March 19, 1997

Ministry of Environment, Lands and Parks
Skeena Region
Box 5000
Smithers, British Columbia
V0J 2N0

Mr. Paul Giroux

Dear Mr. Giroux:

The following represents our final report for a Reconnaissance Survey of Twin Lake (alias); Watershed Code unknown.

Yours truly,

KLOHN-CRIPPEN CONSULTANTS LTD.

Richard Couture, R.P. Bio.
Project Manager

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EXECUTIVE SUMMARY

Klohn-Crippen Consultants Ltd. was retained by the Fisheries Branch of the BC Ministry of Environment, Lands and Parks in Smithers, British Columbia, to conduct a reconnaissance level survey of Twin Lake (alias) which lies within the Babine River watershed. The lake is located 18.8 km north, northwest of Fort Babine, approximately 2 km from the Babine River. Lake access for this study was by float plane and helicopter as road or trail access did not exist at the time of this survey. Lastly, the lake was surveyed by Klohn-Crippen on September 24 and 25, 1996.

Twin Lake has one inlet and one outlet which are separated from each other by less than 100 metres of shoreline suggesting that hydraulic short-circuiting is common. Neither inlet or outlet could be surveyed because marsh and dense vegetation prevented access by boat or on foot.

The lake is quite productive. The fish population consists of a multi-species assemblage of sport and non-sport fish including cutthroat trout (*Oncorhynchus clarki*), Dolly Varden (*Salvelinus malma*), northern squawfish (*Ptycheilus oregonensis*) and longnose sucker (*Catostomus catostomus*). Cutthroat are the most dominant sport fish but their Fulton's Condition Factor was <1.0.

The maximum depth of Twin Lake (alias) is 6.2 metres suggesting that the lake is shallow for its size (surface area = 320,100 m^2 and for the surrounding terrain. At the time of sampling, dissolved oxygen levels remained above that required by salmonids from 0 to almost 5 metres (8 mg/L: Anon. 1996b), below which the dissolved oxygen concentration dropped to 6.4 mg/L at the lake bottom.

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1. INTRODUCTION

Klohn-Crippen Consultants Ltd. was retained by the Fisheries Branch of the BC Ministry of Environment, Lands and Parks in Smithers (MELP), British Columbia, to conduct a reconnaissance level survey of Twin Lake within the Babine River watershed. The field survey was conducted on September 24 and 25, 1996 by G. Scarborough and J. Calvert. This lake is located 18.8 km north, northwest of Fort Babine, approximately 2 km from the Babine River. The purpose of this survey was to collect the fish and fish habitat information necessary for the effective management of the resource.

Fish sampling was conducted overnight using a combination of gillnets and minnow traps. Electrofishing was not conducted on any of the tributaries of this lake. All surveys (except the bathymetric survey) were conducted according to Resource Inventory Committee (RIC) standards (Anon. 1995a). The bathymetric survey of this lake utilized a Trimble Pro-XL GPS-data logger combined with a Meridata depth sounder. After post-mission differential correction, the GPS data provided sub-meter positional accuracy for plotting individual depth soundings. The perimeter of the lake was also traced using the GPS system, providing accuracy in lake perimeter and surface area estimates.

The data and photographs collected during this survey have been processed and stored in appropriate mediums. Appropriate fish collection, lake biophysical and photo-documentation forms have been completed and are provided with this report. All photographs and their negatives taken as part of this report are stored in an album with the lake files in the MELP office in Smithers, British Columbia.

Although this late is not gazetted, it is herein referred to as Twin Lake. It should be emphasized, however, that Twin is not the lake's official name and is only an alias.

Figure 1 Lake Location

2. DATA ON FILE

The following represents a directory of the specific components that can comprise a reconnaissance lake survey and also indicates those components that are completed in this survey.

Location	√	**Winter Diss. O_2/Temp. Profiles**	
Lake Morphometric Data	√	**Netting record**	√
Bench Mark	√	**Lake Catch Summary**	√
Terrain Features	√	**Individual Fish Summary**	√
Access	√	**Fish Preserved**	√
Resorts and Campsites	√	**Stomach Analysis**	
Special Restrictions	√	**Scale Reading**	
Aquatic Plants	√	**Location of Inventory Sites**	√
Wildlife Observations	√	**Appendices:**	√
Summary of Rare or Endangered Species	√	**I: Data Forms**	√
Lake Drainage	√	**II: Fish Scale Microfiche Prints**	√
Fisheries Management Comments	√	**III: Water Chemistry Analysis**	√
History of Previous Surveys	√	**IV: Photograph Directory**	√
Water Chemistry Summary	√	**Bathymetric Map Reduction**	
Dissolved O_2/Temp. Profiles	√	**Bathymetric Map**	√

3. SURVEY AND ANALYTICAL METHODS

3.1 Bathymetry

The bathymetric survey utilized a Trimble Pro-XL GPS datalogger unit coupled to a Meridata digital depth sounder. The datalogger was programmed to record position (NAD 83) once every second and depth and position every three seconds. The GPS antenna was attached to one end of a length of plywood (4' x 1/2' x 36') and the depth sounder transponder was attached to the other end. This plywood was then fixed to the boat's transom with a C-clamp and an angular wedge placed between the transom and plywood such that the plywood, antenna and transponder were oriented perpendicular to the water surface. The antenna was positioned approximately 1 m above the water while the transponder was positioned immediately below the surface.

Due to the inherent error in GPS signals, post-mission processing of the field GPS data was necessary to achieve the sub-meter accuracy required to plot bathymetric data. Post-mission differential correction was achieved with the P-Finder software package (Trimble Corp.) by matching the field GPS data with British Columbia Active Control System (BCACS) 1-second network base station data from the Maps BC continuous GPS recorder base station in Terrace, British Columbia. A base station very close to the actual field GPS unit would provide the most accurate post-mission differential correction but Terrace was close enough (<500 km) to still provide sub-meter accuracy (Amin Kassam, Geographic Data BC, Ministry of Environment, Lands and Parks, Fourth Floor - 1802 Douglas St., Victoria, British Columbia, V8V 1X4; *pers. comm.* September 9, 1996).

The first task during a bathymetric survey was to trace the perimeter of the study lake. This was done by placing the outboard motor is shallow drive (to avoid collisions with rocks and logs) and driving around the perimeter maintaining a constant distance from shore for the entire perimeter trace. A distance of 4 m was usually sufficient to avoid collisions and still allow a detailed trace of the perimeter. After differential correction and analysis of this perimeter trace data, the perimeter was expanded by 4 m do delineate the actual lake perimeter and not just the boat's path.

Following the perimeter trace, the lake's longest axis (e-line) was traced to illuminate the general depth trends and then transects were made across the shorter axis in directions generally perpendicular to the e-line. These shorter transects were conducted such that the depth sounder was allowed to track depths from shore to opposite shore. Additional depth data were obtained through excursions into small bays along the shoreline. The coordinates for these bathymetric data were then differentially corrected and analyzed along with the corrected perimeter data to generate bathymetric contours via the AdCADD® Civil/Survey software package. The resulting bathymetric map was then examined by Greg Scarborough (Klohn-Crippen, Aquatic Ecologist) and adjustments to

contours were made as necessary. Bathymetric statistics (volume, area at 6m, etc.) were also generated from the AdCADD® Civil/Survey software package.

3.2 Stream Surveys

Stream surveys were conducted according to Resource Inventory Committee (RIC) standards (Anon. 1995a). Wherever possible, 500 m of stream was walked or at least to the first lake or impassable barrier. At a section of the stream possessing representative habitat, an area no less than 9 bank-full widths long was surveyed and the mandatory fields of the DFO/MoELP stream card were completed. Wherever possible, electrofishing of at least 100 m^2 of fish habitat was also conducted. Photographs of stream habitat and views from the upstream and downstream limits of the survey site were also taken if they provided additional detail of the surrounding habitat.

3.3 Gillnetting

Mesh sizes of monofilament gillnets used in this study, in experimental order, were: 18, 38, 63 and 88 mm. Each gillnet panel measured 17.4 metres long by 2.8 metres deep and the panels were ganged together for a total net size of 69.6 metres by 2.8 metres representing a sample surface area of 194.9 m^2. Each gillnet gang was set with the 18 mm mesh closest to shore and mesh size increasing towards the lake's center.

The Resource Inventory Committee (RIC) standards for gillnetting require a gillnet with six panels of varying mesh sizes to be ganged together in a specific sequence (i.e., 25 mm, 76 mm, 51 mm, 89 mm, 38 mm and 64 mm). The gillnet dimensions used for this inventory did not exactly match the RIC standard. Gillnet mesh sizes increased in size in the order as stated above. The only difference with the RIC standard net design is the absence of the 54 mm and 76 mm panels. RIC standard nets were not used for this survey because the Lake and Stream Inventory manual was unavailable to Klohn-Crippen when this project was initiated. The gillnets used for this inventory have been used by Klohn-Crippen for many years and have produced consistently defensible catch results. For comparison purposes with RIC standard gillnets and where catch data permit, an analysis of the catch length distribution has been provided to highlight trends in the fish length data and the occurrence of any bias in the catch population. See results for this discussion.

3.4 Minnow Traps

Standard gee type minnow traps were used in this study. Each trap was baited with a small piece of salted roe that was suspended by a length of line near the trap's center. The traps were then attached to the shoreline with a long piece of line and the shoreline area was marked with flagging tape for easy re-location.

3.5 Set Lines

The set line used in this study consisted of a 30 lb monofilament center line with 1 m long 30 lb monofilament leaders extending outwards from this center line at 1 m intervals. Barbed hooks were fixed to the end of each leader and baited with small pieces of salted roe. The set line was weighted with a rock, then lowered to the bottom, after which the line was pulled taught and fixed to a large float at the surface.

3.6 Limnological Investigations

Bathymetric investigations (section 3.1) allowed the field crew to estimate the lake's deepest point. The boat was anchored here and general observations on weather and surface conditions were noted. Lake water temperature and dissolved oxygen were determined at 1 m intervals to the lake bottom and the resulting field data were examined to determine metalimnetic depth. Water samples were then extracted from the surface (0.5m) and from a depth below the metalimnion with a Van Dorn. Specific conductance and pH were also determined in the field at each of the sample depths.

3.7 Water Chemistry

Water chemistry was determined in the field (e.g., temperature, pH, specific conductance) or by a laboratory from samples collected in the field. Water samples collected in the field were stored in properly labelled, clean plastic sample bottles. A glass jar was used to store water for NH_3 analysis. These samples were then stored in a cooler under ice until the field crew returned to the motel where the samples were placed in a refrigerator at 4°C until shipment to Vancouver the following day. When samples were collected on a Friday or Saturday, they were placed in the freezer (-10°C) until shipment on Monday morning.

3.7.1 Alkalinity

Alkalinity was determined by the titration method outlined in Eaton et al. (1995).

3.7.2 Total Dissolved Solids

TDS was examined according to Eaton et al. (1995).

3.7.3 Ammonia (NH_3)

Ammonia was examined according to the Nessler method (Hach 1994).

3.7.4 Nitrate

Nitrate was examined according to the Nessler method (Hach 1994).

3.7.5 Total Phosphorus

Total phosphorus was examined through the ascorbic acid method using powder pillows. A method equivalent to USEPA method 365.2 and Standard Method 4500-P-E for wastewater (Hach 1994).

3.7.6 Total Dissolved Phosphorus

Total Dissolved Phosphorus was examined by the ascorbic acid method using powder pillows after first filtering the sample through a Whatman GFC filter (Hach 1994).

3.7.7 Chlorophyll *a*

The measurement of chlorophyll *a* followed APHA standard methods, 18th Edition, pages 10-17. Plankton are extracted from the sample through a Whatman GFC filter prior to pigment extraction in aqueous acetone. The optical density of the extract is then determined by spectrophotometry.

3.7.8 Total Kjeldhal Nitrogen

The measurement of total nitrogen followed APHA standard methods, 18th Edition, pages 94-94 as well as the EPA-600/4-79-020 method 351. The method basically involved conversion of all the solution's nitrogenous compounds into ammonia through acidification then distillation. Measurement is then made with an ammonia selective electrode.

