A FISHERIES INVESTIGATION
of
LOWER HALGRAVE LAKE

Prepared for

The Mica Fisheries Technical Committee

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SECTION 1
INTRODUCTION AND OBJECTIVES

The Mica Fisheries Technical Committee, comprised of members from BC Environment and B.C. Hydro have recognized the need to renew, upgrade and complete fisheries inventories of selected small lakes in the Kinbasket and Revelstoke reservoir drainages. The studies will provide information required to formulate management plans or to define further information requirements by BC Environment, Kootenay Region.

R. L. & L. Environmental Services Ltd. was contracted in 1991 to conduct comprehensive fisheries inventories on eleven lakes in the Kinbasket and Revelstoke reservoir drainages. The overall objectives of the inventory project were to produce a series of individual lake reports detailing the following (from Request for Proposal, dated 17 May 1991):

- The presence, relative abundance, and distribution of all fish species (both native and introduced stocks) in the study lakes and major tributaries to these lakes.
- The location, description, and photographic documentation of habitats, both within the lake and major tributaries (including inlet and outlet tributaries) that are important to the life history stages of resident fish.
- A bathymetric profile of the lake.
- A description of the basic chemical characteristics of each lake.
- A professional assessment of the quality of existing fisheries in the lakes based on their physical, biological, chemical, and use characteristics.
- A professional assessment of existing fisheries management practices for the individual lakes within the study area, and a detailed description of any viable optional management strategies which could be implemented to create additional fishing opportunities.
- A professional assessment of enhancement or management methods which could be used to create additional fish habitat, fish populations, and/or fishing opportunities in selected lakes.
- The identification of specific fish stocks that may be detrimentally impacted by enhancement activities directed at target species.

Data from each of the eleven lakes are presented in individual reports. This document presents the summary and discussion of data from Lower Halgrave Lake.

SECTION 2
STUDY AREA DESCRIPTION

Lower Halgrave Lake is located approximately 35 km northwest of Invermere, British Columbia (Figure 2.1). The lake is situated in the Interior Douglas Fir biogeoclimatic zone. The average annual precipitation in the area ranges from 35-60 cm; soils in the area are typically podzolic (Farley 1979). Prevailing wind directions are south and south-southwest, and on the average, there are 115 frost free days, typically from 25 May to 18 September (Environment Canada 1982).

SECTION 3
METHODS

3.1 DATA COLLECTION/ANALYSIS

3.1.1 Drainage Basin Characteristics

Prior to field studies and data analyses, sources of available data for Lower Halgrave Lake were identified and pertinent data were reviewed.

During the review of available literature, data for the following parameters were extracted and, where possible, checked to ensure reasonable accuracy.

- Lake Name - official (i.e., Gazetteered) name and all known aliases.
- Waterbody Code - lake watershed code and management unit provided by BC Environment.
- Location - the lake centre as described by both legal (subdivision-section-township-range-meridian) and longitude/latitude in degrees-minutes-seconds plus the most recent aerial photo coverage (including flight lines, and photo number) plus the N.T.S. mapsheet coverage.
- Elevation - surface elevation of the lake in metres above sea level.
- Drainage Relationship - description of inlet and outlet drainage networks.
- Drainage Area - area of the watershed in km^2.
- Land Use and Access - description of local land usages and intensities plus the availability of public access and/or facilities.

3.1.2 Lake Characteristics

1) Lake Morphometry Parameters

i) Surface Area - the surface area of the lake was measured using a digital planimeter.

ii) Lake Volume - the lake volume was calculated from the bathymetric map by measuring the area of each depth contour (using a digital planimeter) and applying the following formula to calculate the volume of water in the depth strata between successive contours (from Welch 1948):

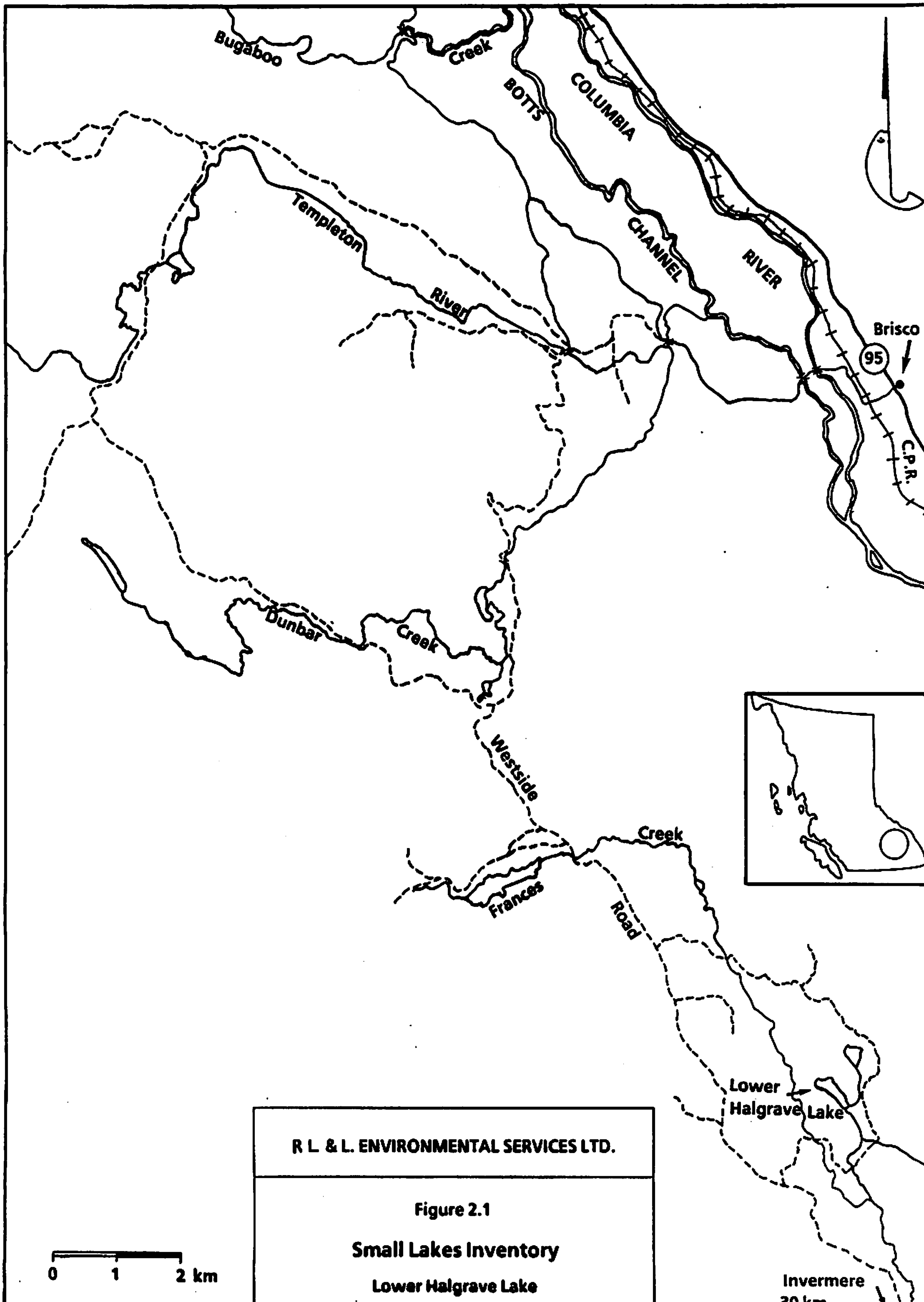

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Figure 2.1

Small Lakes Inventory

Lower Halgrave Lake

$$Stratum\ Volume = \frac{h}{3}\ (a_1+a_2+\sqrt{a_1 a_2})$$

where: h = the vertical depth of each stratum,
a_1 = the area of the upper surface, and
a_2 = the area of the lower surface of each depth stratum.

The total volume is the sum of the individual volumes for each stratum.

iii) Shoreline length - the shoreline length was measured with a digital planimeter.

iv) Shoreline development factor - the shoreline development factor (S.D.F.) is an index figure used to describe the degree of regularity or irregularity of the shoreline and was calculated using the following formula (Welch 1948):

$$S.D.F = \frac{s}{2\sqrt{a\pi}}$$

where: s = the length of shoreline (km), and
a = the area of the lake (km^2).

v) Maximum depth - the maximum depth was determined directly from the bathymetric map.

vi) Mean depth - the mean depth was calculated by dividing the volume of the lake (m^3) by the area of the lake (m^2).

vii) Depth distribution - the depth distribution defines the percentage of each contour interval as measured from the bathymetric map.

viii) Percentage of littoral zone - percentage of littoral zone defines the percentage of the lake surface area shallower than 3.0 m (determined from the bathymetric map).

ix) Percentage of shoal area - percentage of shoal area defines the percentage of the lake surface area shallower than 6 m (20 feet) as determined from the bathymetric map.

2) Water Level Fluctuations

Obvious water level fluctuations were identified by observation of high water marks (if present) on terrestrial vegetation near the lake shore and by the degree of shoreline erosion. A bench mark was established at 2 m above the water level at the time surveyed. The bench mark consisted of a fluorescent orange machine-washer permanently affixed to a tree for future reference. The benchmark location was recorded and mapped.

3) Lake Outline Map

Lake outline maps were produced from a photo enlargement of the most recent air photo coverage of the lake.

4) Bathymetry

Bathymetric profiles were developed by performing sounding transects. The transects were conducted at right angles to the long axis of the lake using a Lowrance X-15 computer sonar from a boat. The start location and direction of each transect was recorded on the lake outline map and positioned at landmarks identifiable from air photos. All transects were sounded at a constant boat speed and the distances from the waters edge of the start and stop locations were recorded.

5) Substrate Typing

Substrate information was obtained through visual observations and periodically confirmed with an Ekman dredge. Additionally, substrate information was obtained during the bathymetric survey (i.e., by observed changes in the bottom tracing on the echogram). Substrate information was drafted on a "substrate map" to indicate the general distribution of the following substrate types and combinations:

- Gravel/Rubble/Boulders: greater than 2.0 mm in diameter
- Sand: coarse and fine, 0.062 to 2.0 mm in diameter
- Clay: finely divided material, not gritty
- Fibrous Organic: detritus, fibrous peat, pulpy peat, recognizable plant particles
- Muck: black ooze, finely divided organic matter; decomposition advanced

6) Water Quality

Water chemistry sampling was conducted as near to mid-day as possible. The following physical and/or chemical properties were measured in the field at the deepest point of the main basin of the lake:

i) Date and time of sampling.

ii) Water transparency (m) measured using a 20 cm diameter Secchi disk, following the method described by Welch (1948).

iii) Cloud cover (% of total visible sky).

iv) Water surface conditions (i.e., extent of wave action) classified as follows:
   - calm: glassy surface
   - rippled: waves not higher than 2 cm
   - wavy: waves not higher than 5 cm
   - rough: waves higher than 5 cm

v) Water temperature profile (°C±0.5°C).
The thermal profile of the lake was determined using the temperature mode of a Hydrolab temperature/dissolved oxygen meter. Prior to field use, the meter was calibrated under laboratory conditions. Temperature measurements were taken 5 cm below the surface and at one metre intervals throughout the water column.

vi) Dissolved oxygen profile (mg/L±0.5 mg/L)
The dissolved oxygen profile of the lake was determined using the dissolved oxygen mode of a Hydrolab temperature/dissolved oxygen meter. Prior to field use the meter was calibrated as noted above. Dissolved oxygen measurements were taken at 5 cm below the surface and at one metre intervals throughout the water column.

vii) Water sample parameter measurements
A water sample was collected at 1 m depth and deposited in a clean glass bottle and a sub-sample removed for analysis. Routine physical/chemical parameters of pH, alkalinity, conductivity and total dissolved solids were measured from the sample in the field.

   - pH: the pH of the water was measured (±.01 pH units) with a Broadley-James portable pH meter or the pH analysis (±0.5 pH units) of a HACH 700 portable water quality kit.

- Alkalinity: the total alkalinity was measured using the alkalinity analysis of a HACH portable water quality kit.

- Conductivity: the conductivity of the water was measured using a Chemtrix Type 700 temperature compensatory conductivity meter and recorded in μS/cm. Prior to field measurements, meter calibration was checked.

- Dissolved solids: the total dissolved solids parameter was calculated using the conductivity value (Rainwater and Thatcher 1960).

