NECHAKO RESERVOIR
IMPACT OF TIMBER SALVAGE ON
FISH AND FISH HABITAT

1996 STUDIES

Prepared for:

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EXECUTIVE SUMMARY

Hatfield Consultants Ltd. (HCL) has been contracted by the Ministry of Environment, Lands and Parks, Smithers, BC (MOELP) to undertake studies to identify potential impacts of proposed harvesting of submerged timber on fish resources in the Nechako Reservoir. HCL has been undertaking these studies in collaboration with BC Research Inc. who were contracted separately (together with Limnotek Research and Development Inc.) to monitor impacts on sediment, water quality, and benthic communities.

The Nechako Reservoir was created in 1954 by construction of the Kenney Dam to supply water to the Alcan power generating station at Kemano. The reservoir flooded approximately 50,000 ha of land containing several million cubic metres of Crown timber. Small amounts of timber have been removed from the reservoir since formation. In 1996, the Ministry of Forests (MOF) issued two 10 year licences for large-scale timber removal (3 to 3.5 million cubic metres for each licence). One licence was issued to a joint venture between Canadian Forest Products and the Cheslatta Development Corporation (Canfor/CDC) for salvage of timber from the portion of the reservoir that lies within the MOF Lakes Timber Supply Area. The second licence was issued to the Cheslatta Carrier Nation Resource Corporation (a joint venture between the Cheslatta Carrier Nation and Fibrecon Management Ltd. - CCNRC) for salvage of timber from the portion of the reservoir that lies within the MOF Morice Timber Supply Area. Timber salvage methods to be used by the licencees and potential environmental effects are not certain. Interim Development Plans were prepared for the later part of 1996 to enable licencees to experiment with harvesting techniques on a small scale and to initiate collection of environmental data related to these operations.

The goal of the fisheries resource studies is to determine effects of submerged and floating timber salvage on sensitive fish populations in the Nechako Reservoir and to develop recommendations for protecting fish resources at sensitive locations and times. Studies conducted in 1996 are intended to be the first of a multi-year assessment program. The 1996 fisheries studies were undertaken in September and October and comprised intensive studies of fish and fish habitat in Ootsa Lake and reconnaissance level surveys of tributary streams. This report presents the results of the lake fish and fish habitat studies.

The following activities were undertaken for the 1996 fish resource studies: review of previous fisheries investigations on the Nechako Reservoir; design and implementation of a fish sampling program; interviews of individuals familiar with local sport and First Nations fishing activity; an aerial video survey of nearshore habitat; preliminary assessment of timber salvage effects on fish resources; and development of recommendations for fish protection.

The 1996 lake studies involved sampling in nearshore timber salvage areas at different times of day using a variety of sampling equipment. Sampling was undertaken in inner embayments close to stream mouths and in outer bay sites away from stream mouths. Sampling was undertaken in

three main areas of Ootsa Lake: a bay off the mouth of Wells Creek; Andrews Bay; and an old lake site, five to six kilometres east of Wells Creek, submerged after reservoir impoundment.

Wells Creek Bay and areas near the submerged lake are located along the south shore of the lake and within the Canfor/CDC timber salvage Development Plan area proposed for 1996. Wells Creek Bay is characterized by a distinctive narrow inner bay and a broader outer bay. Wells Creek flows into the head of the inner bay. Wells Creek Bay was chosen as a sample location because it represented a salvage location at the mouth of a major tributary to the lake (Wells Creek) and was the location intended for initial timber salvage trials by Canfor/CDC.

Andrews Bay is located at the west end of Ootsa Lake on the north side of the lake. Andrews Bay possesses a similar inner bay configuration to Wells Creek Bay. Andrews Bay was selected as a sample location to enable comparison with data collected from inner and outer portions Wells Creek Bay.

The old lake site was chosen from maps prepared by Alcan on which the pre-inundation shoreline are superimposed on current shorelines; these maps show a distinctive lake or wetland feature within the previously forested area. This location was selected as a sample location because it represented a shoreline area similar to the outer bay of Wells Creek Bay and exhibited treed and untreed submerged areas for comparative sampling.

Priority for the 1996 field program was design of a sample program and mobilization of field personnel for collection of baseline data from Canfor/CDC proposed timber salvage locations at Wells Creek. Elements of the reservoir fish and fish habitat assessment were timed to overlap with other timber salvage impact assessments (Water Quality Impact and Stream Reconnaissance Inventory).

Biological sampling of fish communities included fish capture with gillnets, minnow traps, and a boat electroshocker, observation with underwater video, and detection with hydroacoustic/ echosounding equipment. Fish capture data were used to evaluate species composition and relative abundance in nearshore timber salvage areas, including inner embayments close to stream mouths and outer bay areas. These data were supplemented with hydroacoustic data which were used to identify relative fish densities and sizes in areas with and without trees. Biological data were analyzed to determine sex ratios, size and growth, reproductive status, condition, and diet for salmonid species. Data summaries were prepared for comparison among the main habitat areas sampled (inner and outer bays for Wells Creek Bay and Andrews Bay, and the submerged lake basin). These data are intended to provide a baseline for comparison with conditions after timber salvage in those locations. The data represent fish resource conditions for the period of sampling (late summer/early fall).

The current water level in Ootsa Lake is approximately 40 m above the pre-impoundment lake shoreline. At present reservoir levels, Ootsa Lake averages 3 km in width. Temperature depth profiles at two locations on Ootsa Lake indicate that weak thermal stratification occurs during summer months and water is mixed over winter and early spring.

Results of the 1996 lake fish resource studies indicate the fish community structure in timber salvage areas of Ootsa Lake is typical of nearshore areas of large lakes in British Columbia. Data collected in 1996 do not suggest the current fish community is influenced by the presence of submerged trees. However, the 1996 studies were conducted during a single season (late summer/early fall) and likely do not represent conditions at other times of the year. In general, fish in nearshore timber areas were captured with sampling gear and detected with echosounding equipment in greater abundance at night. All salmonids found in the lake (rainbow trout, kokanee, and mountain whitefish) were captured in small inner embayments near stream mouths and in deeper outer bay areas. In these areas, rainbow nighttime abundance was slightly higher than daytime abundance. Spatial differences in rainbow relative abundance that would indicate association with habitat features were not evident. Kokanee were mainly absent during the day, but at night represented a high proportion of fish caught in outer bay areas (up to 80% in some locations). Mountain whitefish relative abundance was low. Northern squawfish were captured in relatively high numbers near stream mouths at the heads of inner bays. Longnose sucker were captured in both inner and outer bays; largescale sucker were captured only in inner bays.

Hydroacoustic surveys were conducted over submerged standing timber areas not suitable for sampling with conventional capture gear. Replicate echosounding transects were made over areas having trees and areas having no trees. These data do not show a clear relation between fish density and the presence of trees. Data indicate higher fish densities in some treed areas compared to nearby untreed areas but lower comparative densities in other treed areas.

Rainbow trout found in inner embayments tended to be younger and smaller than fish in outer bay areas. Rainbow catches suggest numbers in the lake are not high in abundance. Fish scales read for aging indicated most captured fish were to 2 to 4 years of age and had two years of slow growth, suggesting several years of residence in streams before entering the lake.

Rainbow trout stomachs contained food organisms associated with both benthic/surface areas and the water column. Diet contents do not suggest rainbow were feeding to a greater or lesser extent on organisms derived from surfaces such as trees. Kokanee stomachs contained mainly food organisms associated with the water column. Whitefish were feeding mainly on bottom organisms.

Kokanee captured in Andrews Bay in the first week of October were in spawning condition. Males were generally captured in a higher proportion than females (60% males and 40% females). Few mountain whitefish were captured during the surveys, but these were mainly larger specimens approaching spawning condition. These fish were captured in late September and early October suggesting spawning might commence as early as mid- to late October.

Data collected thus far do not suggest tree removal will reduce population sizes of species observed. Similarly, the data do not indicate remnant stumps on the lake bottom will have an influence on community structure or population sizes of important recreational species.

Most operational activities are not expected to produce noises having frequencies and pressures causing long term disturbance, partly because these noise parameters are expected to fall in acceptable mid-ranges for most activities and partly because fish are expected to habituate to noises of these types. Noises that have potential to cause disturbance are those that are characterized by irregular rapid increases. At this stage it is not known whether salvage operations will produce such noises.

Small oil slicks were observed around test salvage operations during aerial surveys and observations of shoreline salvage. Oil slicks would be a concern during large scale salvage on open water and even on a small scale in confined embayments and near stream mouths.

Stream surveys conducted in 1996 indicate most streams flowing into Ootsa Lake have potential spawning and rearing areas accessible to fish from the lake. Rainbow trout were captured in lower reaches of all but two streams sampled. Kokanee were observed spawning in Andrews Creek in mid-September (these were observed upstream from a lake on Andrews Creek and might originate from that lake and not Ootsa Lake). Among streams surveyed a subjective appraisal of habitat quality and lengths of stream potentially accessible to fish from the reservoir suggests the main streams important as contributors to reservoir fish populations are:

- Andrews Creek (180-8529);
- Unnamed Creek, alias Ukrainian Creek (180-8416);
- Wells Creek (180-7927);
- McIvor Creek (180-8174);
- Unnamed Creek, north of Andrews Creek (180-8526); and
- Unnamed Creek, south of Andrews Creek (180-8532).

Six other streams were found to contain salmonids in reaches accessible to fish from the lake and all would likely contribute to lake production though possibly on a smaller scale than streams listed above.

Most streams clearly support populations of rainbow trout and likely contribute to rainbow trout production in Nechako Reservoir. The time of spawning has not been identified for rainbow trout but typically rainbow trout migrate to spawning areas over spring and early summer. Local residents indicated adults begin moving into stream mouth areas in late April and early May with spawning occurring mainly over the months of May and June.

Kokanee were observed spawning in Andrews Creek in mid-September but it is not known whether these fish originated from lakes within the Andrews Creek watershed (the kokanee were observed upstream of Fish Lake) or from the Nechako Reservoir. Kokanee in spawning condition were collected from Ootsa Lake near shore areas in the first week in October. This suggests spawning likely occurs over the general mid-September to mid-October period. Other salmonids (e.g., mountain whitefish) were not captured or observed in streams but likely utilize some streams given their known presence in Ootsa Lake.

General fish protection timing windows have been developed for different parts of the province to reduce risks to fish species in sensitive locations. Timing windows that apply to the Nechako Reservoir area for key species found in the reservoir are:

Species	Timing Window
Rainbow trout	July 15 - April 15
Kokanee	June 01 - August 31
Mountain whitefish	June 01 - September 15

In order to accommodate all three species this would mean a timing window of July 15 to August 31 in which timber salvage activity could take place with minimum risk to salmonids. A preliminary recommendation is application of this window to all stream mouths suspected of containing salmonids.

The absence of fall spawning species (kokanee and mountain whitefish) in stream samples but known to occupy Ootsa Lake (based on lake sampling), might reflect time and/or location of sampling. For example, spawning might take place by these species in submerged portions of stream mouths (lake water levels were high at the time of the field investigations and potential spawning habitat was inundated and not visible) or other shoreline areas. A conservative approach at this stage is to assume streams in which rainbow were found in accessible reaches also contain fall spawning salmonids.

In the lake, data show fish generally tend to rise in the water column and move into shallower areas at the onset of dusk. A further suggestion with respect to timing is not to conduct harvesting activity from sunset until one hour after sunrise. This would apply at all times of the year that harvesting takes place.

Inner embayments such as those at Andrews Bay and Wells Creek are steep, narrow portions of flooded stream channels. These will be passage ways during spawning migrations and should be included in application of the above operational windows.

The 1997 field program is intended to take place in early summer with repeat sampling at the main sites sampled in the fall 1996. Refinements to sample collection for 1997 are outlined.

1.0 INTRODUCTION

Hatfield Consultants Ltd. (HCL) has been contracted by the Ministry of Environment, Lands and Parks, Smithers, British Columbia (MOELP) to undertake studies to identify potential impacts of proposed harvesting of submerged timber on fish resources in the Nechako Reservoir. HCL has undertaken these studies in collaboration with BC Research Inc. (BCRI), who were contracted separately (with Limnotek Research and Development Inc.) to monitor impacts on sediment, water quality, and benthic communities.

The Nechako Reservoir, created in 1954 by construction of the Kenney Dam, supplies water to the Aluminum Company of Canada (Alcan) power generating station at Kemano. The reservoir flooded approximately 50,000 ha of land which held several million cubic metres of Crown timber. A small amount of timber has since been harvested: Alcan has removed 5,000 to 10,000 m^3 to provide safe navigation for recreational boaters in high traffic areas; commercial salvage was also initiated on a small scale in the late 1960s (Bond Brothers), though it was discontinued after several years.

In 1996, the Ministry of Forests (MOF) issued two ten-year licences for large-scale timber removal (3 to 3.5 million m^3 for each licence). One licence was issued to a joint venture between Canadian Forest Products Ltd. and the Cheslatta Development Corporation (Canfor/CDC) for salvage of timber from the portion of the reservoir lying within the MOF Lakes Timber Supply Area. The second was issued to the Cheslatta Carrier Nation Resource Corporation (a joint venture between the Cheslatta Carrier Nation and Fibrecon Management Ltd. [CCNRC]) for salvage of timber from the portion of the reservoir lying within the MOF Morice Timber Supply Area. Timber salvage methods to be used by the licencees and potential environmental effects are not certain. Interim Development Plans were prepared during the latter part of 1996 to enable licencees to experiment with harvesting techniques on a small scale and to initiate collection of environmental data related to these operations.

The goal of the fisheries resource studies is to determine effects of submerged and floating timber salvage on sensitive fish populations in the Nechako Reservoir and to develop recommendations for protecting fish resources at sensitive locations and times. Study objectives are:

- to determine diurnal and seasonal changes in fish use of or association with submerged timber;
- to assess the sensitivity of various fish species found in the reservoir to the impacts of timber salvage activities;
- to identify sensitive fish habitats within the reservoir;
- to provide recommendations on "in-lake" operational/harvesting windows; and
- to provide recommendations for future study.

Studies conducted in 1996 are intended to be the first of a multi-year assessment program. The 1996 fisheries studies were undertaken in September and October and comprised intensive studies of fish and fish habitat in Ootsa Lake and reconnaissance level surveys of tributary streams. This report presents the results of the lake fish and fish habitat studies. Results of the reconnaissance stream surveys are presented separately in a series of individual stream reports (Hatfield Consultants Ltd. 1997).

The 1996 lake studies involved sampling in different types of nearshore habitat at different times of day using a variety of sampling equipment. Sampling was undertaken in inner embayments close to stream mouths and in outer bay sites away from stream mouths. In addition to data collection on the ground, habitat data was recorded during aerial surveys along the reservoir shoreline.

2.0 STUDY AREA AND METHODS

2.1 STUDY AREA

The Nechako Reservoir fish and fish habitat study area is shown in Figure 2.1.1. Fish sampling activities for the 1996 data collection program were conducted at sites in Ootsa Lake.

2.1.1 Overview of Nechako Reservoir

The Nechako Reservoir was formed in 1954 by damming the Nechako River in Nechako Canyon and flooding the Eutsuk/Tahtsa drainage basins. Kenney Dam is a rockfill dam with a maximum height of 95 m and a top length of 450 m; no water is released from this structure. The entire Nechako Reservoir has a surface area of approximately 1,200 km^2 and a useful storage capacity of 7,100 million m^3. Water exits the reservoir at two locations: the Kemano penstock, located at the west end of Tahtsa Lake; and the Skins Lake spillway, located at the east end of Ootsa Lake.

The Tahtsa drainage basin extends from Tahtsa Lake, located east of the town of Kemano, to Ootsa Lake (approximately 60 km long prior to flooding), flowing east. The Eutsuk drainage basin lies south of the Tahtsa Lake/Ootsa Lake basin and consists of Eutsuk and Tetachuck lakes. Flow from this system joins the Tahtsa basin flows to form the Nechako River, flowing north and east towards Prince George. The Kenney Dam impounds water at 40.8 m above the original level of Ootsa Lake, thereby connecting the two drainage basins into one reservoir.

2.1.2 General Features of Ootsa Lake

At present reservoir levels, Ootsa Lake averages 3 km in width. At the main historic river inflow location at the western end of the lake, a depth profile indicates the impoundment of 40 m of water over a relatively flat flood plain (Transect #5; Figure 2.1.2). Approximately two thirds of the way down the lake to the east, the depth profile (Transect #6) indicates a maximum depth of approximately 100 m at the present reservoir height.

The Skins Lake spillway is located on the northeastern side of the lake and can be opened to release water from the reservoir into the Murray/Cheslatta system to the north. This drainage basin flows into the Nechako River downstream of Kenney Dam. The spillway releases flows for fisheries purposes as well as excess water inflows for flood control as necessary. Since 1987, flow releases for fisheries have been made under provisions of the Settlement Agreement between Alcan and the federal and provincial governments, regarding water resource management in the Nechako River. The maximum release of water allowed by the Water Comptroller is 283 m^3/s.

INSERT FIGURE 2.1.1

Figure 2.1.2 Ootsa Lake pre- and post-impoundment area.

Source: Triton Environmental Consultants Ltd. 1993.

Temperature depth profiles at two locations on Ootsa Lake indicate that thermal stratification occurs during summer months and mixing occurs during the winter and early spring.

The Ootsa Lake watershed lies within the Fraser Plateau Ecoregion of the Central Interior Ecoprovince. Within this ecoregion, the north shore of the lake lies within the Bulkley Basin Ecosection; uplands on the south shore west of McIvor Creek lie within the Nechako Plateau Ecosection.

The north side of Ootsa Lake and much of the south side fall within the Sub-boreal Spruce (SBS) Biogeoclimatic Zone. The north side of the lake falls primarily within the Dry Cool Sub-zone of the SBS while lower elevations on the south side fall within the Moist Cold Sub-zone of the SBS. Mature forests within the study area are dominated by hybrid white spruce (*Picea engelmannii* x *glauca*) and subalpine fir (*Abies lasiocarpa*); lodgepole pine (*Pinus contorta*) and trembling aspen (*Populus tremuloides*) occur as seral species. Higher elevations on the south side of Ootsa Lake lie within the Engelmann Spruce - Subalpine Fir Biogeoclimatic Zone (ESSF).

2.1.3 Fish Sample Sites

Fish sample sites for 1996 data collection are shown in Figure 2.2.1. Sampling was undertaken in three main areas:

- a bay off the mouth of Wells Creek;
- Andrews Bay; and
- an old lake site, 5 to 6 km east of Wells Creek, submerged after reservoir impoundment.

2.1.3.1 Wells Creek Bay

Wells Creek Bay and areas near the submerged lake are located along the south shore of Ootsa Lake and within the Canfor/CDC timber salvage Development Plan area proposed for 1996. Wells Creek Bay is characterized by a distinctive narrow inner bay and a broader outer bay. Wells Creek flows into the head of the inner bay (Figure 2.2.1). Wells Creek Bay was chosen as a sample location because it represented a salvage location at the mouth of a major tributary to the lake (Wells Creek) and was the location intended for initial timber salvage trials by Canfor/CDC. Data were collected from sites in both the inner and outer bays. Most standing timber in the inner bay was cut several metres below the surface and removed by Alcan, together with floating timer, in 1991. Snags exist along the margin of the inner bay; stumps and snags can be seen below the water surface around the bay and are evident during depth sounding. The outer bay contains emergent standing timber along its margin; depth sounding indicates the presence of submerged standing timber, submerged stream channels, and flat areas without trees (possibly former meadows or swamps). Some standing timber was previously removed from the

INSERT FIGURE 2.2.1

outer bay to improve boat passage. Wells Creek was included in 1996 stream reconnaissance surveys conducted at the same time as the lake studies.

Fish sampling took place at the head of the inner bay, close to the mouth of Wells Creek, at a mid-point along the inner bay and in the outer bay. Fish were captured at inner bay locations using floating gillnets and boat electroshocking. In addition, remotely operated underwater video was used to examine habitat conditions and presence of fish near the mouth of Wells Creek. Fish were captured in the outer bay using floating and sinking gillnets. The outer bay was also one of three areas surveyed with hydroacoustic equipment (Section 4.2).

2.1.3.2 Andrews Bay

Andrews Bay is located at the west end of Ootsa Lake on the north side of the lake. Andrews Bay possesses a similar inner bay configuration to Wells Creek Bay (Figure 2.2.1). Andrews Bay was selected as a sample location to enable comparison with data collected from inner and outer portions of Wells Creek Bay. Andrews Creek and two nearby streams flowing into Andrews Bay were included in 1996 stream reconnaissance surveys. Andrews inner bay contains standing and floating timber; a large amount of floating timber occurs near the head of the bay and blocks boat passage to the mouth of Andrews Creek. The outer bay contains emergent standing timber, mainly in pockets along the south shore of the bay; submerged standing timber is evident in much of the bay when utilizing echosounding techniques. Timber was extracted from portions of the bay in the mid-1980s and early 1990s.

Fish sampling took place in Andrews Bay inner bay close to the head of the inner bay and at a mid-point along the length of the inner bay. Fish were collected at the head of the inner bay with floating gillnets, minnow traps, and boat electroshocker; fish were collected from the mid portion of the inner bay with floating gill nets and boat electroshocker. A remotely operated underwater video camera was used to record fish presence at both locations. Fish were collected from the outer bay location using floating and sinking gill nets.

2.1.3.3 Submerged Lake Basin

The old lake site was chosen from maps prepared by Alcan on which the pre-inundation shoreline was superimposed on current shorelines; these maps show a distinctive lake or wetland feature within the previously forested area. This location was selected as a sample location because it represented a shoreline area similar to the outer bay of Wells Creek Bay and exhibited treed and untreed submerged areas for comparative sampling. Fish were captured with floating and sinking gillnets in the submerged lake basin.

2.2 STUDY METHODS

The following activities were undertaken for the 1996 fish resource studies:

- review of previous fisheries investigations on the Nechako Reservoir;
- design and implementation of a fish sampling program;
- interviews of individuals familiar with local sport and First Nations fishing activity; and
- an aerial video survey of nearshore habitat.

Priority for the 1996 field program was the design of a sample program and mobilization of field personnel for collection of baseline data from Canfor/CDC proposed timber salvage locations at Wells Creek. Elements of the reservoir fish and fish habitat assessment were timed to overlap with other timber salvage impact assessments (Water Quality Impact Assessment and Stream Reconnaissance Inventories).

Biological sampling of fish communities included fish capture with gillnets, minnow traps, and a boat electroshocker, observation with underwater video, and detection with hydroacoustic/ echosounding equipment. Sampling was undertaken from September 14 to October 5, 1996. Field survey procedures followed those prescribed in *RIC 1995 Draft Lake and Stream Inventory Standards and Procedures*. Emphasis was placed on preliminary review of data and air photos for sample site selection and mobilization for data collection over late summer/early fall. Data collection included an aerial photo reconnaissance of habitat features along the reservoir shoreline. A video record was made using protocols outlined in *RIC 1996 Draft, A Guide to Photodocumentation*, and *RIC 1996 Draft Aerial Photography and Videography Standards for Fish and Fish Habitat Channel Assessment*. Habitat features and other data will be digitally mapped as the study progresses over 1997/1998. A glossary of common and scientific names of species captured during the current study and referred to in previous investigations is presented in Table 2.1.1.

2.2.1 Fish Capture

Fish were captured using floating and sinking gillnets, boat electroshocker, and minnow traps. In the inner bays of both Wells Creek Bay and Andrews Bay, fish were captured using floating gillnets situated at two separate sites and with boat electroshocking. Minnow traps were also used in the inner bay of Andrews Bay. In outer bay locations and at the submerged lake basin, fish were captured with floating and sinking gillnets. Gillnet sets in the outer bay of Wells Creek Bay and the submerged lake basin were within two areas examined with fish echosounding equipment (Section 2.2.2). Fish sampling was undertaken during day and night at the same sample sites selected for all sampling equipment. Two work boats were used for fish capture: a 6.4 m Gregor aluminum jetboat, rigged for electroshocking, and a 5.5 m fiberglass runabout.

2.2.1.1 Gillnet Capture

Standard six-panel experimental monofilament floating gillnets were used. These gillnets consisted of six 15.2 m long by 2.4 m deep panels, with panel mesh sizes arranged in the following sequence: 25 mm, 76 mm, 51 mm, 89 mm, 38 mm, and 64 mm. Each gillnet contained small floats along the top to maintain buoyancy and a lead line to keep the net stretched through the water column. Airphotos were used to aid identification of gaps among standing trees in inner bays where the risk of nets snagging on trees was considered low. Only floating nets were used at these locations as submerged snags were evident during depth sounding and bottom conditions were uncertain. For outer bay locations, airphotos and large open areas identified during echosounding were used to identify sample locations for floating and sunken nets.

Table 2.1.1 Glossary of common and scientific names of species identified during current or previous investigations.

Common Name	Scientific Name	MOELP/DFO Species Code
Kokanee	*Oncorhynchus nerka*	KO
Rainbow trout (Kamloops trout)	*O. mykiss*	RB
Mountain whitefish (Rocky Mountain whitefish)	*Prosopium williamsoni*	MW
Burbot (Ling)	*Lota lota*	BB
Lake chub	*Couesius plumbeus*	LKC
Northern squawfish	*Ptychocheilus oregonensis*	NSC
Peamouth chub	*Mylocheilus caurinus*	PCC
Largescale sucker (Coarsescale sucker)	*Catostomus macrocheilus*	CSU
Longnose sucker (Fine-scaled sucker)	*C. catostomus*	LSU
Prickly sculpin	*Cottus asper*	CAS
Slimy sculpin	*C. cognatus*	CCG

Gillnets were deployed from large tubs placed at the bow of the workboats. For floating gillnets, the end of the first gillnet panel was attached to a tree or float (as site conditions warranted); the gillnet was slowly fed out of the tub with the boat operating in reverse. At the end of the net set, an anchor was attached using a rope length corresponding to the depth of the water column at that location. For sunken nets, anchors were attached to both ends of the net using short ropes; appropriate rope lengths were used to connect the ends of nets to surface floats. In order to avoid possible snags, anchor ropes and surface lines were adjusted to set nets several metres above the bottom of the reservoir. Even with this precaution, bottom snags caused small tears in several panels of submerged nets.

Retrieval of the nets was initiated from the downwind end with two personnel on the bow of the boat. Each crew member pulled in either the float or lead line and the net was placed back into its tub. Fish were carefully removed to minimize damage to the fish and gillnet, and placed into a large bucket appropriately labeled for later identification and measurement.

Setting gillnets for day capture consisted of deploying the net as close to sunrise as weather conditions and site logistics allowed, and retrieving close to dusk. Similarly, setting gillnets for night capture consisted of deploying the net around dusk and retrieving it around sunrise.

Gillnet set and retrieval time was recorded as well as the start and end UTM coordinates. UTM coordinates were collected using a Garmin 45 GPS unit.

2.2.1.2 Minnow Trapping

Day and night minnow trap sets were used to capture fish at sample sites in the inner bay of Andrews Bay. Gee-trap type minnow traps (approximately 40 cm in length and 23 cm in diameter at the mid-point) were baited with opened cat food tins and placed on the lake bottom at each sample location. Traps were deployed from the workboat and tied onto a snag or standing tree. Set and retrieval times were recorded as well as the UTM location coordinate. Traps were retrieved and captured fish were identified and measured.

2.2.1.3 Boat Electroshocking

Fish were captured using a boat electroshocker in nearshore areas at the mouths of Wells and Andrews creeks. Electroshocking equipment was comprised of a 6.4 m Gregor aluminum jetboat fitted with extendible bow electrodes and a Coffelt model VV-15 boat-mounted electroshocker unit. The electroshocker was powered by a 5,000 watt Honda generator producing 600 volts and 0.25 to 0.5 amperes. Output voltage was kept to a maximum due to the minimal conductivity and range of depths electroshocked. Electroshocking was undertaken during the day and after sundown. The boat was equipped with bow-mounted lighting for night electroshocking. Personnel on the bow of the boat used long dipnets to retrieve electroshocked fish. Fish were placed temporarily in a bucket until they could be identified, measured, and later released. Electroshocking locations were recorded using the GPS and transferred to a 1:50,000 NTS map.

2.2.1.4 Biological Measurements

All captured fish were identified and measured for fork or total length, according to species tail configuration. Live specimens captured in minnow traps or with electroshocking equipment were sedated briefly with Alka Seltzer to enable measurement, allowed to recover from sedation, and released. Fish captured in gill nets were placed in plastic bags for later identification and measurement on shore. For salmonids (rainbow trout, kokanee, and mountain whitefish), weights were measured, sex and maturity recorded, external and internal condition noted, and gonads and livers weighed. Maturity ratings were based on a six stage scale of 1 (immature), 2 (maturing), 3 (mature), 4 (spawning), 5 (spent), and 6 (resting) (RIC 1995). Stomachs and scales were removed from some specimens for later analysis. Tissue samples for DNA analysis were collected from a small number of rainbow trout. For other species, weights were recorded and stomachs and aging structures removed from some specimens (northern squawfish). Small numbers of specimens of most species were retained and preserved in buffered formalin as voucher specimens for future reference.

2.2.2 Fish Echosounding/Hydroacoustics

Hydroacoustic data were collected along transects in three areas on the south shore in the vicinity of Wells Creek Bay (Figure 2.2.1; Section 4.2): the outer bay of Wells Creek Bay, the submerged lake basin, and a third area north of Wells Creek and situated over the shoreline of the lake before impoundment (offshore site). Data were collected using BioSonics dual beam digital echosounding equipment mounted to a 5.5 m fiberglass runabout. Transects were conducted during the day and at night. Digital information from the transducer was stored on a laptop computer. A Garmin 45 GPS unit was connected directly to the laptop computer to give precise real-time location coordinates. The transducer was mounted to a hinged plate to allow positioning for both down scanning and side scanning. Most transects were run using downscanning; however, several in each of the three transect areas were run using sidescanning to identify fish presence in the near surface layer of the water column. Parallel transects were run approximately 100 m apart over the desired area. All hydroacoustic data was backed up on floppy disks once the transect was completed. Data were later analyzed using BioSonics DT Analyzer software; analytical methods are described in Appendix A1.

Echosounding traces indicated all areas contained large sections covered by submerged trees and sections having no submerged trees. Four to six downscan echosounding transects were run across each area; one to four sidescans were also conducted. During data analysis, fish counts were made separately for treed and untreed portions of transects. Estimates were made of fish densities and hydroacoustic target sizes for comparison among areas and depth strata.

2.2.3 Underwater Video

A Seamor remotely operated vehicle (ROV) underwater video was used to observe fish to detect fish presence at test locations in the inner bays of Wells Creek Bay and Andrews Bay. The Seamor ROV underwater video camera was connected to a 35 cm monitor and a VHS recorder on the electroshocker boat. A 5,000 watt Honda generator normally used for electroshocking was used to power the electronic equipment. The ROV was connected to the surface by an electronic cable and controlled using a joy-stick which enabled side-to-side and diving movements while viewing direction on the surface monitor. Also, the camera can be swiveled vertically to allow viewing from a forward direction to directly downward.

Trials were made to guide the ROV into the mouths of streams in Wells Creek Bay and Andrews Bay to observe fish during daylight and darkness. The ROV was also used among timber and snags; however, potential for entanglement of the electronic cable was deemed high given poor distance visibility and limited camera width of view, so use as a mobile unit was discontinued. Trials were made placing the ROV in a stationary position on the lake bottom. A 1 m long arm was fitted to the ROV with bait (canned cat food) on the end. The bait container was positioned in the centre of the camera field of view to observe attracted fish. The camera was left on the bottom and video records made for intervals of 20 minutes to one hour. Several fish were recorded with this method, though few relative to the observation time period; risks associated with equipment loss were low. Video tapes were later reviewed to identify recorded fish.

2.2.4 Interviews With First Nations and Recreational Fishing Interests

Interviews were held with the Chief of the Cheslatta Carrier Nation, local fishing/hunting guides, and local residents to identify important traditional and recreational fish species, fishing locations, known or suspected spawning streams and times, and other local fisheries knowledge. Chief M. Charlie of the Cheslatta Carrier Nation provided information on important traditional species, historical fisheries use and knowledge before reservoir impoundment, and current fishing activities. Local residents and guides provided information on seasonal recreational fishing locations, fishing depths, types of food observed in fish stomachs, spawn timing, and important spawning streams.

2.2.5 Aerial Video

Aerial video records were made of the Nechako Reservoir shoreline for later examination of nearshore habitat features. These surveys were conducted on September 20 and October 28, 1996; the latter survey was timed to coincide with test removal activities of one timber salvage operator (CCNRC/Fibrecon) (these activities were included in the aerial video tapes). The entire reservoir was circumnavigated in the two sessions. A Canon 8 mm camera was used for video recording. The video tape was annotated during the flight with positioning information. This tape will be used to aid habitat mapping as the study progresses. Information extracted from the video tape includes areas of shoreline erosion, submerged timber areas, and areas of large floating log debris buildup (especially near stream mouths). Aircraft used during aerial recording were a Cessna 185 with floats for the first session (most of Ootsa Lake, Whitesail Reach, and Tahtsa Reach) and a de Havilland Beaver equipped with floats for the remainder.

2.2.6 Data Analysis and Interpretation

Fish capture data were used to evaluate species composition and relative abundance in nearshore timber salvage areas, including inner embayments close to stream mouths and outer bay areas. Data collected during daytime were compared to data collected at night for each gear type at each capture location. Percent species composition and species catch per unit effort (CPUE) were calculated for fish caught by each gear type to enable relative comparisons among catch locations. Fish capture data were supplemented with hydroacoustic data used to identify relative fish densities and sizes in areas with and without trees.

Biological data were analyzed to determine sex ratios, size, and growth (mean length, mean weight, mean age of each sex, length and weight at age, length-weight relation), maturity/reproductive status (state of maturation and gonad development, mean age of each maturity stage, gonad weight and gonadosomatic index), condition (condition factor and hepatosomatic index), and diet for salmonid species. Gonadosomatic and hepatosomatic indices, expressed as organ weight as a percentage of body weight (Nikolsky 1963, Nielson and Johnson 1983), were calculated for salmonid species and Fulton's condition factors, equal to w/l^3 (Ricker 1975, p. 209) were calculated for all species. Stomach contents were weighed before and after content removal, examined for relative percent fullness, and then subject to counts of individual food items to enable calculation of average numeric indices for comparisons among fish sizes and capture areas. Numeric methods provide a rapid method to identify relative contribution to diet but do not account for food item size, which normally requires volumetric or gravimetric methods (Hyslop 1980), and must be interpreted with caution. For example, a single large item may be equal in weight or dimension to many small food organisms. Species biological data were compared among the main habitat areas sampled (inner and outer bays for both Wells Creek Bay and Andrews Bay, and the submerged lake basin). These data are intended to provide baseline for comparison with conditions after timber salvage in those locations. The data represent fish resource conditions for the period of sampling (late summer/early fall).

The data were used as the basis of a preliminary assessment of timber salvage effects on fish resources in the reservoir, for development of fish protection recommendations, and for recommendations to guide future studies.

3.0 SUMMARY OF PREVIOUS FISHERIES INVESTIGATIONS ON NECHAKO RESERVOIR

Previous fisheries investigations on the Nechako Reservoir are summarized in this section. These investigations are:

- The effects on sport fisheries of the Aluminum Company of Canada Limited Development in the Nechako Drainage (Lyons and Larkin 1952);
- Fish diseases and parasites associated with the proposed Kemano Completion Hydroelectric Development (Envirocon Limited 1984);
- Nechako Reservoir fish fauna studies: sampling at Kenney Dam (Triton Environmental Consultants 1989a);
- Nechako Reservoir fish fauna studies: Tahtsa Narrows and adjacent tributaries (Triton Environmental Consultants 1989b); and
- Survey of mercury levels in Nechako Reservoir, British Columbia, 1991 (Triton Environmental Consultants 1993).

The purpose, fish capture methods, and fish captured are briefly described for each study. Results of fish collection during previous surveys are summarized in Tables 3.1.1 and 3.1.2.

3.1 THE EFFECTS ON SPORT FISHERIES OF THE ALUMINUM COMPANY OF CANADA LIMITED DEVELOPMENT IN THE NECHAKO DRAINAGE

3.1.1 Purpose

This study was undertaken before creation of the Nechako Reservoir in order to evaluate effects on fish resources and recommend appropriate remedial measures (Lyons and Larkin 1952).

3.1.2 Methods

The report is based on field data collected in July 1950 and July/August 1951. Data are presented for physical, chemical, and biological features in pre-impoundment lakes and streams, including the presence of fish species.

3.1.3 Fish Reported

Fish reported to be present in lakes which would be flooded by the storage reservoir are summarized in Table 3.1.1.

Table 3.1.1 Fish present in reservoir lakes, 1950/1951, before impoundment.

Lake	Rainbow Trout	Mountain whitefish	Kokanee	Fine-scaled sucker	Coarse-scale sucker	Squawfish	Burbot	Cottids
Tahtsa	Yes	Yes						Yes
Ootsa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Natalkuz	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Eutsuk	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Tetachuk	Yes		Yes					Yes
Euchu	Yes	Yes	Yes	Yes	Yes	Yes		

Source: Lyons and Larkin (1952).

3.2 FISH DISEASES AND PARASITES ASSOCIATED WITH THE PROPOSED KEMANO COMPLETION HYDROELECTRIC DEVELOPMENT

3.2.1 Purpose

The purpose of the study was to determine distribution of parasites, pathogenic bacteria, and pathogenic viruses in the Nechako Reservoir, Nechako River, and nearby water bodies (Nanika, Kidprice, Cheslatta, Nadina, Fraser, and Stuart lakes, and Kemano River) in order to identify transfer risks associated with the Kemano Completion Project (Envirocon Limited 1984).

3.2.2 Methods

Fish specimens were collected in 1979, 1980, and 1981. Within the Nechako Reservoir, specimens were collected from:

- 1979 - Tahtsa Lake (nine sites) and behind Kenney Dam (three sites); and
- 1980 - Tahtsa Lake (five sites).

Prior to field sampling, numbers of fish specimens to be collected were identified following guidelines that specify sample sizes necessary to statistically detect pathogens. In the field, sample sizes were dictated by fish availability at each sample location. The report indicates that in 1979 fish were captured in most locations with beach seines, gill nets, minnow traps, electrofishing, and angling, although specific methods used in each Nechako Reservoir location are not specified. In 1980, fish from Tahtsa Lake were captured with gill nets and minnow traps. Fish were captured in the following seasons:

- 1979: summer (mid-July to end August) and fall (end September to end October); and
- 1980: late summer (September).

Table 3.1.2 Summary of fish collected during Nechako Reservoir post impoundment studies.

Year	Location	Sampling Period	Method[a]	RB	MW	KO	LSU	CSU	NSC	BB	PCC	CAS	CCG	Unid. Cottids	Catch Totals
1979[1]	Kenney Dam	Mid-July to end Aug	G, M, E, S, A	35 (14)	26 (10)	32 (13)	29 (12)	23 (9)	51 (20)	3 (1)	-	50 (20)	-	-	249
		End Sept to end Oct	G, M, E, S, A	76 (23)	72 (22)	55 (16)	6 (2)	18 (5)	62 (18)	10 (3)	-	35 (10)	-	-	334
	Tahtsa Lake	Mid-July to end Aug	G, M, E, S, A	40 (15)	92 (35)	59 (22)	55 (21)	-	16 (6)	2 (1)	-	-	-	-	264
		end Sept to end Oct	G, M, E, S, A	59 (33)	31 (17)	43 (24)	25 (14)	-	19 (11)	3 (2)	-	-	-	-	180
1980[2]	Tahtsa Lake	September	G, M	44 (18)	70 (29)	94 (39)	12 (5)	-	14 (6)	1 (1)	-	9 (4)	-	-	244
1989[3]	Kenney Dam	Nov 14 to 16	G	42 (33)	11 (9)	49 (39)	1 (1)	3 (2.4)	21 (17)	-	-	-	-	-	127
		Nov 14 to 16	M, E	-	-	-	-	1 (5)	6 (29)	2 (10)	1 (5)	5 (24)	6 (29)	-	21
1989[4]	Tahtsa Narrows	June 16 to 22	G, M, E, S	13 (9)	17 (12)	2 (1)	19 (14)	-	34 (24)	1 (1)	-	27 (19)	13 (9)	15 (11)	141
		Aug 23 to 25	G, M, E, S	28 (26)	4 (4)	36 (33)	4 (4)	-	17 (16)	-	-	10 (9)	9 (8)	-	108
		Oct 3 to 8	G, M, E, S	13 (5)	7 (2)	260 (89)	1 (<1)	-	8 (3)	1 (<1)	-	-	1 (<1)	-	291
1991[5]	Euchu Reach	Nov 13 to 25	G	10 (43)	5 (22)	-	-	-	8 (35)	-	-	-	-	-	23
	Intata Reach	Nov 13 to 25	G	8 (30)	8 (30)	-	-	7 (26)	4 (15)	-	-	-	-	-	27
	Natalkuz Lake	Nov 13 to 25	G	14 (100)	-	-	-	-	-	-	-	-	-	-	14
	Ootsa Lake	Nov 13 to 25	G	2 (8)	19 (79)	-	-	-	3 (13)	-	-	-	-	-	24
	Tahtsa Lake	Nov 13 to 25	G	2 (100)	-	-	-	-	-	-	-	-	-	-	2
	Tahtsa Reach	Nov 13 to 25	G	15 (100)	-	-	-	-	-	-	-	-	-	-	15
	Tetachuck Lake	Nov 13 to 25	G	10 (29)	11 (32)	-	-	3 (9)	10 (29)	-	-	-	-	-	34
	Whitesail Lake	Nov 13 to 25	G	15 (62)	9 (38)	-	-	-	-	-	-	-	-	-	24

[a] G = gillnetting; M = minnow trapping; E = electrofishing; S = seining; A=angling

RB = rainbow trout; MW = mountain w hitefish; KO = kokanee; LSU = longnose sucker; CSU = largescale sucker; NSC = northern squaw fish; BB = burbot; PCC = peamouth chub; CAS = prickly sculpin; CCG = slimy sculpin

Source: [1]Envirocon Limited (1984); [2] Envirocon Limited (1984); [3] Triton Environmental Consultants (1989a); [4] Triton Environmental Consultants (1989b); [5] Triton Environmental Consultants (1993).

3.2.3 Fish Captured

Fish collected from Nechako Reservoir locations during the study are summarized in Table 3.1.2.

3.3 NECHAKO RESERVOIR FISH FAUNA STUDIES: SAMPLING AT KENNEY DAM

3.3.1 Purpose

Fish sampling was undertaken to evaluate potential entrainment of fish in a proposed multi-purpose water release facility at Kenney Dam (Triton Environmental Consultants 1989a). Data were collected from sites in the vicinity of Kenney Dam to determine potential for fish loss and to develop design criteria to minimize losses.

3.3.2 Methods

Fish were sampled at four sites near Kenney Dam in the fall of 1989 (November 14 to 16). Specimens were collected with gillnets placed at three depths (surface, midwater, and bottom), electrofishing gear, and Gee traps. Gillnets were set for 24 hours. Gillnets were used to sample limnetic and littoral areas; electrofishing equipment and Gee traps were used to sample littoral areas.

3.3.3 Fish Captured

One hundred and forty-eight fish were captured, most with gillnets (127 fish). Total catch is summarized in Table 3.1.2.

The gillnet catch was comprised mainly of kokanee (39%) and rainbow trout (33%). The catch in littoral areas using an electroshocker and Gee traps was comprised mainly of northern squawfish (29%), slimy sculpin (29%), and prickly sculpin (24%). Data indicate all gillnet specimens except one longnose sucker were adults and all Gee trap/electrofishing specimens were juveniles.

The report suggests that relative abundance and species diversity was greatest in areas along the shore adjacent to the dam (in contrast to sample sites at the surface intake location and along the face of the dam) and fish are strongly associated with the shoreline. Total fish catches are identified for gillnet net catches at depth (Table 3.1.3); species are not identified for the catch at each depth.

Table 3.1.3 Summary of fish captured at different depths and distances from Kenney Dam, 1989.

Net Depth	Hypolimnetic Intake (150 m offshore)	Surface Intake Adjacent to Dam (15 m offshore)	Along Face of Kenney Dam (up to 50 m offshore)	500 m South of Kenney Dam (up to 50 m offshore)	Total
Surface	0	24	14	10	48
Mid-water	1	8	3	20	32
Bottom	1	13	3	30	47
Total	**2**	**45**	**20**	**60**	**127**

Source: Triton Environmental Consultants (1989a).

3.4 NECHAKO RESERVOIR FISH FAUNA STUDIES: TAHTSA NARROWS AND ADJACENT TRIBUTARIES

3.4.1 Purpose

Fish sampling was undertaken in Tahtsa Narrows to assess the potential effects of channel dredging on fish populations (Triton Environmental Consultants 1989b). The report presents results of fish sampling in Tahtsa Narrows.

3.4.2 Methods

The study was comprised of data collection from three transects located in Tahtsa Narrows and from Rhine Creek and its major tributary, Sweeney Creek, and an unnamed tributary. Data were collected in early summer (June 16 to 22), late summer (August 23 to 25), and fall (October 3 to 8), 1989. Data collected from transects were physical observations (temperatures, lake levels, and depth measurement along transects) and biological sampling (fish collection and benthic invertebrate sampling). Fish were collected with gillnets, set lines, Gee traps, and beach seines. Data collected from streams were visual observations and fish sampling using beach seines and electroshocking.

3.4.3 Fish Captured

A summary of fish captured from Tahtsa Narrows transect locations is presented in Table 3.1.2**.** Eight fish species were captured during the study. Kokanee were the most abundant species captured overall (56%), attributed mainly to the high proportion of kokanee caught in early October (90%). Northern squawfish was the second most abundant species (11%), with greatest seasonal abundance in early summer (24%). Rainbow trout was the third most abundant species (10%), with greatest seasonal abundance in late summer (26%). Species abundance in different sample locations was as follows:

- in early summer, the most abundant species captured in the western portion of Tahtsa Narrows was prickly sculpin, and in the eastern portion, northern squawfish;
- in late summer, the most abundant species captured in the western portion of Tahtsa Narrows was rainbow trout, and in the eastern portion, kokanee; and
- in fall, the most abundant species captured in both the western and eastern portions of Tahtsa Narrows was kokanee.

Four species of fish were captured in Rhine Creek and its tributaries: rainbow trout, mountain whitefish, kokanee, and prickly sculpin. The report identifies an impassable barrier (15 m) to upstream migration on Sweeney Creek 2 km downstream from Sweeney Lake. In early summer the only location where fish were captured was the Rhine Creek delta. In late summer, three species were captured in the Rhine Creek delta (rainbow trout, mountain whitefish, and prickly sculpin); one species (rainbow trout) was captured above the lower 50 to 100 m reach. In fall, five species were captured in the stream system: rainbow trout, kokanee, mountain whitefish, longnose sucker, and prickly sculpin. Kokanee were observed in large numbers from the delta to the upper reach surveyed; juvenile rainbow trout were found throughout the survey area.

3.5 SURVEY OF MERCURY LEVELS IN NECHAKO RESERVOIR, BRITISH COLUMBIA, 1991

3.5.1 Purpose

Fish were collected as part of a study to identify mercury concentrations in fish, water, and sediment from the Nechako Reservoir (Triton Environmental Consultants 1993). Elevated mercury has been identified in numerous reservoirs for periods of five to ten years after impoundment. This study was undertaken to determine the status of mercury levels within the Nechako Reservoir.

3.5.2 Methods

Fish specimens were collected from eight sites in the Nechako Reservoir and two control lakes (Anzus Lake and Sweeney Lake) in November, 1991. Nechako Reservoir specimens were collected from Euchu Reach, Intata Reach, Natalkuz Lake, Ootsa Lake (near mouth of Wells Creek), Tahtsa Lake, Tahtsa Reach, Tetachuk Lake, and Whitesail Reach. Fish were collected using gillnets.

3.5.3 Fish Captured

Fish catches presented in the report are summarized in Table 3.1.2. Four species are reported in the results: rainbow trout, mountain whitefish, largescale sucker, and northern squawfish.

3.6 SUMMARY

Fish were captured in Nechako Reservoir lakes during fisheries surveys before and after impoundment. Fish capture locations after impoundment varied according to study objectives; some studies (fish parasite/disease and mercury contamination surveys) involved fish capture at numerous sites throughout the reservoir while others involved capture at several geographically small areas based on site-specific objectives (dredging in Tahtsa Narrows and entrainment at Kenney Dam). Sample methods and collection seasons also have varied among studies so results are not directly comparable. In general, data indicate kokanee, rainbow trout, and mountain whitefish represent high proportions of the catch during the mid-summer to fall seasons at some locations. The percentage of kokanee in the catch was sometimes very high (90% in Tahtsa Reach in fall).

4.0 RESULTS OF 1996 FIELD STUDIES

4.1 FISH CAPTURE

4.1.1 Wells Creek Bay

4.1.1.1 Gillnets

Species composition of gillnet catches in the inner and outer bays of Wells Creek Bay are summarized in Table 4.1.1. Catch per unit effort data (CPUE) are summarized in Table 4.1.2.

Species Composition

Inner Bay

Northern squawfish were the most abundant species captured at both sites in the inner bay during night sets (73% at Site 1, 56% at Site 2). Kokanee were the second most abundant species at these sites (18% at Site 1, 33% at Site 2).

Few specimens were captured during day sets compared to night sets. Rainbow trout were the only species captured at the two inner bay locations during day sets. Shannon-Wiener Function values are shown in Table 4.1.3. These data indicate greater species diversity in the night gill net catches compared to day catches.

Outer Bay

Kokanee were the most abundant species captured in the night floating gill net set at the outer bay location (50%); rainbow trout were the second most abundant species (40%). Data illustrate:

- a progressive increase in kokanee percent occurrence in the floating gillnet night catch from the innermost capture site (Site 1 in the inner bay) to the outer bay site; and
- a progressive decrease in northern squawfish occurrence in the floating gillnet catch from the innermost capture site to the outer bay site.

Northern squawfish were the most abundant species (33%) in the sinking gillnet night catch at the outer bay site. Mountain whitefish were the second most abundant species (27%) at this location.

Rainbow trout and kokanee were the only species captured in the floating gill net day set at the outer bay site. Northern squawfish was the most abundant species (50%) captured in the sinking gill net day set at the outer bay site; longnose sucker was the second most abundant species captured at this site. Mountain whitefish and burbot also were captured.

Table 4.1.1 Species composition of gillnet catches at Wells Creek Bay, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	No. of Fish Captured[1]							Total Catch
				RB	KO	MW	NSC	LSU	CSU	BB	
Inner Bay 1	Day	Float	28-Sep	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2
Inner Bay 2	Day	Float	28-Sep	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7
Outer Bay	Day	Float	30-Sep	1 (33)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3
Outer Bay	Day	Sink	1-Oct	0 (0)	0 (0)	1 (13)	4 (50)	2 (25)	0 (0)	1 (13)	8
Inner Bay 1	Night	Float	28/29-Sep	8 (10)	14 (18)	0 (0)	58 (73)	0 (0)	0 (0)	0 (0)	80
Inner Bay 2	Night	Float	28/29-Sep	5 (10)	17 (33)	0 (0)	29 (56)	1 (2)	0 (0)	0 (0)	52
Outer Bay	Night	Float	29/30-Sep	8 (40)	10 (50)	0 (0)	2 (10)	0 (0)	0 (0)	0 (0)	20
Outer Bay	Night	Sink	30-Sep/1-Oct	1 (7)	3 (20)	4 (27)	5 (33)	2 (13)	0 (0)	0 (0)	15

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

[1] Percent composition represented in parentheses.

Table 4.1.2 Catch per unit effort of gillnet catches at Wells Creek Bay, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	Time			Catch Per Unit Effort (no. fish/hour)							
				Start	Stop	Duration	RB	KO	MW	NSC	LSU	CSU	BB	All Species
Inner Bay 1	Day	Float	28-Sep	9:05	18:20	9.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Inner Bay 2	Day	Float	28-Sep	9:30	18:45	9.25	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Outer Bay	Day	Float	30-Sep	10:25	18:45	7.75	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.4
Outer Bay	Day	Sink	1-Oct	9:30	19:00	9.5	0.0	0.0	0.1	0.4	0.2	0.0	0.1	0.8
Inner Bay 1	Night	Float	28/29-Sep	18:25	9:30	15	0.5	0.9	0.0	3.9	0.0	0.0	0.0	5.3
Inner Bay 2	Night	Float	28/29-Sep	19:00	10:20	15.25	0.3	1.1	0.0	1.9	0.1	0.0	0.0	3.4
Outer Bay	Night	Float	29/30-Sep	19:05	10:00	15	0.5	0.7	0.0	0.1	0.0	0.0	0.0	1.3
Outer Bay	Night	Sink	30-Sep/1-Oct	19:00	8:50	13.75	0.1	0.2	0.3	0.4	0.1	0.0	0.0	1.1

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

Table 4.1.3 Species proportions and Shannon - Wiener Function for communities sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Species Proportions							Shannon-Wiener Value
				RB	KO	MW	NSC	CSU	LSU	BB	
Wells Creek Bay	Inner Bay 1	Gillnet	Day	1.000							***0.00***
			Night	0.100	0.175		0.725				***1.11***
	Inner Bay 2	Gillnet	Day	1.000							***0.00***
			Night	0.096	0.327		0.558	0.019			***1.43***
	Outer Bay	Gillnet - floating	Day	0.333	0.667						***0.92***
			Night	0.400	0.500		0.100				***1.36***
		Gillnet - sinking	Day			0.143	0.429		0.286	0.143	***1.84***
			Night	0.067	0.200	0.267	0.333		0.133		***2.15***
Submerged Lake Basin		Gillnet - floating	Day	1.000							***0.00***
			Night	0.209	0.535		0.256				***1.46***
		Gillnet - sinking	Day	1.000							***0.00***
			Night		0.300		0.500		0.200		***1.49***
Andrews Bay	Inner Bay 1	Gillnet	Day	0.167			0.667	0.056	0.111		***1.40***
			Night	0.043		0.011	0.908	0.027	0.011		***0.60***
	Inner Bay 2	Gillnet	Day	1.000							***0.00***
			Night	0.111	0.667		0.185		0.037		***1.37***
	Outer Bay	Gillnet - floating	Day	1.000							***0.00***
			Night	0.200	0.771		0.029				***0.90***
		Gillnet - sinking	Day	0.375	0.625						***0.95***
			Night		0.968	0.032					***0.21***

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

Shannon-Wiener Function values (Table 4.1.3) suggest species diversity is greatest in sunken gill net catches, especially at night.

Catch per Unit Effort

Catch per unit effort (CPUE) data for Wells Creek Bay are summarized in Table 4.1.2.

Gillnet Night Sets

Floating gillnet CPUE data (summarized in Figure 4.1.1) indicate:

- catch was comparable among Wells Creek inner and outer bay floating gillnet catches for rainbow trout (0.3 to 0.5 fish/h);
- catch was comparable among Wells Creek inner and outer bay floating gillnet catches for kokanee (0.7 to 1.1 fish/h); and
- northern squawfish catch per unit effort was much greater in the inner bay locations (1.9 to 3.9 fish/h) compared to the outer bay location (0.1 fish/h).

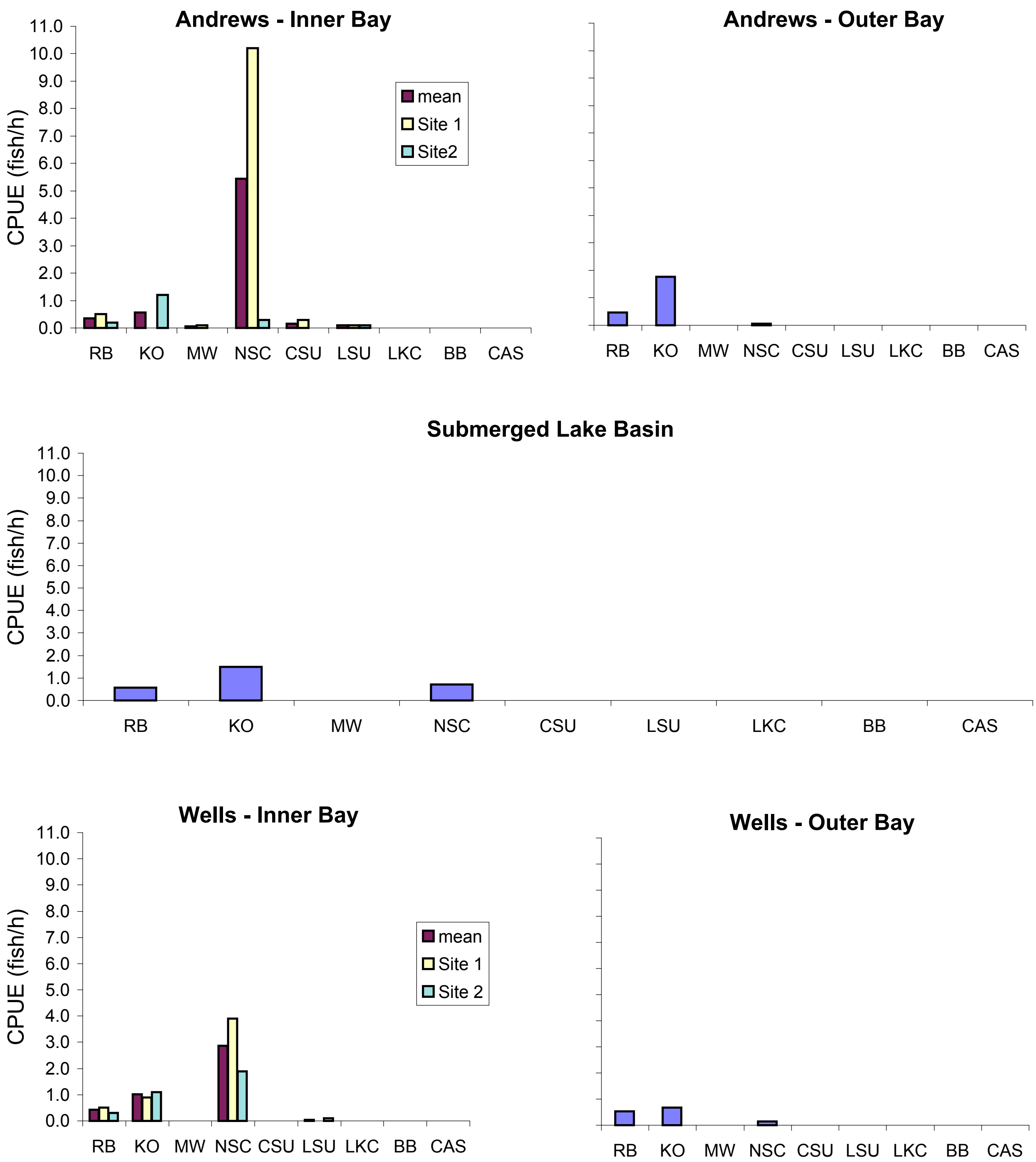
Sunken gillnet CPUE (Figure 4.1.2) for Wells Creek outer bay was low for rainbow trout (0.1 fish/h) and kokanee (0.2 fish/h) compared to respective floating gillnet catches (Figure 4.1.1). Northern squawfish CPUE in the sunken gillnet was high (0.4 fish/h) compared to the floating gillnet catch. Mountain whitefish and longnose sucker were present in the sunken catch but not in the floating catch.

Gillnet Day Sets

Rainbow trout CPUE for Wells Creek Bay floating gillnet day sets (Figure 4.1.3) varied considerably among sites, being highest in inner bay Site 2 (0.8 fish/h) and lowest in the outer bay site (0.1 fish/h). Kokanee was the only other species captured in floating gillnet day sets and only at the outer bay site (0.3 fish/h). The average inner bay CPUE for rainbow trout (0.5 fish/h) for the day set was similar to the night set (0.4 fish /h).

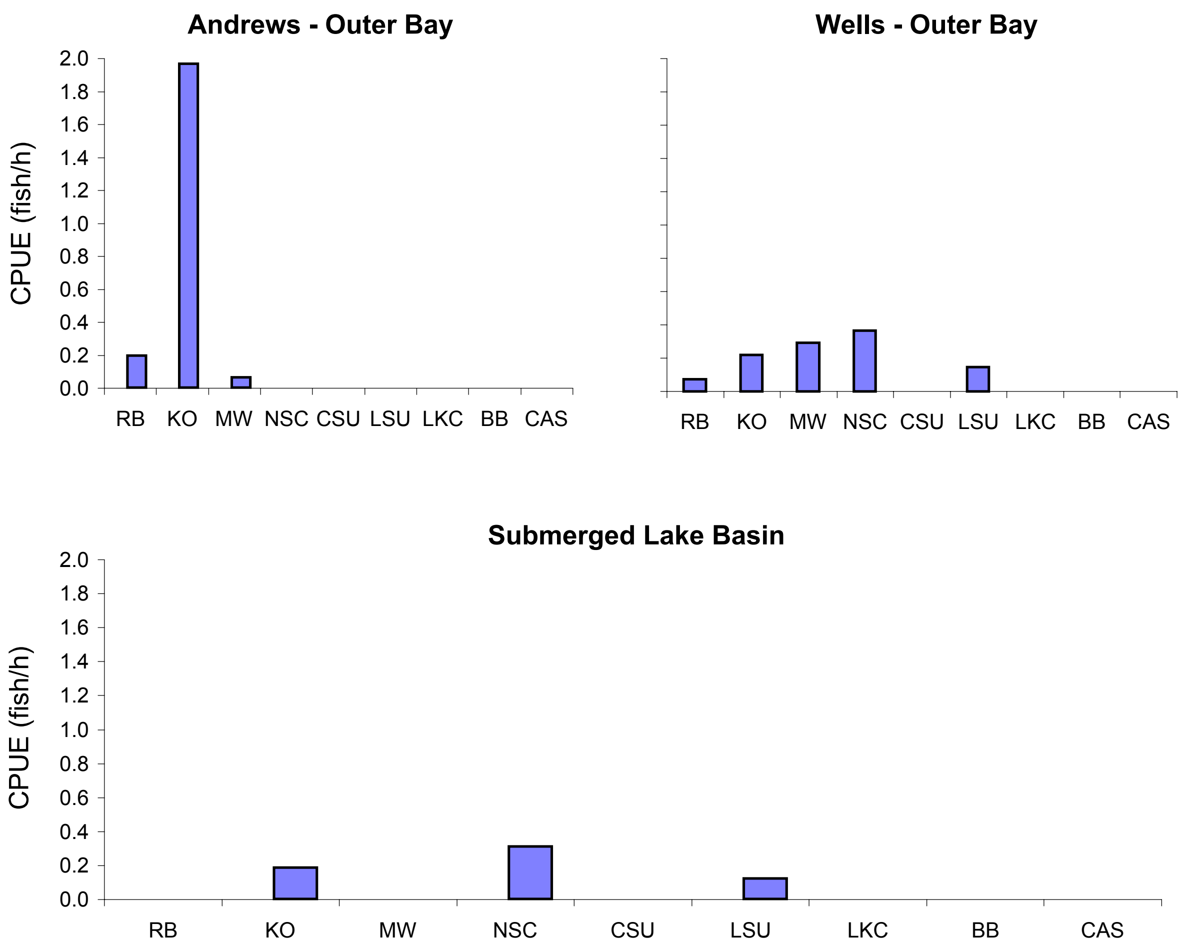
No rainbow trout or kokanee were captured in the sunken gillnet at the outer bay site (Figure 4.1.4). Northern squawfish CPUE at this location (0.4 fish/h) was the same as the night set CPUE (0.4 fish/h). Mountain whitefish, longnose sucker, and burbot were also captured in the sunken gillnet.

Figure 4.1.1 Catch per unit effort for floating gillnets (night sets) in Nechako Reservoir, September and October 1996.



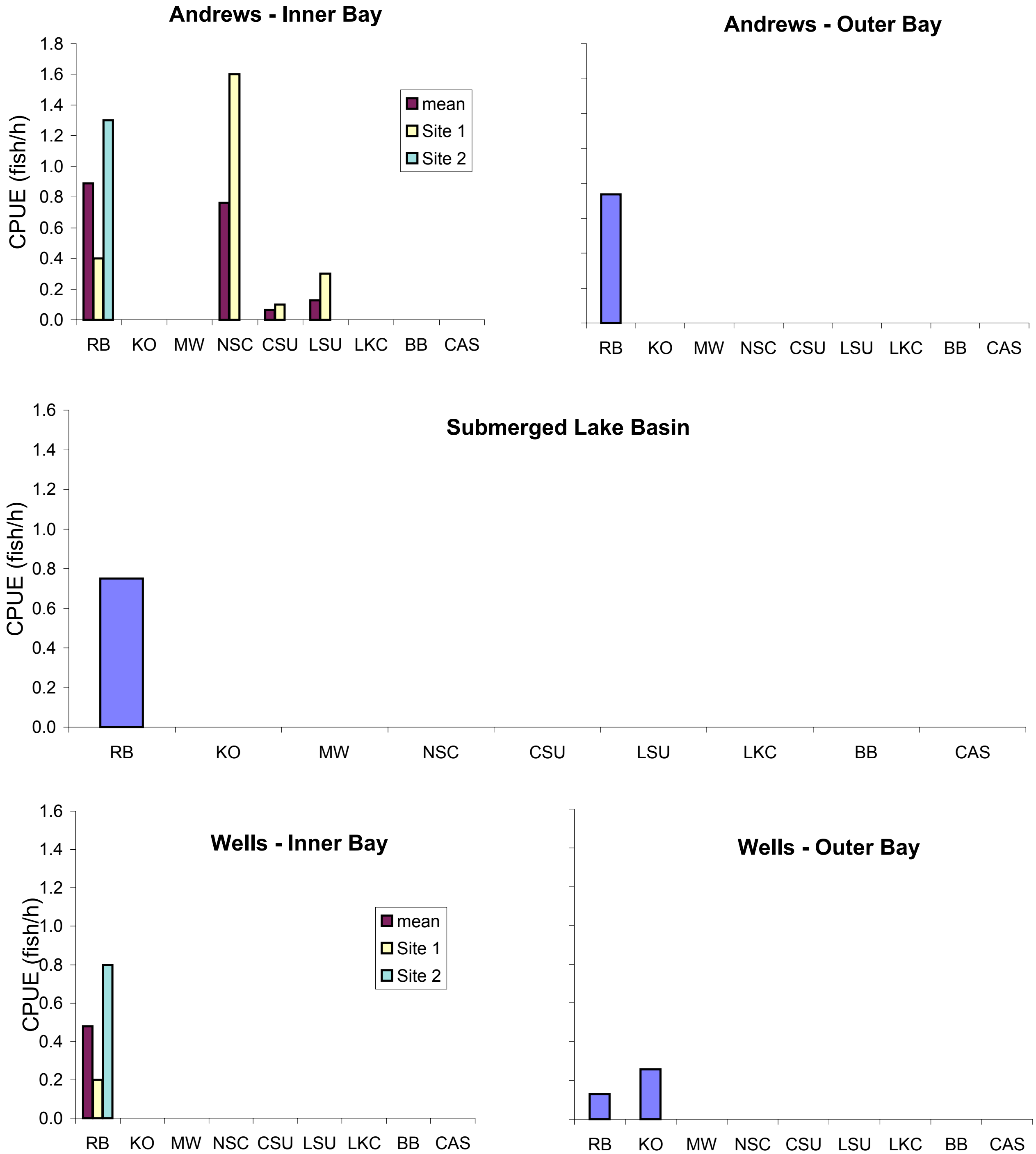
RB = rainbow trout; KO = kokanee; MW = mountain whitefish; NSC = northern squawfish; LSU = longnose sucker; CSU = largescale sucker; BB = burbot.

Figure 4.1.2 Catch per unit effort for sinking gillnets (night sets) in Nechako Reservoir, September and October 1996.