3.7.9 Filterable Residue

Filterable residue was estimated by passing 25 ml of solution through a washed and weighed 0.45 μm filter. This filter was then washed again, dried and weighed with the amount of filterable residue equal to the difference in weight of the filter and the volume of sample used.

3.7.10 Metals (Sodium, Magnesium and Calcium)

Solution is filtered through a 0.45 μm filter then acidified with Nitric acid, prior to analysis with ICPMS.

3.8 Biogeoclimatic zone

Biogeoclimatic zone was determined with PC-Arc Info by matching lake outflow coordinates with those on a digital map of British Columbia's biogeoclimatic zones.

3.9 Native Land Claim Area

The Native land claim area applicable to each lake was determined from up to date land claim area maps provided by the British Columbia Treaty Commission and, for the Gitskan Nation claim, from a map provided directly from the Gitskan First Nation.

3.10 Mining Claims

Existing mining claims were searched under the Mineral and Placer, No Staking Reserve document, BC Reg. 91/91, March 24, 1993: Amended by BC Reg. 119/95 on March 29, 1995.

4. LAKE GEOGRAPHICAL AND MANAGEMENT INFORMATION

The following represents a summary of the geographical and management information for Twin Lake.

Survey Data:	September 24-25, 1996
Watershed Name:	Babine River Watershed
Watershed Code:	Unknown
Watershed Area:	16,660,000 m^2
Location:	18.8 km north, north west of Fort Babine, approximately 2 km from the Babine River.
Elevation	773.7 m ± 1.5 m (determined from corrected GPS data)
Latitude/Longitude:	lat. -55° 30' 58" long. - 126°46' 9"
U.T.M.:	9. 640837. 6154539
N.T.S. Map No.:	93M.10
TRIM Map No.:	93M.057
Biogeoclimatic Zone:	Sub-Boreal Spruce, Moist Cold
Forest Region:	Prince Rupert
Forest District:	Bulkley
Wildlife Management Unit:	6-8
LRMP Planning Unit:	2: Babine River
LRMP Management Zone:	Special Management Zone (2) • Forestry and Mining exploration and development are allowed, but are subject to constraints that give priority to other resource values in the areas (see Anon. 1996c) • Particular wildlife species, viewscapes and soils may be earmarked for special management.
LRMP Ecosystem Network:	n/a
Native Land Claim Area:	Nat'oot'en First Nation, Carrier Sekani Tribal Council, Gitskan Nation
Drainage:	Twin Lake > Unnamed outflow (watershed code 480-3352) > Babine River

4.1 Lake Morphometric Data

An investigation of Twin Lake's morphometry was conducted on September 25, 1996. Fifteen transects were made across the short axis of this lake and a single transect was made along the lake's long axis (the e-line). Because the survey technique used here involved a GPS unit with post-mission differential correction allowing sub-meter locational accuracy, the standard method for bathymetric surveys was not followed in this study. This resulted in the lack of paper traces, transect calculation sheets and percentage distance along transect determinations (see Anon. 1996a) so these required items are not summarized here. However, the survey transects for assessing Twin Lake's bathymetry have been recorded and are shown in Figure 2. The bathymetric map generated from these surveys is shown in Figure 3.

The following bathymetric summary statistics for Twin Lake are:

Total surface area: 320,100 m^2

Surface area at 6 m contour: 12,300 m^2

Shoreline perimeter: 3,530 m

Island perimeter: 0

Number of islands: 0

Maximum depth: 6.2 m

Mean depth: 3.4 m

Secchi depth: 2.1 m

Sounding device: Meridata depth sounder

Figure 2 Bathymetric Survey Transects

Figure 3 Bathymetric Contours

Volume (by Stratum, and Total):

Stratum	Volume (m^3)
0-2 m	565,882
2-4 m	376,054
4-6 m	142,526
6 m-max. depth (m)	6,145
Total	1,090,607

4.2 Benchmark

The benchmark in Twin Lake was indicated by an iron spike driven 180.9 cm above the water surface into the base of a large pine tree near the waters edge near the lake's northern corner. The spike itself is marked by fluorescent orange flagging tape, as is the surrounding area, for easy re-location (Plate 1). The coordinates for the benchmark, as recorded in the field by GPS, are 9.640032.6155703 (NAD83). The location of the benchmark in relation to Twin Lake is indicated in Figure 4. Figure 5 shows an air photo enlargement of Twin Lake and also shows the location of the benchmark. A photograph of the benchmark was not taken at Twin Lake because of technical difficulties.

The high water mark for this lake was not readily visible suggesting that the lake was at its high water stage at the time of this survey.

4.3 Terrain Features

4.3.1 Immediate Shoreline

Twin Lake is primarily forested with pine and spruce trees down to the waters edge around much of the lake's perimeter, except for the north and south ends where grassy meadows and marsh areas exist (Plates 1, 2, 3 and 4). Both the east and west banks of the lake have abundant treefall that sometimes extends far out into the lake (Plates 5 and 6). Both the lake's bank materials and immediate lake bed substrates are composed of fines and scattered gravels that do not present abundant spawning habitat.

Figure 4 Location of Lake Survey Sites

Figure 5 Air Photo Enlargement Showing Lake and Benchmark's Location

Plate 1 View of northwest end of Twin Lake from float plane

Plate 2 View of southeast end of Twin Lake from float plane

Plate 3 Panoramic views of Twin Lake from lake's north end

Plate 4 Panoramic views of Twin Lake from its south end

Plate 5 View of littoral area and minnow trap Sampling Site #2

Plate 6 View of littoral area and minnow trap Sampling Site #5

4.3.2 Surrounding Terrain

Twin Lake is situated in a long valley orientated almost parallel to the nearby Babine River. The banks on the east and west side of this lake are quite steep but do not extend much above the lake in height. Conversely, the banks are much less prominent at the north and south ends of this lake where there is only a slight climb from the lake to the surrounding terrain. The area at the southern end of Twin Lake is particularly flat and is composed mostly of an extensive marsh that appeared from the float plane to extend for almost 1 km.

4.4 Stream Surveys

Streams could not be surveyed at this lake because of the extensive marshy area and associated dense vegetation at the south end prevented access to both the inflow and outflow.

Stream #1 (Watershed Code unknown)

Stream #1 is the single apparent inlet to Twin Lake which enters the lake at a large grassy swamp (Plate 7). Upstream of this swamp, the stream appeared to meander through dense bushes (Plates 8 and 9) through which walking was not possible. A single access point to this stream was reached by cutting west then south through the navigable woods bordering the stream to the north. The channel here was too deep to wade and too narrow for boat navigation so a direct survey of the channel was not possible.

Stream #2 (Watershed Code 480-3352)

Stream #2 is the outlet of Twin Lake which passes through a wide and long marsh (Plate 10) before eventually turning east and entering the Bulkley River located approximately 2 km to the east. This stream was inaccessible so was not surveyed.

4.5 Previous Surveys

Twin Lake itself has not been previously surveyed but the Fisheries Information Summary System (FISS) does provide information on the lake's outlet. FISS indicates that steelhead trout (*Oncorhynchus mykiss*) were previously captured in the lake's outlet (stream #2) in two locations; approximately 1.0 and 2.2 km downstream from the lake.

Plate 7 View of inlet from shore of lake

Plate 8 View of inlet at only accessible location

Plate 9 View of inlet at only accessible location

Plate 10 View of outlet from boat

5. LAKE ACCESS AND AREA DEVELOPMENT

5.1 Access and Directions

There is no road or trail access directly to this lake but logging road construction was occurring not far to the southwest so future road/trail access might be possible. Access to the lake for this study was via floatplane on the evening of September 24 and the morning of September 25 while a helicopter was used to move from Twin Lake to Boucher Lake (alias) on the evening of September 24. Both aircraft were chartered from Smithers. The floatplane base is located on Tyhee Lake, approximately 10 km southeast of Smithers. The airbase was accessed by driving south from Smithers on Highway 16 for 8 km, turning left onto the Old Babine Lake road and following this for 2 km, then turning right onto the Telkwa High Road and following this for 2 km prior to tuning left onto the Seaplane Base Road, which is only about 400 metres long and leads directly to the seaplane base. From Tyhee Lake, Twin Lake is 67.5 km and a 33 minute flight in the floatplane north by northeast of Tyhee Lake.

5.2 Road Type and Conditions

Highway 16 is entirely paved but all other roads are gravel but are still suitable for two-wheel drive vehicles.

5.3 Restrictions

There are no known aircraft restrictions applicable to Twin Lake.

5.4 Resorts and Campsites

None is known.

5.5 Mining Claims

None is known.

5.6 Timber Harvests

Forest cover maps do not indicate any previous or planned logging near this lake but logging road construction was occurring to the south so it is possible that timber harvests will occur nearby in the future.

5.7 Waste Permits

None is known (Remington and Lough 1995).

5.8 Water Licences

None is known (Remington and Lough 1995).

6. FLORA AND FAUNA

6.1 Aquatic Plants

Aquatic plants were identified in the field to genus with the aid of Prescott (1969) and Warrington (1994) and their distribution throughout the lake was recorded. Figure 6 summarizes the distribution of the four aquatic plant species recorded in Twin Lake; horsetail (*Equisetum sp.*), lilly (*Nuphar sp.*), *Potamogeton sp.*, and *Myriophyllum sp.*

6.2 Aquatic Invertebrates

Aquatic invertebrates were observed occasionally in Twin Lake. Specific taxa noted include macrocrustacea (*Amphipoda sp.*) and beetles (*Coleoptera sp.*).

6.3 Wildlife Observations

Wildlife observed on or around Twin Lake included beaver, moose and migratory waterfowl.

6.4 Summary of Rare and Endangered Species

Rare or endangered species were not encountered in or around Twin lake.

Figure 6 Distribution of Aquatic Plant Communities

7. FISH POPULATION SAMPLING

7.1 Total Fish Catch Summary

Twin Lake contains a diverse assemblage of sport fish including cutthroat trout (*Oncohrynchus clarki*) and Dolly Varden (*Salvelinus malma*) as well as non-sport fish including longnose sucker (*Catastomus catastomus*) and northern squawfish (*Ptycheilus oregonensis*). Seventy three cutthroat, 1 Dolly Varden, 44 northern squawfish (Plate 11) and 14 longnose suckers were captured in this lake. Furthermore, all fish were captured using a gillnet and none were captured by minnow traps. Thirty cutthroat were sub-sampled for age analysis by scale removal. Three of the scales were regenerate and could not be aged. Fish collection data forms are provided in Appendix I while fish scale microfiche prints are provided in Appendix II.

The relationship between length and weight for the cutthroat from Twin Lake is shown in Figure 7. The average Fulton's Condition Factor for cutthroat was 0.96 (SD = 0.12). Figure 8 shows the relationship between age and fork length for cutthroat trout as well as the linear regression equation for this relationship. Overall, age explains up to 74% of the variation in fork length. Based on this regression line, there do not appear to be any anomalous year classes for this species over the range of data examined. Figure 9 shows the relationship between fork length and weight for all other species captured in this lake. The average Fulton's Condition Factor for longnose sucker, northern squawfish and Dolly Varden captured from this lake were 1.18 (SD = 0.08), 1.09 (SD = 0.08) and 0.84 (n = 1), respectively.

The total sampling effort applied to this lake was 80 hours and 12 minutes. Fish were not captured by the minnow traps utilized in this study but the gillnetting catch per unit effort values for the floating and sinking gillnets used in this study were 23.14 and 25.87 fish/100 m^2/12 hr period, respectively.

Angling was not conducted on this lake.

Plate 11 View of gillnet sampling site and fish samples

Figure 7 Cutthroat Trout Fork Length Versus Weight

Figure 8 Cutthroat Trout Age Versus Fork Length

Figure 9 Fork Length Versus Weight for Three Species of Fish from Twin Lake.