7) Vegetation Mapping

i) Terrestrial Vegetation

The percentage composition of the terrestrial vegetation within the area visible from the lake shore was subjectively estimated. Vegetation data was then transferred to lake outline maps. Terrestrial vegetation was categorized by the following types:

- sedges and grasses (may contain small areas of open water)
- muskeg (hydric terrain characterized by mosses and patches of open water)
- brush (understory species of woody or herbaceous plants)
- upland (xeric to mesic terrain with stands of coniferous/deciduous species)

The upland areas were further classified in the following categories:

- coniferous (greater than 75% coniferous species)
- deciduous (greater than 75% deciduous species)
- mixed-wood (approximately 50:50 mix of coniferous and deciduous species)
- burnt (recently burned areas with little re-growth)
- cut (logged/cleared areas with little re-growth)

ii) Aquatic Vegetation

Concentrations of submergent and emergent aquatic vegetation present within the littoral zone were surveyed and mapped. Mapping was done from the boat while circumnavigating the lake. Dominant species were identified in the field and ranked in order of relative abundance. Identification of specimens was accomplished using keys presented in "An Identification Guide to Alberta Aquatic Plants" (Burland, 1981) and "Common Marsh Plants of Saskatchewan" (Carmichael, no date). A list of species in descending order of abundance was prepared, although only a higher taxonomic level (e.g., family or genus) was reported for some of the more difficult to identify species.

8) Fish Sampling

The objectives of the fish sampling program were to 1) determine or update fish species composition and relative abundance while ensuring that as many species, size and age-classes as possible were captured, and 2) obtain representative growth data for each sport species present. Standardized sampling procedures and gear were employed to allow comparisons of catch statistics between waterbodies. Detailed specifications on the fish sampling program are provided below:

i) Sampling Methods

a) Gill Netting

Standard gangs of sinking monofilament nylon nets were employed. Each gang consisted of 15.2 m x 2.4 m panels of each of the following mesh sizes (stretched measure mesh): 25 mm, 76 mm, 51 mm, 89 mm, 38 mm and 64 mm. A net-unit approach was used (i.e., combined surface area of all panels fished for the equivalent of a 12 hour period constitutes one net-unit or standard unit of effort). To facilitate catch-per-unit-effort (CPUE) calculations, the catch results are expressed on an overall basis as number of fish (by species) per standard net-unit and for specific mesh sizes and net parameters (fish/100 m^2 and fish/100 m^2•h for each mesh size). Nets were initially set during the day and were checked periodically to ensure excessive numbers of fish were not taken. Nets were set overnight only if the numbers of fish obtained during the day were insufficient for analysis of life history parameters.

Information on fish concentrations was obtained during the sounding transects to assist in net placement and maximize netting efficiency. Nets were set approximately perpendicular to the shoreline with the smallest mesh size (i.e., 25 mm) nearest to shore. Net sites were located on maps (in relation to fixed landmarks) to permit future sampling.

All captured fish were identified to species and the capture mesh size recorded. Fork lengths (mm) and weights (g) were measured for all species; appropriate ageing structures were taken from all fish. Fish sampling data were recorded on standard Fish Life History Record Forms. Pertinent netting data (set/pull time, set location/orientation, set depth, net efficiency, habitat conditions at site, etc.) were recorded on standard Gill Net Record Forms.

Where possible, arrangements were made locally to utilize captured sport fish (e.g., distributed to senior citizens centres); other fish remains were disposed of in accordance with fisheries regulations.

b) Beach Seining

A 5.5 m x 1.5 m beach seine constructed of 8 mm (stretched measure) nylon mesh with a centre-mounted collection bag (8 mm mesh) was used. Standard seine hauls were conducted in shallow-water habitats at selected locations along the lake shoreline.

Prior to seining, sample sections were measured and flagged. The catch was enumerated according to species; sport fish were weighed and measured, and the appropriate ageing structures removed. When necessary, fish samples were preserved in 10% formalin and returned to the laboratory for positive species identification. All pertinent information on the haul (e.g., haul length/width, maximum depth, median depth, efficiency, habitat conditions, etc.) and haul location were recorded on standard Seine Haul Record Forms.

CPUE was calculated for each standard haul and for the combined lake results, and expressed (for each species) on an area basis (e.g., no. fish/100 m^2 of sampled area).

With the exception of preserved fish, all fish were identified/enumerated and returned unharmed to the lake.

c) Minnow Traps

Minnow traps (i.e., standard Gee-trap) were baited with bread and placed at lake locations where forage species would likely be found. This method was used to sample habitats where seining could not be efficiently performed (i.e., areas of dense vegetative growth and/or excessively soft or irregular bottoms). Pertinent data (set/pull time, location and depth, etc.) were recorded for each trap set.

ii) Fish Ageing

Appropriate ageing structures were collected from fish captured by all collection methods. In Lower Halgrave Lake, the species of interest was cutthroat trout (*Oncorhynchus clarki*). The primary and secondary ageing structures collected from cutthroat trout were otoliths and scales, respectively. A detailed description of the collection and ageing methods for each structure is presented below.

a) Otoliths

Otoliths were obtained by dissection in the field and stored dry in labelled coin envelopes. Ageing was conducted using a binocular microscope using transmitted light. Larger, opaque otoliths were ground down and polished (with emery cloth) to allow sufficient light transmission for annuli identification.

b) Scales

Scales were collected from the area below the anterior insertion of the dorsal fin and above the lateral line. Scales were stored in labelled coin envelopes in the field. Ageing was conducted by mounting scales between two glass microscope slides and viewed using a Canon PC Printer 80. Photocopies of the scales are provided collectively under a separate cover.

iii) Data Analysis

Gill net, beach seine, and minnow trap catch statistics were tabulated and CPUE values generated. Fish age-and-growth data were entered into a computer file and analyzed with an in-house computer facility (386-33 MHz computer) using the software program (FISHPAK) developed by Mr. G. Ash of R.L. & L. Environmental Services Ltd. The output of this analysis program, presented in Appendix C, provided the following information:

- length-frequency distribution.
- weight-frequency distribution.
- length-weight regression (including values necessary to statistically compare regression and scatter plots of the regressions).
- mean lengths, weights, and condition factors (K) and related statistics (e.g., standard error of the mean, confidence intervals, etc.) for each age group.
- age-at-maturity analysis.

Where appropriate, the growth characteristics (age-length, length-weight, age-at-maturity, etc.) and age structure (length frequency/age modal distribution) of the sportfish population were compared to those derived for other populations in the study area and region.

9) Resource Use

Available information regarding the degree of angler use in the lake was summarized (including angling pressure, sportfish catch, and catch rate). Angler use also was recorded on an opportunistic basis. Project personnel recorded numbers of anglers, type of angler (i.e., boat or shore-based), and whenever possible, interviewed anglers to determine angler effort and catch rates.

10) Stocking History

A stocking history summation (including stocking year, species, number, and size-class stocked) is presented based on information obtained from BC Environment.

11) Productivity and Potential Yields

Morphometric and edaphic factors strongly influence both fish production and sportfish yields for natural lakes. Ryder (1965) derived the morphoedaphic index (MEI) which is obtained by dividing total dissolved solids (TDS) by the mean depth (z). The MEI can be used to estimate the potential yield of a lake but is also related to the lakes trophic level (Ryder et al. 1974). A regression model developed by Ryder (1965) is as follows:

$y = 1.381\ (x^{0.44610})$ n=23 $r^2=0.856$

where: y = annual harvestable fish production (kg/ha/yr)
x = morphoedaphic index (in metric units)

It should be noted, however, that the predictions obtained from the equation are useful only as a "rough" indication of potential yield. Since the regression was developed using a wide-range of north-temperate lakes in Canada, the validity of the equation for predicting harvestable fish production in sub-alpine lakes is tenuous.

3.1.3 Tributary Characteristics

An overview level of survey effort was applied to the major tributaries to the lake (i.e., an examination of the lower reaches of inlets and upper reaches of outlets accessible from the lake). Where logistically feasible, approximately 500 m of each tributary was walked; general habitat availability and suitability information was recorded. Approximately 100 m of stream was sampled using a Smith Root Type VII backpack electrofisher to determine fish species composition and relative abundance.

SECTION 4
RESULTS

4.1 LOCATION AND ACCESS

Lower Halgrave Lake (latitude 50° 43'41"; longitude 116° 17'04") is located northwest of Invermere, British Columbia. The lake is accessible from Invermere by travelling 30 km northwest on the Westside Road (an all-weather road which originates at Invermere) and approximately 5 km north on an unnamed all-weather road to a parking area (Figure 2.1). Public access to the lake from the parking area is via a 250 m walk-in trail to the southeast corner of the lake.

4.2 DRAINAGE BASIN CHARACTERISTICS

Lower Halgrave Lake lies within the Columbia River Basin (Table 4.1) and is situated in a wide, forested valley. At present, the lake receives surficial inflow from the surrounding lake basin (i.e., during spring run-off and during precipitation events) and from a small, permanent creek that enters on the southeast corner of the lake. This creek originates from Upper Halgrave Lake. An intermittent outlet, draining to Frances Creek, origninates from the south end of the lake and would regulate lake levels during high water periods.

The predominant land-use in the basin is timber extraction by Canadian Forest Industries (C.F.I.). A wide buffer zone of mature forest separates cut-block areas in the basin from the lake proper. Additionally, cattle grazing occurred in the drainage basin. All of the lands surrounding the lake are owned by the Crown.

Table 4.1 Location and watershed characteristics of Lower Halgrave Lake.

Official Name	Lower Halgrave Lake
Alias Name	
Watershed Code	0-1
Management Unit	4-34
Location (Lake centre)	
- Meridian	50°43'41" Lat., 116°17'04"Long.
- Legal	
NTS Map Sheet	82K/9
Air Photo Series	BBC Flight 914, No. 194
Elevation (asl)	approximately 1080 m
Drainage Relationship	inlet: unnamed Creek outflow: Unnamed creek - Frances Creek - Forster Creek - Columbia River
Drainage Area (km²)	3.7