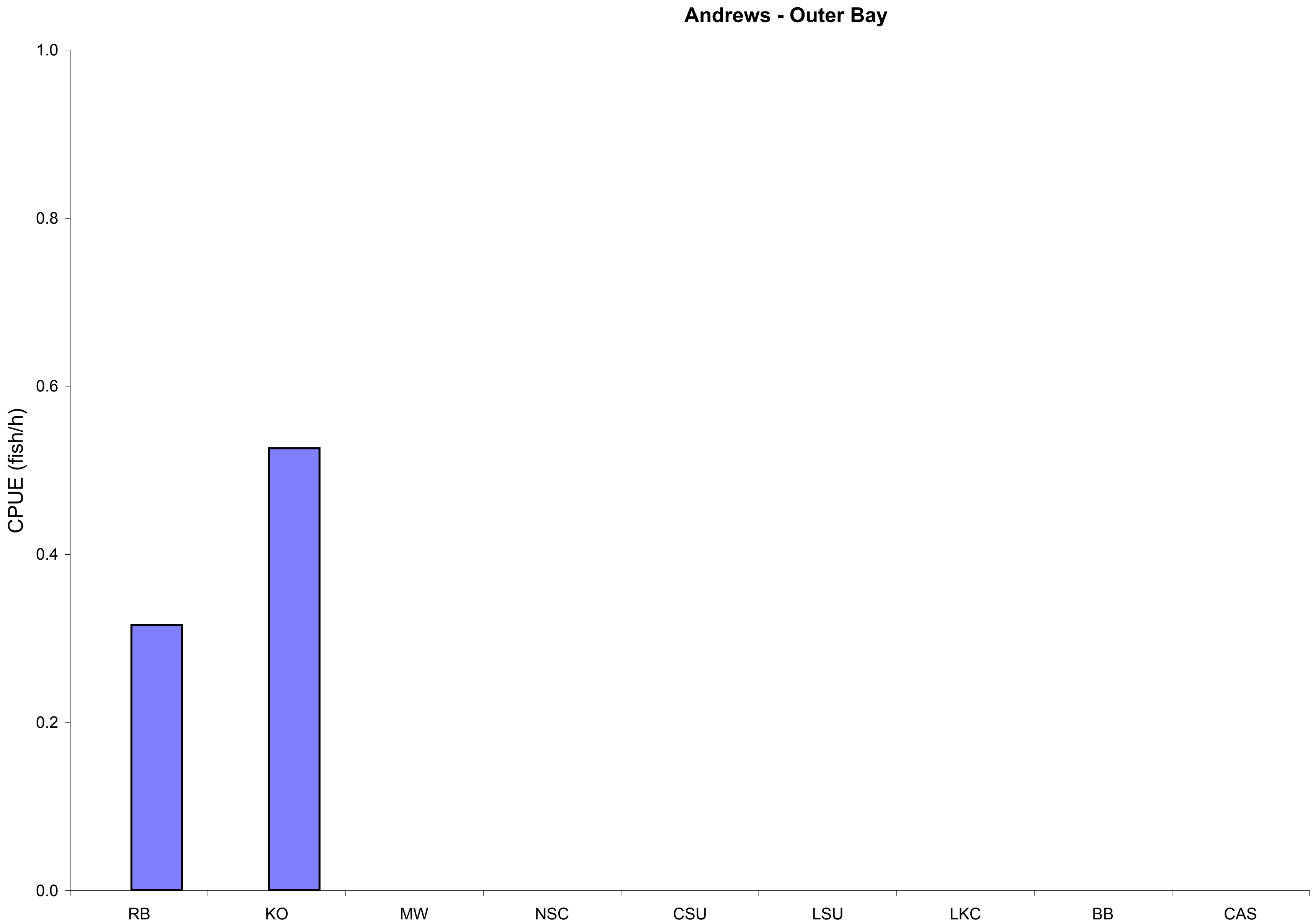


RB = rainbow trout; KO = kokanee; MW = mountain whitefish; NSC = northern squawfish; LSU = longnose sucker; CSU = largescale sucker; BB = burbot.

Figure 4.1.3 Catch per unit effort for floating gillnets (day sets) in Nechako Reservoir, September and October 1996.



RB = rainbow trout; KO = kokanee; MW = mountain whitefish; NSC = northern squawfish; LSU = longnose sucker; CSU = largescale sucker; BB = burbot.


Andrews - Outer Bay
CPUE (fish/h)
1.0
0.8
0.6
0.4
0.2
0.0
RB
KO
MW
NSC
CSU
LSU
LKC
BB
CAS

4.1.1.2 Boat Electrofishing

Results of boat electroshocking in near-shore water is summarized in Table 4.1.4.

Species Composition

Five species were captured at night (Table 4.1.4); no fish were captured during the day. Most fish captured at night were caught in relatively shallow water (2 to 3 m) within 50 m of the stream mouth. Rainbow trout and northern squawfish each represented 30% of the catch.

Table 4.1.4 Boat electroshocking results near Wells and Andrews creeks.

	Andrews Creek					Wells Creek		
	Night Shocking			Day Shocking		Night Shocking		Day Shocking
Date	Sept. 19/96			Sept 19/96		Sept 17/96		Sept 15/96
Time	21:00 - 22:00			2:20 - 3:00		21:30 - 21:50		16:00 - 16:30
Site	1[1]	2[2]	3[3]	1[1]	2[2]	1[1]	2[4]	1[1]
Shocking time (s)	490	435	438	400	402	200	621	379
Water depth (m)	2-3	3-4	5-7	2-3	3-4	2-3	3-7	2-3
Species Captured								
Rainbow trout	1	0	0	0	0	3	0	0
Mountain whitefish	0	0	1	1	0	2	0	0
Northern squawfish	6	0	0	0	0	3	0	0
Largescale sucker	1	0	0	0	0	1	0	0
Longnose sucker	0	0	0	0	0	1	0	0

[1] Within 50 m of stream mouth.
[2] 50 to 100 m from stream mouth.
[3] 300 m from stream mouth.
[4] 50 to 200 m from stream mouth.

Catch per Unit Effort

No fish were captured during the day. Ten fish were captured at night after 3.3 minutes of electroshocking within 50 m of the stream mouth. No fish were captured after an additional 10.3 minutes at distances 50 to 200 m from the stream mouth. Catch per unit effort for captured fish is summarized in Table 4.1.5.

Table 4.1.5 Catch per unit effort for boat electroshocking near Wells Creek, Nechako Reservoir, September/October 1996.

Species	CPUE
Rainbow trout	0.9 fish/min
Northern squawfish	0.9 fish/min
Mountain whitefish	0.6 fish/min
Largescale sucker	0.3 fish/min
Longnose sucker	0.3 fish/min

4.1.1.3 Underwater Video

Results of underwater video taping in nearshore water is summarized in Table 4.1.6. A remotely operated underwater video was operated for approximately one hour during the day to examine fish presence among snags and weed areas near the stream mouth. No fish were observed on the video monitor in the field. Twenty minutes of video operation were taped; no fish were evident on the tape during later playback. Northern squawfish and mountain whitefish were observed in Andrews Bay (Section 4.1.3.3) at night using this method, though the frequency of individuals being observed was low.

4.1.2 Submerged Lake Basin

4.1.2.1 Gillnets

Species composition of gillnet catches from the submerged lake basin is summarized in Table 4.1.7.

Species Composition

Night Sets

Kokanee were the most abundant species (53%) in the floating gillnet catch; northern squawfish were the second most abundant species (26%). Percent occurrence of kokanee at the submerged lake site was comparable to the percent occurrence of kokanee in the floating gillnet catch at the Wells Creek Bay outer bay site (50%). Northern squawfish were the most abundant species (50%) in the sunken gillnet catch. Kokanee and longnose sucker were also present in the sunken gillnet catch (30% and 20% respectively). Shannon-Wiener Function values (Table 4.1.3) suggest species diversity is comparable for floating and sunken night gill net catches.

Table 4.1.6 **Underwater video observations in Wells Creek Bay and Andrews Bay.**

	Wells Creek	Andrews Bay			
		Night	Night	Day	Day
Date	Sept 15/96	Sept 21/96	Sept 21/96	Sept 19/96	Sept 19/96
Site Location	Mouth of Wells Creek	100 m from mouth of unnamed creek 180-8532	300 m from mouth of unnamed creek 180-8532	mouth of unnamed creek 180-8532	100 m from mouth of unnamed creek 180-8532
Time	14:00 - 15:00	20:15 - 20:45	21:05 - 22:05	11:35 - 11:45	21:50 - 13:20
Operating Depth	1 - 3 m	2 - 3 m	7 m	1 - 3 m	2 - 3 m
Operation Type	Mobile operation approx 1 hr	Stationary using minnow trap bait	Stationary using minnow trap bait	Stationary using minnow trap bait	Stationary using minnow trap bait
Duration	20 min. recorded on tape	30 min recorded on tape	1 hour recorded on tape	45 min recorded on tape	30 min recorded on tape
Visibility	Approx. 2.2 m	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.5 m
Habitat Type	Near shore snags, weeds and submerged stream bottom	Among standing and fallen trees with 0.5 - 1.0 m high weeds on bottom.	Among standing trees with snags visible near bottom	Near shore weeds and submerged stream bottom	Among standing and fallen trees with 0.5 - 1.0 m high weeds on bottom.
Species Observed					
Northern squawfish	0	1	0	0	0
Mountain whitefish	0	0	1	0	0

Table 4.1.7 Species composition of gillnet catches at Submerged Lake Basin, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	No. of Fish Captured[1]							Total Catch
				RB	KO	MW	NSC	LSU	CSU	BB	
Submerged Lake Basin	Day	Float	30-Sep	6 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6
	Day	Sink	2-Oct	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
	Night	Float	29/30-Sep	9 (21)	23 (53)	0 (0)	11 (26)	0 (0)	0 (0)	0 (0)	43
	Night	Sink	2/3-Oct	0 (0)	3 (30)	0 (0)	5 (50)	2 (20)	0 (0)	0 (0)	10

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

[1] Percent composition represented in parentheses.

Table 4.1.8 Catch per unit effort of gillnet catches at Submerged Lake Basin, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	Time			Catch Per Unit Effort (no. fish/hour)							
				Start	Stop	Duration	RB	KO	MW	NSC	LSU	CSU	BB	All Species
Submerged Lake Basin	Day	Float	30-Sep	11:20	19:15	8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
	Day	Sink	2-Oct	9:50	19:00	9.25	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Night	Float	29/30-Sep	19:38	11:10	15.5	0.6	1.5	0.0	0.7	0.0	0.0	0.0	2.8
	Night	Sink	2/3-Oct	19:10	11:10	16	0.0	0.2	0.0	0.3	0.1	0.0	0.0	0.6

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

Day Sets

Similar to other sites, few specimens were captured during day sets compared to night sets. Rainbow trout was the only species captured in both the floating and sunken gillnets. Accordingly, Shannon-Wiener Function values (Table 4.1.3) indicate species diversity is much lower in the gillnet day catch compared to the night catch.

Catch per Unit Effort

Gill net catch per unit effort (CPUE) at the submerged lake basin site is summarized in Table 4.1.8.

Night Sets

Rainbow trout CPUE in the floating gillnet (0.6 fish /h) was similar to the CPUE in the night floating gillnet set at the Wells Creek Bay outer bay site (0.5 fish/h) (Figure 4.1.1). Kokanee CPUE (1.5 fish/h) was higher than the Wells Creek Bay outer bay site (0.7 fish/h). Northern squawfish CPUE was also higher (0.7 fish/h at the submerged lake site and 0.1 fish/h at the outer bay site).

The CPUE for kokanee in the sunken gillnet (0.2 fish/h) was the same as the CPUE for kokanee in Wells Creek outer bay (Figure 4.1.2). The CPUE for northern squawfish in the sunken gillnet (0.3 fish/h; Figure 4.1.2) was similar to the CPUE for northern squawfish in the sunken gillnet at the Wells Creek outer bay site (0.4 fish/h).

Day Sets

Only rainbow trout were captured in both the floating and sunken gillnet day sets (Figures 4.1.3 and 4.1.4). The rainbow trout CPUE in the floating gillnet (0.8 fish/h) was comparable to the CPUE in the night gillnet (0.6 fish/h), higher than the day set for the floating gillnet at the Wells Creek Bay outer bay site (0.1 fish/h) and the same as one of the two Wells Creek inner bay sites (Site 1: 0.8 fish/h).

4.1.3 Andrews Bay

4.1.3.1 Gillnets

Species Composition

Species composition of gill net catches are summarized in Table 4.1.9.

Inner Bay

Northern squawfish were the most abundant species (91%) in the night gill net catch at the innermost site in the inner bay (Site 1). However, kokanee were the most abundant species (67%) in the catch at the second site in the inner bay. Northern squawfish were the second most abundant species (19%) at that site.

Northern squawfish also were the most abundant species (67%) in the day gill net catch at the innermost site in the inner bay (Site 1). Rainbow trout were the second most abundant species (17%) captured at that location. Only rainbow trout were captured at the second inner bay site.

Species diversity appears to differ in catches at the two inner bay sites (Table 4.1.3). The outermost site (Site 2) exhibits a comparatively high species diversity value for the night catch, similar to the differences in species diversity between day and night catches in Wells Creek inner bay. However, the innermost site (Site 1) shows a low diversity value for the night catch compared to the day catch. The low night catch value is attributable to the large proportion of northern squawfish in the night catch.

Outer Bay

Kokanee were the most abundant species (77%) in the floating night gill net catch at the outer bay site. Rainbow trout were the second most abundant species (20%) at that location.

Kokanee were the most abundant species (88%) in the sunken night gill net catch at the outer bay site. Field personnel noted slackness in the buoy line for one end of the sunken net when retrieving and believe that end may have rested on a tree limb or snag when set, holding the end approximately four to five metres above the bottom. This meant that a portion of the net was likely at an angle from the bottom, possibly capturing kokanee higher in the water column .

Rainbow trout were the only species captured in the floating day gill net set at the outer bay site. Kokanee were the most abundant species (63%) captured in the sunken day gill net. Rainbow trout were the second most abundant species (38%) captured at that location.

Species diversity indices are higher for the floating gill net night catch compared to the day catch (Table 4.1.3). The diversity value for the sinking night catch was low compared to the day catch due to the proportionately high numbers of kokanee in the night catch.

Catch per Unit Effort

Gill net catch per unit effort at Andrews Bay is summarized in Table 4.1.10.

Table 4.1.9 Species composition of gillnet catches at sites in Andrews Bay, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	No. of Fish Captured[1]							Total Catch
				RB	KO	MW	NSC	LSU	CSU	BB	
Inner Bay 1	Day	Float	20-Sep	3 (17)	0 (0)	0 (0)	12 (67)	2 (11)	1 (6)	0 (0)	18
Inner Bay 2	Day	Float	3-Oct	11 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	11
Outer Bay	Day	Float	2-Oct	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7
Outer Bay	Day	Sink	2-Oct	3 (38)	5 (63)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8
Inner Bay 1	Night	Float	20/21-Sept	8 (4)	0 (0)	2 (1)	168 (91)	2 (1)	5 (3)	0 (0)	185
Inner Bay 2	Night	Float	4-Oct	3 (11)	18 (67)	0 (0)	5 (19)	1 (4)	0 (0)	0 (0)	27
Outer Bay	Night	Float	2/3-Oct	7 (20)	27 (77)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	35
Outer Bay	Night	Sink	2/3-Oct	3 (9)	30 (88)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	34

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

[1] Percent composition represented in parentheses.

Table 4.1.10 Catch per unit effort of gillnet catches at sites in Andrews Bay, September/October 1996.

Site	Day or Night Set	Floating or Sinking	Date	Time			Catch Per Unit Effort (no. fish/hour)							
				Start	Stop	Duration	RB	KO	MW	NSC	LSU	CSU	BB	All Species
Inner Bay 1	Day	Float	20-Sep	11:30	19:00	7.5	0.4	0.0	0.0	1.6	0.3	0.1	0.0	2.4
Inner Bay 2	Day	Float	3-Oct	9:50	18:00	8.25	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Outer Bay	Day	Float	2-Oct	8:00	17:30	9.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Outer Bay	Day	Sink	2-Oct	8:20	17:50	9.5	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.8
Inner Bay 1	Night	Float	20/21-Sept	18:45	11:20	16.5	0.5	0.0	0.1	10.2	0.1	0.3	0.0	11.2
Inner Bay 2	Night	Float	4-Oct	18:10	8:20	15.25	0.2	1.2	0.0	0.3	0.1	0.0	0.0	1.8
Outer Bay	Night	Float	2/3-Oct	17:40	8:50	15.25	0.5	1.8	0.0	0.1	0.0	0.0	0.0	2.3
Outer Bay	Night	Sink	2/3-Oct	18:10	9:30	15.25	0.2	2.0	0.1	0.0	0.0	0.0	0.0	2.2

RB = rainbow trout, KO = kokanee, MW = mountain whitefish, NSC = northern squawfish, LSU = longnose sucker, CSU = largescale sucker, BB = burbot.

Night Sets

The CPUE for the floating gillnet night catches (Figure 4.1.1) indicate:

- the CPUE for northern squawfish was very high at the innermost site (10.2 fish/h) and low at the outer bay site (0.1 fish/h) - the CPUE at the Andrews Bay outer bay site was the same as the CPUE at the Wells Creek Bay outer bay site (0.1 fish/h) and lower than the CPUE at the submerged lake site (0.7 fish/h);
- the CPUE for rainbow trout in the outer bay site (0.5 fish/h) was comparable to the Wells Creek Bay outer bay site (0.5 fish/h) and submerged lake site (0.6 fish/h), the Wells Creek Bay inner bay sites (0.3 to 0.5 fish/h), and one Andrews Bay inner bay site (0.5 fish/h);
- the CPUE for kokanee in the outer bay site (1.8 fish/h) was higher than the CPUE for kokanee at the Wells Creek Bay outer bay site (0.7 fish/h) but was similar to the CPUE for the submerged lake site (1.5 fish/h).

The catch for the sinking gillnet at the outer bay site (Figure 4.1.2) indicates:

- a low CPUE for rainbow trout (0.2 fish/h) compared to the CPUE for the floating gillnet at that site (0.5 fish/h) but was comparable to the sunken gillnet CPUE for the Wells Creek Bay outer bay site (0.1 fish/h);
- a kokanee CPUE (2.0 fish/h) was comparable to the floating gillnet catch (1.8 fish/h) but higher than the CPUE for the sunken gillnet at the Wells Creek Bay outer bay site and submerged lake site (0.2 fish/h at both of those locations). The high night CPUE may reflect capture of kokanee above the bottom, as one end of the net was believed to be suspended on a tree limb 4 to 5 m from the bottom.

Day Sets

The rainbow trout CPUE for the floating day gill net set (Figure 4.1.3) in the outer bay (0.7 fish/h) was slightly higher than the CPUE for the set in one inner bay site (Site 1: 0.4 fish/h) and lower than the second inner site (1.3 fish/h). The outer bay CPUE for rainbow trout in the day set was also slightly higher than the CPUE for the night set.

The outer bay floating gill net CPUE for rainbow trout was higher than the CPUE for the Wells Creek Bay outer bay site (0.1 fish/h) but comparable to the CPUE for the submerged lake basin site (0.8 fish/h). CPUEs varied between inner bay sites at both Andrews Bay inner bay (0.4 fish/h at one site and 1.3 fish/h at the second site) and Wells Creek Bay inner bay (0.2 fish/h at one site and 0.8 fish/h at the second).

A summary of gillnet catch per unit effort for all species at each site is presented in Table 4.1.11.

Table 4.1.11 Gillnet catch per unit effort (no. of fish/h) - all species, Nechako Reservoir, September/October 1996.

		Day		Night	
Location	**Site**	**Floating**	**Sinking**	**Floating**	**Sinking**
Wells Creek Bay	Inner Bay Site 1	0.2	-	5.3	-
	Inner Bay Site 2	0.8	-	3.4	-
	Outer Bay	0.4	0.8	1.3	1.1
Submerged Lake Basin		0.8	0.1	2.8	0.6
Andrews Bay	Inner Bay Site 1	2.4	-	11.2	-
	Inner Bay Site 2	1.3	-	1.8	-
	Outer Bay	0.7	0.8	2.3	2.2

4.1.3.2 Boat Electrofishing

Boat electrofishing was undertaken at the head of the inner bay near the mouth of an unnamed creek (180-8532) and near the middle of the inner bay (approximately 300 m from the mouth of the unnamed creek). Fish capture results are shown in Table 4.1.4. One fish specimen was obtained during daytime electrofishing (mountain whitefish). Nine fish were collected at night: eight were collected in close proximity to the stream mouth and one (mountain whitefish) was collected in deeper water among standing trees away from the stream mouth. Most specimens collected close to the stream mouth were northern squawfish (75%); one rainbow trout was captured.

4.1.3.3 Underwater Video

A remote operated underwater video was placed in a stationary position among snags and trees at three different locations in the inner bay. Records of fish presence were made on video tape for fixed intervals at each site. The results are summarized in Table 4.1.6. Fish were observed only at night. One northern squawfish was observed at 2 to 3 m among fallen and standing trees approximately 100 m from the mouth of the unnamed creek. One mountain whitefish was observed at approximately 7 m depth among snags at the base of standing trees in the middle portion of the inner bay (approximately 300 m from the mouth of the unnamed creek).

Number of fish observations per minute of observation are summarized in Table 4.1.12.

Table 4.1.12 Fish observations using underwater video, Andrews Bay, September/October 1996.

Site	Species	Night	Day
Inner Bay 1	None	0 fish/min observation	0 fish/min observation
Inner Bay 2	Northern squawfish Mountain whitefish	0.03 fish/min observation 0.02 fish/min observation	0 fish/min observation 0 fish/min observation

4.1.3.4 Minnow Traps

Minnow traps were set in and adjacent to the creek mouth and among fallen and standing trees approximately 100 m from the creek mouth. Fish capture results are shown in Table 4.1.13. Three fish were captured: northern squawfish, lake chub, and slimy sculpin.

Table 4.1.13 Minnow trap results for Andrews Bay[1].

	Night Sets		Day Sets	
Date	Sept 20/96	Sept 20/96	Sept 21/96	Sept 21/96
Site	1 [2]	2 [3]	1 [2]	2 [3]
Time in	18:55	19:10	10:05	9:55
Time out	10:05	9:55	19:20	19:15
Duration	15.2 hrs	14.8 hrs	9.25 hrs	9.2 hrs
No. of traps	3	3	3	3
Depth	1 - 2 m	2 -3 m	1 - 2 m	2 - 3 m
Species Captured				
Northern squawfish	1	0	0	0
Lake chub	0	0	0	1
Slimy sculpin	0	1	0	0

[1] Minnow traps were not used in Wells Creek Bay.
[2] Among snags in and among stream mouth.
[3] Among snags approximately 100 m from stream mouth.

Catch per unit effort was low as summarized in Table 4.1.14.

Table 4.1.14 Catch per unit effort at Andrews Bay Creek, minnow traps, September/October 1996.

Site	Species	Night	Day
1	Northern squawfish	0.02 fish/trap hour	0 fish/trap hour
2	Lake chub	0 fish/trap hour	0.04 fish/trap hour
2	Slimy sculpin	0.02 fish/trap hour	0 fish/trap hour

4.2 HYDROACOUSTIC SURVEYS

Hydroacoustic survey locations are shown in Figure 4.2.1; transect coordinates are listed in Table 4.2.1 (downscan) and Table 4.2.2 (sidescan). Hydroacoustic data collected during the program are presented in Appendix A1. Densities of fish recorded at different depths are summarized in Table 4.2.3; hydroacoustic target sizes are summarized in Table 4.2.4.

Table 4.2.1 Echosounder transect coordinates for sidescans, Ootsa Lake, September 1996.

Transect			Time (24 hour)		UTM Coordinates	
Number	Computer File	Date	Start	Stop	Start	Stop
Area A - Wells Creek Bay Outer Bay (Transects run on north-south axis)						
4	-	24/09/96	1914	1927		
2	1A2502S2	25/09/96	1015	1022	686509 E 5961832 N	686505 E 5961970 N
6	1A2502S6	25/09/96	1039	1054	687386 E 5960486 N	687298 E 5961800 N
4A	1A2504S4	25/09/96	2303	2317	6867994 E 5960591 N	686849 E 5961922 N
1	1A2504S1	25/09/96	2325	2335	686324 E 5961932 N	686335 E 5961087 N
Area B - Offshore (Transects run on north-south axis)						
2A	1B2503S2	25/09/96	1746	1800	687907 E 5963297 N	687899 E 5962032 N
2B	1B2605S2	25- 26/09/96	2359	0014	687864 E 5962053 N	687834 E 5963313 N
5	1B2605S5	26/09/96	0210	0229	688801 E 5961832 N	688713 E 5963281 N
Area C - Submerged Lake Basin (Transects run on east-west axis)						
	1C2808S1	28/09/96	2154	2215	690356 E 5960660 N	691695 E 5960636 N

INSERT FIGURE 4.2.1

Table 4.2.2 Echosounder transect coordinates for downscans, Ootsa Lake, September 1996.

Transect			Time (24 hour)		UTM Coordinates	
Number	Computer File	Date	Start	Stop	Start	Stop
Area A - Wells Creek Bay Outer Bay (Transects run on north-south axis)						
1A	1A0124D1	24/09/96	1717	1722	686295 E 5961191 N	686307 E 5961882 N
1B	1A2502D1	25/09/96	0956	1005	686302 E 5961109 N	686256 E 5961922 N
1C	1A2504D1	25/09/96	2049	2056	686322 E 5961207 N	686300 E 5961883 N
2A	1A0224D1	24/09/96	1730	1741	686461 E 5961839 N	686487 E 5961006 N
2B	1A2502D2	25/09/96	1027	1037	686550 E 5961980 N	686473 E 5961827 N
2C	1A2504D2	25/09/96	2102	2111	686484 E 5961064 N	686512 E 5961926 N
3A	1A0324D1	24/09/96	1750	1802	686653 E 5960739 N	686646 E 5961884 N
3B	1A2402D3	25/09/96	1040	1054	686656 E 5961883 N	686803 E 5960593 N
3C	1A2504D3	25/09/96	2122	2132	686665 E 5960752 N	686705 E 5961935 N
4A	1A0424D1	24/09/96	1807	1823	686800 E 5961866 N	686889 E 5960503 N
4B	1A2502D4	25/09/96	1058	1111	686895 E 5960490 N	686772 E 5961868 N
4C	1A2504D4	25/09/96	2140	2151	686845 E 5961875 N	686631 E 5960519 N
5A	1A0524D1	24/09/96	1827	1839	687114 E 5960545 N	687025 E 5961744 N
5B	1A2502D5	25/09/96	1118	1132	687021 E 5961749 N	687055 E 5960490 N
5C	1A2504D5	25/09/96	2220	2233	687086 E 5960551 N	687135 E 5961769 N
6A	1A0624D1	24/09/96	1843	1858	687300 E 5961780 N	687424 E 5960492 N
6B	1A2502D6	25/09/96	1200	1216	687281 E 5961809 N	687393 E 5960432 N
6C	1A2504D6	25/06/96	2237	2252	687333 E 5960443 N	687305 E 5961742 N

Table 4.2.2 cont'd

Transect Number	Computer File	Date	Time (24 hour) Start	Stop	UTM Coordinates Start	Stop
Area B - Offshore (Transects run on north-south axis)						
1A	1B2503D1	25/09/96	1721	1734	687709 E 5962052 N	687724 E 5963312 N
1B	1B05D1A 1B05D1B	26/09/96	0050	0107	687687 E 5962072 N	687684 E 5963354 N
2A	1B2503D2	25/09/96	1809	1824	687941 E 5962052 N	687919 E 5963345 N
2A+	-	25/09/96	1832	1836	687927 E 5963017 N	687905 E 5963363 N
2B	1B0526D2 1B05D2B	26/09/96	0026	0043	687913 E 5963275 N	687979 E 5961967 N
3A	1B2503D3	25/09/96	1844	1900	688201 E 5963290 N	688200 E 5962032 N
3B	1B05D3A 1B05D3B	26/09/96	0119	0135	688226 E 5963275 N	688238 E 5962027 N
4A	1b2503D4	25/09/96	1903	1919	688442 E 5962048 N	688493 E 5963433 N
4B	1B05D4A 1B05D4B	26/09/96	0145	0202	688416 E 5962086 N	688372 E 5963473 N
5A	1B2503D5	25/09/96	1924	1939	688712 E 5963340 N	688650E 5961856 N
5B	1B05D5A 1B05D4B	26/09/96	0238	0255	688687 E 5961911 N	688725 E 5963439 N
Area C - Submerged Lake Basin (Transects run on east-west axis)						
1A	1C27NWD1 1C27N8D1	27/09/96	1610	1637	690322 E 5960430 N	691564 E 5960508 N
1B	1C2807D1	28/09/96	1935	1949	690311 E 5960451 N	691565 E 5960457 N
1C	1C2808D1	28/09/96	2028	2043	691538 E 5960523 N	690383 E 5960415 N
2A	1C2706D2	27/09/96	1650	1700	690341 E 5960689 N	691564 E 5960690 N
2B	1C2807D2	28/09/96	2006	2022	690243 E 5960613 N	691581 E 5960763 N
2C	1C2808D2	28/09/96	2048	2105	690231 E 5960620 N	691777 E 5960803 N
3A	1C2706D3	27/09/96	1718	1730	690232E 5960976 N	691681 E 5961035 N
3B	1C2808D3	28/09/96	2110	2113	691798 E 5961059 N	691500 E 5961059 N
3C	1C28N8D3	28/09/96	2125	2146	691699 E 5961019 N	690152 E 5960996 N

Table 4.2.3 Summary of estimated fish density at depth using hydroacoustic equipment, Ootsa Lake, September 1996. Data given are depth (m), number of passes (No.), and mean and standard deviation of number of fish (fish/1,000 m³ water).

	Morning				Afternoon				Night			
	Treed		Untreed		Treed		Untreed		Treed		Untreed	
Depth (m)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)
Wells Creek Bay - Outer Bay												
0 - 5	6	0	6	0.89 ± 1.81	6	0.50 ± 0.79	6	0	6	0.22 ± 0.36	6	0.49 ± 1.20
5 - 10	6	0	6	0	6	0.12 ± 0.20	6	0	6	0.35 ± 0.44	6	0.76 ± 0.62
10 - 15	6	0.04 ± 0.11	6	0	6	0	6	0	6	0.47 ± 0.41	6	0.41 ± 0.41
15 - 20	6	0.26 ± 0.34	6	0.04 ± 0.06	6	0.08 ± 0.19	6	0	6	0.36 ± 0.33	6	0.43 ± 0.52
20 - 25	6	0	6	0.10 ± 0.13	6	0.07 ± 0.18	6	0.04 ± 0.08	6	0.90 ± 1.32	6	0.26 ± 0.19
25 - 30	3	0	4	0.06 ± 0.12	3	0.37 ± 0.63	4	0.03 ± 0.06	3	0	4	0.17 ± 0.20
Submerged Lake Basin												
0 - 5					3	0	3	0	3	0	3	1.30 ± 1.84
5 - 10					3	0	3	0.10 ± 0.17	3	0.47 ± 0.67	3	0.58 ± 0.82
10 - 15					3	0	3	0.06 ± 0.10	3	0.51 ± 0.72	3	0.48 ± 0.06
15 - 20					2	0	3	0.16 ± 0.20	2	1.27 ± 1.79	3	0.98 ± 0.16
20 - 25					1	0	3	0.07 ± 0.07	1	0	3	1.04 ± 0.93
25 - 30					1	0	3	0.10 ± 0.09			3	1.04 ± 0.91
30 - 35							3	0.05 ± 0.05			3	0.25 ± 0.26

Note: Morning scans were not conducted at the submerged lake basin or offshore. Blank cells indicate no data were collected.

Table 4.2.3 cont'd

	Morning				Afternoon				Night			
	Treed		Untreed		Treed		Untreed		Treed		Untreed	
Depth (m)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)	No. Pass	Mean ± SD (Fish/1,000 m^3)
Offshore												
0 - 5					5	0	5	0	5	0	5	0
5 - 10					5	0	5	0	5	0.32 ± 0.45	5	0.40 ± 0.21
10 - 15					5	0	5	0.07 ± 0.16	5	0.43 ± 0.35	5	0.79 ± 0.28
15 - 20					5	0.07 ± 0.15	5	0.09 ± 0.09	5	0.20 ± 0.31	5	0.36 ± 0.21
20 - 25					5	0.10 ± 0.11	5	0.14 ± 0.10	5	0.30 ± 0.29	5	0.33 ± 0.15
25 - 30					5	0.08 ± 0.13	5	0.04 ± 0.07	5	0.16 ± 0.20	5	0.18 ± 0.08
30 - 35					5	0.06 ± 0.13	5	0.04 ± 0.03	5	0.07 ± 0.10	5	0.39 ± 0.13
35 - 40					4	0.16 ± 0.32	5	0	4	0.06 ± 0.10	5	0.94 ± 0.18
40 - 45							5	0.04 ± 0.07			5	1.04 ± 0.44
45 - 50							5	0			4	1.10 ± 0.32
50 - 55							5	0			4	0.56 ± 0.28

Note: Morning scans were not conducted at the submerged lake basin or offshore. Blank cells indicate no data were collected.

Table 4.2.4 Summary of hydroacoustic target strengths at depth, Ootsa Lake, September 1996. Data given are depth (m), number of fish (No.), and mean and standard deviation of decibels.

	Morning				Afternoon				Night			
	Treed		Untreed		Treed		Untreed		Treed		Untreed	
Depth (m)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)
Wells Creek Bay - Outer Bay												
0 - 5	0		0		0		0		2	-45.3 ± 2.7	0	
5 - 10	0		0		3	-51.9 ± 1.8	0		25	-45.5 ± 4.6	15	-36.7 ± 6.9
10 - 15	0		0		0		0		46	-42.7 ± 5.9	20	-43.7 ± 7.5
15 - 20	0		13	-38.9 ± 7.0	6	-48.0 ± 1.7	0		24	-45.5 ± 6.3	42	-41.9 ± 5.8
20 - 25	0		0		1	-53.8	1	-48.8	34	-53.6 ± 2.7	46	-45.0 ± 8.6
25 - 30	0		0		0		1	-47.8	0		32	-50.4 ± 3.2
Submerged Lake Basin												
0 - 5					0		3	-55.5 ± 2.5	0		5	-43.5 ± 9.0
5 - 10					0		2	-47.0 ± 1.0	0		10	-46.3 ± 5.3
10 - 15					0		2	-55.1 ± 1.7	9	-46.6 ± 9.1	14	-48.0 ± 6.3
15 - 20					0		9	-46.6 ± 9.6	35	-49.8 ± 4.5	36	-42.7 ± 7.1
20 - 25					0		11	-46.0 ± 6.4	12	-48.6 ± 3.4	20	-49.2 ± 5.5
25 - 30					0		18	-55.1 ± 2.8	2	-44.0 ± 1.1	41	-46.0 ± 6.0
30 - 35					0		35	-51.2 ± 5.1	0		18	-46.7 ± 5.1

Note: Morning scans were not conducted at the submerged lake basin or offshore. Blank cells indicate no data were collected.

Table 4.2.4 cont'd

	Morning				Afternoon				Night			
	Treed		Untreed		Treed		Untreed		Treed		Untreed	
Depth (m)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)	No. Fish	Mean ± SD (Decibels)
Offshore												
0 - 5					0		0		0		0	
5 - 10					0		0		17	-48.0 ± 6.3	13	-45.6 ± 7.5
10 - 15					0		13	-48.9 ± 5.8	59	-45.0 ± 6.5	83	-44.5 ± 6.9
15 - 20					6	-35.6 ± 3.2	28	-48.1 ± 6.8	131	-45.2 ± 5.9	82	-44.0 ± 6.2
20 - 25					2	-35.2 ± 7.9	56	-46.1 ± 6.0	46	-44.4 ± 6.5	106	-42.5 ± 6.1
25 - 30					0		22	-44.4 ± 6.1	30	-48.3 ± 6.1	89	-45.6 ± 6.0
30 - 35					10	-43.9 ± 2.9	31	-47.3 ± 3.8	36	-49.0 ± 4.9	150	-47.3 ± 6.1
35 - 40					0		6	-37.6 ± 4.6	56	-48.7 ± 5.3	678	-44.8 ± 5.5
40 - 45					0		16	-40.3 ± 7.3	6	-48.3 ± 4.0	536	-46.8 ± 4.9
45 - 50							0				465	-46.5 ± 4.4
50 - 55							0				208	-47.6 ± 3.9
55 - 60							0				223	-48.2 ± 4.2

Note: Morning scans were not conducted at the submerged lake basin or offshore. Blank cells indicate no data were collected.

In Wells Creek Bay outer bay area (Area A), the bottom depth ranged from approximately 10 m to 30 m, with a small steep submerged hill visible in several transects (the reservoir bottom was less than 5 m deep in some locations). The distance between tree tops and water surface ranged from approximately 15 to 20 m in water depths of approximately 30 m to as little as 2 to 4 m in shallower areas. In the submerged lake basin area, bottom depths and tree heights below the water surface were comparable to the Wells Creek Bay outer bay location. In the offshore location, bottom depths extended from approximately 20 m to greater than 70 m, when transects were terminated. Trees were evident at bottom depths between 20 m and 40 m, but not below 40 m. Tree top depths below the water surface were approximately 10 m at bottom depths of 20 m and 20 m at bottom depths of 40 m.

4.2.1 Fish Densities

4.2.1.1 Daytime

Fish densities at night were greater than densities recorded during the day at most depths in all areas (Table 4.2.3; Figure 4.2.2). Most daytime transects were conducted in the late afternoon. One morning transect series was undertaken in Wells Creek Bay outer bay. The greatest mean densities obtained during daytime transects among all areas occurred in the Wells Creek outer bay. The greatest density (0.89 fish/1,000 m^3) occurred in the 0 to 5 m segment of the water column in the Wells Creek Bay outer bay morning transect series over areas with no trees. Other high mean daytime densities were recorded in the morning and afternoon in this area (0.50 fish/1,000 m^3 at the 0 to 5 m depth in the afternoon and 0.37 fish/1,000 m^3 near the bottom, 25 to 30 m, also in the afternoon). These densities were recorded over trees (0 to 5 m) and among trees (25 to 30 m).

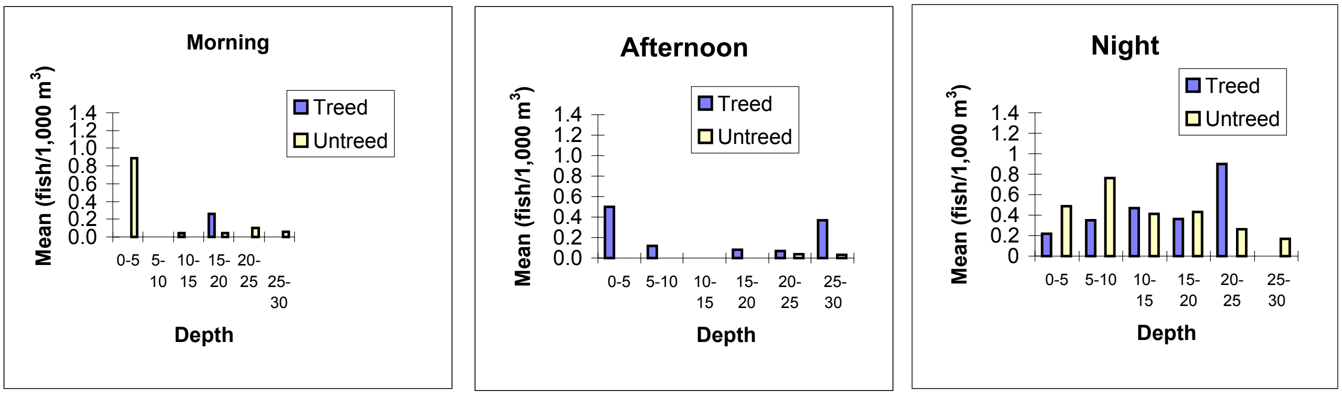
Data for the Wells Creek Bay outer bay area suggest higher densities of fish among trees during the afternoon (Figure 4.2.2). This relation is not evident for the submerged lake area where no fish were detected among submerged trees. Data for the offshore area suggests comparable values for treed and untreed areas at depths at which trees are located in that area, though densities were in general very low compared to night densities (Figure 4.2.2).

4.2.1.2 Nighttime

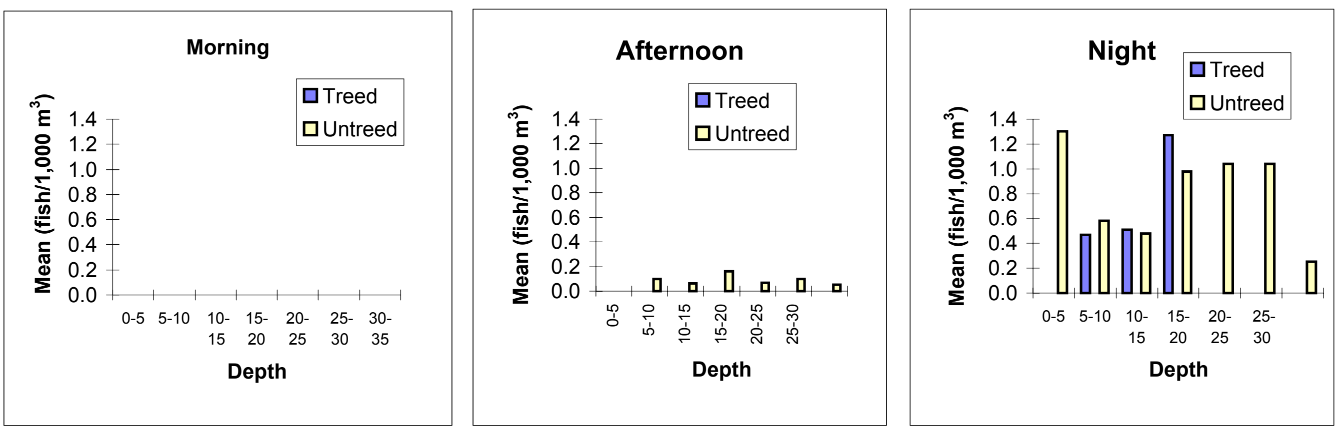
In comparison to daytime mean densities, nighttime values were clearly greater in all areas (Figure 4.2.2). Highest values were recorded in the area of the submerged lake basin (1.27 to 1.30 fish/1,000 m^3). Data do not show a clear relation between mean fish densities and treed or untreed areas. Similarly, mean densities do not show a clear relationship with depth. This suggests that fish detected during the night transects have dispersed into the water column at night from locations other than those in which they were detected during the daytime transects.

Figure 4.2.2 **Summary of estimated fish density at depth using hydroacoustic equipment, Ootsa Lake, September 1997.**

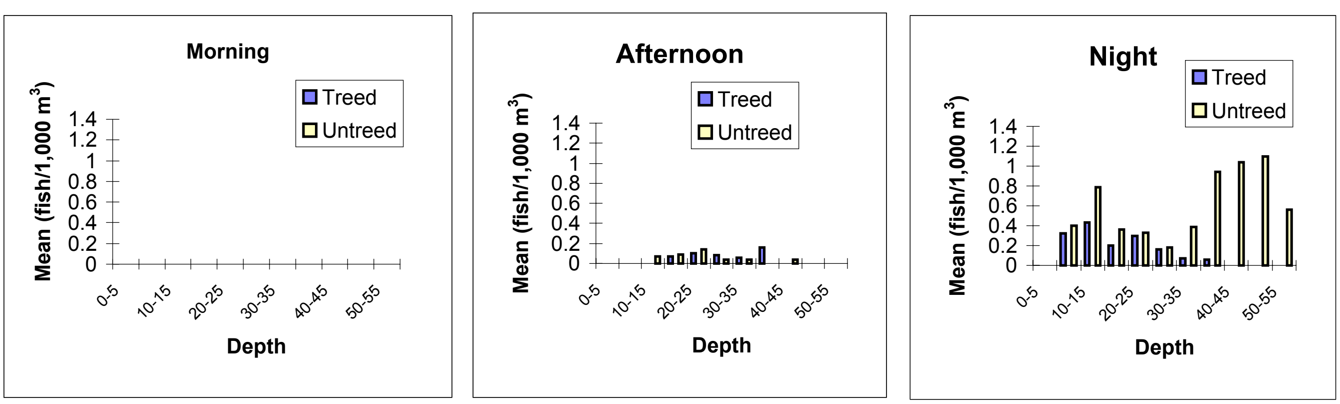
Wells Creek Bay - Outer Bay



Submerged Lake Basin



Offshore



4.2.2 Fish Target Strengths

Hydroacoustic target strengths are related to fish size. Fish target strengths recorded during the present surveys are summarized in Table 4.2.4 and Figure 4.2.3.

4.2.2.1 Daytime

The largest mean target strengths for fish during daytime were recorded at 15 to 25 m depths among trees in the offshore area (mean target strengths of -35.2 to -35.6 decibels), at 35 to 40 m in the untreed area offshore (-37.6 decibels) and in the untreed area of Wells Creek Bay outer bay (-38.9 decibels). These target strengths roughly correspond to fish 30 to 40 cm in length. Smallest fish mean target strengths were recorded at several depths among trees in Wells Creek Bay outer bay (-51.9 to -53.8) and at different depths in untreed areas of the submerged lake basin (-51.2 to -55.5 decibels). These target strengths correspond to fish roughly 3 to 5 cm in length.

4.2.2.2 Nighttime

The largest mean target strength during night surveys was recorded at 5 to 10 m in the untreed areas of Wells Creek Bay outer bay (-36.7 decibels). As noted above such a value would represent larger fish approximately 30 to 40 cm in length. Apart from this value, similar target strengths (ranging from approximately -42 to -49 decibels) appear to be generally distributed throughout the portion of the water column scanned. Smallest fish were recorded near the bottom of both treed and untreed areas of Wells Creek Bay outer bay (-53.6 decibels at 20 to 25 m in the treed area; -50.4 decibels at 25 to 30 m in the untreed area).

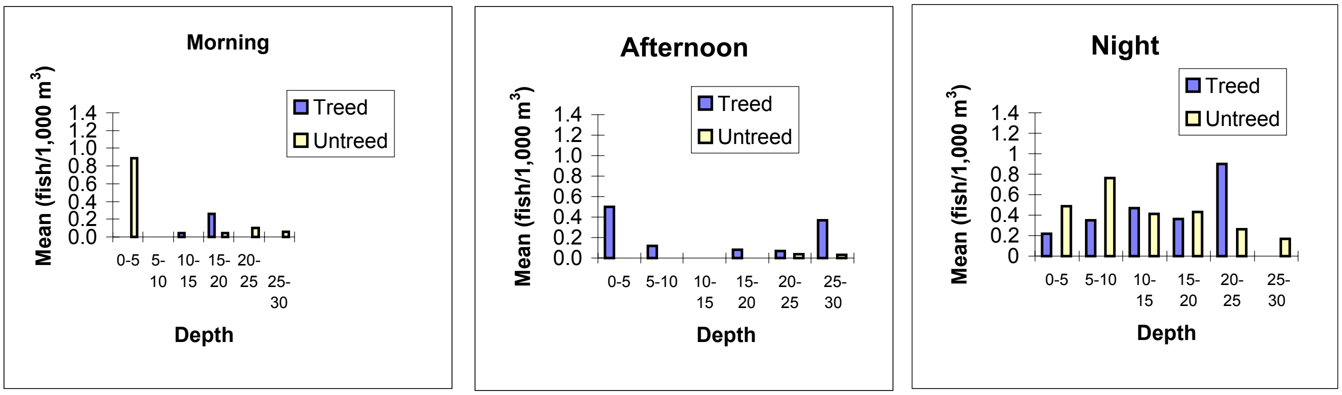
4.3 RAINBOW TROUT

4.3.1 Sex Ratio

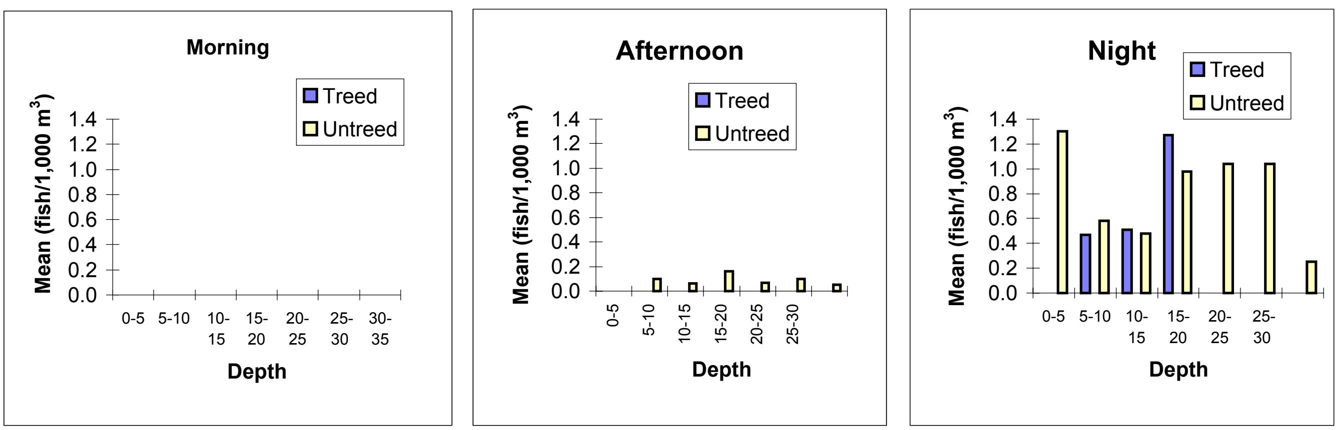
Sex ratios among rainbow trout captured at lake sample locations are summarized in Table 4.3.1.

Figure 4.2.2 Summary of estimated fish density at depth using hydroacoustic equipment, Ootsa Lake, September 1997.

Wells Creek Bay - Outer Bay



Submerged Lake Basin



Offshore

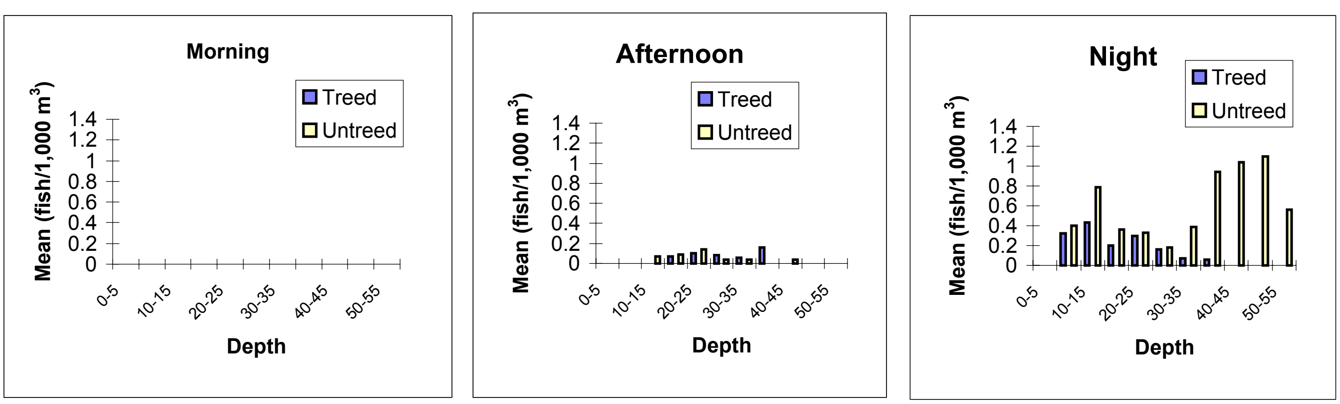


Table 4.3.1 Rainbow trout sex ratio, Nechako Reservoir, September/October 1996.

		Male		Female	
Location	**Site**	**Number**	***Percent***	**Number**	***Percent***
Wells Creek Bay	Inner bay	12	*60*	8	*40*
	Outer bay	2	*20*	8	*80*
	All sites	**14**	***47***	**16**	***53***
Submerged Lake Basin	All sites	6	*38*	10	*62*
Andrews Bay	Inner bay	10	*40*	15	*60*
	Outer bay	10	*50*	10	*50*
	All sites	**20**	***44***	**25**	***56***
TOTAL	**All sites**	**40**	***44***	**51**	***56***

Overall, the data suggest a slightly higher proportion of females among locations sampled (approximately 56%) relative to males (44%). A high proportion of females were collected at three locations (Wells Creek Bay outer bay, the submerged lake basin, and Andrews Bay inner bay). The proportion of males was greater among fish captured in the Wells Creek Bay inner bay (60% males, 40% females), which differed considerably from the outer bay site (20% males, 80% females). Proportions for the submerged lake basin were 38% males and 62% females; for Andrews Bay inner bay were 40% males and 60% females.

4.3.2 Size/Age

4.3.2.1 Length

Mean fork lengths of rainbow trout captured from all lake sample sites are summarized in Table 4.3.2. Mean length of rainbow trout from Wells Creek Bay inner bay was 215.4 mm (n=25); mean length of Wells Creek Bay outer bay fish was 269.0 mm (n=10). Rainbow trout captured at Andrews Bay also tended to be smaller in the inner bay compared to the outer bay: in the inner bay trout averaged 202.1 mm (n=26) in length; in the outer bay trout averaged 304.4 mm (n=20). These data suggest fish in inner bay locations tend to be slightly smaller than fish in outer bay locations. Fish collected over the submerged lake basin were relatively large, averaging 266.1 mm (n=16), comparable to rainbow trout captured in the Wells Creek Bay outer bay. Males appear to be slightly longer than females in all samples, averaging 264.3 mm compared to 233.8 mm for females. Mean lengths for fish collected from Wells Creek Bay (inner and outer bays) appear to be slightly smaller relative to mean lengths of fish collected from Andrews Bay. A histogram of size class frequency (Figure 4.3.1) illustrates a higher frequency of fish >300 mm at Andrews Bay relative to Wells Creek Bay.

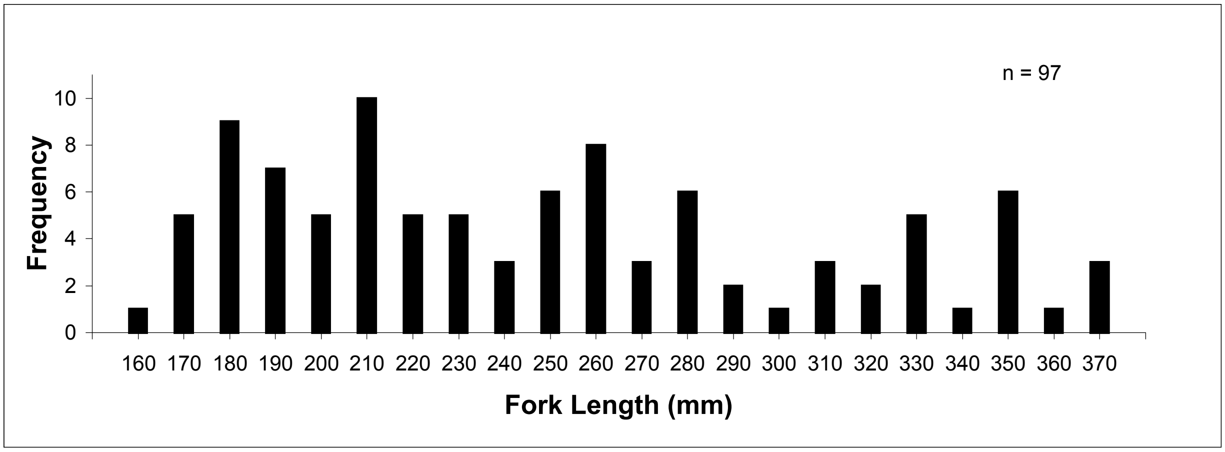
Table 4.3.2 Mean fork lengths (mm) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night									3	190.7	22.0	176-216
		Gillnet	Day	6	223.2	56.7	182-330	3	207.3	38.8	166-243	9	217.9	49.5	166-330
			Night	4	256.8	70.2	170-342	3	200.3	31.3	172-234	8	225.1	60.1	170-342
	Inner Bay 2	Gillnet	Day												
			Night	2	234.5	36.1	209-260	2	180.0	0.0	180-180	5	210.4	33.4	180-260
	All Inner Bay Samples	All Gear Types	All Times	12	236.3	56.3	170-342	8	197.9	29.0	166-243	25	215.4	47.0	166-342
	Outer Bay	Gillnet - floating	Day					1	350.0			1	350.0		
			Night	1	198.0			7	253.3	48.3	186-332	8	246.4	48.8	186-332
		Gillnet - sinking	Day												
			Night	1	369.0							1	369.0		
	All Outer Bay Samples	All Gear Types	All Times	2	283.5	120.9	198-369	8	265.4	56.3	186-350	10	269.0	64.4	186-369
	All Wells Creek Bay Samples	All Gear Types	All Times	14	243.0	64.1	170-369	16	231.6	55.6	166-350	35	230.7	57.1	166-369
Submerged Lake Basin		Gillnet - floating	Day	2	267.5	10.6	260-275	4	270.8	6.1	262-265	6	269.7	6.9	260-275
			Night	4	308.0	33.6	270-348	5	219.6	41.8	166-280	9	258.9	58.9	166-348
		Gillnet - sinking	Day					1	309.0			1	309.0		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	294.5	33.7	260-348	10	249.0	43.4	166-309	16	266.1	45.0	166-348
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									1	214.0		
		Gillnet	Day	2	227.0	26.9	208-246	1	197.0			3	217.0	25.7	197-246
			Night	2	203.5	29.0	183-224	6	190.5	20.3	155-209	8	193.8	21.2	155-224
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	200.3	29.7	166-250	5	212.8	30.7	166-249	11	206.0	29.3	166-250
			Night					3	191.3	25.8	174-221	3	191.3	25.8	174-221
	All Inner Bay Samples	All Gear Types	All Times	10	206.3	28.0	166-250	15	198.5	25.0	155-249	26	202.1	25.5	155-250
	Outer Bay	Gillnet - floating	Day	4	339.3	24.0	307-365	3	332.3	9.5	325-343	7	336.3	18.2	307-365
			Night	4	329.8	19.4	311-357	3	238.7	47.6	185-276	7	290.7	57.6	185-357
		Gillnet - sinking	Day	1	361.0			2	242.0	5.7	238-246	3	281.7	68.8	238-361
			Night	1	302.0			2	276.0	14.1	266-286	3	284.7	18.0	266-302
	All Outer Bay Samples	All Gear Types	All Times	10	333.9	23.1	302-365	10	274.9	48.3	185-343	20	304.4	47.7	185-365
	All Andrews Bay Samples	All Gear Types	All Times	20	270.1	70.1	166-365	25	229.1	51.9	155-343	46	246.6	62.8	155-365
All Areas	All Locations	All Gear Types	All Times	40	264.3	65.0	166-369	51	233.8	51.2	155-350	97	244.1	58.9	155-369

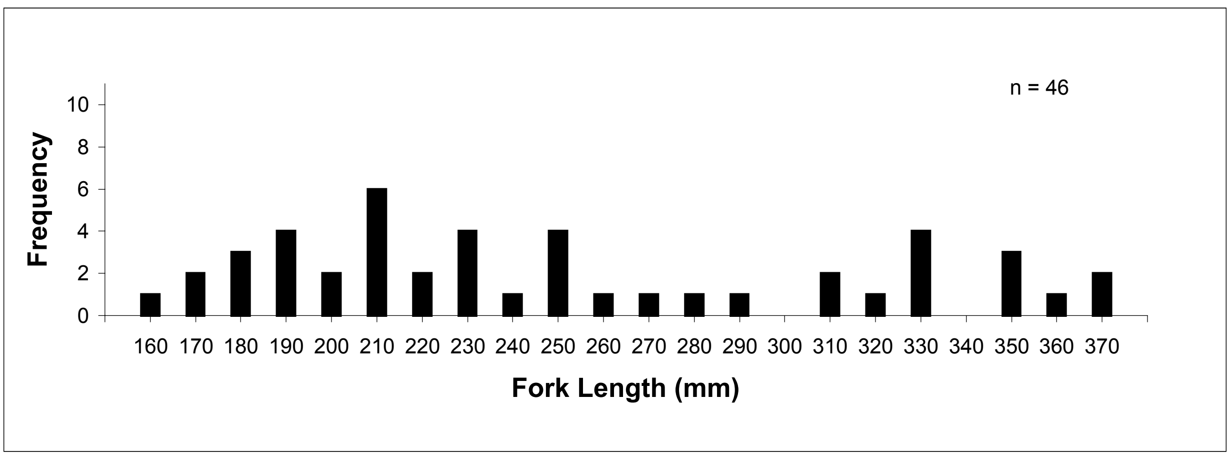
Note: Combined sex numbers include fish captured but not sexed.

Figure 4.3.1 Length frequencies for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

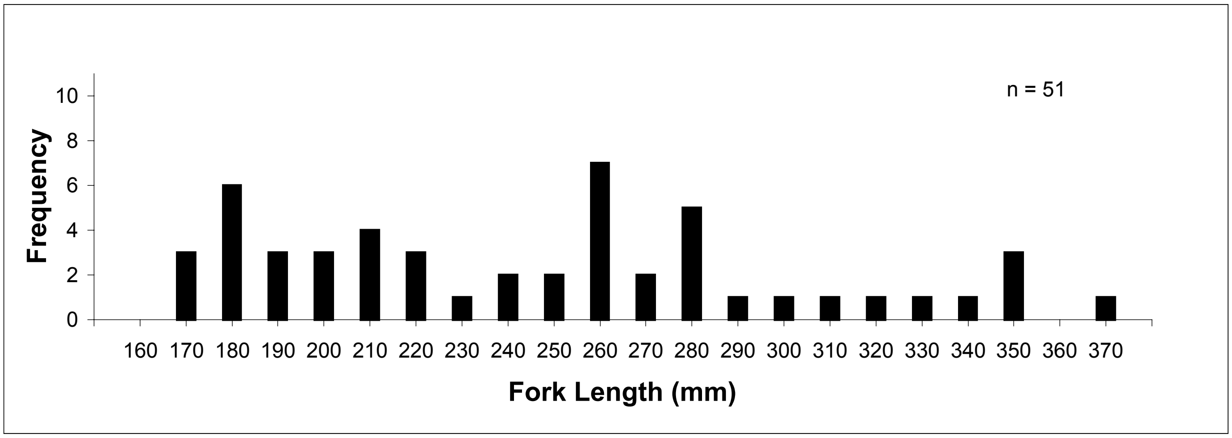
A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin



4.3.2.2 Weight

Mean weights of rainbow trout captured from all lake sample sites are summarized in Table 4.3.3. Males and females at Wells Creek Bay inner bay weighed on average 159.3 g (n=12) and 89.3 g (n=8), respectively. Rainbow trout from Wells Creek Bay outer bay weighed more than fish captured in the inner bay: males 312.0 g (n=2), females 204.9 g (n=8). Rainbow trout captured in the submerged lake basin were intermediate in weight (compared to Wells Creek Bay inner and outer bay locations); males averaged 260.4 g (n=6) and females averaged 172.9 g (n=10). A large difference was observed in weight of Andrews Bay trout. Males from the inner bay averaged 97.4 g (n=10) and females 89.6 g (n=15) relative to fish from the outer bay where males weighed 376.8 g (n=10) and females 226.1 g (n=10). These data suggest fish in the inner bay locations tend to be smaller relative to fish in outer bay locations, including fish collected over the submerged lake basin. Males appear to be slightly larger than females in all samples. Mean weights for fish collected from Wells Creek Bay (inner and outer bays) appear to be smaller than mean weights of fish collected from Andrews Bay.

4.3.2.3 Age

Mean ages of rainbow trout captured from all lake sample sites are summarized in Table 4.3.4. Mean ages of male trout captured at Wells Creek Bay were 2.7 years (n=11) at inner bay sites and 2.5 years (n=2) at outer bay sites. Mean age of male trout was 3.2 years at the submerged lake basin (n=6), 2.2 years at Andrews Bay inner sites (n=10), and 4.0 years at Andrews Bay outer bay (n=9). Mean ages of female trout at each site were: 1.9 and 3.0 years at Wells Creek Bay inner bay and outer bay, respectively; 2.5 years at the submerged lake basin; and 2.1 and 3.3 years at Andrews Bay inner and outer bay, respectively. Females were younger than males on average (2.5 years for females, 2.9 years for males) except at Wells Creek Bay outer bay. In general, mean ages of rainbow trout captured during surveys were younger at inner bay sites (2.2 years at both Wells Creek Bay inner bay and Andrews Bay inner bay), compared to outer bay sites and the submerged lake basin fish (average 2.8 to 3.6 years).

Estimated years of stream residency of rainbow trout captured in Andrews Bay and Wells Creek Bay based on scale readings are shown in Table 4.3.5.

Table 4.3.3 Mean wet weights (g) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night									3	83.53	31.60	64.2-120
		Gillnet	Day	6	138.75	113.91	68.0-363.8	3	105.93	53.27	48.6-153.9	9	127.81	95.33	48.6-363.8
			Night	4	201.85	137.05	64.2-391.6	3	91.27	38.54	55.1-131.8	8	142.06	112.69	55.1-391.6
	Inner Bay 2	Gillnet	Day												
			Night	2	135.85	53.81	97.8-173.9	2	61.20	4.95	57.7-64.7	5	97.66	46.12	57.7-173.9
	All Inner Bay Samples	All Gear Types	All Times	12	159.30	110.78	64.2-391.6	8	89.25	39.80	48.6-153.9	25	121.03	87.32	48.6-391.6
	Outer Bay	Gillnet - floating	Day					1	465.50			1	465.50		
			Night	1	80.80			7	167.73	74.22	71.7-284.5	8	156.86	75.27	71.7-284.5
		Gillnet - sinking	Day												
			Night	1	543.20							1	543.20		
	All Outer Bay Samples	All Gear Types	All Times	2	312.00	326.97	80.8-543.2	8	204.95	125.72	71.7-465.5	10	226.36	161.89	71.7-543.2
	All Wells Creek Bay Samples	All Gear Types	All Times	14	181.11	147.25	64.2-543.2	16	147.10	108.10	48.6-465.5	35	151.12	121.04	48.6-543.2
Submerged Lake Basin		Gillnet - floating	Day	2	196.55	27.65	177.0-216.1	4	204.93	13.23	187.8-218.2	6	202.13	16.63	177.0-218.8
			Night	4	292.35	108.35	189.9-438.8	5	121.00	66.62	49.7-223.4	9	197.16	121.56	49.7-438.8
		Gillnet - sinking	Day					1	304.50			1	304.50		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	260.42	98.20	177.0-438.8	10	172.92	76.86	49.7-304.5	16	205.73	93.13	49.7-438.8
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									1	125.00		
		Gillnet	Day	2	125.35	50.98	89.3-161.4	1	87.20			3	112.63	42.25	87.2-161.4
			Night	2	102.05	40.23	73.6-130.5	6	80.27	26.37	46.4-112.2	8	85.71	28.81	46.4-130.5
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	86.57	38.24	48.5-154.2	5	106.92	42.65	48.7-166.0	11	95.82	39.65	48.5-166.0
			Night					3	79.93	39.05	54.6-124.9	3	79.93	39.05	54.6-129.9
	All Inner Bay Samples	All Gear Types	All Times	10	97.42	39.21	48.5-161.4	15	89.55	33.92	46.4-166.0	26	93.94	35.40	46.4-166.0
	Outer Bay	Gillnet - floating	Day	4	388.88	83.25	276.2-476.0	3	351.90	97.21	241.6-425.1	7	373.03	83.70	241.6-476.0
			Night	4	367.48	58.98	297.7-441.4	3	153.73	82.57	63.3-225.1	7	275.87	130.63	63.3-441.1
		Gillnet - sinking	Day	1	447.60			2	154.20	20.93	139.4-169.0	3	252.00	170.04	139.4-447.6
			Night	1	295.00			2	217.70	26.16	199.2-236.2	3	243.47	48.31	199.2-295.0
	All Outer Bay Samples	All Gear Types	All Times	10	376.80	69.81	276.2-476.0	10	226.07	109.20	63.3-425.1	20	301.44	118.05	63.3-476.0
	All Andrews Bay Samples	All Gear Types	All Times	20	237.11	153.55	48.5-476.0	25	144.16	99.01	46.4-425.1	46	184.15	131.89	46.4-476.0
All Areas	All Locations	All Gear Types	All Times	40	221.01	144.55	48.5-543.2	51	150.72	96.95	46.4-465.5	97	175.79	122.89	46.4-543.2

Note: Combined sex numbers include fish captured but not sexed.

Table 4.3.4 Mean ages for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night									2	1.0	0.0	1-1
		Gillnet	Day	6	2.5	1.2	2-5	3	1.7	0.6	1-2	9	2.2	1.1	1-5
			Night	3	3.3	0.6	3-4	3	2.0	1.0	1-3	7	2.6	1.0	1-4
	Inner Bay 2	Gillnet	Day												
			Night	2	2.5	0.7	2-3	2	2.0	0.0	2-2	5	2.2	0.4	2-3
	All Inner Bay Samples	All Gear Types	All Times	11	2.7	1.0	2-5	8	1.9	0.6	1-3	23	2.2	1.0	1-5
	Outer Bay	Gillnet - floating	Day					1	5.0			1	5.0		
			Night	1	1.0			7	2.7	0.5	2-3	8	2.5	0.8	1-3
		Gillnet - sinking	Day												
			Night	1	4.0							1	4.0		
	All Outer Bay Samples	All Gear Types	All Times	2	2.5	2.1	1-4	8	3.0	0.9	2-5	10	2.9	1.1	1-5
	All Wells Creek Bay Samples	All Gear Types	All Times	13	2.7	1.1	1-5	16	2.4	1.0	1-5	33	2.4	1.0	1-5
Submerged Lake Basin		Gillnet - floating	Day	2	2.5	0.7	2-3	4	2.8	0.5	2-3	6	2.7	0.5	2-3
			Night	4	3.5	0.6	3-4	5	2.2	0.4	2-3	9	2.8	0.8	2-4
		Gillnet - sinking	Day					1	3.0			1	3.0		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	3.2	0.8	2-4	10	2.5	0.5	2-3	16	2.8	0.7	2-4
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									1	3.0		
		Gillnet	Day	2	3.0	1.4	2-4	1	3.0			3	3.0	1.0	2-4
			Night	2	2.0	0.0	2-2	6	2.3	0.8	2-4	8	2.3	0.7	2-4
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	2.0	0.6	1-3	4	2.0	0.8	1-3	10	2.0	0.7	1-3
			Night					3	1.3	0.6	1-2	3	1.3	0.6	1-2
	All Inner Bay Samples	All Gear Types	All Times	10	2.2	0.8	1-4	14	2.1	0.8	1-4	25	2.2	0.8	1-4
	Outer Bay	Gillnet - floating	Day	3	4.0	1.0	3-5	3	4.7	0.6	4-5	6	4.3	0.8	3-5
			Night	4	4.3	1.3	3-6	3	3.0	1.0	2-4	7	3.7	1.3	2-6
		Gillnet - sinking	Day	1	4.0			2	2.0	0.0	2-2	3	2.7	1.2	2-4
			Night	1	3.0			2	3.0	0.0	3-3	3	3.0	0.0	3-3
	All Outer Bay Samples	All Gear Types	All Times	9	4.0	1.0	3-6	10	3.3	1.2	2-5	19	3.6	1.1	2-6
	All Andrews Bay Samples	All Gear Types	All Times	19	3.1	1.3	1-6	24	2.6	1.1	1-5	44	2.8	1.2	1-6
All Areas	All Locations	All Gear Types	All Times	38	2.9	1.1	1-6	50	2.5	1.0	1-5	93	2.7	1.1	1-6

Table 4.3.5 Estimated stream residency of rainbow trout captured in Andrews Bay and Wells Creek Bay, 1996.