7.2 Netting Record

Mesh sizes of monofilament gillnets used in this study, in experimental order, were: 18, 38, 63 and 88 mm. Each gillnet panel measured 17.4 metres long by 2.8 metres deep and the panels were ganged together for a total net size of 69.6 metres by 2.8 metres representing a sample surface area of 194.9 m^2. Each gillnet gang was set with the 18 mm mesh closest to shore and mesh size increasing towards the lake's center. The gillnet sample record for Twin Lake is shown in Table 1.

Table 1 Gillnet Summary

Site No.	Net Type	Date Set	Time Set	Depths (m)		Date Lifted	Time Lifted	Soak Time (hr)	CPUE
				Shallow	Deep				
1	floating	96/9/24	18:39	0-2	0-2	96/9/25	11:10	16:31	23.14
2	sinking	96/9/24	18:58	0-2	2-4	96/9/25	11:50	16:52	25.87

Notes:
- See Figure 4 for location of gillnet sample sites.
- CPUE - #fish/100 m^2/12 hr period.

7.3 Minnow Trap Record

The minnow trap sample record for Twin Lake is shown in Table 2.

Table 2 - Minnow Trap Summary

Site No.	Gee trap No.	Date Set	Time Set	Depth (m)	Substrate	Date Lifted	Time Lifted	Soak Time	CPUE
3	1	96/9/24	18:23	0.5	LWD, silt	96/9/25	09:16	14:53	0.0
4	2	96/9/24	18:25	0.5	LWD, silt	96/9/25	09:18	14:53	0.0
5	3	96/9/24	18:28	0.5	LWD, silt	96/9/25	09:21	14:53	0.0
6	4	96/9/24	18:30	0.5	LWD, silt	96/9/25	09:26	14:56	0.0
7	5	96/9/24	18:32	0.5	LWD, silt	96/9/25	09:28	14:56	0.0

Notes:
- See Figure 4 for location of minnow trap sample sites.
- LWD - large woody debris.
- CPUE - #fish/trap/12 hr period.

7.4 Set Line Record

A set line was not placed in this lake therefore no data are available using this gear.

7.5 Individual Fish Data

Individual fish sampling data are shown in Tables 3 and 4.

Table 3 Individual Fish Data

Site No.	Species Code	Fork Length (cm)	Weight (g)	Scale Sample No.	Sex	Age	Samples Taken
2	CT	336	468	e223702-01	F	4+	SC
2	CT	276	210	e223702-02	M	3+	SC
2	CT	275	190	e223702-03	F	3+	SC
2	CT	249	150	e223702-04	F	3+	SC
2	CT	238	126	e223702-05	M	3+	SC
2	CT	305	282	e223702-06	M	R	SC
2	CT	274	222	e223702-07	F	3+	SC
2	CT	277	190	e223702-08	M	3+	SC
2	CT	226	102	e223702-09	F	2+	SC
2	CT	255	164	e223702-10	F	3+	SC
2	CT	206	88	e223702-11	M	2+	SC
2	CT	182	54	e223702-12	M	2+	SC
2	CT	214	90	e223702-13	F	3+	SC
2	CT	194	70	e223702-14	M	3+	SC
2	CT	212	96	e223702-15	M	3+	SC
2	CT	251	144	e223702-16	M	3+	SC
2	CT	213	118	e223702-17	M	R	SC
2	CT	199	76	e223702-18	F	3+	SC
2	CT	222	108	e223702-20	F	R	SC
2	CT	174	50	e223702-21	F	2+	SC
2	CT	194	74	e223702-22	F	2+	SC
2	CT	209	90	e223702-23	M	3+	SC
2	CT	203	74	e223702-24	M	3+	SC
2	CT	192	64	e223702-25	M	2+	SC
2	CT	186	68	e223702-26	F	2+	SC

continued...

Table 3 Individual Fish Data (Continued)

Site No.	Species Code	Fork Length (cm)	Weight (g)	Scale Sample No.	Sex	Age	Samples Taken
2	CT	156	40	e223702-27	F	1+	SC
2	CT	224	108	e223702-28	M	2+	SC
2	CT	179	52	e223702-29	M	2+	SC
2	CT	183	56	e223702-30	M	1+	SC

Notes:

- See Figure 4 for location of sample sites.
- CT - cutthroat trout (*Oncorhynchus clarki*)
- F - female, M - male, SC - scale sample, R - regenerated scale that could not be aged.

Table 4 Individual Fish Data, Site, Species, Fork Length, Weight and Sex Only

Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex	Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex	Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex
1	CT	173	48	M	1	LSU	389	772	F	2	CT	204	86	M
1	CT	224	112	M	1	LSU	274	254	M	2	CT	330	384	M
1	CT	272	204	M	1	LSU	284	272	M	2	CT	189	62	M
1	CT	229	24	F	1	LSU	196	90	M	2	CT	194	62	F
1	CT	183	60	F	1	LSU	164	44	M	2	CT	214	92	F
1	CT	178	56	M	1	LSU	298	318	M	2	CT	179	54	F
1	CT	222	72	F	1	NSC	159	48	M	2	CT	206	86	F
1	CT	201	82	F	1	NSC	175	48	M	2	CT	258	194	F
1	CT	183	60	F	1	NSC	175	60	M	2	CT	228	110	F
1	CT	173	56	M	1	NSC	162	50	M	2	CT	196	80	F
1	CT	188	62	F	1	NSC	181	58	F	2	CT	240	116	F
1	CT	229	116	M	1	NSC	165	52	F	2	CT	207	84	F
1	CT	199	74	M	1	NSC	159	46	M	2	LSU	331	432	M
1	CT	173	50	F	1	NSC	175	48	M	2	NSC	169	54	M
1	CT	238	124	M	1	NSC	142	32	F	2	NSC	171	54	M
1	CT	179	52	F	1	NSC	168	46	F	2	NSC	171	52	F
1	CT	204	82	M	1	NSC	169	50	F	2	NSC	152	38	M
1	CT	274	172	F	1	NSC	164	50	M	2	NSC	164	52	F
1	CT	211	82	F	1	NSC	169	48	F	2	NSC	156	44	M
1	CT	200	80	F	1	NSC	148	38	M	2	NSC	175	62	M
1	CT	204	78	M	1	NSC	141	30	M	2	NSC	168	54	F

Continued...

Table 4 Individual Fish Data, Site, Species, Fork Length, Weight and Sex Only

Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex	Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex	Site No.	Species Code	Fork Length (cm)	Wt. (g)	Sex
1	CT	176	52	M	1	NSC	185	62	M	2	NSC	162	46	M
1	CT	218	96	F	1	NSC	166	50	F	2	NSC	176	54	F
1	CT	202	88	F	1	NSC	171	54	F	2	NSC	171	56	F
1	CT	193	74	F	1	NSC	176	56	M	2	NSC	171	54	M
1	CT	197	72	M	1	NSC	169	52	M	2	NSC	175	56	M
1	DV	195	62	F	1	NSC	147	36	M	2	NSC	174	62	F
1	LSU	279	244	M	1	NSC	170	54	F	2	NSC	186	62	M
1	LSU	280	242	M	2	CT	191	64	F	2	NSC	178	64	F
1	LSU	240	182	M	2	CT	178	58	M	2	NSC	175	60	M
1	LSU	305	348	F	2	CT	179	58	F	2	NSC	164	56	M
1	LSU	271	238	F	2	CT	173	44	F	2	NSC	136	28	F
1	LSU	313	340	F	2	CT	189	70	F	2	NSC	180	60	M
1	LSU	295	288	M	2	CT	191	66	M	2	NSC	166	50	M
										2	NSC	161	50	M

Notes:

- See Figure 4 for location of sample sites.
- CT - cutthroat trout (*Oncorhynchus clarki*), DV - dolly varden (*Salvelinus malma*), NSC - northern squawfish (*Ptycheilus oregonensis*) and LSU - longnose sucker (*Catastomus catastomus*)
- Wt. - Wet weight, F - female, M - male.

7.6 Electrofishing Record

Both the inlet and outlet of Twin Lake were inaccessible by either boat or by foot. Therefore, no data are available for this sampling technique.

7.7 Fisheries Management Concerns

This lake has a large population of sport and non-sport fish species. The cutthroat trout are particularly abundant in this lake and they appear to be maintaining healthy population numbers given the presence of cutthroat's competitor, northern squawfish. This competitive relationship should be taken into consideration if future management concerns include stock augmentation.

Access to the lake at the time of this survey was by air only but a logging road is under construction to the south. Therefore, although access management is not a concern at the present time, it might be a concern in the future given the attractiveness of this lake's sport fish population to anglers.

7.8 Catch Analysis - Fork Length Frequency Distribution

The frequency distribution of fish fork length groupings for all fish measured in this inventory is shown in Figure 10. These fork length range groupings were selected based on those used by Hamley (1972, cited in Anon. 1995a) who determined the average size of whitefish caught in various gillnet mesh sizes. The RIC Standards for experimental gillnet gangs are based on this research.

The gillnets employed by Klohn-Crippen in this inventory did not have the mesh panels that select for fish in approximately the 179-228 mm and 281-345 mm fork length ranges as suggested by Hamley (1972 op. cit.). Figure 10 displays a uni-modal distribution with the largest proportion of total catch (39%) belonging to the 179-228 mm size group. The catch from this lake consisted mostly of cutthroat trout (n = 73, average fork length = 213 mm) and northern squawfish (n = 44, average fork length = 167 mm) which are morphologically similar and of comparable population mean fork lengths. Figure 10, therefore, displays a length frequency distribution that would be expected from a fairly uniform population and does not suggest any fish size bias in the catch. Furthermore, the mesh sizes used in this study targeted the minimum, average and maximum sizes of fish and thus provided data to describe the entire range of sizes in the fish population as a whole.

Figure 10 Frequency Distribution of Fish Fork Length Groupings

8. FIELD CONDITIONS AND WATER CHEMISTRY

The following is a summary of the limnological investigations of Twin Lake.

Date:	September 25, 1996	**Time:**	12:30
Limnology Station:	LS	**Maximum Depth:**	6.2 m
Seam Site:	e 223702	**Water Sampler Used:**	Van Dorn

Laboratories Used

1) Elemental Research Inc.: #309-267 West Esplanade, North Vancouver, British Columbia, V7M 1A5.

2) Klohn-Crippen in-house laboratory

3) Chlorophyll *a* and Total Kjeldahl Nitrogen were measured by the CAEAL certified laboratory: Analytical Services Laboratories Ltd., 1988 Triumph St., Vancouver, British Columbia, V5L 1K5.

8.1 Field Conditions

The limnology of Twin Lake was investigated on a cloudy day. Table 5 summarizes the field.

Table 5 Field Conditions

Parameter Measured	Result	Method Used
Wind Velocity (m/s)	0	Estimation
Wind Direction	n/a	Observation
Air Temperature (°C)	8°C	Glass thermometer
Cloud Cover	100%	Observation
Surface Condition	smooth	Observation
Water Colour	brown	Observation
Water Clarity (m)	2.1	Secchi Disk

8.2 Water Chemistry

Water samples were removed from Twin Lake at depths of 0.5 and 5 metres. A thermocline was not evident in the lake at the time of this survey so the latter depth was chosen to best represent non-surface water quality conditions. Tables 6 and 7 present summaries of the water chemistry findings and water nutrient data for the two sample depths, respectively. Appendix III contains laboratory summary reports of the water quality analysis for Twin Lake.

