake on July 4, 1987. Water samples were collected at the surface and at 12.0 m depth. These samples were subsequently analyzed at the Ministry of Environment and Parks Environmental Laboratory. Results of these analyses and a Secchi depth measurement are presented in Table 2. Temperature and dissolved oxygen profiles were also taken with a YSI temperature/oxygen meter. Profiles are shown in Figure 3.

Table 2. Water quality analysis results for Crowston Lake July 4, 1987.

PARAMETER	UNITS	SURFACE	12.0 m
Filterable Residue	mg/l	34	28
Specific Conductance	$\mu\text{S/cm}$	26	26
pH		6.4	6.2
Total Alkalinity	mg/l	8.5	7.0
Nitrogen: total organic	mg/l	0.31	0.08
total Kjeldahl	mg/l	0.31	0.15
nitrate and nitrite	mg/l	<0.02	0.11
ammonia	mg/l	<0.005	0.069
total	mg/l	0.31	0.26
Phosphorus: total	mg/l	0.020	0.014
Secchi Depth	m	1.7	

Total alkalinity indicates low productivity. Total nitrogen concentration measured at the surface is $<400 \text{ mg/m}^3$, total phosphorus between 15 and 25 mg/m^3 , and transparency between 1.0 and 2.5 m (on a windy overcast day). According to a rating system proposed by Forsberg and Ryding (1980), these 3 parameters suggest a trophic state somewhere between oligotrophic and mesotrophic. Crowston Lake appears to be phosphate limited, although this is not clear-cut (total nitrogen:total phosphorus = 15.5:1). Phosphorus levels in both surface and 12 m samples are

Figure 3: Temperature and oxygen profiles for Crowston Lake (July 4, 1987).



above the 0.005 minimum recommended by Nordin (1985) for salmonid production. Using ammonia nitrogen levels as an indicator of total ammonia present, both surface and 12 m concentrations are below the recommended maxima for salmonid production (Sigma Resource Consultants Ltd., 1979). Values for pH are just below the recommended range of 6.5 - 8.

Thermal stratification was evident on the sampling date (Fig. 3) with a sudden temperature drop occurring between 1.5 and 6.5 m. A metalimnial oxygen maximum was present in association with the thermocline. This increase in oxygen concentration probably resulted from photosynthetic activity. Since mixing by turbulence is impossible due to lake stratification, oxygen produced by photosynthesis is retained in the stratum where it originated (Ruttner, 1963). The slope of the oxygen curve is more typical of oligotrophic lakes, where little oxidization occurs, than lakes with higher productivity (Birge and Juday, 1911; Theinemann, 1918; cited in Ruttner, 1963).

One time measurement of these parameters suggest the lake is capable of low to moderate salmonid production. It is not known how representative these values are of the total growing season.

FISH SPECIES PRESENT AND STOCKING HISTORY

Crowston Lake appears to contain an allopatric population of cutthroat trout (Salmo clarki). No other fish were captured during netting nor were fish remains found in stomach contents of captured cutthroat. In 1984 and 1986 the lake was stocked with 1000 Taylor River cutthroat at 95 and 89.6/kg respectively. Prior to this the lake was barren. The Regional Stocking Plan was recently ammended and now calls for 500 fall fry every 2 years in an effort to increase fish size.

FISH CAPTURES JULY 4, 1987

Two standard six panel experimental nets were set July 4, 1987 (Fig. 2). Net A was set from 0910-1130/2.2 hours while Net B fished from 0925-1200/2.6 hours. A total of 16 cutthroat were taken for a capture rate of 3.33/hour. Overall mean length was 263.4 mm with a range of 189-320 mm. Results of the gillnet captures are presented in Table 3.

CONDITION FACTORS

The mean condition factor for captured trout was $1.0308 \times 10^{-5} \pm 2.8\%$ from a sample of 16 fish. Condition factors for individual fish are shown in Table 3 while statistics for the means are

shown in Table 4.

Table 3. Crowston Lake gillnet captures July 4, 1987.