Location	Age (years)	Years of Stream Residency			
		1 year	**2 years**	**3 years**	**4 years**
Andrews Bay	1	2	-	-	-
	2	3	8	-	-
	3	1	12	2	-
	4	-	4	2	1
	5	-	2	-	-
	6	-	1	-	-
Wells Creek Bay	1	3	1	-	-
	2	2	16	-	-
	3	3	7	1	-
	4	1	1	-	-
	5	1	1	-	-
TOTALS		**16**	**53**	**5**	**1**

These data suggest most rainbow trout migrated into the lake after one or two years of stream residency (mean = 2.0; SD = 0.6); only one fish was found to be resident in streams for four years.

4.3.2.4 Length and Weight at Age

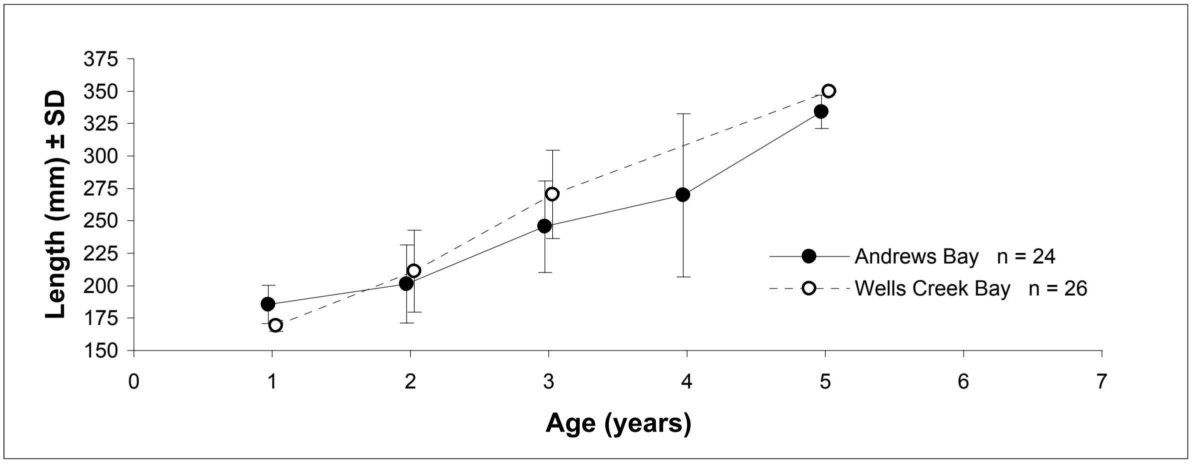
Rainbow trout lengths at different ages are summarized in Figure 4.3.2; weights at different ages are summarized in Figure 4.3.3. These size-at-age data indicate slow growth compared to locations elsewhere (Larkin *et al.* 1956; Scott and Crossman 1973).

4.3.4.5 Length-Weight Relationship

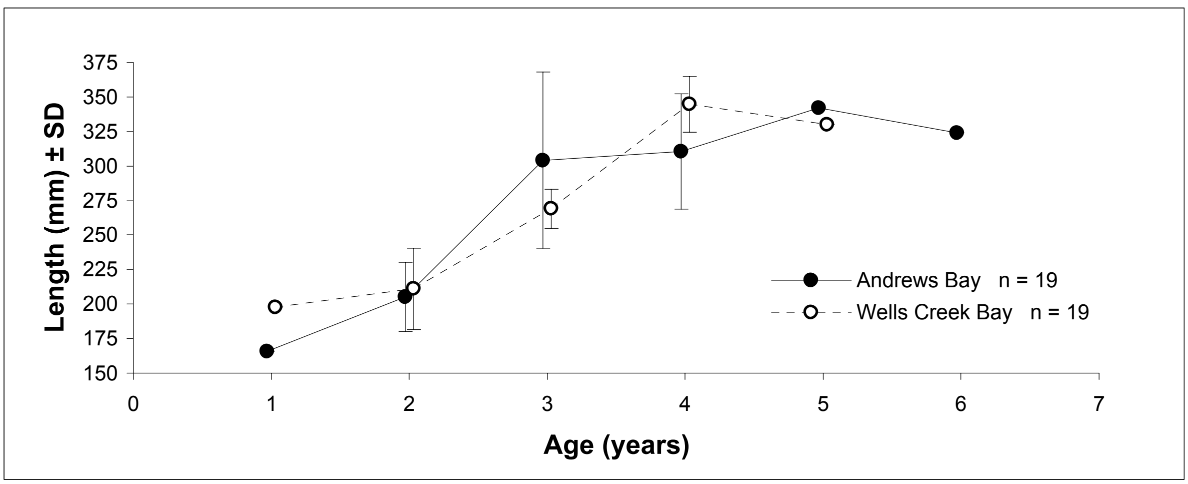
Figure 4.3.4 illustrates length versus weight for rainbow trout for all catch locations. Rainbow trout weight-at-length relation is comparable among catch locations.

Figure 4.3.2 **Mean length at age for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

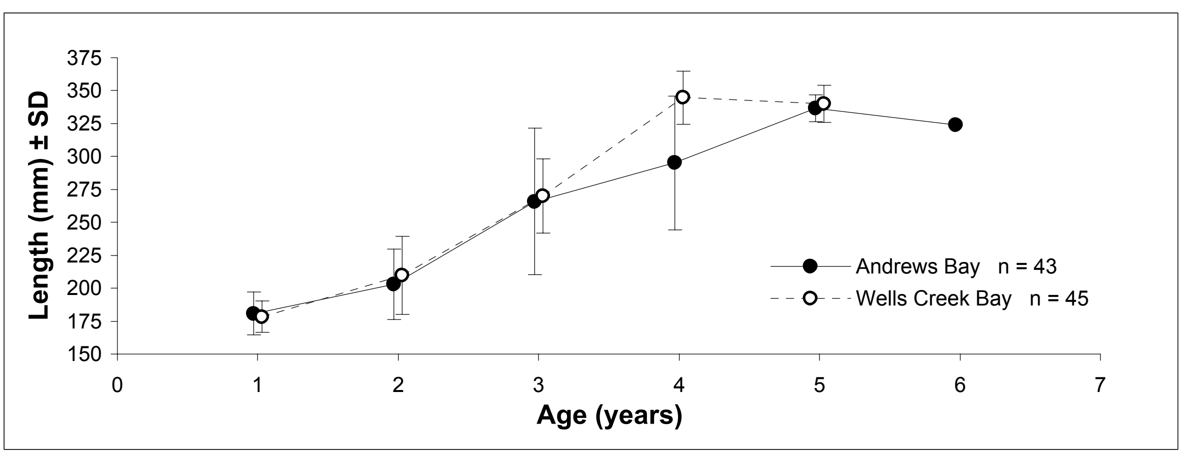
A. Female



B. Male



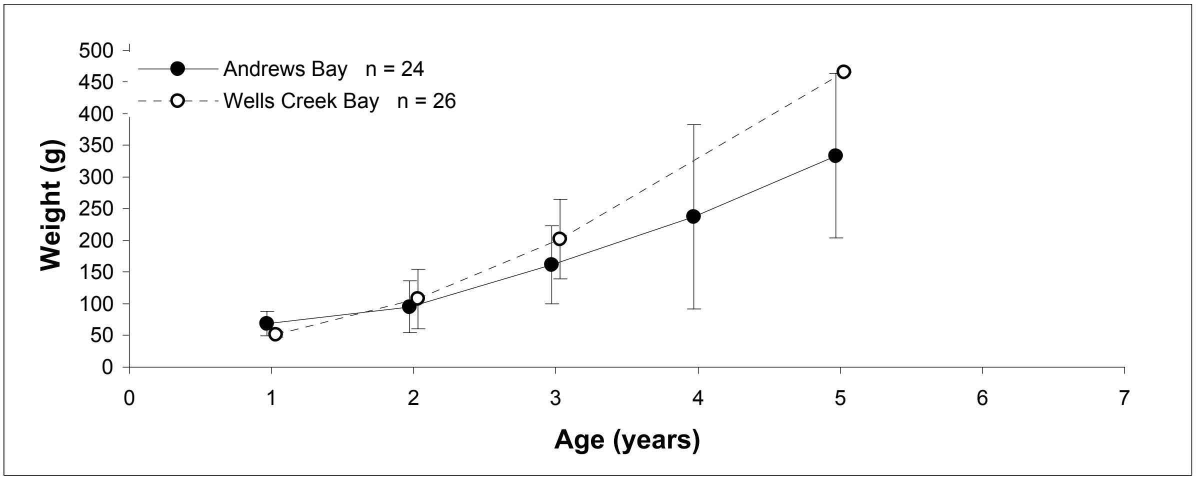
C. Combined Sex



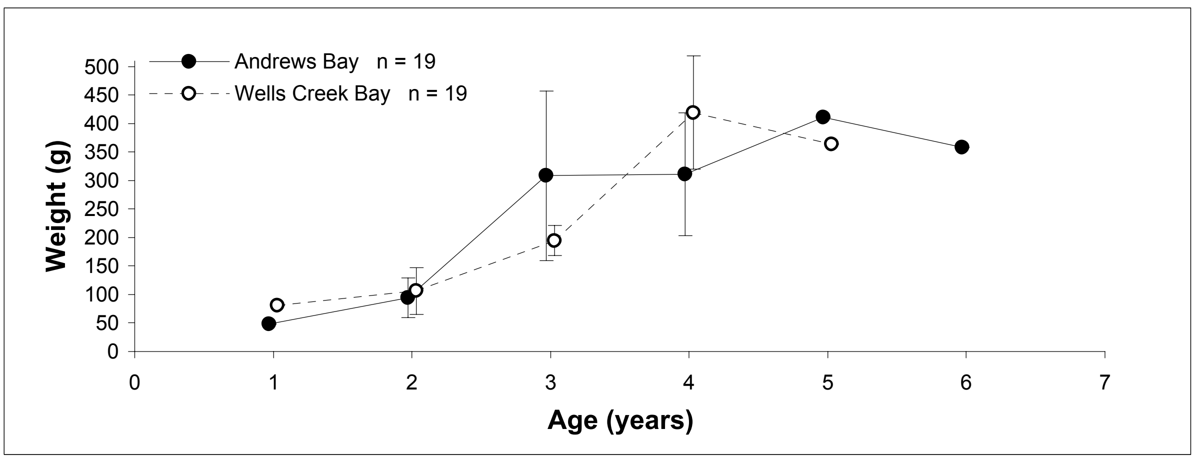
Note: Wells Creek Bay values include submerged lake basin dat

Figure 4.3.3 **Mean weight at age for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

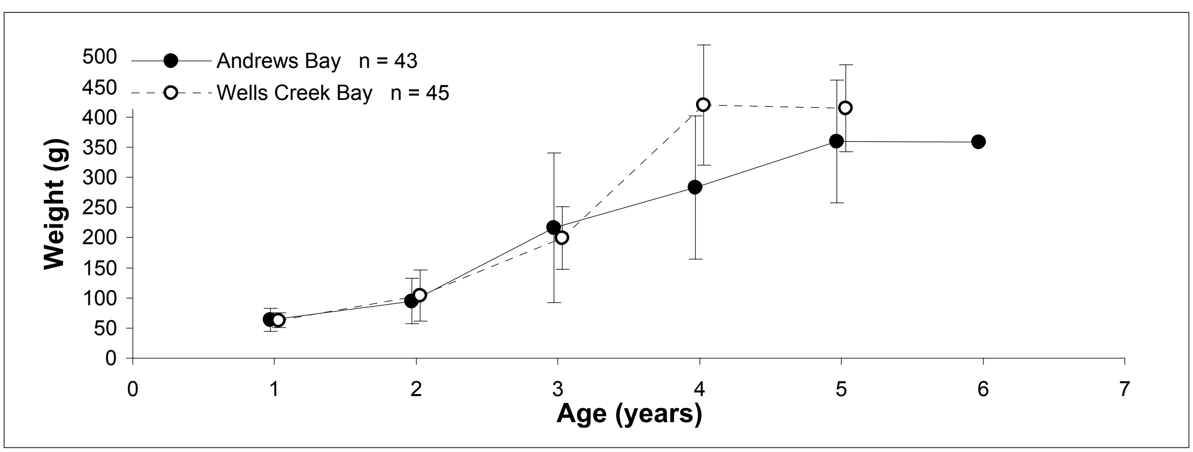
A. Female



B. Male



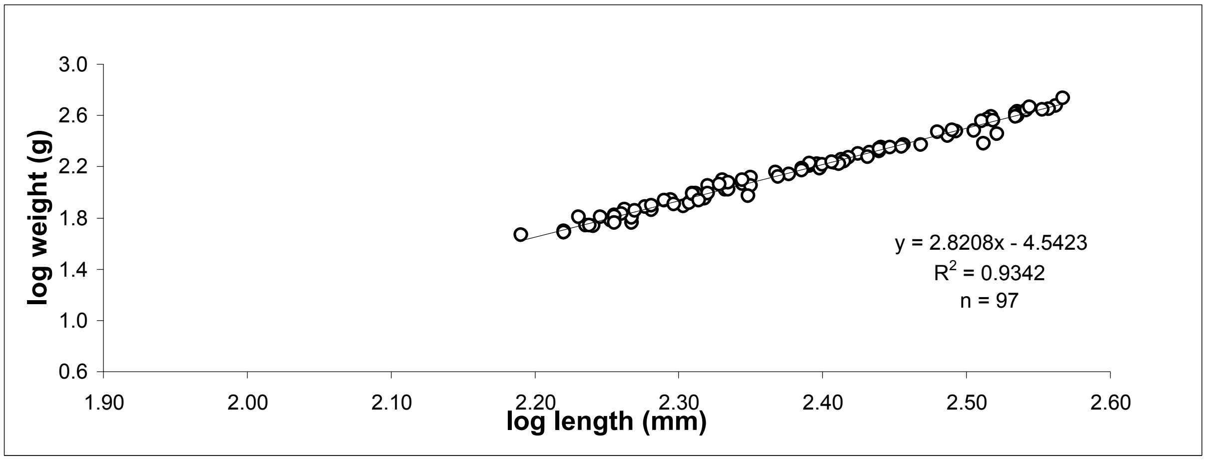
C. Combined Sex



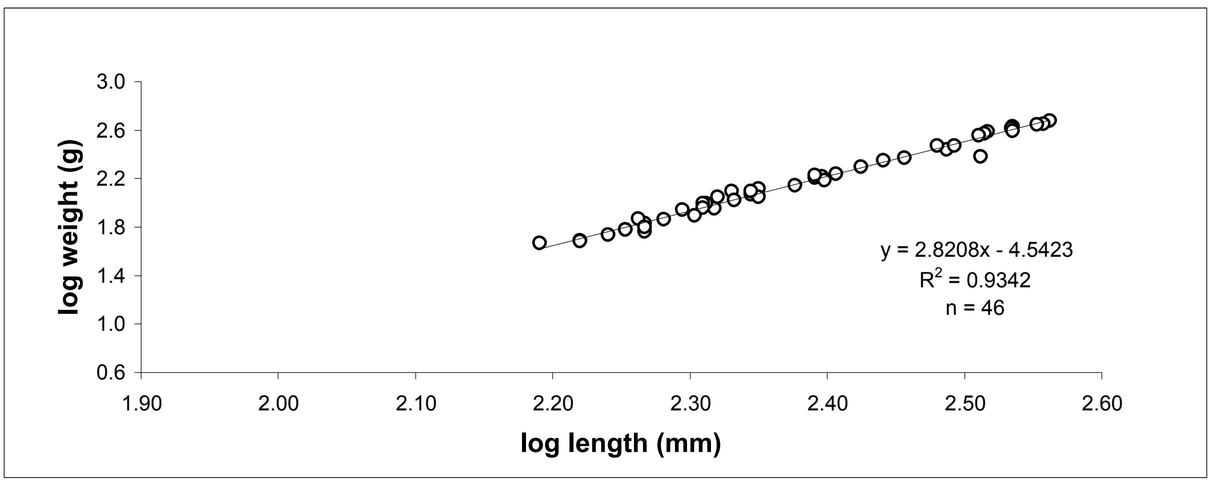
Note: Wells Creek Bay values include submerged lake basin dat

Figure 4.3.4 **Length-weight regressions for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

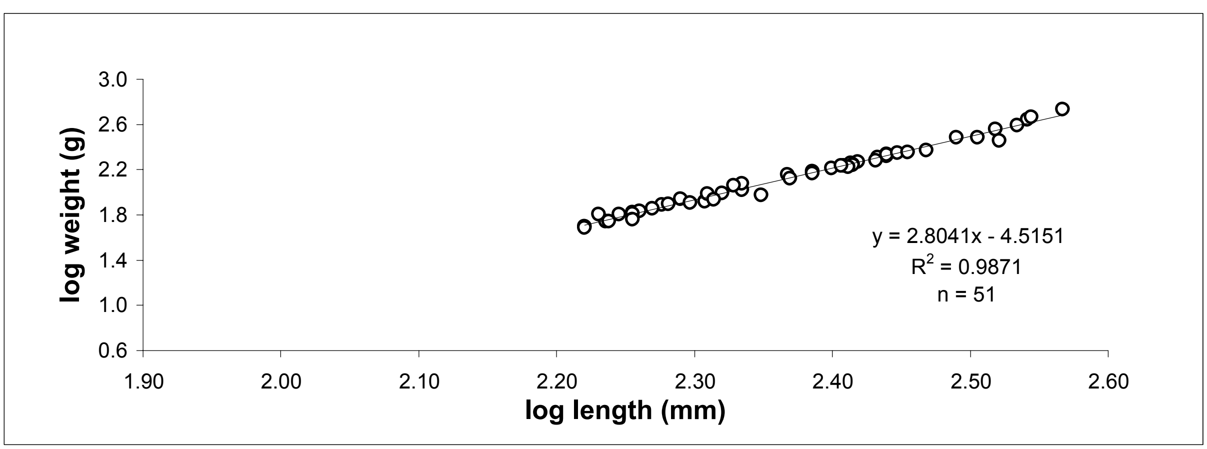
A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin



4.3.3 Maturity/Reproductive Status

4.3.3.1 Maturity/Gonad Development

Mean maturities of rainbow trout captured from all lake sample sites are summarized in Table 4.3.6. Since rainbow trout spawn over spring/early summer, no gonads were approaching ripeness. Mean maturity for Wells Creek Bay inner bay trout was 1.1 (n=12) for males and 1.0 (n=8) for females. Wells Creek Bay outer bay fish averaged 1.0 (n=2) for males and 2.3 (n=8) for females. Maturity of fish from the submerged lake basin averaged 1.3 (n=6) for males and 1.1 (n=10) for females. Gonad development was similar for rainbow trout captured in Andrews Bay inner bay relative to trout captured in the outer bay. Inner bay males averaged 1.8 (n=10) and females averaged 1.0 (n=15). Outer bay averages were 1.3 (n=10) for males and 1.1 (n=10) for females. Overall, fish collected from the submerged lake basin exhibited a state of gonad development (1.2) the same as fish collected from Andrews Bay outer bay (1.2) and Wells Creek Bay outer bay (1.2).

4.3.3.2 Age at Maturity

Mean age-at-maturity for rainbow trout captured in Ootsa Lake sample locations is summarized in Figure 4.3.5. Gonads were generally well developed by ages 3 to 4 for both males and females.

4.3.3.3 Gonad Weight

Mean gonad weights of rainbow trout captured from all lake sample sites are summarized in Table 4.3.7. Gonad weights vary with stage of maturity of gonads. The wide range of gonad weights and small sample sizes at some locations limit comparison among sites. In general, male gonads weighed more than female gonads. The heaviest male gonads were observed in male trout from Andrews Bay outer bay; ten male gonads averaged 8.49 g; the second highest mean gonad weight occurred in male fish from the submerged lake basin (4.55 g). The heaviest female gonads also were observed in trout from Andrews Bay outer bay (mean: 2.71 g); the second highest mean weight was observed for fish from Wells Creek Bay outer bay (mean: 2.44 g).

4.3.3.4 GSI

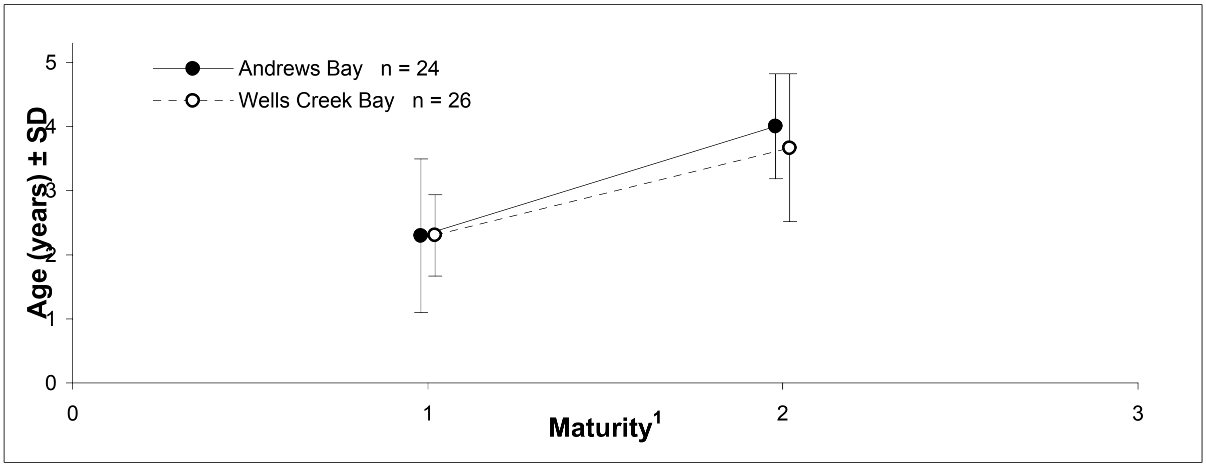
Mean gonadosomatic indices (GSI) of rainbow trout captured from all lake sample sites are summarized in Table 4.3.8. GSI values are highly variable reflecting the large range of gonad weights and small sample sizes. GSI values were highest for rainbow trout captured in Andrews Bay (means: 1.68 for males and 0.73 for females). Similar patterns in GSI were noted relative to gonad weight and maturity.

Table 4.3.6 Mean maturities for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

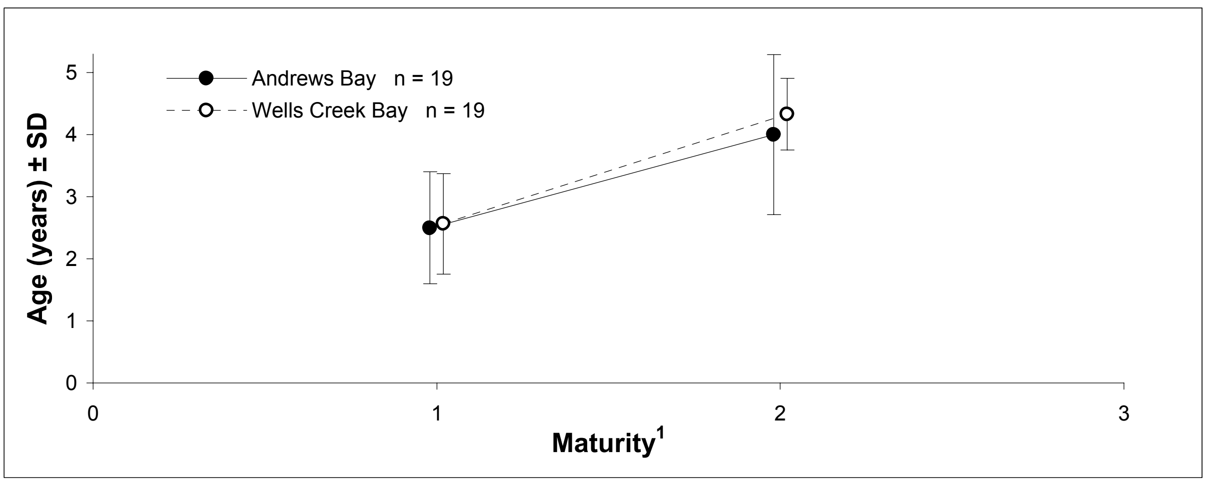
General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day	6	1.2	0.4	1-2	3	1.0	0.0	1-1	9	1.1	0.3	1-2
			Night	4	1.0	0.0	1-1	3	1.0	0.0	1-1	7	1.0	0.0	1-1
	Inner Bay 2	Gillnet	Day												
			Night	2	1.0	0.0	1-1	2	1.0	0.0	1-1	5	1.0	0.0	1-1
	All Inner Bay Samples	All Gear Types	All Times	12	1.1	0.3	1-2	8	1.0	0.0	1-1	21	1.0	0.2	1-2
	Outer Bay	Gillnet - floating	Day					1	2.0			1	2.0		
			Night	1	1.0			7	1.1	0.4	1-2	8	1.1	0.4	1-2
		Gillnet - sinking	Day												
			Night	1	1.0							1	1.0		
	All Outer Bay Samples	All Gear Types	All Times	2	1.0	0.0	1-1	8	1.3	0.5	1-2	10	1.2	0.4	1-2
	All Wells Creek Bay Samples	All Gear Types	All Times	14	1.1	0.3	1-2	16	1.1	0.3	1-2	31	1.1	0.3	1-2
Submerged Lake Basin		Gillnet - floating	Day	2	1.0	0.0	1-1	4	1.3	0.5	1-2	6	1.2	0.4	1-2
			Night	4	1.5	0.6	1-2	5	1.0	0.0	1-1	9	1.2	0.4	1-2
		Gillnet - sinking	Day					1	1.0			1	1.0		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	1.3	0.5	1-2	10	1.1	0.3	1-2	16	1.2	0.4	1-2
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									0	0.0		
		Gillnet	Day	2	1.5	0.7	1-2	1	1.0			3	1.3	0.6	1-2
			Night	2	1.5	0.7	1-2	6	1.2	0.4	1-2	8	1.3	0.5	1-2
	Inner Bay 2	Electrofishing	Day	6	1.0	0.0	1-1	5	1.0	0.0	1-1	11	1.0	0.0	1-1
			Night					3	1.0	0.0	1-1	3	1.0	0.0	1-1
		Gillnet	Day	10	1.2	0.4	1-2	15	1.1	0.3	1-2	25	1.1	0.3	1-2
			Night	4	1.5	0.6	1-2	3	1.7	0.6	1-2	7	1.6	0.5	1-2
	All Inner Bay Samples	All Gear Types	All Times	4	1.8	0.5	1-2	3	1.0	0.0	1-1	7	1.4	0.5	1-2
	Outer Bay	Gillnet - floating	Day	1	2.0			2	1.0	0.0	1-1	3	1.3	0.6	1-2
			Night	1	1.0			2	1.5	0.7	1-2	3	1.3	0.6	1-2
		Gillnet - sinking	Day	10	1.6	0.5	1-2	10	1.3	0.5	1-2	20	1.5	0.5	1-2
			Night	20	1.4	0.5	1-2	25	1.2	0.4	1-2	45	1.3	0.4	1-2
	All Outer Bay Samples	All Gear Types	All Times	40	1.3	0.5	1-2	51	1.1	0.3	1-2	92	1.2	0.4	1-2
	All Andrews Bay Samples	All Gear Types	All Times	20	2.3	1.5	1-2	25	1.8	0.8	1-2	45	2.0	1.2	1-2
All Areas	All Locations	All Gear Types	All Times	40	1.9	1.3	1-2	51	1.9	0.7	1-2	91	1.9	1.0	1-2

Figure 4.3.5 **Mean age at maturity for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

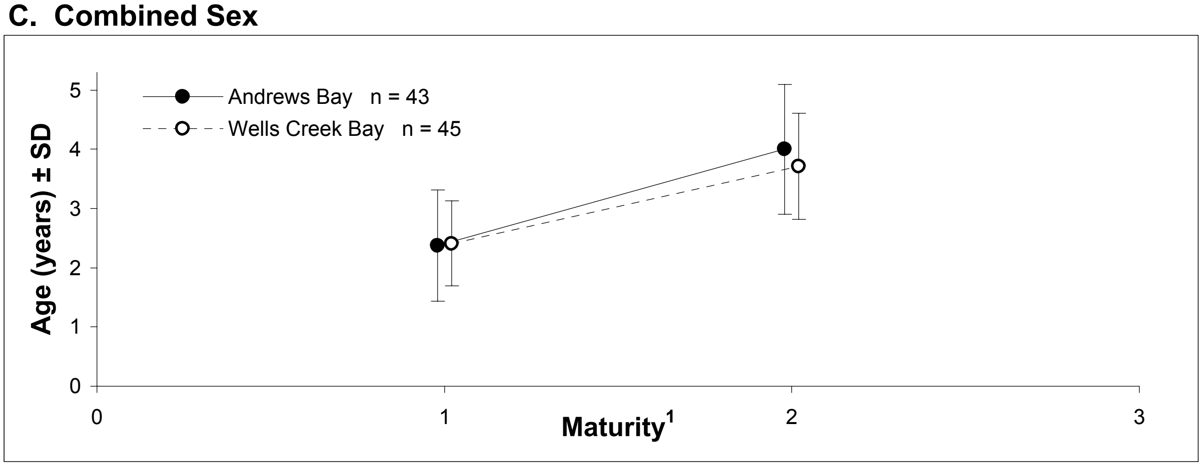
A. Female



B. Male



C. Combined Sex



[1] 1 = Immature; 2 = Maturing; 3= Mature; 4 = Spawning; 5 = Spent; 6= Resting

Note: Wells Creek Bay values include submerged lake basin data.

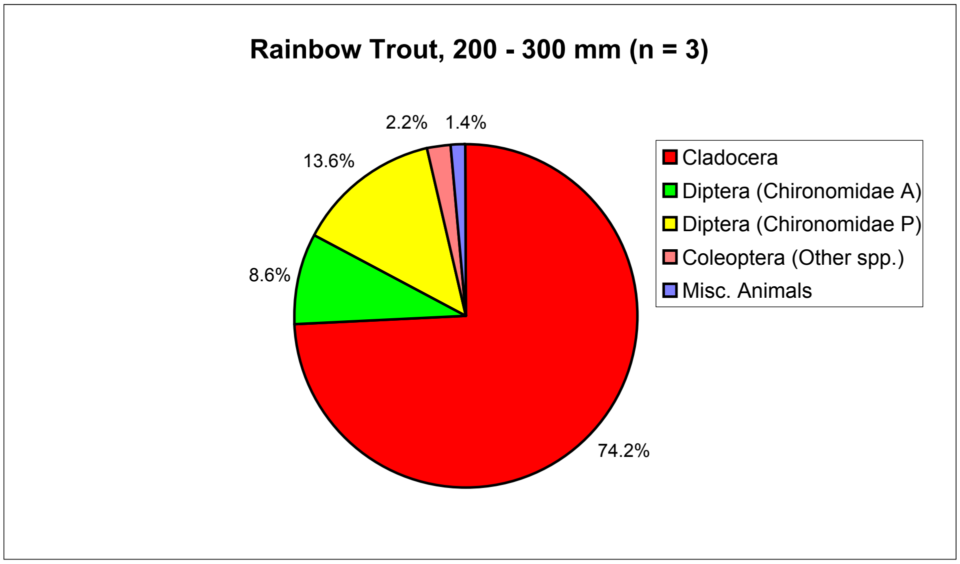
Table 4.3.7 Mean gonad weights (g) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day	6	2.27	5.31	0.1-13.1	3	0.20	0.10	0.1-0.3
			Night	4	0.10	0.00	0.1-0.1	3	0.23	0.06	0.2-0.3
	Inner Bay 2	Gillnet	Day								
			Night	2	0.20	0.14	0.1-0.3	2	0.20	0.00	0.2-0.2
	All Inner Bay Samples	All Gear Types	All Times	12	1.20	3.75	0.1-13.1	8	0.21	0.06	0.1-0.3
	Outer Bay	Gillnet - floating	Day					1	13.10		
			Night	1	0.10			7	0.91	1.00	0.2-2.9
		Gillnet - sinking	Day								
			Night	1	0.20						
	All Outer Bay Samples	All Gear Types	All Times	2	0.15	0.07	0.1-0.2	8	2.44	4.41	0.2-13.1
	All Wells Creek Bay Samples	All Gear Types	All Times	14	1.05	3.47	0.1-13.1	16	1.33	3.22	0.1-13.1
Submerged Lake Basin		Gillnet - floating	Day	2	0.10	0.00	0.1	4	1.75	2.64	0.3-5.7
			Night	4	6.78	8.49	0.1-17.9	5	0.34	0.15	0.2-0.6
		Gillnet - sinking	Day					1	1.20		
			Night								
	All Submerged Lake Samples	All Gear Types	All Times	6	4.55	7.42	0.1-17.9	10	0.99	1.68	0.2-5.7
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day	2	2.10	2.83	0.1-4.1	1	0.20		
			Night	2	3.65	4.74	0.3-7.0	6	1.32	2.78	0.1-7.0
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day	6	0.10	0.00	0.1	5	0.16	0.09	0.1-0.3
			Night					3	0.17	0.12	0.1-0.3
	All Inner Bay Samples	All Gear Types	All Times	10	1.21	2.39	0.1-7.0	15	0.63	1.76	0.1-7.0
	Outer Bay	Gillnet - floating	Day	4	8.45	9.73	0.1-18.4	3	7.07	6.05	0.1-11.0
			Night	4	8.95	6.12	0.1-14.1	3	0.43	0.06	0.4-0.5
		Gillnet - sinking	Day	1	15.20			2	0.10	0.00	0.1
			Night	1	0.10			2	2.20	2.83	0.2-4.2
	All Outer Bay Samples	All Gear Types	All Times	10	8.49	7.55	0.1-18.4	10	2.71	4.32	0.1-11.0
	All Andrews Bay Samples	All Gear Types	All Times	20	4.85	6.60	0.1-18.4	25	1.46	3.15	0.1-11.0
All Areas	All Locations	All Gear Types	All Times	40	3.48	5.97	0.1-18.4	51	1.33	2.90	0.1-13.1

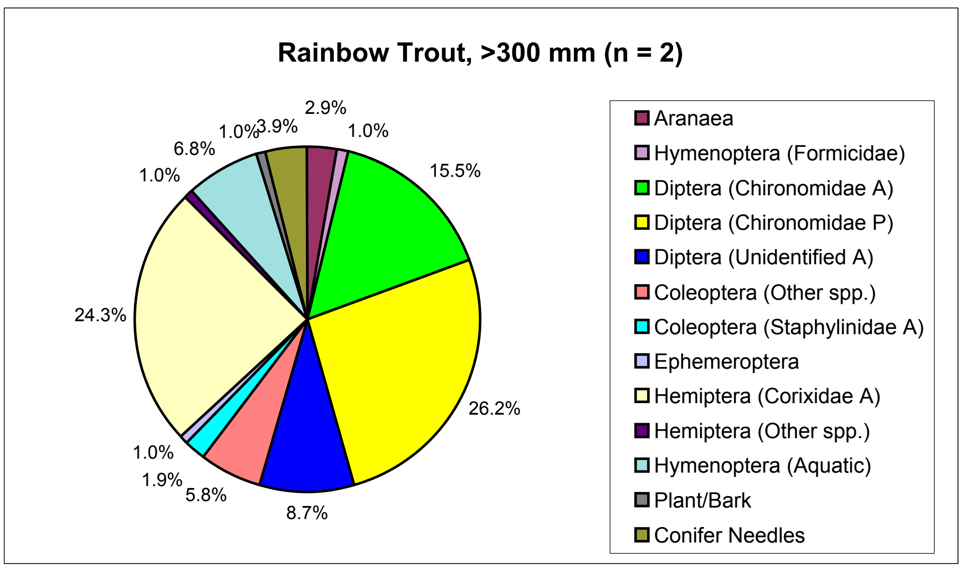
Table 4.3.8 Mean gonadosomatic indices (GSI) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day	6	0.70	1.42	0.07-3.60	3	0.19	0.02	0.17-0.21
			Night	4	0.07	0.06	0.03-0.16	3	0.27	0.08	0.23-0.36
	Inner Bay 2	Gillnet	Day								
			Night	2	0.18	0.18	0.06-0.31	2	0.33	0.03	0.31-0.35
	All Inner Bay Samples	All Gear Types	All Times	12	0.40	1.01	0.03-3.60	8	0.26	0.07	0.17-0.36
	Outer Bay	Gillnet - floating	Day					1	2.81		
			Night	1	0.12			7	0.73	1.16	0.12-3.35
		Gillnet - sinking	Day								
			Night	1	0.04						
	All Outer Bay Samples	All Gear Types	All Times	2	0.08	0.06	0.04-0.12	8	0.99	1.31	0.12-3.35
	All Wells Creek Bay Samples	All Gear Types	All Times	14	0.36	0.94	0.03-3.60	16	0.62	0.97	0.12-3.35
Submerged Lake Basin		Gillnet - floating	Day	2	0.05	0.01	0.05-0.06	4	0.81	1.19	0.15-2.61
			Night	4	1.79	2.04	0.05-4.08	5	0.31	0.08	0.21-0.40
		Gillnet - sinking	Day					1	0.39		
			Night								
	All Submerged Lake Samples	All Gear Types	All Times	6	1.21	1.81	0.05-4.08	10	0.52	0.74	0.15-2.61
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day	2	1.33	1.72	0.11-2.54	1	0.23		
			Night	2	4.87	6.56	0.23-9.51	6	1.39	2.80	0.18-7.11
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day	6	0.13	0.05	0.06-0.21	5	0.15	0.05	0.09-0.21
			Night					3	0.20	0.04	0.17-0.24
	All Inner Bay Samples	All Gear Types	All Times	10	1.32	2.98	0.06-9.51	15	0.66	1.78	0.09-7.11
	Outer Bay	Gillnet - floating	Day	4	1.91	2.17	0.03-3.87	3	1.75	1.50	0.04-2.83
			Night	4	2.33	1.64	0.03-3.79	3	0.36	0.23	0.22-0.63
		Gillnet - sinking	Day	1	3.40			2	0.07	0.01	0.06-0.07
			Night	1	0.03			2	0.94	1.19	0.10-1.78
	All Outer Bay Samples	All Gear Types	All Times	10	2.04	1.78	0.03-3.87	10	0.83	1.07	0.04-2.83
	All Andrews Bay Samples	All Gear Types	All Times	20	1.68	2.41	0.03-9.51	25	0.73	1.52	0.04-7.11
All Areas	All Locations	All Gear Types	All Times	40	1.14	1.98	0.03-9.51	51	0.65	1.22	0.04-7.11

Figure 4.3.8 Stomach content as percentage of total food items consumed by rainbow trout, submerged lake basin, September/October 1996.



Misc. Animal	(1.4%)
Acarina	0.1
Aranaea	0.1
Hymenoptera (Formicidae)	0.1
Copepoda	0.1
Hemiptera (Corixidae A)	0.4
Hymenoptera (Aquatic)	0.3
Gastropoda	0.1



4.3.4 Fish Condition

4.3.4.1 Condition Factor

Mean condition factors of rainbow trout captured from all lake sample sites are summarized in Table 4.3.9. Mean condition factors were similar among the main sample areas, ranging from 1.02 for fish collected from the submerged lake basin to 1.06 for both the nearby Wells Creek Bay area and the Andrews Bay area. In most cases (except both outer bay locations), female condition was slightly higher relative to male condition. The lowest condition factor for individual male fish was observed at the submerged lake basin (0.93); the highest was found at Wells Creek Bay inner bay (1.31). For individual female fish, the lowest condition factor occurred at Andrews Bay outer bay (0.70), the highest at Andrews Bay inner bay (1.25).

4.3.4.2 Liver Weight and Hepatosomatic Index

Mean liver weights of rainbow trout captured from all lake sample sites are summarized in Table 4.3.10. Mean hepatosomatic (liver somatic) indices (HSI) of rainbow trout captured from all lake sample sites are summarized in Table 4.3.11. Mean liver weights followed patterns of mean fish weight; smaller fish had smaller livers. Lowest liver weights were obtained from Andrews Bay inner bay: males averaged 1.16 g (n=10), females averaged 0.87 g (n=15). Livers of Andrews Bay outer bay fish were heaviest among all sample locations collected from Ootsa Lake; livers from males averaged 3.73 g (n=10) and females 2.38 g (n=10).

Mean HSI from all sites was similar, ranging from 0.95% (Andrews Bay outer bay females) to 1.16% (Andrews Bay inner bay males). The lowest individual HSI values were observed for one male and two female rainbow trout captured at Andrews Bay outer bay (0.38% to 0.45%).

4.3.5 Diet

4.3.5.1 Content

A total of 39 rainbow trout stomachs (non-empty) were analyzed for contents. Detailed taxonomic lists of food items for each fish are included in Tables A7.1 to A7.5, Appendix A7. Summary data using averages of rainbow trout by site and size are discussed in a following section.

Rainbow trout captured from sites in the Nechako Reservoir exhibited varying levels of stomach fullness, ranging from 0% to 88% full. Different levels of fullness were observed at all sites, indicating sufficient food supply but different feeding patterns or the loss of stomach contents upon capture. Most fish stomachs analyzed were from fish captured during night sets of gillnets; however, nine fish from Wells Creek Bay inner bay and one fish from Wells Creek Bay outer bay were collected during day sets.

Table 4.3.9 Mean condition factors (K) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night									3	1.17	0.03	1.14-1.19
		Gillnet	Day	6	1.10	0.06	1.01-1.15	3	1.11	0.07	1.06-1.19	9	1.10	0.06	1.01-1.19
			Night	4	1.09	0.15	0.98-1.31	3	1.09	0.07	1.03-1.17	8	1.09	0.11	0.98-1.31
	Inner Bay 2	Gillnet	Day												
			Night	2	1.03	0.06	0.99-1.07	2	1.05	0.08	180-180	5	1.00	0.10	0.85-1.11
	All Inner Bay Samples	All Gear Types	All Times	12	1.08	0.09	0.98-1.31	8	1.09	0.07	0.99-1.19	25	1.09	0.09	0.85-1.31
	Outer Bay	Gillnet - floating	Day					1	1.09			1	1.09		
			Night	1	1.04			7	0.99	0.10	0.78-1.11	8	0.99	0.10	0.78-1.11
		Gillnet - sinking	Day												
			Night	1	1.08							1	1.08		
	All Outer Bay Samples	All Gear Types	All Times	2	1.06	0.03	1.04-1.08	8	1.00	0.10	0.78-1.11	10	1.01	0.09	0.78-1.11
	All Wells Creek Bay Samples	All Gear Types	All Times	14	1.08	0.09	0.98-1.31	16	1.04	0.10	0.78-1.19	35	1.06	0.10	0.78-1.31
Submerged Lake Basin		Gillnet - floating	Day	2	1.02	0.02	1.01-1.04	4	1.03	0.02	1.01-1.05	6	1.03	0.02	1.01-1.05
			Night	4	0.97	0.05	0.93-1.04	5	1.06	0.06	0.99-1.13	9	1.02	0.07	0.93-1.13
		Gillnet - sinking	Day					1	1.03			1	1.03		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	0.99	0.05	0.93-1.04	10	1.04	0.04	0.99-1.13	16	1.02	0.05	0.93-1.13
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									1	1.28		
		Gillnet	Day	2	1.04	0.06	0.99-1.08	1	1.14			3	1.07	0.07	0.99-1.14
			Night	2	1.18	0.03	1.16-1.20	6	1.13	0.12	0.92-1.25	8	1.14	0.11	0.92-1.25
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	1.03	0.04	0.96-1.06	5	1.06	0.03	1.00-1.08	11	1.04	0.04	0.96-1.08
			Night					3	1.08	0.07	1.04-1.16	3	1.08	0.07	1.04-1.16
	All Inner Bay Samples	All Gear Types	All Times	10	1.06	0.07	0.96-1.20	15	1.10	0.09	0.92-1.25	26	1.09	0.09	0.92-1.28
	Outer Bay	Gillnet - floating	Day	4	0.98	0.03	0.95-1.03	3	0.95	0.21	0.70-1.09	7	0.97	0.13	0.70-1.09
			Night	4	1.02	0.05	0.97-1.06	3	1.04	0.04	1.00-1.07	7	1.03	0.04	0.97-1.07
		Gillnet - sinking	Day	1	0.95			2	1.08	0.07	1.03-1.14	3	1.04	0.09	0.95-1.14
			Night	1	1.07			2	1.03	0.03	1.01-1.06	3	1.05	0.03	1.01-1.07
	All Outer Bay Samples	All Gear Types	All Times	10	1.00	0.05	0.95-1.07	10	1.02	0.12	0.70-1.14	20	1.01	0.09	0.70-1.14
	All Andrews Bay Samples	All Gear Types	All Times	20	1.03	0.07	0.95-1.20	25	1.07	0.10	0.70-1.25	46	1.06	0.10	0.70-1.28
All Areas	All Locations	All Gear Types	All Times	40	1.04	0.08	0.93-1.31	51	1.05	0.09	0.70-1.25	97	1.05	0.09	0.70-1.31

Note: Combined sex numbers include fish captured but not sexed.

Table 4.3.10 Mean liver weights (g) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day	6	1.17	0.77	0.7-2.7	3	1.17	0.65	0.5-1.8	9	1.17	0.69	0.5-2.7
			Night	4	1.65	0.64	1.0-2.5	3	0.83	0.31	0.5-1.1	8	1.23	0.64	0.5-2.5
	Inner Bay 2	Gillnet	Day												
			Night	2	1.45	0.49	1.1-1.8	1	0.60			4	1.13	0.50	0.6-1.8
	All Inner Bay Samples	All Gear Types	All Times	12	1.38	0.67	0.7-2.7	7	0.94	0.47	0.5-1.8	21	1.18	0.61	0.5-2.7
	Outer Bay	Gillnet - floating	Day					1	4.60			1	4.60		
			Night	1	0.80			7	1.86	0.80	0.8-3.2	8	1.73	0.83	0.8-3.2
		Gillnet - sinking	Day												
			Night	1	4.70							1	4.70		
	All Outer Bay Samples	All Gear Types	All Times	2	2.75	2.76	0.8-4.7	8	2.20	1.22	0.8-4.6	10	2.31	1.43	0.8-4.7
	All Wells Creek Bay Samples	All Gear Types	All Times	14	1.57	1.10	0.7-4.7	15	1.61	1.12	0.5-4.6	31	1.55	1.07	0.5-4.7
Submerged Lake Basin		Gillnet - floating	Day	2	2.00	0.42	1.7-2.3	4	2.15	0.58	1.7-3.0	6	2.10	0.49	1.7-3.0
			Night	4	2.85	1.18	2.1-4.6	5	1.12	0.61	0.5-2.0	9	1.89	1.24	0.5-4.6
		Gillnet - sinking	Day					1	2.90			1	2.90		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	2.57	1.03	1.7-4.6	10	1.71	0.85	0.5-3.0	16	2.03	0.98	0.5-4.6
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night									0	0.00		
		Gillnet	Day	2	1.75	0.92	1.1-2.4	1	0.90			3	1.47	0.81	0.9-2.4
			Night	2	1.15	0.49	0.8-1.5	6	0.75	0.24	0.4-1.1	8	0.85	0.33	0.4-1.5
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	0.97	0.44	0.6-1.7	5	1.14	0.53	0.4-1.8	11	1.05	0.47	0.4-1.8
			Night					3	0.67	0.21	0.5-0.9	3	0.67	0.21	0.5-0.9
	All Inner Bay Samples	All Gear Types	All Times	10	1.16	0.58	0.6-2.4	15	0.87	0.38	0.4-1.8	25	0.99	0.48	0.4-2.4
	Outer Bay	Gillnet - floating	Day	4	3.75	0.70	2.7-4.2	3	4.77	1.46	3.1-5.8	7	4.19	1.12	2.7-5.8
			Night	4	4.20	1.38	3.0-6.1	3	1.50	1.20	0.3-2.7	7	3.04	1.87	0.3-6.1
		Gillnet - sinking	Day	1	2.00			2	1.65	0.35	1.4-1.9	3	1.77	0.32	1.4-2.0
			Night	1	3.50			2	0.85	0.07	0.8-0.9	3	1.73	1.53	0.8-3.5
	All Outer Bay Samples	All Gear Types	All Times	10	3.73	1.11	2.0-6.1	10	2.38	1.90	0.3-5.8	20	3.06	1.66	0.3-6.1
	All Andrews Bay Samples	All Gear Types	All Times	20	2.45	1.57	0.6-6.1	25	1.48	1.42	0.3-5.8	45	1.91	1.55	0.3-6.1
All Areas	All Locations	All Gear Types	All Times	40	2.16	1.39	0.6-6.1	50	1.56	1.22	0.3-5.8	92	1.81	1.32	0.3-6.1

Table 4.3.11 Mean hepatosomatic indices (HSI) for rainbow trout sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day	6	0.91	0.13	0.74-1.03	3	1.08	0.08	1.03-1.17	9	0.97	0.14	0.74-1.17
			Night	4	0.99	0.40	0.64-1.56	3	0.93	0.10	0.83-1.04	8	1.00	0.29	0.64-1.56
	Inner Bay 2	Gillnet	Day												
			Night	2	1.08	0.06	1.04-1.12	1	1.04			4	1.07	0.04	1.04-1.12
	All Inner Bay Samples	All Gear Types	All Times	12	0.97	0.24	0.64-1.56	7	1.01	0.11	0.83-1.17	21	1.00	0.20	0.64-1.56
	Outer Bay	Gillnet - floating	Day					1	0.99			1	0.99		
			Night	1	0.99			7	1.24	0.74	0.75-1.34	8	1.21	0.69	0.75-1.34
		Gillnet - sinking	Day												
			Night	1	0.87							1	0.87		
	All Outer Bay Samples	All Gear Types	All Times	2	0.93	0.09	0.87-0.99	8	1.21	0.69	0.75-1.34	10	1.15	0.62	0.75-1.34
	All Wells Creek Bay Samples	All Gear Types	All Times	14	0.96	0.22	0.64-1.56	15	1.12	0.50	0.75-1.34	31	1.05	0.38	0.64-1.56
Submerged Lake Basin		Gillnet - floating	Day	2	1.01	0.07	0.96-1.06	4	1.04	0.22	0.91-1.37	6	1.03	0.17	0.91-1.37
			Night	4	0.99	0.21	0.69-1.16	5	0.94	0.22	0.60-1.21	9	0.96	0.20	0.60-1.21
		Gillnet - sinking	Day					1	0.95			1	0.95		
			Night												
	All Submerged Lake Samples	All Gear Types	All Times	6	1.00	0.16	0.69-1.16	10	0.98	0.20	0.60-1.37	16	0.99	0.18	0.60-1.37
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day	2	1.36	0.18	1.23-1.49	1	1.03			3	1.25	0.23	1.03-1.49
			Night	2	1.12	0.04	1.09-1.15	6	0.94	0.13	0.80-1.12	8	0.99	0.14	0.80-1.15
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day	6	1.11	0.10	0.99-1.24	5	1.03	0.15	0.82-1.25	11	1.08	0.13	0.82-1.25
			Night					3	0.88	0.14	0.72-1.00	3	0.88	0.14	0.72-1.00
	All Inner Bay Samples	All Gear Types	All Times	10	1.16	0.14	0.99-1.49	15	0.97	0.14	0.72-1.25	25	1.05	0.17	0.72-1.49
	Outer Bay	Gillnet - floating	Day	4	0.97	0.10	0.84-1.07	3	1.35	0.06	1.28-1.39	7	1.13	0.21	0.84-1.39
			Night	4	1.14	0.33	0.95-1.64	3	0.85	0.36	0.47-1.20	7	1.02	0.35	0.47-1.64
		Gillnet - sinking	Day	1	0.45			2	1.06	0.08	1.00-1.12	3	0.86	0.36	0.45-1.12
			Night	1	1.19			2	0.39	0.01	0.38-0.40	3	0.66	0.46	0.38-1.19
	All Outer Bay Samples	All Gear Types	All Times	10	1.01	0.29	0.45-1.64	10	0.95	0.40	0.38-1.39	20	0.98	0.34	0.38-1.64
	All Andrews Bay Samples	All Gear Types	All Times	20	1.09	0.24	0.45-1.64	25	0.96	0.27	0.38-1.39	45	1.02	0.26	0.38-1.64
All Areas	All Locations	All Gear Types	All Times	40	1.03	0.23	0.45-1.64	50	0.98	0.22	0.38-1.39	92	1.01	0.22	0.38-1.64

Major food items in rainbow trout stomachs consisted of: Acarina (*Hydracarina* spp.; water mites), Cladocera (*Daphnia* spp. and *Eurycercus* [*Bullatifrons*] sp.; water fleas), Diptera (Chironomidae and others; true flies and midges), Coleoptera (beetles), and Hemiptera (true bugs). Other aquatic insects, copepods, and gastropods were consumed in small proportions (Table A7.1 to A7.5; Table 4.3.12 and 4.3.13). In addition, small amounts of bark and plant fragments, conifer needles, and large insect moults were found in trout stomachs.

Freshwater *Hydracarina* spp. are often bright red; many are active swimmers with long hairs on their legs (Barnes 1980). Larval forms are often parasitic on aquatic insects, such as dragonflies. Cladocera (i.e., *Daphnia* spp) are planktonic, and often migrate vertically during the day (i.e., upwards to surficial waters as darkness approaches; Wetzel 1975). Cladocera legs are used for filter feeding and swimming.

Chironomidae larvae are planktonic during early instar stages and settle to benthic substrates at later instar stages (Merritt and Cummins 1984). These larvae feed on detrital particles of all sizes. Food habits depend upon the size of particle consumed (i.e., coarse detrital particles of leaves and wood are consumed by shredders). Other Chironomidae species scrape algae, pierce vascular plants, or gather fungal spores and hyphae. Chironomids form pupa, which are hidden in debris of the substrate. At emergence, the pupa swims to the surface, where the adult emerges. Eggs are broadcast or laid on the surface of the water or emerging vegetation. Life histories of other Dipterans are similar to Chironomids in that larval and pupal forms are usually submerged, emerging to air-living adults (Merritt and Cummins 1984).

Coleoptera and Hemiptera comprise some taxa which are aquatic; however, most adults live near littoral zones in moist sediments or on vegetation. Larval Coleopterans often exist submerged along the substrate; some adults are efficient swimmers which need to return to the surface to renew their oxygen supply (Merritt and Cummins 1984). Some Hemiptera taxa are true water bugs, swimming underwater with a store of air; others are supported by surface tension on the water and "stride" on the surface of lentic waterbodies. Corixidae are agile swimmers, are good indicators of lentic water quality, and are associated with vascular hydrophytes (Merritt and Cummins 1984).

Two trout had consumed *Hydracarina* spp. (Acarina) in large quantities at time of capture (Tables A7.1 to A7.5). Three trout consumed predominantly *Daphnia* and other Cladocera species. Rainbow trout collected from all lake locations generally had consumed Chironomidae pupae and adults; larvae were seldom consumed. Other Dipteran adults were part of rainbow trout diets. Dipteran taxa consumed by trout included Tipulidae, Empidae, Muscidae, and unidentified adults.

Table 4.3.12 Mean number of organisms or items consumed by rainbow trout, by size category of fish; September/October 1996.

Parameters	Wells Creek Inner Bay			Wells Creek Outer Bay			Submerged Lake Basin		Andrews Bay Site 1		Andrews Bay Outer	
	<200 mm (n = 8)	200 - 300 mm (n = 7)	>300 mm (n = 2)	<200 mm (n = 1)	200 - 300 mm (n = 2)	>300 mm (n = 2)	200 - 300 mm (n = 3)	>300 mm (n = 2)	<200 mm (n = 2)	200 - 300 mm (n = 3)	200 - 300 mm (n = 3)	>300 mm (n = 5)
Fish Data												
Mean Fork Length (mm)	179.8	236.0	336.0	198	245.5	341.0	259.0	334.0	169.0	206.0	265.7	324.2
Mean Total Weight (g)	66.8	142.5	377.7	80.8	207.1	375.0	181.0	371.6	60.0	103.1	199.0	353.0
Mean Stomach Fullness (%)	70.9	64.3	36.0	83	42.5	5.5	50.0	13.0	25.0	50.0	35.0	55.6
Taxonomic Group (mean number of organisms/items)												
Acarina	0.1	15.3			183.5		0.3					
Aranaea	1.5	1.0	0.5	7	3.0		0.3	1.5		0.7		0.4
Hemiptera (Terrestrial)	0.3											
Hymenoptera (Formicidae)	2.5	2.9	0.5				0.3	0.5		0.3	0.3	0.4
Amphipoda		0.1				1.5						
Cladocera	13.3	48.3	0.5	95	63.5	14.0	177.3		150.0	0.3	0.3	1.4
Copepoda		0.3					0.3					
Diptera (Chironomidae A)	18.6	5.6	7.0	3	7.5		20.7	8.0	1.5	42.0	10.3	19.4
Diptera (Chironomidae P)	72.4	93.3	5.5	148	34.5	2.0	32.7	13.5	4.0	40.0	75.0	28
Diptera (Chironomidae L)		0.1								0.3		0.6
Diptera (Unidentified A)	12.8	5.9	12.0	3	2.5			4.5	1.0	6.3	2.0	22.8
Diptera (Unidentified L)	0.6	0.1	0.5							2.0		
Coleoptera (Other spp.)	5.1	3.9	4.0		3.5		5.3	3.0		0.3		0.2
Coleoptera (Staphylinidae A)	0.9	3.6	36.0	1				1.0				0.4
Ephemeroptera	0.1	0.3				0.5		0.5		0.7		0.4
Hemiptera (Corixidae A)	1.8	0.9	0.5		1.0	3.5	1.0	12.5		0.7	4.3	33.8
Hemiptera (Other spp.)	0.8	1.0	1.0	1				0.5		0.3		
Homoptera	0.4	0.3	0.5	1								
Hymenoptera (Aquatic)	8.9	4.7	3.5	3	2.5		0.7	3.5		1.0	1.3	4.4
Megaloptera	0.1	0.1										
Orthoptera												7.0
Trichoptera	3.3	1.1	0.5		2.0	0.5				1.3		0.2
Gastropoda	0.8	0.1		1	0.5	0.5	0.3			0.7		0.2
Nematoda		0.1										
Large Insect Moults										1.3		
Plant/Bark	0.6	0.3				0.5		0.5	0.5	0.3		0.2
Conifer Needles	0.4	1.1						2.0				
TOTAL	**145.0**	**190.4**	**72.5**	**263.0**	**304.0**	**23.0**	**239.3**	**51.5**	**157.0**	**98.6**	**93.7**	**119.8**

A = adult, P = pupa, L = larva, unid. = unidentified.

Table 4.3.13 Occurrence of various taxa in rainbow trout stomachs, by size category of fish; September/October 1996.

Taxonomic Group	Wells Creek Inner Bay			Wells Creek Outer Bay			Submerged Lake Basin		Andrews Bay Site 1		Andrews Bay Outer	
	<200 mm (n = 8)	200 - 300 mm (n = 7)	>300 mm (n = 2)	<200 mm (n = 1)	200 - 300 mm (n = 2)	>300 mm (n = 2)	200 - 300 mm (n = 3)	>300 mm (n = 2)	<200 mm (n = 2)	200 - 300 mm (n = 3)	200 - 300 mm (n = 3)	>300 mm (n = 5)
Acarina	1	4			1		1					
Aranaea	6	5	1	1	1		1	1		2		1
Hemiptera (Terrestrial)	1											
Hymenoptera (Formicidae)	6	7	1				1	1		1	1	2
Amphipoda		1				1						
Cladocera	3	3	1	1	2	2	1		1	1	1	2
Copepoda		1					1					
Diptera (Chironomidae A)	4	4	2	1	1		3	1	1	2	3	5
Diptera (Chironomidae P)	8	7	2	1	1	2	3	2	1	3	3	4
Diptera (Chironomidae L)		1								1		1
Diptera (Unidentified A)	7	7	2	1	1			1	1	3	2	2
Diptera (Unidentified L)	1	1	1									
Coleoptera (Other spp.)	8	5	1		1		3	1				1
Coleoptera (Staphylinidae A)	4	2	1	1				1				2
Ephemeroptera	1	2				1		1		2		1
Hemiptera (Corixidae A)	4	4	1		1	1	2	1		2	3	2
Hemiptera (Other spp.)	3	4	1	1				1		1		
Homoptera	1	2	1	1								
Hymenoptera (Aquatic)	8	5	2	1	2		1	1		1	1	1
Megaloptera	1	1										
Orthoptera												2
Trichoptera	5	3	1		1	1				2		1
Gastropoda	3	2		1	1	1	1			1		1
Nematoda		1										
Large Insect Moults										2		
Plant/Bark	3	1				1		1	1	1		1
Conifer Needles	2	2						1				

A = adult, P = pupa, L = larva.

Other aquatic insects found in rainbow trout stomachs included Coleoptera (adult Elmidae and Staphylinidae, and Chrysomellidae). Elmidae are riffle beetles, found usually in lotic habitats, but may be associated with vascular hydrophytes (rooted vascular aquatic plants) in lentic habitats (Merritt and Cummins 1984). Staphylinidae (rove beetles) are generally found along shorelines and beaches and in littoral habitats; this taxon was the primary food for one trout from Wells Creek Inner Bay (Table A7.1).

Hemiptera (aquatic and semiaquatic bugs) are primarily represented by Corixidae (water boatman). Nymphs were consumed more often than adults by rainbow trout in all five areas of the reservoir. Other aquatic taxa consumed by rainbow trout include Homoptera (Aphididae and Cicadellidae), Hymenoptera (wasp-like parasites), and Trichoptera (caddis flies). These taxa may be associated with vascular plants along waterbody margins, parasites on aquatic insects (Hymenoptera: Ichneumonidae), or fastened to rocks or logs along the substrate as pupae and emerge to the surface as adults (Trichoptera).

Rainbow trout commonly eat flying ants (Formicidae) that land on water; terrestrial insects may also fall into the water from overhanging branches.

4.3.5.2 Interpretation

Generally, rainbow trout feed on various invertebrates including plankton, larger crustaceans, insects, snails, and leeches (Scott and Crossman 1973). The bottom organisms consumed by rainbow trout consist mainly of larger crustaceans such as *Gammarus*, and the larvae of virtually all aquatic insects occurring in its habitats. As rainbow trout grow, there is usually a shift in diet with increase in size, from plankton to insects and crustaceans and then to fishes, if available. Rainbow trout commonly feed on bottom organisms, but rise to feed at the surface on emerging or egg-laying insects.

One historical study in Lake Koocanusa indicated Cladocera comprised nearly the entire diet of rainbow and cutthroat trout, especially during winter (McMullin 1979). Cladocera (specifically *Daphnia pulex*) also comprised the highest proportion of the diet of trout from Paul Lake between 1947 and 1949 (Larkin *et al.* 1950). Other food items consumed by trout in these studies included fish, terrestrial insects, and aquatic insects in Lake Koocanusa and Amphipoda, aquatic insects, terrestrial insects, and molluscs in Paul Lake.

Rainbow trout captured in Ootsa Lake during the 1996 field studies were feeding on similarly diverse food items. In general, trout are opportunistic feeders, selecting items from substrate, water column, and surface areas. The presence of conifer needles and various plant and bark fragments in stomachs might reflect feeding on material floating at the surface or substrate material. Some food items, such as chironomid adults and pupae, that are likely taken from upper portions of the water column occupy benthic areas for much of their life history. In consequence, availability of these organisms as food in the water column is linked to the amount and quality of substrate for benthic production.

Kokanee are reportedly eaten by large rainbow captured in the sport fishery (Section 4.8.2). Kokanee were not evident in stomachs of rainbow captured during the 1996 field studies, likely reflecting the small size of fish captured in experimental samples compared to larger fish reported in the sport fishery.

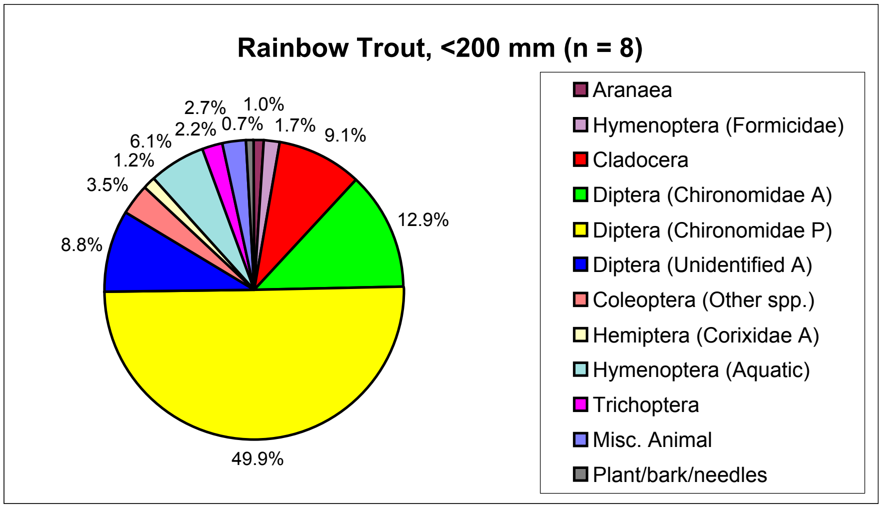
4.3.5.3 Comparison of Diet by Area and Size

Rainbow trout captured during the current fish sampling program exhibited a large range of sizes. For the purpose of comparing diet by area, the function of size is also considered. Three size categories of rainbow trout fork length include: <200 mm, 200 to 300 mm, and >300 mm. Summaries of average number of organisms and occurrence of each organism in the stomachs of various sizes of fish from different areas are presented in Tables 4.3.12 and 4.3.13 and Figures 4.3.6 to 4.3.10.

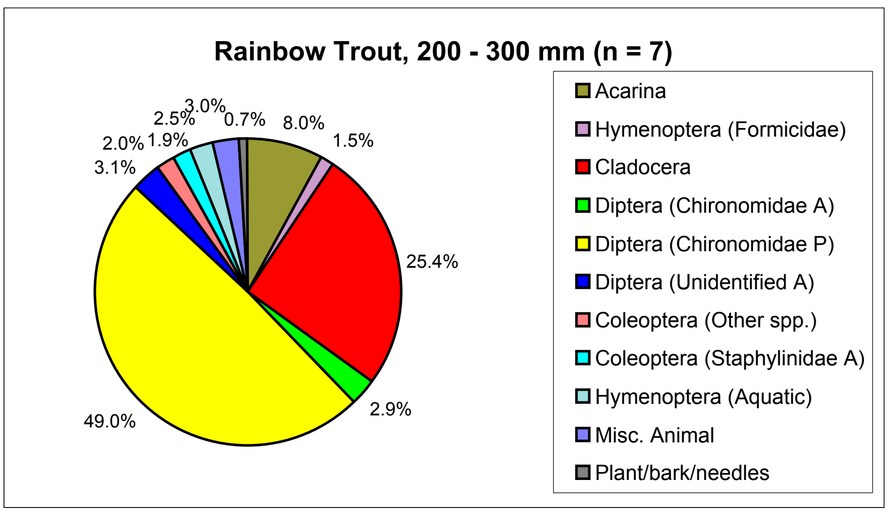
All three size categories of fish were collected at Wells Creek Bay inner bay. Eight fish <200 mm long consumed predominantly Chironomidae pupae (49.9%) and adults (12.9%), other Dipteran adults (8.8%), and Cladocera (9.1%). For seven trout 200 to 300 mm long, Chironomidae pupae (48.9%) and Cladocera (25.3%) comprised the major proportion of their diet. Three trout >300 mm consumed predominantly Staphylinidae adults (Coleoptera, 44.4%) and adult Dipterans (unidentified 15.4%, Chironomidae 8.6%). Remaining food items were selected from a variety of aquatic and terrestrial animals and included some plant/bark fragments and conifer needles.

Fewer taxa were consumed by rainbow trout in the outer bay relative to the inner bay at Wells Creek Bay (Table 4.3.12). Cladocera (36.1%) and Chironomidae pupae (56.3%) were the primary food items for the one small trout from the outer bay (<200 mm) (Figure 4.3.7). One mid-sized (200 to 300 mm) trout consumed primarily Acarina (*Hydracarin*a sp.) and Chironomidae pupae, while the second one consumed Cladocera (Table A7.2). Overall percentage of the number of these food items consumed by mid-sized fish were Acarina (60.4%), Cladocera (20.9%), and Chironomidae pupae (11.3%). One rainbow trout >300 mm consumed primarily Cladocera (96.4%), followed by Chironomidae pupae (3.6%). These major food items for trout from Wells Creek Bay outer bay are found in the water column, especially if the Chironomidae pupae were swimming to the surface for emergence. No plant or bark fragments or conifer needles were found in the stomachs of outer bay fish.