Table 6 Water Chemistry Summary

Parameter Measured	Result (0.5 m)	Result (5 m)	Method Used
Dissolved Oxygen (mg/L)	11.74	7.8	YSI model 57 O_2 meter
Water Temperature (°C)	10.4	10.2	YSI model 57 O_2 meter
pH (field)	8.6	8.4	Oakpon pH tester-2
Specific Conductance (µS/cm)	20	30	Oakpon TDS tester
Chlorophyll *a* (mg/m^3)	12.1	4.33	See Section 3
Filterable Residue(ppm)	<1	<1	See Section 3
Dissolved Sodium (ppb)	2029	4580	See Section 3
Dissolved Magnesium (ppb)	1010	2210	See Section 3
Calcium (ppb)	5910	13200	See Section 3
Alkalinity (mg/L)	55.79	57.05	See Section 3
TDS (mg/L)	88.06	57.46	See Section 3

8.3 Water Nutrient Summary

Table 7 Summary of Available Phosphorus and Nitrogen

Parameter Measured	Result (0.5 m)	Result (10 m)	Method Used
NH_3 (mg/L)	0.10	0.13	See Section 3
Total Dissolved Phosphorus (ppm)	0.02	0.04	See Section 3
Total Phosphorus (ppm)	0.06	0.11	See Section 3
Total Kjeldahl Nitrogen (ppm)	0.235	0.300	See Section 3
N:P Ratio	3.9	2.7	Average = 3.3

Notes:

- N:P ratio determined as: $\frac{\text{Total Kjeldahl Nitrogen}}{\text{Total Phosphorus}}$

The total phosphorus (TP) data for this lake (see Appendix III) suggests a eutrophic classification (Wetzel 1983). The high algal abundance is consistent with this classification but the N:P ratio indicates that algal production in the lake is not limited by the availability of phosphorus (i.e., N:P < 15) suggesting that perhaps TP is not the best variable for classifying this lake. Additionally, the lake was a dark brown color with very abundant littoral zone vegetation. This suggests that rooted vegetation, not pelagic algae, are the dominant productive plants in this lake and also suggests that the lake could be classified as dystrophic (Wetzel 1983). However, this lake remains difficult to classify because although its water colour and littoral vegetation suggest dystrophy, this classification of lakes normally has a low pH which was not the case for Twin Lake

(pH = 8.6-8.4). Therefore, the most appropriate classification for this lake will require further investigation.

8.4 Dissolved Oxygen and Temperature Data

Dissolved oxygen concentration and temperature were determined at 1 metre intervals from a vertical profile below the limnological station in Twin Lake on September 25, 1996. Table 8 summarizes these data while the relationship between depth, dissolved oxygen concentration and water temperature is shown in Figure 11. This figure suggests that there was negligible thermal stratification at the time of this survey and also that dissolved oxygen concentrations remained suitable for salmonids (> 8 mg/L: Anon. 1996b) down to almost 5 metres.

Table 8 Dissolved Oxygen Concentration and Temperature Data.

Depth (m)	Dissolved Oxygen (ppm)	Temperature (°C)
0	11.74	10.4
1	11.52	10.4
2	11.23	10.3
3	11.11	10.3
4	8.2	10.3
5	7.8	10.2
6	6.9	10.1

Figure 11 Dissolved Oxygen and Temperature Profiles

9. SUMMARY AND RECOMMENDATIONS

Twin Lake is located 18.8 km north by northwest of Fort Babine, approximately 2 km from the Babine River. The maximum depth in this lake is 6.2 metres with mean depths and volumes of 3.4 metres and 1,090,607 m^3, respectively. There are no shoal areas that would present a hazard to navigation.

Twin Lake contains a multi-species assemblage of both sport and non-sport fish species. Overall, this lake's fishery, and especially the sport fish fishery, was very productive with a maximum catch per unit effort of 25.87 fish/100 m^2/12 hr sample period. Twin lake's water chemistry is suitable for fish (Anon. 1996b) and dissolved oxygen concentrations remained above 8 mg/L for the top 5 metres, below which it declined to a minimum of 6.9 mg/L. Although not captured in this lake, steelhead trout have been documented in the lake's outflow. It is not known if a barrier exists downstream of the lake but if none exists, then this lake could potentially be used for steelhead juvenile rearing which would present a serious management issue.

Access at the time of this survey was by air only. However, nearby logging roads are under construction so road access might be possible in the future. This potential access, combined with the significant sport fish fishery and its attractiveness to anglers, might introduce potential management concerns for this lake that do not currently exist.

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Project Manager

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Aquatic Ecologist

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APPENDIX I

Fish Collection Data Form and Lake Biophysical Data Form

Lake Biophysical Data Form

Date (yy/mm/dd): 1996/9/24-25 Crew: GS/JC

Site ID

Watershed Code:	n/a	Sequence No.:	n/a
Gazetted Name:	n/a	Alias:	Twin Lake
FW Region:	Prince Rupert	UTM (Zone, Easting, Northing):	9.640837.6154539
Management Unit:	n/a	NTS Map No.:	93M.10

Biophysical

Biogeo Zone:	Sub-boreal Spruce	Biogeo Zone No.:	PR-235
Benchmark (Y/N)	Y	Elevation (m):	773.7
Benchmark details:	iron spike		

Nutrient Status

SEAM No.:	e223702
Secchi depth (m):	2.1
Other samples taken:	water (0.5 m and 5 m)

Limno Station No.:	1(0.5 m)	1(5 m)	
H2S (mg/l)	n/a	n/a	
H2S comments	n/a	n/a	
TDS method	n/a	n/a	
TEMP method	n/a	n/a	
Alkalinity	55.79	57.05	

Field Conditions

Wind velocity (km/h):	0	Wind direction:	n/a	Air temp. (c):	8
Cloud cover (/10 O.C.):	100	Surface conditions:	calm	Water colour:	brown

Development

MOF rec sites (Y/N)	N	Resort cmpsts (Y/N)	N	Residences (Y/N)	N
MOF campsites (Y/N)	N	Resots (Y/N)	N	Co. Rec facilities	N
Parks cmpgrds (Y/N)	N	Resort cabins (Y/N)	N		

Recreation

ROS	N	Biophys features:	N	Biophys subfeat.:	N

Inlets/Outlets **see Stream Survey Card for mandatory fields**

Biological

Fish Card attached (Y/N)	Y	Fish Man. Com.	Y
Wildlife:	Y	Reptiles:	N
Aquatic Birds:	Y	Invertebrates:	Y
Amphibians:	N	Aquatic Plants:	Y

Comments:

Fish Collection Data Form

Card 1 of 1

Date (yy/mm/dd):	1996/9/24-25	Agency:	Kohn-Crippen	Crew:	GS/JC
Gazetted Name:	n/a	Alias:	Twin Lake	UTM:	9.640837.6154539
Lake/Stream/Wetland:	Lake	Location:	18.8 km northwest of Fort Babine		
Sequence No.:	n/a	Weather:	cloudy and warm		
Watershed Code:	n/a	Reach #:	n/a		

Area Sampled: n/a Air Temp (C): 8 Water Temp (C): 10.4-10.1 EC ms/cm: 20-30

Site No.	Capture Method	Pass # or trap/net #	Species (code)	Mark or Tag No.	Length FL (mm)	Weight (g)	Fish #	Sex (code)	Maturity (code)	Activity (code)	Scale Nos.
1	GL	1	CT	n/a	173	48	1	M	n/a	n/a	-
1	GL	1	CT	n/a	224	112	2	M	n/a	n/a	-
1	GL	1	CT	n/a	272	204	3	M	n/a	n/a	-
1	GL	1	CT	n/a	229	24	4	F	n/a	n/a	-
1	GL	1	CT	n/a	183	60	5	F	n/a	n/a	-
1	GL	1	CT	n/a	178	56	6	M	n/a	n/a	-
1	GL	1	CT	n/a	222	72	7	F	n/a	n/a	-
1	GL	1	CT	n/a	201	82	8	F	n/a	n/a	-
1	GL	1	CT	n/a	183	60	9	F	n/a	n/a	-
1	GL	1	CT	n/a	173	56	10	M	n/a	n/a	-
1	GL	1	CT	n/a	188	62	11	F	n/a	n/a	-
1	GL	1	CT	n/a	229	116	12	M	n/a	n/a	-
1	GL	1	CT	n/a	199	74	13	M	n/a	n/a	-
1	GL	1	CT	n/a	173	50	14	F	n/a	n/a	-
1	GL	1	CT	n/a	238	124	15	M	n/a	n/a	-
1	GL	1	CT	n/a	179	52	16	F	n/a	n/a	-
1	GL	1	CT	n/a	204	82	17	M	n/a	n/a	-
1	GL	1	CT	n/a	274	172	18	F	n/a	n/a	-
1	GL	1	CT	n/a	211	82	19	F	n/a	n/a	-
1	GL	1	CT	n/a	200	80	20	F	n/a	n/a	-
1	GL	1	CT	n/a	204	78	21	M	n/a	n/a	-
1	GL	1	CT	n/a	176	52	22	M	n/a	n/a	-
1	GL	1	CT	n/a	218	96	23	F	n/a	n/a	-
1	GL	1	CT	n/a	202	88	24	F	n/a	n/a	-
1	GL	1	CT	n/a	193	74	25	F	n/a	n/a	-
1	GL	1	CT	n/a	197	72	26	M	n/a	n/a	-
1	GL	1	DV	n/a	195	62	27	F	n/a	n/a	-
1	GL	1	LSU	n/a	279	244	28	M	n/a	n/a	-
1	GL	1	LSU	n/a	280	242	29	M	n/a	n/a	-
1	GL	1	LSU	n/a	240	182	30	M	n/a	n/a	-

Area Sampled: n/a | Air Temp (C): 8 | Water Temp (C): 10.4-10.1 | EC ms/cm: 20-30

Site No.	Capture Method	Pass # or trap/net #	Species (code)	Mark or Tag No.	Length FL (mm)	Weight (g)	Fish #	Sex (code)	Maturity (code)	Activity (code)	Scale Nos.
1	GL	1	LSU	n/a	305	348	31	F	n/a	n/a	-
1	GL	1	LSU	n/a	271	238	32	F	n/a	n/a	-
1	GL	1	LSU	n/a	313	340	33	F	n/a	n/a	-
1	GL	1	LSU	n/a	295	288	34	M	n/a	n/a	-
1	GL	1	LSU	n/a	389	772	35	F	n/a	n/a	-
1	GL	1	LSU	n/a	274	254	36	M	n/a	n/a	-
1	GL	1	LSU	n/a	284	272	37	M	n/a	n/a	-
1	GL	1	LSU	n/a	196	90	38	M	n/a	n/a	-
1	GL	1	LSU	n/a	164	44	39	M	n/a	n/a	-
1	GL	1	LSU	n/a	298	318	40	M	n/a	n/a	-
1	GL	1	NS	n/a	159	48	41	M	n/a	n/a	-
1	GL	1	NS	n/a	175	48	42	M	n/a	n/a	-
1	GL	1	NS	n/a	175	60	43	M	n/a	n/a	-
1	GL	1	NS	n/a	162	50	44	M	n/a	n/a	-
1	GL	1	NS	n/a	181	58	45	F	n/a	n/a	-
1	GL	1	NS	n/a	165	52	46	F	n/a	n/a	-
1	GL	1	NS	n/a	159	46	47	M	n/a	n/a	-
1	GL	1	NS	n/a	175	48	48	M	n/a	n/a	-
1	GL	1	NS	n/a	142	32	49	F	n/a	n/a	-
1	GL	1	NS	n/a	168	46	50	F	n/a	n/a	-
1	GL	1	NS	n/a	169	50	51	F	n/a	n/a	-
1	GL	1	NS	n/a	164	50	52	M	n/a	n/a	-
1	GL	1	NS	n/a	169	48	53	F	n/a	n/a	-
1	GL	1	NS	n/a	148	38	54	M	n/a	n/a	-
1	GL	1	NS	n/a	141	30	55	M	n/a	n/a	-
1	GL	1	NS	n/a	185	62	56	M	n/a	n/a	-
1	GL	1	NS	n/a	166	50	57	F	n/a	n/a	-
1	GL	1	NS	n/a	171	54	58	F	n/a	n/a	-
1	GL	1	NS	n/a	176	56	59	M	n/a	n/a	-
1	GL	1	NS	n/a	169	52	60	M	n/a	n/a	-
1	GL	1	NS	n/a	147	36	61	M	n/a	n/a	-
1	GL	1	NS	n/a	170	54	62	F	n/a	n/a	-
2	GL	2	CT	n/a	191	64	63	F	n/a	n/a	-
2	GL	2	CT	n/a	178	58	64	M	n/a	n/a	-
2	GL	2	CT	n/a	179	58	65	F	n/a	n/a	-
2	GL	2	CT	n/a	173	44	66	F	n/a	n/a	-
2	GL	2	CT	n/a	189	70	67	F	n/a	n/a	-
2	GL	2	CT	n/a	191	66	68	M	n/a	n/a	-

