

## Elk and Beaver Lakes Fish Inventory



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## EXECUTIVE SUMMARY

This work was performed in accordance with Contract EPro2017-106-Elk/Beaver Lake Fish Survey between Hemmera Envirochem Inc. (Hemmera) and Capital Regional District (CRD), dated April 13, 2017 (Contract). This report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by CRD. In performing this work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

This Executive Summary is not intended to be a stand-alone document, but a summary of findings as described in the following Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

In August, 2017 Hemmera was contracted by the Capital Regional District (CRD) to collect fish and fish habitat baseline data in Elk and Beaver Lakes in Saanich, BC. The primary purpose of this work was to characterize the overall fish community in the lakes. The objective of the field fish inventory surveys of Elk Lake and Beaver Lake was to prepare a fish inventory report that includes: enumeration of all sampled fish species; description of the lake's fish assemblage and fish community; summary of oxygen and temperature profiles and other relevant biophysical information; and recommendations for Elk Lake and Beaver Lake fish management.

The fish sampling methodology used for the field program was based on sampling protocols in the Ontario (ON) and British Columbia (BC) guidelines (BC Ministry of Environment, Lands and Parks 1997; Sandstrom et al. 2013). The field program took place from August 21 – 25, 2017. Fish sampling was conducted using gill nets and minnow traps, in order to characterize the fish community. Gill nets were set in Beaver Lake in three locations, and a single set was in Beaver Channel. The remaining 17 sets were in Elk Lake. A total of 10 baited Gee-type minnow traps were set in nearshore locations each day, to supplement gill net sampling. Fish captured in gill nets were biologically processed on-site each day after all nets were retrieved. Water quality profiles were taken at two locations in Elk Lake and one location in Beaver Lake.

Earliest introductions were likely to have included carp and bullhead (*Ameiurus* spp.), in the early 1900s (Clifford and Guiguet 1958). Smallmouth bass were likely introduced after 1923, and pumpkinseed sunfish were likely accidentally introduced along with bass fry; however, largemouth bass or yellow perch were not recorded as present in south Vancouver Island lakes in the 1950s or before that time (Clifford and Guiguet 1958). Previous surveys conducted in Elk and Beaver Lakes between 1973 and 2001 sampled primarily non-native species.

Fish sampling during the August 2017 field program consisted of: a total of 21 gill net sets, for a combined 330 hours of soak time; and a total of 40 minnow trap sets, for a combined 869 hours of soak time. Fish were captured in 16 of 21 gill net sets. No native species were captured or observed by the survey crew, with the

exception of two signal crayfish captured incidentally. Of the five nets with zero fish captured, four locations were set in deep water in Elk Lake (>12 m) and the remaining set was in deep water in Beaver Lake (>5 m). A total of 640 fish were captured in gill nets, of which 61.1% were yellow perch. Largemouth bass were also well represented at 13.3 % of the total catch, followed by bullhead (9.8 %), carp (7.5 %) smallmouth bass (4.5%) and rainbow trout (2.5 %). Only 6 pumpkinseed (0.9 %) were sampled in gill nets, and all were sampled in Elk Lake sets. Bullhead dominated the gill net catch in Beaver Lake. In Elk Lake, yellow perch dominated the total catch, followed by largemouth bass.

The largest fish captured by length and weight were carp, with a mean length and weight of 40.9 cm and 1234.5 g, respectively. Sampled smallmouth bass were notably larger than largemouth bass; smallmouth bass had a mean length of 27.9 cm and weighed an average of 583.5 g, while largemouth bass were an average length of 19.4 cm and weighed an average of 155.3 g. Yellow perch had a mean length of 14.0 cm and mean weight of 47.7 g.