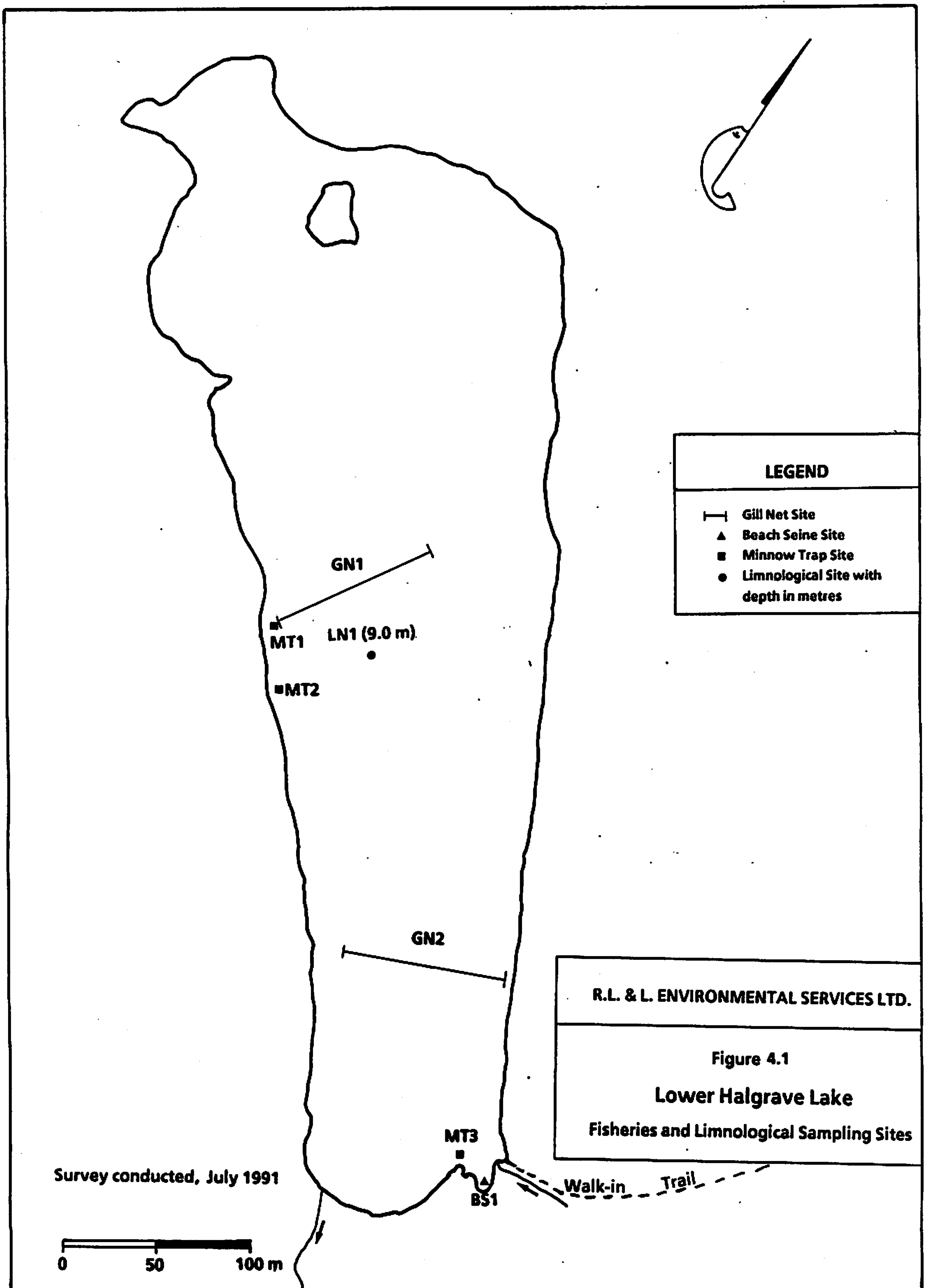

Figure 4.1
Lower Halgrave Lake
Fisheries and Limnological Sampling Sites

4.3 LAKE CHARACTERISTICS

4.3.1 Lake Morphometry

Lower Halgrave Lake is a rectangular shaped waterbody. The surrounding topography and tree growths around the lake perimeter reduce the effects of wind action on the lake. Lower Halgrave Lake has a surface area of 8.82 ha, a volume of 1.74 x 10^5 m^3 and a mean depth of 2.0 m (Table 4.2). A maximum depth of 9.1 m was recorded in Lower Halgrave Lake. The littoral zone (<3.0 m depth) contributes approximately 67% to the total lake surface area and 77% to the total lake volume (Table 4.3). The shoal area of the lake (<6 m deep) was 7.77 ha, or 88.1% of the total lake surface area. The lake consists of one main basin with greatest depths present in the centre of the basin (Figure 4.2).

Lower Halgrave Lake, with its long axis situated in a NW-SE direction, has a maximum effective length of 0.6 km and a maximum effective width of 0.2 km. The shoreline development factor (comparison of the actual shoreline length to the shortest length that would enclose the same area) was 1.97, indicative of an irregular shoreline configuration.

Table 4.2 Morphometry of Lower Halgrave Lake.

PARAMETER	VALUE
Surface Area (ha)	8.82
Volume (m^3)	1.74 x 10^5
Maximum Effective Length (km)	0.6
Maximum Effective Width (km)	0.2
Maximum Depth (m)	9.1
Mean Depth (m)	2.0
Shoreline Length (km)	1.64
Shoreline Development Factor	1.97

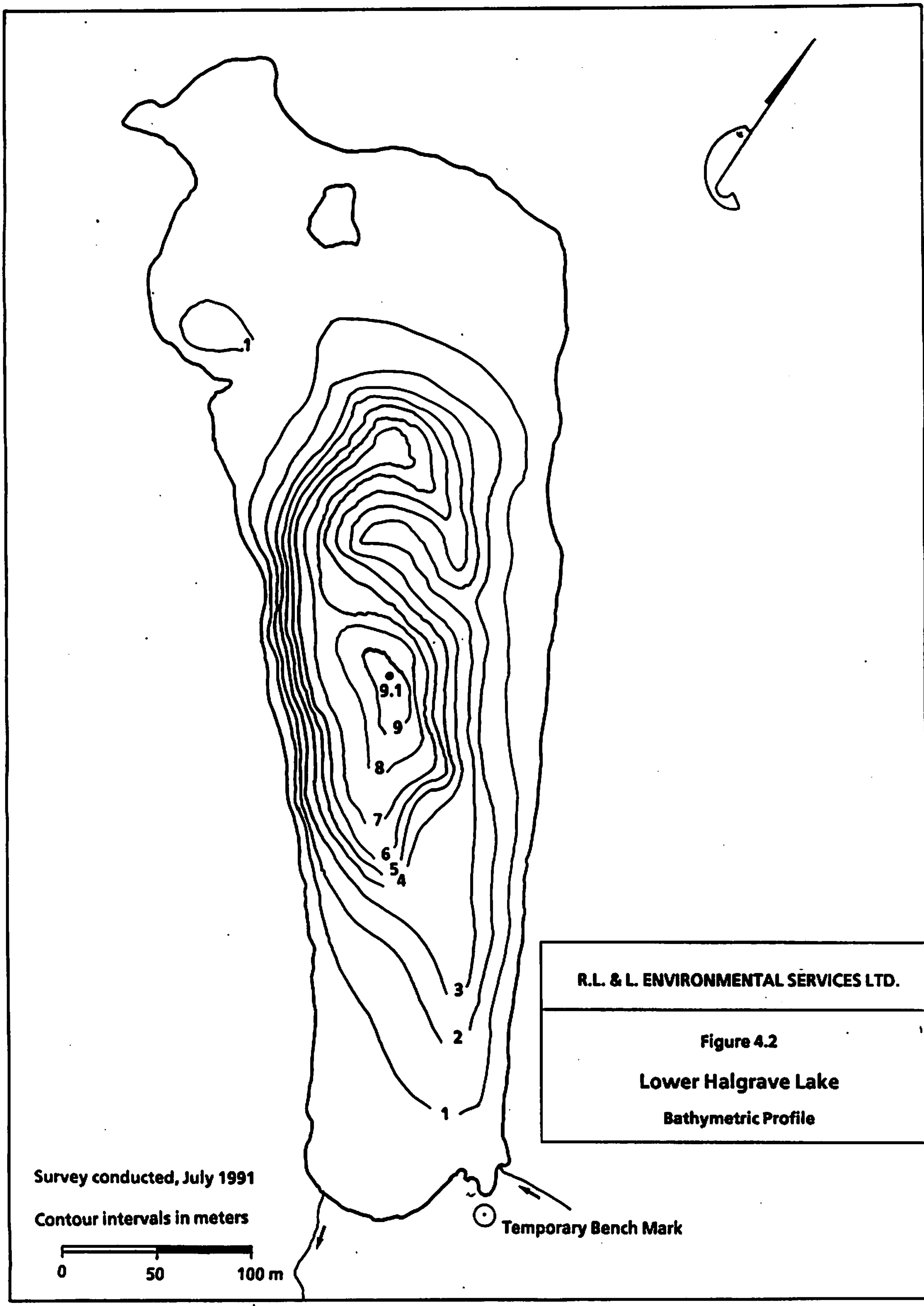

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Figure 4.2

Lower Halgrave Lake

Bathymetric Profile

Table 4.3 Depth distribution of Lower Halgrave Lake.

DEPTH CONTOUR	AREA (ha)	% SHALLOWER
0 m	8.82	0.0
1.0 m	4.53	48.6
2.0 m	3.19	63.8
3.0 m[a]	2.93	66.8
4.0 m	1.80	79.6
5.0 m	1.38	84.4
6.0 m[b]	1.05	88.1
7.0 m	0.63	92.9
8.0 m	0.27	96.9
9.0 m	0.11	100.0

[a] Littoral Zone (<3.0 m depth)
[b] Shoal Area (< 6.0 m depth)

4.3.2 Water Level Fluctuations

Recent indications of substantial water level fluctuations were not observed at Lower Halgrave Lake. The presence of a permanent inlet and an intermittent outlet suggests that the lake drains via seepage, to lower reaches of the outlet creek. When surveyed, the outlet near the lake was not flowing.

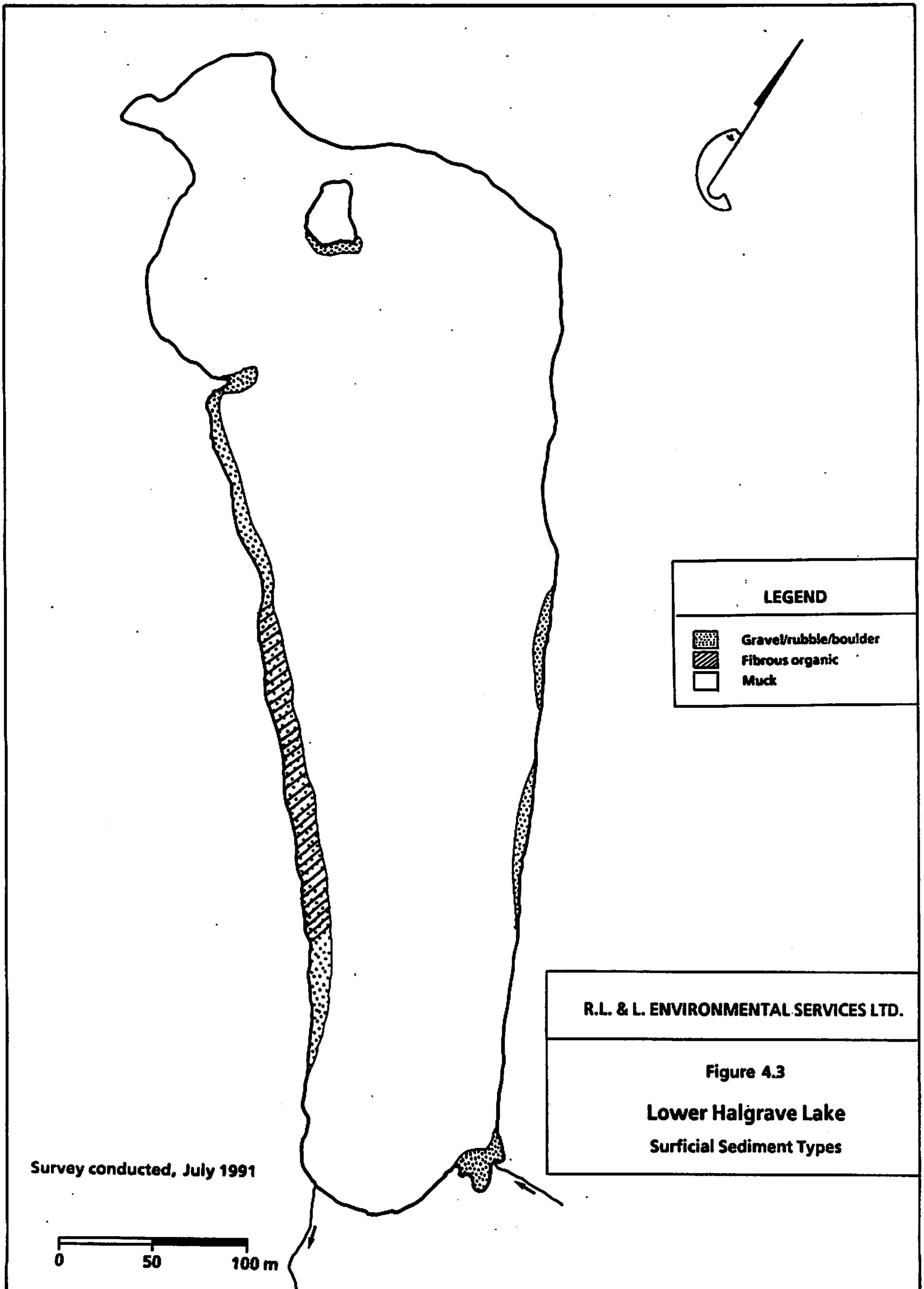
4.3.3 Substrate Typing

The surficial substrate of Lower Halgrave Lake was dominated by Muck material (Figure 4.3). The southwestern shoreline of the lake contained a wide band (3-5 m) of Gravel/Rubble/Boulder materials overlain with Fibrous Organic matter (mostly in the form of coniferous debris). The north and south ends were characterized by a thick layer of Muck. An outwash fan of Gravel/Rubble/Boulder materials was present at the mouth of the inlet creek.

4.3.4 Water Quality

4.3.4.1 Water Chemistry

The results of the on-site water chemistry analyses conducted at the limnology station established in Lower Halgrave Lake (Figure 4.1) are provided in Table 4.4. Lower Halgrave Lake water was characterized as being very alkaline (pH 11.7), with high levels of total dissolved solids (455 mg/L).



Survey conducted, July 1991

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Figure 4.3

Lower Halgrave Lake

Surficial Sediment Types

Table 4.4 Water chemistry analysis for Lower Halgrave Lake, 23 July 1991.