Area Sampled: n/a | Air Temp (C): 8 | Water Temp (C): 10.4-10.1 | EC ms/cm: 20-30

Site No.	Capture Method	Pass # or trap/net #	Species (code)	Mark or Tag No.	Length FL (mm)	Weight (g)	Fish #	Sex (code)	Maturity (code)	Activity (code)	Scale Nos.
2	GL	2	CT	n/a	204	86	69	M	n/a	n/a	-
2	GL	2	CT	n/a	330	384	70	M	n/a	n/a	-
2	GL	2	CT	n/a	189	62	71	M	n/a	n/a	-
2	GL	2	CT	n/a	194	62	72	F	n/a	n/a	-
2	GL	2	CT	n/a	214	92	73	F	n/a	n/a	-
2	GL	2	CT	n/a	179	54	74	F	n/a	n/a	-
2	GL	2	CT	n/a	206	86	75	F	n/a	n/a	-
2	GL	2	CT	n/a	258	194	76	F	n/a	n/a	-
2	GL	2	CT	n/a	228	110	77	F	n/a	n/a	-
2	GL	2	CT	n/a	196	80	78	F	n/a	n/a	-
2	GL	2	CT	n/a	240	116	79	F	n/a	n/a	-
2	GL	2	CT	n/a	207	84	80	F	n/a	n/a	-
2	GL	2	CT	n/a	336	468	81	F	n/a	n/a	e223702-01
2	GL	2	CT	n/a	276	210	82	M	n/a	n/a	e223702-02
2	GL	2	CT	n/a	275	190	83	F	n/a	n/a	e223702-03
2	GL	2	CT	n/a	249	150	84	F	n/a	n/a	e223702-04
2	GL	2	CT	n/a	238	126	85	M	n/a	n/a	e223702-05
2	GL	2	CT	n/a	305	282	86	M	n/a	n/a	e223702-06
2	GL	2	CT	n/a	274	222	87	F	n/a	n/a	e223702-07
2	GL	2	CT	n/a	277	190	88	M	n/a	n/a	e223702-08
2	GL	2	CT	n/a	226	102	89	F	n/a	n/a	e223702-09
2	GL	2	CT	n/a	255	164	90	F	n/a	n/a	e223702-10
2	GL	2	CT	n/a	206	88	91	M	n/a	n/a	e223702-11
2	GL	2	CT	n/a	182	54	92	M	n/a	n/a	e223702-12
2	GL	2	CT	n/a	214	90	93	F	n/a	n/a	e223702-13
2	GL	2	CT	n/a	194	70	94	M	n/a	n/a	e223702-14
2	GL	2	CT	n/a	212	96	95	M	n/a	n/a	e223702-15
2	GL	2	CT	n/a	251	144	96	M	n/a	n/a	e223702-16
2	GL	2	CT	n/a	213	118	97	M	n/a	n/a	e223702-17
2	GL	2	CT	n/a	199	76	98	F	n/a	n/a	e223702-18
2	GL	2	CT	n/a	222	108	99	F	n/a	n/a	e223702-20
2	GL	2	CT	n/a	174	50	100	F	n/a	n/a	e223702-21
2	GL	2	CT	n/a	194	74	101	F	n/a	n/a	e223702-22
2	GL	2	CT	n/a	209	90	102	M	n/a	n/a	e223702-23
2	GL	2	CT	n/a	203	74	103	M	n/a	n/a	e223702-24
2	GL	2	CT	n/a	192	64	104	M	n/a	n/a	e223702-25
2	GL	2	CT	n/a	186	68	105	F	n/a	n/a	e223702-26
2	GL	2	CT	n/a	156	40	106	F	n/a	n/a	e223702-27

Area Sampled: n/a | Air Temp (C): 8 | Water Temp (C): 10.4-10.1 | EC ms/cm: 20-30

Site No.	Capture Method	Pass # or trap/net #	Species (code)	Mark or Tag No.	Length FL (mm)	Weight (g)	Fish #	Sex (code)	Maturity (code)	Activity (code)	Scale Nos.
2	GL	2	CT	n/a	224	108	107	M	n/a	n/a	e223702-28
2	GL	2	CT	n/a	179	52	108	M	n/a	n/a	e223702-29
2	GL	2	CT	n/a	183	56	109	M	n/a	n/a	e223702-30
2	GL	2	LSU	n/a	331	432	110	M	n/a	n/a	-
2	GL	2	NS	n/a	169	54	111	M	n/a	n/a	-
2	GL	2	NS	n/a	171	54	112	M	n/a	n/a	-
2	GL	2	NS	n/a	171	52	113	F	n/a	n/a	-
2	GL	2	NS	n/a	152	38	114	M	n/a	n/a	-
2	GL	2	NS	n/a	164	52	115	F	n/a	n/a	-
2	GL	2	NS	n/a	156	44	116	M	n/a	n/a	-
2	GL	2	NS	n/a	175	62	117	M	n/a	n/a	-
2	GL	2	NS	n/a	168	54	118	F	n/a	n/a	-
2	GL	2	NS	n/a	162	46	119	M	n/a	n/a	-
2	GL	2	NS	n/a	176	54	120	F	n/a	n/a	-
2	GL	2	NS	n/a	171	56	121	F	n/a	n/a	-
2	GL	2	NS	n/a	171	54	122	M	n/a	n/a	-
2	GL	2	NS	n/a	175	56	123	M	n/a	n/a	-
2	GL	2	NS	n/a	174	62	124	F	n/a	n/a	-
2	GL	2	NS	n/a	186	62	125	M	n/a	n/a	-
2	GL	2	NS	n/a	178	64	126	F	n/a	n/a	-
2	GL	2	NS	n/a	175	60	127	M	n/a	n/a	-
2	GL	2	NS	n/a	164	56	128	M	n/a	n/a	-
2	GL	2	NS	n/a	136	28	129	F	n/a	n/a	-
2	GL	2	NS	n/a	180	60	130	M	n/a	n/a	-
2	GL	2	NS	n/a	166	50	131	M	n/a	n/a	-
2	GL	2	NS	n/a	161	50	132	M	n/a	n/a	-

1 Capture method: angler report (AR), angling (AG), creel census (CR), dead capture (DC), dip netting (DN), electroshocking (EL), gill netting (GN), minnow trapping (MT), seining (SN), swimming (SW), visual observation above water (VO), method unknown (UN).

2 Activity: migration (MI), spawning (S), incubation (I), rearing (feeding or resting) (R).

3a Level of life phase, Method 1: egg/alevin (E), fry (F), ,juvenile (J), adult (A) - or use Method 2.

3b Level of maturity, Method 2: egg/alevin (E), fry (F), immature (IM), maturing (MT), mature (M), spawning (SP), spent (ST).

4 Species codes: see manual.

APPENDIX II

Fish Scale Microfiche Prints

Appendix III

Water Chemistry Analysis

APPENDIX IV

Photograph Directory

Photo Survey Form 1 - Equipment Details

Survey Start Date: 13/09/1996
Survey end Date: 27/09/1996

Agency: Klohn-Crippen
Crew: GS/JS or GS/JC

Camera # 1

Make and Model:	Ricoh LX-33W date	**Lenses:** A
Format:	35 mm film	

Camera # 2

Make and Model:	Fuji Dosposable	**Lenses:** A
Format:	35 mm film	

Lenses

Focal Length (mm)
A - fixed

Roll and/or Batch Details

Roll #	Camera #	Output Medium	Film Type	ISO
1	1	neg, print	colour	400
2	1	neg, print	colour	400
3	2	neg, print	colour	400
4	1	neg, print	colour	400
5	1	neg, print	colour	400
6	1	neg, print	colour	400
7	1	neg, print	colour	400
8	1	neg, print	colour	400

Date	Roll	Negative	Counter	NTS Map Sheet	Watershed Code	Description	Photodocumentation Form2 Photo Direction	Reach	Site	Picture Type	UTM Zone	Efield	Nfield	Ecorrect	Ncorrect	Crew	Focal Length	Scale
12/09/1996	1	4	4	93L10	460-7449-858	Gee Trap #1 in North L, note the lack of aquatic vegetation	NW			L						GS/JS	St	n/a
14/09/1996	1	5	5	93L10	460-7449-858	View west over the Bulkley Valley taken from above North L	W			WS						GS/JS	St	n/a
14/09/1996	1	6	6	93L10	460-7449-858	Panoramic of the south end of North L taken from the helicopter				L						GS/JS	Wd	n/a
14/09/1996	1	7	7	93L10	460-7449-858	North L Inlet looking upstream from the L	W	1		Ch	9			677930	6048686	GS/JS	St	n/a
14/09/1996	1	8	8	93L10	460-7449-858	Marsh located 110m upstream of North L Inlet	Up	1		Ch						GS/JS	St	n/a
14/09/1996	1	9	9	93L10	460-7449-858	Looking S from outlet of L that drains into North L (190m upstream from North L)	S	1		Ch						GS/JS	St	n/a
14/09/1996	1	10	10	93L10	460-7449-858	Looking upstream from downstream limit of North L Inlet site	Up	1	1	Ch						GS/JS	St	Folding ruler hanging in tree
14/09/1996	1	11	11	93L10	460-7449-858	Old cabin near North L outlet				O	9			647794	6049278	GS/JS	St	n/a
14/09/1996	1	12	12	93L10	460-7449-858	Example of the falls that cover the North L Outlet (falls are 1.2 m high, 140 m downstream from outlet)	Up	1		Ch						GS/JS	St	Folding ruler placed near top of falls
14/09/1996	1	13	13	93L10	460-7449-858	looking down chute section of North L outlet	Dn	1	1	Ch						GS/JS	St	n/a
12/09/1996	1	14	14	93L10	460-7449-858	90 cm high falls 90 m downstream from North L outlet	Up	1	1	Ch						GS/JS	St	Folding ruler
14/09/1996	1	16	16	93L10	460-7449-858	Just upstream of falls in #14: Bottom end of North L Outflow site	Up	1	1	Ch						GS/JS	St	n/a
14/09/1996	1	17	17	93L10	460-7449-858	Upstream limit of North L outflow site	Dn	1	1	Ch						GS/JS	St	n/a
14/09/1996	1	18	18	93L10	460-7449-858	North L outlet taken from L	E			L,Ch	9			647794	6049278	GS/JS	St	n/a
14/09/1996	1	19	19	93L10	460-7449-858	Panoramic (#1) of north end of North L	S			L						GS/JS	Wd	n/a
14/09/1996	1	20	20	93L10	460-7449-858	Panoramic (#2) of north end of North L	S			L						GS/JS	Wd	n/a
14/09/1996	1	21	21	93L10	460-7449-858	Panoramic (#3) of north end of North L	S			L						GS/JS	Wd	n/a
14/09/1996	1	22	22	93L10	460-7449-858	Panoramic (#1) of south end of North L	N			L						GS/JS	Wd	n/a
14/09/1996	1	23	23	93L10	460-7449-858	Panoramic (#2) of south end of North L	N			L						GS/JS	Wd	n/a
14/09/1996	1	24	24	93L10	460-7449-858	Panoramic (#3) of south end of North L	N			L						GS/JS	Wd	n/a
14/09/1996	1	25	25	93L10	460-7449-858	Panoramic (#4) of south end of North L	N			L						GS/JS	Wd	n/a
14/09/1996	1	26	26	93L10	460-7449-858	Benchmark in North L (note aquatic vegetation)	E			L	9			647878	6048791	GS/JS	St	n/a
14/09/1996	1	27	27	93L10	460-7449-858	Aerial view of North L from helicopter	W			WS						GS/JS	St	n/a
14/09/1996	1	28	28	93L10	460-7449-858	Aerial view of North L from helicopter	E			WS						GS/JS	St	n/a
14/09/1996	1	30	30	93L10	460-5177-361	Zodiac in Coppermine L on shore near old mine entrance	N			L						GS/JS	St	10'2" Zodiac
14/09/1996	1	31	31	93L10	460-5177-361	Panoramic (#1, E to W) of Coppermine L taken from mine site	NE			L						GS/JS	Wd	n/a
14/09/1996	1	32	32	93L10	460-5177-361	Panoramic (#2, E to W) of Coppermine L taken from mine site	N			L						GS/JS	Wd	n/a
14/09/1996	1	34	34	93L10	460-5177-361	Panoramic (#4, E to W) of Coppermine L taken from mine site	NW			L						GS/JS	Wd	n/a
14/09/1996	1	35	35	93L10	460-5177-361	Panoramic (#5, E to W) of Coppermine L taken from mine site	W			L						GS/JS	Wd	n/a
14/09/1996	1	35	35	93L10	460-5177-361	Old cabin near the outlet of Coppermine L	NW			WS						GS/JS	St	n/a
14/09/1996	1	37	37	93L10	460-5177-361	Sunset over Coppermine L	W			L						GS/JS	St	n/a
15/09/1996	2	0	1	93L10	460-5177-361	Coppermine inflow form the edge of Coppermine L	Up	1		Ch						GS/JS		
15/09/1996	2	1	2	93L10	460-5177-361	Benchmark in Coppermine L	W			L	9			647157	6048020	GS/JS	St	n/a