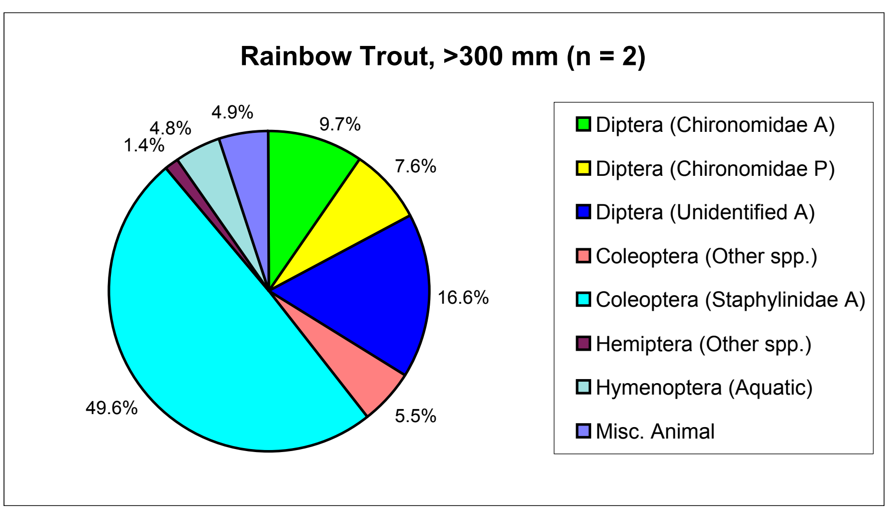
Figure 4.3.6 Stomach content as percentage of total food items consumed by rainbow trout, Wells Creek Bay inner bay, September/October 1996.



Misc. Animal	(2.8%)
Acarina	0.1
Hemiptera (Terrestrial)	0.2
Diptera (Unidentified L)	0.4
Coleoptera (Staphylinidae A)	0.6
Ephemeroptera	0.1
Hemiptera (Other spp.)	0.5
Homoptera	0.3
Megaloptera	0.1
Gastropoda	0.5

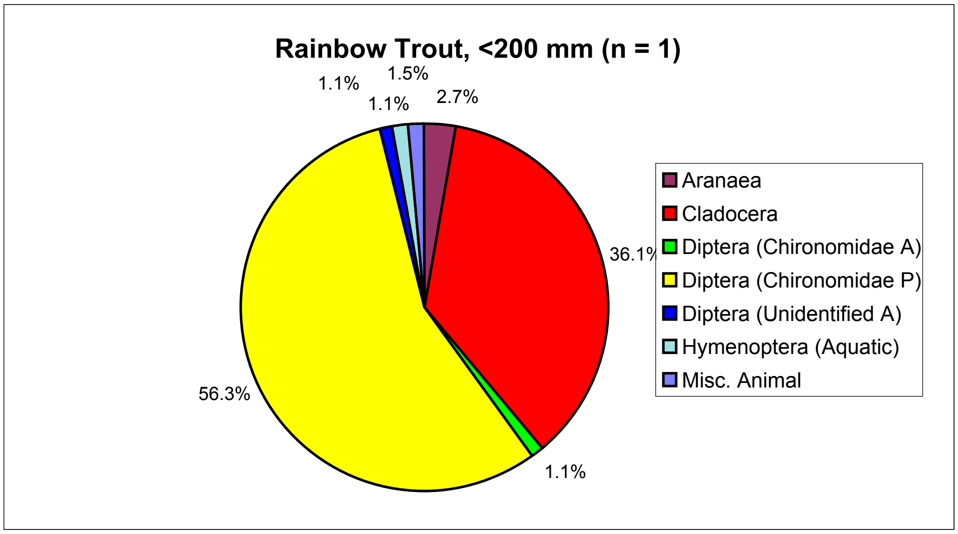


Misc. Animal	(3.0%)
Aranaea	0.5
Amphipoda	0.1
Copepoda	0.1
Diptera (Chironomidae L)	0.1
Ephemeroptera	0.1
Hemiptera (Corixidae A)	0.4
Hemiptera (Other spp.)	0.5
Homoptera	0.1
Megaloptera	0.1
Trichoptera	0.6
Gastropoda	0.1
Nematoda	0.1

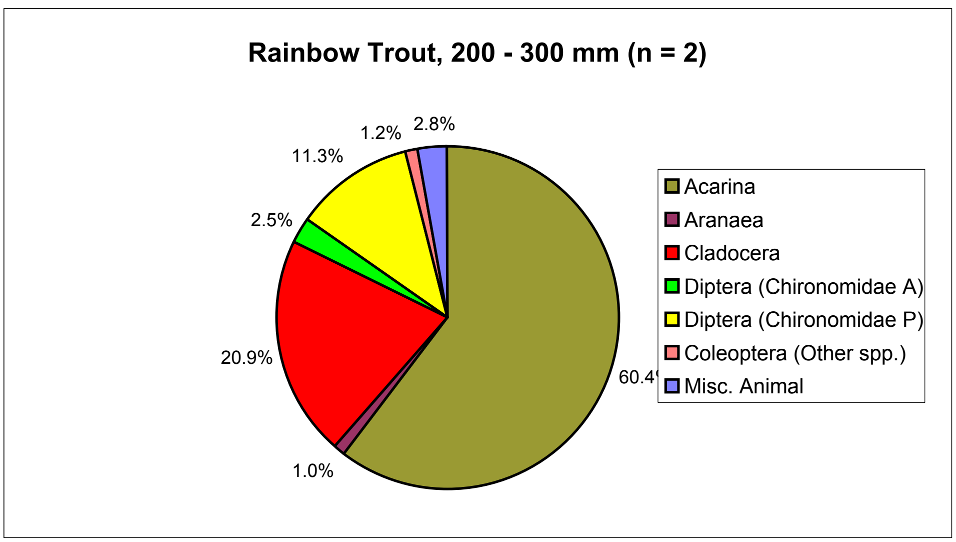


Misc. Animal	(4.9%)
Aranaea	0.7
Hymenoptera (Formicidae)	0.7
Cladocera	0.7
Diptera (Unidentified L)	0.7
Hemiptera (Corixidae A)	0.7
Homoptera	0.7
Trichoptera	0.7

Figure 4.3.7 **Stomach content as percentage of total food items consumed by rainbow trout, Wells Creek Bay outer bay, September/October 1996.**



Misc. Animal	**(1.5%)**
Coleoptera (Staphylinidae A)	0.4
Hemiptera (Other spp.)	0.4
Homoptera	0.4
Gastropoda	0.4



Misc. Animal	**(2.8%)**
Diptera (Unidentified A)	0.8
Hemiptera (Corixidae A)	0.3
Hymenoptera (Aquatic)	0.8
Trichoptera	0.7
Gastropoda	0.2

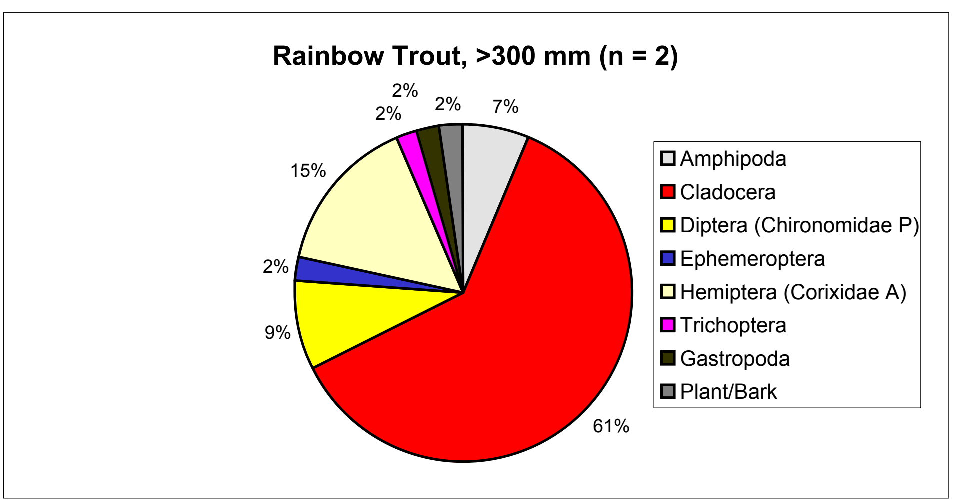
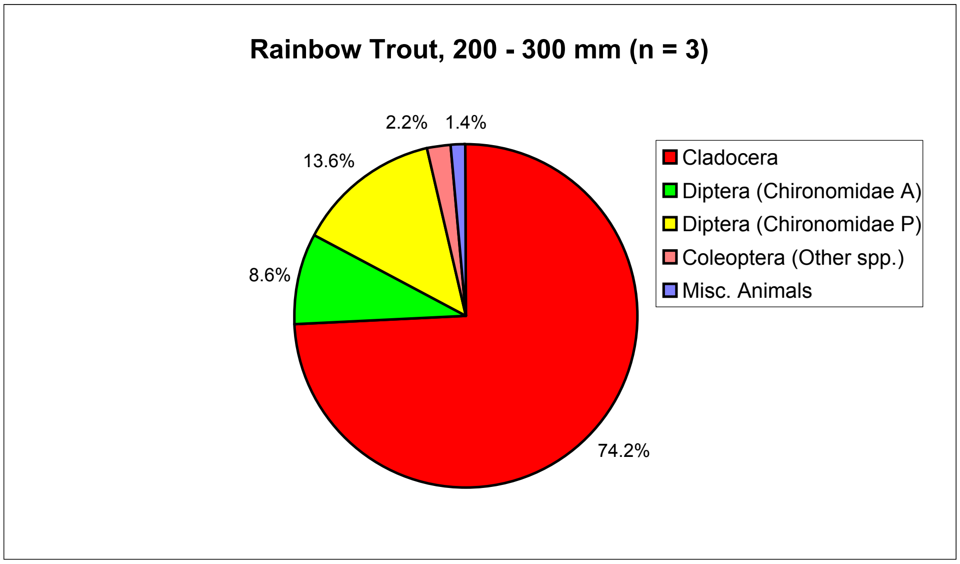


Figure 4.3.8 Stomach content as percentage of total food items consumed by rainbow trout, submerged lake basin, September/October 1996.



Misc. Animal	**(1.4%)**
Acarina	0.1
Aranaea	0.1
Hymenoptera (Formicidae)	0.1
Copepoda	0.1
Hemiptera (Corixidae A)	0.4
Hymenoptera (Aquatic)	0.3
Gastropoda	0.1

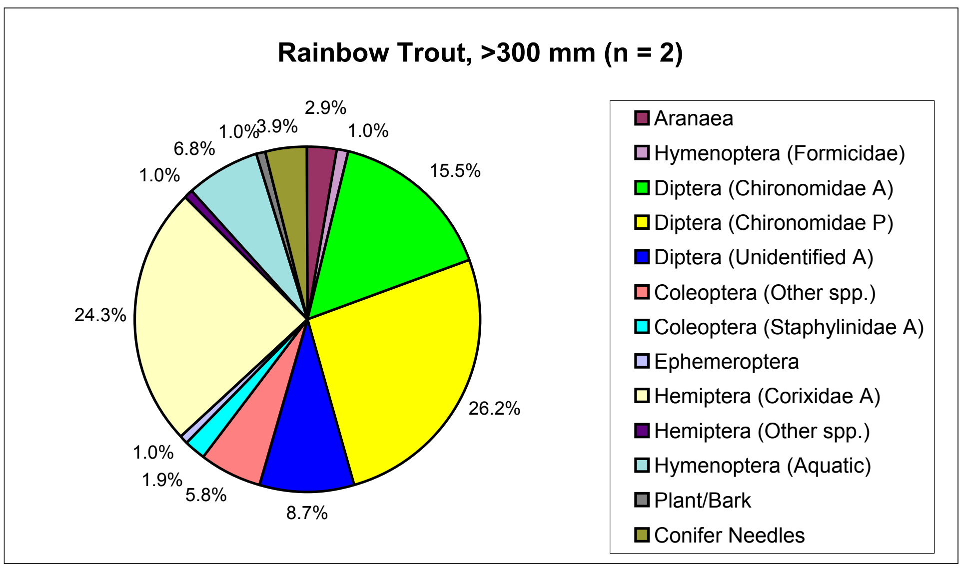
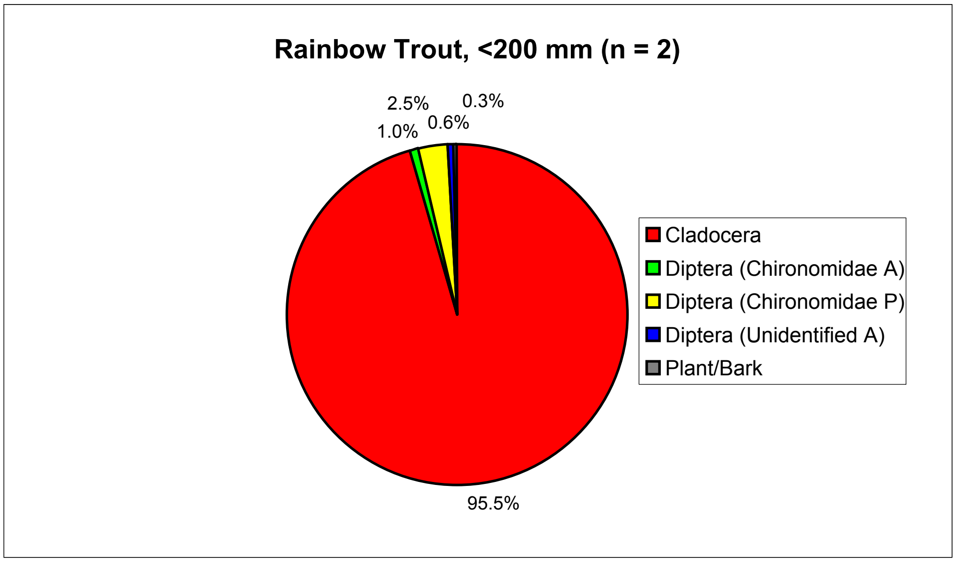
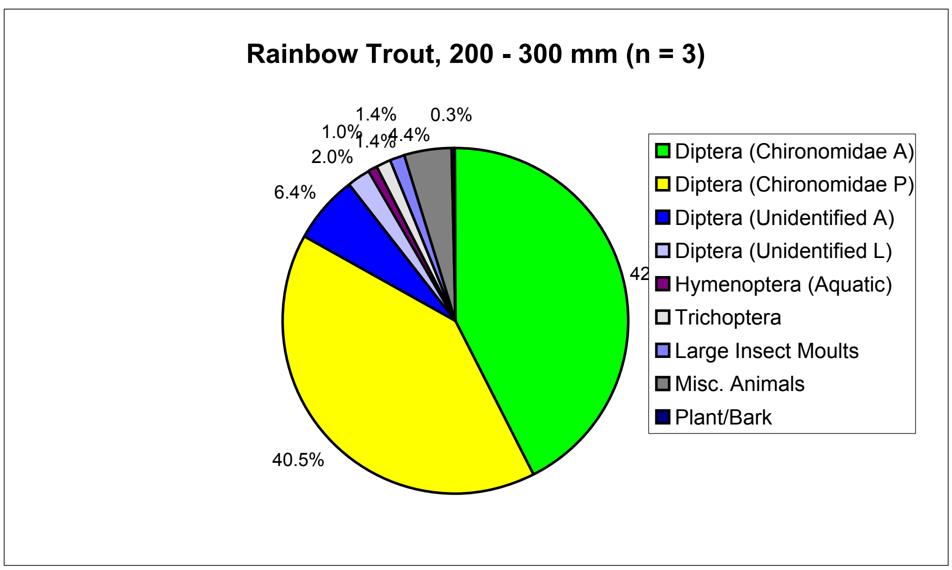


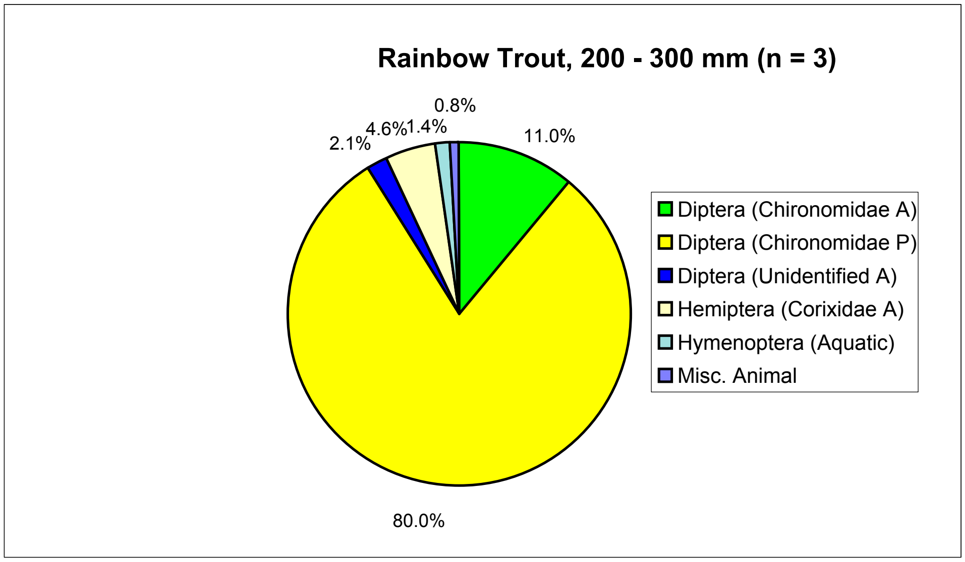
Figure 4.3.9 Stomach content as percentage of total food items consumed by rainbow trout, Andrews Bay Site 1 (inner bay), September/October 1996.



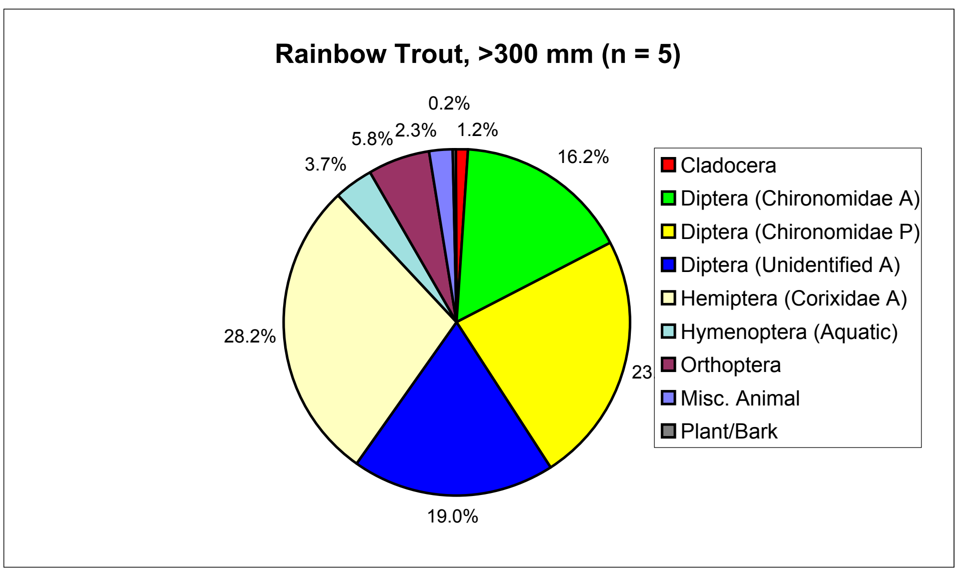


Misc. Animal	**(4.4%)**
Aranaea	0.7
Hymenoptera (Formicidae)	0.3
Cladocera	0.3
Diptera (Chironomidae L)	0.3
Coleoptera (Other spp.)	0.3
Ephemeroptera	0.7
Hemiptera (Corixidae A)	0.7
Hemiptera (Other spp.)	0.3
Gastropoda	0.7

Figure 4.3.10 **Stomach content as percentage of total food items consumed by rainbow trout, Andrews Bay outer bay, September/October 1996.**



Misc. Animal	**(0.8%)**
Hymenoptera (Formicidae)	0.4
Cladocera	0.4



Misc. Animal	**(2.3%)**
Aranaea	0.3
Hymenoptera (Formicidae)	0.3
Diptera (Chironomidae L)	0.5
Coleoptera (Other spp.)	0.2
Coleoptera (Staphylinidae A)	0.3
Ephemeroptera	0.3
Trichoptera	0.2
Gastropoda	0.2

Stomachs of rainbow trout captured at the submerged lake basin contained a number of different food items. One mid-sized fish (200 to 300 mm) consumed large numbers of Cladocera (*Eurycercus/Bullatifrons* sp.; Table A7.3), which dominated the percentage calculations of number of items consumed (average 74.4% for this size range of three fish; Figure 4.3.8). The more common food, consumed by all three of the mid-sized fish, were Chironomidae adults (8.7%) and pupae (13.7%). Several other food items were consumed by these fish, including Coleoptera and other insects. Two larger fish (>300 mm) were more generalist feeders; however, Chironomidae adults (15.5%) and pupae (26.2%) were common. One fish consumed a high proportion of Corixidae adults (Hemiptera, 24.3% of average). Several other insects, including some terrestrial species, were consumed as well as plant/bark fragments and conifer needles. Trout from the submerged lake basin appeared to feed throughout the water column.

One small trout (<200 mm) from Andrews Bay inner bay Site 1 had consumed large quantities of Cladocera (*Daphnia longiremus*) exclusively (Table A7.4). Consequently, the few Chironomidae consumed by the second small trout comprised a small proportion of the average: Cladocera 96.5%, Chironomidae pupae 2.5% (Figure 4.3.9). Three mid-sized rainbow trout (200 to 300 mm) consumed predominantly Chironomidae adults (42.7%) and pupae (40.7%) and other Dipteran adults (8.5%). Several other food items were consumed (primarily insects) as well as some plant and bark fragments.

One mid-sized rainbow trout from Andrews Bay outer bay (200 to 300 mm) consumed large quantities of Chironomidae pupae (Table A7.5), resulting in a high average proportion for this size category (80.1%; Figure 4.3.10). Other items consumed by fish in this category were Chironomidae adults (11.0%) and Corixidae (Hemiptera, 4.6%). Food items were those typically present in the water column or at the surface. Larger fish (>300 mm) consumed a wider variety of food items relative to smaller fish in the Andrews Bay outer bay samples; consumption included Corixidae (28.2%), Chironomidae pupae (23.4%) and adults (16.2%), and other Dipteran adults (19.0%). Most other food items were included in stomachs, ranging from terrestrial organisms to Gastropoda and some plant and bark fragments.

4.4 KOKANEE DATA

4.4.1 Sex Ratio

Sex ratios among kokanee captured at lake sample locations are summarized in Table 4.4.1.

Table 4.4.1 Kokanee sex ratio, Nechako Reservoir, September/October 1996.

		Male		Female	
Location	**Site**	**Number**	**Percent**	**Number**	**Percent**
Wells Creek Bay	Inner bay Site 1	7	*70*	3	*30*
	Inner bay Site 2	10	*59*	7	*41*
	Outer bay	9	*82*	2	*18*
	All sites	**26**	***68***	**12**	***32***
Submerged Lake Basin	All sites	17	*65*	9	*35*
Andrews Bay	Inner bay Site 2	8	*44*	10	*56*
	Outer bay	36	*58*	26	*42*
	All sites	**44**	***55***	**36**	***45***
TOTAL	**All sites**	**87**	***63***	**52**	***37***

Overall, the data indicate a slightly higher proportion of males among locations sampled (approximately 60%) relative to 40% females. A higher proportion of males was collected at all sites except Andrews Bay inner bay (44% males, 56% females). Andrews Bay outer bay sex ratio was 58% male and 42% female. A very high proportion of males occurred in Wells Creek Bay outer bay samples (82% males and 18% females). Ratios for the submerged lake basin were 65% males and 35% females.

4.4.2 Size

4.4.2.1 Length

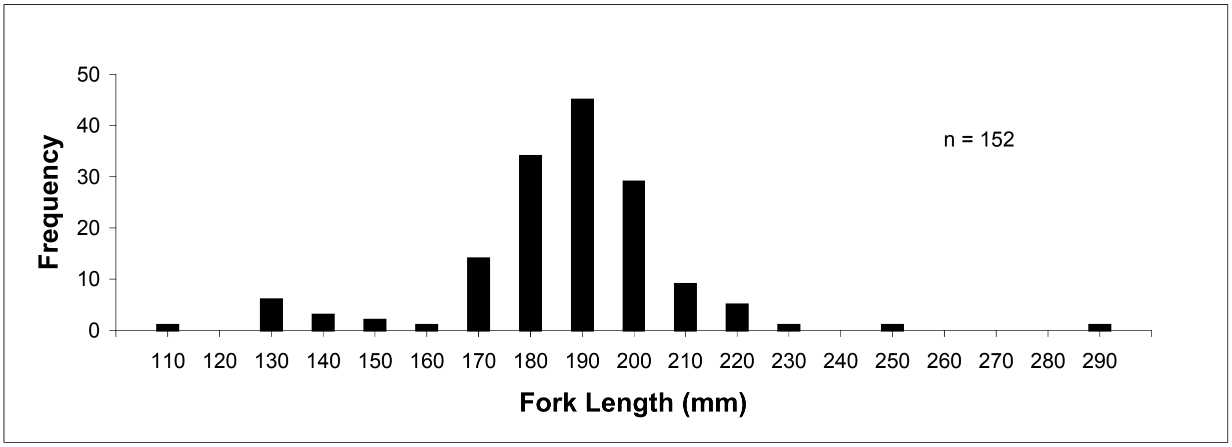
Mean fork lengths of kokanee captured from all lake sample sites are summarized in Table 4.4.2. In general, mean lengths of kokanee were similar among sample locations. Mean length of kokanee from Wells Creek Bay inner bay was 186.8 mm (n=31); mean length of Wells Creek Bay outer bay fish was 172.4 mm (n=15). In Andrews Bay the length of kokanee from the inner bay averaged 187.8 mm (n=18) and kokanee from the outer bay averaged 185.1 mm (n=62). Fish collected from the submerged lake basin were relatively small, averaging 174.3 mm (n=26). Male kokanee were very similar in length relative to females. A histogram of size class frequency (Figure 4.4.1) shows a group of smaller fish captured from Wells Creek Bay area, including the submerged lake basin, and not evident in Andrews Bay samples.

4.4.2.2 Weight

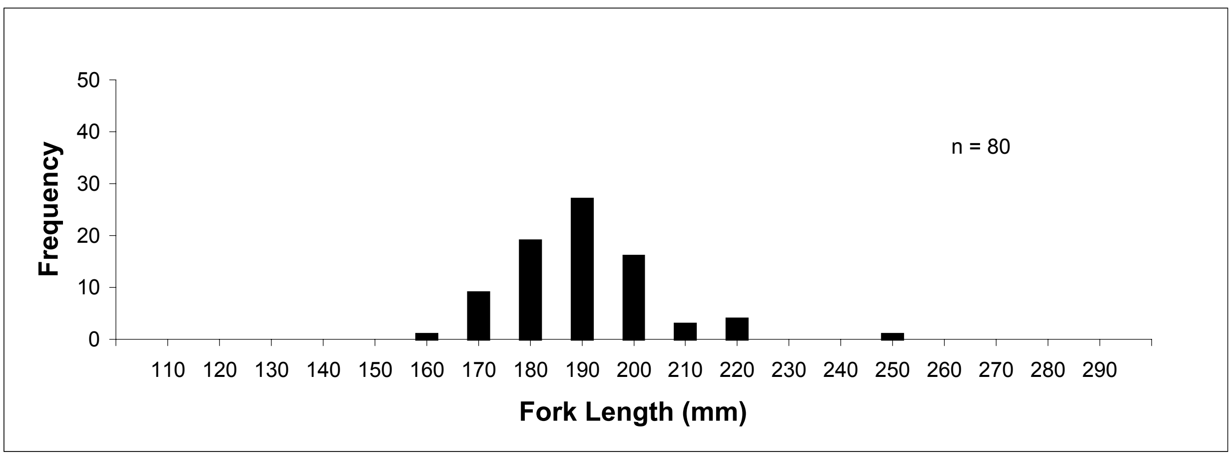
Mean weight of kokanee captured from all lake sample sites are summarized in Table 4.4.3. Overall mean weights were similar among sample locations, ranging from 62.4 g for fish captured in the submerged lake basin to 74.5 g for fish captured in Wells Creek Bay inner bay. Kokanee captured in Wells Creek Bay outer bay had a mean weight (64.6 g) comparable to the nearby submerged lake basin.

Figure 4.4.1 **Length frequencies for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

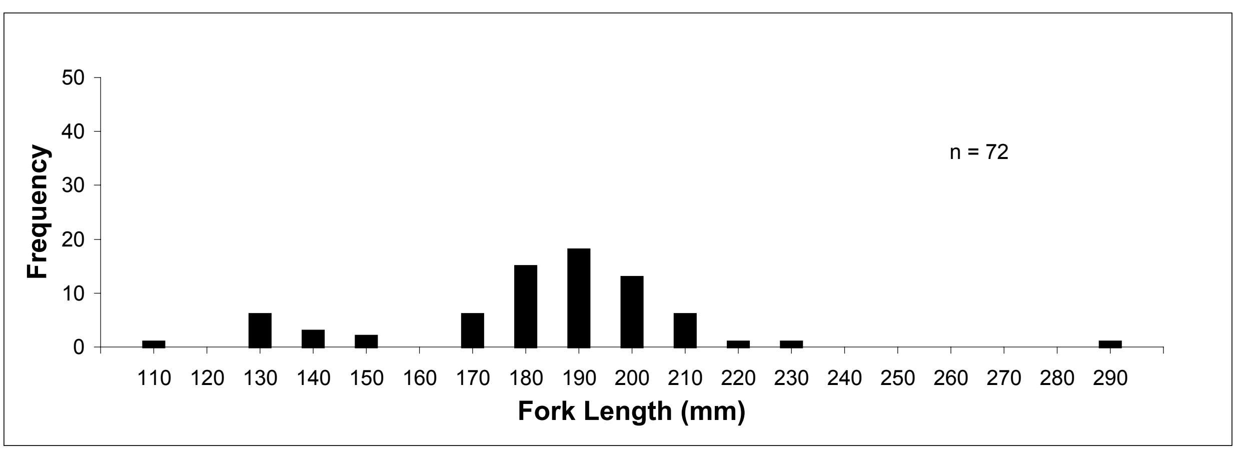


Table 4.4.2 Mean fork lengths (mm) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	190.6	11.3	174-206	3	190.0	13.1	175-199	14	191.9	11.8	174-208
	Inner Bay 2	Gillnet	Day												
			Night	10	179.2	6.0	168-190	7	187.3	21.4	165-224	17	182.5	14.5	165-224
	All Inner Bay Samples	All Gear Types	All Times	17	183.9	10.1	168-206	10	188.1	18.6	165-224	31	186.8	14.0	165-224
	Outer Bay	Gillnet - floating	Day	2	249.0	55.2	210-288					2	249.0	55.2	210-288
			Night	4	180.8	10.0	167-190	2	185.5	2.1	184-187	10	161.4	29.4	110-190
		Gillnet - sinking	Day												
			Night	3	158.0	30.0	135-192					3	158.0	30.0	135-192
	All Outer Bay Samples	All Gear Types	All Times	9	188.3	44.0	135-288	2	185.5	2.1	184-187	15	172.4	43.2	110-288
	All Wells Creek Bay Samples	All Gear Types	All Times	26	185.4	26.3	135-288	12	187.7	16.9	165-224	46	182.1	27.5	110-288
Submerged Lake Basin		Gillnet - floating	Day												
			Night	15	170.3	28.6	121-205	8	185.9	25.6	130-220	23	175.7	28.0	121-220
		Gillnet - sinking	Day												
			Night	2	150.0	31.1	128-172	1	191.0			3	163.7	32.3	128-191
	All Submerged Lake Samples	All Gear Types	All Times	17	167.9	28.7	121-205	9	186.4	24.0	130-220	26	174.3	28.1	121-220
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	188.9	10.3	179-204	10	187.0	13.6	162-213	18	187.8	11.9	162-213
	All Inner Bay Samples	All Gear Types	All Times	8	188.9	10.3	179-204	10	187.0	13.6	162-213	18	187.8	11.9	162-213
	Outer Bay	Gillnet - floating	Day												
			Night	14	181.6	19.6	164-241	13	192.9	16.8	160-220	27	187.1	18.8	160-241
		Gillnet - sinking	Day	3	190.0	8.7	180-196	2	196.5	3.5	194-199	5	192.6	7.3	180-199
			Night	19	179.6	11.5	161-206	11	186.4	8.2	174-200	30	182.1	10.8	161-206
	All Outer Bay Samples	All Gear Types	All Times	36	181.3	14.9	161-241	26	190.4	13.3	160-220	62	185.1	14.9	160-241
	All Andrews Bay Samples	All Gear Types	All Times	44	182.6	14.4	161-241	36	189.5	13.3	160-220	80	185.7	14.2	160-241
All Areas	All Locations	All Gear Types	All Times	87	180.6	22.3	121-288	57	188.6	15.8	130-224	152	182.7	21.9	110-288

Note: Combined sex numbers include fish captured but not sexed.

Table 4.4.3 Mean wet weights (g) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	80.8	16.6	59.4-104.3	3	69.6	11.6	58.7-81.7	14	79.5	14.9	58.7-104.3
	Inner Bay 2	Gillnet	Day												
			Night	10	67.2	6.5	54.2-79.3	7	74.8	27.4	49.3-117.6	17	70.3	17.9	49.3-117.6
	All Inner Bay Samples	All Gear Types	All Times	17	72.8	13.2	54.2-104.3	10	73.2	23.1	49.3-117.6	31	74.5	17.0	49.3-117.6
	Outer Bay	Gillnet - floating	Day	2	164.9	96.0	97.0-232.8					2	164.9	96.0	97.0-232.8
			Night	4	71.5	11.5	56.0-80.8	2	60.8	0.1	60.7-60.9	10	50.3	24.5	15.1-80.8
		Gillnet - sinking	Day												
			Night	3	45.6	26.1	27.2-75.5					3	45.6	26.1	27.2-75.5
	All Outer Bay Samples	All Gear Types	All Times	9	83.6	60.3	27.2-232.8	2	60.8	0.1	60.7-60.9	15	64.6	52.9	15.1-232.8
	All Wells Creek Bay Samples	All Gear Types	All Times	26	76.5	36.1	27.2-232.8	12	71.2	21.5	49.3-117.6	46	71.3	33.0	15.1-232.8
Submerged Lake Basin		Gillnet - floating	Day												
			Night	15	61.0	27.5	17.2-102.9	8	69.8	24.8	23.1-110.8	23	64.1	26.4	17.2-110.8
		Gillnet - sinking	Day												
			Night	2	38.3	21.6	23.0-53.5	1	71.8			3	49.4	24.7	23.0-71.8
	All Submerged Lake Samples	All Gear Types	All Times	17	58.3	27.3	17.2-102.9	9	70.0	23.3	23.1-110.8	26	62.4	26.1	17.2-110.8
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	77.1	15.2	62.9-99.4	10	67.6	14.6	43.1-98.5	18	71.8	15.2	43.1-99.4
	All Inner Bay Samples	All Gear Types	All Times	8	77.1	15.2	62.9-99.4	10	67.6	14.6	43.1-98.5	18	71.8	15.2	43.1-99.4
	Outer Bay	Gillnet - floating	Day												
			Night	14	69.3	27.4	52.8-158.1	13	79.3	22.4	44.4-126.9	27	74.1	25.2	44.4-158.1
		Gillnet - sinking	Day	3	73.1	7.5	64.7-78.9	2	79.7	5.9	75.5-83.9	5	75.8	7.0	64.7-83.9
			Night	19	69.1	13.1	49.8-100.6	11	69.2	8.0	60.0-86.5	30	69.1	11.3	49.8-100.6
	All Outer Bay Samples	All Gear Types	All Times	36	69.5	19.3	49.8-158.1	26	75.0	17.2	44.4-126.9	62	71.8	18.5	44.4-158.1
	All Andrews Bay Samples	All Gear Types	All Times	44	70.9	18.7	49.8-158.1	36	73.0	16.6	43.1-126.9	80	71.8	17.7	43.1-158.1
All Areas	All Locations	All Gear Types	All Times	87	70.1	27.1	17.2-232.8	57	72.1	18.5	23.1-126.9	152	70.0	24.8	15.1-232.8

Note: Combined sex numbers include fish captured but not sexed.

4.4.2.3 Length-Weight Relationship

Figure 4.4.2 illustrates length versus weight relationships for kokanee in Ootsa Lake (all sample locations), Andrews Bay, and Wells Creek Bay. The data indicate a comparable length-weight relationship among fish captured at both Wells Creek Bay and Andrews Bay; Wells Creek specimens include fish smaller than 150 mm.

4.4.3 Maturity/Reproductive Status

4.4.3.1 Maturity/Gonad Development

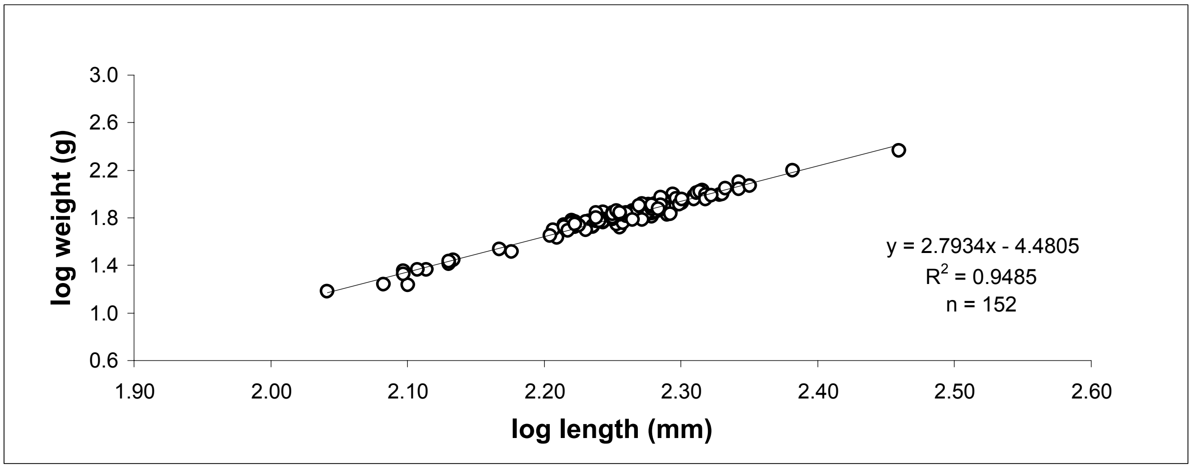
Mean maturity of kokanee captured from all lake sample sites are summarized in Table 4.4.4. Most kokanee were in an advanced state of gonad development and included fish in spawning condition. Gonad development indices were higher than those for rainbow trout (Section 4.3.3), reflecting the seasonal difference in spawn timing for the two species (rainbow trout spawn in spring/early summer; kokanee spawn in late summer/early fall). Mean maturity for Wells Creek Bay inner bay kokanee was 2.7 (n=17) for males and 2.4 (n=10) for females. Wells Creek Bay outer bay fish averaged 2.0 (n=9) for males and 2.5 (n=28) for females. Fish from the submerged lake basin averaged 2.4 (n=17) for male maturity and 2.6 (n=9) for female maturity. Mean maturity was comparable for Andrews Bay inner bay kokanee males relative to outer bay. Inner bay males averaged 3.0 (n=8) relative to outer bay males of 2.8 (n=36). Maturity of female kokanee was lower in the inner bay (2.4, n=10) relative to the outer bay (2.8, n=26). Overall, maturity was slightly higher for Andrews Bay fish (2.8) relative to Wells Creek Bay mean maturity (2.4) and the submerged lake basin (2.4).

4.4.3.2 Gonad Weight

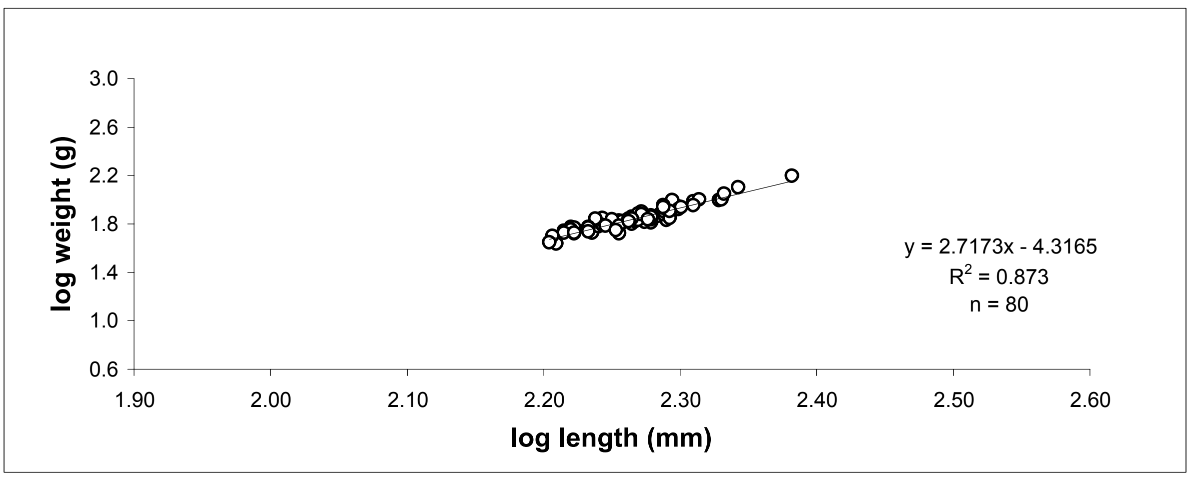
Mean gonad weights of kokanee captured from all lake sample sites are summarized in Table 4.4.5. Gonad weights vary with stage of maturity of gonads. At all sites, mean male gonad weight was higher relative to female gonads. Mean weight of male gonads ranged from 6.2 g (n=17) at the submerged lake basin to 8.7 g (n=17) at the Wells Creek Bay inner bay. Mean weight of female gonads ranged from 3.4 g (n=2) at Wells Creek Bay outer bay to 6.7 g (n=26) at Andrews Bay outer bay.

Figure 4.4.2 **Length-weight regressions for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

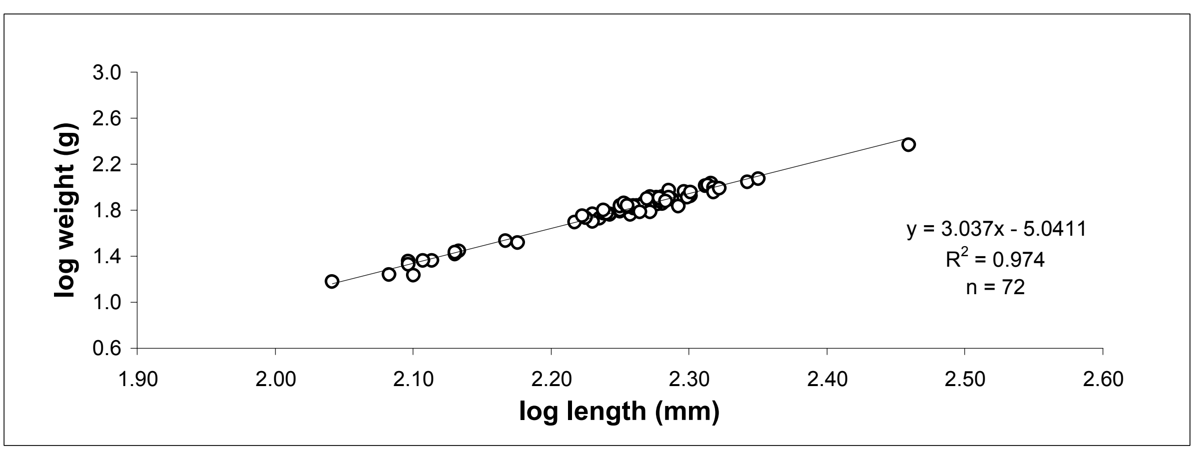


Table 4.4.4 Mean maturities for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	2.9	0.4	2-3	3	3.0	3.0	3-3	10	2.9	0.3	2-3
	Inner Bay 2	Gillnet	Day												
			Night	10	2.6	0.5	2-3	6	2.1	3.0	1-3	16	2.4	0.7	1-3
	All Inner Bay Samples	All Gear Types	All Times	17	2.7	0.5	2-3	9	2.4	3.0	1-3	26	2.6	0.6	1-3
	Outer Bay	Gillnet - floating	Day	2	2.0	1.4	1-3					2	2.0	1.4	1-3
			Night	4	2.5	0.6	2-3	2	2.5	3.0	2-3	7	2.3	0.8	1-3
		Gillnet - sinking	Day												
			Night	3	1.3	0.6	1-2					3	1.3	0.6	1-2
	All Outer Bay Samples	All Gear Types	All Times	9	2.0	0.9	1-3	2	2.5	3.0	2-3	12	2.0	0.9	1-3
	All Wells Creek Bay Samples	All Gear Types	All Times	26	2.5	0.7	1-3	11	2.4	3.0	1-3	38	2.4	0.8	1-3
Submerged Lake Basin		Gillnet - floating	Day												
			Night	15	2.4	0.9	1-3	8	2.5	3.0	1-3	23	2.4	0.8	1-3
		Gillnet - sinking	Day												
			Night	2	2.0	1.4	1-3	1	3.0			3	2.3	1.2	1-3
	All Submerged Lake Samples	All Gear Types	All Times	17	2.4	0.9	1-3	9	2.6	3.0	1-3	26	2.4	0.9	1-3
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	3.0	0.0	3-3	10	2.4	3.0	1-3	18	2.7	0.7	1-3
	All Inner Bay Samples	All Gear Types	All Times	8	3.0	0.0	3-3	10	2.4	3.0	1-3	18	2.7	0.7	1-3
	Outer Bay	Gillnet - floating	Day												
			Night	14	2.7	0.7	1-4	13	2.8	4.0	1-4	27	2.7	0.7	1-4
		Gillnet - sinking	Day	3	3.0	0.0	3-3	2	3.0	3.0	3-3	5	3.0	0.0	3-3
			Night	19	2.9	0.3	2-3	11	2.8	3.0	2-3	30	2.9	0.3	2-3
	All Outer Bay Samples	All Gear Types	All Times	36	2.8	0.5	1-4	26	2.8	4.0	1-4	62	2.8	0.5	1-4
	All Andrews Bay Samples	All Gear Types	All Times	44	2.9	0.5	1-4	36	2.7	4.0	1-4	80	2.8	0.6	1-4
All Areas	All Locations	All Gear Types	All Times	87	2.6	0.7	1-4	56	2.6	4.0	1-4	144	2.6	0.7	1-4

Table 4.4.5 Mean gonad weights (g) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	7	9.1	3.9	3.4-14.0	3	5.7	1.1	4.5-6.6
	Inner Bay 2	Gillnet	Day								
			Night	10	8.4	2.5	5.9-12.5	7	5.0	4.6	0.5-12.6
	All Inner Bay Samples	All Gear Types	All Times	17	8.7	3.1	3.4-14.0	10	5.2	3.8	0.5-12.6
	Outer Bay	Gillnet - floating	Day	2	5.7	7.9	0.1-11.3				
			Night	4	8.1	3.1	5.6-12.0	2	3.4	0.0	3.4-3.4
		Gillnet - sinking	Day								
			Night	3	2.6	4.4	0.1-7.7				
	All Outer Bay Samples	All Gear Types	All Times	9	5.7	4.7	0.1-12.0	2	3.4	0.0	3.4-3.4
	All Wells Creek Bay Samples	All Gear Types	All Times	26	7.7	3.9	0.1-14.0	12	4.9	3.5	0.5-12.6
Submerged Lake Basin		Gillnet - floating	Day								
			Night	15	6.4	4.2	0.1-11.7	8	5.4	3.2	0.2-10.2
		Gillnet - sinking	Day								
			Night	2	4.7	6.4	0.1-9.2	1	7.3		
	All Submerged Lake Samples	All Gear Types	All Times	17	6.2	4.3	0.1-11.7	9	5.6	3.1	0.2-10.2
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	8	7.6	2.3	4.2-11.4	10	4.0	2.5	0.2-8.4
	All Inner Bay Samples	All Gear Types	All Times	8	7.6	2.3	4.2-11.4	10	4.0	2.5	0.2-8.4
	Outer Bay	Gillnet - floating	Day								
			Night	14	6.9	3.1	0.1-10.9	13	7.8	4.3	0.4-18.3
		Gillnet - sinking	Day	3	5.4	0.6	5.0-6.1	2	6.3	0.3	6.1-6.5
			Night	19	7.9	2.5	2.9-13.6	11	5.5	1.2	3.5-7.8
	All Outer Bay Samples	All Gear Types	All Times	36	7.3	2.7	0.1-13.6	26	6.7	3.2	0.4-18.3
	All Andrews Bay Samples	All Gear Types	All Times	44	7.4	2.6	0.1-13.6	36	6.0	3.3	0.2-18.3
All Areas	All Locations	All Gear Types	All Times	87	7.2	3.4	0.1-14.0	57	5.7	3.3	0.2-18.3

4.4.3.3 GSI

Mean gonadosomatic indices (GSI) of kokanee captured from all lake sample sites are summarized in Table 4.4.6. Mean GSI for female kokanee ranged from 5.59% for fish captured in Wells Creek Bay outer bay to 8.60% for fish captured in Andrews Bay outer bay. Mean GSI values for male kokanee ranged from 7.44% for fish collected from Wells Creek Bay outer bay to 11.89% for fish from Wells Creek Bay inner bay. Similar patterns in GSI were noted relative to gonad weight and maturity; GSI was lower at all sites for female kokanee (range of 5.59 to 8.60%) relative to males. The most mature female fish were observed at Andrews Bay outer bay (maturity 2.8), resulting in a GSI of 8.60%.

4.4.4 Fish Condition

4.4.4.1 Condition Factor

Mean condition factors of kokanee captured from all lake sample sites are summarized in Table 4.4.7. Mean condition factor was highest for males at all locations. Mean condition factor for Wells Creek Bay fish ranged from 1.16 (male) to 1.07 (female) from the inner bay; fish from the outer bay averaged 1.12 for males and 0.95 for females. Submerged lake basin fish condition was approximately the same; male average condition was 1.12, female condition 1.04. Andrews Bay inner bay kokanee exhibited mean condition factors of 1.13 for males and 1.02 for females. Outer bay fish condition factors were 1.15 for males and 1.07 for females.

4.4.4.2 Liver Weight and Hepatosomatic Index

Mean liver weights of kokanee captured from all lake sample sites are summarized in Table 4.4.8. Mean hepatosomatic (liver somatic) indices (HSI) of kokanee captured from all lake sample sites are summarized in Table 4.4.9. Mean liver weights were relatively consistent given the small range in overall size of fish captured at all sites. At all sites, mean female liver weights (1.51 g) were higher relative to male weights (0.84 g). Wells Creek Bay inner bay kokanee livers averaged 0.89 g (n=17) for males and 1.57 g (n=9) for females. Wells Creek Bay outer bay fish livers averaged 0.96 g (n=9) for males and 1.30 g (n=2) for females. Mean liver weights for submerged lake basin fish were 0.64 g (n=15) for males and 1.42 g (n=9) for females. Andrews Bay inner bay kokanee livers averaged 0.93 g (n=8) for males, females averaged 1.38 g (n=10). Livers of Andrews Bay outer bay fish averaged 0.86 g (n=36) for males and 1.58 g (n=26) for females

Mean HSI were higher for females (2.07% compared to 1.18% for males). HSI in male kokanee ranged from 1.01% (submerged lake basin) to 1.23% (Andrews Bay outer bay). Mean HSI for females ranged from 1.95% (submerged lake basin) to 2.16% (Andrews Bay outer bay).

Table 4.4.6 **Mean gonadosomatic indices (GSI) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	7	11.09	3.91	4.50-15.49	3	8.18	1.30	7.22-9.66
	Inner Bay 2	Gillnet	Day								
			Night	10	12.44	3.35	7.69-17.55	7	5.78	3.91	1.01-11.68
	All Inner Bay Samples	All Gear Types	All Times	17	11.89	3.54	4.50-17.55	10	6.50	3.45	1.01-11.68
	Outer Bay	Gillnet - floating	Day	2	5.85	8.21	0.04-11.65				
			Night	4	11.10	2.84	8.07-14.85	2	5.59	0.01	5.58-5.60
		Gillnet - sinking	Day								
			Night	3	3.62	5.70	0.29-10.20				
	All Outer Bay Samples	All Gear Types	All Times	9	7.44	5.69	0.04-14.85	2	5.59	0.01	5.58-5.60
	All Wells Creek Bay Samples	All Gear Types	All Times	26	10.35	4.80	0.04-17.55	12	6.35	3.14	1.01-11.68
Submerged Lake Basin		Gillnet - floating	Day								
			Night	15	8.81	5.67	0.36-16.79	8	7.10	3.66	0.87-11.58
		Gillnet - sinking	Day								
			Night	2	8.82	11.85	0.43-17.20	1	10.17		
	All Submerged Lake Samples	All Gear Types	All Times	17	8.81	6.07	0.36-17.20	9	7.44	3.57	0.87-11.58
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	8	9.99	2.62	4.34-12.58	10	5.72	3.09	0.93-2.90
	All Inner Bay Samples	All Gear Types	All Times	8	9.99	2.62	4.34-12.58	10	5.72	3.09	0.93-2.90
	Outer Bay	Gillnet - floating	Day								
			Night	14	10.64	4.84	0.15-16.55	13	9.25	3.18	0.95-2.95
		Gillnet - sinking	Day	3	7.40	0.58	6.73-7.73	2	7.94	0.95	1.67-2.25
			Night	19	11.60	3.36	4.23-19.57	11	7.95	1.11	1.74-3.10
	All Outer Bay Samples	All Gear Types	All Times	36	10.88	3.98	0.15-19.57	26	8.60	2.41	0.95-3.10
	All Andrews Bay Samples	All Gear Types	All Times	44	10.72	3.76	0.15-19.57	36	7.80	2.88	0.93-3.10
All Areas	All Locations	All Gear Types	All Times	87	10.23	4.60	0.04-19.57	57	7.44	3.05	0.84-3.10

Table 4.4.7 Mean condition factors (K) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	1.15	0.07	1.09-1.30	3	1.01	0.10	0.91-1.10	14	1.12	0.10	0.91-1.30
	Inner Bay 2	Gillnet	Day												
			Night	10	1.17	0.06	1.09-1.26	7	1.10	0.07	1.01-1.22	17	1.14	0.07	1.01-1.26
	All Inner Bay Samples	All Gear Types	All Times	17	1.16	0.06	1.09-1.30	10	1.07	0.08	0.91-1.22	31	1.13	0.08	0.91-1.30
	Outer Bay	Gillnet - floating	Day	2	1.01	0.05	0.97-1.05					2	1.01	0.05	0.97-1.05
			Night	4	1.20	0.03	1.18-1.24	2	0.95	0.03	0.93-0.98	10	1.10	0.11	0.93-1.24
		Gillnet - sinking	Day												
			Night	3	1.08	0.02	1.07-1.11					3	1.08	0.02	1.07-1.11
	All Outer Bay Samples	All Gear Types	All Times	9	1.12	0.09	0.97-1.24	2	0.95	0.03	0.93-0.98	15	1.08	0.09	0.93-1.24
	All Wells Creek Bay Samples	All Gear Types	All Times	26	1.15	0.07	0.97-1.30	12	1.05	0.09	0.91-1.22	46	1.11	0.09	0.91-1.30
Submerged Lake Basin		Gillnet - floating	Day												
			Night	15	1.12	0.10	0.86-1.21	8	1.04	0.04	0.97-1.10	23	1.09	0.09	0.86-1.21
		Gillnet - sinking	Day												
			Night	2	1.07	0.03	1.05-1.10	1	1.03			3	1.06	0.03	1.03-1.10
	All Submerged Lake Samples	All Gear Types	All Times	17	1.12	0.09	0.86-1.21	9	1.04	0.04	0.97-1.10	26	1.09	0.09	0.86-1.21
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	1.13	0.08	1.03-1.30	10	1.02	0.06	0.91-1.08	18	1.07	0.09	0.91-1.30
	All Inner Bay Samples	All Gear Types	All Times	8	1.13	0.08	1.03-1.30	10	1.02	0.06	0.91-1.08	18	1.07	0.09	0.91-1.30
	Outer Bay	Gillnet - floating	Day												
			Night	14	1.12	0.07	0.97-1.24	13	1.08	0.05	0.99-1.19	27	1.10	0.07	0.97-1.24
		Gillnet - sinking	Day	3	1.07	0.04	1.04-1.11	2	1.05	0.02	1.03-1.06	5	1.06	0.03	1.03-1.11
			Night	19	1.18	0.10	0.90-1.34	11	1.07	0.06	0.94-1.14	30	1.14	0.10	0.90-1.34
	All Outer Bay Samples	All Gear Types	All Times	36	1.15	0.09	0.90-1.34	26	1.07	0.05	0.94-1.19	62	1.12	0.09	0.90-1.34
	All Andrews Bay Samples	All Gear Types	All Times	44	1.15	0.09	0.90-1.34	36	1.06	0.06	0.91-1.19	80	1.11	0.09	0.90-1.34
All Areas	All Locations	All Gear Types	All Times	87	1.14	0.09	0.86-1.34	57	1.05	0.06	0.91-1.22	152	1.11	0.09	0.86-1.34

Note: Combined sex numbers include fish captured but not sexed.

Table 4.4.8 Mean liver weights (g) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	0.96	0.37	0.5-1.5	3	1.63	0.21	1.4-1.8	10	1.16	0.46	0.5-1.8
	Inner Bay 2	Gillnet	Day												
			Night	10	0.84	0.18	0.6-1.2	6	1.53	0.90	0.5-2.6	16	1.10	0.64	0.5-2.6
	All Inner Bay Samples	All Gear Types	All Times	17	0.89	0.27	0.5-1.5	9	1.57	0.72	0.5-2.6	26	1.12	0.57	0.5-2.6
	Outer Bay	Gillnet - floating	Day	2	1.90	0.99	1.2-2.6					2	1.90	0.99	1.2-2.6
			Night	4	0.78	0.15	0.7-1.0	2	1.30	0.14	1.2-1.4	7	0.83	0.42	0.1-1.4
		Gillnet - sinking	Day												
			Night	3	0.57	0.38	0.3-1.0					3	0.57	0.38	0.3-1.0
	All Outer Bay Samples	All Gear Types	All Times	9	0.96	0.68	0.3-2.6	2	1.30	0.14	1.2-1.4	12	0.94	0.65	0.1-2.6
	All Wells Creek Bay Samples	All Gear Types	All Times	26	0.91	0.44	0.3-2.6	11	1.52	0.66	0.5-2.6	38	1.07	0.59	0.1-2.6
Submerged Lake Basin		Gillnet - floating	Day												
			Night	14	0.67	0.32	0.1-1.2	8	1.35	0.63	0.2-2.3	22	0.92	0.56	0.1-2.3
		Gillnet - sinking	Day												
			Night	1	0.20			1	2.00			2	1.10	1.27	0.2-2.0
	All Submerged Lake Samples	All Gear Types	All Times	15	0.64	0.34	0.1-1.2	9	1.42	0.63	0.2-2.3	24	0.93	0.60	0.1-2.3
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	0.93	0.39	0.5-1.7	10	1.38	0.68	0.4-2.5	18	1.18	0.60	0.4-2.5
	All Inner Bay Samples	All Gear Types	All Times	8	0.93	0.39	0.5-1.7	10	1.38	0.68	0.4-2.5	18	1.18	0.60	0.4-2.5
	Outer Bay	Gillnet - floating	Day												
			Night	14	0.86	0.40	0.6-2.2	13	1.58	0.42	0.9-2.2	27	1.21	0.54	0.6-2.2
		Gillnet - sinking	Day	3	1.03	0.25	0.8-1.3	2	1.55	0.21	1.4-1.7	5	1.24	0.35	0.8-1.7
			Night	19	0.83	0.23	0.5-1.3	11	1.59	0.36	1.2-2.2	30	1.11	0.47	0.5-2.2
	All Outer Bay Samples	All Gear Types	All Times	36	0.86	0.31	0.5-2.2	26	1.58	0.37	0.9-2.2	62	1.16	0.49	0.5-2.2
	All Andrews Bay Samples	All Gear Types	All Times	44	0.87	0.32	0.5-2.2	36	1.53	0.47	0.4-2.5	80	1.17	0.51	0.4-2.5
All Areas	All Locations	All Gear Types	All Times	85	0.84	0.37	0.1-2.6	56	1.51	0.53	0.2-2.6	142	1.10	0.55	0.1-2.6

Table 4.4.9 Mean hepatosomatic indices (HSI) for kokanee sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	7	1.17	0.35	0.74-1.66	3	2.36	0.14	2.20-2.49	10	1.53	0.64	0.74-2.49
	Inner Bay 2	Gillnet	Day												
			Night	10	1.25	0.21	0.88-1.52	6	1.82	0.59	0.84-2.41	16	1.46	0.48	0.84-2.41
	All Inner Bay Samples	All Gear Types	All Times	17	1.22	0.27	0.74-1.66	9	2.00	0.54	0.84-2.49	26	1.49	0.54	0.74-2.49
	Outer Bay	Gillnet - floating	Day	2	1.18	0.09	1.12-1.24					2	1.18	0.09	1.12-1.24
			Night	4	1.10	0.19	0.87-1.26	2	2.14	0.24	1.97-2.31	7	1.33	0.60	0.66-2.31
		Gillnet - sinking	Day												
			Night	3	1.22	0.31	0.88-1.47					3	1.22	0.31	0.88-1.47
	All Outer Bay Samples	All Gear Types	All Times	9	1.16	0.21	0.87-1.47	2	2.14	0.24	1.97-2.31	12	1.28	0.47	0.66-2.31
	All Wells Creek Bay Samples	All Gear Types	All Times	26	1.20	0.25	0.74-1.66	11	2.03	0.49	0.84-2.49	38	1.42	0.52	0.66-2.49
Submerged Lake Basin		Gillnet - floating	Day												
			Night	14	1.02	0.26	0.57-1.52	8	1.84	0.55	0.87-2.75	22	1.32	0.56	0.57-2.75
		Gillnet - sinking	Day												
			Night	1	0.87			1	2.79			2	1.83	1.35	0.87-2.79
	All Submerged Lake Samples	All Gear Types	All Times	15	1.01	0.25	0.57-1.52	9	1.95	0.61	0.87-2.79	24	1.36	0.62	0.57-2.79
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	8	1.17	0.31	0.76-1.76	10	1.99	0.79	0.93-2.90	18	1.63	0.74	0.76-2.90
	All Inner Bay Samples	All Gear Types	All Times	8	1.17	0.31	0.76-1.76	10	1.99	0.79	0.93-2.90	18	1.63	0.74	0.76-2.90
	Outer Bay	Gillnet - floating	Day												
			Night	14	1.25	0.24	0.91-1.69	13	2.07	0.56	0.95-2.95	27	1.65	0.59	0.91-2.95
		Gillnet - sinking	Day	3	1.41	0.27	1.24-1.72	2	1.96	0.41	1.67-2.25	5	1.63	0.41	1.24-2.25
			Night	19	1.19	0.21	0.96-1.79	11	2.31	0.47	1.74-3.10	30	1.60	0.64	0.96-3.10
	All Outer Bay Samples	All Gear Types	All Times	36	1.23	0.23	0.91-1.79	26	2.16	0.51	0.95-3.10	62	1.62	0.59	0.91-3.10
	All Andrews Bay Samples	All Gear Types	All Times	44	1.22	0.24	0.76-1.79	36	2.12	0.60	0.93-3.10	80	1.62	0.62	0.76-3.10
All Areas	All Locations	All Gear Types	All Times	85	1.18	0.26	0.57-1.79	56	2.07	0.57	0.84-3.10	142	1.53	0.60	0.57-3.10

4.4.5 Diet

4.4.5.1 Content

Kokanee captured in three areas (Wells Creek Bay inner and outer bays and the submerged lake basin) exhibited very similar lengths and weights (Tables 4.4.2 and 4.4.3). This discussion of stomach contents compares areas and not size categories due to relatively uniform size distribution among fish. Stomach content data are presented in Table A7.6, Tables 4.4.10 and 4.4.11, and Figure 4.4.3. Stomachs were approximately 50% full at time of capture (night-set gillnets).

All kokanee fed predominantly on Cladocera (96.2 to 100% of stomach contents). At Wells Creek Bay inner bay, *Daphnia longiremus* was the primary food item (92.3%; Figure 4.4.3) for the four kokanee. Also included in the diet at this location were *Diaptomus* sp. (Calanoid copepod, 2.4%), Chironomidae pupae (1.3%), and the occasional unidentified Dipteran adult, Homoptera, and Nematoda (Table 4.4.10).

Kokanee at Wells Creek Bay outer bay consumed *Daphnia* sp. or other Cladocera which could not be identified from fragments (99.5%). A few Chironomidae pupae (0.5%) were also consumed by one of the four fish. At the submerged lake basin, kokanee stomachs were 100% Cladocera, primarily *Daphnia rosea* and *D. longiremus*. Data indicate these kokanee were feeding from the water column and Cladocera was the primary food item for this size fish (125 to 220 mm fork length).

Cladocera and Calanoid copepods are planktonic organisms which may migrate vertically during a day (Wetzel 1975). Organisms usually rise at dusk to near the surface, sinking again by morning. Other food items consumed by kokanee occur at the surface (Dipteran adult) or at the bottom (Chironomidae pupae and Nematoda).

4.4.5.2 Interpretation

The kokanee is mainly a pelagic, plankton feeder but it may derive a significant portion of its food from bottom organisms (Scott and Crossman 1973). Crustacean plankton formed the bulk of food of adults in summer and autumn in Nicola Lake, British Columbia, and diaptomids were dominant in the spring (Scott and Crossman 1973). Chironomidae pupae were important (up to 70% volume) throughout the summer, but larvae contributed in only a minor way. In addition, miscellaneous zooplankters, terrestrial insects, water mites, mayflies, and adult dipterans have been observed in kokanee stomachs. *Daphnia* spp. were by far the most important food item for kokanee in Lake Koocanusa from 1983 to 1987 (Chisholm *et al.* 1989). The copepod Diaptomus was the second most important food item, followed by dipteran pupae.

Ootsa Lake kokanee consumed Cladocera, Copepoda, and Chironomidae pupae, which is consistent with observations of kokanee from other waterbodies in British Columbia.

Table 4.4.10 Mean number of organisms or items consumed by kokanee, mountain whitefish, and northern squawfish; September/October 1996.

Parameters	Kokanee			Mountain Whitefish		Northern Squawfish
	Wells Creek Inner Bay (n = 4)	Wells Creek Outer Bay (n = 4)	Submerged Lake Basin (n = 6)	Wells Creek Outer Bay (n = 2)	Andrews Bay Outer (n = 1)	Wells Creek Inner Bay (n = 3)
Fish Data						
Mean Fork Length (mm)	190.4	180.8	185.9	300	309	210.4
Mean Total Weight (g)	77.4	71.5	76	321.5	328.9	108.6
Mean Stomach Fullness (%)	45.8	48.8	55.0	50.0	10.0	36.7
Taxonomic Group (mean number of organisms/items)						
Acarina				0.5		
Aranaea						
Hemiptera (Terrestrial)						
Hymenoptera (Formicidae)						
Amphipoda						
Cladocera	521.3	625.0	1066.7			
Copepoda	13.3					
Diptera (Chironomidae A)						18.0
Diptera (Chironomidae P)	6.8	3.0		426.5		16.3
Diptera (Chironomidae L)				6.1		
Diptera (Unidentified A)	0.5					
Diptera (Unidentified L)						
Coleoptera (Other spp.)				0.5		
Coleoptera (Staphylinidae A)						
Ephemeroptera						
Hemiptera (Corixidae A)						3.0
Hemiptera (Other spp.)						
Homoptera	0.3					
Hymenoptera (Aquatic)						
Megaloptera						
Orthoptera						
Trichoptera					2	1.0
Bryozoa					50% volume	6.7
Bivalvia				0.5		
Gastropoda						2.3
Nematoda	0.3					
Large Insect Moults						
Plant/Bark						
Conifer Needles						
TOTAL	**542.3**	**628.0**	**1066.7**	**434.0**	**2**	**47.3**

A = adult, P = pupa, L = larva, unid. = unidentified.

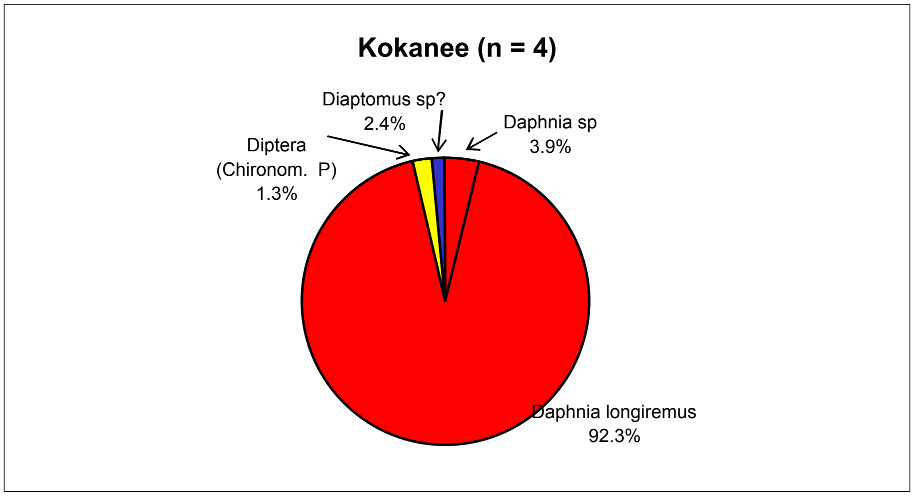
Table 4.4.11 Occurrence of various taxa in kokanee, mountain whitefish, and northern squawfish stomachs; September/October 1996.