PARAMETER	VALUE
pH	11.7
Alkalinity, Total as $CaCO_3$ (mg/L)	82
Specific Conductance (μS/cm)	700
Total Dissolved Solids (mg/L)	455
Seechi Disk Depth (m)	5.3

4.3.4.2 Temperature and Dissolved Oxygen

Water temperature and dissolved oxygen concentrations recorded in Lower Halgrave Lake on 23 July 1991 are presented in Table 4.5 and Figure 4.4. The temperature and dissolved oxygen regimes on this date were suitable for salmonid fish species throughout the majority of the water column. Dissolved oxygen concentrations of <5 mg/L (i.e., the minimum level recommended for the maintenance of trout populations) were encountered below the 6 m depth interval. The presence of a weak thermocline between the 5-7 m depth contours indicates the lake stratifies during the summer months. An oxycline was recorded between the 5-8 m depth contours. Considering the protected nature of the lake basin, stratification likely persists throughout the summer period. Fish kills related to low dissolved oxygen levels during the winter or summer periods have not previously been reported for Lower Halgrave Lake.

4.3.5 Vegetation

4.3.5.1 Terrestrial

Foreshore vegetation around Lower Halgrave Lake, especially along the north and south shores, consisted of a wide band (generally 10-20 m wide) of vegetation dominated by sedges and grasses (85%). The backshore vegetation consisted mainly (90%) of coniferous species that provided protection from the prevailing winds (Table 4.6).

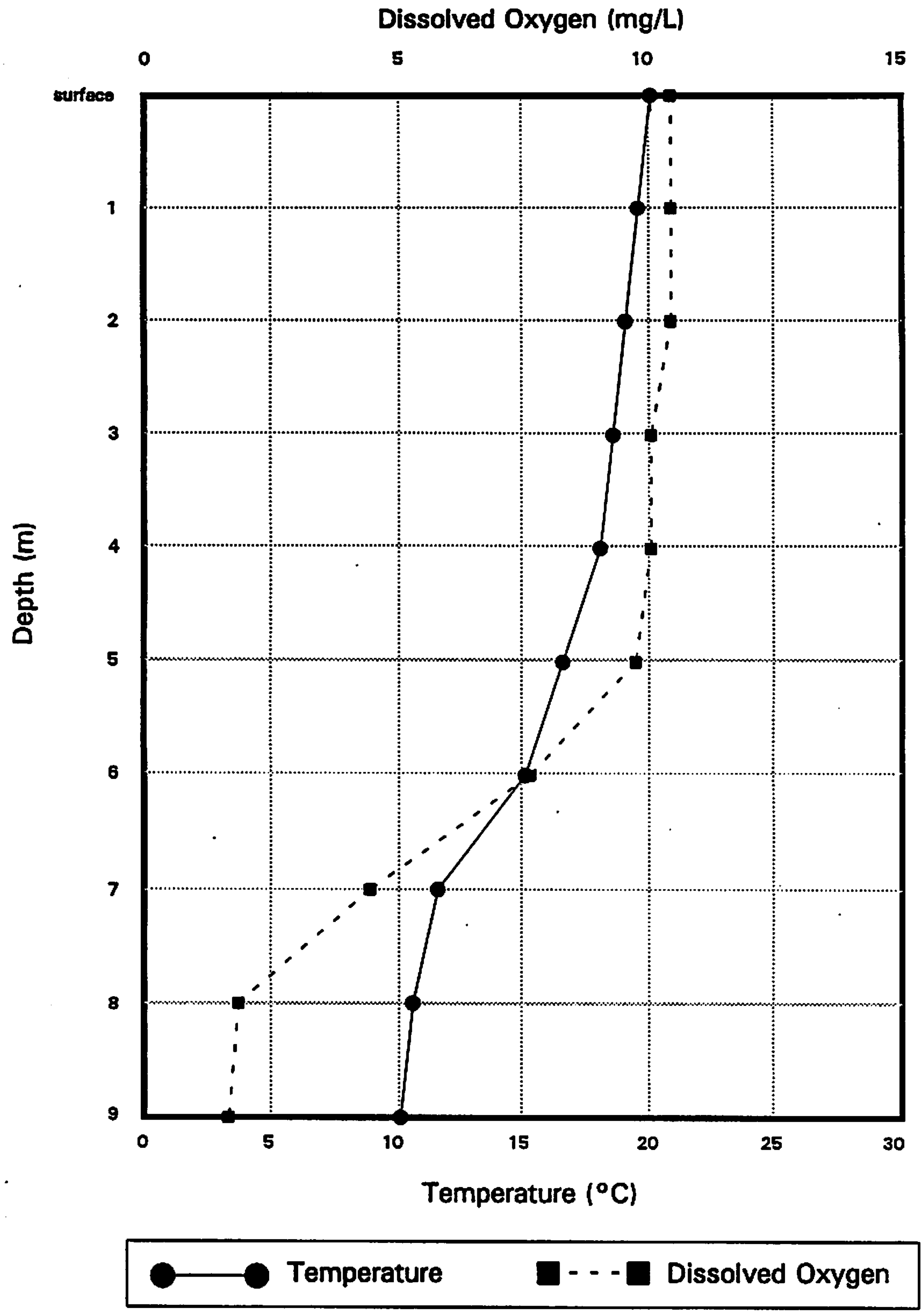

Figure 4.4. Dissolved oxygen and temperature profile of Lower Halgrave Lake, 23 July 1991.

Table 4.5 Temperature and dissolved oxygen in Lower Halgrave Lake. 23 July 1991.

DEPTH (m)	TEMP (°C)	D.O.[a] (mg/L)
0 (surface)	20	10.4
1.0	19.5	10.4
2.0	19	10.4
3.0	18.5	10
4.0	18	10
5.0	16.5	9.7
6.0	15	7.6
7.0	11.5	4.4
8.0	10.5	1.8
9.0	10	1.6

[a] Dissolved Oxygen

Conditions at time of sampling:

a) Start Time: 1300 h
b) Water Transparency: 5.3 m
c) Cloud Cover (% of total visible sky): 100%
d) Water Surface Conditions: calm

Table 4.6 Composition of terrestrial vegetation cover types around the perimeter of Lower Halgrave Lake.

FORESHORE	%[a]	BACKSHORE	%
Sedges and grasses	70	Coniferous	90
Muskeg	20	Deciduous	0
Brush	5	Mixed-wood	10
Upland	5	Burnt	0
		Cut	0

[a] Percentage composition

4.3.5.2 Aquatic

The shoreline of Lower Halgrave Lake was characterized by a wide fringe (5-10 m) of dense growths of sedges and rushes (Figure 4.5). The species composition and relative abundance of aquatic macrophytes in Lower Halgrave Lake are given in Table 4.7. Additionally, chara spp. was recorded in shallow areas with a thick layer of Muck substrate.

Table 4.7 Species of aquatic macrophytes in Lower Halgrave Lake, listed in descending order of abundance for each of the major types.

SCIENTIFIC NAME	COMMON NAME
Emergents	
Juncus spp.	Rush
Carex spp.	Sedge
Typha latifolia	Cattail
Floating leaved	
Nuphar variegatum	Pond lily
Polygonum natans	Water smartweed

4.3.6 Fish

Cutthroat trout (*Oncorhynchus clarki*) was the only fish species collected from Lower Halgrave Lake in 1991 (Table 4.8). This species has never been stocked in Lower Halgrave Lake (B. Westover, East Kootenay Fisheries Biologist, Cranbrook, B.C., *pers. comm.*). Fish collection sites established in 1991 are shown on Figure 4.1.

Table 4.8 Summary of fish species collected in Lower Halgrave Lake, July 1991.

SPECIES	NO. COLLECTED (ALL CAPTURE METHODS)	GILL NETTING		BEACH SEINING		MINNOW TRAP	
		NO.	CATCH/NET UNIT	NO.	CATCH/100 m²	NO.	NO./HR
Cutthroat trout	89	11	6.28	78	520	0	0
TOTAL	89	11	6.28	78	520	0	0

The overall catch rate from gill nets set in Lower Halgrave Lake was 6.28 cutthroat trout/net-unit. In Lower Halgrave Lake, cutthroat trout were captured by all mesh sizes except the 64 and 89 mm mesh sizes (Table 4.9). The highest catch rate (5.48 cutthroat trout/100 m²) was recorded from the 51 mm mesh size. Compared to other lakes in the region, catch rates of cutthroat trout from Lower Halgrave Lake were lower than catch rates recorded for this species from either Botts Lake or Twin Lakes (Table 4.10).

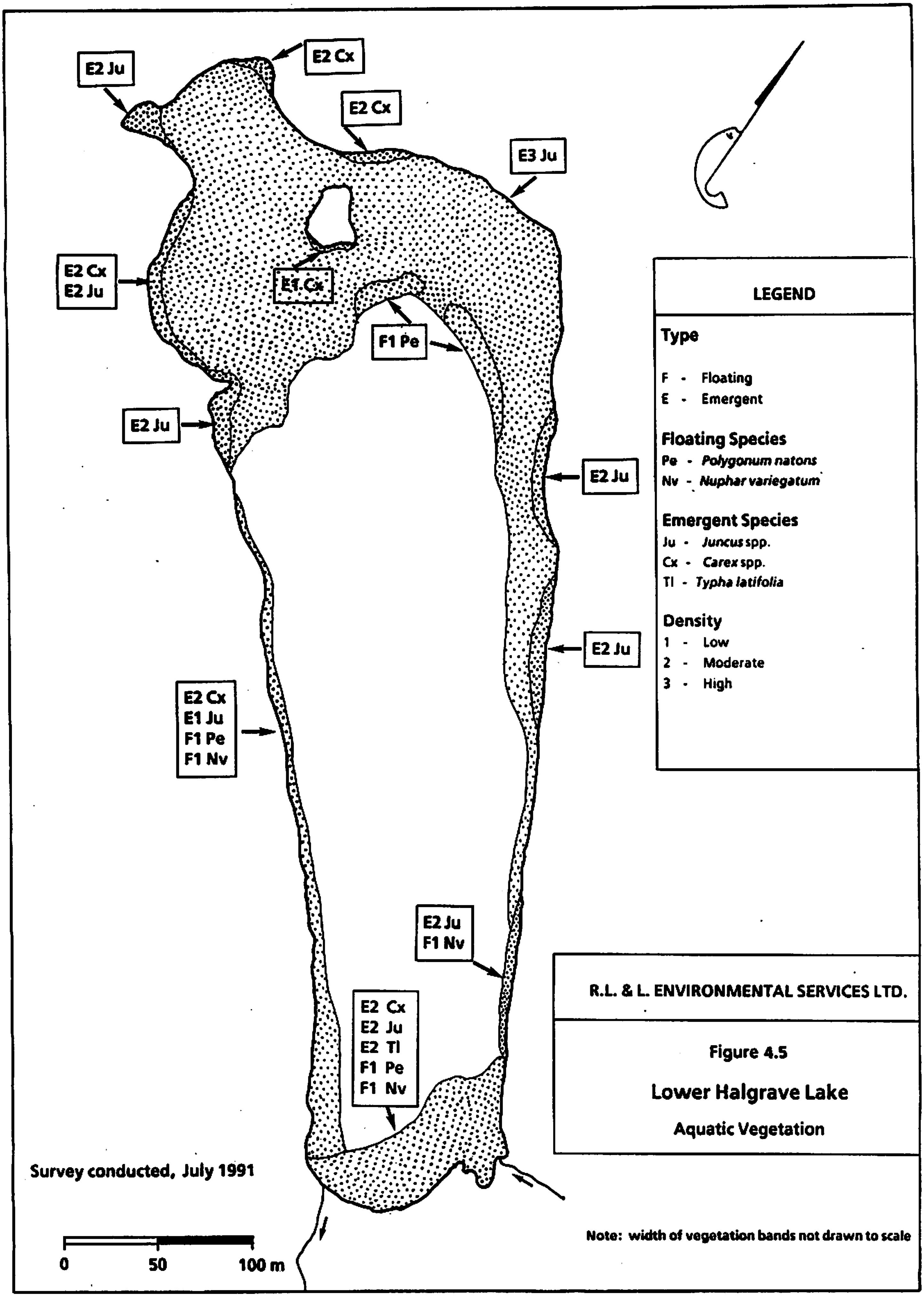

Figure 4.5

Lower Halgrave Lake

Aquatic Vegetation

Table 4.9 Summary of catch and catch rates for fish collected by gill netting in Lower Halgrave Lake, July 1991.