SPECIES	LENGTH (mm)	WEIGHT (g)	CONDITION FACTOR	AGE
CT	216	105.5	1.05×10^{-5}	1+
CT	320	340.9	1.04×10^{-5}	3+
CT	301	278.8	1.02×10^{-5}	3+
CT	189	68.6	1.02×10^{-5}	1+
CT	272*	226.1	1.12×10^{-5}	2+
CT	206	86.9	0.99×10^{-5}	1+
CT	241	148.6	1.06×10^{-5}	1+
CT	290	265.2	1.09×10^{-5}	3+
CT	308*	261.8	0.90×10^{-5}	3+
CT	293	262.0	1.04×10^{-5}	2S+
CT	295	277.0	1.08×10^{-5}	3+
CT	237	145.6	1.09×10^{-5}	-
CT	300	267.9	0.99×10^{-5}	2S+
CT	200	79.9	1.00×10^{-5}	-
CT	291	260.2	1.06×10^{-5}	-
CT	255	156.1	0.94×10^{-5}	-

*These fish were spawn bound females.

Overall Crowston Lake trout were in good condition with a few exceptions. Most of the fish in poorer condition were either maturing or past maturity. The fish aged 2+ was most likely a 3+ with an indistinct annulus since no stocking occurred in 1985. Most stomachs were full of insects and/or plankton. Scales indicated 2 fish with spawning checks; a female at 293 mm and a male at 300 mm.

Table 4. Statistics for the mean condition factor from Crowston Lake cutthroat captured July 4, 1987.

STATISTIC	TROUT
Mean	1.0308×10^{-5}
Standard Deviation	0.0577×10^{-5}
N	16
Coefficient of Variation	5.60%
Standard Error	0.0124×10^{-5}
Confidence Interval	0.0247×10^{-5}

INLETS AND OUTLETS

Crowston Lake has 1 inlet tributary located at the southeast end. The inlet was dry on the day of survey. Near the lake, inlet flows were not contained in a channel and had spread out over the ground in several directions. There was no discharge in any of the braids on the survey date, although from physical evidence, it appeared as though there was lots of water on occasion. Patches of sand and small gravel were present where runoff had occurred. It is not known how much water is present at spawning time or later for incubation.

The beaver dam at the outlet, Wakefield Creek, acts as a partial barrier to fish movement. A few meters downstream of the dam the access road completely covers the streambed.

ENHANCEMENT CONSIDERATIONS AND RECOMMENDATIONS

A channel could be excavated in the inlet and gravel provided to create spawning habitat. This would at least reduce the numbers of spawnbound fish. Trout that are spawnbound tend to decrease feeding activity and do not fight as well if hooked. Anglers complain about the aesthetic appearance of the fish as well, due to the presence of partly resorbed eggs in the gut cavity. It is possible improved inlet spawning conditions could provide some natural recruitment to the lake. How much production could be achieved would depend on flows and the amount of habitat made available. Supplies and crew could be transported to the work site by boat. A zodiac overlain with 4X8 plywood could be used to

haul gravel from the lakeshore to the mouth of the inlet. Although there is no ready access to the inlet except by water, work in the inlet is recommended over outlet enhancement.

Taylor River stocks would naturally tend to be inlet spawners and benefits of inlet work should be greater. Without an inlet spawning site, many of these fish will drop over the dam to spawn when conditions permit. Having spawned in the outlet their instinct would be to move downstream rather than upstream to the lake. This downstreaming behaviour appears to be magnified where velocities and gradient are relatively high. Once spawned fish move downstream towards the ocean they will be lost to the fishery.

There is a beaver dam at the outlet (0.5 - 1.0 m high). Downstreaming adults may not find this a barrier during spring floods which could overtop the dam. In this way spring floods could provide temporary access for spawning adults to a small area of stream between the dam and the road, and further downstream if the road was flooded as well. Any fry produced in this way would not be able to upstream to the lake until they were of sufficient size to clear the dam.

Truck access to Wakefield Creek below the beaver dam is good but there is very little usable area above the road crossing. Seepage through the dam accounted for all the water observed in the channel on the survey date. The gradient in this section is above 3%. Due to the high gradient maintenance of any enhancement works could be an ongoing problem, depending on velocities generated.

It is not recommended that the beaver dam be removed. The lake is small and relatively shallow. A reduction in lake size and volume could adversely affect production. The amount of littoral vegetation present as a result of bank flooding is likely a significant contributor to the productivity of this lake. Beavers are determined animals and they will persist in rebuilding and repairing the dam leading to ongoing maintenance problems.

EVALUATION

In order to assess the effectiveness of this enhancement project the plan to stock on alternate years should be maintained. After the project has been completed for at least two years the lake should be sampled by netting and scale samples collected from all captured cutthroat. These scales can then be examined for the presence and relative abundance of "odd" year recruits.