Date	Roll	Negative	Counter	NTS Map Sheet	Watershed Code	Description	Photo Direction	Reach	Site	Picture Type	UTM Zone	Efield	Nfield	Ecorrect	Ncorrect	Crew	Focal Length	Scale
15/09/1996	2	2	3	93L10	460-5177-361	Coppermine L outflow taken from the lake, note the structure in background	n/a			L, Ch	9	647181	6047903			GS/JS	St	n/a
15/09/1996	2	3	4	93L10	460-5177-361	Upstream limit of Coppermine outflow stream site	Dn	1	1	Ch	9					GS/JS	St	n/a
15/09/1996	2	4	5	93L10	460-5177-361	Downstream limit of Coppermine L outlet	Up	1	1	Ch	9					GS/JS	St	n/a
15/09/1996	2	5	6	93L10	460-5177-361	Meadow below the downstream limit of Coppermine L outlet site	Dn	1		Ch	9					GS/JS	St	n/a
15/09/1996	2	6	7	93L10	460-5177-361	Coppermine L from helicopter	E			WS	9					GS/JS	St	n/a
15/09/1996	2	7	8	93L10	460-5177-361	North L form helicopter	N			WS	9					GS/JS	St	n/a
15/09/1996	2	8	9	n/a	n/a	Access (helicopter) to Ceber L from Smithers along Toboggan Creek	W			O	9					GS/JS	St	n/a
15/09/1996	2	9	10	n/a	n/a	Toboggan Glacier from helicopter	S			O	9					GS/JS	St	n/a
15/09/1996	2	10	11	93L13	n/a	Shoreline area where gee trap #2 was placed in Ceber L	NW			L	9					GS/JS	St	n/a
15/09/1996	2	11	12	93L13	n/a	Shoreline area where gee trap #3 was placed in Ceber L	NE			L	9					GS/JS	St	n/a
15/09/1996	2	13	13	93L13	n/a	Tree fall to which gee trap #4 was attached in Ceber L	E			L	9					GS/JS	St	n/a
15/09/1996	2	15	15	93L13	n/a	Shoreline area where gee trap #1 was placed in Ceber L. Note the aquatic vegetation	E			L	9					GS/JS	St	n/a
16/09/1996	2	17	17	93L13	n/a	Ceber L from helicopter (south end)	W			WS	9					GS/JS	St	n/a
16/09/1996	2	16	16	93L13	n/a	Ceber L from helicopter (north end)	NW			WS	9					GS/JS	St	n/a
15/09/1996	2	18	18	93L10	n/a	Rainbow trout mortality from gillnet in Ceber L	n/a			Fi	9					GS/JS	St	10 L pail near fish's head
16/09/1996	2	19	19	93L13	n/a	Greg releasing rainbow that remained alive in gillnet in Ceber L	n/a			Fi	9					GS/JS	St	Person
16/09/1996	2	20	20	93L10	n/a	Example of invertebrate (copepods) size found in Ceber L (also in North L and Coppermine L)	n/a			O	9					GS/JS	St	persons hand
16/09/1996	2	21	21	93L13	n/a	Ceber L outlet taken from lakeshore	S			L, Ch	9			589191	6077763	GS/JS	St	person and boat
16/09/1996	2	22	22	93L13	n/a	80 cm falls in Ceber L outlet, 60 m from lake	Up	1		Ch	9					GS/JS	St	folding ruler
16/09/1996	2	23	23	93L13	n/a	Habitat and vegetation at Ceber outlet sample site. Note the abundant tree fall	Up	1	1	Ch	9					GS/JS	St	n/a
16/09/1996	2	24	24	93L13	n/a	1.8 m chute in Ceber outflow 100 m from outlet	Up	1		Ch	9					GS/JS	St	field book with scale in inches
16/09/1996	2	25	25	93L10	n/a	Downstream limit of Ceber L outlet site	Up	1	1	Ch	9					GS/JS	St	n/a
16/09/1996	2	26	26	93L13	n/a	Upstream limit of Ceber L outlet site. Note the extensive cover	Dn	1	1	Ch	9					GS/JS	St	n/a
16/09/1996	2	27	27	93L13	n/a	Ceber L inlet from the shoreline	E, Up	1		L, Ch	9			582282	6078000	GS/JS	St	n/a
16/09/1996	2	28	28	93L13	n/a	Benchmark in tree near Ceber L (note flagging tape)	N			L	9	588883	6077755			GS/JS	St	n/a
16/09/1996	2	29	29	93L13	n/a	Jack Mould L from helicopter. Note access rode in foreground and background	N			WS	9					GS/JS	St	n/a
16/09/1996	2	30	30	93L13	n/a	Jack Mould L inlet taken from the boat. Note beaver dam in background	E			L, Ch	9					GS/JS	St	n/a
16/09/1996	2	31	31	93L13	n/a	Beaver dam in Jack Mould outlet, seperates lake from channel	W, Up	1		L, Ch	9					GS/JS	St	n/a
16/09/1996	2	32	32	93L13	n/a	1.2 m high beaver dam at Jack Mould L outlet	W, Up	1		L, Ch	9					GS/JS	St	note book with scale in inches

Date	Roll	Negative	Counter	NTS Map Sheet	Watershed Code	Description	Photodocumentation Form2 Photo Direction	Reach	Site	Picture Type	UTM Zone	Efield	Nfield	Ecorrect	Ncorrect	Crew	Focal Length	Scale
16/09/1996	2	33	33	93L13	n/a	1.2 m high beaver dam in Jack Mould L outlet	W			L, Ch	9					GS/JS	St	n/a
16/09/1996	2	35	35	103I16	440-6382-012	Mulwain Creek from helicopter, also represents access to Mulwain L	NW			WS	9					GS/JS	St	n/a
16/09/1996	2	36	36	103I16	n/a	Mulwain L from helicopter	n/a			WS	9					GS/JS	St	n/a
17/09/1996	3	0	1	103I16	n/a	Moose near Mulwain L inlet	E			O	9					GS/JS	St	n/a
17/09/1996	3	1	2	103I16	n/a	Moose near Mulwain L inlet	E			O	9					GS/JS	St	n/a
17/09/1996	3	2	3	103I16	n/a	Jamie under zodiac seeking protection from the rain	NW			L, O	9					GS/JS	St	10'6" boat & person
17/09/1996	3	3	4	103I16	n/a	Benchmark in Mulwain L	SE			L	9					GS/JS	St	n/a
17/09/1996	3	4	5	103I16	n/a	Unsurveyed inflow into Mulwain L	Up			L, Ch	9					GS/JS	St	n/a
17/09/1996	3	5	6	103I16	440-6382-012	Small 0.7 m falls in Mulwain L inlet	Up	1		Ch	9					GS/JS	St	note book with scale in inches
17/09/1996	3	6	7	103I16	440-6382-012	Downstream limit of Mulwain L outlet sample site	Up	1	1	Ch	9					GS/JS	St	30 m tape
17/09/1996	3	7	8	103I16	440-6382-012	Upstream limit of Mulwain L outlet sample site	Dn	1	1	Ch	9					GS/JS	St	n/a
17/09/1996	3	8	9	103I16	440-6382-012	Example of a ground water pool discharging into Mulwain L outlet. Pool was 0.7 m above main channel	Dn	1		Ch	9					GS/JS	St	notebook with scale in inches
17/09/1996	3	9	10	103I16	440-6382-012	Large meadow at 500m mark of Mulwain L outlet	Dn	1		Ch	9					GS/JS	St	n/a
17/09/1996	3	10	11	103I16	440-6382-012	Example of meandering outlet of Mulwain L	Up	1		Ch	9					GS/JS	St	n/a
17/09/1996	3	12	13	103I16	440-6382-012	Small 100m x 30m lake immediately downstream of Mulwain L	Dn	1		Ch	9					GS/JS	St	n/a
17/09/1996	3	11	12	103I13	440-6382-012	Area where large tributary empties into Mulwain L outlet	Dn	1		Ch	9					GS/JS	St	n/a
1006/9/17	3	13	14	103I16	n/a	Mulwain L outlet taken from stream section	Up, N	1		L, Ch	9					GS/JS	St	boat in background
17/09/1996	3	14	15	103I16	n/a	Downstream limit of Mulwain L inlet sampling site	Up	1	1	Ch	9					GS/JS	St	notebook with scale in inches
17/09/1996	3	15	16	103I16	n/a	Upstream limit of Mulwain L inlet sample site	Dn	1	1	Ch	9					GS/JS	St	rain jacket and 30m tape
17/09/1996	3	16	17	103I16	n/a	End of Mulwain L Inlet at a groundwater pool	Up	1		Ch	9					GS/JS	St	n/a
17/09/1996	3	17	18	103I16	n/a	Example of how Mulwain L inlet meanders through meadow	Up	1		Ch	9					GS/JS	St	20x13 cm field chemistry case placed in grass
17/09/1996	3	18	19	103I16	n/a	Mulwain L inlet taken from edge of lake	Up	1		Ch	9					GS/JS	St	n/a
17/09/1996	3	19	20	103I16	n/a	Gee trap #5 in Mulwain L	E			L	9					GS/JS	St	n/a
17/09/1996	3	24	24	103I16	n/a	Mulwain L from helicopter	NW			WS	9					GS/JS	St	n/a
18/09/1996	4	3	3	93L13	n/a	Old beaver dam across outlet of Bud L (doesn't hold water)	Dn	1		Ch	9			586644	6078191		GS/JS	n/a
18/09/1996	4	4	4	93L13	n/a	Second old beaver dam across Bud L outlet (doesn't hold water)	Up	1		Ch	9					GS/JS	St	30m tape coil
18/09/1996	4	5	5	93L13	n/a	Example of how Bud L outlet flows through a meadow area immediately downstream of outlet	Up	1	1	Ch	9					GS/JS	St	person (6')
18/09/1996	4	6	6	93L13	n/a	2 m high chute/falls in Bud L outlet	Up	1	1	Ch	9					GS/JS	St	Person (6')
18/09/1996	4	7	7	93L13	n/a	Looking upstream from 500 m mark on Bud L outlet	Up	1		Ch	9					GS/JS	St	Person (6')
18/09/1996	4	8	8	93L13	n/a	Upstream limit of Bud L outlet sample site	Dn	1	1	Ch	9					GS/JS	St	n/a
18/09/1996	4	9	9	93L13	n/a	Downstream limit of Bud L outlet sample site	Dn	1	1	Ch	9					GS/JS	St	n/a
18/09/1996	4	10	10	93L13	n/a	GS electrofishing in Bud L outlet	Up	1	1	Ch	9					GS/JS	St	Person (6'1")