CUTTHROAT TROUT		
Total No. Caught		11
Mean Set Duration (h)		4.8
Net Units[a]		1.75
Catch per net unit		6.28
Catch Rate by Mesh Size		
25 mm	No.	1
	No. Fish/100 m²	1.37
	Fish/100 m² • h[b]	0.29
38 mm	No.	3
	No. Fish/100 m²	4.11
	Fish/100 m² • h	0.86
51 mm	No.	4
	No. Fish/100 m²	5.48
	Fish/100 m² • h	1.14
64 mm	No.	0
	No. Fish/100 m²	0
	Fish/100 m² • h	0
76 mm	No.	3
	No. Fish/100 m²	4.11
	Fish/100 m² • h	0.86
89 mm	No.	0
	No. Fish/100 m²	0
	Fish/100 m² • h	0
Combined	No.	32
	No. Fish/100 m²	14.62
	Fish/100 m² • h	0.66

[a] one net unit = 100 m² of gill net set for the equivalent of 12 hours

[b] 100 m² • h = 100 m² of gill net set for 1 hour

Table 4.10 Comparisons of catch rate for cutthroat trout from Lower Halgrave Lake to other lakes in the study area.

Lake	CPUE[a]
Lower Halgrave	6.28
Botts	26.85
Twin Lakes	14.59

[a] CPUE expressed as catch per net-unit (100 m² of gill net set for the equivalent of 12 hours).

All (n=11) of the cutthroat trout captured by gill net from Lower Halgrave Lake were sacrificed for life history information. Fork lengths ranged from 180 mm to 374 mm with the mean being 296.4±35.3 (95% confidence interval). Approximately 73% of the catch from gill nets was greater than 290 mm in length (Appendix C). The weight of cutthroat trout ranged from 76 g to 802 g with the mean being 379±128.7 (95% confidence interval). Approximately 55% of the catch was in the 300 to 440 g weight range (Appendix C).

A sample (n=30) of the cutthroat trout captured by beach seines also were sacrificed for life history information. Fork lengths ranged from 31 mm to 57 mm with the mean being 40±2.3 mm (95% confidence interval). Approximately 60% of the beach seine catch was in the 40 mm to 59 mm size-class (Appendix C).

The length-frequency distribution of cutthroat trout (i.e., from all capture methods) from Lower Halgrave Lake is presented in Figure 4.6. The length-weight regression for cutthroat trout from Lower Halgrave Lake was:

$$W = 0.3999 \times 10^{-5} L^{3.2053} \qquad (r^2=0.98;\ n=11)$$

where:

W=weight in grams, L=fork length in millimetres, r^2=coefficient of determination, and n=sample size

The mean condition factor (K) of cutthroat trout from Lower Halgrave Lake was 1.29±0.04 (95% confidence interval).

Ages of cutthroat trout in Lower Halgrave Lake ranged from 0 to 5 years, excluding age 1 fish (Table 4.11). The presence of several age-classes indicates spawning and recruitment occurs either in Lower Halgrave Lake or in the inlet tributary. The dominance of age 0 fish (73.7% of the sample) suggests excellent survival of the 1991 spawn. The absence of age 1 fish could be explained by poor survival of the 1990 progeny, the presence of this year class in their natal stream, or a low efficiency of the sample gear in capturing this year-class.

Fish sampling at Lower Halgrave Lake was previously conducted by BC Environment personnel in May 1989. Mean length-at-age of cutthroat trout caught was given as: age 1+=141 mm (n=3) and age 2+=318 mm (n=3). These lengths are larger than mean lengths of same-aged fish determined in the present study. These differences may result either from discrepancies in ageing techniques or differences in growth rate.

The growth rate of cutthroat trout in the Kootenay Region is considered to be "Acceptable" if fish achieve a length of 250 mm after three growing seasons (i.e., age 2+) (B. Westover, *pers. comm.*). In the present survey, most cutthroat trout in Lower Halgrave Lake did not attain lengths of 250 mm until age 3 although some individuals may have reached 250 mm in length at age 2 by the end of the summer.

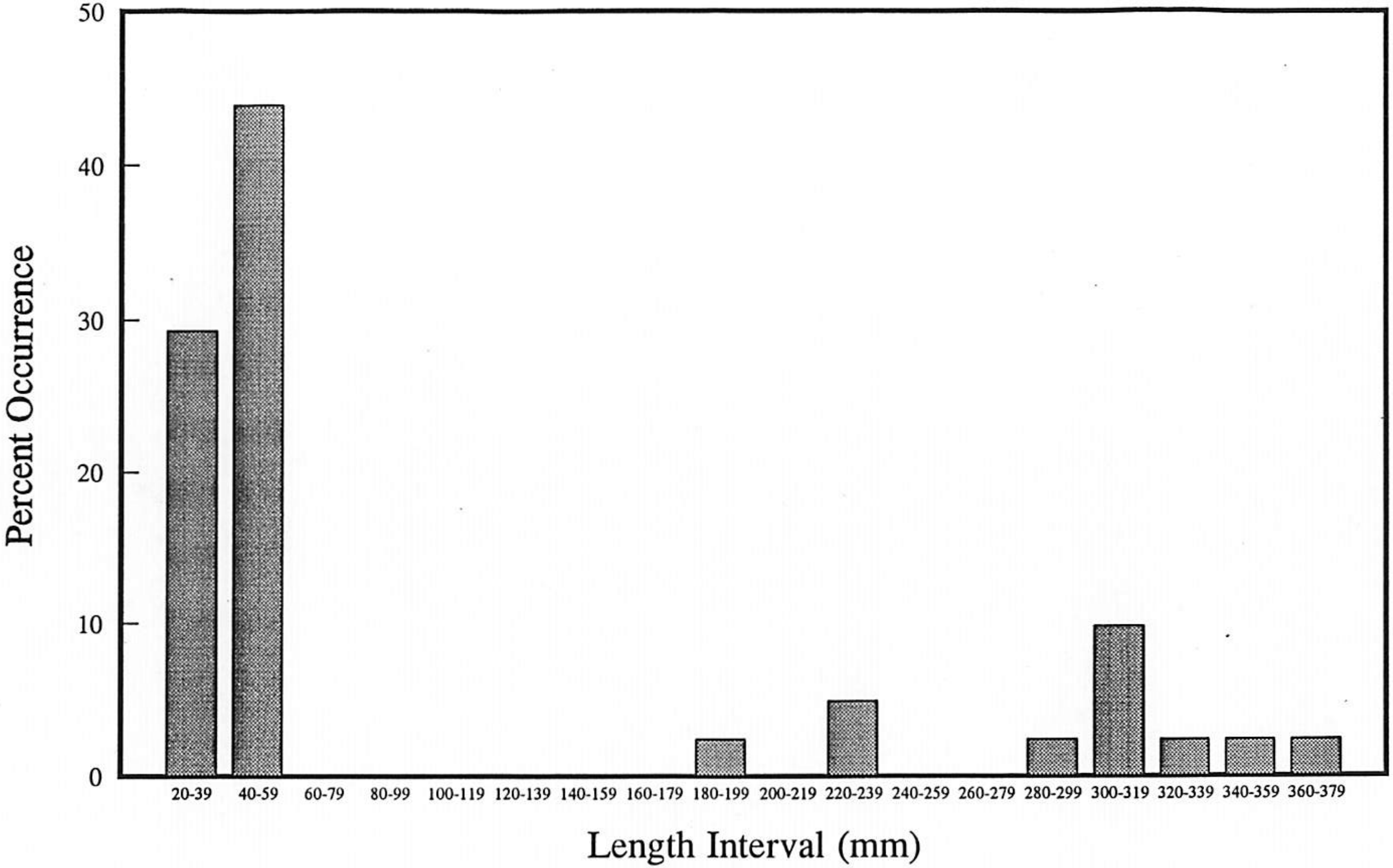

Figure 4.6. Length-frequency distribution of cutthroat trout (n=41) from Lower Halgrave Lake, July 1991.

An analyses of cutthroat trout stomach contents indicated that, in July, the cutthroat trout in Lower Halgrave Lake fed mainly on Hemipterans (water boatmen). This food item occurred in 45% of the stomachs that contained food items (n=5). No other food items were identified in stomachs. Typically, seine hauls can provide an indication of the presence and/or abundance of food items; the one seine haul conducted in Lower Halgrave Lake indicated that Odaonata (dragonfly larvae), and Amphipoda (*gammarids*) were common food items in the lake.

Table 4.11 Age-length data and mean condition factor (K) for cutthroat trout from Lower Halgrave Lake, July 1991. (x=mean fork length in mm; n=sample size).

LAKE		AGE										K±CI[a]
		0	1	2	3	4	5	6	7	8	9	
McLain	x	42		215	305	319	360	486				1.29±0.04
	n	30		3	2	4	2	4				11

[a] 95% Confidence Intervals

4.3.7 Resource Use

Anglers were not observed or interviewed at Lower Halgrave Lake during the survey. Conversations with other local anglers indicated that summer angling pressure at Lower Halgrave Lake was low due to the walk-in status of the lake (i.e., the access trail is 250 m long and a boat is required for successful angling). A creel survey conducted by BC Environment estimated that in both 1989 and 1990, zero angler days were spent at Lower Halgrave Lake during the summer period, based on aerial boat count surveys (BC Environment, Lake Management Plan File).

4.3.8 Stocking History

The BC Environment Release Records Database File indicated that Lower Halgrave Lake was stocked once in 1988 with 2000 yellowstone cutthroat trout. According to B. Westover (*pers comm..*) however, this record is in error and the lake has never been stocked. Lower Halgrave Lake retains a drainage connection from Upper Halgrave Lake, which has previously been stocked with cutthroat trout. It is possible that cutthroat trout in Lower Halgrave Lake originated from stocked populations in Upper Halgrave Lake.

The formula for fish stocking in the Kootenay Region of British Columbia is given below (B. Westover, *pers. comm.*).

$$Y = TDS\,[(2.47 \bullet Sh) + (0.247 x LSA)]$$

where: Y= Number of yearling fish, TDS= Total dissolved solids in ppm,
Sh= Shoal area (ha) of lake < 6 m deep, and LSA= Total lake surface area (ha).

For Lower Halgrave Lake, the calculated annual stocking rate would be 3270 yearling fish. This is the equivalent of approximately 6550 fall fry (i.e., two fall fry are considered equivalent to one yearling).

4.3.9 Productivity and Potential Yields

The morphoedaphic index (MEI) of Lower Halgrave Lake was calculated at 40.7. According to Rawson (1955), by using the mean depth as an indication of productivity, Lower Halgrave Lake would be considered eutrophic. It must be noted, however, that his calculations are based on "large" lakes. Using the MEI and the regression model developed by Ryder (1965), the potential annual harvestable fish production of Lower Halgrave Lake was estimated at 7.2 kg/ha/yr. As previously stated in Section 3.1.11, these predictions are only a "rough" prediction of potential yield. Given the surface area of Lower Halgrave Lake (9.95 ha), this equates to a potential harvest of 72 kg/year.

4.3.10 Tributary Characteristics

The lower 300 m of the inlet to Lower Halgrave Lake was surveyed on 23 July 1991. Stream discharge at this time was estimated at 0.02 $m^3 \bullet s^{-1}$; water temperature was 14 °C. Substrate consisted of 15% Fines, 60% Gravels, 15% Cobbles and 10% Boulders. Within the lower 150 m of the inlet, a high density of cutthroat trout redds was recorded. The section of stream surveyed was rated as having a high potential for spawning and a moderate potential for rearing.

A defined, flowing outlet tributary was not identified at Lower Halgrave Lake. Outflow from the lake occurs by seepage through an extensive bog area located on the southern perimeter of the lake.

SECTION 5
MANAGEMENT CONSIDERATIONS

Alternative management strategies for Lower Halgrave Lake were assessed on the basis of existing habitat and fish populations, historical fish population information, present resource use patterns, and the potential for enhancement. Two general options for future management were evaluated.

- Optimization of the present cutthroat trout fishery
- Maintain walk-in status of the lake

Management considerations related to these options are discussed below.

5.1 OPTIMIZATION OF THE PRESENT CUTTHROAT TROUT FISHERY

Lower Halgrave Lake has never been actively managed as a trout fishery. The existing cutthroat trout population likely originated from stocked populations in Upper Halgrave Lake. In view of the small size of Lower Halgrave Lake and difficult public access (i.e., walk-in status), future use by anglers is expected to remain low. It may be possible to improve angler success rates in Lower Halgrave Lake by:

- an intermittent stocking program
- enhancement of the inlet to improve spawning success
- providing artificial shelters to improve survival of younger trout, and
- ensuring that appropriate stocking procedures (which favour survival of newly stocked trout) are followed.