Taxonomic Group	Kokanee			Mountain Whitefish		Northern Squawfish
	Wells Creek Inner Bay (n = 4)	Wells Creek Outer Bay (n = 4)	Submerged Lake Basin (n = 6)	Wells Creek Outer Bay (n = 2)	Andrews Bay Outer (n = 1)	Wells Creek Inner Bay (n = 3)
Acarina				1		
Aranaea						
Hemiptera (Terrestrial)						
Hymenoptera (Formicidae)						
Amphipoda						
Cladocera	4	4	6			
Copepoda	1					
Diptera (Chironomidae A)						3
Diptera (Chironomidae P)	1	1		2		3
Diptera (Chironomidae L)				1		
Diptera (Unidentified A)	1					
Diptera (Unidentified L)						
Coleoptera (Other spp.)				1		
Coleoptera (Staphylinidae A)						
Ephemeroptera						
Hemiptera (Corixidae A)						1
Hemiptera (Other spp.)						
Homoptera	1					
Hymenoptera (Aquatic)						
Megaloptera						
Orthoptera						
Trichoptera					1	2
Bryozoa						1
Bivalvia				1		
Gastropoda						1
Nematoda	1					
Large Insect Moults						
Plant/Bark						
Conifer Needles						

A = adult, P = pupa, L = larva.

Figure 4.4.3 Stomach content as percentage of total food items consumed by kokanee, September/October 1996.

Wells Creek Bay Inner Bay

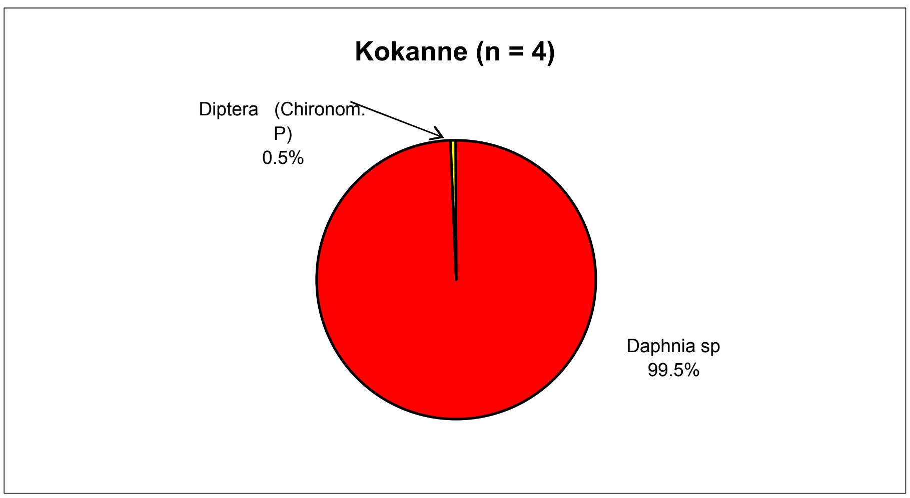


Note:

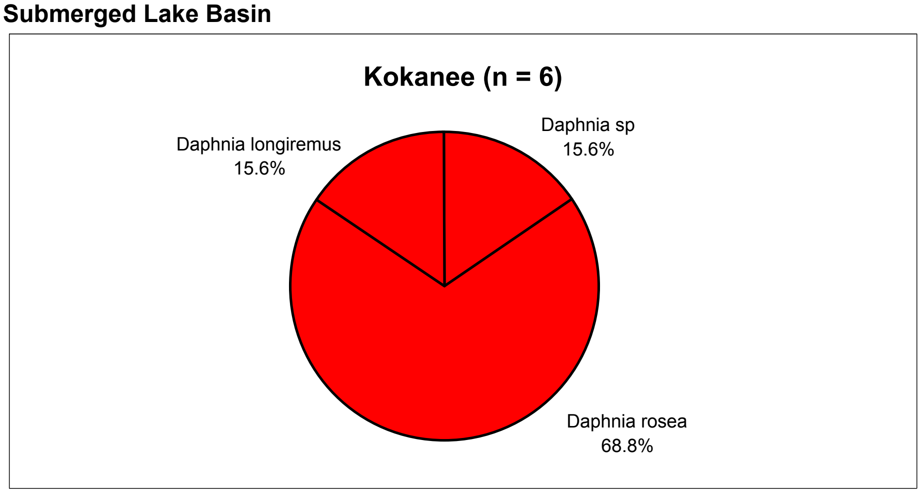
Cladocera comprise 96.2% of contents

Diaptomus sp. belong to Copepoda.

Wells Creek Bay Outer Bay



Submerged Lake Basin



4.5 MOUNTAIN WHITEFISH

4.5.1 Sex Ratio

Twelve mountain whitefish were captured during the program; of these, eight were sexed. Three males (37%) were captured: one each from Wells Creek Bay outer bay and Andrews Bay inner and outer bays. Five females (63%) were captured: four from Wells Creek Bay outer bay and one from Andrews Bay inner bay.

4.5.2 Size

4.5.2.1 Length

Mean fork lengths of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.1. Fork length of all captured mountain whitefish ranged from 250 to 374 mm. Mean length of Wells Creek Bay fish was 307.0 mm; mountain whitefish from Andrews Bay averaged 293.4 mm. A histogram illustrates the frequency of catch by size category (Figure 4.5.1).

4.5.2.2 Weight

Mean weight of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.2. Individual wet weight for mountain whitefish ranged from 179.0 to 623.7 g. The largest and smallest fish were captured at Wells Creek Bay inner bay. Mean weight of fish was 355.1 g for Wells Creek Bay and 315.0 g for Andrews Bay.

4.5.2.3 Length-Weight Relationship

Figure 4.5.2 illustrates the length-weight relationship for mountain whitefish captured in Ootsa Lake.

4.5.3 Maturity/Reproductive Status

4.5.3.1 Maturity/Gonad Development

Mean maturity of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.3. Mountain whitefish gonads were in an advanced state of gonad development. Individual maturity for mountain whitefish ranged from 3 to 4 among all sites for fish which were sexed. Mean maturity was 3.0 for males; maturity was the same at all sites and ranged from 3.0 to 4.0 for females.

Table 4.5.1 Mean fork lengths (mm) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									2	312.0	87.7	250-374
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times									2	312.0	87.7	250-374
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	300.0							1	300.0		
			Night					4	306.3	10.7	294-320	4	306.3	10.7	294-320
	All Outer Bay Samples	All Gear Types	All Times	1	300.0			4	306.3	10.7	294-320	5	305.0	9.6	294-320
	All Wells Creek Bay Samples	All Gear Types	All Times	1	300.0			1	306.3	10.7	294-320	7	307.0	36.8	250-374
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day									1	310.0		
			Night												
		Gillnet	Day												
			Night	1	266.0			1	305.0			2	285.5	27.6	266-305
	Inner Bay 2	Electrofishing	Day									1	277.0		
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	266.0			1	305.0			4	289.5	21.4	266-305
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	309.0							1	309.0		
	All Outer Bay Samples	All Gear Types	All Times	1	309.0							1	309.0		
	All Andrews Bay Samples	All Gear Types	All Times	2	287.5	30.4	266-309	1	305.0			5	293.4	20.5	266-310
All Areas	All Locations	All Gear Types	All Times	3	291.7	22.7	266-309	2	306.0	9.2	294-320	12	301.3	30.7	250-374

Table 4.5.2 Mean wet weights (g) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									2	401.35	314.45	179.0-623.7
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times									2	401.35	314.45	179.0-623.7
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	334.70							1	334.70		
			Night					4	337.03	39.99	305.0-393.1	4	337.03	39.99	305.0-393.1
	All Outer Bay Samples	All Gear Types	All Times	1	334.70			4	337.03	39.99	305.0-393.1	5	336.56	34.65	305.0-393.1
	All Wells Creek Bay Samples	All Gear Types	All Times	1	334.70			1	337.03	39.99	305.0-393.1	7	355.07	135.20	179.0-623.7
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	1	234.00			1	397.20			2	315.60	115.40	234.0-397.2
	Inner Bay 2	Electrofishing	Day									1	300.00		
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	234.00			1	397.20			3	310.40	82.10	234.0-397.2
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	328.90							1	328.90		
	All Outer Bay Samples	All Gear Types	All Times	1	328.90							1	328.90		
	All Andrews Bay Samples	All Gear Types	All Times	2	281.45	67.10	234.0-334.7	1	397.20			4	315.03	67.67	234.0-397.2
All Areas	All Locations	All Gear Types	All Times	3	299.20	56.54	234.0-334.7	2	349.06	43.86	305.0-393.1	11	340.51	112.91	179.0-623.7

Note: Combined sex numbers include fish captured but not sexed.

Figure 4.5.1 **Length frequencies for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/ October 1996.**

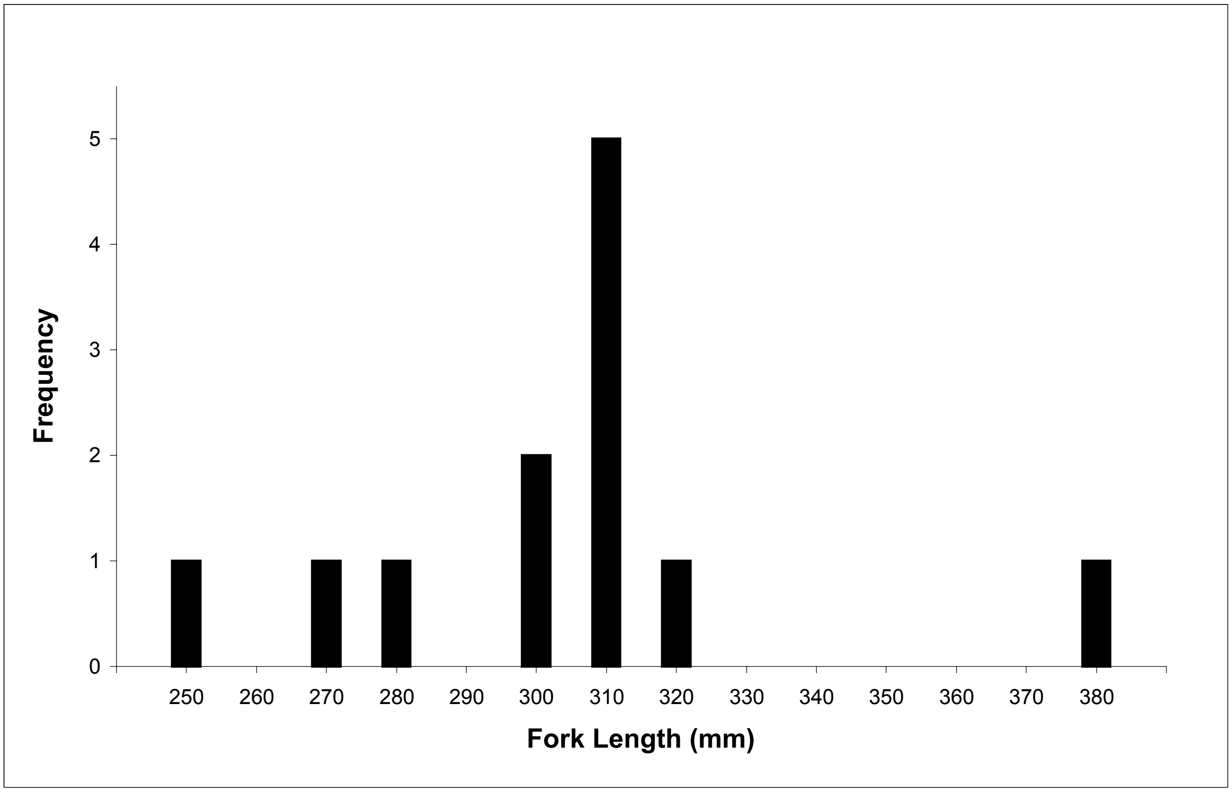


Figure 4.5.2 **Length-weight regressions for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

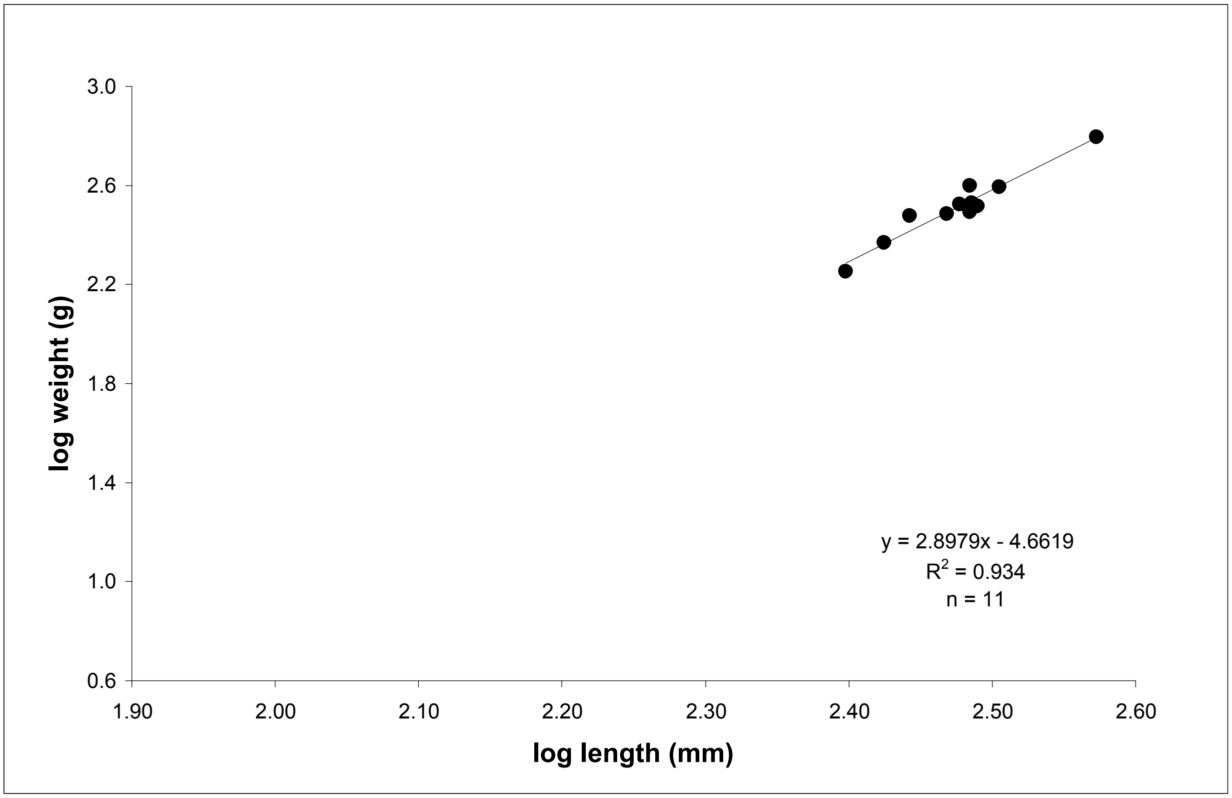


Table 4.5.3 Mean maturities for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times												
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	3.0							1	3.0		
			Night					4	3.3	0.5	3-4	4	3.3	0.5	3-4
	All Outer Bay Samples	All Gear Types	All Times	1	3.0			4	3.3	0.5	3-4	5	3.2	0.4	3-4
	All Wells Creek Bay Samples	All Gear Types	All Times	1	3.0			1	3.3	0.5	3-4	5	3.2	0.4	3-4
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	1	3.0			1	4.0			2	3.5	0.7	3-4
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	3.0			1	4.0			2	3.5	0.7	3-4
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	3.0							1	3.0		
	All Outer Bay Samples	All Gear Types	All Times	1	3.0							1	3.0		
	All Andrews Bay Samples	All Gear Types	All Times	2	3.0	0.0	3-3	1	4.0			3	3.3	0.6	3-4
All Areas	All Locations	All Gear Types	All Times	3	3.0	0.0	3-3	2	3.4	0.5	3-4	8	3.3	0.5	3-4

4.5.3.2 Gonad Weight

Mean gonad weights of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.4. Gonad weights were relatively large given the advanced maturity of all fish. Female mountain whitefish exhibited larger gonads relative to male fish Ootsa Lake sites (43.7 g females, 26.7 g males)

4.5.3.3 GSI

Mean gonadosomatic indices (GSI) of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.5. Overall female GSI averaged 12.4%; male mean GSI was 8.8%.

4.5.4 Fish Condition

4.5.4.1 Condition Factor

Mean condition factors of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.6. Individual condition factors ranged from 1.10 to 1.41 for Ootsa Lake mountain whitefish. Two fish from Andrews Bay inner bay exhibited the highest condition (1.40 and 1.41). Male and female fish exhibited similar mean condition factors: 1.20 for males, 1.22 for females.

4.5.4.2 Liver Weight and Hepatosomatic Index

Mean liver weights of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.7. Mean hepatosomatic (liver somatic) indices (HSI) of mountain whitefish captured from all lake sample sites are summarized in Table 4.5.8. Individual liver weights ranged from 1.4 g (male) to 8.0 g (female), both observed at Andrews Bay inner bay. Male livers were generally smaller, averaging 1.67 g for all sites relative to female mean liver weight of 6.5 g.

Individual HSI from all sites ranged from 0.49% to 2.24%. Mean HSI followed the same trends as liver weights: male HSI (0.6%) was lower relative to female HSI (1.9%).

4.5.5 Diet

4.5.5.1 Content

Three mountain whitefish stomachs were analyzed for food content; two fish were captured in Wells Creek Bay outer bay and one in Andrews Bay outer bay (night-set gillnets). These fish were approximately 300 mm in length, and were considerably larger relative to kokanee.

Table 4.5.4 Mean gonad weights (g) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	Inner Bay 2	Gillnet	Day								
			Night								
	All Inner Bay Samples	All Gear Types	All Times								
	Outer Bay	Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day	1	33.00						
			Night					4	40.75	12.25	24.7-53.3
	All Outer Bay Samples	All Gear Types	All Times	1	33.00			4	40.75	12.25	24.7-53.3
	All Wells Creek Bay Samples	All Gear Types	All Times	1	33.00			1	40.75	12.25	24.7-53.3
Submerged Lake Basin		Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day								
			Night								
	All Submerged Lake Samples	All Gear Types	All Times								
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	1	18.90			1	55.70		
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	All Inner Bay Samples	All Gear Types	All Times	1	18.90			1	55.70		
	Outer Bay	Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day								
			Night	1	28.20						
	All Outer Bay Samples	All Gear Types	All Times	1	28.20						
	All Andrews Bay Samples	All Gear Types	All Times	2	23.55	6.58	18.9-28.2	1	55.70		
All Areas	All Locations	All Gear Types	All Times	3	26.70	7.17	18.9-28.2	2	43.74	12.54	24.7-55.7

Table 4.5.5 **Mean gonadosomatic indices (GSI) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

General Sample Area	Sample Location	Sample Method	Time	Male				Female			
				n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	Inner Bay 2	Gillnet	Day								
			Night								
	All Inner Bay Samples	All Gear Types	All Times								
	Outer Bay	Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day	1	9.9						
			Night					4	12.0	3.1	8.10-15.77
	All Outer Bay Samples	All Gear Types	All Times	1	9.9			4	12.0	3.1	8.10-15.77
	All Wells Creek Bay Samples	All Gear Types	All Times	1	9.9			1	12.0	3.1	8.10-15.77
Submerged Lake Basin		Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day								
			Night								
	All Submerged Lake Samples	All Gear Types	All Times								
Andrews Bay	Inner Bay 1	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night	1	8.1			1	14.0		
	Inner Bay 2	Electrofishing	Day								
			Night								
		Gillnet	Day								
			Night								
	All Inner Bay Samples	All Gear Types	All Times	1	8.1			1	14.0		
	Outer Bay	Gillnet - floating	Day								
			Night								
		Gillnet - sinking	Day								
			Night	1	8.6						
	All Outer Bay Samples	All Gear Types	All Times	1	8.6						
	All Andrews Bay Samples	All Gear Types	All Times	2	8.3	0.4	8.08-8.57	1	14.0		
All Areas	All Locations	All Gear Types	All Times	3	8.8	0.9	8.08-9.86	2	12.4	2.9	8.10-15.77

Table 4.5.6 Mean condition factors (K) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									2	1.17	0.03	1.15-1.19
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times									2	1.17	0.03	1.15-1.19
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	1.24							1	1.24		
			Night					4	1.17	0.05	1.10-1.20	4	1.17	0.05	1.10-1.20
	All Outer Bay Samples	All Gear Types	All Times	1	1.24			4	1.17	0.05	1.10-1.20	5	1.18	0.05	1.10-1.24
	All Wells Creek Bay Samples	All Gear Types	All Times	1	1.24			1	1.17	0.05	1.10-1.20	7	1.18	0.04	1.10-1.24
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	1	1.24			1	1.40			2	1.32	0.11	1.24-1.40
	Inner Bay 2	Electrofishing	Day									1	1.41		
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	1.24			1	1.40			3	1.35	0.09	1.24-1.41
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	1.11							1	1.11		
	All Outer Bay Samples	All Gear Types	All Times	1	1.11							1	1.11		
	All Andrews Bay Samples	All Gear Types	All Times	2	1.18	0.09	1.11-1.24	1	1.40			4	1.29	0.14	1.11-1.41
All Areas	All Locations	All Gear Types	All Times	3	1.20	0.07	1.11-1.24	2	1.22	0.11	1.10-1.40	11	1.22	0.10	1.10-1.41

Table 4.5.7 Mean liver weights (g) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times												
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	2.00							1	2.00		
			Night					4	6.13	0.65	5.5-7.0	4	6.13	0.65	5.5-7.0
	All Outer Bay Samples	All Gear Types	All Times	1	2.00			4	6.13	0.65	5.5-7.0	5	5.30	1.93	2.0-7.0
	All Wells Creek Bay Samples	All Gear Types	All Times	1	2.00			1	6.13	0.65	5.5-7.0	5	5.30	1.93	2.0-7.0
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	1	1.40			1	8.00			2	4.70	4.67	1.4-8.0
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	1.40			1	8.00			2	4.70	4.67	1.4-8.0
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	1.60							1	1.60		
	All Outer Bay Samples	All Gear Types	All Times	1	1.60							1	1.60		
	All Andrews Bay Samples	All Gear Types	All Times	2	1.50	0.14	1.4-1.6	1	8.00			3	3.67	3.75	1.4-8.0
All Areas	All Locations	All Gear Types	All Times	3	1.67	0.31	1.4-2.0	2	6.50	1.01	5.5-8.0	8	4.69	2.62	1.4-8.0

Table 4.5.8 Mean hepatosomatic indices (HSI) for mountain whitefish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/ October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	Inner Bay 2	Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times												
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day	1	0.6							1	0.6		
			Night					4	1.8	0.4	1.48-2.24	4	1.8	0.4	1.48-2.24
	All Outer Bay Samples	All Gear Types	All Times	1	0.6			4	1.8	0.4	1.48-2.24	5	1.6	0.6	0.60-2.24
	All Wells Creek Bay Samples	All Gear Types	All Times	1	0.6			1	1.8	0.4	1.48-2.24	5	1.6	0.6	0.60-2.24
Submerged Lake Basin		Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night												
	All Submerged Lake Samples	All Gear Types	All Times												
Andrews Bay	Inner Bay 1	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night	1	0.6			1	2.0			2	1.3	1.0	0.60-2.01
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gillnet	Day												
			Night												
	All Inner Bay Samples	All Gear Types	All Times	1	0.6			1	2.0			2	1.3	1.0	0.60-2.01
	Outer Bay	Gillnet - floating	Day												
			Night												
		Gillnet - sinking	Day												
			Night	1	0.5							1	0.5		
	All Outer Bay Samples	All Gear Types	All Times	1	0.5							1	0.5		
	All Andrews Bay Samples	All Gear Types	All Times	2	0.5	0.1	0.49-0.60	1	2.0			3	1.0	0.9	0.49-2.01
All Areas	All Locations	All Gear Types	All Times	3	0.6	0.1	0.49-0.60	2	1.9	0.3	1.48-2.24	8	1.4	0.7	0.49-2.24

Stomach content data are presented in Table A7.7; summaries are presented in Tables 4.4.10 and 4.4.11 and Figure 4.5.3. Stomach fullness ranged from 10 to 75%.

Stomachs of two mountain whitefish from Wells Creek Bay contained primarily Chironomidae pupae (98.4%; Figure 4.5.3) and a few larvae (1.3%). One Acarina, one Coleoptera, and one bivalve were consumed by one fish. The mountain whitefish from Andrews Bay had consumed two Trichoptera larvae (Table A7.7); however, the stomach was only 10% full and 50% of that volume consisted of Bryozoa (Table 4.4.10).

Chironomidae pupae are usually found among substrate debris until time of emergence to the adult stage; at that time pupae swim to the surface (Merritt and Cummins 1984). Bryozoa are sessile zooplankters which construct colonies, usually in shallow water (Wetzel 1975). Sometimes associated with bryozoan colonies are protozoans, and chironomids and other insect larvae.

4.5.5.2 Interpretation

Mountain whitefish is primarily a bottom feeder consuming a variety of organisms, especially aquatic insect larvae such as those of mayflies, stoneflies, caddisflies, and chironomids, small molluscs, and, on occasion, fishes (Scott and Crossman 1973). When bottom fauna is scarce, mountain whitefish will eat midwater plankton and surface insects. The most important zooplankton consumed by mountain whitefish in Lake Koocanusa was *Daphnia* sp. (Chisholm *et al.* 1989).

Interpretation of Ootsa Lake mountain whitefish stomachs is constrained by the small sample size (three fish). Contents of those stomachs suggested bottom feeding and included Chironomidae pupae and other organisms associated with the substrate. Trichopteran larvae observed in the diet may have been situated among a Bryozoa colony.

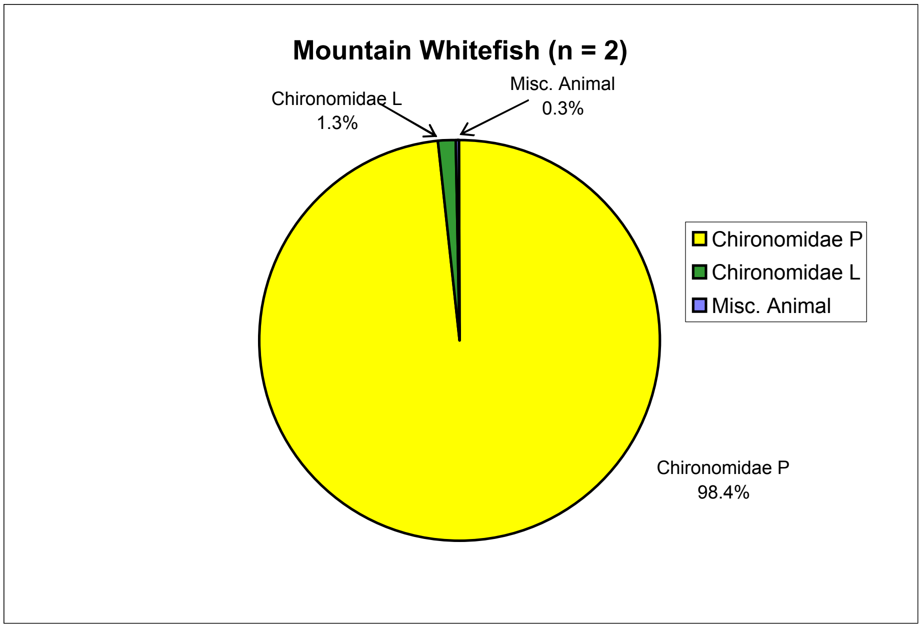
4.6 OTHER FISH DATA

4.6.1 Northern Squawfish

A total of 307 northern squawfish were captured during gillnet and electrofishing activities at five sites on the Nechako Reservoir, primarily at inner bay sites. Ninety fish were captured at Wells Creek Bay inner bay and 189 at Andrews Bay inner bay. Squawfish catches at other sites were 11 at Wells Creek Bay outer bay, 16 at the submerged lake basin, and 1 at Andrews Bay outer bay. Only three fish were sexed from Wells Creek Bay inner bay (1 male, 2 females).

Figure 4.5.3 Stomach content as percentage of total food items consumed by mountain whitefish, September/October 1996.

Wells Creek Bay Outer Bay



Misc Animal	**(0.3%)**
Acarina	0.1
Coleoptera	0.1
Bivalvia	0.1

4.6.1.1 Size

Mean fork length, wet weight, and condition factor are presented in Tables 4.6.1 to 4.6.3. Length frequency is shown in Figure 4.6.1. Fork length ranged from 84 to 343 mm; the largest specimens were collected from Wells Creek Bay inner bay and the submerged lake basin. Mean lengths for each site were 174.6 mm for Wells Creek Bay inner bay, 205.9 mm for Wells Creek Bay outer bay, 216.4 mm for the submerged lake basin, 177.1 mm for Andrews Bay inner bay, and 212 mm for the one Andrews Bay outer bay fish. Submerged lake basin fish generally appear to be larger relative to fish from other sites. Overall mean fork length for Wells Creek Bay (178.0 mm) and Andrews Bay (177.3 mm) were the same, though at both locations samples from inner bay sites included specimens of smaller size than those collected from outer bay sites.

Mean wet weight of northern squawfish also indicated that larger fish were captured from the submerged lake basin (Table 4.6.2). Weight for the submerged basin fish averaged 156.1 g relative to Wells Creek Bay average of 77.1 g and Andrews Bay average of 72.07 g. Slightly heavier squawfish were captured at outer bay sites relative to the inner bay (i.e., Well Creek Bay outer bay mean weight was 106.8 g relative to 73.4 g for the inner bay). Individual squawfish weights ranged from 6.0 to 574.9 g.

Length-weight regressions are shown in Figure 4.6.2. Mean condition factors were similar among samples (Table 4.6.3); mean values ranged from 1.14 for submerged lake basin northern squawfish relative to 1.07 for Wells Creek Bay fish and 1.09 for Andrews Bay fish. Wells Creek Bay outer bay fish exhibited slightly higher condition factor (1.16) relative to inner bay fish (1.05). Individual condition factors for squawfish ranged from 0.86 to 1.52.

4.6.1.2 Diet

Stomachs from three northern squawfish captured at Wells Creek Bay inner bay were analyzed for content (stomachs were 10 to 50% full). Average fish size was 210 mm in length. Stomach content data are presented in Table A7.8, Tables 4.4.10 and 4.4.11, and Figure 4.6.3.

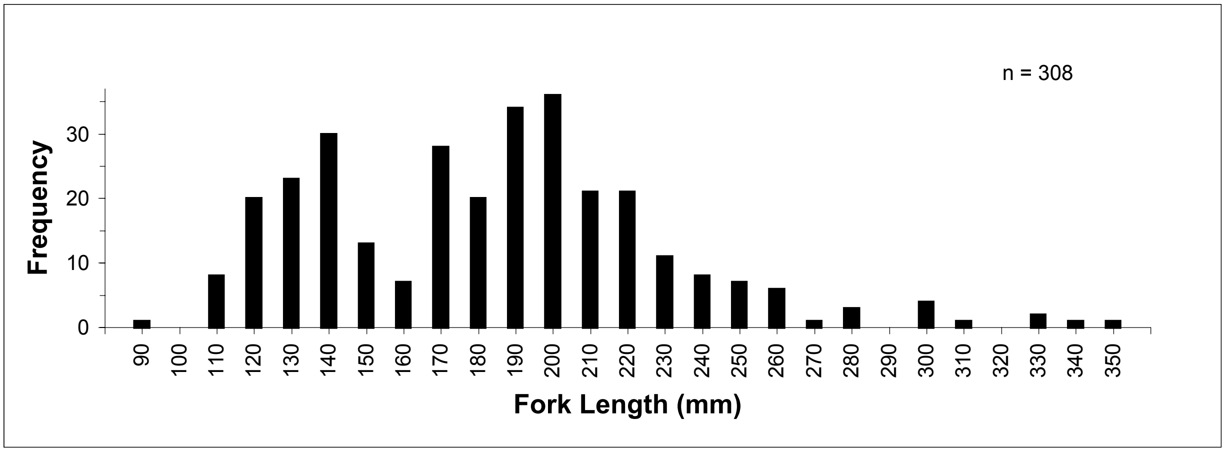
Northern squawfish stomachs contained predominantly Chironomidae adults (38.0%) and pupae (34.5%) and Bryozoa (*Cristetella* sp., 14.1%) (Figure 4.6.1). Several other food items were found in either fish with 50% stomach fullness, including Corixidae (Hemiptera), Trichoptera, and Gastropoda.

Several food items of northern squawfish are associated with substrates: Chironomidae pupae, Trichoptera larvae, and Gastropoda are found in and among the substrate; Bryozoa are attached to large substrate. Trichoptera adults and Corixidae are associated with the surface.

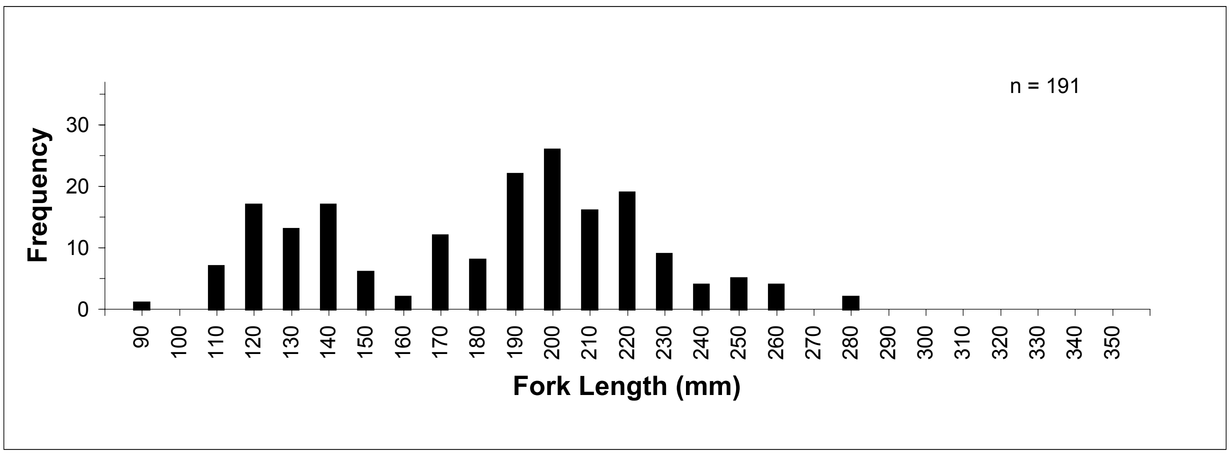
Stomachs of squawfish from various areas in Canada have exhibited consumption of shiners, sticklebacks, terrestrial insects, some plankton, aquatic insect larvae, and crustaceans (Scott and Crossman 1973). Smaller, younger fish (to 100 mm) primarily consume insects, but as they grow larger, fish becomes increasingly more important in the diet.

Figure 4.6.1 Length frequencies for northern squawfish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

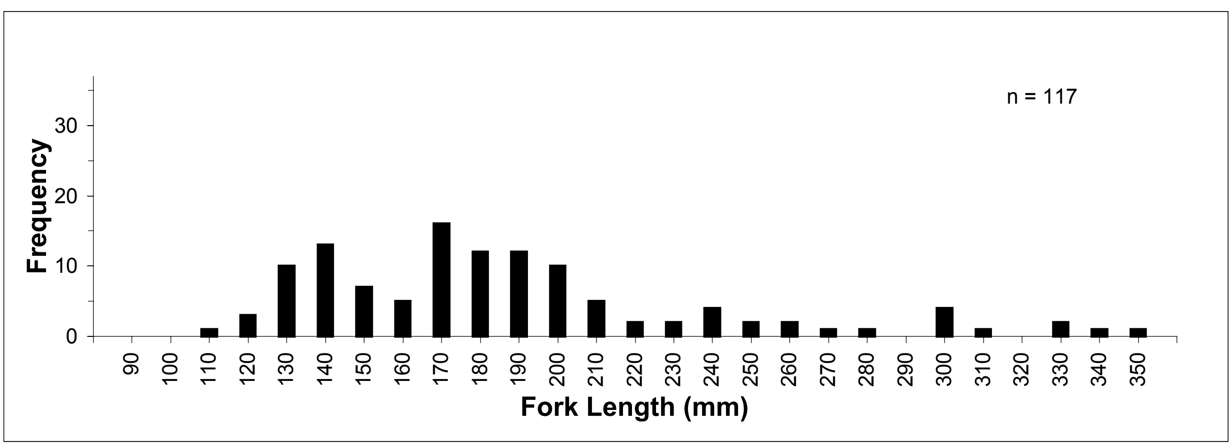


Table 4.6.1 Mean fork lengths (mm) for northern squawfish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October, 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									3	149.0	25.1	134-178
			Night												
		Gillnet	Day												
			Night	1	238.0			2	231.5	9.2	225-238	58	163.2	36.8	113-292
	Inner Bay 2	Gillnet	Day												
			Night									29	200.2	54.9	125-343
	All Inner Bay Samples	All Gear Types	All Times	1	238.0			2	231.5	9.2	225-238	90	174.6	46.4	113-343
	Outer Bay	Gillnet - floating	Day									2	210.0	31.1	188-232
			Night												
		Gillnet - sinking	Day									4	174.5	5.3	170-182
			Night									5	229.4	35.7	176-262
	All Outer Bay Samples	All Gear Types	All Times									11	205.9	35.9	170-262
	All Wells Creek Bay Samples	All Gear Types	All Times	1	238.0			2	231.5	9.2	225-238	101	178.0	46.3	113-343
Submerged Lake Basin		Gillnet - floating	Day												
			Night									11	191.9	54.6	108-275
		Gillnet - sinking	Day												
			Night									5	270.4	77.7	134-330
	All Submerged Lake Samples	All Gear Types	All Times									16	216.4	70.8	108-330
Andrews Bay	Inner Bay 1	Electrofishing	Day									6	149.0	62.0	84-245
			Night												
		Gillnet	Day									12	179.8	51.0	112-260
			Night									165	178.1	40.4	104-275
		Minnow Trap	Night									1	115.0		
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gilnet	Day												
			Night									5	183.8	42.4	122-232
	All Inner Bay Samples	All Gear Types	All Times									189	177.1	42.0	84-275
	Outer Bay	Gillnet - floating	Day												
			Night									1	212.0		
		Gillnet - sinking	Day												
			Night												
	All Outer Bay Samples	All Gear Types	All Times									1	212.0		
	All Andrews Bay Samples	All Gear Types	All Times									190	177.3	42.0	84-275
All Areas	All Locations	All Gear Types	All Times	1	238.0			2	231.5	9.2	225-238	307	179.6	45.9	84-343

Table 4.6.2 Mean wet weights (g) for northern squawfish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									3	34.27	15.36	25.0-52.0
			Night												
		Gillnet	Day												
			Night	1	157.00			2	147.10	14.00	137.2-157.0	58	54.41	48.63	13.9-299.5
	Inner Bay 2	Gillnet	Day												
			Night									28	116.95	136.04	38.9-574.9
	All Inner Bay Samples	All Gear Types	All Times	1	157.00			2	147.10	14.00	137.2-157.0	89	73.41	90.05	13.9-574.9
	Outer Bay	Gillnet - floating	Day									2	104.25	45.75	71.9-136.6
			Night												
		Gillnet - sinking	Day									4	69.20	6.19	63.4-74.7
			Night									5	137.84	61.04	54.5-199.3
	All Outer Bay Samples	All Gear Types	All Times									11	106.77	52.54	54.5-199.3
	All Wells Creek Bay Samples	All Gear Types	All Times	1	157.00			2	147.10	14.00	137.2-157.0	100	77.08	87.16	13.9-574.9
Submerged Lake Basin		Gillnet - floating	Day												
			Night									11	99.22	78.74	15.1-248.3
		Gillnet - sinking	Day												
			Night									5	281.12	149.24	28.6-427.5
	All Submerged Lake Samples	All Gear Types	All Times									16	156.06	132.88	15.1-427.5
Andrews Bay	Inner Bay 1	Electrofishing	Day									6	56.33	70.08	6.0-181.2
			Night												
		Gillnet	Day									12	79.84	56.59	15.3-185.5
			Night									165	71.73	46.28	11.9-252.9
		Minnow Trapping	Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gilnet	Day												
			Night									5	77.58	47.70	20.7-143.7
	All Inner Bay Samples	All Gear Types	All Times									188	71.91	47.54	6.0-252.9
	Outer Bay	Gillnet - floating	Day												
			Night									1	101.80		
		Gillnet - sinking	Day												
			Night												
	All Outer Bay Samples	All Gear Types	All Times									1	101.80		
	All Andrews Bay Samples	All Gear Types	All Times									189	72.07	47.46	6.0-252.9
All Areas	All Locations	All Gear Types	All Times	1	157.00			2	147.10	14.00	137.2-157.0	305	78.12	71.28	6.0-574.9

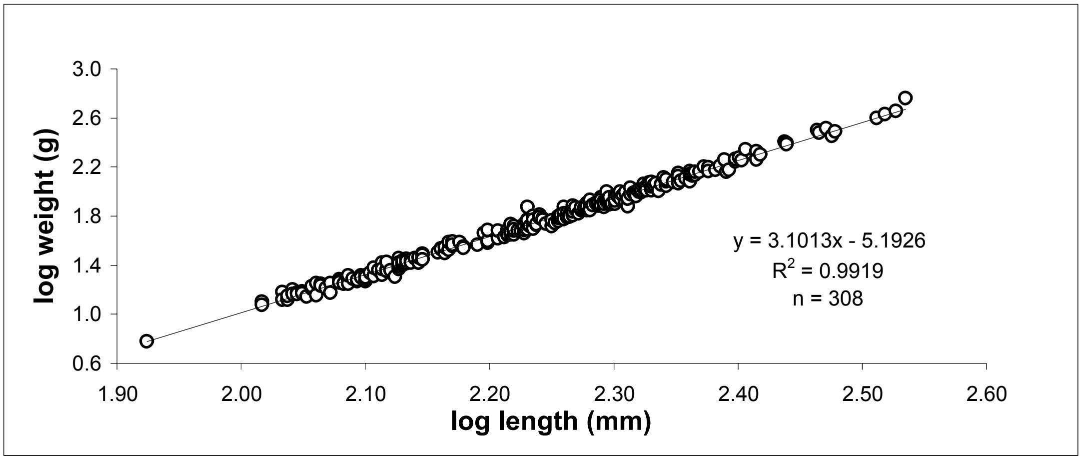
Note: Combined sex numbers include fish captured but not sexed.

Table 4.6.3 Mean condition factors (K) for northern squawfish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

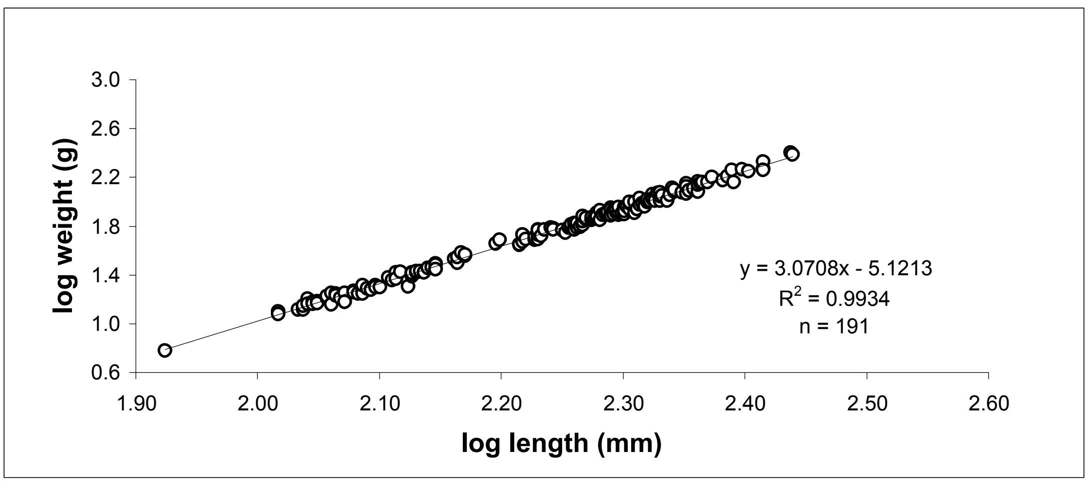
General Sample Area	Sample Location	Sample Method	Time	Male				Female				Combined Sex			
				n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day									3	1.00	0.08	0.92-1.07
			Night												
		Gillnet	Day												
			Night	1	1.16			2	1.18	0.03	1.16-1.20	58	1.05	0.07	0.93-1.20
	Inner Bay 2	Gillnet	Day												
			Night									28	1.07	0.11	0.88-1.42
	All Inner Bay Samples	All Gear Types	All Times	1	1.16			2	1.18	0.03	1.16-1.20	89	1.05	0.08	0.88-1.42
	Outer Bay	Gillnet - floating	Day									2	1.09	0.01	1.08-1.09
			Night												
		Gillnet - sinking	Day									4	1.31	0.14	1.22-1.52
			Night									5	1.07	0.08	0.99-1.17
	All Outer Bay Samples	All Gear Types	All Times									11	1.16	0.15	0.99-1.52
	All Wells Creek Bay Samples	All Gear Types	All Times	1	1.16			2	1.18	0.03	1.16-1.20	100	1.07	0.10	0.88-1.52
Submerged Lake Basin		Gillnet - floating	Day												
			Night									11	1.11	0.10	0.99-1.33
		Gillnet - sinking	Day												
			Night									5	1.21	0.06	1.13-1.28
	All Submerged Lake Samples	All Gear Types	All Times									16	1.14	0.10	0.99-1.33
Andrews Bay	Inner Bay 1	Electrofishing	Day									6	1.06	0.13	0.86-1.23
			Night												
		Gillnet	Day									12	1.13	0.08	1.00-1.24
			Night									165	1.09	0.07	0.91-1.24
		Minnow Trapping	Night												
	Inner Bay 2	Electrofishing	Day												
			Night												
		Gilnet	Day												
			Night									5	1.10	0.06	1.01-1.15
	All Inner Bay Samples	All Gear Types	All Times									188	1.09	0.07	0.86-1.24
	Outer Bay	Gillnet - floating	Day												
			Night									1	1.07		
		Gillnet - sinking	Day												
			Night												
	All Outer Bay Samples	All Gear Types	All Times									1	1.07		
	All Andrews Bay Samples	All Gear Types	All Times									189	1.09	0.07	0.86-1.24
All Areas	All Locations	All Gear Types	All Times	1	1.16			2	1.18	0.03	1.16-1.20	305	1.09	0.08	0.86-1.52

Figure 4.6.2 Length-weight regressions for northern squawfish sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

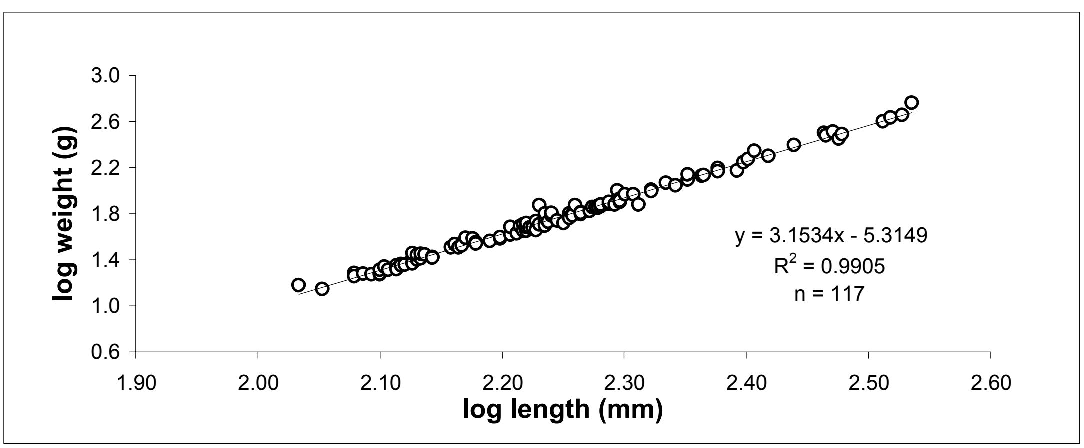
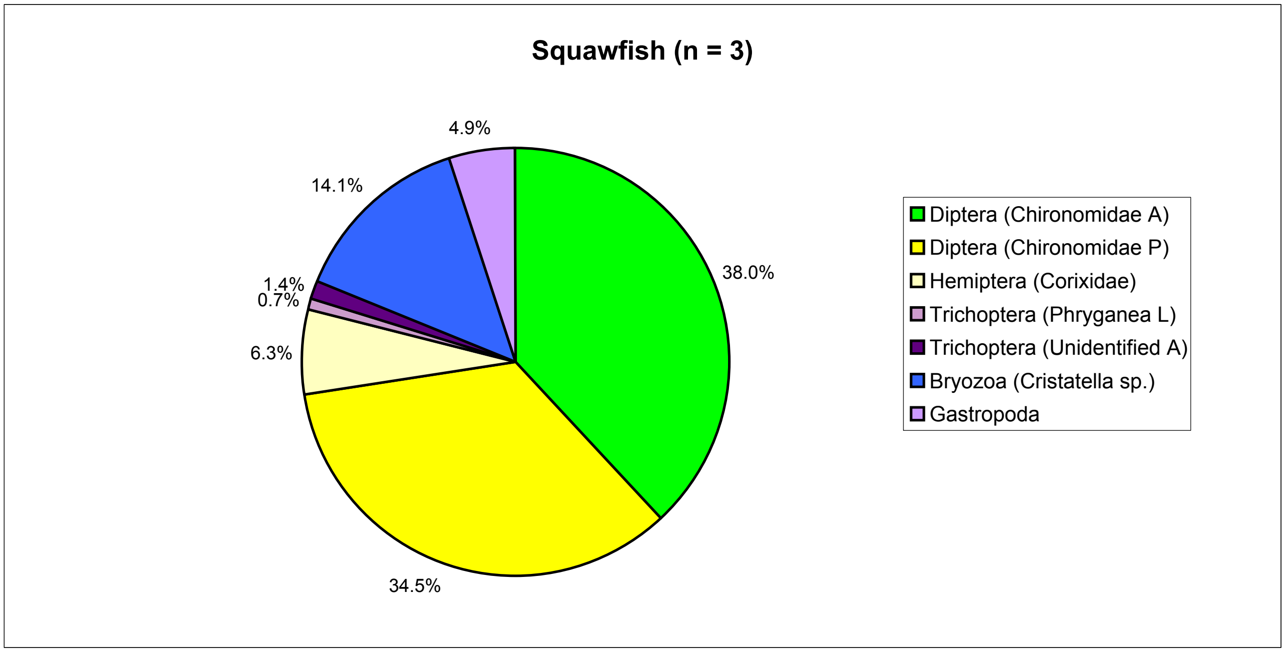


Figure 4.6.3 Stomach content as percentage of total food items consumed by northern squawfish, September/October 1996.

Wells Creek Bay Inner Bay



Contents of the three squawfish stomachs from Ootsa Lake suggest opportunistic feeding, and included prey which may occupy substrate, water column, and surface areas. No fish were noted in these stomachs even though the squawfish were approximately 200 mm in length.

4.6.2 Longnose Sucker

A total of 12 longnose sucker were captured during gillnet and electrofishing activities at five sites on Ootsa Lake. One fish each was captured at Wells Creek Bay inner bay and Andrews Bay outer bay; four sucker were captured at Wells Creek Bay outer bay and Andrews Creek inner bay; two longnose sucker were captured the submerged lake basin.

Mean fork length, wet weight, and condition factor are presented in Tables 4.6.4 to 4.6.6. Length frequency is shown in Figure 4.6.4. Fork length ranged from 109 to 397 mm (mean of 280.3 mm); the largest specimens were collected from the submerged lake basin. Longnose suckers captured in outer bay locations ranged in size from 292 mm to 400 mm; specimens collected from inner bay sites ranged in size from 109 mm to 238 mm.

Mean wet weight of longnose sucker also indicated that larger fish were captured from the submerged lake basin and outer bay locations (Table 4.6.5). Weight for the submerged basin fish averaged 776.7 g; in Well Creek Bay outer bay mean weight was 582.6 g. Individual longnose sucker weights ranged from 12.0 to 828.0 g.

The length-weight regression for longnose sucker is shown in Figure 4.6.5a. Mean condition factor for all locations was 1.18 (Table 4.6.6). Individual condition factors for longnose sucker ranged from 0.93 to 1.40.

4.6.3 Largescale Sucker

A total of nine largescale sucker were captured during gillnet and electrofishing activities at two sites on Ootsa Lake. Two fish were captured at Wells Creek Bay inner bay; seven fish were captured at Andrews Creek inner bay.

Mean fork length, wet weight, and condition factor are presented in Tables 4.6.7 to 4.6.9. Length frequency is shown in Figure 4.6.6. Fork length ranged from 176 to 295 mm (overall mean of 258.8 mm); specimens were of comparable mean size at both inner bay locations. Mean lengths of largescale sucker were 269.0 mm at Wells Creek Bay and 255.9 mm for Andrews Bay.

Mean wet weights of largescale sucker were also similar, averaging 247.5 g at Wells Creek Bay and 224.9 g at Andrews Bay (Table 4.6.8). Individual largescale sucker weights ranged from 69.0 to 330.6 g.

Table 4.6.4 Mean fork lengths (mm) for longnose suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	109.0		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	1	109.0		
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day	2	316.0	33.9	292-340
			Night	2	386.0	15.6	375-397
	All Outer Bay Samples	All Gear Types	All Times	4	351.0	45.8	292-397
	All Wells Creek Bay Samples	All Gear Types	All Times	5	302.6	115.3	109-397
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night	2	391.0	12.7	382-400
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day				
			Night				
		Gillnet	Day	2	192.0	42.4	162-222
			Night	2	182.5	78.5	127-238
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	4	187.3	51.8	127-238
	Outer Bay	Gillnet - floating	Day				
			Night	1	319.0		
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	5	213.6	74.1	127-319
All Areas	All Locations	All Gear Types	All Times	12	280.3	106.4	109-400

Table 4.6.5 Mean wet weights (g) for longnose suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

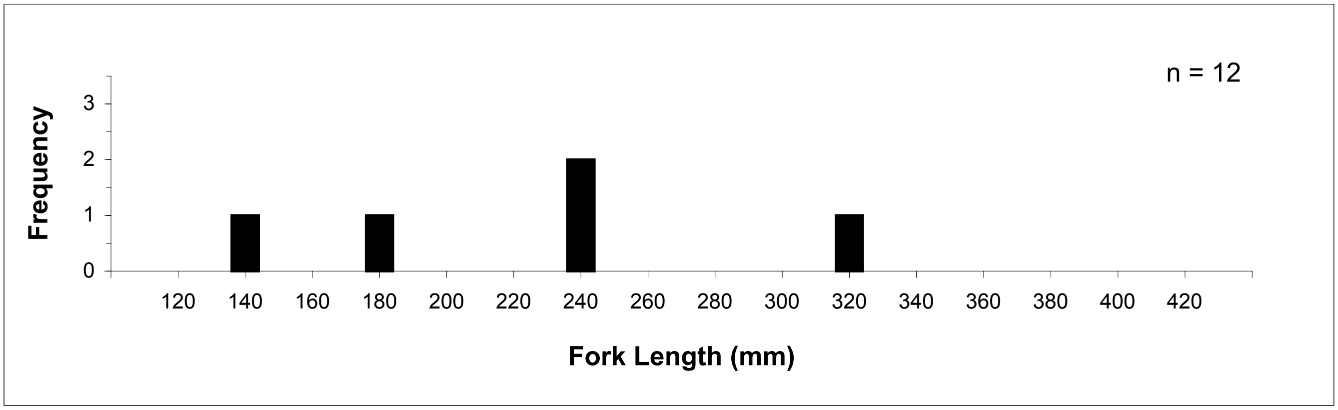
General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	12.00		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	1	12.00		
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day	2	431.65	169.21	312.0-551.3
			Night	2	733.45	133.71	638.9-828.0
	All Outer Bay Samples	All Gear Types	All Times	4	582.55	214.16	312.0-828.0
	All Wells Creek Bay Samples	All Gear Types	All Times	5	468.44	315.44	12.0-828.0
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night	2	776.70	0.99	776.0-777.4
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day				
			Night				
		Gillnet	Day	2	89.85	63.99	44.6-135.1
			Night	2	86.30	93.20	20.4-152.2
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	4	88.08	65.30	20.4-152.2
	Outer Bay	Gillnet - floating	Day				
			Night	1	344.60		
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	5	139.38	127.90	20.4-344.6
All Areas	All Locations	All Gear Types	All Times	12	382.71	317.19	12.0-828.0

Table 4.6.6 Mean condition factor (K) for longnose suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

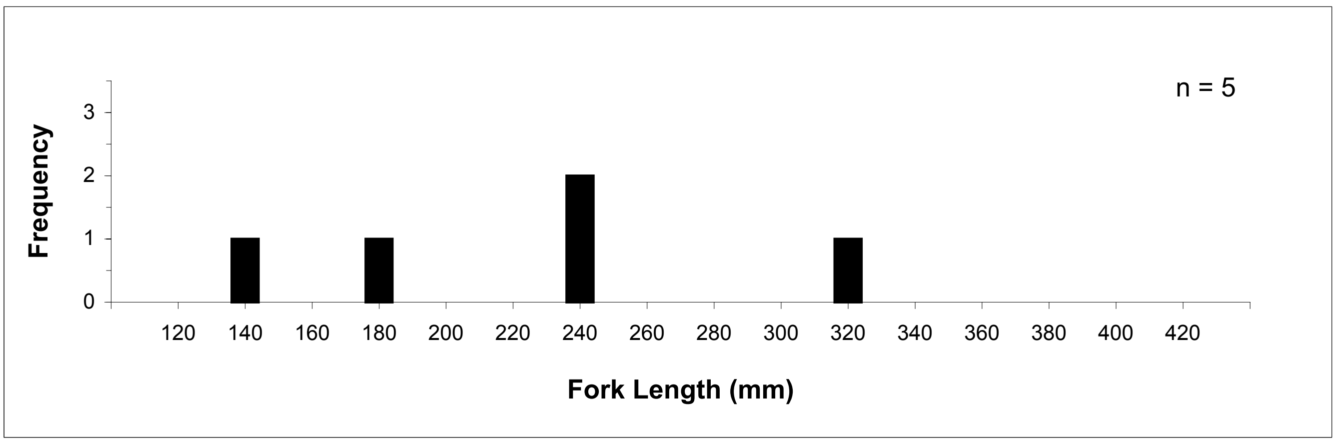
General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	0.93		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	1	0.93		
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day	2	1.33	0.11	1.25-1.40
			Night	2	1.27	0.08	1.21-1.32
	All Outer Bay Samples	All Gear Types	All Times	4	1.30	0.08	1.21-1.40
	All Wells Creek Bay Samples	All Gear Types	All Times	5	1.22	0.18	0.93-1.4
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night	2	1.30	0.13	1.21-1.39
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day				
			Night				
		Gillnet	Day	2	1.14	0.13	1.05-1.23
			Night	2	1.06	0.09	1.00-1.13
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	4	1.10	0.10	1.00-1.23
	Outer Bay	Gillnet - floating	Day				
			Night	1	1.06		
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	5	1.09	0.09	1.00-1.23
All Areas	All Locations	All Gear Types	All Times	12	1.18	0.15	0.93-1.40

Figure 4.6.4 **Length frequencies for longnose suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.**

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

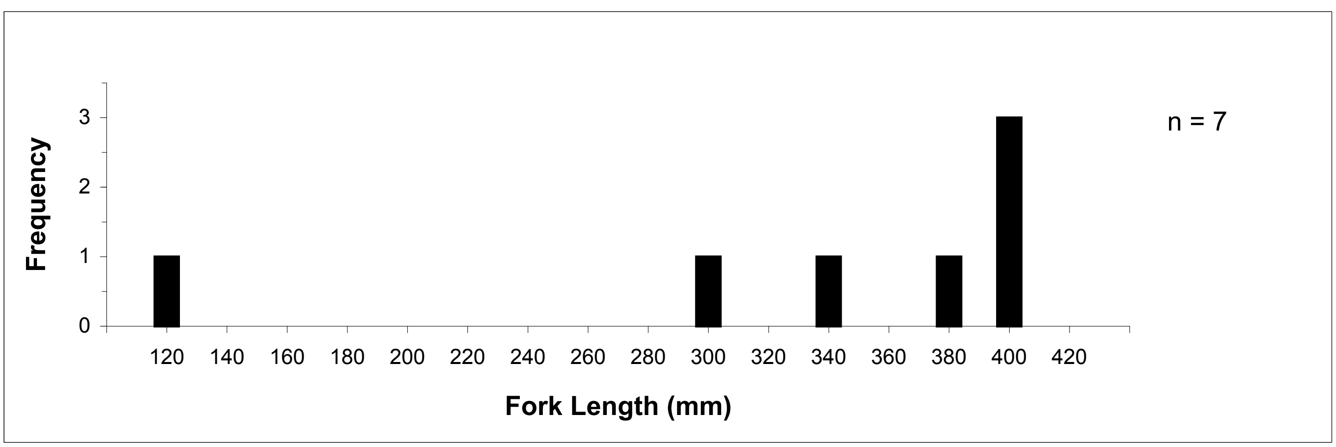
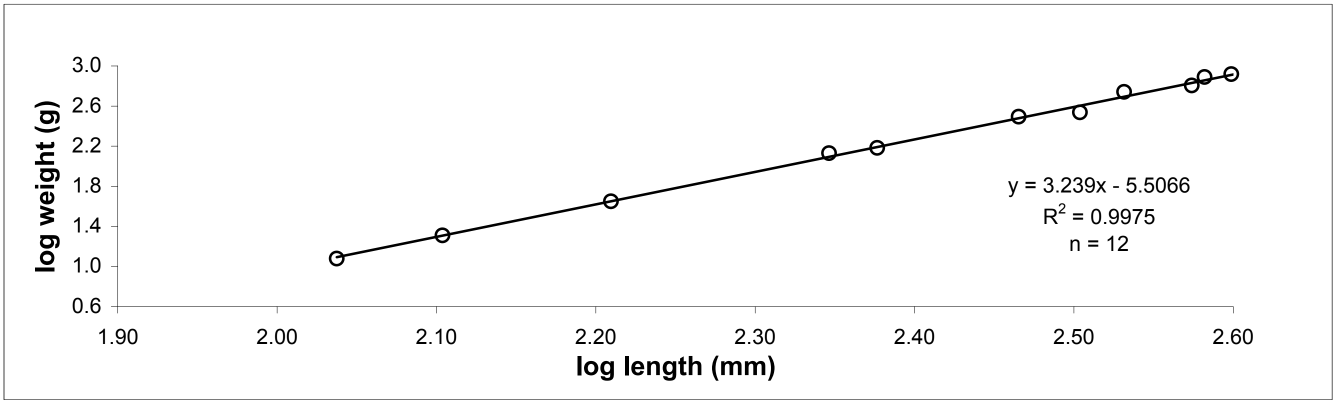


Figure 4.6.5 Length-weight regressions for longnose and largescale suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/ October, 1996.

a. Longnose sucker



b. Largescale sucker

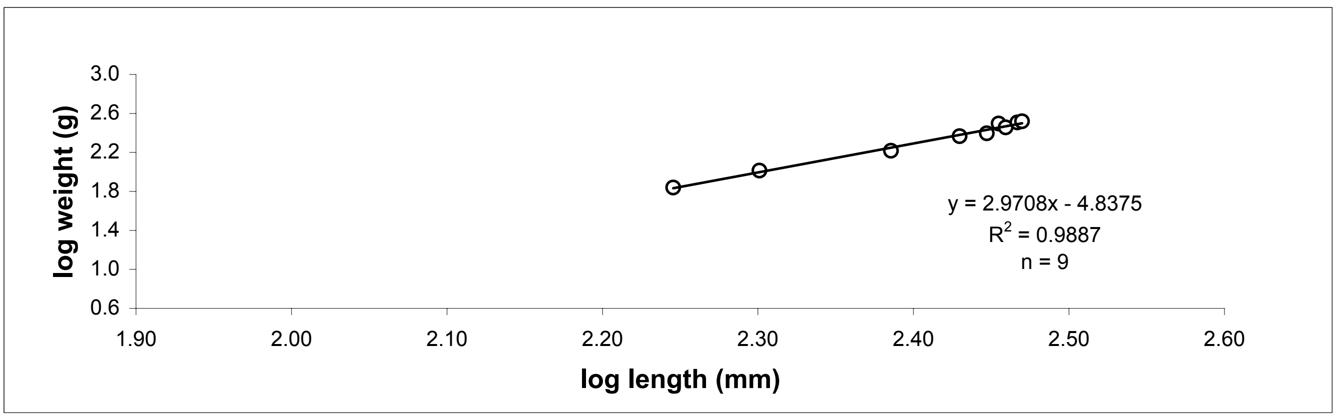
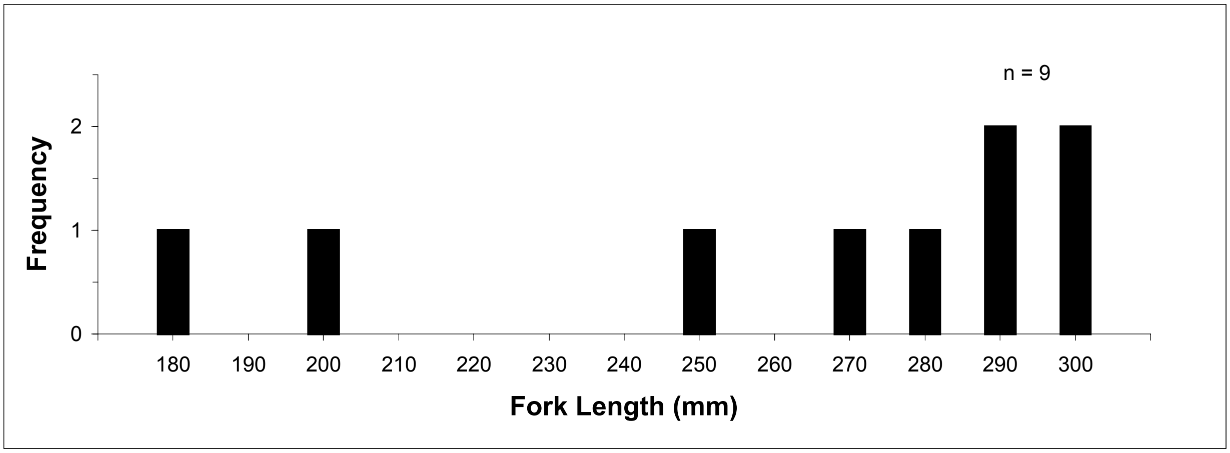
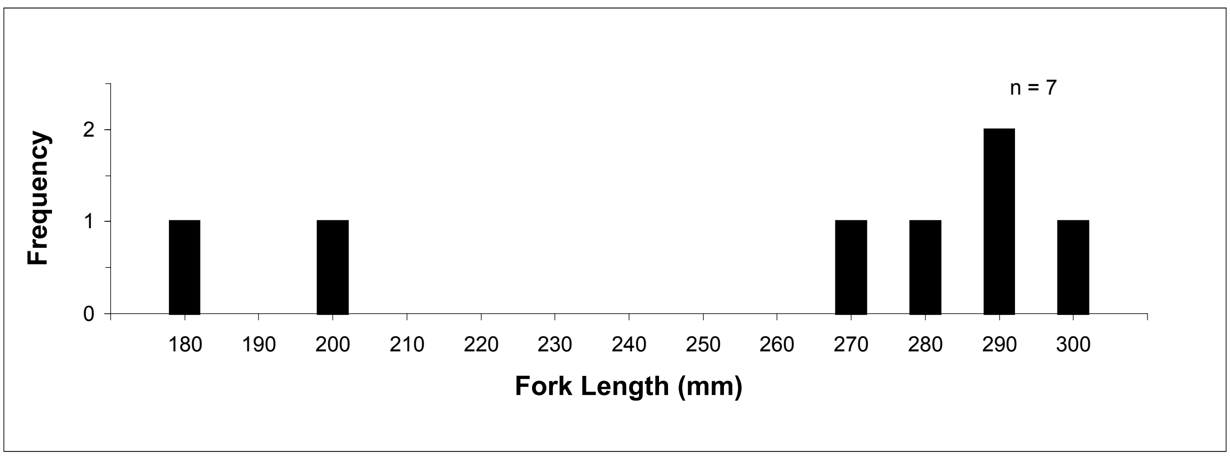


Figure 4.6.6 Length frequencies for largescale suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

A. All locations combined



B. Andrews Bay



C. Wells Creek Bay and Submerged Lake Basin

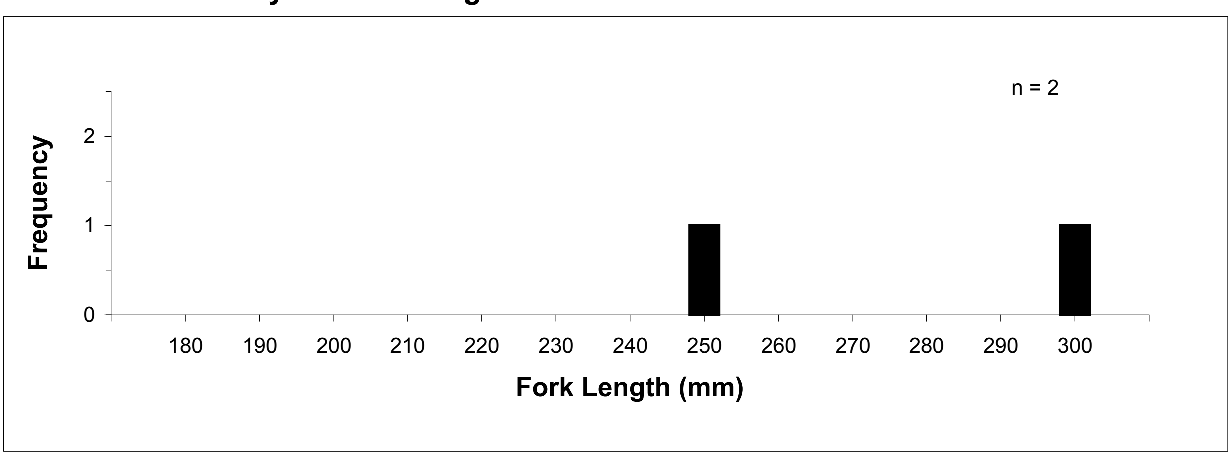


Table 4.6.7 Mean fork lengths (mm) for largescale suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	243.0		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night	1	295.0		
	All Inner Bay Samples	All Gear Types	All Times	2	269.0	36.8	243-295
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Wells Creek Bay Samples	All Gear Types	All Times	2	269.0	36.8	243-295
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day	1	176.0		
			Night				
		Gillnet	Day	1	200.0		
			Night	5	283.0	9.1	269-293
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	7	255.9	47.5	176-293
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	7	255.9	47.5	176-293
All Areas	All Locations	All Gear Types	All Times	9	258.8	43.5	176-295

Table 4.6.8 Mean wet weights (g) for largescale suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	164.50		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night	1	330.60		
	All Inner Bay Samples	All Gear Types	All Times	2	247.55	117.45	164.5-330.6
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Wells Creek Bay Samples	All Gear Types	All Times	2	247.55	117.45	164.5-330.6
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day	1	69.00		
			Night				
		Gillnet	Day	1	103.00		
			Night	5	280.42	38.97	232.4-321.6
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	7	224.87	100.54	69.0-321.6
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	7	224.87	100.54	69.0-321.6
All Areas	All Locations	All Gear Types	All Times	9	229.91	96.98	69.0-330.6

Table 4.6.9 Mean condition factor (K) for largescale suckers sampled at Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

General Sample Area	Sample Location	Sample Method	Time	Combined Sex			
				n	Mean	SD	Range
Wells Creek Bay	Inner Bay 1	Electrofishing	Day	1	1.15		
			Night				
		Gillnet	Day				
			Night				
	Inner Bay 2	Gillnet	Day				
			Night	1	1.29		
	All Inner Bay Samples	All Gear Types	All Times	2	1.22	0.10	1.15-1.29
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Wells Creek Bay Samples	All Gear Types	All Times	2	1.22	0.10	1.15-129
Submerged Lake Basin		Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Submerged Lake Samples	All Gear Types	All Times				
Andrews Bay	Inner Bay 1	Electrofishing	Day	1	1.27		
			Night				
		Gillnet	Day	1	1.29		
			Night	5	1.23	0.08	1.20-1.35
	Inner Bay 2	Electrofishing	Day				
			Night				
		Gillnet	Day				
			Night				
	All Inner Bay Samples	All Gear Types	All Times	7	1.24	0.07	1.20-1.35
	Outer Bay	Gillnet - floating	Day				
			Night				
		Gillnet - sinking	Day				
			Night				
	All Outer Bay Samples	All Gear Types	All Times				
	All Andrews Bay Samples	All Gear Types	All Times	7	1.24	0.07	1.20-1.35
All Areas	All Locations	All Gear Types	All Times	9	1.24	0.07	1.15-1.35

The length-weight regression for largescale sucker is shown in Figure 4.6.5a. Mean condition factor ranged from 1.22 for Wells Creek Bay largescale suckers to 1.24 for Andrews Bay fish. Individual condition factors for largescale sucker ranged from 1.15 to 1.35.