Date	Roll	Negative	Counter	NTS Map Sheet	Watershed Code	Description	Photodocumentation Form2 Photo Direction	Reach	Site	Picture Type	UTM Zone	Efield	Nfield	Ecorrect	Ncorrect	Crew	Focal Length	Scale
18/09/1996	4	11	11	93L13	n/a	Possible inlet to Bud L, no water or channel visible though	Up, XS			Ch	9					GS/JS	St	n/a
18/09/1996	4	12	12	93L13	n/a	Gee trap #1 in Bud L	S			L	9					GS/JS	St	Gee trap
18/09/1996	4	13	13	93L13	n/a	Gee trap # 3 in Bud L	NW			L	9					GS/JS	St	n/a
18/09/1996	4	14	14	93L13	n/a	Second possible inlet to Bud L. No water or channel visible	Up, S			L, Ch	9					GS/JS	St	n/a
18/09/1996	4	15	15	93L13	n/a	Shoreline area where gee trap # 5 was placed in Bud L	E			L	9					GS/JS	St	n/a
18/09/1996	4	16	16	93L13	n/a	Benchmark in Bud L. Note old high water marks	SW			L	9					GS/JS	St	n/a
19/09/1996	4	17	17	93L13	n/a	Gee trap # 5 in Bud L	E			L	9					GS/JS	St	n/a
19/09/1996	4	18	18	93L13	n/a	Gee trap # 4 in Bud L	N			L	9					GS/JS	St	Gee trap
19/09/1996	4	19	19	93L13	n/a	Shoreline area of Bud L where gee trap #2 was placed	W			L	9					GS/JS	St	n/a
19/09/1996	4	21	21	93L13	n/a	Example of invertebrates in Bud L	n/a			O	9					GS/JS	St	Note book with scale in inches
19/09/1996	4	22	22	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
19/09/1996	4	23	23	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
19/09/1996	4	24	24	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
19/09/1996	4	25	25	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
19/09/1996	4	26	26	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
19/09/1996	4	27	27	93M3	n/a	Netalzul Meadow L from the helicopter	n/a			WS	9					GS/JC	St	n/a
21/09/1996	4	28	28	93M3	n/a	Netalzul Meadow L from helicopter				WS	9					GS/JC	St	n/a
21/09/1996	4	29	29	93M3	n/a	Helicopter landing area and Netalzul Meadow inlet	Up, E			L, Ch	9					GS/JC	St	n/a
21/09/1996	4	30	30	93M3	n/a	Example of fish caught in gillnets	n/a			Fi	9					GS/JC	St	Zodiac pontoon
21/09/1996	4	31	31	93M3	n/a	Tadpoles and invertebrates captured in gee trap # 1 in Netalzul Meadow L	n/a			Fi	9					GS/JC	St	Zodiac pontoon
21/09/1996	4	32	32	93M6	n/a	Netalzul L form N end, zodiac in foreground	S			L	9					GS/JC	St	10'6" zodiac
22/09/1996	4	34	34	93M6	n/a	Netalzul L from helicopter, approached from SE end	NW			WS	9					GS/JC	St	n/a
22/09/1996	4	35	35	93M6	n/a	Netalzul L from helicopter, approached from SE end	NW			WS	9					GS/JC	St	n/a
22/09/1996	4	36	36	93M6	n/a	Netalzul L from helicopter, view of N end of lake	NW			WS	9					GS/JC	St	n/a
22/09/1996	5	1	1	93M6	n/a	Gee trap #1 in Netalzul L	N			L	9					GS/JC	St	n/a
22/09/1996	5	2	2	93M6	n/a	Example of large lake trout captured in Netalzul L gillnets	n/a			Fi	9					GS/JC	St	n/a
22/09/1996	5	3	3	93M6	n/a	Example of abundant tree-fall in Netalzul L	n/a			L	9					GS/JC	St	n/a
22/09/1996	5	4	4	93M6	n/a	Netalzul L inflow. Note abundant cover	Up	1		Ch	9					GS/JC	St	n/a
22/09/1996	5	5	5	93M6	n/a	Upstream limit of Netalzul L inflow sample site	Dn	1	1	Ch	9					GS/JC	St	n/a
22/09/1996	5	6	6	93M6	n/a	Downstream limit of Netalzul L inflow sample site	Up	1	1	Ch	9					GS/JC	St	n/a
22/09/1996	5	7	7	93M6	n/a	Panoramic (#1) looking N from lake's S end	N			L	9					GS/JC	St	n/a
22/09/1996	5	8	8	93M6	n/a	Panoramic (#2) looking N from lake's S end	N			L	9					GS/JC	St	n/a
22/09/1996	5	9	9	93M6	n/a	Panoramic (#3) looking N from lake's S end	N			L	9					GS/JC	St	10'6" zodiac

Date	Roll	Negative	Counter	NTS Map Sheet	Watershed Code	Description	Photodocumentation Form2 Photo Direction	Reach	Site	Picture Type	UTM Zone	Efield	Nfield	Ecorrect	Ncorrect	Crew	Focal Length	Scale
22/09/1996	5	10	10	93M6	n/a	Netalzul L outflow from lake's edge	S	1		L, Ch	9			624878	6128369	GS/JC	St	n/a
22/09/1996	5	11	11	93M6	n/a	Example of habitat in Netalzul L outlet	Bd	1	1	Ch	9					GS/JC	St	n/a
22/09/1996	5	12	12	93M6	n/a	lake downstream from Netalzul L	Dn	1		Ch, L	9					GS/JC	St	n/a
22/09/1996	5	13	13	93M6	n/a	Downstream limit of Netalzul lake outlet sample site	Up	1	1	Ch	9					GS/JC	St	note book
22/09/1996	5	14	14	93M6	n/a	Upstream limit of Netalzul L outflow sample site	Dn	1	1	Ch	9					GS/JC	St	notebook
22/09/1996	5	15	15	93M6	n/a	Benchmark in Netalzul lake	NE			L	9					GS/JC	St	n/a
23/09/1996	5	16	16	93M3	n/a	Helicopter access to Camp L	SW			WS	9					GS/JC	St	n/a
23/09/1996	5	17	17	93M3	n/a	Camp L from helicopter	NE			WS	9					GS/JC	Wd	n/a
23/09/1996	5	18	18	93M3	n/a	Gee trap #1 in Camp L	n/a			L	9					GS/JC	St	Side of zodiac
23/09/1996	5	19	19	93M3	n/a	Shoreline area near which gee trap #2 is placed	SW			L	9					GS/JC	St	n/a
23/09/1996	5	20	20	93M3	n/a	Tree fall where gee trap #3 is placed in Camp L	n/a			L	9					GS/JC	St	Side of zodiac
23/09/1996	5	21	21	93M3	n/a	Tree fall where gee trap #4 was placed in Camp L	n/a			L	9					GS/JC	St	n/a
23/09/1996	5	22	22	93M3	n/a	LOD where gee trap #5 was placed in Camp L	n/a			L	9					GS/JC	St	n/a
23/09/1996	5	23	23	93M3	n/a	Panoramic (#1)of Camp L from N end	NW			L	9					GS/JC	Wd	n/a
23/09/1996	5	24	24	93M3	n/a	Panoramic (#2)of Camp L from N end	NW			L	9					GS/JC	Wd	n/a
23/09/1996	5	25	25	93M3	n/a	Panoramic (#3)of Camp L from N end	W			L	9					GS/JC	Wd	n/a
23/09/1996	5	26	26	93M3	n/a	Panoramic (#4)of Camp L from N end	W			L	9					GS/JC	Wd	n/a
23/09/1996	5	27	27	93M3	n/a	Panoramic (#5)of Camp L from N end	SW			L	9					GS/JC	Wd	n/a
23/09/1996	5	28	28	93M3	n/a	Panoramic (#6)of Camp L from N end	SW			L	9					GS/JC	Wd	n/a
23/09/1996	5	29	29	93M3	n/a	Panoramic (#7)of Camp L from N end	S			L	9					GS/JC	Wd	n/a
23/09/1996	5	30	30	93M3	n/a	Dock for the hunting camp on Camp L	NE			L	9					GS/JC	St	n/a
23/09/1996	5	31	31	93M3	n/a	Road crossing on Camp L outlet, also bottom of sample site	Bd	1	1	Ch	9					GS/JC	St	n/a
23/09/1996	5	32	32	93M3	n/a	Upstream limit of Camp lake outlet sample site	Dn	1	1	Ch	9					GS/JC	St	n/a
23/09/1996	5	33	33	93M3	n/a	Black wolf shot the previous night at hunting camp	n/a			O	9					GS/JC	St	n/a
23/09/1996	5	34	34	93M3	n/a	Benchmark on Camp lake	NE			L	9	626275	6122305			GS/JC	St	n/a
23/09/1996	5	35	35	93M3	n/a	Camp L inlet taken from shoreline	NW			L, Ch	9	626275	6122305			GS/JC	St	n/a
23/09/1996	5	36	36	93M3	n/a	Camp L outlet taken from boat	S			L, Ch	9					GS/JC	St	n/a
23/09/1996	6	1	1	93M7	480-4026	Young bear swimming across Clota L	W			L	9					GS/JC	St	n/a
23/09/1996	6	2	2	93M7	480-4026	Young bear swimming across Clota L	W			L	9					GS/JC	St	n/a
24/09/1996	6	3	3	93M10		Twin L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	4	4	93M10		Twin L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	5	5	93M7	480-4026	Clota L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	6	6	93M7	480-4026	Clota L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	7	7	93M7	480-4026	Clota L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	8	8	93M7	480-4026	Clota L from floatplane	S			WS	9					GS/JC	Wd	n/a
24/09/1996	6	9	9	93M7	480-4026	Floatplane leaving Clota L	S			L	9					GS/JC	St	n/a
24/09/1996	6	10	10	93M7	480-4026	Shoreline area where gee trap #1 was placed in Clota L	W			L	9					GS/JC	St	n/a
24/09/1996	6	11	11	93M7	480-4026	Shoreline area where gee trap #2 was placed in Clota L	W			L	9					GS/JC	St	n/a
24/09/1996	6	12	12	93M7	480-4026	Shoreline area where gee trap #3 was placed in Clota L	W			L	9					GS/JC	St	n/a
24/09/1996	6	13	13	93M7	480-4026	Shoreline area where gee trap #4 was placed in Clota L	SE			L	9					GS/JC	St	n/a
24/09/1996	6	14	14	93M7	480-4026	Shoreline area where gee trap #5 was placed in Clota L	E			L	9					GS/JC	St	n/a
24/09/1996	6	15	15	93M7	480-4026	Panoramic (#1) showing marshy section between main and secondary basins of Clota L	SE			L	9					GS/JC	Wd	n/a