Intermittent stocking (i.e., every 2 or 3 years) is recommended to minimize the effects of occassional year-class failures of the resident, self-reproducing population. It is expected that the stocking of larger yearling trout would result in increased survivability, and since they would enter the catchable population earlier, would provide a higher return rate to the angler creel. Applying the stocking guidelines and adjusting for the increased survivability of yearlings and the low current angling pressure and harvest, a recommended stocking rate in the order of 2-3000 yearling cutthroat trout should be considered for Lower Halgrave Lake.

The inlet stream to Lower Halgrave Lake is an excellent candidate for enhancement works to improve the suitability and availability of spawning habitat. This potential has already been identified by BC Environment personnel; enhancement works on the inlet are scheduled to occur in the fall of 1991 (B. Westover, *pers. comm.*).

Artificial shelters (reefs) have been shown to attract fish by providing cover and increased food availability. These structures could increase yearling trout survival as well as angler success rates (i.e., due to concentration of catchable trout). In Running Rain Lake, a clear, subalpine lake in Alberta, artificial shelters (submerged conifers) have been shown to attract cutthroat trout by providing cover in areas where submerged structure is lacking (J. Stelfox, Kananaskis Area Fishery Biologist, Alberta Fish and Wildlife Division, Calgary, Alberta, *pers. comm.*). Although the effectiveness of these structures in increasing the survival of stocked cutthroat trout has not been quantified, observations indicated a high use by all size-classes of fish. Anglers were quick to exploit these fish concentrations and areas around the structures became "hot-spots" for angling.

5.2 MAINTAIN WALK-IN STATUS

The small size of Lower Halgrave Lake and the current reliance of the cutthroat trout population on natural recruitment reduce the potential to manage the lake as anything but a low-yield fishery. Toward this objective, the lake should be maintained as a walk-in fishery. Improving access to the lake would likely result in overexploitation of the fishery unless annual stocking programs were implemented to augment natural recruitment.

5.3 CONCLUSION

Lower Halgrave Lake offers a relatively stable habitat for trout (i.e., winterkills are rare). The limited access and small size of the lake limit the potential to manage the lake as a high-yield trout fishery. A more realistic approach would be to continue managing the lake as a low-yield, walk-in fishery. Angler success rates for trout at Lower Halgrave Lake could be increased through occasional stocking, or by the implementation of habitat enhancement measures in the inlet stream.

SECTION 6
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APPENDIX A

Fish Collection Record

Lake: Lower Halgrave Lake

NETTING RECORD
Mesh Sizes experimental order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE: GN1

Type: Sinking monofilament
Date/Time Set: 23 July 1991 @ 1100
Date/Time Lifted: 23 July 1991 @ 1610
Net Dimensions: Length=91.4 m Depth=2.4 m

Shallow End Mesh: Size=25 mm Depth= 2 m Substrate= Gravel/Cobble/Boulder
Deep End Mesh: Size=64 mm Depth= 3 m Substrate= Muck

NETTING SITE: GN2

Type: Sinking monofilament
Date/Time Set: 23 July 1991 @ 1615
Date/Time Lifted: 23 July 1991 @ 2040
Net Dimensions: Length=91.4 m Depth=2.4 m

Shallow End Mesh: Size=25 mm Depth= 1 m Substrate= Gravel/Cobble/Boulder
Deep End Mesh: Size=64 mm Depth= 1 m Substrate= Muck

BEACH SEINING RECORD
Mesh Size: 8 mm

BEACH SEINE SITE: BS1
Date/Time Pulled: 23 July 1991 @ 1700
Seine Dimensions: 5.5 m x 1.5 m
Mean Depth Sampled: 0.25 m
Area Sampled: 15 m^2

MINNOW TRAPPING RECORD

Mesh Size: 8 mm

MINNOW TRAP SITE: MT1
Date/Time Set: 23 July 1991 @ 1100
Date/Time Pulled: 23 July 1991 @ 1610
Depth: 2 m Substrate: Muck

MINNOW TRAP SITE: MT2
Date/Time Set: 23 July 1991 @ 1110
Date/Time Pulled: 23 July 1991 @ 1830
Depth: 1 m Substrate: Muck

MINNOW TRAP SITE: MT3
Date/Time Set: 23 July 1991 @ 1115
Date/Time Pulled: 23 July 1991 @ 1900
Depth: 1 m Substrate: Muck

APPENDIX B

Information Sources

BC Ministry of the Environment, Fish and Wildlife Branch, Kootenay Region.

Joyce Hutchinson (personal communication)
F & W FD (BC Environment, file data)

Bill Westover (personal communication)
East Kootenay Fisheries Biologist, BC Environment

Alberta Fish and Wildlife Division, Calgary Region
Jim Stelfox
Kananaskis Area Fisheries Biologist

APPENDIX C

Fisheries Data

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*** FISHERIES DATA ANALYSIS ***
***        -------           ***
***   PROGRAMS WRITTEN BY    ***
***   G. ASH  SUMMER, 1978   ***
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RL&L ENVIRONMENTAL SERVICES LTD.
FISH SPECIES ABBREVIATIONS

ABBREV.	COMMON NAME	SCIENTIFIC NAME	ABBREV.	COMMON NAME	SCIENTIFIC NAME
RT	RAINBOW TROUT	/SALMO GAIRDNERI/	YW	WALLEYE	/STIZOSTEDION VITREUM/
SH	STEELHEAD	/SALMO GAIRDNERI/	SA	SAUGER	/STIZOSTEDION CANADENSE/
BNT	BROWN TROUT	/SALMO TRUTTA/	YP	YELLOW PERCH	/PERCA FLAVESCENS/
CT	CUTTHROAT TROUT	/SALMO CLARKI/	LING	BURBOT	/LOTA LOTA/
DV	DOLLY VARDEN	/SALVELINUS MALMA/	SS	SLIMY SCULPIN	/COTTUS COGNATUS/
LT	LAKE TROUT	/SALVELINUS NAMAYCUSH/	SHS	SPOONHEAD SCULPIN	/COTTUS RICEI/
AC	ARCTIC CHAR	/SALVELINUS ALPINUS/	PS	PRICKLY SCULPIN	/COTTUS ASPER/
BT	BROOK TROUT	/SALVELINUS FONTINALIS/	CS	COASTRANGE SCULPIN	/COTTUS ALEUTICUS/
AG	ARCTIC GRAYLING	/THYMALLUS ARCTICUS/	PSS	PACIFIC STAGHORN SCULPIN	/LEPTOCOTTUS ARMATUS/
MW	MOUNTAIN WHITEFISH	/PROSOPIUM WILLIAMSONI/	MS	MOTTLED SCULPIN	/COTTUS BAIRDI/
RW	ROUND WHITEFISH	/PROSOPIUM CYLINDRACEUM/	TS	TORRENT SCULPIN	/COTTUS RHOTHEUS/
PW	PYGMY WHITEFISH	/PROSOPIUM COULTERI/	BS	BROOK STICKLEBACK	/CULAEA INCONSTANS/
LW	LAKE WHITEFISH	/COREGONUS CLUPEAFORMIS/	NSS	NINESPINE STICKLEBACK	/PUNGITIUS PUNGITIUS/
BW	BROAD WHITEFISH	/COREGONUS NASUS/	TSS	THREESPINE STICKLEBACK	/GASTEROSTEUS ACULEATUS/
LC	CISCO	/COREGONUS ARTEDII/	RSS	REDSIDE SHINER	/RICHARDSONIUS BALTEATUS/
INC	INCONNU	/STENODUS LEUCICHTHYS/	NSF	NORTHERN SQUAWFISH	/PTYCHOCHEILUS OREGONENSIS/
PINK	PINK SALMON	/ONCORHYNCHUS GORBUSCHA/	PD	PEARL DACE	/SEMOTILUS MARGARITA/
CHUM	CHUM SALMON	/ONCORHYNCHUS KETA/	PM	PEAMOUTH	/MYLOCHEILUS CAURINUS/
COHO	COHO SALMON	/ONCORHYNCHUS KISUTCH/	FHC	FLATHEAD CHUB	/PLATYGOBIO GRACILIS/
SOCK	SOCKEYE SALMON	/ONCORHYNCHUS NERKA/	LKC	LAKE CHUB	/COUESIUS PLUMBEUS/
K	KOKANEE	/ONCORHYNCHUS NERKA/	LND	LONGNOSE DACE	/RHINICHTHYS CATARACTAE/
CHIN	CHINOOK SALMON	/ONCORHYNCHUS TSHAWYTSCHA/	FSD	FINESCALE DACE	/PFRILLE NEOGAEUS/
LNS	LONGNOSE SUCKER	/CATOSTOMUS CATOSTOMUS/	NRD	NORTHERN REDBELLY DACE	/CHROSOMUS EOS/
WS	WHITE SUCKER	/CATOSTOMUS COMMERSONI/	LD	LEOPARD DACE	/RHINICHTHYS FALCATUS/
LSS	LARGESCALE SUCKER	/CATOSTOMUS MACROCHEILUS/	ES	EMERALD SHINER	/NOTROPIS ATHERINOIDES/
BLS	BRIDGELIP SUCKER	/CATOSTOMUS COLUMBIANUS/	STS	SPOTTAIL SHINER	/NOTROPIS HUDSONIUS/
MNS	MOUNTAIN SUCKER	/CATOSTOMUS PLATYRHYNCHUS/	FHM	FATHEAD MINNOW	/PIMEPHALES PROMELAS/
CARP	CARP	/CYPRINUS CARPIO/	TP	TROUT-PERCH	/PERCOPSIS OMISCOMAYCUS/
CM	CHISELMOUTH	/ACROCHEILUS ALUTACEUS/	ID	IOWA DARTER	/ETHEOSTOMA EXILE/
SMB	SMALLMOUTH BASS	/MICROPTERUS DOLOMIEVI/	SF	STARRY FLOUNDER	/PLATICHTHYS STELLATUS/
LS	LAKE STURGEON	/ACIPENSER FULVESCENS/	LFS	LONGFIN SMELT	/SPIRINCHUS THALEICHTHYS/
WST	WHITE STURGEON	/ACIPENSER TRANSMONTANUS/	EU	EUALCHON	/THALEICHTHYS PACIFICUS/
GE	GOLDEYE	/HIODON ALOSOIDES/	PL	PACIFIC LAMPREY	/ENTOSPHENUS TRIDENTATUS/
NP	NORTHERN PIKE	/ESOX LUCIUS/	AL	ARCTIC LAMPREY	/LAMPETRA JAPONICA/
WBL	WESTERN BROOK LAMPREY	/LAMPETRA RICHARDSONI/	ACIS	ARCTIC CISCO	/COREGONUS AUTUMNALIS/
LCIS	LEAST CISCO	/COREGONUS SARDINELLA/			

CODE DESCRIPTIONS

SEX AND MATURITY DESCRIPTIONS

MALE	FEMALE	CLASS	DESCRIPTION
99		IMMATURE A -	SEX INDETERMINABLE DUE TO SMALL GONAD SIZE.
01	11	IMMATURE B -	SMALL GONAD SIZE; FISH HAS NEVER SPAWNED AND WILL NOT SPAWN DURING THE COMING SPAWNING SEASON.
02	12	MATURITY QUESTIONABLE -	SMALL GONAD SIZE; IT CANNOT BE DETERMINED IF FISH IS IMMATURE OR IF IT WILL SPAWN DURING THE COMING SPAWNING SEASON.
03	13	DEVELOPING A -	DEFINITE GONAD DEVELOPMENT; FISH HAS NEVER SPAWNED BEFORE BUT WILL SPAWN DURING THE COMING SEASON.
04	14	DEVELOPING B -	DEFINITE GONAD DEVELOPMENT; THE FISH HAS SPAWNED BEFORE AND WILL SPAWN DURING THE COMING SEASON.
05	15	DEVELOPING C -	DEFINITE GONAD DEVELOPMENT; THE FISH HAS SPAWNED BEFORE BUT WILL NOT SPAWN DURING THE COMING SPAWNING SEASON, I.E. ALTERNATE YEAR SPAWNERS.
06	16	DEVELOPING D -	USED TO INDICATE DEFINITE GONAD DEVELOPMENT WHEN THE CLASSIFICATION INTO CATEGORIES "DEVELOPING A,B,OR C" CANNOT BE DETERMINED, OR WHEN SUCH A BREAKDOWN IS UNSUITABLE OR UNNECESSARY.
07	17	GRAVID/FULLY DEVELOPED -	SEXUAL ORGANS FILL VENTRAL CAVITY TESTES WHITE, DROPS OF MILT FALL WITH PRESSURE; EGGS COMPLETELY ROUND, SOME ALREADY TRANSLUCENT.
08	18	RIPE -	ROE OR MILT ARE EXTRUDED BY SLIGHT PRESSURE ON THE BELLY.
09	19	SPENT -	SPAWNING COMPLETED; RESORPTION OF RESIDUAL OVARIAN TISSUE IS NOT YET COMPLETE.
10	20	EXTERNAL -	SEX DETERMINED BY EXTERNAL CHARACTERISTICS; MATURITY AND SEX NOT VERIFIED BY GONAD EXAMINATION.
97		ADULT -	BASED ON FISH SIZE; SEX NOT DETERMINED
98		JUVENILE -	BASED ON FISH SIZE; SEX NOT DETERMINED