4.7 WATER QUALITY CONDITIONS DURING FISH CAPTURE

The fish sampling program took place over the same time period as the second of two water sampling programs of the water quality impact assessment project. Two sample sites of that project (Station 2, at Windy Point near Andrews Bay, and Station 9, near Wells Creek Bay/Knox Island) are located in proximity to the two main fish survey locations of the current study. A summary of data collected at those site is presented below (Perrin *et al*. 1997).

Water quality at water collection sites near Andrews Bay and near Wells Creek Bay are presented in Tables 4.7.1 and 4.7.2 and Figures 4.7.1 and 4.7.2. pH was similar at both sites in August (approximately 7.4); however, pH decreased near Andrews Bay in September (to 6.6) while values remained unchanged at the site near Wells Creek Bay. Mean values of conductivity (44 and 45 µS/cm), suspended solids (generally <1 mg/L), total dissolved solids (22.2 and 22.6 mg/L), alkalinity (20 mg $CaCO_3$/L), and color (<5) were very similar between the two sites. The higher suspended solids and turbidity levels of 28.0 mg/L and 8.0 NTU, respectively, at 30 m near Andrews Bay may have been due to disturbance of sediments during sampling. Total organic carbon concentrations were comparable (3.0 to 4.9 mg/L); sulphides were not detected. Secchi depth was greater near Wells Creek Bay (7.1 m in August and 6.5 m in September) relative to the site near Andrews Bay (5.9 m in August and 4.1 m in September), indicating greater clarity of water on both sample occasions.

Nutrient concentrations were similar in September. Ammonia was slightly higher near Wells Creek Bay (8.1 to 9.4 µg/L) relative to the site near Andrews Bay (5.1 to 5.8 µg/L); nitrate was slightly lower near Wells Creek Bay (0.3 to 0.7 µg/L, relative to 1.5 to 3.1 µg/L at Andrews Bay). Phosphorus species were slightly higher near Wells Creek Bay relative to the site near Andrews Bay.

Depth profiles of temperature and dissolved oxygen near Andrews Bay illustrate well mixed water to 36 m depth during August and September (Figure 4.7.1). Temperature decreased approximately 1°C below 10 m during August, but varied <0.4°C in September with depth. Dissolved oxygen remained approximately the same for both months. In the vicinity of Wells Creek Bay, temperature decreased below 18 m in August, particularly below 35 m (Figure 4.7.2). A similar decrease was observed below 32 m in September. Dissolved oxygen concentrations remained relatively consistent with depth on both dates. Temperatures near Wells Creek Bay were approximately 1°C higher relative to those near Andrews Bay; September temperatures were approximately 1°C cooler relative to August.

Table 4.7.1 General water quality, nutrient analysis, and Secchi depth data collected near Andrews Bay (Station 2), August and September 1996.

Parameter	August 19, 1996			Mean	Standard Deviation	September 28, 1996			Mean	Standard Deviation
Depth (m)	0	15	30	-	-	0	15	30	-	-
pH	7.3	7.4	7.3	**7.3**	0.1	6.8	6.6	6.5	**6.6**	0.2
Conductivity (µS/cm)	43.4	44.1	44.4	**44.0**	0.5	-	-	-	**-**	-
Suspended Solids (mg/L)	<1	<1	<1	**<1**	-	<1	<1	28.0	**<28**	-
Total Dissolved Solids (mg/L)	21.8	22.2	22.5	**22.2**	0.4	-	-	-	**-**	-
Turbidity (NTU)	0.30	0.30	0.30	**0.30**	0.00	0.65	0.35	8.00	**3.00**	4.33
Alkalinity (mg $CaCO_3$/L)	20	20	21	**20**	1	20	20	20	**20**	0
Color (APHA V.)	<5	<5	<5	**<5**	-	<5	<5	<5	**<5**	-
Total Organic Carbon (mg C/L)	4.9	3.8	4.2	**4.3**	0.6	3.2	3.0	3.6	**3.3**	0.3
Sulfide (mg/L)	<0.005	<0.005	<0.005	**<0.005**	-	<0.005	<0.005	<0.005	**<0.005**	-
Ammonia (NH3) (µg/L)	7.1	6.0	4.0	**5.7**	1.6	5.8	5.1	5.3	**5.4**	0.4
Nitrate (NO3) (µg/L)	0.7	1.2	3.3	**1.7**	1.4	1.5	2.6	3.1	**2.4**	0.8
Soluble Reactive Phosphate (µg/L)	0.4	0.2	0.2	**0.3**	0.1	1.2	0.9	1.4	**1.2**	0.3
Total Phosphorus (µg/L)	3.7	3.0	6.0	**4.2**	1.6	5.6	6.1	6.1	**5.9**	0.3
Total Dissolved Phosphorus (µg/L)	1.6	1.7	1.6	**1.6**	0.1	3.6	2.8	2.6	**3.0**	0.5
Secchi (m)	5.9	-	-	**5.9**	-	4.1	-	-	**4.1**	-

- = measurement not taken, or not applicable.

Source: Perrin *et al.* 1997.

Table 4.7.2 General water quality, nutrient analysis, and Secchi depth data collected at Knox Island (Station 9), near Wells Creek Bay, August and September 1996.

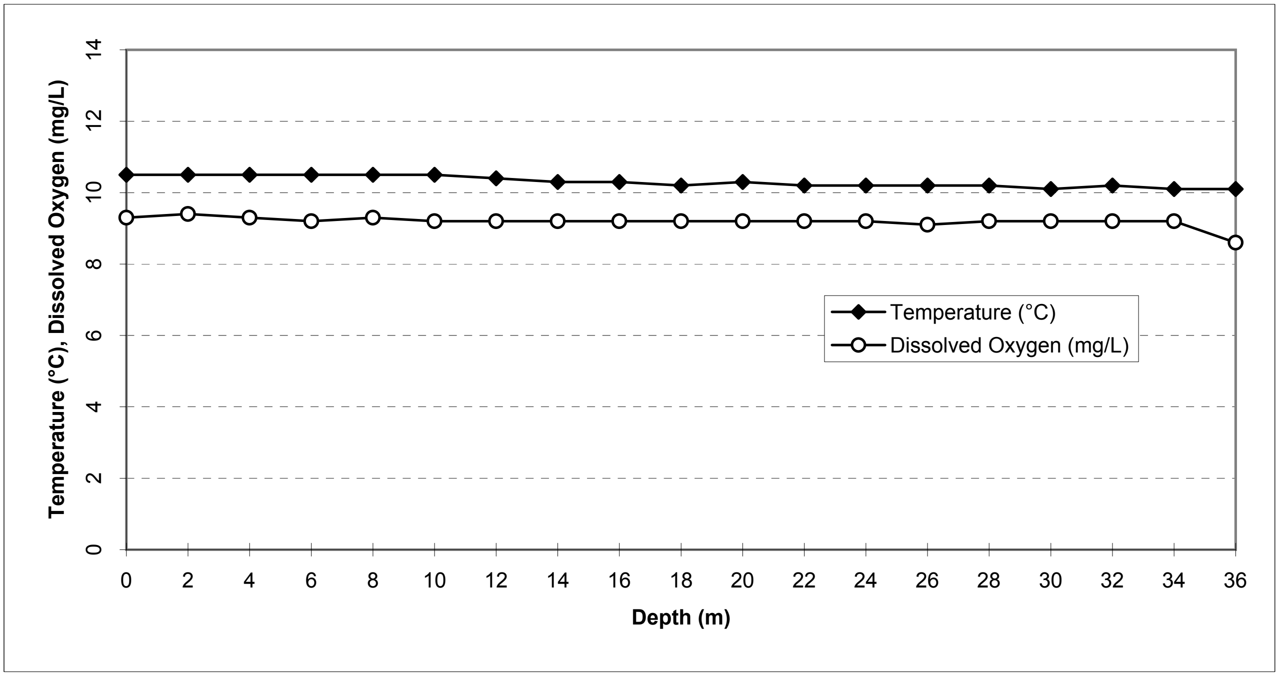
Parameter	August 20, 1996			Mean	Standard Deviation	September 29, 1996			Mean	Standard Deviation
Depth (m)	0	15	30	**-**	-	0	15	30	-	-
pH	7.5	7.4	7.3	**7.4**	0.1	7.4	7.4	7.4	**7.4**	0.0
Conductivity (µS/cm)	45.4	44.1	45.6	**45.0**	0.8	-	-	-	**-**	-
Suspended Solids (mg/L)	<1	<1	<1	**<1**	-	<1	<1	<1	**<1**	-
Total Dissolved Solids (mg/L)	22.7	22.2	22.9	**22.6**	0.4	-	-	-	**-**	-
Turbidity (NTU)	0.30	0.35	0.30	**0.3**	0.0	0.33	0.25	0.22	**0.3**	0.1
Alkalinity (mg $CaCO_3$/L)	20	20	21	**20**	1	20	20	19	**20**	1
Color (APHA V.)	<5	<5	<5	**<5**	-	<5	<5	<5	**<5**	-
Total Organic Carbon (mg C/L)	4.1	3.7	4.1	**4.0**	0.2	3.3	3.3	3.3	**3.3**	0.0
Sulfide (mg/L)	<0.005	<0.005	<0.005	**<0.005**	-	<0.005	<0.005	<0.005	**<0.005**	-
Ammonia (NH3) (µg/L)	6.6	8.6	11.0	**8.7**	2.2	8.5	9.4	8.1	**8.7**	0.7
Nitrate (NO3) (µg/L)	1.3	2.3	1.0	**1.5**	0.7	0.3	0.3	0.7	**0.4**	0.2
Soluble Reactive Phosphate (µg/L)	0.4	0.6	0.6	**0.5**	0.1	1.5	1.3	1.8	**1.5**	0.3
Total Phosphorus (µg/L)	4.8	4.5	4.0	**4.4**	0.4	7.9	6.3	6.5	**6.9**	0.9
Total Dissolved Phosphorus (µg/L)	2.0	2.0	2.5	**2.2**	0.3	2.3	2.7	3.0	**2.7**	0.4
Secchi (m)	7.1	-	-	**7.1**	-	6.5	-	-	**6.5**	-

- = measurement not taken, or not applicable.

Source: Perrin *et al.* 1997.

Figure 4.7.1 Depth profiles of temperature and dissolved oxygen near Andrews Bay (Station 2), August and September, 1996.

September 28, 1996



August 19, 1996

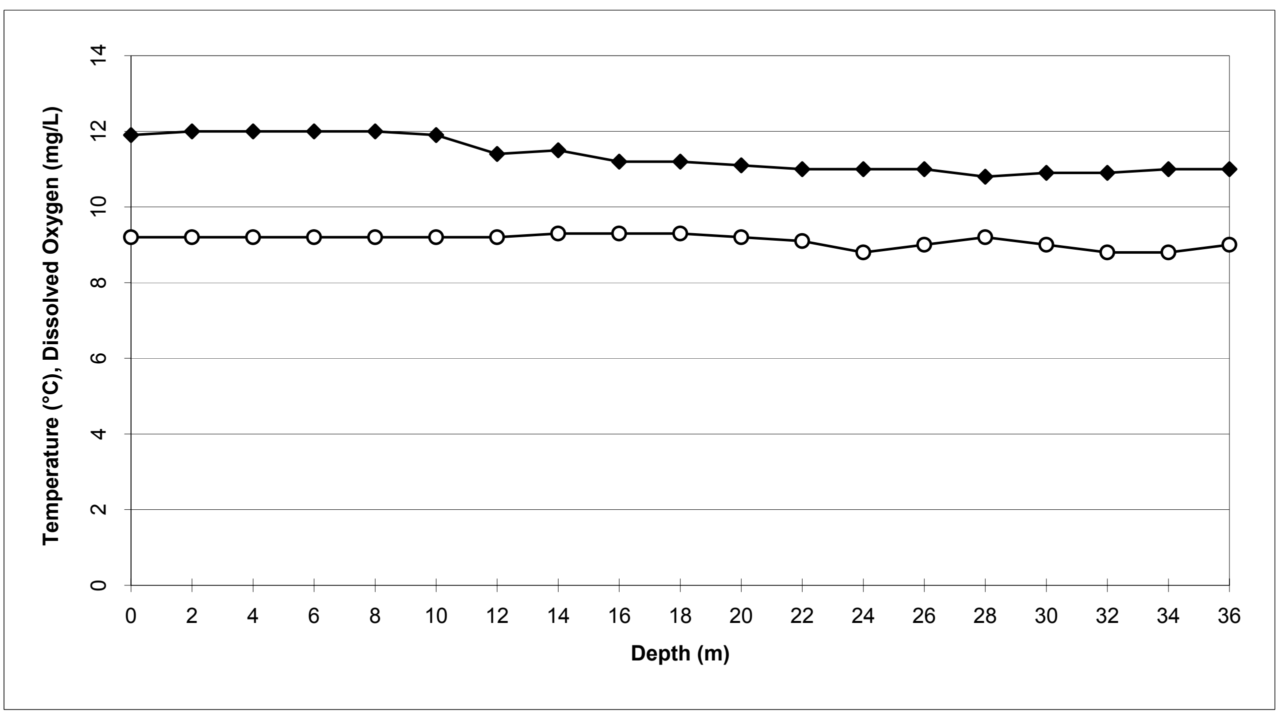
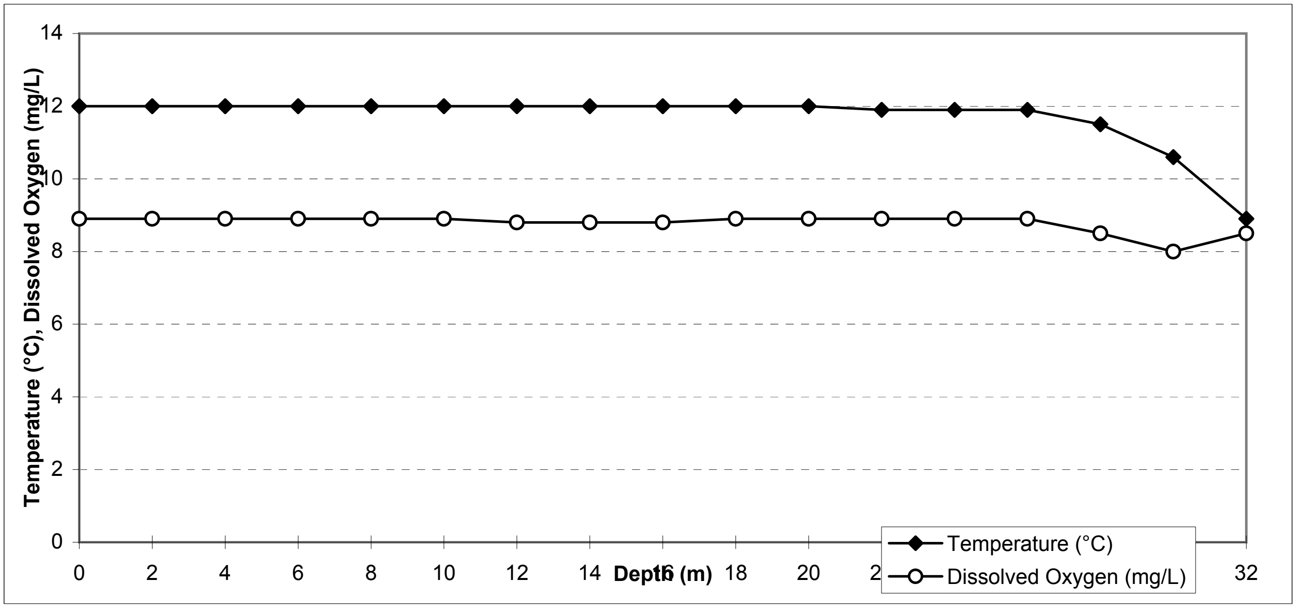
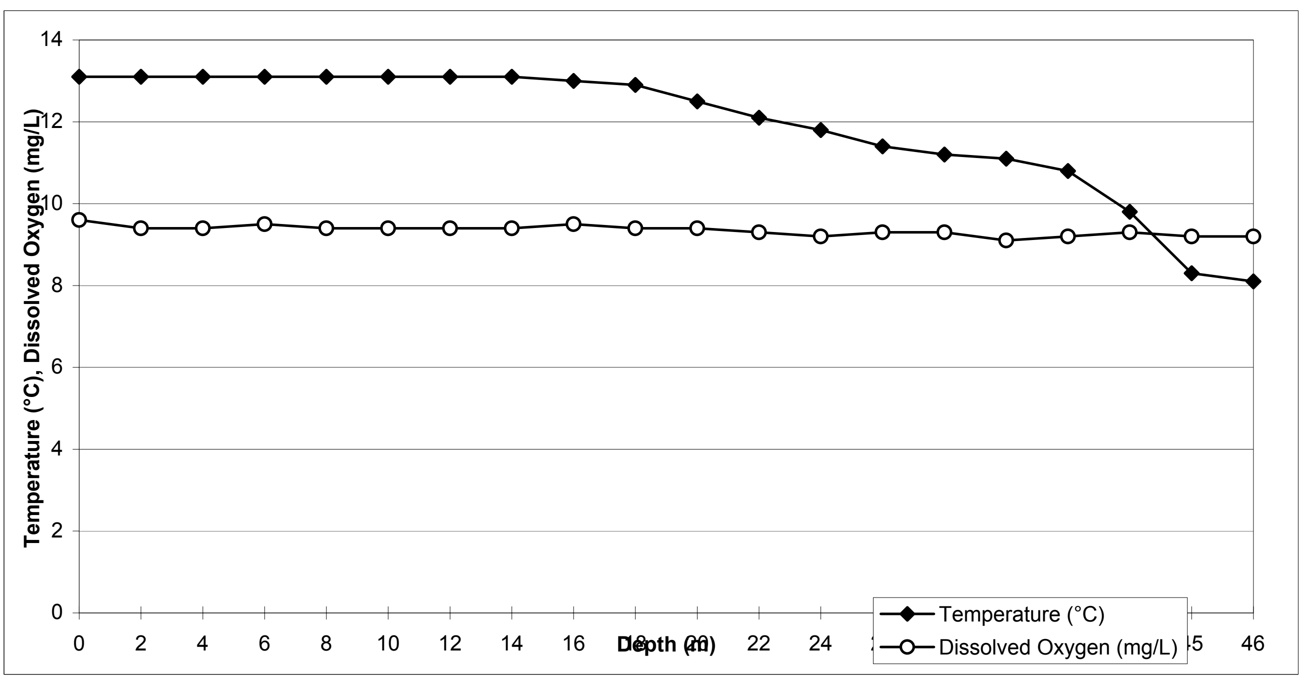


Figure 4.7.2 **Depth profiles of temperature and dissolved oxygen near Knox Island (Station 9) nea Wells Creek Bay, August and September 1996.**

September 29, 1996



August 19, 1997



4.8 RESOURCE USE AND LOCAL KNOWLEDGE

4.8.1 Cheslatta Carrier First Nation

Cheslatta Carrier First Nation people harvested fish in reservoir lakes with gillnets prior to reservoir flooding (Chief M. Charlie, *pers. comm*. 1996). Fish were captured mainly in Henson Narrows, at the head of Intata Reach, Chief Louis Arm, Whitesail Lake, Tetachuk Lake, and in Cheslaslie Arm. Whitefish, suckers, and rainbow trout were the main species captured, with different size nets used to catch different species. Occasionally burbot were caught in Ootsa Lake with gillnets and set lines. Today, the main reason the community does not fish in reservoir lakes is because they are not able to use nets in areas of trees and snags. Nets were attempted in 1965 but were lost. Currently fish are taken from reservoir areas by rod and reel during camping trips, although the community now uses mainly Cheslatta Lake for such trips.

When the community was engaged in net fishing on the lakes, fishing took place at all times except spawning periods. Rainbow trout were captured primarily in July; whitefish were captured in March using nets set under the ice; suckers (mainly largescale sucker and sometimes longnose sucker) were taken at all times. Kokanee were captured incidentally with other species, though many were believed to occupy Ootsa Lake. Fishing camps were set up on Chief Louis Arm, Tetachuk Falls, and Whitesail Lake. Species captured in Ootsa Lake were mountain whitefish, largescale sucker, some longnose sucker, burbot, and kokanee. Comments provided based on historical observation are:

- Blue River (Kasalka Creek), which enters the west end of Tahtsa Reach, is believed to be an important fish bearing stream and should be protected;
- Tetachuk River is believed to be good for spawning and fishing is good, even today; and
- Ootsa Lake fish catches appear to have remained the same since reservoir creation, but the body shape of burbot has changed. Previously burbot bodies were long and big but recent catches have exhibited big heads with skinny bodies.

4.8.2 Recreational Fishing

Seasonal lake fishing locations and activities, locations of important fish-bearing tributaries and observations on sport fish spawning times and locations were identified during discussions with resident fishing guide and lodge operators (Mr. J. Van Tine, Van Tine Outfitters, and Mr. J. Doerig, Nechako Lodge, *pers. comm.* 1996).

Important lake fishing locations are summarized in Table 4.8.1 together with comments on fishing activities. Lake recreational fishing is directed mainly at large rainbow trout. Fishing takes place mainly from June to August in the eastern portion of the reservoir and from the end of August through September in the western portion, especially Whitesail Lake. Fishing depths are commonly 10 to 20 m though large rainbow trout are occasionally taken at depths of 25 to 30 m.

Kokanee are caught in the eastern portion of the reservoir but seldom in the western portion. Mountain whitefish are seldom captured in either location. Some fishermen will fish for burbot; burbot are occasionally caught incidentally by fishermen trolling for rainbow trout.

Table 4.8.1 Important lake fishing locations and activities.

Reservoir Area	Comments
Whitesail Lake	• fishing occurs mainly end of August through September • depth for big rainbow about 35 to 45 ft, sometimes to 80 ft
Whitesail Reach	• lots of kokanee on east side of lake near St. Clair Lake
Ootsa Lake	• often see fish on sounder over tree tops at dusk • catch fish up to 18 lb (in Eutsuk Lake, not so big) • lots of fish in Chief Louis Arm
Chelaslie Arm	• lots of fish in Chelaslie Arm • fishing tends to be better towards head of arm - bigger rainbow
Tetachuk Lake	• good fishing in Tetachuk River ; also good in Tetachuk Lake
Euchu Reach/ Natalkuz Lake/Jim Smith Point	• fishing mainly in summer • depth also 35 to 45 ft in summer; deeper in spring - fished at 86 ft one time • on sounder see fish down to 120 ft
Eutsuk Lake	• spawners observed to the end of June • fishing good off Buchanan Island • size of fish in catch has been getting smaller • people go in largely for aesthetics - fishing is better, but mainly aesthetics
East end of reservoir	• most fishermen troll at 30 to 60 feet, generally at thermocline over mid-water • approx. June - big fish about 20 feet • approx. Aug./Sept. - big fish about 50 to 60 feet • usually fishing goes to Labour Day weekend • most fishermen who fish in the reservoir are local, mainly from Prince George. People who fly into smaller lakes are mainly from the USA and Europe • "Big trout" are 10 to 12 lb

Important fish-bearing tributaries to the reservoir identified by sport fishing interests are summarized in Table 4.8.2. Most small streams along the north and south shores of Ootsa Lake were identified as important for rainbow trout and/or kokanee. At the eastern end of the reservoir, several large streams are clearly important for both fish production and angling: Entiako River, Cheslaslie River, Chedakuz Creek, and Lucas Creek. On the west side of the reservoir, important streams identified for Tahtsa Lake are: Blue Creek (Kasalka Creek), Laventie Creek, Sandifer Creek, and Boulder Creek. Important streams flowing into Whitesail Lake include: Coles Creek, Gibbons Creek, and Cummins Creek (at the south end of the lake); and, Michel Creek and several streams nearby (on the east side of the lake mid way along its length). Along Whitesail Reach, streams include: Fish Lake Creek and an adjacent creek (at the south end of the reach on the west side), and Lucy Creek (at the north end of the reach on the west side).

Table 4.8.2 Comments provided by sport fishing interests on fish bearing streams.

Area	Stream	Comments
Streams around Ootsa Lake and the lakes to the west	1. Johnny Creek	• used to be lots of rainbow • spawning below highway
	2. Busters Creek	• used to be good fishing for rainbow trout in the spring time - not so much lately • fishing off mouth in standing timber
	3. Ukrainian Creek	• used to have kokanee • called Soda Spring before flooding
	4. Shelford Creek	• good rainbow fishing
	5. Eastern Creek/Lake	• used to be good rainbow fishing • Alcan put up a dam to keep squawfish out
	6. Brewers Creek	• still used by rainbow trout spawners
	7. Goodwin Creek	• still has spawners • plugged with willows -would be good to keep open
	8. Square Lake Creek, Chief Louis Arm	• filled with squawfish; no rainbow trout
	9. Wells Creek	• lots of fish
	10. Tributary into Knox Lake	• some fish
Streams to the east of Ootsa Lake	1. Lucas Creek	• rainbow trout and kokanee use this creek • kokanee used to spawn far up in Lucas Creek - quite a few beaver dams • Lucas Lake also has kokanee
	2. Chedakuz Creek	• rainbow and kokanee use this system • good spawning habitat in lower reaches - believed spawning there • believe contributes to big rainbow in Narrows and also small rainbow in bays
	3. Chelaslie River	• Chelaslie is main producer of rainbow • good fishing in lower 1 to 2 km • some trolling but mainly fly fishing - primarily July
	4. Mary's Creek (Aslin Creek)	• rainbow and kokanee are found here
	5. Entiako River	• rainbow here - very good fishing • good spawning gravel in lower 4 to 5 km
	6. Big Bend River	• kokanee observed spawning in Big Bend River • rainbow trout spawn in lower 5 km of Big

Area	Stream	Comments
		Bend
Streams around Whitesail Lake	1. Coles Creek	• off little Whitesail Lake • good rainbow trout fishing all year • not as many kokanee
	2. Cummins Creek	• has rainbow trout • also good for kokanee • observe seagulls in fall over lower part of stream
	3. Michel Creek	• spawning kokanee believed to utilize because grizzlies are seen in fall
	4. Creek to south of Michel Creek	• rainbow trout • catch fish off mouth
	5. Creek to north of Michel Creek	• dry in summer • fish in flat area
	6. Small creek east of Little Whitesail Lake - Gibbons	• lots of spawners in spring
	8. Streams on west side of Whitesail Lake	• Most streams dry up too much to be good for spawning
	9. Lucy Creek (north Whitesail Reach)	• good stream for fish
	10. Fish Lake Creek (south Whitesail Reach)	• good stream for fish
	11. North of Fish Lake Creek	• this one is also good; planes fly in for fly fishing off floats so appears very good fly fishing lake
Tahtsa Lake	1. Laventie Creek	• lots of kokanee • also rainbow trout
	2. Blue Creek	• rainbow trout and kokanee
	3. Sandifer Creek	• kokanee
	4. Small creek with island in front (Hog Island), near end of Tahtsa Lake	• good for rainbow trout in spring
	5. Boulder Creek	• believes rainbow spawners in spring

Anecdotal observations provided on spawning times, feeding, and other characteristics of sport species are summarized in Table 4.8.3. Rainbow trout appear to spawn mainly over the end of May and early June, with fish in spawning condition observed into end of June. Kokanee appear to spawn mainly over the end of September.

Table 4.8.3 Observations on spawning times, feeding, and other fish characteristics.

Species	Spawn Timing	Comments
Rainbow trout	• main run is the end of May/early June • fish start heading up streams as soon as ice is off creeks • stop seeing around the end of June into mid-July • find in Narrows - main spot for late spawners • begin seeing rainbow spawners the early part of June • find rainbow spawners in Narrows - main spot for late spawners	• catch rainbow trout in June, all sizes, feeding on flying ants • big rainbow eat kokanee - feed at certain times: end June August October • east end of Reservoir: catch rainbow in spring • used to be good rainbow fishing near the dam • also in Big bend where the lake turns • these two areas (above) vary year to year • at Narrows fishing is usually good and consistent all seasons • big rainbow food - mainly kokanee • downward trend in rainbow catches

Kokanee	• peak spawning - 3rd week in September
	• spawning takes place 2 to 3 weeks around this time
		• West end of reservoir: nobody seems to fish for them
		• East end of reservoir:
		  • 3 to 4 years ago kokanee were a fair size
		  • recently catches have been poor - downward trend in kokanee catches

Whitefish	-	• occasionally caught • Skins Lake used to be good • fished commercially before flooding • Rocky Mountain whitefish - caught in Cheslaslie R. and Blue R. • Podosa Lk - into Eutsuk Lake

Burbot	-	• West end of reservoir:
		  • sometimes caught off Ootsa landing 10 ft depth, 100 ft from shore
		  • use frozen fish (caught in summer)
		  • caught trolling:- usually going slow, close to bottom, 50 to 60 ft; outside of Knox Island up to 100 ft
		• East end of reservoir:
		  • odd one caught - have to go after to get
		  • use setlines
		  • one person caught trolling last year
		  • (general comment - no winter fishing)

Squawfish	-	• catch them about 10 ft going slow • squawfish and suckers are also caught when fishing for rainbow trout

5.0 PRELIMINARY ASSESSMENT OF TIMBER SALVAGE IMPACTS

5.1 TIMBER REMOVAL OPERATIONS

Timber salvage licencees (CCNRC-Fibrecon and CDC-Canfor) will be collecting both standing and floating timber. Both licencees are field testing methods for extracting standing timber from depth; barges will be used as working platforms in both cases. Preferred extraction methods involve the use of choker cables/grapples to pull trees to the surface, removing roots at the surface, and placing timber in bundles for transport along the lake. In shallow areas, timber may be pulled from the bottom or cut from stumps/roots using equipment such as feller bunchers and circular saw heads. Trees pulled from the bottom are expected to be removed in bunches of five or six at a time.

Initial salvage activities will be small as methods continue to be refined. Eventually, salvage is expected to take place over approximately five to six months each year, with each operator harvesting 0.5 to 1.0 million trees per year (300,000 to 350,000 m^3).

5.2 OOTSA LAKE FISH COMMUNITY

5.2.1 Species Composition and Characteristics

The fish community in Ootsa Lake and elsewhere in the Nechako Reservoir contains three species of salmonids (rainbow trout, kokanee, and mountain whitefish), burbot, two species of sucker (largescale and longnose), three species of cyprinid (northern squawfish, lake and peamouth chub) and two species of sculpin (slimy and prickly). Data collected during previous fisheries investigations in different seasons and reservoir locations are summarized in Section 3.0; data collected during the 1996 field program for the present study are presented in Section 4.0; information on current resource use is presented in Section 4.8.

5.2.1.1 Rainbow Trout

Inland rainbow trout (*Oncorhynchus mykiss*) exhibit three life history strategies that vary considerably depending on geographic location and habitat. Some populations live their entire lives in streams, some are characterized by fish that are born in small streams then migrate into larger rivers, and others are characterized by fish that are born in small streams then migrate into nursery lakes to rear. Fish scales collected during the 1996 studies suggest most rainbow trout (approximately 70%) spend two years in streams before entering the reservoir. Rainbow trout generally spawn in the inlet or outlet streams of lakes between March and August, although mid-April to late June is more common due to a preference for water temperatures of 10.0° to 15.5°C during spawning. Local sport fishing guides and lodge operators indicate rainbow spawning takes place primarily from the end of May to early June in streams entering the Nechako Reservoir (Section 4.8). Fish reportedly move into spawning grounds as soon as ice melts from spawning creeks. In other areas, adults have been observed moving to spawning grounds before ice break-up (Ford *et al*. 1995). In general, rainbow trout reach maturity at 3 to 5 years of age, with males usually maturing one year earlier than females (Ford *et al.* 1995). Rearing rainbow trout display seasonal movements in search of suitable feeding and overwintering habitats. These movements may be over a short distance in a small tributary or over several kilometres within a larger system (Ford *et al.* 1995). In larger lakes, rainbow trout are piscivorous and grow to a larger size than those rearing in smaller lakes where insects are the primary food source (Ford *et al.* 1995). Growth is generally faster in lakes than in streams (Carlander 1969), although local conditions may mask geographic variability. Rainbow trout captured during the 1996 studies were: generally smaller in samples collected from small inner bays compared to outer bay locations (on average fish in inner bays were 200 to 220 mm and fish in outer bays were 270 to 300 mm); and, were smaller than fish reported in the sport fishery (few specimens were above 400 g during lake sampling while fish greater than 1 to 2 kg are commonly reported in the sport fishery). Most aged specimens were 2 to 4 years of age.

5.2.1.2 Kokanee

Kokanee (*Oncorhynchus nerka*) are believed to have evolved from a common anadromous stock in recent geological times (Ricker 1940) and thus share many common morphological and behavioural characteristics with anadromous stocks of sockeye salmon. Like sockeye, kokanee utilize both the inlet streams of nursery lakes as well as the gravels of lake beaches for spawning, preferring to build redds in gravelly substrates with upwelling. Kokanee mature primarily in their fourth year, though a few 2-, 3-, and 5- year old fish are usually present. Thus, size at maturity varies considerably with age and among populations. Adults often move onto spawning grounds between August and February, but more commonly in September and October. Kokanee captured in Ootsa Lake during the current surveys were in advanced spawning condition over late September. Kokanee were observed spawning in Andrews Creek in mid-September during stream surveys.

Females generally lay between 300 and 2,000 eggs (depending upon fish size); adults die a few days to a few weeks after spawning. The eggs incubate for approximately two months (depending upon water temperature) before hatching and, after emergence, fry either move directly from the lakeshore to the pelagic environment or stay temporarily in the littoral zone near either the outlet of their natal stream or the lake spawning area (Ford *et al.* 1995). As juveniles they move offshore and mature for two to five years. During the lake rearing period, kokanee adults prefer temperatures of 10 to 15°C and actively seek out these temperatures by moving into deeper water during the summer and winter. Summer observations of rearing kokanee adults have shown noticeable daily vertical and onshore-offshore movement. Intraspecific competition in the lake is a potential limiting factor for kokanee in terms of growth rate and survival as several age classes of kokanee and sockeye may be present in a lake simultaneously (Burgner 1991).

Kokanee were captured in inshore/littoral areas in greater abundance at night during the 1996 studies, suggesting a strong diel movement of kokanee into inshore/littoral areas at least during the season of the 1996 surveys (late summer/early fall).

5.2.1.3 Mountain Whitefish

Mountain whitefish (*Prosopium williamsoni*) are bottom feeders found abundantly in large rivers, streams, and shallow portions of lakes. In British Columbia populations, sexual maturity is generally reached at between 2 and 4 years and spawning occurs between late fall and early winter (October through February). During the 1996 surveys, mountain whitefish were captured between September 21 and October 3 and were in advanced spawning condition. Spawning fish deposit their eggs in tributary streams and sometimes in gravel shoals in the littoral zone of nursery lakes (Ford *et al*. 1995). Whitefish do not construct nests for the eggs, preferring to spawn over gravel or gravel rubble. Fry emerge in early spring and spend several weeks in stream margins and backwaters downstream of the spawning ground before moving offshore. As adults, lake rearing mountain whitefish generally utilize the upper 5 to 6 m and are seldom found deeper than 20 m. Different races have been observed in the same lake, distinguished by varying spawning times and locations.

Although they are bottom feeders that feed primarily on aquatic insect larvae and the pupae of chironomidae and other aquatic dipterans, whitefish will feed at any level (including the surface) if bottom fauna is not prevalent. Riverine populations have been found to have a more diverse diet than do lake dwellers (Carlander 1969).

5.2.2 Fish Presence in Nearshore Submerged Timber Areas

The 1996 field studies were undertaken in the fall and represent biological conditions for that season. In general, fish in nearshore timber areas were captured with sampling gear and detected with echosounding/hydroacoustic equipment in greater relative abundance at night. All salmonids found in the lake (rainbow trout, kokanee, and mountain whitefish) were captured in small inner embayments close to stream mouths and in deeper outer bay areas. Mountain whitefish relative abundance was low. Kokanee were captured in comparatively high numbers at night but were mainly absent during the day. Rainbow trout night time abundance was slightly higher than day time abundance.

The outer bay of Wells Creek bay is characterized by a 100 to 200 m wide band of emergent standing timber along the south shore of the bay and extending eastward toward the submerged lake basin. In the outer bay of Andrews Bay emergent timber is in lower abundance and exists mainly in patches along the south shore. The inner bay of Wells Creek is characterized by submerged snags and stumps and little emergent timber; the inner bay of Andrews Bay contains emergent standing timber, snags, and dense floating timber in front of the mouth of Andrews Creek. Selective tree clearing has taken place throughout the reservoir, including portions of the two main sample locations for the 1996 studies (Wells Creek Bay and Andrews Bay).

Rainbow trout captured in inner embayments during the 1996 surveys were younger and smaller than fish in outer bay areas. Rainbow trout stomachs contained food organisms associated with both benthic/surface areas and the water column. Diet contents do not suggest rainbow were feeding to a greater or lesser extent on organisms derived from surfaces such as trees. Kokanee stomachs contained mainly food organisms associated with the water column. Whitefish were feeding primarily on bottom organisms.

Hydroacoustic surveys were conducted over submerged standing timber areas not suitable for sampling with conventional capture gear. Replicate echosounding transects were made over areas having trees and areas having no trees. These data do not show a clear relation between fish density and trees. The data show higher fish densities in some treed areas compared to nearby untreed areas, but lower comparative densities in other treed areas.

5.2.3 Streams Contributing to Lake Fish Production

Most streams flowing into Ootsa Lake have potential spawning and rearing areas accessible to fish from the lake. Rainbow trout were collected in the lower reaches of all but two streams sampled; most captured rainbow were ages 0+ to 2+. Scale analyses of rainbow trout captured in the lake suggest approximately 70% of the fish remained in streams for two years before entering the lake. Kokanee were observed spawning in Andrews Creek in mid-September (these were observed upstream from a lake on Andrews Creek and might originate from that lake and not Ootsa Lake); kokanee in advanced spawning condition were captured during lake sampling in Andrews Bay in the first week in October. Among streams surveyed a preliminary subjective appraisal of stream importance as contributors to reservoir fish populations are (based on habitat quality and approximate lengths of stream accessible to fish from the reservoir):

- Andrews Creek (180-8529)
- Unnamed Creek, alias Ukrainian Creek (180-8416)
- Wells Creek (180-7927)
- McIvor Creek (180-8174)
- Unnamed Creek, north of Andrews Creek (180-8526)
- Unnamed Creek, south of Andrews Creek (180-8532)

Six other streams were found to contain salmonids in reaches accessible to fish from the lake and all would likely contribute to lake production, though possibly on a smaller scale than streams listed above.

5.3 POTENTIAL EFFECTS OF TIMBER SALVAGE

5.3.1 Habitat Change Resulting from Tree Removal

5.3.1.1 Influence of Submerged Timber on Reservoir Fish Resources

Ploskey (1981) conducted a literature review of changes in fish production and other trophic levels after reservoir creation, factors related to reservoir filling (changes in nutrient and organic detritus over time), and factors related to submerged structures such as trees and brush. Most citations deal with locations and fish species that are not typical of the Nechako Reservoir; locations cited are mainly in the central and southeastern United States and fish species are typical of those locations (e.g., largemouth bass, bluegill, walleye, buffalo, crappie). This continues to be the situation with more recent publications (e.g., van den Ayle and Petering 1988; Bettoli *et al.* 1993). The review by Ploskey (1981) indicated submerged vegetation in littoral areas is associated with high fish biomass and harvest for some of the species investigated, compared to areas without vegetation. No information is presented to suggest cold water salmonids benefit from such vegetation, though some evidence suggested that, in California, retention of cover on cold water reservoirs did not appear to benefit salmonid fisheries.

Ploskey (1985) reviewed literature describing the ecology of inundated terrestrial vegetation in warm and cold water locations in North America. The review encompassed effects on water quality and nutrients, aquatic plants, aquatic invertebrates, fish, and fishing. In general, the literature indicated retention of vegetation increased fish production and improved fishing opportunities in warm water reservoirs. This was not demonstrated for cold water reservoirs. In fact, the effects of selective vegetation clearing, particularly near stream mouths, appeared to be positive in that it prevented interference of fish movement to and from streams and improved fishability of some areas. Among literature reviewed, most references dealt with warm water reservoirs as compared to cold water reservoirs.

Studies were conducted in Wyman Lake, a reservoir on the Kennebec River (Maine) to evaluate effects of log salvaging on fish, invertebrates, and water quality (Moring *et al.* 1982, 1986, 1989). These studies were undertaken between 1979 and 1980. Submerged logs in the reservoir and elsewhere originated from log driving down the Kennebec River over approximately 140 years. The logs were mainly spruce and fir intended for use as pulp wood.

Results of these investigations indicate differences in fish numbers between log and non log areas based on gear type (variable mesh experimental gill nets and vertical gill nets) and/or year of capture (1979, 1980, 1981), species, season, sex, and sexual maturity. Some species (suckers, shiners, and fallfish) were found in significantly higher numbers in areas with submerged logs while others (yellow perch and rainbow smelt) were in higher numbers in areas without logs. Data for the most abundant species found in the reservoir (yellow perch) showed a seasonal difference, whereby fish were found in equal to higher numbers in log areas in summer and lower numbers in fall. Macroinvertebrate biomass was significantly greater in sediments than on logs, suggesting log concentrations may serve more a protective function for fish rather than providing an attachment site for food items.

5.3.1.2 Timber Salvage Activity in the Nechako Reservoir

The 1996 study results show a fish community structure typical of nearshore areas of large lakes and do not indicate species composition or abundance is influenced by presence of submerged trees. Rainbow trout, mountain whitefish, and kokanee were captured in embayments near stream mouths and other nearshore areas which will be subject to timber salvage. Rainbow trout, mountain whitefish, and burbot are found near the bottom in timber salvage areas.

Fish were captured in fish collection gear and detected with hydroacoustic equipment in greatest numbers at night. Fish capture results suggest that during late summer and early fall rainbow trout utilize nearshore timber salvage areas during both day and night while kokanee utilize the areas mainly at night. Few mountain whitefish were captured, but it appears this species utilizes the areas during both day and night, tending to occupy near bottom and possibly mid water areas. Fish were feeding on organisms typical of their diet in lakes in which submerged trees are not present. Current data are not sufficient to suggest that removal of trees will reduce population sizes of these species or that remnant stumps or placement of new stumps will increase population sizes. Although stumps on the lake bottom can not be predicted to have a positive influence on populations, their presence is unlikely to be negative. Mountain whitefish and burbot might derive greatest benefit from existence of habitat structures such as these. A potential drawback will be the existence of snags for angling gear; locations will not be visible from the water surface.

5.3.2 Noise and Operational Activity

5.3.2.1 Characteristics of Underwater Sound

Underwater sound is characterized by frequency measured in hertz (Hz - cycles per second) as well as total sound pressure from all frequencies measured in decibels (dB in reference to 1.0 µPa). Underwater sound is detectable in the water column as a combination of pressure waves of various frequencies from extremely low frequency sound (infrasound @ 5 to 10 Hz) up to high frequency sound (up to 200 KHz). When considering the effects of sound on fish, both the frequency range of the emitted sound as well as the total sound pressure in specific frequency ranges must be considered. Sound is measured in the water column using underwater hydrophones which convert sound pressure waves into electronic signals that can be recorded either as a digital or analog signal for later analysis. A total sound pressure (measured in decibels) can be further analyzed to determine the contributions to this total sound pressure from sound vibrations in selected frequency ranges of interest. Sound is characterized as being either high or low frequency depending on the frequency range from which the majority of sound pressure is derived.

Schwarz and Greer (1984) reviewed sound emission characteristics for a number of different types of marine equipment used in the Pacific herring fishery. Generally, they found that larger vessels generated lower frequency emissions. For example, drum seiners had a characteristic frequency range of 0 to 1.9 KHz while smaller tender skiffs were typically in the range of 1.5 to 2.0 KHz. Seiner deck gear such as hydraulic winches and bilge pumps had characteristic sound frequencies of 0 to 0.8 KHz and 1.1 to 1.8 KHz respectively. Main engine noise produced higher frequency sound in the range of 2.2 to 2.5 KHz. For the above-noted study, total sound pressures were measured at various distances from the sound sources and compared to background noise levels. Background levels were always less than 75 dBµPa. Sound levels of 95 to 100 dBµPa were measured for vessels and equipment at a distance of 1.6 km.

Sound attenuates (decreases) with distance from the source. Dunning *et al.* (1992) described the sound propagation loss (due to attenuation) by the following relationship:

$$SPL_x = SPL_Y - 20 (\log d)$$

where

SPL_x = the sound pressure level (measured in dBμPa) at distance d

SPL_y = sound pressure level at the source (i.e., at 1.0 metre from emission point)

d = distance (in metres) from the emission point to the point of measurement.

The decibel measurement scale is exponential such that each 3.0 dB decrease results in a halving of acoustic power.

These sound attenuation relationships can be used to predict resultant sound levels at various distances from underwater tree harvesting activities based on initial underwater sound measurement for these activities.

5.3.2.2 Fish Sensitivities to Sound Pressure Levels and Specific Frequencies

Underwater sound and its effects on fish populations has been studied by a number of researchers interested in using sound as a deterrent near water intakes. Knudsen *et al.* (1992 and 1994) looked at avoidance of lower frequency (5 to 150 Hz) sound by Atlantic salmon under both laboratory and field conditions. Their studies showed that, in this frequency range, salmon would effectively avoid 10 Hz of sound at 10 dB above their level of awareness while no avoidance was observed with sound in the 150 Hz frequency range even at 114 dB above the fish hearing threshold level. The results of this study support the theory that fish are sensitive to very low frequency sound as these sounds would be emitted by the swimming actions of large predators (Enger *et al.* 1989 in Knudsen *et al.* 1992). These studies also demonstrated that Atlantic salmon also habituate (cease to react to) sooner to 150 Hz sound versus 10 Hz sound when presented at similar sound pressure levels above hearing thresholds. Repeated field tests of Atlantic salmon smolts to low frequency (10 Hz) sound showed no habituation, even after as many as eight encounters.

Fay (1988, *cited in* Ross *et al.* 1993) reported that 10 KHz is the highest frequency of sound that fishes can hear. Hawkins and Johnstone (1978, *cited in* Knudsen *et al*. 1992) determined that hearing in salmon is restricted at frequencies above 150 Hz, dropping off steeply. However, Ross *et al.* (1993) used high frequency sound (122 to 128 KHz) to deter alewives from becoming impinged on intake screens at a nuclear power station. No mechanism for detection of this frequencies was identified although the authors suggested that high frequency sounds at sufficiently high sound pressure levels (190 dB) could theoretically cause cavitation and resonance at membrane surfaces. In this case, the fish would be reacting to a tactile sensation rather than to the detection of sound *per se*. Haymes and Patrick (1986) and Dunning *et al.* (1992) conducted field studies of alewives (*Alosa pseudoharengus*) near water intakes for nuclear power plants. In the former study, pneumatic poppers were used to elicit avoidance. This sound source produced a sound signal with a predominant frequency of 60 Hz at a sound pressure level of 180 dBμPa.

They concluded that low frequency high intensity sound was an effective deterrent and that it was the rapid rise in sound pressure (i.e., rate of change of sound pressure) that was important in causing avoidance reaction. Schwarz and Greer (1984) concluded that Pacific herring (*Clupea harengus*) responded in various ways with a high degree of sensitivity to rapidly increasing amplitude sound sources. Dunning *et al.* (1992) during field experiments with alewives (*Alosa pseudoharengus*) tested pure tone (125 KHz) and pulsed broadband sound in the 117 to 133 KHz range. They found that fish habituated to pure tone sound but not to the pulsed signal.

The results of studies of fish avoidance of underwater sound indicate that:

- fish are very sensitive to both low frequency sound (<10 Hz) and extremely high frequency sound (>120 KHz);
- fish are more sensitive to and less likely to habituate to sound signals that demonstrate rapid rise to amplitude; and
- fish have been shown to be able to detect signals that are 25 to 30 dB above background noise levels.

There is a high degree of variability from species to species. Skalski *et al.* (1992) found that different species of rockfish (*Sebastes* sp.) exhibited different reactions to air gun discharges during geotechnical surveys depending on whether they were found in pelagic or demersal habitats.

Most researchers conclude that, at least for low frequencies, fish avoidance has survival value as a mechanism to detect predator swimming noises. Observed differences in species reaction is consistent with this theory; different species will react differently to the presence of large fish or swimming mammals.

5.3.2.3 Underwater Sound Resulting from Timber Salvage Activities

The intended underwater harvesting activity will generate underwater sounds both from the barge based activity as well as the underwater cut-off or extraction process. If the underwater cut-off option using saws is selected, this could also result in the production of very high frequency (>100 KHz) signals. Most activity likely will generate intermediate sound frequencies. A concern is that many of the sounds generated by the operation will exhibit rapid temporal change to which fish are most sensitive. There is no indication from the literature reviewed as to what sound pressure levels might be expected from the tree removal operations. Extremely high sound pressure levels can travel for considerable distance (1.0 to 2.0 km) before signals attenuate to levels approaching background. Habituation will likely play an important role, with most fish adjusting to routine operational noises. Sustained negative reactions would potentially occur for those noises creating irregular rapid increases in sound pressure or that are at very low or high frequencies (as outlined above).

The following is necessary to assess the potential impacts of underwater sound:

- establish background sound pressure levels and frequency characteristics;
- establish nature of sounds (i.e., pressure levels and frequencies) generated by operations at a known distance from the source of noise emission;
- establish presence of receptor species in the area and determine whether these species are migratory or territorial; and
- monitor change in receptor species presence/absence relative to operational activities.

Field studies to measure the effects if underwater sounds on fish can be complicated by a number of factors which affect both background noise levels and sound attenuation. Some of these exacerbating factors include:

- time of day;
- temperature variations;
- wind speed and direction;
- water depth;
- bottom type and angle of inclination; and
- objects in the water.

Various fish species have different adaptations which affect the ability to detect sound. For example, herring and alewives have bullae which are bone-encased air pockets acoustically coupled to the ear and lateral line. This adaptation helps to detect high frequency sound. These same sounds may be undetectable by salmonids, which do not have this adaptation. Field studies to statistically assess/interpret the specific reaction of fish species found in the Nechako Reservoir to sound levels anticipated for the harvesting operation would be extremely complex. Short-term exposure studies are not likely to adequately address issues of sound avoidance versus habituation over time for resident fish populations. Collection of noise data alone would aid understanding of the range of noise types produced by timber salvage activity and, if further study was deemed necessary, would be a first step for developing experimental conditions to evaluate fish reaction to specific operational noises. Baseline noise data would also aid definition of operational windows and distances to protect fish migrating during sensitive times, such as spawning migrations.

5.3.2.4 Other Operation Concerns

Small oil slicks were observed around test salvage operations during aerial surveys and during observations of shoreline salvage activity. Spillage or leakage of fuels or oils can be harmful to fish and other aquatic biota. Small amounts of these substances might do no detectable damage, but large amounts have potential to cause fish mortality and/or impairment of habitat and food resources. Damage could be high if sizeable quantities were released in confined areas such as inner bays, particularly during periods of high fish use such as spawning migrations.

5.3.3 Interference with Stream Usage

Most streams around Ootsa Lake and other reservoir lakes likely support reservoir populations of rainbow trout and kokanee. Reconnaissance level stream surveys conducted in parallel to the lake studies indicated the presence of rainbow trout in stream reaches accessible to fish from the lake in 12 of 14 streams examined. Kokanee and possibly mountain whitefish also likely use most of these streams. Timber salvage activities have potential to interfere with adult fish moving upstream to spawn and juvenile fish moving downstream. Some timber salvage will involve removal of logs at stream mouths. Clearly, this could cause delays for migrating fish if activity were to take place during the migration period. Use of operational timing windows can essentially eliminate such effects. A number of the streams entering Ootsa Lake flow into long narrow embayments which are submerged portions of steep-sided stream channels. Migrating fish must pass through these embayments to reach potential spawning streams located at the heads of the embayments. The confined nature of these embayments suggest timber salvage activities taking place in them but away from the stream mouth could nonetheless disrupt fish migration. Potential effects in these embayments can be mitigated by including the entire embayment within the operational window intended to protect the target stream.

5.3.4 Suspended Sediment

Data collected by BCRI/Limnotek during the water quality surveys undertaken over the same time period as the fish surveys indicate that sediment disturbed by timber pulling activity settled in approximately 15 minutes. These data are for one pulling location in the reservoir and bottom sediment conditions at that location. If these conditions are typical of most locations, disturbance of fish is expected to be minimal. Concern would arise if large amounts of sediment settled over lake spawning areas (e.g., kokanee, mountain whitefish, and burbot). Lake spawning locations for these species have not been identified. The small amount of sampling undertaken so far limits application of results for broad geographical interpretation of potential effects within the reservoir.

5.3.5 Mercury and Other Metals

Potential accumulation of mercury in fish tissue is a concern associated with release of methyl mercury from bottom sediments during timber salvage. Data collected during BCRI/Limnotek water quality surveys in 1996 indicated that methyl mercury and other metals exhibited low concentrations in samples (Perrin *et al*. 1997). Methyl mercury samples were collected during tree pulling; elevated levels were not noted. The BCRI/Limnotek 1996 studies indicated mercury levels in fish collected from the reservoir showed increases in tissue concentration with increased fish size and age. Levels in fish from the Nechako Reservoir were significantly higher than levels in fish from nearby Francois Lake, though generally within limits prescribed for fish consumption by humans. Previous Alcan studies of mercury in sediments and fish tissues indicated low concentrations and suggested low likelihood of high concentrations occurring during timber salvage (Triton Environmental Consultants Ltd. 1993). Data collected so far suggest there is a low likelihood that fish will be contaminated by mercury or affected by other metals during timber salvage. However, potential changes in fish tissue mercury levels that will result from large scale timber salvage encompassing a range of bottom soil conditions are not clear from available data.

5.3.6 Altered Nutrient Pathways

Preliminary results of the water quality data collection program indicated elevated levels of total phosphorus and ammonia after tree pulling. Increased nutrient availability during timber salvage has potential to increase abundance of fish food over the salvage period. This likely would be beneficial for fish production in the reservoir given the current very low levels of nutrients and relatively low fish abundance. Preliminary findings also suggested existing submerged timber might be a source of carbon supply in the food chain, removal of which over the long term could reduce availability of carbon as a nutrient to levels below those which currently exist. Nutrients released from submerged soils and vegetation normally decline in reservoirs as reservoirs age. The Nechako Reservoir has been in place for over four decades such that nutrient release from submerged sources has likely declined to low levels. The long term effect on fish resources of timber removal as a nutrient source and attachment surface for benthic food organisms is difficult to predict with available data. Timber removal is, in effect, accelerating transition of the reservoir to a lacustrine habitat that otherwise would not possess submerged trees, though physical characteristics of the reservoir, such as hypolimnetic syphoning, prevent natural lake conditions from existing.

5.4 Data Limitations and Uncertainties

The 1996 fish survey data indicate the nature of the fish community in nearshore timber salvage areas over late summer and early fall. Field data for the 1996 season were collected from mid-September to early October and represent biological conditions for that period. At the time of sampling, reservoir water was at extreme high level, even for the fall season when the reservoir water level is normally high. Uncertainties include: which species actively utilize habitat among snags and the base of trees; the degree to which fish use food organisms found on standing trees or snags, especially near the bottom; the timing of spawning runs for key species, especially for streams considered most important for reservoir fish production; and, characteristics of noise produced by salvage operation and whether some operational noises (for sustained periods) are in ranges potentially disruptive to fish activity.

A variety of fish sampling equipment was used to detect or capture fish in the nearshore study areas. Sampling among standing timber without incurring equipment loss or damage remains problematic. Problems are associated mainly with fallen or leaning trees underwater which create snags for equipment used in those areas. Consequently, ability to observe or collect specimens close to the bottom among trees is constrained. Trials were conducted with a remote operated underwater video camera by maneuvering close to the bottom in stream mouth areas and suspension to deeper areas among snags without attempting to maneuver. Although fish were observed in the latter case, the method is deemed to be of low utility given site conditions. Conditions affecting use were: visibility was generally poor, limited to several metres; the short visible distance, combined with the camera angle of view, creates difficulty maneuvering among snags and, in particular, backtracking to prevent or remedy entanglement of the electronic cable/tether; and, the number of fish observations per unit of time was low, limiting the device's usefulness as a method for active fish observation. An alternate method to sample in these locations would involve use of divers to mark areas clear of snags through use of weighted floats - sinking gillnet panels (possibly involving individual placement of panels that form the currently used six-panel gangs) would then be lowered following the surface floats.

Examination of diets during the present study do not clearly indicate what food organisms may have been taken from tree surfaces. Diet analyses suggest rainbow trout and possibly mountain whitefish may use food organisms from trees or snags. Examination of the surface biological communities, in particular benthic invertebrates, on standing and fallen timber would aid interpretation of these sources as food. Information on spawn timing has been obtained from local residents; this information broadly indicates spawn timing in the reservoir and should be verified for several key streams in salvage locations. Collection of preliminary data on background underwater noise and the types of noise produced by salvage activities would aid interpretation of likely effects of activities on fish and whether more intensive study is warranted.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Results of the 1996 lake fish resource studies indicate:

- The fish community structure in timber salvage areas of Ootsa Lake during late summer and early fall exhibits features similar to nearshore areas of large lakes elsewhere in British Columbia. Data collected in 1996 do not suggest the current fish community is influenced by the presence of submerged trees. However, 1996 studies were conducted in late summer/early fall and likely do not represent conditions that may exist at other times of the year.
- In general, fish moved from deep water during the day to shallower water at night. Rainbow trout and kokanee were present in embayments near stream mouths. In these areas, rainbow night time abundance increased slightly over day time abundance; kokanee were mainly absent during the day. At night kokanee represented a high proportion of fish caught in outer bay areas (up to 80% in some locations) compared to inner bay locations.
- Sampling was undertaken close to treed areas with conventional capture gear. In addition, replicate echosounding transects were made over areas having trees and areas having no trees. Data indicate higher fish numbers in some treed areas but opposite results appear in other areas. The data do not show a clear pattern of association with trees.
- Rainbow trout found in inner embayments tended to be younger and smaller than fish in outer bay areas. Rainbow trout stomachs contained food organisms associated with both benthic/surface areas and the water column. Diet contents do not suggest rainbow were feeding to a greater or lesser extent on organisms derived from surfaces such as trees. Nonetheless, note should be made that some organisms commonly observed in the late summer/early fall diet, such as dipterans/chironomids, depend on benthic areas for production. Kokanee stomachs contained mainly food organisms associated with the water column. Whitefish were feeding mainly on bottom organisms.
- Kokanee captured in Andrews Bay in the first week of October were in spawning condition. Males were generally captured in higher proportion than females (60% males and 40% females).
- Rainbow catches suggest numbers in the lake are not high in abundance. Fish scales read for aging indicate most captured rainbow were to 2 to 4 years of age and had two years of slow growth suggesting several years of residence in streams before entering the lake.

- Few mountain whitefish were captured during the surveys, mainly larger specimens approaching spawning condition. These fish were captured in late September and early October, suggesting spawning might commence as early as mid- to late October.
- Northern squawfish were captured in very high numbers in some locations, notably the head of Andrews Bay near the mouth of Andrews Creek and unnamed creek 180-8532. Squawfish represent an important potential predator of salmonid juveniles entering the lake from upstream locations in this area. Longnose suckers were captured at both inner bay and outer bay locations; largescale suckers were captured only at inner bay locations.
- Data collected during the 1996 studies do not suggest tree removal will reduce population sizes of species observed.
- The data do not indicate remnant stumps on the lake bottom will have an influence on community structure or population sizes of important recreational species.
- Most operational activities are not expected to produce noises having frequencies and pressures causing long term disturbance, partly because these noise parameters are expected to fall in acceptable mid-ranges for most activities and partly because fish are expected to habituate to noises of these types. Noises that have potential to cause disturbance are those that are characterized by irregular rapid increases. At this stage it is not known whether salvage operations will produce such noises.
- Small oil slicks were observed around test salvage operations during aerial surveys and observations of shoreline salvage. Oil slicks would be a concern during large scale salvage on open water and even on a small scale in confined embayments and near stream mouths.
- The 1996 investigations were undertaken in the fall and are representative of conditions during that season; reservoir water levels were at high seasonal levels.
- Stream surveys conducted in 1996 indicate most streams flowing into Ootsa Lake have potential spawning and rearing areas accessible to fish from the lake. Rainbow trout were collected in lower reaches of all but two streams sampled; most captured rainbow were ages 0+ to 2+. Kokanee were observed spawning in Andrews Creek in mid-September (these were observed upstream from a lake on Andrews Creek and might originate from that lake and not Ootsa Lake). Among streams surveyed, a subjective appraisal suggests the main streams important as contributors to reservoir fish populations are:
    - Andrews Creek (180-8529);
    - Unnamed Creek, alias Ukrainian Creek (180-8416);
    - Wells Creek (180-7927);
    - McIvor Creek (180-8174);
    - Unnamed Creek, north of Andrews Creek (180-8526); and

- Unnamed Creek, south of Andrews Creek (180-8532).

Six other streams were found to contain salmonids in reaches accessible to fish from the lake and all would likely contribute to lake production, though possibly on a smaller scale than streams listed above.

6.2 RECOMMENDATIONS

6.2.1 Fish Protection Measures

Most streams clearly support populations of rainbow trout and likely contribute to rainbow trout production in the Nechako Reservoir. The time of spawning has not been identified for rainbow trout but typically rainbow migrate to spawning areas over spring and early summer. Local residents indicated adults begin moving into stream mouth areas in late April and early May, with spawning occurring mainly over the months of May and June.

Kokanee were observed spawning in Andrews Creek in mid-September but it is not known whether these fish originated from lakes within the Andrews Creek watershed (kokanee were observed upstream of Fish Lake) or from the Nechako Reservoir. Kokanee in spawning condition were collected from Ootsa Lake nearshore areas in the first week in October. This suggests spawning likely occurs over the general mid-September to mid-October period. Other salmonids (e.g., mountain whitefish) were not captured or observed in streams but likely utilize some streams given their known presence in Ootsa Lake and requirement for stream spawning areas.

6.2.1.1 Tentative Timing Windows

General fish protection timing windows have been developed for different parts of the province to reduce risks to fish species in sensitive locations. Timing windows that apply to the Nechako Reservoir area for key species found in the reservoir are:

Species	Timing Window
Rainbow trout	July 15 - April 15
Kokanee	June 01 - August 31
Mountain whitefish	June 01 - September 15

In order to accommodate all three species, a timing window of July 15 to August 31 in which timber salvage activity near stream mouths could take place with minimum risk to salmonids is recommended. A preliminary recommendation is application of this window to all stream mouths suspected of containing salmonids.

The absence of fall spawning species (kokanee and mountain whitefish) in stream samples but known to occupy Ootsa Lake (based on lake sampling) may reflect time and/or location of sampling. For example, spawning by these species may take place in submerged portions of stream mouths (lake water levels were high at the time of the field investigations and potential spawning habitat was inundated and not visible). A conservative approach at this stage is to assume streams in which rainbow were found in accessible reaches also contain fall spawning salmonids.

In the lake, data show fish generally tend to rise in the water column and move into shallower areas at the onset of dusk. A further suggestion with respect to timing is to conduct timber harvesting activity outside of the period between sunset and one hour after sunrise. This would apply at all times of the year harvesting will be taking place.

6.2.1.2 Distances/Locations

Inner embayments such as those at Andrews Bay and Wells Creek Bay are steep, narrow portions of flooded stream channels. These will be passageways during spawning migrations and should be included in application of the above operational windows. For example, the inner bay at Andrews Bay extends as a narrow channel for approximately 1 km from the mouth of Andrews Creek to the point of connection with Andrews Bay proper. At this point in time sufficient data are not available to define distances for harvesting that will prevent delays in migration of spawning fish. An interim measure might be to use a distance of 1 km from the lakeward end of the inner embayment to avoid fish disruption. For the Andrews Bay example this would mean no timber salvage would take place outside the chosen operational window for a distance of 1 km along north and south shorelines from the lakeward end of the inner bay (total length from the actual mouth of Andrews Creek in this case would be approximately 2 km, including the 1 km length of the inner bay). Clearly, if a new sensitive embayment is encountered within this limit the boundary would be extended accordingly. Safe distances would be adjusted based on the results of ongoing studies.

6.2.2 Future Studies

6.2.2.1 Lake Sampling

It is intended that the 1997 field programs will focus on data collection in early summer, with repeat sampling at the main sites sampled in the fall of 1996. Activities suggested for inclusion in future studies are:

- collection of stomach contents in coordination with a proposed element of the water quality program (collection of potential food organisms from submerged trees and other substrate);
- inclusion of an additional sample site in Eutsuk Lake (where submerged trees are absent), tentatively in close proximity to Site 1 (Eutsuk Lake) of the Water Quality Program, to enable comparison with fish collected at Ootsa Lake sample sites;

- underwater video of habitat conditions and sample collection before and after harvest with tree harvest methods most likely to represent long term procedures;
- collection of data on underwater background noise characteristics and operational noises from timber salvage; and
- use of divers to identify areas among trees suitable for placement of gillnets on the reservoir bottom (a possible approach is placement of individual gillnet panels, from currently used six-panel gangs, on bottom areas among trees using weighted surface markers put down by divers beforehand to show safe areas).

6.2.2.2 Stream Reconnaissance Surveys

Stream surveys are intended to continue based on identification of priority streams along Tahtsa Reach/Tahtsa Lake and Whitesail Reach/Whitesail Lake. Streams along the south shore of Tahtsa Reach and west shore of Whitesail Reach have been previously surveyed; efforts will be directed towards streams not covered by those surveys.

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Appendices

Appendix A1

Hydroacoustic Analysis Methods and Data

APPENDIX A1 HYDROACOUSTICS ANALYSIS METHODS AND DATA

In the office, data files of transects were processed using BioSonics DT Analyzer software to produce echograms for quantitative trace counts, and to estimate fish target strength (TS) by the dual-beam method. Fish density (fish/m^3) was estimated by counting fish traces on paper echograms according to standard hydroacoustic processing techniques (Thorne 1983), with high quality color echograms displayed on the computer monitor used to assist in trace identification. The minimum chart threshold was -60dB for down-looking echograms and -55 dB for side-looking echograms. For down-looking transects, fish traces were counted within each five metre thick depth interval of each transect, from the lake surface to a maximum depth of 60 metres (e.g., 0 to 5 m, 5 to 10 m, etc.). As a means of excluding extraneous "noise" from fish counts, at least two hits per trace were required in the 0 to 30 m depth range, and three in the 30 to 60 m range, for acceptance as a valid fish. Trees were present in many parts of the survey area and were often easily distinguished from fish echoes. Ambiguous echoes were were not counted as fish. Close or integral association with tree shapes and broader than expected echo thickness were criteria for exclusion from fish counts. Submerged timber density (trees per unit area) varied over a broad continuum within the survey area, so, for this analysis, portions of echograms with no timber extending more than 5 m above the bottom for a stretch of more than 500 pings (about 70 to 90 m) were classified as untreed; other areas were classified as treed.