A total of 40 minnow traps were set over the course of 4 days, with 25 traps set in Elk Lake and 15 traps set in Beaver Lake. A total of 92 fish, comprised of 76 juvenile pumpkinseed, 11 juvenile yellow perch and 5 juvenile largemouth bass were captured in 16 of 40 traps. According to the combined results of the field program, a grand total of 732 fish were captured during the 2017 field program, with yellow perch comprising over half (54.9%) the total catch. Largemouth bass (12.3%) and pumpkinseed (11.2%) were the next most abundant species captured.

Age analysis of fish scales was conducted for a total of 100 fish, comprised of 12 carp, 28 largemouth bass, 14 rainbow trout, 21 smallmouth bass, and 25 yellow perch. Yellow perch were primarily aged 2 to 3 years, while the oldest specimens aged were smallmouth bass (range from 1 to 11 years), followed by largemouth bass (range of 0 to 9 years).

Water quality profiles from the three sites sampled in Elk and Beaver Lakes show thermal stratification in Elk Lake, with temperature remaining fairly constant with increasing depth, up to a clearly defined thermocline at approximately 6 m. In Beaver Lake, temperature began to decrease rapidly at approximately 3 m in depth. Dissolved oxygen (DO) in the epilimnion at both Elk Lake sites was approximately 9.9 mg/L. DO was observed to increase slightly at both sites at 7 m in depth, then decrease rapidly with depth. The hypolimnion was virtually anoxic. A similar trend in DO was observed at the Beaver Lake Site No.1. At 2 m in depth, DO began to decline rapidly and water at 4 m depth was nearly anoxic (0.5 mg/L).

The results of the 2017 field program suggest that yellow perch may currently be the dominant species in Elk Lake in terms of abundance and potentially also biomass. The results of the field program also suggest that yellow perch are likely to be a key food source for piscivorous fishes; perch (and/or bass) remains were found in largemouth bass stomachs in the 2017 field program. It is also noted that some of the larger rainbow trout appeared to have yellow perch remains in their stomachs.

Largemouth bass were the second most abundant fish species captured in gill nets in the 2017 field program (13.3% of the total catch) and were captured in both lakes. In Elk Lake, the survey crew observed that smallmouth bass tended to be captured along with rainbow trout in deeper waters with less aquatic vegetation, while largemouth bass were more likely to be captured in nearshore sets with aquatic vegetation and submerged logs nearby. The 2017 sampling design may have been unintentionally biased towards the netting of largemouth over smallmouth bass, with a larger number of sets located in areas with vegetation. However, largemouth bass may also be outcompeting smallmouth bass in Elk and Beaver Lakes. Scott and

Crossman (1998) noted that smallmouth bass do not grow as fast or as large as largemouth bass, and the more constrained habitat requirements of smallmouth bass may be factors contributing to lower numbers of smallmouth bass captured in the 2017 field program.

The majority of carp captured in 2017 were in two gill net sets: nearshore in Elk Lake, and in Beaver Channel. The survey crew noted that carp were generally captured in depths less than 5 m, although some were also captured in 6 to 7.5 m of depth. Stocked rainbow trout were captured in both lakes, with the majority captured in 6 to 8 m depth sets in Elk Lake. Water quality profiles from Elk Lake do show optimum depths for trout at approximately 6 to 8m, below which DO falls to less than 3 mg/L, and where temperatures are cooler than surface water temperature of 22°C. The survey crew expected to capture prickly sculpin in gill nets or minnow traps, since this species is reported as present in Elk and Beaver Lakes; however, no sculpin were captured. Ongoing predation on sculpin by piscivorous fishes in the lakes may be a contributing factor to the 2017 field program. In addition to predation by smallmouth and largemouth bass, adult yellow perch may consume sculpin.

Recommendations for potential follow-up for CRD include:

- Further investigate methods and approaches to improve water quality conditions within Elk and Beaver Lakes, to benefit a broader range of fish species including stocked trout (i.e., improved DO levels, through aeration).
- Continue to implement the submerged weed control program, not only to maintain a diversity of recreational uses (e.g., rowing and boating), but also as a broad means of helping manage non-native species (e.g., yellow perch).
- Implement follow-up fish sampling programs, consistent with the methodology applied in this 2017 study.
- Conduct interim fish sampling to further investigate the status of native fish species within these lakes (e.g., threespine stickleback and prickly sculpin).
- Continue to work with BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) and other agencies and organizations to educate anglers and other users about the ecological, economic and social risks of invasive species introductions.