OTHER CODES

CODE	AGEING METHODS	CODE	AGEING METHODS
SC	SCALES	CL	CLEITHRA
OT	OTOLITHS	CS	CLEITHRA AND SCALES
SO	SCALES AND OTOLITHS	VE	VERTEBRAE
FR	FIN RAY	OB	OTHER BONES
SF	SCALES AND FIN RAYS	LF	LENGTH FREQUENCY

CODE	CAPTURE METHODS (COL. 33-34)
FD	FOUND DEAD
SL	SET LINE
DN	DIP NET
GN	GILL NET
ES	ELECTROSHOCKER - BOAT SHOCKER
EF	ELECTROFISHER - BACKPACK SHOCKER
BS	BEACH SEINE
PS	POLE SEINE
OB	OBSERVED - NOT CAPTURED
TU	TRAP - FISH MOVING UPSTREAM
TD	TRAP - FISH MOVING DOWNSTREAM
EX	EXPLOSIVES - SEISMIC OPERATION
AL	ANGLING (USING LURES)
AF	ANGLING (USING FLIES)
AB	ANGLING (USING BAIT)
CR	CREEL - SAMPLED FROM A FISHERMAN'S CREEL
CF	COMMERCIAL FISHERMAN'S CATCH
DF	DOMESTIC FISHERMAN'S CATCH
TO	TOXICANTS
TN	TANGLE NET
TR	TRAWL

CODE	TAG CODE (COL.38)
Y,W,R.	COLOR CODE FOR TAG (I.E.YELLOW,WHITE,OR RED,ETC.)
F	FIN CLIP: 1=ADIPOSE, 2=R. PECTORAL, 3=L. PECTORAL 4=R. PELVIC, 5=L. PELVIC, 6=DORSAL, 9=FIN PUNCH

CODE	CAPTURE CODE (COL. 60)
0	FIRST CAPTURE, RELEASED
1	FIRST CAPTURE, SACRIFICED
2	RECAPTURE, RELEASED
3	RECAPTURE, SACRIFICED

CODE	PRESERVATION CODE (COL. 61)
1	WHOLE SPECIMEN PRESERVED
2	STOMACH ONLY PRESERVED
3	WHOLE SPECIMEN AND STOMACH PRESERVED SEPARATELY
4	STOMACH CONTENTS EVACUATED AND PRESERVED
5	GONADS PRESERVED
6	PARISITES PRESERVED
7	HEAD PRESERVED

*NOTE-SITE ABBREV. IS IN KM FROM CONFLUENCE WHERE APPLICABLE.

NEW SET OF DATA - NEW SET OF DATA - NEW SET OF DATA - NEW SET OF DATA - NEW SET OF DATA - NEW SET OF DATA - NEW SET OF DATA
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PRINT-OUT OF RAW DATA TO BE ANALYSED

SAMPLE NO.	SP.	LENGTH (MM)	WEIGHT (G)	SEX-MAT.	GONAD WT(G)	AGE	AGE METH	CAPT METH	MESH (CM)	TAG NO.	DATE DAY MO YR	LOCATION	SITE	CAPT CODE	PRES CODE	COMMENTS
58	CT	374.	802.	14	.	5	SO	gn	5.1		23 07 91	LOWER	.	0		
59	CT	315.	431.	04	.	3	SO	gn	5.1		23 07 91	LOWER	.	0		
60	CT	358.	619.	14	.	5	SO	gn	5.1		23 07 91	LOWER	.	0		
61	CT	295.	319.	14	.	3	SO	gn	5.1		23 07 91	LOWER	.	0		
62	CT	312.	443.	14	.	4	SO	gn	7.6		23 07 91	LOWER	.	0		
63	CT	315.	406.	14	.	4	SO	gn	7.6		23 07 91	LOWER	.	0		
64	CT	180.	76.	11	.	2	SO	gn	2.5		23 07 91	LOWER	.	0		
65	CT	332.	432.	04	.	4	SO	gn	7.6		23 07 91	LOWER	.	0		
66	CT	315.	359.	14	.	4	SO	gn	3.8		23 07 91	LOWER	.	0		
67	CT	234.	141.	11	.	2	SO	gn	3.8		23 07 91	LOWER	.	0		
68	CT	230.	142.	01	.	2	SO	gn	3.8		23 07 91	LOWER	.	0		
12	CT	41.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
13	CT	39.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
14	CT	50.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
15	CT	44.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
16	CT	46.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
17	CT	43.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
18	CT	34.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
19	CT	31.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
20	CT	36.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
21	CT	51.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
22	CT	38.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
23	CT	37.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
24	CT	33.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
25	CT	41.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
26	CT	46.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
27	CT	44.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
28	CT	42.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
29	CT	48.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
30	CT	53.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
31	CT	48.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
32	CT	47.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
33	CT	33.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
34	CT	38.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
35	CT	38.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
36	CT	40.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
37	CT	38.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
38	CT	57.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
39	CT	44.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
40	CT	42.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		
41	CT	38.	.		.	0	SC	BS	.		23 08 91	LOWER	.	1		

NOTE SEPARATE ANALYSIS FOR EACH SPECIES ONLY (ALL LOCATIONS AND SITES GROUPED)***NOTE***

SPECIES = CT

LOCATION= LOWER SITE(S)= .

LENGTH - WEIGHT ANALYSIS

NO. FISH NOT SEXED = 30

LENGTH FREQUENCY DISTRIBUTION

CLASS INTERVAL	ALL GROUPED				MALES				FEMALES				SEX INDETERMINABLE			
UNITS = MM	# FISH	%	MEAN CF	N	# FISH	%	MEAN CF	N	# FISH	%	MEAN CF	N	# FISH	%	MEAN CF	N
20- 39	12	29.3	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
40- 59	18	43.9	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
60- 79	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
80- 99	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
100- 119	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
120- 139	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
140- 159	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
160- 179	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
180- 199	1	2.4	1.30	1	0	.0	.00	0	1	12.5	1.30	1	0	.0	.00	0
200- 219	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
220- 239	2	4.9	1.13	2	1	33.3	1.17	1	1	12.5	1.10	1	0	.0	.00	0
240- 259	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
260- 279	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
280- 299	1	2.4	1.24	1	0	.0	.00	0	1	12.5	1.24	1	0	.0	.00	0
300- 319	4	9.8	1.32	4	1	33.3	1.38	1	3	37.5	1.30	3	0	.0	.00	0
320- 339	1	2.4	1.18	1	1	33.3	1.18	1	0	.0	.00	0	0	.0	.00	0
340- 359	1	2.4	1.35	1	0	.0	.00	0	1	12.5	1.35	1	0	.0	.00	0
360- 379	1	2.4	1.53	1	0	.0	.00	0	1	12.5	1.53	1	0	.0	.00	0
TOTALS	41	100.0	-	11	3	100.0	-	3	8	100.0	-	8	0	.0	-	0

COND. FACTORS SUMMARY	ALL GROUPED	MALES	FEMALES	SEX INDETERMINABLE
MEAN =	1.2874	1.2422	1.3043	.0000
STDDEV =	.1358	.1186	.1453	.0000
COEVAR =	10.5470	9.5499	11.1401	.0000
STDERR =	.0212	.0685	.0514	.0000
N =	11	3	8	0
MEDIAN SIZE	50 MM	311 MM	307 MM	0 MM

WEIGHT FREQUENCY DISTRIBUTION

CLASS INTERVAL UNITS = G	ALL GROUPED # FISH	ALL GROUPED %	ALL GROUPED MEAN CF	ALL GROUPED N	MALES # FISH	MALES %	MALES MEAN CF	MALES N	FEMALES # FISH	FEMALES %	FEMALES MEAN CF	FEMALES N	SEX INDETERMINABLE # FISH	SEX INDETERMINABLE %	SEX INDETERMINABLE MEAN CF	SEX INDETERMINABLE N
60- 79	1	9.1	1.30	1	0	.0	.00	0	1	12.5	1.30	1	0	.0	.00	0
80- 99	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
100- 119	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
120- 139	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
140- 159	2	18.2	1.13	2	1	33.3	1.17	1	1	12.5	1.10	1	0	.0	.00	0
160- 179	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
180- 199	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
200- 219	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
220- 239	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
240- 259	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
260- 279	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
280- 299	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
300- 319	1	9.1	1.24	1	0	.0	.00	0	1	12.5	1.24	1	0	.0	.00	0
320- 339	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
340- 359	1	9.1	1.15	1	0	.0	.00	0	1	12.5	1.15	1	0	.0	.00	0
360- 379	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
380- 399	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
400- 419	1	9.1	1.30	1	0	.0	.00	0	1	12.5	1.30	1	0	.0	.00	0
420- 439	2	18.2	1.28	2	2	66.7	1.28	2	0	.0	.00	0	0	.0	.00	0
440- 459	1	9.1	1.46	1	0	.0	.00	0	1	12.5	1.46	1	0	.0	.00	0
460- 479	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
480- 499	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
500- 519	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
520- 539	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
540- 559	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
560- 579	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
580- 599	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
600- 619	1	9.1	1.35	1	0	.0	.00	0	1	12.5	1.35	1	0	.0	.00	0
620- 639	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
640- 659	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
660- 679	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
680- 699	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
700- 719	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
720- 739	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
740- 759	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
760- 779	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
780- 799	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0	0	.0	.00	0
800- 819	1	9.1	1.53	1	0	.0	.00	0	1	12.5	1.53	1	0	.0	.00	0
TOTALS	11	100.0	-	11	3	100.0	-	3	8	100.0	-	8	0	.0	-	0

COND. FACTORS SUMMARY	ALL GROUPED	MALES	FEMALES	SEX INDETERMINABLE
MEAN =	1.2874	1.2422	1.3043	.0000
STDDEV =	.1358	.1186	.1453	.0000
COEVAR =	10.5470	9.5499	11.1401	.0000
STDERR =	.0212	.0685	.0514	.0000
N =	11	3	8	0
MEDIAN SIZE	411 G	426 G	401 G	0 G

LENGTH - WEIGHT REGRESSION

1) THE COEF. OF DETERMINATION (R SQUARED) OF THE LENGTH-WEIGHT RELATIONSHIP = .982313500

2) N = 11

3) THE LENGTH - WEIGHT REGRESSION EQUATION IS LOG10(WEIGHT) = -5.398095 + 3.20529100 LOG10(LENGTH)

OR WEIGHT= .39986E-05 LENGTH TO THE 3.20529100

4) TEST OF REGRESSION COEFFICIENTS:

	REGRESSION COEFF.	T	S.D.
INTERCEPT	-5.398095	-15.276990	.353348
SLOPE	3.205291	22.357550	.143365

5) LOG10(LENGTH) MEANS = 2.463001

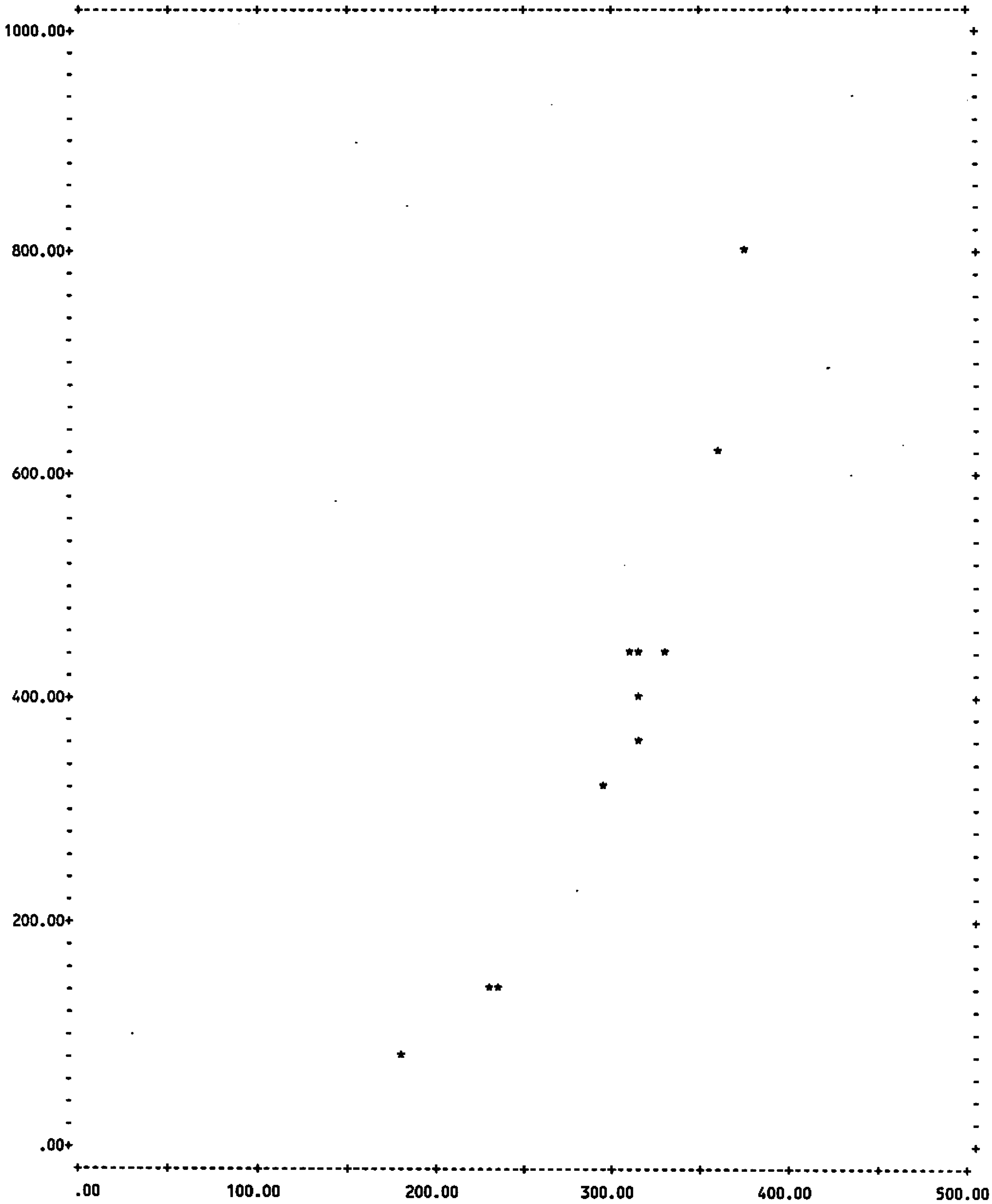
6) LOG10(WEIGHT) MEANS = 2.496542

7) SUM OF X SQUARED	= 66.8208	SUM OF SMALL X SQUARED	=	.090673
8) SUM OF Y SQUARED	= 69.5083	SUM OF SMALL Y SQUARED	=	.948342
9) SUM OF XY	= 67.9295	SUM OF SMALL XY	=	.290639

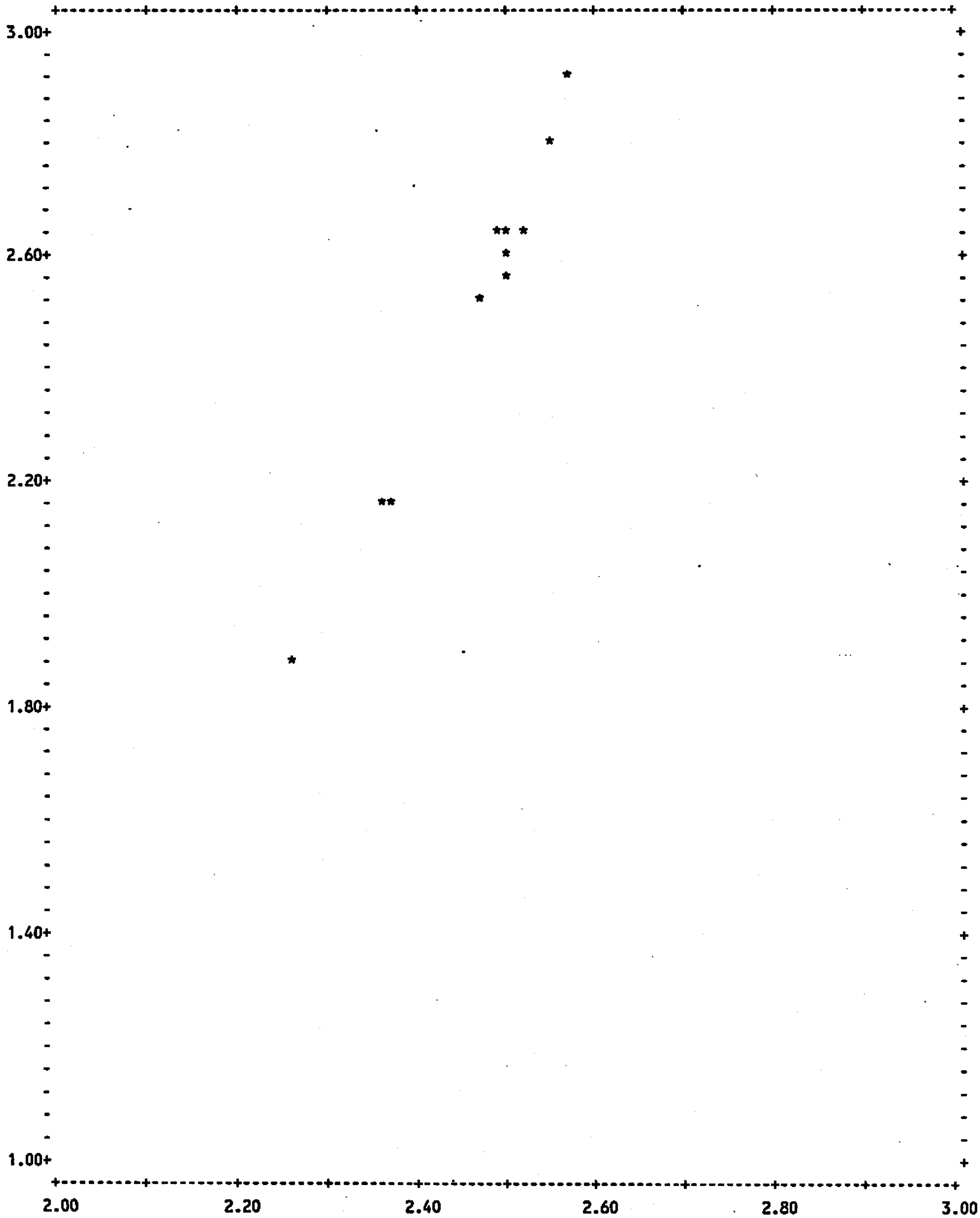
10) ANALYSIS OF VARIANCE TABLE:

SOURCE	D.F.	SUM SQ.	MEAN SQ	F
REGRESS	1	.93156860	.93156860	499.86020000
ERROR	9	.01677293	.00186366	
TOTAL	10	.9483415		

PLOT OF LENGTH (X-AXIS) VRS WEIGHT (Y-AXIS)



PLOT OF LOG10 LENGTH (X-AXIS) VRS LOG10 WEIGHT (Y-AXIS)



AGE-GROWTH ANALYSIS

ALL GROUPED

AGE-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	OLDER
*LENGTH(MM)																	
MAX	57.0	.0	234.0	315.0	332.0	374.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	44.3	.0	289.4	432.1	333.0	467.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	42.0	.0	214.7	305.0	318.5	366.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	39.7	.0	139.9	177.9	304.0	264.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	31.0	.0	180.0	295.0	312.0	358.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER	30.		3.	2.	4.	2.											
SD	6.26	.00	30.09	14.14	9.11	11.31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	1.14	.00	17.37	10.00	4.56	8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	14.90	.00	14.02	4.64	2.86	3.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
*WEIGHT(G)																	
MAX	.0	.0	142.0	431.0	443.0	802.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	.0	.0	213.6	1086.5	469.5	1873.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	.0	.0	119.7	375.0	410.0	710.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	.0	.0	25.7	-336.5	350.5	-452.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	.0	.0	76.0	319.0	359.0	619.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER			3.	2.	4.	2.											
SD	.00	.00	37.82	79.20	37.37	129.40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	21.84	56.00	18.69	91.50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	31.60	21.12	9.12	18.21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
*CONDITION																	
MAX	.000	.000	1.303	1.379	1.459	1.533	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN+CI	.000	.000	1.447	2.177	1.495	2.610	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN	.000	.000	1.190	1.311	1.272	1.441	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN-CI	.000	.000	.934	.444	1.048	.272	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MIN	.000	.000	1.100	1.243	1.149	1.349	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
NUMBER			3.	2.	4.	2.											
SD	.00	.00	.10	.10	.14	.13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	.06	.07	.07	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	8.68	7.36	11.04	9.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

AGE-GROWTH ANALYSIS

*** MALES ONLY ***

AGE-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	OLDER
LENGTH(MM)																	
MAX	.0	.0	230.0	315.0	332.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	.0	.0	230.0	315.0	332.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	.0	.0	230.0	315.0	332.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER			1.	1.	1.												
SD	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
WEIGHT(G)																	
MAX	.0	.0	142.0	431.0	432.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	.0	.0	142.0	431.0	432.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	.0	.0	142.0	431.0	432.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER			1.	1.	1.												
SD	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CONDITION																	
MAX	.000	.000	1.167	1.379	1.181	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN+CI	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN	.000	.000	1.167	1.379	1.181	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN-CI	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MIN	.000	.000	1.167	1.379	1.181	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
NUMBER			1.	1.	1.												
SD	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

AGE-GROWTH ANALYSIS

FEMALES ONLY

AGE-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	OLDER
LENGTH(MM)																	
MAX	.0	.0	234.0	295.0	315.0	374.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	.0	.0	550.1	.0	318.3	467.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	.0	.0	207.0	295.0	314.0	366.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	.0	.0	-136.1	.0	309.7	264.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	.0	.0	180.0	295.0	312.0	358.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER			2.	1.	3.	2.											
SD	.00	.00	38.18	.00	1.73	11.31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	27.00	.00	1.00	8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	18.45	.00	.55	3.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
WEIGHT(G)																	
MAX	.0	.0	141.0	319.0	443.0	802.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN+CI	.0	.0	521.4	.0	507.3	1873.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN	.0	.0	108.5	319.0	402.7	710.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MEAN-CI	.0	.0	-304.4	.0	298.1	-452.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MIN	.0	.0	76.0	319.0	359.0	619.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NUMBER			2.	1.	3.	2.											
SD	.00	.00	45.96	.00	42.10	129.40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	32.50	.00	24.31	91.50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	42.36	.00	10.46	18.21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CONDITION																	
MAX	.000	.000	1.303	1.243	1.459	1.533	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN+CI	.000	.000	2.490	.000	1.687	2.610	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN	.000	.000	1.202	1.243	1.302	1.441	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MEAN-CI	.000	.000	-.086	.000	.917	.272	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
MIN	.000	.000	1.100	1.243	1.149	1.349	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
NUMBER			2.	1.	3.	2.											
SD	.00	.00	.14	.00	.16	.13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
STERR	.00	.00	.10	.00	.09	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
COVAR	.00	.00	11.93	.00	11.91	9.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

NO SEX INDETERMINABLE IN AGED SAMPLE

AGE-MATURITY ANALYSIS

SEX/ MAT. \ AGE-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	OLDER	TOTAL
99																		0
1			1															1
2																		0
3																		0
4				1	1													2
5																		0
6																		0
7																		0
8																		0
9																		0
10																		0
11			2															2
12																		0
13																		0
14				1	3	2												6
15																		0
16																		0
17																		0
18																		0
19																		0
20																		0
TOTAL			3	2	4	2												11