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24/09/1996	6	16	16	93M7	480-4026	Panoramic (#2) showing marshy section between main and secondary basins of Clota L	SE			L	9					GS/JC	Wd	n/a
24/09/1996	6	17	17	93M7	480-4026	Extensive marshy area surrounding Clota L inlet	N			L	9					GS/JC	St	n/a
24/09/1996	6	18	18	93M7	480-4026	Beaver dam at Clota L outlet	N	1		L, Ch	9	651187	6139961			GS/JC	St	notebook
24/09/1996	6	19	19	93M7	n/a	Upstream limit of Clota L outlet sample site	Dn	1	1	Ch	9					GS/JC	St	n/a
24/09/1996	6	20	20	93M7	n/a	Downstream limit of Clota L outlet sample site	Up	1	1	Ch	9					GS/JC	St	n/a
24/09/1996	6	21	21	93M7	n/a	Substrate of Clota L outlet sample site	Bd	1	1	Ch	9					GS/JC	St	Electrofisher backpack
24/09/1996	6	22	22	93M7	480-4026	Benchmark in Clota L	E			L	9	651606	6140218			GS/JC	St	n/a
24/09/1996	6	23	23	93M7	480-4026	Panoramic (#1) of Clota L from S end going E to W	SE			L	9					GS/JC	St	n/a
24/09/1996	6	24	24	93M7	480-4026	Panoramic (#2) of Clota L from S end going E to W	S			L	9					GS/JC	St	n/a
24/09/1996	6	25	25	93M7	480-4026	Panoramic (#3) of Clota L from S end going E to W	SW			L	9					GS/JC	St	n/a
24/09/1996	6	26	26	93M7	480-4026	Example of water lilies that are found throughout N, S, and W shores of Clota L	n/a			L	9					GS/JC	St	notebook with scale in inches
24/09/1996	6	27	27	93M7	480-4026	Panoramic (#!) of Clota L from N end going W to E	NW			L	9					GS/JC	St	Equipment on zodiac
24/09/1996	6	28	28	93M7	480-4026	Panoramic (#2) of Clota L from N end going W to E	NW			L	9					GS/JC	St	Equipment on zodiac
24/09/1996	6	29	29	93M7	480-4026	Panoramic (#3) of Clota L from N end going W to E	N			L	9					GS/JC	St	n/a
24/09/1996	6	30	30	93M7	480-4026	Panoramic (#4) of Clota L from N end going W to E	NE			L	9					GS/JC	St	n/a
24/09/1996	6	31	31	93M7	480-4026	Panoramic (#5) of Clota L from N end going W to E	NE			L	9					GS/JC	St	n/a
24/09/1996	6	32	32	93M7	480-4026	Example of tree fall and macrophyte habitat along shoreline of Clota L	W			L	9					GS/JC	St	n/a
24/09/1996	6	33	33	93M7	480-4026	GS on top of beaver lodge at N end of Clota L	W			L	9					GS/JC	St	n/a
25/09/1996	6	34	34	93M10	n/a	Gee trap #2 in Twin L	E			L	9					GS/JC	St	Gee trap
25/09/1996	6	35	35	93M10	n/a	Habitat in which gee trap #3 was placed in Twin L	n/a			L	9					GS/JC	St	n/a
25/09/1996	6	36	36	93M10	n/a	Gee trap #4 in Twin L	S			L	9					GS/JC	St	Gee trap
25/09/1996	6	37	37	93M10	n/a	Gee trap #5 in Twin L	n/a			L	9					GS/JC	St	Bow of zodiac
25/09/1996	7	1	1	93M10	n/a	Example of the number of fish caught in Twin L gillnets	n/a			L	9					GS/JC	St	Side of zodiac
25/09/1996	7	2	2	93M10	n/a	Only accessible site on Twin L inlet	Dn	1	1	Ch	9					GS/JC	St	n/a
25/09/1996	7	3	3	93M10	n/a	Only accessible site on Twin L inlet	Up	1	1	Ch	9					GS/JC	St	n/a
25/09/1996	7	4	4	93M10	n/a	Twin L inlet from lake shore: inaccessible	Dn, W	1		Ch, L	9	640730	6154528			GS/JC	St	n/a
25/09/1996	7	5	5	93M10	n/a	Panoramic (#1) of Twin L from S end	NE			L	9					GS/JC	St	n/a
25/09/1996	7	6	6	93M10	n/a	Panoramic (#2) of Twin L from S end	N			L	9					GS/JC	St	n/a
25/09/1996	7	7	7	93M10	n/a	Panoramic (#3) of Twin L from S end	N			L	9					GS/JC	St	n/a
25/09/1996	7	8	8	93M10	n/a	Panoramic (#4) of Twin L from S end	NW			L	9					GS/JC	St	n/a
25/09/1996	7	9	9	93M10	n/a	Panoramic (#5) of Twin L from S end	W			L	9					GS/JC	St	n/a
25/09/1996	7	10	10	93M10	n/a	Twin L outlet from boat	SE	1		L	9	640837	6154539			GS/JC	St	
25/09/1996	7	11	11	93M10	n/a	Panoramic (#1) of Twin L from N end going W to S	W			L	9					GS/JC	St	n/a
25/09/1996	7	12	12	93M10	n/a	Panoramic (#2) of Twin L from N end going W to S	W			L	9					GS/JC	St	n/a
25/09/1996	7	13	13	93M10	n/a	Panoramic (#3) of Twin L from N end going W to S	SW			L	9					GS/JC	St	n/a
25/09/1996	7	14	14	93M10	n/a	Panoramic (#4) of Twin L from N end going W to S	S			L	9					GS/JC	St	n/a

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25/09/1996	7	15	15	93M10	n/a	Panoramic (#5) of Twin L from N end going W to S	S			L	9					GS/JC	St	n/a
25/09/1996	7	16	16	93M7	n/a	Moose on shoreline of Boucher L. Note abundant macrophytes	E			L	9					GS/JC	St	n/a
26/09/1996	7	17	17	93M7	n/a	N end of Boucher L from helicopter	n/a			WS	9					GS/JC	St	n/a
26/09/1996	7	18	18	93M7	n/a	Boucher L from helicopter. Note old lake in top right corner	S			WS	9					GS/JC	St	n/a
26/09/1996	7	19	19	93M7	n/a	Looking NW from center of lake showing aquatic plant coverage	NW			L	9					GS/JC	St	n/a
26/09/1996	7	20	20	93M7	n/a	Habitat in which gee trap #1 was placed in Boucher L	n/a			L	9					GS/JC	St	n/a
26/09/1996	7	21	21	93M7	n/a	Habitat in which gee trap #2 was placed in Boucher L	n/a			L	9					GS/JC	St	bow of zodiac, gee trap
26/09/1996	7	22	22	93M7	n/a	Habitat in which gee trap #3 was placed in Boucher L	n/a			L	9					GS/JC	St	Gee trap
26/09/1996	7	23	23	93M7	n/a	Habitat in which gee trap #4 was placed in Boucher L	n/a			L	9					GS/JC	St	n/a
26/09/1996	7	25	25	93M7	n/a	Habitat in which gee trap #6 was placed in Boucher L	n/a			L	9					GS/JC	St	n/a
26/09/1996	7	26	26	93M7	n/a	Inlet to Boucher L. Note the 2 beaver dams	E			L, Ch	9			653205	6147248	GS/JC	St	n/a
26/09/1996	7	27	27	93M7	n/a	Another angle showing the aquatic vegetation infestation of Boucher L	E			L	9					GS/JC	St	n/a
26/09/1996	7	28	28	93M7	n/a	Boucher L outlet from boat	S			L, Ch	9			653289	6146103	GS/JC	St	n/a
26/09/1996	7	29	29	93M7	n/a	Beaver lodge 80 m from Boucher L outlet	S			L	9					GS/JC	St	n/a
26/09/1996	7	30	30	93M10	n/a	Upstream limit of Boucher L outlet sample site	Dn	1	1	Ch	9					GS/JC	St	notebook
26/09/1996	7	31	31	93M10	n/a	Downstream limit of Boucher L outlet sample site	Up	1	1	Ch	9					GS/JC	St	30m tape
26/09/1996	7	32	32	93M10	n/a	Example of habitat at Boucher L outlet sample site	Bd	1	1	Ch	9					GS/JC	St	30m tape
26/09/1996	7	33	33	93M10	n/a	Marsh above beaver dam at Boucher L inlet: not surveyed	E	1		L, Ch	9					GS/JC	St	n/a
26/09/1996	7	34	34	93M10	n/a	Beaver dam in Boucher L inlet	E	1		L, Ch	9					GS/JC	St	n/a
26/09/1996	7	35	35	93M10	n/a	Benchmark in Boucher L	E			L	9	653247	6146464			GS/JC	St	n/a
26/09/1996	7	36	36	93M10	n/a	Panoramic (#1) of Boucher L from S end going E to W	NE			L	9					GS/JC	St	n/a
26/09/1996	7	37	37	93M10	n/a	Panoramic (#2) of Boucher L from S end going E to W	N			L	9					GS/JC	Wd	n/a
26/09/1996	8	1	5	93M10	n/a	Panoramic (#3) of Boucher L from S end going E to W	N			L	9					GS/JC	Wd	n/a
26/09/1996	8	2	6	93M10	n/a	Panoramic (#4) of Boucher L from S end going E to W	N			L	9					GS/JC	Wd	n/a
26/09/1996	8	3	7	93M10	n/a	Panoramic (#5) of Boucher L from S end going E to W	N			L	9					GS/JC	Wd	n/a
26/09/1996	8	4	8	93M10	n/a	Panoramic (#6) of Boucher L from S end going E to W	NW			L	9					GS/JC	Wd	n/a
26/09/1996	8	5	9	93M10	n/a	Panoramic (#7) of Boucher L from S end going E to W	NW			L	9					GS/JC	Wd	n/a
26/09/1996	8	6	10	93M10	n/a	Panoramic (#8) of Boucher L from S end going E to W	NW			L	9					GS/JC	Wd	n/a
26/09/1996	8	7	11	93M10	n/a	Panoramic (#1) of Boucher L from N end going W to E	SW			L	9					GS/JC	Wd	n/a
26/09/1996	8	8	12	93M10	n/a	Panoramic (#2) of Boucher L from S end going W to E	S			L	9					GS/JC	Wd	n/a
26/09/1996	8	9	13	93M10	n/a	Panoramic (#3) of Boucher L from S end going W to E	SE			L	9					GS/JC	Wd	n/a
27/09/1996	8	11	15	93L10	n/a	Unnamed L from helicopter	E			WS	9					GS/JC	St	n/a
27/09/1996	8	12	15	93L10	n/a	S end of Unnamed L from helicopter including meandering inlet	E			WS	9					GS/JC	St	n/a

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27/09/1996	8	15	18	93L10	n/a	Gee trap #3 in littoral habitat of Unnamed L	E			L	9					GS/JC	St	Gee trap
27/09/1996	8	16	19	93L10	n/a	Littoral habitat of Unnamed L in which gee trap #4 was placed	S			L	9					GS/JC	St	n/a
27/09/1996	8	17	20	93L10	n/a	Unnamed L outlet including beaver lodge to right. Gee trap #5 placed at edge of dam	N			L	9	647527	6166191			GS/JC	Wd	n/a
27/09/1996	8	18	21	93L10	n/a	Gee trap #4 in Unnamed L	W			L	9					GS/JC	St	Gee trap
27/09/1996	8	19	22	93L10	n/a	View from behind 1m high beaver dam at Unnamed L outlet	S	1		L	9					GS/JC	St	30m tape roll
27/09/1996	8	20	23	93L10	n/a	Second beaver dam 20m below first in Unnamed L outlet	S	1		Ch	9					GS/JC	St	n/a
27/09/1996	8	21	24	93L10	n/a	Third beaver dam below second in Unnamed L outlet	S	1		Ch	9					GS/JC	St	n/a
27/09/1996	8	22	25	93L10	n/a	Fourth beaver dam below third in Unnamed L outlet	S	1		Ch	9					GS/JC	St	30m tape roll
27/09/1996	8	23	26	93L10	n/a	Downstream limit of Unnamed L outlet sample site	Up	1	1	Ch	9					GS/JC	St	30m tape roll
27/09/1996	8	24	27	93L10	n/a	Upstream limit of Unnamed L outlet sample site	Dn	1	1	Ch	9					GS/JC	St	30m tape roll
27/09/1996	8	25	28	93L10	n/a	GS electrofishing in Unnamed L outlet	XS	1	1	Ch	9					GS/JC	St	Person (6'1")
27/09/1996	8	26	29	93L10	n/a	Example of habitat in Unnamed L outlet sample site	Bd	1	1	Ch	9					GS/JC	St	Person (6'1")
27/09/1996	8	27	30	93L10	n/a	Beaver dam in Unnamed L inlet	Up, S	1		Ch, L	9					GS/JC	St	Person and notebook
27/09/1996	8	28	31	93L10	n/a	Benchmark in Unnamed L	E			L	9	651565	6054572			GS/JC	St	n/a
27/09/1996	8	29	32	93L10	n/a	Littoral habitat of Unnamed L in which gee trap #1 was placed	E			L	9					GS/JC	St	n/a
27/09/1996	8	30	33	93L10	n/a	Littoral habitat of Unnamed L in which gee trap #2 was placed	E			L	9					GS/JC	St	n/a
27/09/1996	8	32	35	93L10	n/a	Marshy area of Unnamed L Inlet: inaccessible by boat	S	1		WS, Ch	9					GS/JC	St	n/a