The wedge model (Kieser and Mulligan 1984) was used to estimate the volume sampled by the acoustic beam. Transect length, its countable fraction by depth interval, mean fish target strength (TS), and echo sounder calibration data were used in this calculation. Side-looking transects were treated similarly for echogram counts and sampling volume estimation, except that only the 5 to 20 m range, representing the 0 to 3 m depth interval, was processed. Several down and side looking transects were excluded from analysis due to poor data quality caused by severe rocking of the transducer in rough weather.

Mean fish density, mean TS and their standard deviation was estimated for each of seven sets of transects collected in September 1996. This included two day and one night data sets from area A, and one day and night each from areas B and C. Mean fish density and TS were calculated for individual depth strata of treed and untreed portions of each data set. Side-looking data, which were only obtained for a limited number of transects, are presented separately from down-looking data as a supplementary estimate of density in the uppermost 3 m of the water column, when available.

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Examples of Downscan Echosounding Traces- Area A

Example of Downscan Echosounding Traces- Area B

Examples of Downscan Echosounding Traces- Area C

Example of Sidescan Echosounding Traces- Area A

Appendix A2

Rainbow Trout Data

Table A2.1 Rainbow trout data for Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI	Age	Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	AI	Night	Electrofishing		8	Rainbow Trout	214	125.0					1.28			3	Y-#1						
#######	AI	Day	Gillnet	Floating	16	Rainbow Trout	197	87.2	f	2	0.2	0.9	1.14	1.03	0.23	3	Y-1	Y-L1		Y-A6			
#######	AI	Day	Gillnet	Floating	17	Rainbow Trout	208	89.3	m	1	0.1	1.1	0.99	1.23	0.11	2	Y-2	Y-L2		Y-A7			
#######	AI	Day	Gillnet	Floating	18	Rainbow Trout	246	161.4	m	4	4.1	2.4	1.08	1.49	2.54	4	Y-3	Y-L3		Y-A8			Cysts on liver
#######	AI	Night	Gillnet	Floating	22	Rainbow Trout	205	98.5	f	2	0.2	0.8	1.14	0.81	0.20	2	Y-4		Y-A1	Y-A1		Snowing	
#######	AI	Night	Gillnet	Floating	42	Rainbow Trout	209	112.2	f	2	0.2	0.9	1.23	0.80	0.18	2	Y-6		Y-A2	Y-A2	R7 / 9	Snowing	
#######	AI	Night	Gillnet	Floating	47	Rainbow Trout	204	98.5	f	4	7.0	1.1	1.16	1.12	7.11	4	Y-8		Y-A3	Y-A3		Snowing	
#######	AI	Night	Gillnet	Floating	67	Rainbow Trout	185	68.0	f	2	0.2	0.7	1.07	1.03	0.29	2	Y-10		Y			Snowing	Voucher, white cysts on kidney
#######	AI	Night	Gillnet	Floating	99	Rainbow Trout	155	46.4	f	2	0.1	0.4	1.25	0.86	0.22	2	Y-13		Y-A4	Y-A4	R7 / 10	Snowing	
#######	AI	Night	Gillnet	Floating	110	Rainbow Trout	185	58.0	f	2	0.2	0.6	0.92	1.03	0.34	2	Y-15		Y			Snowing	Voucher, Scale loss due to Gillnet
#######	AI	Night	Gillnet	Floating	183	Rainbow Trout	224	130.5	m	2	0.3	1.5	1.16	1.15	0.23	2	Y-19		Y			Snowing	Voucher
#######	AI	Night	Gillnet	Floating	184	Rainbow Trout	183	73.6	m	4	7.0	0.8	1.20	1.09	9.51	2	Y-20		Y	Y-A5		Snowing	
#######	AI-2	Day	Gillnet	Floating	2	Rainbow Trout	249	166.0	f	1	0.3	1.8	1.08	1.08	0.18	r	Y-2						
#######	AI-2	Day	Gillnet	Floating	3	Rainbow Trout	204	90.6	f	1	0.1	0.9	1.07	0.99	0.11	1	Y-3						
#######	AI-2	Day	Gillnet	Floating	5	Rainbow Trout	221	117.0	f	1	0.2	1.2	1.08	1.03	0.17	2	Y-5						
#######	AI-2	Day	Gillnet	Floating	7	Rainbow Trout	224	112.3	f	1	0.1	1.4	1.00	1.25	0.09	3	Y-7						
#######	AI-2	Day	Gillnet	Floating	11	Rainbow Trout	166	48.7	f	1	0.1	0.4	1.06	0.82	0.21	2	Y-11						
#######	AI-2	Day	Gillnet	Floating	1	Rainbow Trout	191	73.0	m	1	0.1	0.8	1.05	1.10	0.14	2	Y-1						
#######	AI-2	Day	Gillnet	Floating	4	Rainbow Trout	250	154.2	m	1	0.1	1.7	0.99	1.10	0.06	2	Y-4						
#######	AI-2	Day	Gillnet	Floating	6	Rainbow Trout	166	48.5	m	1	0.1	0.6	1.06	1.24	0.21	1	Y-6						
#######	AI-2	Day	Gillnet	Floating	8	Rainbow Trout	215	105.2	m	1	0.1	1.3	1.06	1.24	0.10	3	Y-8						
#######	AI-2	Day	Gillnet	Floating	9	Rainbow Trout	201	78.1	m	1	0.1	0.8	0.96	1.02	0.13	2	Y-9						
#######	AI-2	Day	Gillnet	Floating	10	Rainbow Trout	179	60.4	m	1	0.1	0.6	1.05	0.99	0.17	2	Y-10						Worms in intestine
#######	AI-2	Night	Gillnet	Floating	7	Rainbow Trout	179	60.3	f	1	0.1	0.6	1.05	1.00	0.17	1	Y-1						
#######	AI-2	Night	Gillnet	Floating	8	Rainbow Trout	221	124.9	f	1	0.3	0.9	1.16	0.72	0.24	2	Y-2						
#######	AI-2	Night	Gillnet	Floating	9	Rainbow Trout	174	54.6	f	1	0.1	0.5	1.04	0.92	0.18	1	Y-3						
#######	AO	Day	Gillnet	Floating	1	Rainbow Trout	343	425.1	f	3	10.1	5.8	1.05	1.36	2.38	5	Y-1			Y-A20			
#######	AO	Day	Gillnet	Floating	3	Rainbow Trout	329	389.0	f	3	11.0	5.4	1.09	1.39	2.83	4	Y-3						
#######	AO	Day	Gillnet	Floating	6	Rainbow Trout	325	241.6	f	1	0.1	3.1	0.70	1.28	0.04	5	Y-6			Y-A21			
#######	AO	Day	Gillnet	Sinking	2	Rainbow Trout	238	139.4	f	1	0.1	1.4	1.03	1.00	0.07	2	Y-2			Y-A22			
#######	AO	Day	Gillnet	Sinking	3	Rainbow Trout	246	169.0	f	1	0.1	1.9	1.14	1.12	0.06	2	Y-3						
#######	AO	Day	Gillnet	Floating	2	Rainbow Trout	307	276.2	m	1	0.1	2.7	0.95	0.98	0.04	4	Y-2						
#######	AO	Day	Gillnet	Floating	4	Rainbow Trout	365	476.0	m	4	18.4	4.0	0.98	0.84	3.87	r	Y-4						
#######	AO	Day	Gillnet	Floating	5	Rainbow Trout	342	411.1	m	4	15.2	4.1	1.03	1.00	3.70	5	Y-5						Internal lesions
#######	AO	Day	Gillnet	Floating	7	Rainbow Trout	343	392.2	m	1	0.1	4.2	0.97	1.07	0.03	3	Y-7						
#######	AO	Day	Gillnet	Sinking	1	Rainbow Trout	361	447.6	m	4	15.2	2.0	0.95	0.45	3.40	4	Y-1						
#######	AO	Night	Gillnet	Floating	6	Rainbow Trout	276	225.1	f	2	0.5	2.7	1.07	1.20	0.22	4	Y-5			Y-A13			
#######	AO	Night	Gillnet	Floating	7	Rainbow Trout	255	172.8	f	2	0.4	1.5	1.04	0.87	0.23	3	Y-6			Y-A14			
#######	AO	Night	Gillnet	Floating	35	Rainbow Trout	185	63.3	f	2	0.4	0.3	1.00	0.47	0.63	2	Y-9						
#######	AO	Night	Gillnet	Sinking	3	Rainbow Trout	266	199.2	f	2	0.2	0.8	1.06	0.40	0.10	3	Y-3			Y-A19			
#######	AO	Night	Gillnet	Sinking	4	Rainbow Trout	286	236.2	f	3	4.2	0.9	1.01	0.38	1.78	3	Y-4						
#######	AO	Night	Gillnet	Floating	2	Rainbow Trout	327	372.2	m	4	14.1	6.1	1.06	1.64	3.79	4	Y-1			Y-A9			
#######	AO	Night	Gillnet	Floating	3	Rainbow Trout	311	297.7	m	1	0.1	3.0	0.99	1.01	0.03	4	Y-2			Y-A10			
#######	AO	Night	Gillnet	Floating	4	Rainbow Trout	324	358.6	m	4	11.3	3.4	1.05	0.95	3.15	6	Y-3			Y-A11			Parasites in stomach
#######	AO	Night	Gillnet	Floating	5	Rainbow Trout	357	441.4	m	4	10.3	4.3	0.97	0.97	2.33	3	Y-4			Y-A12			
#######	AO	Night	Gillnet	Sinking	2	Rainbow Trout	302	295.0	m	1	0.1	3.5	1.07	1.19	0.03	3	Y-2			Y-A18			
#######	OL	Day	Gillnet	Floating	1	Rainbow Trout	275	209.2	f	2	0.5	2.0	1.01	0.96	0.24	3	Y-1			Y-E12		Overcast	
#######	OL	Day	Gillnet	Floating	3	Rainbow Trout	262	187.2	f	2	0.5	1.7	1.04	0.91	0.27	2	Y-3			Y-E14		Overcast	
#######	OL	Day	Gillnet	Floating	5	Rainbow Trout	275	218.8	f	3	5.7	3.0	1.05	1.37	2.61	3	Y-5					Overcast	
#######	OL	Day	Gillnet	Floating	6	Rainbow Trout	271	204.5	f	2	0.3	1.9	1.03	0.93	0.15	3	Y-6					Overcast	
#######	OL	Day	Gillnet	Floating	2	Rainbow Trout	275	216.1	m	1	0.1	2.3	1.04	1.06	0.05	3	Y-2			Y-E13		Overcast	
#######	OL	Day	Gillnet	Floating	4	Rainbow Trout	260	177.0	m	1	0.1	1.7	1.01	0.96	0.06	2	Y-4					Overcast	
#######	OL	Day	Gillnet	Sinking	1	Rainbow Trout	309	304.5	f	2	1.2	2.9	1.03	0.95	0.39	3	Y-1			Y-E15			

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI	Age	Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	OL	Night	Gillnet	Floating	38	Rainbow Trout	280	223.4	f	2	0.6	2.0	1.02	0.90	0.27	3	Y-10			Y-E4		Overcast	
#######	OL	Night	Gillnet	Floating	39	Rainbow Trout	203	83.1	f	2	0.3	0.5	0.99	0.60	0.36	2	Y-11			Y-E5		Overcast	
#######	OL	Night	Gillnet	Floating	41	Rainbow Trout	216	105.4	f	2	0.3	1.1	1.05	1.04	0.28	2	Y-13					Overcast	
#######	OL	Night	Gillnet	Floating	42	Rainbow Trout	233	143.4	f	2	0.3	1.4	1.13	0.98	0.21	2	Y-14					Overcast	
#######	OL	Night	Gillnet	Floating	43	Rainbow Trout	166	49.7	f	2	0.2	0.6	1.09	1.21	0.40	2	Y-15					Overcast	
#######	OL	Night	Gillnet	Floating	35	Rainbow Trout	320	304.3	m	3	8.9	2.1	0.93	0.69	2.92	4	Y-7			Y-E1		Overcast	
#######	OL	Night	Gillnet	Floating	36	Rainbow Trout	294	236.4	m	2	0.2	2.5	0.93	1.06	0.08	3	Y-8			Y-E2		Overcast	
#######	OL	Night	Gillnet	Floating	37	Rainbow Trout	348	438.8	m	4	17.9	4.6	1.04	1.05	4.08	4	Y-9			Y-E3		Overcast	
#######	OL	Night	Gillnet	Floating	40	Rainbow Trout	270	189.9	m	1	0.1	2.2	0.96	1.16	0.05	3	Y-12					Overcast	
#######	WI	Night	Electrofishing		3	Rainbow Trout	176	64.2					1.18			1	Y-#2						
#######	WI	Night	Electrofishing		6	Rainbow Trout	180	66.4					1.14			1	Y-#4						
#######	WI	Night	Electrofishing		7	Rainbow Trout	216	120.0					1.19			r	Y-#5						
#######	WI	Day	Gillnet	Floating	2	Rainbow Trout	243	153.9	f	2	0.3	1.8	1.07	1.17	0.19	2	Y-2		Y	Y-C9			
#######	WI	Day	Gillnet	Floating	4	Rainbow Trout	213	115.3	f	2	0.2	1.2	1.19	1.04	0.17	2	Y-4		Y	Y-C2			
#######	WI	Day	Gillnet	Floating	8	Rainbow Trout	166	48.6	f	1	0.1	0.5	1.06	1.03	0.21	1	Y-8	Y-3	Y	Y-C6			
#######	WI	Day	Gillnet	Floating	1	Rainbow Trout	330	363.8	m	4	13.1	2.7	1.01	0.74	3.60	5	Y-1		Y	Y-C8			
#######	WI	Day	Gillnet	Floating	3	Rainbow Trout	243	147.9	m	1	0.1	1.2	1.03	0.81	0.07	2	Y-3		Y	Y-C1			
#######	WI	Day	Gillnet	Floating	5	Rainbow Trout	204	96.7	m	1	0.1	0.8	1.14	0.83	0.10	2	Y-5		Y	Y-C3			
#######	WI	Day	Gillnet	Floating	6	Rainbow Trout	189	77.5	m	1	0.1	0.8	1.15	1.03	0.13	2	Y-6	Y-1	Y	Y-C4			
#######	WI	Day	Gillnet	Floating	7	Rainbow Trout	191	78.6	m	1	0.1	0.8	1.13	1.02	0.13	2	Y-7	Y-2	Y	Y-C5			
#######	WI	Day	Gillnet	Floating	9	Rainbow Trout	182	68.0	m	1	0.1	0.7	1.13	1.03	0.15	2	Y-9	Y-4	Y	Y-C7			
#######	WI	Night	Gillnet	Floating	64	Rainbow Trout	195	86.9	f	2	0.2	0.9	1.17	1.04	0.23	2	Y-6			Y-B5			
#######	WI	Night	Gillnet	Floating	65	Rainbow Trout	172	55.1	f	2	0.2	0.5	1.08	0.91	0.36	1	Y-7			Y-B6			
#######	WI	Night	Gillnet	Floating	66	Rainbow Trout	234	131.8	f	2	0.3	1.1	1.03	0.83	0.23	3	Y-8			Y-B7			
#######	WI-2	Night	Gillnet	Floating	41	Rainbow Trout	180	64.7	f	2	0.2		1.11		0.31	2	Y-6						
#######	WI-2	Night	Gillnet	Floating	43	Rainbow Trout	180	57.7	f	2	0.2	0.6	0.99	1.04	0.35	2	Y-8						
#######	WI	Night	Gillnet	Floating	1	Rainbow Trout	256	171.3	m	1	0.1	1.7	1.02	0.99	0.06	3	Y-1	Y-5		Y-B1			Cyst on Kidney
#######	WI	Night	Gillnet	Floating	2	Rainbow Trout	170	64.2	m	1	0.1	1.0	1.31	1.56	0.16	r	Y-2	Y-2		Y-B2			
#######	WI	Night	Gillnet	Floating	61	Rainbow Trout	342	391.6	m	1	0.1	2.5	0.98	0.64	0.03	4	Y-3		Y	Y-B23			Parasites on stomach lining
#######	WI	Night	Gillnet	Floating	62	Rainbow Trout	259	180.3	m	1	0.1	1.4	1.04	0.78	0.06	3	Y-4		Y	Y-B3			
#######	WI-2	Night	Gillnet	Floating	1	Rainbow Trout	260	173.9	m	1	0.1	1.8	0.99	1.04	0.06	3	Y-1						
#######	WI-2	Night	Gillnet	Floating	2	Rainbow Trout	209	97.8	m	2	0.3	1.1	1.07	1.12	0.31	2	Y-2						
#######	WI	Night	Gillnet	Floating	63	Rainbow Trout	173	55.3	u			0.7	1.07	1.27		2	Y-5			Y-B4			
#######	WI-2	Night	Gillnet	Floating	42	Rainbow Trout	223	94.2	u	1	0.1	1.0	0.85	1.06	0.11	2	Y-7						
#######	WO	Day	Gillnet	Floating	3	Rainbow Trout	350	465.5	f	3	13.1	4.6	1.09	0.99	2.81	5	Y-2			Y-D10			Internal parasites
#######	WO	Night	Gillnet	Floating	13	Rainbow Trout	332	284.5	f	2	1.5	3.2	0.78	1.12	0.53	3	Y-8			Y-D1		Overcast	Internal Parasites
#######	WO	Night	Gillnet	Floating	14	Rainbow Trout	285	227.5	f	2	0.9	2.0	0.98	0.88	0.40	3	Y-9			Y-D2		Overcast	
#######	WO	Night	Gillnet	Floating	15	Rainbow Trout	206	186.6	f	3	2.9	2.5	2.13	1.34	1.55	3	Y-10			Y-D3		Overcast	
#######	WO	Night	Gillnet	Floating	17	Rainbow Trout	251	164.0	f	2	0.4	1.7	1.04	1.04	0.24	3	Y-12					Overcast	
#######	WO	Night	Gillnet	Floating	18	Rainbow Trout	258	167.3	f	2	0.3	1.5	0.97	0.90	0.18	3	Y-13					Overcast	
#######	WO	Night	Gillnet	Floating	19	Rainbow Trout	255	172.5	f	2	0.2	1.3	1.04	0.75	0.12	2	Y-14					Overcast	
#######	WO	Night	Gillnet	Floating	20	Rainbow Trout	186	71.7	f	2	0.2	0.8	1.11	1.12	0.28	2	Y-15					Overcast	
#######	WO	Night	Gillnet	Floating	16	Rainbow Trout	198	80.8	m	1	0.1	0.8	1.04	0.99	0.12	1	Y-11			Y-D4		Overcast	
#######	WO	Night	Gillnet	Sinking	15	Rainbow Trout	369	543.2	m	1	0.2	4.7	1.08	0.87	0.04	4	Y-7		Y	Y-F3			

Table A2.2 Rainbow trout age data from Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

No.	Sample #	Effort	Date	Location	FLEN	TLEN	SEX	AGEMT	NCA	EDGE	CONF	AGEA	COMMENTS
#1	RB#1	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(6)	2H	FC 2 - Edge
#2	RB#2	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	All Regenerated Scales				
#3	RB#3	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	1	H	(6)	1H	Fast Growth
#4	RB#4	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(5)	2H	FC -2- Edge
#5	RB#5	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(6)	2H	2 Slow growth years - 1 Fast
#6	RB#6	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	1	H	(7)	1H	Good Example of 1 slow year (stream??)
#7	RB#7	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	3	H	(6)	3H	2 Slow; 2 Fast
#8	RB#8	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	3	H	(6)	3H	2 Slow; 2 Fast
#9	RB#9	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(6)	2H	2 Slow; 1 Fast
#10	RB#10	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(5)	2H	1st way out - poss. 2 lake years
#11	RB#11	Floating Day	Oct.3/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(7)	2H	
#1	RB#7	Floating Night	Oct. 4/96	Andrews Inner Bay - Site #2	-	-	-	Sc.	1	H	(5 TO 6)	1H	Reg'n in centre of station
#2	RB#8	Floating Night	Oct. 4/97	Andrews Inner Bay - Site #2	-	-	-	Sc.	2	H	(7)	2H	Fish shocks - Fast growth patterning
#3	RB#9	Floating Night	Oct. 4/98	Andrews Inner Bay - Site #2	-	-	-	Sc.	1	H	(6)	1H	1 Slow; 1 Fast
#1	RBTR #8	Night Electro	Sept.19/96	Andrews, mouth of unnamed creek	-	-	-	Sc.	3	H	(7)	3H	3 Slow growth
#4	RB#22	Floating Night	Sept. 21/96	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(7)	2H	2 Slow; 1 Rapid
#6	RB#42	Floating Night	Sept. 21/97	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(6)	2H	2 Slow; 1 Rapid
#8	RB#47	Floating Night	Sept. 21/98	Andrews Inner Bay - Site #1	-	-	-	Sc.	4	H	(6)	4H	4 Slow growth years? - Edge ?
#10	RB#67	Floating Night	Sept. 21/99	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(6)	2H	2 Slow; 1 Rapid
#13	RB#99	Floating Night	Sept. 21/100	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(6)	2H	Appears to be a 2 to 2nd edge of scales see env.
#15	RB#110	Floating Night	Sept. 21/101	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(6)	2H	Few Scales
#19	RB#183	Floating Night	Sept. 21/102	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(7)	2H	Few Scales; a low - 1 Fast
#20	RB#184	Floating Night	Sept. 21/103	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(7)	2H	Few Scales 2 low; 1 Fast
#1	RBT 16	Floating Day	Sept. 21/96	Andrews Inner Bay - Site #1	-	-	-	Sc.	3	H	(7)	3H	3 Slow -1 Fast
#2	RBT 17	Floating Day	Sept. 21/96	Andrews Inner Bay - Site #1	-	-	-	Sc.	2	H	(7)	2H	Good Example - 2 Slow; 1 Fast
#3	RBT 18	Floating Day	Sept. 21/96	Andrews Inner Bay - Site #1	-	-	-	Sc.	4	H	(6)	4H	2 Slow; 3 Fast - Last annulus spawning shock
#1	RB#1	Sinking Day	Oct. 03/96	Andrews Bay - Outer	-	-	-	Sc.	4	H	(6)	4H	2 Slow - 3 Fast - outside growth - Tricky
#2	RB#2	Sinking Day	Oct. 03/96	Andrews Bay - Outer	-	-	-	Sc.	2	H	(7)	2H	2 Slow, 1 Fast
#3	RB#3	Sinking Day	Oct. 03/96	Andrews Bay - Outer	-	-	-	Sc.	2	H	(7)	2H	1 Slow; 2 Fast
#1	RB#1	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	5	H	(6)	5H	2 Slow - 4 Fast - possible couple of spawning checks @ edge
#2	RB#2	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	4	H	(6)	4H	2 Slow; 3 Fast
#3	RB#3	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	4	H	(6)	4H	2 Slow; 3 Faster
#4	RB#4	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	All Region				
#5	RB#5	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	5	H	(6)	5H	2 Slow; 4 Faster - Poss. 4H
#6	RB#6	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	5	H	(5)	5H	Fairly old fish - 2 or 3 slow growth year inside
#7	RB#7	Floating Day	Oct. 3/96	Andrews Bay - Outer	-	-	-	Sc.	3	H	(7)	3H	1 Slow; 3 Fast - Good

No.	Sample #	Effort	Date	Location	FLEN	TLEN	SEX	AGEMT	NCA	EDGE	CONF	AGEA	COMMENTS
#1	RB#2	Floating Night	Oct 3/96	Andrew's Bay - Outer	-	-	-	Sc.	4	H	(6)	4H	4 annuli - close to edge
#2	RB#3	Floating Night	Oct 3/97	Andrew's Bay - Outer	-	-	-	Sc.	4	H	(6)	4H	3 Slow growth yrs - inside
#3	RB#4	Floating Night	Oct 3/98	Andrew's Bay - Outer	-	-	-	Sc.	6	H	(6)	6H	2 Slow yrs (stream ?); 2 lake prior to maturity
#4	RB#5	Floating Night	Oct 3/99	Andrew's Bay - Outer	-	-	-	Sc.	3	H	(5)	3H	Lots of false checks
#5	RB#6	Floating Night	Oct 3/100	Andrew's Bay - Outer	-	-	-	Sc.	4	H	(7)	4H	3 Slow; 2 Fast (lake ??) spawning checks
#6	RB#7	Floating Night	Oct 3/101	Andrew's Bay - Outer	-	-	-	Sc.	3	H	(7)	3H	2 Slow growth; 2 Fast growth years
#9	RB#35	Floating Night	Oct 3/102	Andrew's Bay - Outer	-	-	-	Sc.	2	H	(6)	2H	1 Slow; 1 Fast
#2	RB#2	Sinking Night	Oct 3/104	Andrew's Bay - Outer	-	-	-	Sc.	3	H	(6)	3H	2 Slow; 2 Fast (Lots of Scales)
#3	RB#3	Sinking Night	Oct 3/105	Andrew's Bay - Outer	-	-	-	Sc.	3	H	(7)	3H	2 Slow; 2 Fast (Lots of Scales)
#4	RB#4	Sinking Night	Oct 3/106	Andrew's Bay - Outer	-	-	-	Sc.	3	H	(6)	3H	2 Slow; 2 Fast (Lots of Scales)
#2	RB#3	Night Electro Shock	Sept 17/96	Wells Crk. mouth	-	176	64.2g	Sc	1	H	(7)	1H	1 Slow; 1 Fast
#4	RB#6	Night Electro Shock	Sept 17/98	Wells Crk. mouth	-		-	Sc	1	H	(4)	1H	Mostly Regenerated Scales - Poss 2H
#5	RB#7	Night Electro Shock	Sept 17/100	Wells Crk. mouth	-	216	120g	Sc	All regenerated Scales - unable to use				
Via #5 - DNA #1	RB#1	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	3	H	(6)	3H	2 Slow; 2 Fast - tricky
Vial 5a DNA #2	RB#2	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	All Regenerated				
#3	RB#61	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	4	H	(5)	4H	1 Slow; 3 Fast - Poss 5t @ edge?
#3a	RB#61	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	3	H	(6)	3H	1 Slow; 2 Fast
#4	RB#62	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	3	H	(6)	3H	1 Slow; 2 Fast- last annulus close to edge
#5	RB#63	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
#6	RB#64	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	2	H	(4)	2H	Mostly Reg'n - appears to be 2 Slow
#7	RB#65	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	1	H	(7)	1H	1 Slow; 1 Fast
#8	RB#66	Night - Set 1	Sept 19/96	Wells Inner Bay	-	-	-	Sc	3	H	(7)	3H	3 Slow growth; outer fast
#1	RB#1	Day - Set 1	Sept 29/96	Wells Inner Bay	-	-	-	Sc	5	H	(6)	5H	2nd? poss 4H - 2 Slow; 4 Fast
#2	RB#2	Day - Set 1	Sept 29/96	Wells Inner Bay	-	-	-	Sc	2	H	(6)	2h	1 Slow; 2 Fast
#8	RB#3	Floating Day Set	Oct.1/96	Wells - Outer Bay	-	-	-	Sc	5	H	(6)	5h	1 Slow; FCE 3rd - poss spawning check - slow 4-5
#7	RB#15	Sinking Night Set	Oct.1/96	Wells - Outer Bay	-	-	-	Sc	4	H	(5)	4H	2 Slow; 3 Fast
#8	RB#13	Night Set	Sept 30/96	Wells - Outer Bay	-	-	-	Sc	3	H	(5)	3H	lots of False checks
#9	RB#14	Night Set	Sept 30/96	Wells - Outer Bay	-	-	-	Sc	3	H	(6)	3H	2 slow; 2 Fast
#10	RB#15	Night Set	Sept 30/96	Wells - Outer Bay				Sc	3	t	(4)	3t	Mostly Reg'n scales
#11	RB#16	Night Set	Sept 30/96	Wells - Outer Bay				Sc	1	H	(7)	1H	1Slow; 1 Fast
#12	RB#17	Night Set	Sept 30/96	Wells - Outer Bay				Sc	3	H	(5)	3H	Poss. 2H
#13	RB#18	Night Set	Sept 30/96	Wells - Outer Bay				Sc	3	H	(7)	3H	
#14	RB#19	Night Set	Sept 30/96	Wells - Outer Bay				Sc	Reg'n Scales - probable 2H 4				
#15	RB#20	Night Set	Sept 30/96	Wells - Outer Bay				Sc	2	H	(6)	2H	2 Slow; 1 Fast

No.	Sample #	Effort	Date	Location	FLEN	TLEN	SEX	AGEMT	NCA	EDGE	CONF	AGEA	COMMENTS
	RB#1	Sinking Day Set	Oct 3/96	Old Lake				Sc	3	t	(6)	3t	Slow 1st year
#1	RB#1	Floating Day Set	Oct 01/96	Old Lake Site	-	-	-	Sc	3	H	(7)	3H	2 Slow - 2 Lake Good Example
#2	RB#2	Floating Day Set	Oct 01/96	Old Lake Site	-	-	-	Sc	3	H	(6)	3H	2 Slow; 2 Fast - Poss. 4H - FCs?
#3	RB#3	Floating Day Set	Oct 01/96	Old Lake Site	-	-	-	Sc	2	H	(6)	2H	1 Slow; 2 Fast
#4	RB#4	Floating Day Set	Oct 01/96	Old Lake Site		-	-	Sc	2	H	(6)	2H	2 Fast
#5	RB#5	Floating Day Set	Oct 01/96	Old Lake Site	-	-	-	Sc	3	H	(7)	3H	2 Slow inside; 2 Fast outside
#6	RB#6	Floating Day Set	Oct 01/96	Old Lake Site	-	-	-	Sc	3	H	(6)	3H	2 Slow; 2 Rapid
#7	Fish #35	Night Set	Sept 30/96	Old Lake Site	-	-	-	Sc	4	H	(5)	4H	Mostly Reg'n scales
#8	Fish #36	Night Set	Sept 30/96	Old Lake Site				Sc	3	H	(6)	2H	
#9	Fish #37	Night Set	Sept 30/96	Old Lake Site				Sc	4	H	(6)	4H	
#10	Fish #38	Night Set	Sept 30/96	Old Lake Site				Sc	3	H	(5)	3H	Difficult to see - Lots of FC's
#11	Fish #39	Night Set	Sept 30/96	Old Lake Site				Sc	2	H	(7)	2H	2 Slow; 1 Fast
#12	Fish #40	Night Set	Sept 30/96	Old Lake Site				Sc	3	H	(6)	3H	
#13	Fish #41	Night Set	Sept 30/96	Old Lake Site				Sc	2	H	(6)	2H	2 Slow growth; 1 Fast growth year.
#14	Fish #42	Night Set	Sept 30/96	Old Lake Site				Sc	2	H	(7)	2H	2 Slow growth; 1 Rapid
#15	Fish #43	Night Set	Sept 30/96	Old Lake Site				Sc	2	H	(6)	2H	2 Slow growth; 1 Rapid
#1	RB#1	Night Set 2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	3	H	(7)	3H	2 Slow; 2 Fast
#2	RB#2	Night Set 2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
#6	RB#41	Night Set 2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(6)	2H	tough scales - 2 slow; 1 Fast
#7	RB#42	Night Set 2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
#8	RB#43	Night Set 2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast - FC@ edge
#3	RB#3	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
#4	RB#4	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(6)	2H	Lots of Reg'n scales
#5	RB#5	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
Vial 1 #6	RB#6	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
Vial 2 DNA #7	RB#7	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast
Vial 3 DNA #8	RB#8	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	1	H	(7)	1H	1 Slow (stream?) 1 Fast (lake?)
Vial 4 DNA #9	RB#9	Day Set #2	Sept 29/96	Wells Crk. Inner Bay	-	-	-	Sc	2	H	(7)	2H	2 Slow; 1 Fast

Appendix A3

Kokanee Data

Table A3.1 Kokanee data for Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI		Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	WI	Night	Gillnet	Floating	70	Kokanee	196	68.3	f	5	6.6	1.7	0.91	2.49	9.66		Y-12		Y	Y-B16			Copepods on gills
#######	WI	Night	Gillnet	Floating	73	Kokanee	199	81.7	f	5	5.9	1.8	1.04	2.20	7.22		Y-15			Y-B20			Copepods on gills
#######	WI	Night	Gillnet	Floating	75	Kokanee	175	58.7	f	5	4.5	1.4	1.10	2.39	7.67		Y-17			Y-B22			Parasites on liver
#######	WI-2	Night	Gillnet	Floating	3	Kokanee	224	117.6	f	5	9.7	2.6	1.05	2.21	8.25		Y-3						
#######	WI-2	Night	Gillnet	Floating	34	Kokanee	207	107.9	f	5	12.6	2.6	1.22	2.41	11.68								Some stomach parasites
#######	WI-2	Night	Gillnet	Floating	44	Kokanee	165	49.3	f	2	0.5	0.8	1.10	1.62	1.01								
#######	WI-2	Night	Gillnet	Floating	45	Kokanee	173	59.2	f	4	3.9	0.5	1.14	0.84	6.59								
#######	WI-2	Night	Gillnet	Floating	46	Kokanee	183	69.2	f	2	0.7	1.1	1.13	1.59	1.01								
#######	WI-2	Night	Gillnet	Floating	47	Kokanee	170	49.8	f	4	2.2		1.01		4.42								
#######	WI-2	Night	Gillnet	Floating	50	Kokanee	189	70.6	f	5	5.3	1.6	1.05	2.27	7.51								
#######	WI	Night	Gillnet	Floating	67	Kokanee	206	104.3	m	5	14.0	1.2	1.19	1.15	13.42		Y-9		Y	Y-B18			Copepods on gills
#######	WI	Night	Gillnet	Floating	68	Kokanee	200	90.3	m	5	9.2	1.5	1.13	1.66	10.19		Y-10		Y	Y-B14			Parasites on stomach and gills
#######	WI	Night	Gillnet	Floating	69	Kokanee	193	93.4	m	5	12.6	1.0	1.30	1.07	13.49		Y-11		Y	Y-B15			
#######	WI	Night	Gillnet	Floating	71	Kokanee	174	59.4	m	5	9.2	0.7	1.13	1.18	15.49		Y-13		Y	Y-B17			
#######	WI	Night	Gillnet	Floating	72	Kokanee	190	75.5	m	4	3.4	1.2	1.10	1.59	4.50		Y-14			Y-B19			Copepods on gills
#######	WI	Night	Gillnet	Floating	74	Kokanee	178	61.5	m	5	4.6	0.5	1.09	0.81	7.48		Y-16			Y-B21			Copepods on gills
#######	WI	Night	Gillnet	Floating	76	Kokanee	193	81.0	m	5	10.6	0.6	1.13	0.74	13.09		Y-18			Y			Parasites on stomach
#######	WI-2	Night	Gillnet	Floating	5	Kokanee	173	62.8	m	5	5.9	0.9	1.21	1.43	9.39		Y-5						Copopods on gills
#######	WI-2	Night	Gillnet	Floating	35	Kokanee	184	68.2	m	5	9.9	0.6	1.09	0.88	14.52								
#######	WI-2	Night	Gillnet	Floating	36	Kokanee	178	69.3	m	5	9.7	0.7	1.23	1.01	14.00								
#######	WI-2	Night	Gillnet	Floating	37	Kokanee	182	65.8	m	4	6.3	1.0	1.09	1.52	9.57								
#######	WI-2	Night	Gillnet	Floating	38	Kokanee	178	63.5	m	4	6.8	0.7	1.13	1.10	10.71								Stomach cysts
#######	WI-2	Night	Gillnet	Floating	39	Kokanee	182	68.5	m	4	8.7	0.8	1.14	1.17	12.70								
#######	WI-2	Night	Gillnet	Floating	40	Kokanee	178	67.8	m	5	11.9	0.9	1.20	1.33	17.55								
#######	WI-2	Night	Gillnet	Floating	48	Kokanee	179	72.5	m	5	12.5	0.9	1.26	1.24	17.24								
#######	WI-2	Night	Gillnet	Floating	49	Kokanee	168	54.2	m	4	6.0	0.7	1.14	1.29	11.07								Gill copopods
#######	WI-2	Night	Gillnet	Floating	52	Kokanee	190	79.3	m	5	6.1	1.2	1.16	1.51	7.69								
#######	WI	Night	Gillnet	Floating	77	Kokanee	208	98.9					1.10						Y				
#######	WI	Night	Gillnet	Floating	78	Kokanee	187	83.0					1.27						Y				
#######	WI	Night	Gillnet	Floating	79	Kokanee	208	90.6					1.01						Y				
#######	WI	Night	Gillnet	Floating	80	Kokanee	180	67.0					1.15						Y				
#######	OL	Night	Gillnet	Floating	14	Kokanee	220	110.8	f	5	10.2	2.3	1.04	2.08	9.21		Y-3			Y-E8		Overcast	
#######	OL	Night	Gillnet	Floating	18	Kokanee	191	76.7	f	4	2.4	1.2	1.10	1.56	3.13							Overcast	
#######	OL	Night	Gillnet	Floating	19	Kokanee	181	57.4	f	4	3.4	1.3	0.97	2.26	5.92							Overcast	
#######	OL	Night	Gillnet	Floating	20	Kokanee	191	72.6	f	5	7.7	2.0	1.04	2.75	10.61							Overcast	
#######	OL	Night	Gillnet	Floating	25	Kokanee	190	72.1	f	5	5.4	1.3	1.05	1.80	7.49							Overcast	
#######	OL	Night	Gillnet	Floating	26	Kokanee	200	83.5	f	5	6.7	1.5	1.04	1.80	8.02							Overcast	
#######	OL	Night	Gillnet	Floating	27	Kokanee	184	62.2	f	5	7.2	1.0	1.00	1.61	11.58							Overcast	
#######	OL	Night	Gillnet	Floating	34	Kokanee	130	23.1	f	2	0.2	0.2	1.05	0.87	0.87							Overcast	No head
#######	OL	Night	Gillnet	Floating	12	Kokanee	185	72.3	m	5	8.2	1.1	1.14	1.52	11.34		Y-1			Y-E6		Overcast	Internal parasites
#######	OL	Night	Gillnet	Floating	13	Kokanee	205	102.9	m	5	8.5	1.0	1.19	0.97	8.26		Y-2			Y-E7		Overcast	Internal parasites
#######	OL	Night	Gillnet	Floating	15	Kokanee	198	91.0	m	5	6.9	1.2	1.17	1.32	7.58		Y-4			Y-E9		Overcast	
#######	OL	Night	Gillnet	Floating	16	Kokanee	191	82.7	m	5	11.4	0.7	1.19	0.85	13.78		Y-5			Y-E10		Overcast	
#######	OL	Night	Gillnet	Floating	17	Kokanee	125	22.6	m	2	0.2	0.3	1.16	1.33	0.88		Y-6			Y-E11		Overcast	
#######	OL	Night	Gillnet	Floating	21	Kokanee	175	57.7	m	5	7.0	0.5	1.08	0.87	12.13							Overcast	
#######	OL	Night	Gillnet	Floating	22	Kokanee	194	78.5	m	4	6.2	0.7	1.08	0.89	7.90							Overcast	Internal parasites
#######	OL	Night	Gillnet	Floating	23	Kokanee	182	69.3	m	5	8.3	0.6	1.15	0.87	11.98							Overcast	
#######	OL	Night	Gillnet	Floating	24	Kokanee	189	81.9	m	5	11.3	0.9	1.21	1.10	13.80							Overcast	Internal parasites
#######	OL	Night	Gillnet	Floating	28	Kokanee	178	65.5	m	5	8.3	0.6	1.16	0.92	12.67							Overcast	
#######	OL	Night	Gillnet	Floating	29	Kokanee	121	17.4	m	1	0.1	0.1	0.98	0.57	0.57							Overcast	
#######	OL	Night	Gillnet	Floating	30	Kokanee	180	69.7	m	5	11.7	0.8	1.20	1.15	16.79							Overcast	No head
#######	OL	Night	Gillnet	Floating	31	Kokanee	170	58.7	m	5	7.9	0.7	1.19	1.19	13.46							Overcast	No head
#######	OL	Night	Gillnet	Floating	32	Kokanee	136	27.9	m	1	0.1	0.2	1.11	0.72	0.36							Overcast	No head
#######	OL	Night	Gillnet	Floating	33	Kokanee	126	17.2	m	1	0.1		0.86		0.58							Overcast	No head
#######	WO	Night	Gillnet	Floating	5	Kokanee	187	60.7	f	5	3.4	1.4	0.93	2.31	5.60		Y-3					Overcast	Parasite internally
#######	WO	Night	Gillnet	Floating	7	Kokanee	184	60.9	f	4	3.4	1.2	0.98	1.97	5.58		Y-5					Overcast	
#######	WO	Night	Gillnet	Floating	4	Kokanee	167	56.0	m	4	5.7	0.7	1.20	1.25	10.18		Y-2			Y-D5		Overcast	

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI		Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	WO	Night	Gillnet	Floating	6	Kokanee	186	79.6	m	5	9.0	1.0	1.24	1.26	11.31		Y-4			Y-D6		Overcast	
#######	WO	Night	Gillnet	Floating	8	Kokanee	190	80.8	m	5	12.0	0.7	1.18	0.87	14.85		Y-6			Y-D7		Overcast	
#######	WO	Night	Gillnet	Floating	9	Kokanee	180	69.4	m	4	5.6	0.7	1.19	1.01	8.07		Y-7			Y-D8		Overcast	
#######	WO	Night	Gillnet	Floating	3	Kokanee	110	15.1	u	1	0.0	0.1	1.13	0.66			Y-1					Overcast	
#######	WO	Night	Gillnet	Floating	10	Kokanee	125	21.2					1.09									Overcast	No Head
#######	WO	Night	Gillnet	Floating	11	Kokanee	150	32.8					0.97									Overcast	
#######	WO	Night	Gillnet	Floating	12	Kokanee	135	26.0					1.06									Overcast	
#######	WO	Day	Gillnet	Floating	1	Kokanee	210	97.0	m	5	11.3	1.2	1.05	1.24	11.65								
#######	WO	Day	Gillnet	Floating	2	Kokanee	288	232.8	m	1	0.1	2.6	0.97	1.12	0.04		Y-1			Y-D9			Internal parasites
#######	WO	Night	Gillnet	Sinking	12	Kokanee	147	34.2	m	1	0.1	0.3	1.08	0.88	0.29		Y-5						
#######	WO	Night	Gillnet	Sinking	13	Kokanee	192	75.5	m	4	7.7	1.0	1.07	1.32	10.20		Y-6						
#######	WO	Night	Gillnet	Sinking	14	Kokanee	135	27.2	m	1	0.1	0.4	1.11	1.47	0.37								No Scales on body
#######	AO	Day	Gillnet	Sinking	4	Kokanee	194	75.5	f	5	6.5	1.7	1.03	2.25	8.61								
#######	AO	Day	Gillnet	Sinking	7	Kokanee	199	83.9	f	5	6.1	1.4	1.06	1.67	7.27								
#######	AO	Day	Gillnet	Sinking	5	Kokanee	180	64.7	m	5	5.0	0.8	1.11	1.24	7.73								
#######	AO	Day	Gillnet	Sinking	6	Kokanee	196	78.9	m	5	6.1	1.0	1.05	1.27	7.73		Y-4						Copopod on anal fin
#######	AO	Day	Gillnet	Sinking	8	Kokanee	194	75.8	m	5	5.1	1.3	1.04	1.72	6.73								Copopod on gills
#######	AO	Night	Gillnet	Sinking	5	Kokanee	174	60	f	5	5	1.5	1.14	2.50	8.33								No head
#######	AO	Night	Gillnet	Sinking	6	Kokanee	181	64.2	f	5	5.4	1.2	1.08	1.87	8.41								
#######	AO	Night	Gillnet	Sinking	9	Kokanee	194	80.5	f	5	7.1	1.4	1.10	1.74	8.82								
#######	AO	Night	Gillnet	Sinking	16	Kokanee	179	64.5	f	5	4.9	2	1.12	3.10	7.60								
#######	AO	Night	Gillnet	Sinking	17	Kokanee	181	65.9	f	5	5.4	1.4	1.11	2.12	8.19								
#######	AO	Night	Gillnet	Sinking	20	Kokanee	190	68.5	f	4	3.5	1.2	1.00	1.75	5.11								
#######	AO	Night	Gillnet	Sinking	22	Kokanee	189	68.8	f	4	4.7	1.3	1.02	1.89	6.83								
#######	AO	Night	Gillnet	Sinking	24	Kokanee	179	60.9	f	5	5.2	1.5	1.06	2.46	8.54								
#######	AO	Night	Gillnet	Sinking	30	Kokanee	187	70.8	f	5	5.7	1.7	1.08	2.40	8.05								
#######	AO	Night	Gillnet	Sinking	31	Kokanee	200	86.5	f	5	7.8	2.2	1.08	2.54	9.02								
#######	AO	Night	Gillnet	Sinking	34	Kokanee	196	70.5	f	5	6	2.1	0.94	2.98	8.51								
#######	AO	Night	Gillnet	Sinking	7	Kokanee	184	72	m	5	10.3	0.8	1.16	1.11	14.31								
#######	AO	Night	Gillnet	Sinking	8	Kokanee	194	89.3	m	5	7.5	1.1	1.22	1.23	8.40		Y-5						
#######	AO	Night	Gillnet	Sinking	10	Kokanee	166	59.7	m	5	6.9	0.8	1.31	1.34	11.56								
#######	AO	Night	Gillnet	Sinking	11	Kokanee	175	70.8	m	4	4.4	0.9	1.32	1.27	6.21								
#######	AO	Night	Gillnet	Sinking	12	Kokanee	206	100.6	m	5	9.5	1.2	1.15	1.19	9.44								
#######	AO	Night	Gillnet	Sinking	13	Kokanee	161	49.8	m	5	5.4	0.5	1.19	1.00	10.84		Y-6						
#######	AO	Night	Gillnet	Sinking	14	Kokanee	185	67.8	m	5	9.6	0.7	1.07	1.03	14.16								
#######	AO	Night	Gillnet	Sinking	15	Kokanee	183	67	m	5	7.5	0.8	1.09	1.19	11.19								
#######	AO	Night	Gillnet	Sinking	18	Kokanee	180	52.3	m	5	6	0.5	0.90	0.96	11.47								No head
#######	AO	Night	Gillnet	Sinking	19	Kokanee	175	61.3	m	5	6.4	1.1	1.14	1.79	10.44		Y-7						
#######	AO	Night	Gillnet	Sinking	21	Kokanee	187	79.6	m	5	9.8	1.3	1.22	1.63	12.31								
#######	AO	Night	Gillnet	Sinking	23	Kokanee	183	69.4	m	5	7.2	0.8	1.13	1.15	10.37		Y-8						
#######	AO	Night	Gillnet	Sinking	25	Kokanee	164	54.9	m	5	7.2	0.6	1.24	1.09	13.11								
#######	AO	Night	Gillnet	Sinking	26	Kokanee	178	68.5	m	4	2.9	0.8	1.21	1.17	4.23								
#######	AO	Night	Gillnet	Sinking	27	Kokanee	186	76.4	m	5	11	0.8	1.19	1.05	14.40		Y-9						
#######	AO	Night	Gillnet	Sinking	28	Kokanee	194	86	m	5	9	1	1.18	1.16	10.47								
#######	AO	Night	Gillnet	Sinking	29	Kokanee	173	69.5	m	5	13.6	0.7	1.34	1.01	19.57								No head
#######	AO	Night	Gillnet	Sinking	32	Kokanee	171	59.1	m	5	8	0.7	1.18	1.18	13.54		Y-10						
#######	AO	Night	Gillnet	Sinking	33	Kokanee	167	58.8	m	5	8.5	0.6	1.26	1.02	14.46								
#######	AO	Night	Gillnet	Floating	9	Kokanee	214	99.6	f	6	7.1	1.3	1.02	1.31	7.13		Y-8			Y-A16			External Copopods
#######	AO	Night	Gillnet	Floating	10	Kokanee	196	80.1	f	5	9.8	1.8	1.06	2.25	12.23								
#######	AO	Night	Gillnet	Floating	12	Kokanee	176	61	f	5	6.1	1.8	1.12	2.95	10.00								
#######	AO	Night	Gillnet	Floating	13	Kokanee	204	90.1	f	5	7.6	2.2	1.06	2.44	8.44								
#######	AO	Night	Gillnet	Floating	14	Kokanee	160	44.4	f	2	0.4	0.9	1.08	2.03	0.90								
#######	AO	Night	Gillnet	Floating	19	Kokanee	220	126.9	f	5	18.3	1.2	1.19	0.95	14.42								
#######	AO	Night	Gillnet	Floating	21	Kokanee	185	66	f	4	5.8	1.4	1.04	2.12	8.79								
#######	AO	Night	Gillnet	Floating	23	Kokanee	215	111.7	f	5	13.3	2.2	1.12	1.97	11.91								
#######	AO	Night	Gillnet	Floating	24	Kokanee	187	72.7	f	4	6.6	2	1.11	2.75	9.08								
#######	AO	Night	Gillnet	Floating	25	Kokanee	190	72.5	f	5	7.1	1.8	1.06	2.48	9.79								
#######	AO	Night	Gillnet	Floating	26	Kokanee	187	71.6	f	5	7	1.1	1.09	1.54	9.78								
#######	AO	Night	Gillnet	Floating	29	Kokanee	188	65.7	f	5	5.2	1.3	0.99	1.98	7.91								
#######	AO	Night	Gillnet	Floating	33	Kokanee	186	68.1	f	5	6.7	1.5	1.06	2.20	9.84								
#######	AO	Night	Gillnet	Floating	8	Kokanee	241	158.1	m	6	5.3	2.2	1.13	1.39	3.35		Y-7			Y-A15			

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI		Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	AO	Night	Gillnet	Floating	11	Kokanee	187	75.9	m	5	10.1	0.7	1.16	0.92	13.31								
#######	AO	Night	Gillnet	Floating	15	Kokanee	167	52.8	m	4	5.4	0.8	1.13	1.52	10.23								
#######	AO	Night	Gillnet	Floating	16	Kokanee	171	58.6	m	5	9.4	0.6	1.17	1.02	16.04								
#######	AO	Night	Gillnet	Floating	17	Kokanee	180	61	m	4	6.2	0.6	1.05	0.98	10.16								
#######	AO	Night	Gillnet	Floating	18	Kokanee	171	54.5	m	5	7.4	0.8	1.09	1.47	13.58								
#######	AO	Night	Gillnet	Floating	20	Kokanee	189	68.9	m	1	0.1	0.9	1.02	1.31	0.15								
#######	AO	Night	Gillnet	Floating	22	Kokanee	179	55.7	m	4	3.1	0.7	0.97	1.26	5.57								
#######	AO	Night	Gillnet	Floating	27	Kokanee	184	69.3	m	5	10.6	0.8	1.11	1.15	15.30								
#######	AO	Night	Gillnet	Floating	28	Kokanee	183	66.2	m	5	9.2	0.6	1.08	0.91	13.90								
#######	AO	Night	Gillnet	Floating	30	Kokanee	166	56.8	m	5	9.4	0.8	1.24	1.41	16.55								
#######	AO	Night	Gillnet	Floating	31	Kokanee	164	53.1	m	5	4.9	0.9	1.20	1.69	9.23								Copopods Internally
#######	AO	Night	Gillnet	Floating	32	Kokanee	194	86.1	m	5	9.9	1	1.18	1.16	11.50								Copopods externally
#######	AO	Night	Gillnet	Floating	34	Kokanee	167	53.2	m	5	5.4	0.7	1.14	1.32	10.15								Copopods Internally
#######	OL	Night	Gillnet	Sinking	8	Kokanee	191	71.8	f	5	7.3	2	1.03	2.79	10.17		Y-1			Y-E16			
#######	OL	Night	Gillnet	Sinking	9	Kokanee	172	53.5	m	5	9.2		1.05		17.20		Y-2			Y-E17			
#######	OL	Night	Gillnet	Sinking	10	Kokanee	128	23	m	1	0.1	0.2	1.10	0.87	0.43		Y-3						
#######	AI-2	Night	Gillnet	Floating	11	Kokanee	172	53	f	4	3	1.4	1.04	2.64	5.66		Y-5						
#######	AI-2	Night	Gillnet	Floating	13	Kokanee	190	74.3	f	2	0.2	0.8	1.08	1.08	0.27		Y-7						Poor gonad development
#######	AI-2	Night	Gillnet	Floating	14	Kokanee	213	98.5	f	5	8.4	2.5	1.02	2.54	8.53		Y-8						
#######	AI-2	Night	Gillnet	Floating	15	Kokanee	184	67.3	f	5	5.2	0.8	1.08	1.19	7.73								
#######	AI-2	Night	Gillnet	Floating	16	Kokanee	193	75.9	f	4	3	2.2	1.06	2.90	3.95								
#######	AI-2	Night	Gillnet	Floating	20	Kokanee	184	63.4	f	5	4.8	1.8	1.02	2.84	7.57								
#######	AI-2	Night	Gillnet	Floating	21	Kokanee	162	43.1	f	1	0.3	0.4	1.01	0.93	0.70								
#######	AI-2	Night	Gillnet	Floating	23	Kokanee	187	68.4	f	5	5.7	1.6	1.05	2.34	8.33								
#######	AI-2	Night	Gillnet	Floating	25	Kokanee	195	67.5	f	5	5.4	1.5	0.91	2.22	8.00								
#######	AI-2	Night	Gillnet	Floating	27	Kokanee	190	64.7	f	5	4.2	0.8	0.94	1.24	6.49								Only 1 gonad developed
#######	AI-2	Night	Gillnet	Floating	10	Kokanee	199	87.9	m	5	9.6	0.8	1.12	0.91	10.92		Y-4						
#######	AI-2	Night	Gillnet	Floating	12	Kokanee	179	62.9	m	5	5.7	0.6	1.10	0.95	9.06		Y-6						
#######	AI-2	Night	Gillnet	Floating	17	Kokanee	197	99.4	m	5	11.4	1.3	1.30	1.31	11.47								
#######	AI-2	Night	Gillnet	Floating	18	Kokanee	179	63.8	m	5	7.5	0.8	1.11	1.25	11.76								
#######	AI-2	Night	Gillnet	Floating	19	Kokanee	180	67.1	m	5	7.4	0.9	1.15	1.34	11.03								
#######	AI-2	Night	Gillnet	Floating	22	Kokanee	204	96.7	m	5	4.2	1.7	1.14	1.76	4.34								
#######	AI-2	Night	Gillnet	Floating	24	Kokanee	192	72.7	m	5	6.4	0.8	1.03	1.10	8.80								
#######	AI-2	Night	Gillnet	Floating	26	Kokanee	181	66	m	5	8.3	0.5	1.11	0.76	12.58								

Appendix A4

Mountain Whitefish Data

Table A4.1 Mountain Whitefish data for Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Mat.	Gonad Weight	Liver Weight	Condition Factor	HSI	GSI	Scales Taken	DNA Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
#######	WI	Day	Electrofishing		1	Mountain Whitefish	374	623.7					1.19			Y-#1						
#######	WI	Day	Electrofishing		5	Mountain Whitefish	250	179.0					1.15			Y-#3						
#######	AI	Day	Electrofishing		1	Mountain Whitefish	310									Y-#1						
#######	AI (2)	Day	Electrofishing		9	Mountain Whitefish	277	300.0					1.41			Y-#2						
#######	AI	Night	Gillnet	Floating	1	Mountain Whitefish	305	397.2	f	6	55.7	8.0	1.40	2.01	14.02	Y-1				R7 / 8	Snowing	
#######	AI	Night	Gillnet	Floating	185	Mountain Whitefish	266	234.0	m	5	18.9	1.4	1.24	0.60	8.08	Y-21		Y		R7 / 11	Snowing	Voucher
#######	WO	Night	Gillnet	Sinking	8	Mountain Whitefish	306	338.0	f	6	53.3	5.5	1.18	1.63	15.77	Y-1			Y-F1			
#######	WO	Night	Gillnet	Sinking	9	Mountain Whitefish	294	305.0	f	5	24.7	6.2	1.20	2.03	8.10	Y-2			Y-F2			
#######	WO	Night	Gillnet	Sinking	10	Mountain Whitefish	305	312.0	f	5	38.7	7.0	1.10	2.24	12.40	Y-3						
#######	WO	Night	Gillnet	Sinking	11	Mountain Whitefish	320	393.1	f	5	46.3	5.8	1.20	1.48	11.78	Y-4						
#######	AO	Night	Gillnet	Sinking	1	Mountain Whitefish	309	328.9	m	5	28.2	1.6	1.11	0.49	8.57	Y-1			Y-A17			
#######	WO	Day	Gillnet	Sinking	8	Mountain Whitefish	300	334.7	m	5	33.0	2.0	1.24	0.60	9.86	Y-1						Internal Parasites

Appendix A5

Northern Squawfish Data

Table A5.1 Nortern Squawfish data for Wells Creek Bay, Submerged Lake Basin and Andrews Bay, September/October 1996.

NB No data on sex

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	WI	Day	Electrofishing		4	Squawfish	134	25.8		1.07						
########	WI	Day	Electrofishing		9	Squawfish	178	52.0		0.92						
########	WI	Day	Electrofishing		10	Squawfish	135	25.0		1.02						
########	WI	Night	Gillnet	Floating	14	Squawfish	225	123.9	f	1.09			Y-B9			
########	WI	Night	Gillnet	Floating	15	Squawfish	225	137.2	f	1.20			Y-B11			
########	WI	Night	Gillnet	Floating	22	Squawfish	238	157.0	m	1.16			Y-B13			
########	WI	Night	Gillnet	Floating	3	Squawfish	169	54.0		1.12						
########	WI	Night	Gillnet	Floating	4	Squawfish	139	26.4		0.98						
########	WI	Night	Gillnet	Floating	5	Squawfish	166	44.8		0.98						
########	WI	Night	Gillnet	Floating	6	Squawfish	139	26.1		0.97						
########	WI	Night	Gillnet	Floating	7	Squawfish	196	75.1		1.00						
########	WI	Night	Gillnet	Floating	8	Squawfish	165	50.5		1.12						
########	WI	Night	Gillnet	Floating	9	Squawfish	292	299.5		1.20						
########	WI	Night	Gillnet	Floating	10	Squawfish	151	35.6		1.03						
########	WI	Night	Gillnet	Floating	11	Squawfish	155	36.6		0.98						
########	WI	Night	Gillnet	Floating	12	Squawfish	150	38.5		1.14						
########	WI	Night	Gillnet	Floating	13	Squawfish	184	62.2		1.00			Y-B10			
########	WI	Night	Gillnet	Floating	16	Squawfish	184	64.4		1.03						
########	WI	Night	Gillnet	Floating	17	Squawfish	168	47.4		1.00						
########	WI	Night	Gillnet	Floating	18	Squawfish	134	23.4		0.97						
########	WI	Night	Gillnet	Floating	19	Squawfish	120	19.1		1.11						
########	WI	Night	Gillnet	Floating	20	Squawfish	136	25.9		1.03						
########	WI	Night	Gillnet	Floating	21	Squawfish	180	62.7		1.08			Y-B12			
########	WI	Night	Gillnet	Floating	23	Squawfish	190	70.4		1.03						
########	WI	Night	Gillnet	Floating	24	Squawfish	145	34.2		1.12						
########	WI	Night	Gillnet	Floating	25	Squawfish	210	101.0		1.09						
########	WI	Night	Gillnet	Floating	26	Squawfish	158	38.2		0.97						
########	WI	Night	Gillnet	Floating	27	Squawfish	126	18.6		0.93						
########	WI	Night	Gillnet	Floating	28	Squawfish	180	58.6		1.00						
########	WI	Night	Gillnet	Floating	29	Squawfish	147	33.4		1.05						
########	WI	Night	Gillnet	Floating	30	Squawfish	136	28.1		1.12						
########	WI	Night	Gillnet	Floating	31	Squawfish	126	19.0		0.95						
########	WI	Night	Gillnet	Floating	32	Squawfish	122	18.9		1.04						
########	WI	Night	Gillnet	Floating	33	Squawfish	165	44.7		1.00						
########	WI	Night	Gillnet	Floating	34	Squawfish	166	48.1		1.05						
########	WI	Night	Gillnet	Floating	35	Squawfish	128	20.4		0.97						
########	WI	Night	Gillnet	Floating	36	Squawfish	161	41.6		1.00						
########	WI	Night	Gillnet	Floating	37	Squawfish	131	22.9		1.02						
########	WI	Night	Gillnet	Floating	38	Squawfish	190	73.4		1.07						
########	WI	Night	Gillnet	Floating	39	Squawfish	126	20.6		1.03						
########	WI	Night	Gillnet	Floating	40	Squawfish	130	22.5		1.02						
########	WI	Night	Gillnet	Floating	41	Squawfish	144	32.0		1.07						
########	WI	Night	Gillnet	Floating	42	Squawfish	132	22.6		0.98						

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	WI	Night	Gillnet	Floating	43	Squawfish	113	13.9		0.96						
########	WI	Night	Gillnet	Floating	44	Squawfish	161	48.1		1.15						
########	WI	Night	Gillnet	Floating	45	Squawfish	124	18.6		0.98						
########	WI	Night	Gillnet	Floating	46	Squawfish	231	134.4		1.09						
########	WI	Night	Gillnet	Floating	47	Squawfish	203	93.1		1.11						
########	WI	Night	Gillnet	Floating	48	Squawfish	194	76.4		1.05						
########	WI	Night	Gillnet	Floating	49	Squawfish	250	176.1		1.13						
########	WI	Night	Gillnet	Floating	50	Squawfish	172	53.3		1.05						
########	WI	Night	Gillnet	Floating	51	Squawfish	130	20.8		0.95						
########	WI	Night	Gillnet	Floating	52	Squawfish	145	34.2		1.12						
########	WI	Night	Gillnet	Floating	53	Squawfish	137	27.7		1.08						
########	WI	Night	Gillnet	Floating	54	Squawfish	146	32.2		1.03						
########	WI	Night	Gillnet	Floating	55	Squawfish	158	39.4		1.00						
########	WI	Night	Gillnet	Floating	56	Squawfish	151	34.7		1.01						
########	WI	Night	Gillnet	Floating	57	Squawfish	135	27.3		1.11						
########	WI	Night	Gillnet	Floating	58	Squawfish	191	72.3		1.04						
########	WI	Night	Gillnet	Floating	59	Squawfish	166	52.0		1.14						
########	WI	Night	Gillnet	Floating	60	Squawfish	127	21.7		1.06						
########	WI-2	Night	Gillnet	Floating	4	Squawfish	205	75.6		0.88						
########	WI-2	Night	Gillnet	Floating	6	Squawfish	194	79.2		1.08						
########	WI-2	Night	Gillnet	Floating	7	Squawfish	184	64.3		1.03						
########	WI-2	Night	Gillnet	Floating	8	Squawfish	198	79.9		1.03						
########	WI-2	Night	Gillnet	Floating	9	Squawfish	174	60.5		1.15						
########	WI-2	Night	Gillnet	Floating	10	Squawfish	187	66.3		1.01						
########	WI-2	Night	Gillnet	Floating	11	Squawfish	167	47.6		1.02						
########	WI-2	Night	Gillnet	Floating	12	Squawfish	169	45.5		0.94						
########	WI-2	Night	Gillnet	Floating	13	Squawfish	173	53.2		1.03						
########	WI-2	Night	Gillnet	Floating	14	Squawfish	168	47.4		1.00						
########	WI-2	Night	Gillnet	Floating	15	Squawfish	181	61.9		1.04						
########	WI-2	Night	Gillnet	Floating	16	Squawfish	220	111.0		1.04						
########	WI-2	Night	Gillnet	Floating	17	Squawfish	325	396.6		1.16						
########	WI-2	Night	Gillnet	Floating	18	Squawfish	299	282.4		1.06						
########	WI-2	Night	Gillnet	Floating	19	Squawfish	343	574.9		1.42						
########	WI-2	Night	Gillnet	Floating	20	Squawfish	198	85.1		1.10						
########	WI-2	Night	Gillnet	Floating	21	Squawfish	197	99.5		1.30						
########	WI-2	Night	Gillnet	Floating	22	Squawfish	337	451.2		1.18						
########	WI-2	Night	Gillnet	Floating	23	Squawfish	189	71.5		1.06						
########	WI-2	Night	Gillnet	Floating	24	Squawfish	181	60.8		1.03						
########	WI-2	Night	Gillnet	Floating	25	Squawfish	173	53.7		1.04						
########	WI-2	Night	Gillnet	Floating	26	Squawfish	170	50.8		1.03						
########	WI-2	Night	Gillnet	Floating	27	Squawfish	164	48.7		1.10						
########	WI-2	Night	Gillnet	Floating	28	Squawfish	125									No head
########	WI-2	Night	Gillnet	Floating	29	Squawfish	191	75.3		1.08						
########	WI-2	Night	Gillnet	Floating	30	Squawfish	163	42.5		0.98						
########	WI-2	Night	Gillnet	Floating	31	Squawfish	210	100.9		1.09						
########	WI-2	Night	Gillnet	Floating	32	Squawfish	148	38.9		1.20						
########	WI-2	Night	Gillnet	Floating	51	Squawfish	172	49.4		0.97						No head

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	WO	Night	Gillnet	Floating	1	Squawfish	232	136.6		1.09					Overcast	
########	WO	Night	Gillnet	Floating	2	Squawfish	188	71.9		1.08					Overcast	
########	WO	Day	Gillnet	Sinking	1	Squawfish	174	64.3		1.22						
########	WO	Day	Gillnet	Sinking	2	Squawfish	172	63.4		1.25						
########	WO	Day	Gillnet	Sinking	3	Squawfish	182	74.4		1.23						
########	WO	Day	Gillnet	Sinking	4	Squawfish	170	74.7		1.52						
########	WO	Night	Gillnet	Sinking	1	Squawfish	210	98.3		1.06						
########	WO	Night	Gillnet	Sinking	2	Squawfish	252	187.7		1.17						
########	WO	Night	Gillnet	Sinking	3	Squawfish	262	199.3		1.11						
########	WO	Night	Gillnet	Sinking	4	Squawfish	247	149.4		0.99						
########	WO	Night	Gillnet	Sinking	7	Squawfish	176	54.5		1.00						
########	OL	Night	Gillnet	Floating	1	Squawfish	200	92.4		1.16					Overcast	
########	OL	Night	Gillnet	Floating	2	Squawfish	275	248.3		1.19					Overcast	
########	OL	Night	Gillnet	Floating	3	Squawfish	238	146.1		1.08					Overcast	
########	OL	Night	Gillnet	Floating	4	Squawfish	255	221.1		1.33					Overcast	
########	OL	Night	Gillnet	Floating	5	Squawfish	198	81.9		1.06					Overcast	
########	OL	Night	Gillnet	Floating	6	Squawfish	108	15.1		1.20					Overcast	No head
########	OL	Night	Gillnet	Floating	7	Squawfish	190	71.3		1.04					Overcast	
########	OL	Night	Gillnet	Floating	8	Squawfish	216	117.1		1.16					Overcast	
########	OL	Night	Gillnet	Floating	9	Squawfish	180	57.5		0.99					Overcast	
########	OL	Night	Gillnet	Floating	10	Squawfish	120	18.1		1.05					Overcast	
########	OL	Night	Gillnet	Floating	11	Squawfish	131	22.5		1.00					Overcast	
########	OL	Night	Gillnet	Sinking	1	Squawfish	330	427.5		1.19						
########	OL	Night	Gillnet	Sinking	2	Squawfish	291	314.8		1.28						
########	OL	Night	Gillnet	Sinking	3	Squawfish	301	309		1.13						
########	OL	Night	Gillnet	Sinking	6	Squawfish	296	325.7		1.26						
########	OL	Night	Gillnet	Sinking	7	Squawfish	134	28.6		1.19						
########	AI	Day	Electrofishing		1	Squawfish	108	13		1.03						
########	AI	Day	Electrofishing		2	Squawfish	84	6		1.01						
########	AI	Day	Electrofishing		3	Squawfish	133	20.2		0.9						
########	AI	Day	Electrofishing		4	Squawfish	120	18.6		1.08						
########	AI	Day	Electrofishing		6	Squawfish	245	181.2		1.23						
########	AI	Day	Electrofishing		7	Squawfish	204	99		1.17						
########	AI	Day	Gillnet	Floating	1	Squawfish	214	103.5		1.06		Y				Voucher
########	AI	Day	Gillnet	Floating	2	Squawfish	195	89.2		1.20		Y				Voucher
########	AI	Day	Gillnet	Floating	3	Squawfish	260	185.5		1.06		Y				Voucher
########	AI	Day	Gillnet	Floating	4	Squawfish	140	31.2		1.14		Y				Voucher
########	AI	Day	Gillnet	Floating	5	Squawfish	116	17.6		1.13		Y				Voucher
########	AI	Day	Gillnet	Floating	6	Squawfish	225	141.8		1.24						
########	AI	Day	Gillnet	Floating	7	Squawfish	213	117.7		1.22						
########	AI	Day	Gillnet	Floating	8	Squawfish	230	121.1		1.00						
########	AI	Day	Gillnet	Floating	9	Squawfish	128	23.9		1.14						
########	AI	Day	Gillnet	Floating	10	Squawfish	134	26.2		1.09						
########	AI	Day	Gillnet	Floating	11	Squawfish	112	15.3		1.09						
########	AI	Day	Gillnet	Floating	12	Squawfish	191	85.1		1.22				R7 / 17		
########	AI	Night	Gillnet	Floating	2	Squawfish	260	212.9		1.21					Snowing	
########	AI	Night	Gillnet	Floating	3	Squawfish	253	178.5		1.10					Snowing	

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	Al	Night	Gillnet	Floating	4	Squawfish	226	122.8		1.06					Snowing	
########	Al	Night	Gillnet	Floating	5	Squawfish	250	184.4		1.18					Snowing	
########	Al	Night	Gillnet	Floating	6	Squawfish	230	146.2		1.20					Snowing	
########	Al	Night	Gillnet	Floating	7	Squawfish	183	61.5		1.00					Snowing	
########	Al	Night	Gillnet	Floating	8	Squawfish	213	117.3		1.21					Snowing	
########	Al	Night	Gillnet	Floating	9	Squawfish	202	87.4		1.06					Snowing	
########	Al	Night	Gillnet	Floating	10	Squawfish	225	132.4		1.16					Snowing	
########	Al	Night	Gillnet	Floating	11	Squawfish	234	144.1		1.12					Snowing	
########	Al	Night	Gillnet	Floating	12	Squawfish	246	145.1		0.97	Ray-2				Snowing	
########	Al	Night	Gillnet	Floating	13	Squawfish	205	87.4		1.01					Snowing	
########	Al	Night	Gillnet	Floating	14	Squawfish	220	121.2		1.14					Snowing	
########	Al	Night	Gillnet	Floating	16	Squawfish	236	159.8		1.22					Snowing	
########	Al	Night	Gillnet	Floating	17	Squawfish	219	129.9		1.24					Snowing	
########	Al	Night	Gillnet	Floating	20	Squawfish	230	137.3		1.13					Snowing	
########	Al	Night	Gillnet	Floating	21	Squawfish	231	140.7		1.14	Ray-3				Snowing	
########	Al	Night	Gillnet	Floating	23	Squawfish	182	66.3		1.10					Snowing	
########	Al	Night	Gillnet	Floating	24	Squawfish	200	90.3		1.13					Snowing	
########	Al	Night	Gillnet	Floating	25	Squawfish	228	128.5		1.08					Snowing	
########	Al	Night	Gillnet	Floating	26	Squawfish	169	48.6		1.01					Snowing	Head missing
########	Al	Night	Gillnet	Floating	28	Squawfish	260	180.8		1.03					Snowing	
########	Al	Night	Gillnet	Floating	29	Squawfish	194	80.3		1.10					Snowing	
########	Al	Night	Gillnet	Floating	30	Squawfish	175	60.2		1.12	Ray-5				Snowing	
########	Al	Night	Gillnet	Floating	31	Squawfish	199	79.7		1.01					Snowing	
########	Al	Night	Gillnet	Floating	32	Squawfish	211	104.9		1.12					Snowing	
########	Al	Night	Gillnet	Floating	33	Squawfish	184	62.1		1.00					Snowing	
########	Al	Night	Gillnet	Floating	34	Squawfish	170	49.1		1.00					Snowing	
########	Al	Night	Gillnet	Floating	35	Squawfish	218	113		1.09					Snowing	
########	Al	Night	Gillnet	Floating	36	Squawfish	214	107.4		1.10					Snowing	
########	Al	Night	Gillnet	Floating	37	Squawfish	217	101.2		0.99					Snowing	
########	Al	Night	Gillnet	Floating	38	Squawfish	193	79.9		1.11					Snowing	
########	Al	Night	Gillnet	Floating	39	Squawfish	172	58.7		1.15					Snowing	
########	Al	Night	Gillnet	Floating	40	Squawfish	158	48.5		1.23					Snowing	Head missing
########	Al	Night	Gillnet	Floating	41	Squawfish	175	58.7		1.10					Snowing	
########	Al	Night	Gillnet	Floating	43	Squawfish	135	26.1		1.06	Ray-7				Snowing	
########	Al	Night	Gillnet	Floating	44	Squawfish	146	31.3		1.01					Snowing	
########	Al	Night	Gillnet	Floating	45	Squawfish	145	33.9		1.11					Snowing	
########	Al	Night	Gillnet	Floating	46	Squawfish	115	17.8		1.17					Snowing	
########	Al	Night	Gillnet	Floating	48	Squawfish	121	17.7		1.00					Snowing	
########	Al	Night	Gillnet	Floating	49	Squawfish	225	116.2		1.02					Snowing	
########	Al	Night	Gillnet	Floating	50	Squawfish	243	160.5		1.12					Snowing	
########	Al	Night	Gillnet	Floating	51	Squawfish	125	20.7		1.06					Snowing	
########	Al	Night	Gillnet	Floating	52	Squawfish	129	22.6		1.05					Snowing	
########	Al	Night	Gillnet	Floating	53	Squawfish	211	114.4		1.22					Snowing	
########	Al	Night	Gillnet	Floating	54	Squawfish	146	35.2		1.13					Snowing	
########	Al	Night	Gillnet	Floating	55	Squawfish	147	38.4		1.21					Snowing	
########	Al	Night	Gillnet	Floating	56	Squawfish	148	35.8		1.10					Snowing	
########	Al	Night	Gillnet	Floating	57	Squawfish	131	26.5		1.18	Ray-9				Snowing	

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	AI	Night	Gillnet	Floating	58	Squawfish	241	150		1.07					Snowing	
########	AI	Night	Gillnet	Floating	59	Squawfish	111	15		1.10					Snowing	
########	AI	Night	Gillnet	Floating	60	Squawfish	135	26.3		1.07					Snowing	
########	AI	Night	Gillnet	Floating	61	Squawfish	130	26.2		1.19					Snowing	
########	AI	Night	Gillnet	Floating	62	Squawfish	134	24.3		1.01					Snowing	
########	AI	Night	Gillnet	Floating	63	Squawfish	114	16.1		1.09					Snowing	
########	AI	Night	Gillnet	Floating	64	Squawfish	190	77.2		1.13					Snowing	
########	AI	Night	Gillnet	Floating	65	Squawfish	112	14.7		1.05					Snowing	
########	AI	Night	Gillnet	Floating	66	Squawfish	136	26.9		1.07					Snowing	
########	AI	Night	Gillnet	Floating	68	Squawfish	139	28.8		1.07					Snowing	
########	AI	Night	Gillnet	Floating	69	Squawfish	197	81.7		1.07	Ray-11				Snowing	
########	AI	Night	Gillnet	Floating	70	Squawfish	137	26.3		1.02					Snowing	
########	AI	Night	Gillnet	Floating	72	Squawfish	140	30.5		1.11					Snowing	
########	AI	Night	Gillnet	Floating	73	Squawfish	140	28		1.02					Snowing	
########	AI	Night	Gillnet	Floating	74	Squawfish	104	12.6		1.12					Snowing	
########	AI	Night	Gillnet	Floating	75	Squawfish	110	15.9		1.19					Snowing	
########	AI	Night	Gillnet	Floating	76	Squawfish	109	13		1.00					Snowing	
########	AI	Night	Gillnet	Floating	77	Squawfish	140	28		1.02					Snowing	
########	AI	Night	Gillnet	Floating	78	Squawfish	120	18.6		1.08					Snowing	
########	AI	Night	Gillnet	Floating	79	Squawfish	116	17		1.09					Snowing	
########	AI	Night	Gillnet	Floating	80	Squawfish	104	11.9		1.06					Snowing	
########	AI	Night	Gillnet	Floating	81	Squawfish	124	19		1.00	Ray-12				Snowing	
########	AI	Night	Gillnet	Floating	82	Squawfish	125	19.9		1.02					Snowing	
########	AI	Night	Gillnet	Floating	83	Squawfish	138	28.6		1.09					Snowing	
########	AI	Night	Gillnet	Floating	84	Squawfish	118	17.8		1.08					Snowing	
########	AI	Night	Gillnet	Floating	85	Squawfish	109	14		1.08					Snowing	
########	AI	Night	Gillnet	Floating	86	Squawfish	210	101.8		1.10					Snowing	
########	AI	Night	Gillnet	Floating	87	Squawfish	215	111.8		1.12					Snowing	
########	AI	Night	Gillnet	Floating	88	Squawfish	196	79.9		1.06					Snowing	
########	AI	Night	Gillnet	Floating	89	Squawfish	220	124.9		1.17					Snowing	
########	AI	Night	Gillnet	Floating	90	Squawfish	165	53.7		1.20					Snowing	
########	AI	Night	Gillnet	Floating	91	Squawfish	134	25.5		1.06					Snowing	
########	AI	Night	Gillnet	Floating	92	Squawfish	130	23.3		1.06					Snowing	
########	AI	Night	Gillnet	Floating	93	Squawfish	120	18		1.04					Snowing	
########	AI	Night	Gillnet	Floating	94	Squawfish	110	14.5		1.09					Snowing	No head
########	AI	Night	Gillnet	Floating	95	Squawfish	111	14.5		1.06					Snowing	
########	AI	Night	Gillnet	Floating	96	Squawfish	126	20		1.00					Snowing	
########	AI	Night	Gillnet	Floating	97	Squawfish	114	16.8		1.13					Snowing	
########	AI	Night	Gillnet	Floating	98	Squawfish	164	44		1.00					Snowing	
########	AI	Night	Gillnet	Floating	100	Squawfish	134	25.9		1.08					Snowing	
########	AI	Night	Gillnet	Floating	101	Squawfish	115	14.3		0.94					Snowing	No head
########	AI	Night	Gillnet	Floating	102	Squawfish	123	19.5		1.05					Snowing	
########	AI	Night	Gillnet	Floating	103	Squawfish	117	16.2		1.01					Snowing	
########	AI	Night	Gillnet	Floating	104	Squawfish	135	27		1.10					Snowing	
########	AI	Night	Gillnet	Floating	105	Squawfish	148	36.8		1.14					Snowing	
########	AI	Night	Gillnet	Floating	106	Squawfish	118	15		0.91					Snowing	
########	AI	Night	Gillnet	Floating	107	Squawfish	122	19		1.05	Ray-14				Snowing	

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	AI	Night	Gillnet	Floating	108	Squawfish	122	17.7		0.97					Snowing	No head
########	AI	Night	Gillnet	Floating	109	Squawfish									Snowing	half of the fish
########	AI	Night	Gillnet	Floating	111	Squawfish	192	77.5		1.09					Snowing	
########	AI	Night	Gillnet	Floating	112	Squawfish	200	85.5		1.07					Snowing	
########	AI	Night	Gillnet	Floating	113	Squawfish	204	81.3		0.96					Snowing	
########	AI	Night	Gillnet	Floating	114	Squawfish	195	80.1		1.08					Snowing	
########	AI	Night	Gillnet	Floating	115	Squawfish	170	59		1.20					Snowing	
########	AI	Night	Gillnet	Floating	116	Squawfish	185	70.5		1.11					Snowing	
########	AI	Night	Gillnet	Floating	117	Squawfish	209	99.1		1.09					Snowing	
########	AI	Night	Gillnet	Floating	118	Squawfish	200	79.3		0.99					Snowing	
########	AI	Night	Gillnet	Floating	119	Squawfish	165	46.8		1.04					Snowing	
########	AI	Night	Gillnet	Floating	120	Squawfish	183	66.3		1.08					Snowing	
########	AI	Night	Gillnet	Floating	121	Squawfish	214	101.9		1.04					Snowing	
########	AI	Night	Gillnet	Floating	122	Squawfish	205	87		1.01					Snowing	
########	AI	Night	Gillnet	Floating	123	Squawfish	214	110.1		1.12					Snowing	
########	AI	Night	Gillnet	Floating	124	Squawfish	190	73.7		1.07					Snowing	
########	AI	Night	Gillnet	Floating	125	Squawfish	185	64.2		1.01					Snowing	
########	AI	Night	Gillnet	Floating	126	Squawfish	195	85.7		1.16					Snowing	
########	AI	Night	Gillnet	Floating	127	Squawfish	208	99.7		1.11	Ray-16				Snowing	
########	AI	Night	Gillnet	Floating	128	Squawfish	181	61		1.03					Snowing	
########	AI	Night	Gillnet	Floating	129	Squawfish	208	91.6		1.02					Snowing	
########	AI	Night	Gillnet	Floating	130	Squawfish	202	96.7		1.17					Snowing	
########	AI	Night	Gillnet	Floating	131	Squawfish	212	109.9		1.15					Snowing	
########	AI	Night	Gillnet	Floating	132	Squawfish	190	80.4		1.17					Snowing	
########	AI	Night	Gillnet	Floating	133	Squawfish	179	55.3		0.96					Snowing	
########	AI	Night	Gillnet	Floating	134	Squawfish	188	70.6		1.06					Snowing	
########	AI	Night	Gillnet	Floating	135	Squawfish	211	106.1		1.13					Snowing	
########	AI	Night	Gillnet	Floating	136	Squawfish	223	119.1		1.07					Snowing	
########	AI	Night	Gillnet	Floating	137	Squawfish	190	73.5		1.07					Snowing	
########	AI	Night	Gillnet	Floating	138	Squawfish	200	88.1		1.10					Snowing	
########	AI	Night	Gillnet	Floating	139	Squawfish	198	78		1.00					Snowing	
########	AI	Night	Gillnet	Floating	140	Squawfish	170	53.9		1.10					Snowing	
########	AI	Night	Gillnet	Floating	141	Squawfish	185	68.8		1.09					Snowing	
########	AI	Night	Gillnet	Floating	142	Squawfish	165	53.9		1.20					Snowing	
########	AI	Night	Gillnet	Floating	143	Squawfish	182	59.3		0.98					Snowing	
########	AI	Night	Gillnet	Floating	144	Squawfish									Snowing	Half fish only
########	AI	Night	Gillnet	Floating	145	Squawfish	198	81.8		1.05					Snowing	
########	AI	Night	Gillnet	Floating	146	Squawfish	180	61.2		1.05					Snowing	
########	AI	Night	Gillnet	Floating	147	Squawfish	215	111.9		1.13					Snowing	
########	AI	Night	Gillnet	Floating	148	Squawfish	188	73.9		1.11					Snowing	
########	AI	Night	Gillnet	Floating	149	Squawfish	186	71.5		1.11					Snowing	
########	AI	Night	Gillnet	Floating	150	Squawfish	184	62.4		1.00					Snowing	No head
########	AI	Night	Gillnet	Floating	151	Squawfish	198	89.7		1.16					Snowing	
########	AI	Night	Gillnet	Floating	152	Squawfish	195	76.7		1.03					Snowing	
########	AI	Night	Gillnet	Floating	153	Squawfish	209	103.7		1.14					Snowing	
########	AI	Night	Gillnet	Floating	154	Squawfish	197	85.6		1.12	Ray-17				Snowing	
########	AI	Night	Gillnet	Floating	155	Squawfish	169	51.3		1.06					Snowing	

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Sex	Condition Factor	Scales Taken	Fish Kept	Stomachs Taken	Roll# / Pic#	Weather	Comments
########	AI	Night	Gillnet	Floating	156	Squawfish	178	58.2		1.03					Snowing	
########	AI	Night	Gillnet	Floating	157	Squawfish	174	61.3		1.16					Snowing	
########	AI	Night	Gillnet	Floating	158	Squawfish	185	76.1		1.20					Snowing	
########	AI	Night	Gillnet	Floating	159	Squawfish	186	73.7		1.15					Snowing	
########	AI	Night	Gillnet	Floating	160	Squawfish	200	87.4		1.09					Snowing	
########	AI	Night	Gillnet	Floating	161	Squawfish	189	72.8		1.08					Snowing	
########	AI	Night	Gillnet	Floating	162	Squawfish	202	99.7		1.21					Snowing	
########	AI	Night	Gillnet	Floating	163	Squawfish	214	119.7		1.22					Snowing	
########	AI	Night	Gillnet	Floating	164	Squawfish	196	83.5		1.11					Snowing	
########	AI	Night	Gillnet	Floating	165	Squawfish	170	58.3		1.19					Snowing	
########	AI	Night	Gillnet	Floating	166	Squawfish	191	70.6		1.01					Snowing	
########	AI	Night	Gillnet	Floating	167	Squawfish	196	79		1.05					Snowing	
########	AI	Night	Gillnet	Floating	168	Squawfish	194	79		1.08					Snowing	
########	AI	Night	Gillnet	Floating	169	Squawfish	206	94.7		1.08					Snowing	
########	AI	Night	Gillnet	Floating	170	Squawfish	157	45.4		1.17					Snowing	
########	AI	Night	Gillnet	Floating	171	Squawfish	190	75.4		1.10					Snowing	
########	AI	Night	Gillnet	Floating	172	Squawfish	200	84.3		1.05					Snowing	
########	AI	Night	Gillnet	Floating	173	Squawfish	274	252.9		1.23					Snowing	
########	AI	Night	Gillnet	Floating	174	Squawfish	275	242.8		1.17	Ray-18				Snowing	
########	AI	Night	Gillnet	Floating	176	Squawfish									Snowing	Half of the fish
########	AI	Night	Gillnet	Floating	178	Squawfish	181	65		1.10					Snowing	
########	AI	Night	Gillnet	Floating	179	Squawfish	206	106.5		1.22					Snowing	
########	AI	Night	Gillnet	Floating	180	Squawfish	201	91.3		1.12					Snowing	
########	AI	Night	Gillnet	Floating	181	Squawfish	171	52		1.04					Snowing	
########	AI	Night	Gillnet	Floating	182	Squawfish	166	49.2		1.08					Snowing	
########	AI		Minnow Trapping		2	Squawfish	115									
########	AI-2	Night	Gillnet	Floating	2	Squawfish	232	143.7		1.15						
########	AI-2	Night	Gillnet	Floating	3	Squawfish	194	81.6		1.12						
########	AI-2	Night	Gillnet	Floating	4	Squawfish	122	20.7		1.14						
########	AI-2	Night	Gillnet	Floating	5	Squawfish	164	44.6		1.01						
########	AI-2	Night	Gillnet	Floating	6	Squawfish	207	97.3		1.10						
########	AO	Night	Gillnet	Floating	1	Squawfish	212	101.8		1.07						

Appendix A6

Sucker Data

Table A6.1 Largescale and longnose sucker data for Wells Creek Bay, Submerged Lake Basin, and Andrews Bay, September/October 1996.

NB No sex data No analysis based on sample site or time of day

Date	Site	Day or Night Set	Capture Method	Floating or Sinking	Fish No.	Species	Length (mm)	Weight (g)	Condition Factor	Fish Kept	Roll# / Pic#	Weather	Comments
17/09/1996	WI	Day	Electrofishing		2	Large Scale Sucker	243	164.5	1.15				
19/09/1996	AI	Day	Electrofishing		5	Large Scale Sucker	176	69.0	1.27				
21/09/1996	AI	Night	Gillnet	Floating	15	Large Scale Sucker	288	286.0	1.20			Snowing	
21/09/1996	AI	Night	Gillnet	Floating	19	Large Scale Sucker	293	321.6	1.28			Snowing	
21/09/1996	AI	Night	Gillnet	Floating	27	Large Scale Sucker	285	313.0	1.35			Snowing	
21/09/1996	AI	Night	Gillnet	Floating	175	Large Scale Sucker	269	232.4	1.19			Snowing	
21/09/1996	AI	Night	Gillnet	Floating	177	Large Scale Sucker	280	249.1	1.13			Snowing	No head
21/09/1996	AI	Day	Gillnet	Floating	13	Large Scale Sucker	200	103.0	1.29	Y	R7 / 16		Voucher
29/09/1996	WI-2	Night	Gillnet	Floating	33	Large Scale Sucker	295	330.6	1.29	Y			
17/09/1996	WI	Day	Electrofishing		8	Longnose Sucker	109	12.0	0.93				
01/10/1996	WO	Night	Gillnet	Sinking	5	Long Nose Sucker	375	638.9	1.21				
01/10/1996	WO	Night	Gillnet	Sinking	6	Long Nose Sucker	397	828.0	1.32				
03/10/1996	WO	Day	Gillnet	Sinking	5	Long Nose Sucker	292	312.0	1.25				
03/10/1996	WO	Day	Gillnet	Sinking	6	Long Nose Sucker	340	551.3	1.40				
03/10/1996	OL	Night	Gillnet	Sinking	4	Long Nose Sucker	382	777.4	1.39				
03/10/1996	OL	Night	Gillnet	Sinking	5	Long Nose Sucker	400	776.0	1.21				
21/09/1996	AI	Night	Gillnet	Floating	18	Long Nose Sucker	238	152.2	1.13			Snowing	
21/09/1996	AI	Night	Gillnet	Floating	71	Long Nose Sucker	127	20.4	1.00			Snowing	
21/09/1996	AI	Day	Gillnet	Floating	14	Long Nose Sucker	222	135.1	1.23	Y	R7 / 16		Voucher
21/09/1996	AI	Day	Gillnet	Floating	15	Long Nose Sucker	162	44.6	1.05	Y			Voucher
04/10/1996	AI-2	Night	Gillnet	Floating	1	Long Nose Sucker	319	344.6	1.06				

Appendix A7

Stomach Content Data

Table A7.1 Stomach contents of rainbow trout, Wells Creek (Inner Bay), September/October 1996.

			Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Average #	<200 mm Average %	OCCUR	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Average #	200-300 mm Average %	OCCUR	Wells Creek Inner Bay	Wells Creek Inner Bay	>300 mm Average #	Average %	OCCUR
		Sample Site	1	1	1	1	2	2	2	2			**n = 8**	1	1	1	2	2	2	1			**n = 7**	1	1			**n = 2**
		Time of Day	Night	Night	Night	Night	Day	Day	Day	Day				Night	Night	Night	Day	Day	Day	Day				Night	Day			
		Species	RBT	RBT	RBT	RBT	RBT	RBT	RBT	RBT				RBT	RBT	RBT	RBT	RBT	RBT	RBT				RBT	RBT			
		Stomach Sample Code	B2	B4	B5	B6	C4	C5	C6	C7				B1	B3	B7	C1	C2	C3	C9				B23	C8			
		Fish Length (mm)	170	173	195	172	189	191	166	182	179.8			256	259	234	243	213	204	243	236.0			342	330	336.0		
		Fish Weight (g)	64.2	55.3	86.9	55.1	77.5	78.6	48.6	68	66.8			171.3	180.3	131.8	147.9	115.3	96.7	153.9	142.5			391.6	363.8	377.7		
		Stomach Weight - Empty (g)	1.342	1.966	1.852	1.781	1.936	1.838	1.278	1.664				3.816	1.966	2.363	3.427	2.521	1.757	2.675				7.035	9.126			
		Stomach Weight - Full (g)	2.181	3.417	2.626	3.911	3.876	3.344	1.835	2.852				4.202	4.213	4.031	4.333	3.806	2.808	3.589				9.802	9.563			
		Estimated Level of Fullness (%)	67	67	50	83	75	75	75	75	70.9			50	75	75	50	75	75	50	64.3			67	5	36.0		
Class/Order	**Family**	**Genus/Species**																										
Arachnida/Acarina		*Hydracarina (Lebertia sp?)*																										
		Hydracarina, Frontipodia sp	0	0	0	0	0	0	0	0	0.0	0.0	**0**	102	0	0	0	0	0	0	14.6	7.7	**1**					
		Hydracarina, sp	0	0	0	1	0	0	0	0	0.1	0.1	**1**	0	0	1	2	0	2	0	0.7	0.4	**3**					
Aranaea			2	1	1	0	1	0	1	6	1.5	1.0	**6**	1	0	0	2	1	2	1	1.0	0.5	**5**	0	1	0.5	0.7	**1**
Crustacea/Amphipoda	Gammaridae	*Hyalella azteca*	0	0	0	0	0	0	0	0	0.0	0.0	**0**	1	0	0	0	0	0	0	0.1	0.1	**1**					
Branchiopoda/Cladocera		*Bosmina longirostris*																										
		Daphnia sp	88	0	0	0	0	0	0	0	11.0	7.6	**1**	0	0	0	28	0	0	0	4.0	2.1	**1**					
		Daphnia rosea																										
		Daphnia longiremus	0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	0	0	300	42.9	22.5	**1**					
		Eurycercus (Bullatifrons) sp	0	1	0	17	0	0	0	0	2.3	1.6	**2**	2	0	0	0	0	0	0	0.3	0.2	**1**	0	1	0.5	0.7	**1**
		Holopedium gibberum																										
		Unid	0	0	0	0	0	0	0	0	0.0	0.0	**0**	8	0	0	0	0	0	0	1.1	0.6	**1**					
Copepoda/Calanoida		*(Diaptomus sp?)*	0	0	0	0	0	0	0	0	0.0	0.0	**0**	2	0	0	0	0	0	0	0.3	0.2	**1**					
	Unid																											
Copepoda/Cyclopoida		*(Cyclops sp?)*																										
Ostracoda																												
Insecta/Diptera	Ceratopogonidae	*Bezzia sp L*	0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	1	0	0	0.1	0.1	**1**					
	Chironomidae A		0	0	0	34	0	34	6	75	18.6	12.8	**4**	0	0	23	5	0	6	5	5.6	2.9	**4**	3	11	7.0	9.7	**2**
	Chironomidae P		94	66	4	68	25	203	62	57	72.4	49.9	**8**	61	8	118	119	149	152	46	93.3	49.0	**7**	2	9	5.5	7.6	**2**
	Chironomidae, Chironomini P																											
	Chironomidae	*Chironomus sp. L*	0	0	0	0	0	0	0	0	0.0	0.0	**0**	1	0	0	0	0	0	0	0.1	0.1	**1**					
	Chironomidae	*Phaenopsectra sp L*																										
	Chironomidae	*Rheotanytarsus sp L*																										
	Chironomidae	*Procladius sp L*																										
	Chironomidae	*Crictopus sp L*																										
	Chironomidae L																											
	Muscidae A		1	0	0	0	0	0	0	0	0.1	0.1	**1**	0	0	0	1	0	0	0	0.1	0.1	**1**					
	Muscidae	*Limnophora sp L*	0	0	0	0	0	0	0	0	0.0	0.0	**0**											1	0	0.5	0.7	**1**
	Muscidae																											
	Tipulidae A		0	3	0	0	0	0	0	0	0.4	0.3	**1**	1	0	0	0	0	0	0	0.1	0.1	**1**					
	Tipulidae	*Prioncera sp*																										
	Tipulidae	*Prioncera sp A*																										
	Tipulidae	*Prioncera sp L*																										
	Tipulidae	*Tipula sp L*																										
	(Empididae?) L		0	0	0	30	0	0	0	0	3.8	2.6	**1**															
	(Muscidae?) A		0	0	0	3	0	3	0	0	0.8	0.5	**2**															
	Unid A		0	1	0	34	1	5	13	8	7.8	5.3	**5**	0	1	7	10	10	8	3	5.6	2.9	**6**	19	5	12.0	16.6	**2**
	Unid L		0	0	0	5	0	0	0	0	0.6	0.4	**5**															
Insecta/Coleoptera	Chrysomellidae A		0	2	0	3	0	0	0	0	0.6	0.4	**2**	0	0	0	0	1	0	0	0.1	0.1	**1**	3	0	1.5	2.1	**1**
	Gyrinidae A		0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	2	0	0	0	0	0.3	0.2	**1**					
	Gyrinidae	*Gyrinus sp A*	0	0	0	0	1	0	0	0	0.1	0.1	**1**															
	Carabidae A		0	0	1	2	0	0	0	0	0.4	0.3	**2**															
	Carabidae? A		0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	3	0	0	0	0	0.4	0.2	**1**					
	Coccinellidae	*Adalia bipunctata A*	0	0	0	0	0	0	0	0	0.0	0.0	**0**											1	0	0.5	0.7	**1**
	Curculionidae A		0	0	0	0	0	0	1	0	0.1	0.1	**1**															
	Elmidae A																											
	(Elmidae?) A																											
	(Elmidae?)																											
	Staphylinidae A		1	3	1	2	0	0	0	0	0.9	0.6	**4**	0	15	10	0	0	0	0	3.6	1.9	**2**	72	0	36.0	49.7	**1**
	Unid A		5	8	5	5	5	2	0	1	3.9	2.7	**7**	1	17	1	0	1	1	0	3.0	1.6	**5**	4	0	2.0	2.8	**1**
	Unid L																											
Insecta/Ephemeroptera	Unid A		0	0	0	0	0	0	0	0	0.0	0.0	**0**	1	0	0	0	0	0	0	0.1	0.1	**1**					
	Unid N																											
		Paraleptophlebia sp	0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	0	0	1	0.1	0.1	**1**					
		Paraleptophlebia sp N	0	0	0	0	0	1	0	0	0.1	0.1	**1**															
		Baetis sp N	0	0	0	0	0	0	0	0	0.0	0.0	**0**															
Insecta/Hemiptera	Corixidae A		0	3	0	0	0	0	0	0	0.4	0.3	**1**	0	0	0	0	1	1	0	0.3	0.2	**2**					
	Corixidae N		2	0	0	0	7	2	0	0	1.4	0.9	**3**	3	0	1	0	0	0	0	0.6	0.3	**2**	1	0	0.5	0.7	**1**
	Pentatomidae A		0	0	0	1	0	0	0	0	0.1	0.1	**1**															
	Unid A		0	0	0	0	0	0	2	0	0.3	0.2	**1**	0	0	2	0	0	1	1	0.6	0.3	**3**					
	Unid N		0	0	0	0	1	0	2	0	0.4	0.3	**2**															
	Gerridae N																											
	(Gerridae?) N		0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	3	0	0	0	0.4	0.2	**1**					
	Unid terrestrial N		0	2	0	0	0	0	0	0	0.3	0.2	**1**															
	Miridae A		0	0	0	0	0	0	0	0	0.0	0.0	**0**											0	2	1.0	1.4	**1**
Insecta/Homoptera	Aphididae																											
	Cicadellidae A		0	0	0	3	0	0	0	0	0.4	0.3	**1**	0	1	0	0	1	0	0	0.3	0.2	**2**					
	Unid A		0	0	0	0	0	0	0	0	0.0	0.0	**0**											1	0	0.5	0.7	**1**
Insecta/Hymenoptera	Carabidae? A		0	0	0	0	0	0	0	0	0.0	0.0	**0**											1	0	0.5	0.7	**1**
	Chalcidoidea A		1	0	0	0	0	0	0	0	0.1	0.1	**1**	0	0	0	0	0	1	0	0.1	0.1	**1**					
	Formicidae		0	0	0	0	9	0	2	0	1.4	0.9	**2**	0	0	2	0	3	3	0	1.1	0.6	**3**					
	Formicidae A		1	0	0	2	0	4	0	2	1.1	0.8	**4**	1	8	0	2	0	0	1	1.7	0.9	**4**	1	0	0.5	0.7	**1**
	Ichneumonoidea A		0	6	0	3	0	0	0	1	1.3	0.9	**3**	0	1	1	0	0	0	1	0.4	0.2	**3**	3	2	2.5	3.4	**2**
	Sphecoidea A		0	2	0	1	0	1	0	0	0.5	0.3	**3**															
	Sphecoidea		0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	0	1	0	0.1	0.1	**1**					
	Unid A		1	3	1	36	9	2	3	1	7.0	4.8	**8**	0	13	10	1	0	3	1	4.0	2.1	**5**	1	0	0.5	0.7	**1**

				Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Average #	<200 mm Average %	OCCUR	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Average #	200-300 mm Average %	OCCUR	Wells Creek Inner Bay	Wells Creek Inner Bay	>300 mm Average #	Average %	OCCUR
			Sample Site	1	1	1	1	2	2	2	2			**n = 8**	1	1	1	2	2	2	1			**n = 7**	1	1			**n = 2**
			Time of Day	Night	Night	Night	Night	Day	Day	Day	Day				Night	Night	Night	Day	Day	Day	Day				Night	Day			
			Species	RBT	RBT	RBT	RBT	RBT	RBT	RBT	RBT				RBT	RBT	RBT	RBT	RBT	RBT	RBT				RBT	RBT			
			Stomach Sample Code	B2	B4	B5	B6	C4	C5	C6	C7				B1	B3	B7	C1	C2	C3	C9				B23	C8			
Insecta/Megaloptera L?				0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	0	0	1	0.1	0.1	**1**					
Insecta/Megaloptera			*Sialis sp L*	0	0	0	0	1	0	0	0	0.1	0.1	**1**															
Insecta/Orthoptera		Cyrtacanthacridinae																											
		Unid A																											
Insecta/Trichoptera			*Phryganea sp L*	0	0	0	0	0	0	0	0	0.0	0.0	**0**															
			Limnephilidae L																										
		Hydroptilidae?		0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	0	0	5	0.7	0.4	**1**					
		Unid A		3	1	0	13	2	0	4	0	2.9	2.0	**5**	0	0	0	0	1	0	0	0.1	0.1	**1**	0	1	0.5	0.7	**1**
		Unid P		0	3	0	0	0	0	0	0	0.4	0.3	**1**	1	0	0	0	1	0	0	0.3	0.2	**2**					
Bryozoa/Cyclostomata			*Cristatella mucedo?*																										
Mollusca/Bivalvia			*Pisidium sp*																										
Mollusca/Gastropoda			*Gyraulus parvus*																										
			Valvata sincera	0	0	0	0	0	1	4	0	0.6	0.4	**2**	0	0	0	0	0	1	0	0.1	0.1	**1**					
			Physa gyrina																										
			Stagnicola (catascopium)	0	0	0	0	0	0	0	0	0.0	0.0	**0**															
Nematoda				0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	0	1	0	0	0.1	0.1	**1**					
Non-Animal/Other			Bark Fragment	0	0	0	0	0	1	0	1	0.3	0.2	**2**															
			Bud (deciduous tree)	0	0	0	0	0	1	0	0	0.1	0.1	**1**															
			Conifer Needles	0	0	0	0	1	0	0	2	0.4	0.3	**2**	0	0	0	4	0	4	0	1.1	0.6	**2**					
			Feather	0	0	0	0	0	0	0	0	0.0	0.0	**0**	0	0	0	1	0	0	0	0.1	0.1	**1**					
			Fish																										
			Large Insect Moults																										
			Sedge Fragment	0	0	0	0	0	0	1	1	0.3	0.2	**2**															
			Stick Fragment	0	0	0	0	0	0	0	1	0.1	0.1	**1**	0	0	0	1	0	0	0	0.1	0.1	**1**					
TOTAL												145.0	100.0									190.4	100.0				72.5	100.0	
COMMENTS			WD = well digested, rem = remnants, est = estimated, dam = damaged		WD insect rem: est 2/3 volume	WD insect rem: est 2/3 volume			a) WD insect rem: est 1/4 of volume, b) one large insect (Hemiptera?)		Conifer (spruce?) needles				a) WD insect fragments: 1/2 volume, b) unid dam cladocera: 8 + many fragments, c) Copepoda, Calanoida (Diaptomus sp?): 2 + many fragments			WD insect rem: est 1/2 of volume	WD insect rem: est 1/4 of volume	WD insect rem: est 1/4 of volume									

Table A7.2 Stomach contents of rainbow trout, Wells Creek (Outer Bay), September/October 1996.

			Wells Creek Outer	<200 mm Average %	OCCUR	Wells Creek Outer	Wells Creek Outer	200-300 mm Average	Average %	OCCUR	Wells Creek Outer	Wells Creek Outer	>300 mm Average #	Average %	OCCUR
		Sample Site			n = 1					n = 2					n = 2
		Time of Day	Night			Night	Night				Night	Day			
		Species	RBT			RBT	RBT				RBT	RBT			
		Stomach Sample Code	D4			D2	D3				D1	D10			
		Fish Length (mm)	198			285	206	245.5			332	350	341.0		
		Fish Weight (g)	80.8			227.5	186.6	207.1			284.5	465.5	375.0		
		Stomach Weight - Empty (g)	1.869			4.679	4.007				7.920	10.235			
		Stomach Weight - Full (g)	2.681			4.842	6.419				7.927	10.901			
		Estimated Level of Fullness (%)	83			10	75	42.5			1	10	5.5		
Class/Order	**Family**	**Genus/Species**													
Arachnida/Acarina		*Hydracarina (Lebertia sp?)*				0	367	183.5	60.4	**1**					
		Hydracarina, Frontipodia sp													
		Hydracarina, sp													
Aranaea			7	2.7	**1**	0	6	3.0	1.0	**1**					
Crustacea/Amphipoda	Gammaridae	*Hyalella azteca*									0	3	1.5	6.1	**1**
Branchiopoda/Cladocera		*Bosmina longirostris*													
		Daphnia sp													
		Daphnia rosea													
		Daphnia longiremus									0	1	0.5	2.0	
		Eurycercus (Bullatifrons) sp	95	36.1	**1**	115	12	63.5	20.9	**2**	27	3	15.0	61.2	
		Holopedium gibberum													**1**
		Unid													**1**
Copepoda/Calanoida		*(Diaptomus sp?)*													
	Unid														
Copepoda/Cyclopoida		*(Cyclops sp?)*													
															1
Ostracoda															
Insecta/Diptera	Ceratopogonidae	*Bezzia sp L*													
	Chironomidae A		3	1.1	**1**	0	15	7.5	2.5	**1**					
	Chironomidae P		148	56.3	**1**	0	69	34.5	11.3	**1**	1	3	2.0	8.2	
	Chironomidae, Chironomini P														
	Chironomidae	*Chironomus sp. L*													
	Chironomidae	*Phaenopsectra sp L*													
	Chironomidae	*Rheotanytarsus sp L*													
	Chironomidae	*Procladius sp L*													
	Chironomidae	*Crictopus sp L*													
	Chironomidae L														
	Muscidae A					0	3	1.5	0.5	**1**					
	Muscidae	*Limnophora sp L*													
	Muscidae		1	0.4	**1**										
	Tipulidae A														
	Tipulidae	*Prioncera sp*													
	Tipulidae	*Prioncera sp A*													
	Tipulidae	*Prioncera sp L*													
	Tipulidae	*Tipula sp L*													
	(Empididae?) L														
	(Muscidae?) A														
	Unid A		2	0.8	**1**	0	2	1.0	0.3	**1**					
	Unid L														
Insecta/Coleoptera	Chrysomellidae A														
	Gyrinidae A														
	Gyrinidae	*Gyrinus sp A*													
	Carabidae A														
	Carabidae? A														
	Coccinellidae	*Adalia bipunctata A*													
	Curculionidae A														
	Elmidae A														
	(Elmidae?) A														
	(Elmidae?)														
	Staphylinidae A		1	0.4	**1**										
	Unid A					0	7	3.5	1.2	**1**					
	Unid L														
Insecta/Ephemeroptera	Unid A														
	Unid N														
		Paraleptophlebia sp													
		Paraleptophlebia sp N													
		Baetis sp N									0	1	0.5	2.0	
Insecta/Hemiptera	Corixidae A														
	Corixidae N					0	2	1.0	0.3	**1**	0	7	3.5	14.3	
	Pentatomidae A														
	Unid A		1	0.4	**1**										
	Unid N														
	Gerridae N														
	(Gerridae?) N														
	Unid terrestrial N														
	Miridae A														
Insecta/Homoptera	Aphididae		1	0.4	**1**										
	Cicadellidae A														
	Unid A														
Insecta/Hymenoptera	Carabidae? A														
	Chalcidoidea A														
	Formicidae														
	Formicidae A														
	Ichneumonoidea A		1	0.4	**1**	0	1	0.5	0.2	**1**	0	0			
	Sphecoidea A														
	Sphecoidea														
	Unid A		2	0.8	**1**	1	3	2.0	0.7	**2**					
Insecta/Megaloptera L?															
Insecta/Megaloptera		*Sialis sp L*													
Insecta/Orthoptera	Cyrtacanthacridinae														
	Unid A														
Insecta/Trichoptera		*Phryganea sp L*									0	1	0.5	2.0	
		Limnephilidae L													
	Hydroptilidae?														
	Unid A					0	4	2.0	0.7	**1**					
	Unid P														
Bryozoa/Cyclostomata		*Cristatella mucedo?*													
Mollusca/Bivalvia		*Pisidium sp*													
Mollusca/Gastropoda		*Gyraulus parvus*													
		Valvata sincera	1	0.4	**1**	1	0	0.5	0.2	**1**					
		Physa gyrina													
		Stagnicola (catascopium)									0	1	0.5	2.0	
Nematoda															
Non-Animal/Other		Bark Fragment													
		Bud (deciduous tree)													
		Conifer Needles													
		Feather													
		Fish													
		Large Insect Moults													
		Sedge Fragment													
		Stick Fragment									0	1	0.5	2.0	
TOTAL			263.0	100.0				304.0	100.0				24.5	100.0	
COMMENTS		WD = well digested, rem = remnants, est = estimated, dam = damaged				Cladocera, Eurycercus (Bullatifrons) sp: 115 + fragments									

Table A7.3 Stomach contents of rainbow trout, Submerged Lake Basin, September/October 1996.

Class/Order	Family	Genus/Species	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	200-300 mm Average #	Average %	OCCUR	Submerged Lake Basin	Submerged Lake Basin	>300 mm Average #	Average %	OCURR
		Sample Site						n = 3					n = 2
		Time of Day	Night	Night	Night				Night	Night			
		Species	RBT	RBT	RBT				RBT	RBT			
		Stomach Sample Code	E2	E4	E5				E1	E3			
		Fish Length (mm)	294	280	203	259.0			320	348	334.0		
		Fish Weight (g)	236.4	223.4	83.1	181.0			304.3	438.8	371.6		
		Stomach Weight - Empty (g)	4.289	4.336	2.097				5.849	7.254			
		Stomach Weight - Full (g)	5.071	5.413	2.436				5.851	9.093			
		Estimated Level of Fullness (%)	50	50	50	50.0			1	25	13.0		
Class/Order	**Family**	**Genus/Species**											
Arachnida/Acarina		*Hydracarina (Lebertia sp?)*											
		Hydracarina, Frontipodia sp											
		Hydracarina, sp	0	1	0	0.3	0.1	**1**					
Aranaea			1	0	0	0.3	0.1	**1**	0	3	1.5	2.9	**1**
Crustacea/Amphipoda	Gammaridae	*Hyalella azteca*											
Branchiopoda/Cladocera		*Bosmina longirostris*											
		Daphnia sp											
		Daphnia rosea											
		Daphnia longiremus											
		Eurycercus (Bullatifrons) sp	0	532	0	177.3	74.1	**1**					
		Holopedium gibberum											
		Unid											
Copepoda/Calanoida		*(Diaptomus sp?)*											
	Unid		0	1	0	0.3	0.1	**1**					
Copepoda/Cyclopoida		*(Cyclops sp?)*											
Ostracoda													
Insecta/Diptera	Ceratopogonidae	*Bezzia sp L*											
	Chironomidae A		50	7	5	20.7	8.6	**3**	0	16	8.0	15.5	**1**
	Chironomidae P		62	17	19	32.7	13.6	**3**	2	25	13.5	26.2	**2**
	Chironomidae	Chironomini P											
	Chironomidae	*Chironomus sp. L*											
	Chironomidae	*Phaenopsectra sp L*											
	Chironomidae	*Rheotanytarsus sp L*											
	Chironomidae	*Procladius sp L*											
	Chironomidae	*Crictopus sp L*											
	Chironomidae L												
	Muscidae A												
	Muscidae	*Limnophora sp L*											
	Muscidae												
	Tipulidae A												
	Tipulidae	*Prioncera sp*											
	Tipulidae	*Prioncera sp A*											
	Tipulidae	*Prioncera sp L*											
	Tipulidae	*Tipula sp L*											
	(Empididae?) L												
	(Muscidae?) A								0	9	4.5	8.7	**1**
	Unid A												
	Unid L												
Insecta/Coleoptera	Chrysomellidae A		1	1	1	1.0	0.4	**3**					
	Gyrinidae A												
	Gyrinidae	*Gyrinus sp A*											
	Carabidae A												
	Carabidae? A												
	Coccinellidae	*Adalia bipunctata A*											
	Curculionidae A												
	Elmidae A												
	(Elmidae?) A		6	0	3	3.0	1.3	**2**					
	(Elmidae?)								0	3	1.5	2.9	**1**
	Staphylinidae A								0	2	1.0	1.9	**1**
	Unid A		0	3	1	1.3	0.6	**2**	0	3	1.5	2.9	**1**
	Unid L												
Insecta/Ephemeroptera	Unid A												
	Unid N												
		Paraleptophlebia sp							1	0	0.5	1.0	**1**
		Paraleptophlebia sp N											
		Baetis sp N											
Insecta/Hemiptera	Corixidae A												
	Corixidae N		2	1	0	1.0	0.4		0	25	12.5	24.3	**1**
	Pentatomidae A												
	Unid A								0	1	0.5	1.0	**1**
	Unid N												
	Gerridae N												
	(Gerridae?) N												
	Unid terrestrial N												
	Miridae A												
Insecta/Homoptera	Aphididae												
	Cicadellidae A												
	Unid A												
Insecta/Hymenoptera	Carabidae? A												
	Chalcidoidea A												
	Formicidae												
	Formicidae A		1	0	0	0.3	0.1	**1**	0	1	0.5	1.0	**1**
	Ichneumonoidea A								0	2	1.0	1.9	**1**
	Sphecoidea A												
	Sphecoidea												
	Unid A		0	2	0	0.7	0.3	**1**	0	5	2.5	4.9	**1**
Insecta/Megaloptera L?													
Insecta/Megaloptera		*Sialis sp L*											
Insecta/Orthoptera	Cyrtacanthacridinae												
	Unid A												
Insecta/Trichoptera		*Phryganea sp L*											
		Limnephilidae L											
	Hydroptilidae?												
	Unid A												

Table A7.3 Stomach contents of rainbow trout, Submerged Lake Basin, September/October 1996.

				Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	200-300 mm Average #	Average %	OCCUR	Submerged Lake Basin	Submerged Lake Basin	>300 mm Average #	Average %	OCURR
			Sample Site						n = 3					n = 2
			Time of Day	Night	Night	Night				Night	Night			
			Species	RBT	RBT	RBT				RBT	RBT			
			Stomach Sample Code	E2	E4	E5				E1	E3			
		Unid P												
Bryozoa/Cyclostomata			*Cristatella mucedo?*											
Mollusca/Bivalvia			*Pisidium sp*											
Mollusca/Gastropoda			*Gyraulus parvus*	0	0	1	0.3	0.1	**1**					
			Valvata sincera											
			Physa gyrina											
			Stagnicola (catascopium)											
Nematoda														
Non-Animal/Other			Bark Fragment							0	1	0.5	1.0	**1**
			Bud (deciduous tree)											
			Conifer Needles							0	4	2.0	3.9	**1**
			Feather											
			Fish											
			Large Insect Moults											
			Sedge Fragment											
			Stick Fragment											
TOTAL							239.3	100.0				51.5	100.0	
COMMENTS			WD = well digested, rem = remnants, est = estimated, dam = damaged	WD insect rem: est 1/2 of volume		WD insect remains: est 1/2 of volume					WD insect rem: est 3/4 of volume			

Table A7.4 Stomach contents of rainbow trout, Andrews Bay Site 1 (Inner Bay), September/October 1996.

Class/Order	Family	Genus/Species	Andrews Bay Site 1	Andrews Bay Site 1	<200 mm Average #	Average %	OCCUR	Andrews Bay Site 1	Andrews Bay Site 1	Andrews Bay Site 1	200-300 mm Average #	Average %	OCCUR
		Sample Site											
		Time of Day	Night	Night			n = 2	Night	Night	Night			n = 3
		Species	RBT	RBT				RBT	RBT	RBT			
		Stomach Sample Code	A4	A5				A1	A2	A3			
		Fish Length (mm)	155	183	169.0			205	209	204	206.0		
		Fish Weight (g)	46.4	73.6	60.0			98.5	112.2	98.5	103.1		
		Stomach Weight - Empty (g)	0.800	0.738				2.086	1.860	2.052			
		Stomach Weight - Full (g)	0.996	0.926				3.693	2.408	2.313			
		Estimated Level of Fullness (%)	25	25	25.0			75	50	25	50.0		
Class/Order	**Family**	**Genus/Species**											
Arachnida/Acarina		*Hydracarina (Lebertia sp?)*											
		Hydracarina, Frontipodia sp											
		Hydracarina, sp											
Aranaea								2	0	0	0.7	0.7	**2**
Crustacea/Amphipoda	Gammaridae	*Hyalella azteca*											
Branchiopoda/Cladocera		*Bosmina longirostris*											
		Daphnia sp											
		Daphnia rosea											
		Daphnia longiremus	0	300	150.0	95.5	**1**						
		Eurycercus (Bullatifrons) sp						0	1	0	0.3	0.3	**1**
		Holopedium gibberum											
		Unid											
Copepoda/Calanoida		*(Diaptomus sp?)*											
	Unid												
Copepoda/Cyclopoida		*(Cyclops sp?)*											
Ostracoda													
Insecta/Diptera	Ceratopogonidae	*Bezzia sp L*											
	Chironomidae A		3	0	1.5	1.0	**1**	108	18	0	42.0	42.6	**2**
	Chironomidae P		8	0	4.0	2.5	**1**	78	37	5	40.0	40.5	**3**
	Chironomidae	Chironomini P											
	Chironomidae	*Chironomus sp. L*											
	Chironomidae	*Phaenopsectra sp L*											
	Chironomidae	*Rheotanytarsus sp L*											
	Chironomidae	*Procladius sp L*						1	0	0	0.3	0.3	**1**
	Chironomidae	*Crictopus sp L*											
	Chironomidae L												
	Muscidae A												
	Muscidae	*Limnophora sp L*											
	Muscidae												
	Tipulidae A							0	0	1	0.3	0.3	**1**
	Tipulidae	*Prioncera sp*	2	0	1.0	0.6	**1**						
	Tipulidae	*Prioncera sp A*											
	Tipulidae	*Prioncera sp L*						3	1	1	1.7	1.7	**3**
	Tipulidae	*Tipula sp L*						1	0	0	0.3	0.3	**1**
	(Empididae?) L												
	(Muscidae?) A												
	Unid A							16	2	0	6.0	6.1	**2**
	Unid L												
Insecta/Coleoptera	Chrysomellidae A												
	Gyrinidae A												
	Gyrinidae	*Gyrinus sp A*											
	Carabidae A												
	Carabidae? A												
	Coccinellidae	*Adalia bipunctata A*											
	Curculionidae A												
	Elmidae A												
	(Elmidae?) A												
	(Elmidae?)												
	Staphylinidae A												
	Unid A												
	Unid L							1	0	0	0.3	0.3	**1**
Insecta/Ephemeroptera	Unid A							1	0	0	0.3	0.3	**1**
	Unid N							0	1	0	0.3	0.3	**1**
		Paraleptophlebia sp											
		Paraleptophlebia sp N											
		Baetis sp N											
Insecta/Hemiptera	Corixidae A												
	Corixidae N							1	0	1	0.7	0.7	**2**
	Pentatomidae A												
	Unid A												
	Unid N												
	Gerridae N							1	0	0	0.3	0.3	**1**
	(Gerridae?) N												
	Unid terrestrial N												
	Miridae A												
Insecta/Homoptera	Aphididae												
	Cicadellidae A												
	Unid A												
Insecta/Hymenoptera	Carabidae? A												
	Chalcidoidea A												
	Formicidae												
	Formicidae A							1	0	0	0.3	0.3	**1**
	Ichneumonoidea A							3	0	0	1.0	1.0	**1**
	Sphecoidea A												
	Sphecoidea												
	Unid A												
Insecta/Megaloptera L?													
Insecta/Megaloptera		*Sialis sp L*											
Insecta/Orthoptera	Cyrtacanthacridinae												
	Unid A												
Insecta/Trichoptera		*Phryganea sp L*											
		Limnephilidae L											
	Hydroptilidae?												
	Unid A							3	0	0	1.0	1.0	**1**
	Unid P							0	1	0	0.3	0.3	**1**
Bryozoa/Cyclostomata		*Cristatella mucedo?*											
Mollusca/Bivalvia		*Pisidium sp*											
Mollusca/Gastropoda		*Gyraulus parvus*											
		Valvata sincera						1	0	0	0.3	0.3	**1**
		Physa gyrina						1	0	0	0.3	0.3	**1**
		Stagnicola (catascopium)											
Nematoda													
Non-Animal/Other		Bark Fragment											
		Bud (deciduous tree)						0	1	0	0.3	0.3	**1**
		Conifer Needles											

Table A7.4 Stomach contents of rainbow trout, Andrews Bay Site 1 (Inner Bay), September/October 1996.

		Andrews Bay Site 1	Andrews Bay Site 1	<200 mm Average #	Average %	OCCUR	Andrews Bay Site 1	Andrews Bay Site 1	Andrews Bay Site 1	200-300 mm Average #	Average %	OCCUR
	Sample Site											
	Time of Day	Night	Night			**n = 2**	Night	Night	Night			**n = 3**
	Species	RBT	RBT				RBT	RBT	RBT			
	Stomach Sample Code	A4	A5				A1	A2	A3			
	Feather											
	Fish											
	Large Insect Moults						3	1	0	1.3	1.4	**2**
	Sedge Fragment	0	1	0.5	0.3	**1**						
	Stick Fragment											
TOTAL				157.0	100.0					98.7	100.0	
COMMENTS	WD = well digested, rem = remnants, est = estimated, dam = damaged	Coleoptera A fragments						Hymenoptera A fragments	Coleoptera A fragments			

Table A7.5 Stomach contents of rainbow trout, Andrews Bay (Outer Bay), September/October 1996.

Class/Order	Family	Genus/Species	Andrews Bay Outer	Andrews Bay Outer	Andrews Bay Outer	200-300 mm Average #	Average %	OCCUR	Andrews Bay Outer	Andrews Bay Outer	Andrews Bay Outer	Andrews Bay Outer	Andrew Bay Outer	>300 mm Average #	Average %	OCCUR
		Sample Site						n=3								n = 5
		Time of Day	Night	Night	Night				Night	Night	Night	Night	Night			
		Species	RBT	RBT	RBT				RBT	RBT	RBT	RBT	RBT			
		Stomach Sample Code	A13	A14	A19				A9	A10	A11	A12	A18			
		Fish Length (mm)	276	255	266	265.7			327	311	324	357	302	324.2		
		Fish Weight (g)	225.1	172.8	199.2	199.0			372.2	297.7	358.6	441.4	295.0	353.0		
		Stomach Weight - Empty (g)	5.203	2.451	3.636				7.776	5.964	5.870	8.698	7.417			
		Stomach Weight - Full (g)	4.009	4.009	3.728				13.633	6.125	6.130	19.661	12.963			
		Estimated Level of Fullness (%)	5	75	25	35.0			75	10	10	88	95	55.6		
Class/Order	**Family**	**Genus/Species**														
Arachnida/Acarina		*Hydracarina (Lebertia sp?)*														
		Hydracarina, Frontipodia sp														
		Hydracarina, sp														
Aranaea									0	0	0	2	0	0.4	0.3	**1**
Crustacea/Amphipoda	Gammaridae	*Hyalella azteca*														
Branchiopoda/Cladocera		*Bosmina longirostris*														
		Daphnia sp														
		Daphnia rosea														
		Daphnia longiremus														
		Eurycercus (Bullatifrons) sp	0	0	1	0.3	0.4	**1**	0	1	0	6	0	1.4	1.2	**2**
		Holopedium gibberum														
		Unid														
Copepoda/Calanoida		*(Diaptomus sp?)*														
	Unid															
Copepoda/Cyclopoida		*(Cyclops sp?)*														
Ostracoda																
Insecta/Diptera	Ceratopogonidae	*Bezzia sp L*														
	Chironomidae A		24	3	4	10.3	11.0	**3**	3	5	1	47	41	19.4	16.2	**5**
	Chironomidae P		8	207	10	75.0	80.1	**3**	0	7	1	92	40	28.0	23.4	**4**
	Chironomidae	Chironomini P														
	Chironomidae	*Chironomus sp. L*														
	Chironomidae	*Phaenopsectra sp L*														
	Chironomidae	*Rheotanytarsus sp L*														
	Chironomidae	*Procladius sp L*														
	Chironomidae	*Crictopus sp L*							2	0	0	0	0	0.4	0.3	**1**
	Chironomidae L								1	0	0	0	0	0.2	0.2	**1**
	Muscidae A															
	Muscidae	*Limnophora sp L*														
	Muscidae															
	Tipulidae A															
	Tipulidae	*Prioncera sp*														
	Tipulidae	*Prioncera sp A*														
	Tipulidae	*Prioncera sp L*														
	Tipulidae	*Tipula sp L*														
	(Empididae?) L															
	(Muscidae?) A															
	Unid A		0	5	1	2.0	2.1	**2**	0	0	0	100	14	22.8	19.0	**3**
	Unid L															
Insecta/Coleoptera	Chrysomellidae A															
	Gyrinidae A															
	Gyrinidae	*Gyrinus sp A*														
	Carabidae A															
	Carabidae? A															
	Coccinellidae	*Adalia bipunctata A*														
	Curculionidae A															
	Elmidae A															
	(Elmidae?) A															
	(Elmidae?)															
	Staphylinidae A								0	0	0	1	1	0.4	0.3	**2**
	Unid A								0	0	0	1	0	0.2	0.2	**1**
	Unid L															
Insecta/Ephemeroptera	Unid A															
	Unid N															
		Paraleptophlebia sp							0	0	0	2	0	0.4	0.3	**1**
		Paraleptophlebia sp N														
		Baetis sp N														
Insecta/Hemiptera	Corixidae A															
	Corixidae N		10	1	2	4.3	4.6	**3**	3	0	0	166	0	33.8	28.2	**2**
	Pentatomidae A															
	Unid A															
	Unid N															
	Gerridae N															
	(Gerridae?) N															
	Unid terrestrial N															
	Miridae A															
Insecta/Homoptera	Aphididae															
	Cicadellidae A															
	Unid A															
Insecta/Hymenoptera	Carabidae? A															
	Chalcidoidea A															
	Formicidae		0	1	0	0.3	0.4	**1**	1	0	0	0	1	0.4	0.3	**2**
	Formicidae A															
	Ichneumonoidea A								0	0	0	14	0	2.8	2.3	**1**
	Sphecoidea A															
	Sphecoidea															
	Unid A		0	4	0	1.3	1.4	**1**	0	0	0	8	0	1.6	1.3	**1**
Insecta/Megaloptera L?																
Insecta/Megaloptera		*Sialis sp L*														
Insecta/Orthoptera	Cyrtacanthacridinae								0	0	0	0	17	3.4	2.8	**1**
	Unid A								18	0	0	0	0	3.6	3.0	**1**
Insecta/Trichoptera		*Phryganea sp L*														
		Limnephilidae L														
	Hydroptilidae?															
	Unid A															
	Unid P								0	0	0	1	0	0.2	0.2	**1**
Bryozoa/Cyclostomata		*Cristatella mucedo?*														
Mollusca/Bivalvia		*Pisidium sp*														
Mollusca/Gastropoda		*Gyraulus parvus*														
		Valvata sincera							1	0	0	0	0	0.2	0.2	**1**
		Physa gyrina														
		Stagnicola (catascopium)														
Nematoda																
Non-Animal/Other		Bark Fragment														
		Bud (deciduous tree)														
		Conifer Needles														
		Feather														
		Fish							0	0	0	1	0	0.2	0.2	
		Large Insect Moults														
		Sedge Fragment														
		Stick Fragment														
TOTAL						93.7	100.0							119.8	100.0	
COMMENTS		WD = well digested, rem = remnants, est = estimated, dam = damaged	Well digested insect rem.		Not on list. Andrews B, Mtn sink Nite set RB#3						W.D. insect rem		B18 on list, A18 on bottle. Baggie labelled: 96/10/3, Andrews B, Outer (sink?) Nite set, RB#2			

Table A7.6 **Stomach contents of kokanee, Ootsa Lake, September/October 1996.**

		Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Wells Creek Inner Bay	Average #	Standard Deviation	Average %	OCCUR
	Sample Site														**n = 4**
	Time of Day	Night	Night	Night	Night	Night	Night	Night	Night	Night	Night				
	Species	KOK	KOK	KOK	KOK	KOK	KOK	KOK	KOK	KOK	KOK				**>0 full**
	Stomach Sample Code	B8	B14	B15	B16	B17	B18	B19	B20	B21	B22				
	Fish Length (mm)	193	200	193	196	174	206	190	199	178	175	190.4			
	Fish Weight (g)	81.0	90.3	93.4	68.3	59.4	104.3	75.5	81.7	61.5	58.7	77.4			
	Stomach Weight - Empty (g)	1.055	0.633	1.073	0.573	0.534	0.897	0.730	1.335	0.785	1.032				
	Stomach Weight - Full (g)	2.151	1.003	1.073	0.573	0.534	1.119	0.730	1.335	1.106	1.032				
	Estimated Level of Fullness (%)	50	33	0	0	0	50	0	0	50	0	45.8			
Class/Order	**Family/Genus/Species**														
Branchiopoda/Cladocera	*Bosmina longirostris*	0	2				0			0		0.5	1.0	0.1	**1**
	Daphnia sp	0	0				82			0		20.5	41.0	3.8	**1**
	Daphnia rosea													0.0	
	Daphnia longiremus	1000	0				0			1000		500.0	577.4	92.2	**1**
	Holopedium gibberum	0	1				0			0		0.3	0.5	0.0	**1**
														0.0	
Copepoda/Calanoida	*(Diaptomus sp?)*	0	0				52			0		13.0	26.0	2.4	**1**
														0.0	
Copepoda/Cyclopoida	*(Cyclops sp?)*	0	0				1			0		0.3	0.5	0.0	**1**
														0.0	
Insecta/Diptera	Chironomidae P	0	27				0			0		6.8	13.5	1.2	**1**
	Unid A	0	2				0			0		0.5	1.0	0.1	**1**
														0.0	
Insecta/Homoptera	Aphididae	0	1				0			0		0.3	0.5	0.0	**1**
														0.0	
Nematoda		0	1				0			0		0.3	0.5	0.0	**1**
														0.0	
														0.0	
TOTAL												542.3		100.0	
COMMENTS	WD = well digested, rem = remnants, est = estimated, dam = damaged	On list as Squawfish. Has pyloric cecae, no ID on bottle. Could be Kokanee	WD Cladocera rem: est 3/4 of volume				Cladocera + Copepoda, dam, est 3/4 of volume								

		Wells Creek Outer Bay	Wells Creek Outer Bay	Wells Creek Outer Bay	Wells Creek Outer Bay	Average #	Standard Deviation	Average %	OCCUR
	Sample Site								**n = 4**
	Time of Day	Night	Night	Night	Night				
	Species	KOK	KOK	KOK	KOK				
	Stomach Sample Code	D5	D6	D7	D8				
	Fish Length (mm)	167	186	190	180	180.8			
	Fish Weight (g)	56.0	79.6	80.8	69.4	71.5			
	Stomach Weight - Empty (g)	0.575	0.769	0.535	0.531				
	Stomach Weight - Full (g)	1.818	1.811	0.560	1.192				
	Estimated Level of Fullness (%)	75	12.5	12.5	95	48.8			
Class/Order	**Family/Genus/Species**								
Branchiopoda/Cladocera	*Bosmina longirostris*							0.0	
	Daphnia sp	1500	0	0	1000	625.0	750.0	99.5	**2**
	Daphnia rosea							0.0	
	Daphnia longiremus							0.0	
	Holopedium gibberum							0.0	
								0.0	
Copepoda/Calanoida	*(Diaptomus sp?)*							0.0	
								0.0	
Copepoda/Cyclopoida	*(Cyclops sp?)*							0.0	
								0.0	
Insecta/Diptera	Chironomidae P	12	0	0	0	3.0	6.0	0.5	**1**
	Unid A							0.0	
								0.0	
Insecta/Homoptera	Aphididae							0.0	
								0.0	
Nematoda								0.0	
								0.0	
								0.0	
TOTAL						628.0		100.0	
COMMENTS			WD Cladocera fragments: 100% of volume	WD Cladocera fragments: 26					

		Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Submerged Lake Basin	Average #	Standard Deviation	Average %	OCCUR
	Sample Site												**n = 6**
	Time of Day	Night	Night	Night	Night	Night	Night	Night	Night				
	Species	KOK	KOK	KOK	KOK	KOK	KOK	KOK	KOK				**>0 full**
	Stomach Sample Code	E6	E7	E8	E9	E10	E11	E16	E17				
	Fish Length (mm)	185	205	220	198	191	125	191	172	185.9			
	Fish Weight (g)	72.3	102.9	110.8	91.0	82.7	22.6	71.8	53.5	76.0			
	Stomach Weight - Empty (g)	0.811	0.879	1.172	0.734	0.749	0.519	1.025	0.434				
	Stomach Weight - Full (g)	0.811	1.014	1.223	0.897	1.266	1.047	1.025	0.778				
	Estimated Level of Fullness (%)	0	50	5	50	75	75	0	75	55.0			
Class/Order	**Family/Genus/Species**												
Branchiopoda/Cladocera	*Bosmina longirostris*											0.0	
	Daphnia sp		0	0	1000	0	0		0	166.7	408.2	15.6	**1**
	Daphnia rosea		0	0	0	2000	2400		0	733.3	1143.1	68.8	**2**
	Daphnia longiremus		0	0	0	0	0		1000	166.7	408.2	15.6	**1**
	Holopedium gibberum											0.0	
												0.0	
Copepoda/Calanoida	*(Diaptomus sp?)*											0.0	
												0.0	
Copepoda/Cyclopoida	*(Cyclops sp?)*											0.0	
												0.0	
Insecta/Diptera	Chironomidae P											0.0	
	Unid A											0.0	
												0.0	
Insecta/Homoptera	Aphididae											0.0	
												0.0	
Nematoda												0.0	
												0.0	
												0.0	
TOTAL										1066.7		100.0	
COMMENTS			WD Cladocera rem: 100% of volume	WD Cladocera rem: 100% of volume									

Table A7.7	Stomach contents of mountain whitefish, Ootsa Lake, September/October 1996.										
			Wells Creek Outer Bay	**Wells Creek Outer Bay**	**Average #**	**Standard Deviation**	**Average (%)**	**OCCUR**	**Andrews Bay Outer**	**Average (%**	**OCCUR**
		Sample Site						**n = 2**			**n = 1**
		Time of Day	Night	Night					Night		
		Species	MWF	MWF					MWF		
		Stomach Sample Code	F1	F2					A17		
		Fish Length (mm)	306	294	300.0				309		
		Fish Weight (g)	338.0	305.0	321.5				328.9		
		Stomach Weight - Empty (g)	3.536	4.582					4.622		
		Stomach Weight - Full (g)	3.955	7.100					5.009		
		Estimated Level of Fullness (%	25	75	50.0				10		
Order or Suborder	**Family**	**Genus/Species**									
Arachnida/Acarina		*Hydracarina, sp*	0	1	0.5	0.7	0.1	**1**			
Insecta/Diptera	Chironomidae, Chironomini P		178	675	426.5	351.4	98.3	**2**			
	Chironomidae	*Chironomus sp. L*	0	8	4.0	5.7	0.9	**1**			
	Chironomidae	*Phaenopsectra sp L*	0	2	1.0	1.4	0.2	**1**			
	Chironomidae	*Rheotanytarsus sp L*	0	1	0.5	0.7	0.1	**1**			
	Chironomidae L		0	1	0.5	0.7	0.1	**1**			
Insecta/Coleoptera	Unid A		1	0	0.5	0.7	0.1	**1**			
Insecta/Trichoptera		*Limnephilidae L*							2	100.0	**1**
Mollusca/Bivalvia		*Pisidium sp*	1	0	0.5	0.7	0.1	**1**			
TOTAL					434.0		100.0		2.0	100.0	
COMMENTS	WD = well digested, rem = remnants, est = estimated, dam = damaged		WD insect rem (Chironomiini P?): est 3/4 of volume						a) Mountain Whitefish, b) Bryozoa (Plumatella sp?) = 50% of volume		

Table A7.8	Stomach contents of northern squawfish, Ootsa Lake, September/October 1996.									
		Wells Creek Inner Bay	**Wells Creek Inner Bay**	**Wells Creek Inner Bay**	**Wells Creek Inner Bay**	**Wells Creek Inner Bay**	**Average**	**Standard Deviation**	**Average (%)**	**OCCUR**
	Sample Site									**n = 3**
	Time of Day	Night	Night	Night	Night	Night				
	Species	SQ	SQ	SQ	SQ	SQ				
	Stomach Sample Code	B9	B10	B11	B12	B13				
	Fish Length (mm)	225	184	225	180	238	210.4			
	Fish Weight (g)	123.9	62.2	137.2	62.7	157.0	108.6			
	Stomach Weight - Empty (g)	3.874	2.635	5.044	2.223	5.393				
	Stomach Weight - Full (g)	4.991	2.979	5.044	2.559	5.393				
	Estimated Level of Fullness (%)	50	50	0	10	0	36.7			
Order or Suborder	**Family/Genus/Species**									
Insecta/Diptera	Chironomidae A	24	25		5		18.0	11.3	38.0	**3**
	Chironomidae P	18	22		9		16.3	6.7	34.5	**3**
Insecta/Hemiptera	Corixidae N	0	9		0		3.0	5.2	6.3	**1**
									0.0	
Insecta/Trichoptera	*Phryganea sp L*	0	1		0		0.3	0.6	0.7	**1**
	Unid A	2	0		0		0.7	1.2	1.4	**1**
									0.0	
Bryozoa/Cyclostomata	*Cristatella mucedo?*	20	0		0		6.7	11.5	14.1	**1**
									0.0	
Gastropoda	*Gyraulus parvus*	0	1		0		0.3	0.6	0.7	**1**
	Valvata sincera	0	6		0		2.0	3.5	4.2	**1**
	Physa gyrina								0.0	
TOTAL							47.3		100.0	
COMMENTS	WD = well digested, rem = remnants, est = estimated, dam = damaged	Bryozoa statoblasts (from Cristatella mucedo?)	Identified on list as Kokanee, but has no pyloric cecae, appears to be squawfish. Bottle ID: Squaw							