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## 1.0 INTRODUCTION

In August, 2017 Hemmera was contracted by the Capital Regional District (CRD) to collect fish and fish habitat baseline data in Elk and Beaver Lakes in Saanich, BC. The primary purpose of this work was to characterize the overall fish community in the lakes. This information can be used to inform management decisions by the CRD with respect to maintaining or improving fish habitat quality in the lakes.

Elk and Beaver Lakes (BC Watershed Code 920-79700) are located north of Victoria on the Saanich peninsula. The lakes are connected by a shallow channel, known locally as Beaver Channel. The total area of both lakes and the channel is approximately 246 hectares (ha) with maximum depths reported to be 17.9 metres (m) in Elk Lake and 7.5 m in Beaver Lake (Holms 1996). O'Donnel Creek, located in the northwest corner of Elk Lake, is the main inflow and the main outflow is Colquitz Creek at the south end of Beaver Lake (Holms 1996). The Elk/Beaver watershed is 11.5 square kilometres (km<sup>2</sup>), or 115,000 ha, in size (Holms 1996).

Information from the provincial Fisheries Inventory Summary System (FISS) database (Province of BC 2017) reports that the following native and non-native fishes have been noted to be present in Elk and Beaver Lakes:

- **Native fishes**
  - Coastal cutthroat trout (*Oncorhynchus clarkii clarkii*)
  - Threespine stickleback (*Gasterosteus aculeatus*)
  - Prickly sculpin (*Cottus asper*)
- **Non-native fishes**
  - Rainbow trout (*Oncorhynchus mykiss*) – stocked
  - Smallmouth bass (*Micropterus dolomieu*)
  - Largemouth bass (*Micropterus salmoides*)
  - Pumpkinseed sunfish (*Lepomis gibbosus*)
  - Black bullhead (*Ameiurus melas*)
  - Brown bullhead (*Ameiurus nebulosus*)
  - Yellow perch (*Perca flavescens*)
  - Carp (*Cyprinus carpio*)

### 1.1 Study Objectives

The objective of the field fish inventory surveys of Elk Lake and Beaver Lake was to prepare a fish inventory report that includes:

- Enumeration of all sampled fish species;
- Description of the lake's fish assemblage and fish community;
- Summary of oxygen and temperature profiles and other relevant biophysical information; and
- Recommendations for Elk Lake and Beaver Lake fish management.

This report describes: methods employed in the field program; a literature review specific to the fish species identified in Elk and Beaver Lakes; fish sampling and water quality profile results; and fish ageing results of scale-sampled fish. The report concludes with some preliminary recommendations for fisheries management.

## 2.0 METHODS

### 2.1 Review of Existing Data Sources and Literature

Information on the freshwater aquatic environment of Elk and Beaver Lakes has been reviewed and is summarized in this report. Reviewed data sources consisted of government reports, databases, and websites, including:

- Government of BC fisheries inventory information (i.e., Fisheries Information Summary System (FISS) (Province of British Columbia 2017a), Habitat Wizard (Province of British Columbia 2017b), iMapBC, and the Ecological Reports Catalogue (EcoCat) ( BC Ministry of Environment 2017);
- Canadian and BC species at risk information (i.e., Species At Risk Public Registry and BC Conservation Data Centre (CDC) (BC Conservation Data Centre 2017);
- Previous consultant's reports for the study area (e.g., MJL Environmental Consultants 2003); and
- Fish sampling protocols (BC Ministry of Environment, Lands and Parks 1997; Sandstrom et al. 2013).

The fish sampling methodology used for the field program was based on sampling protocols in the Ontario (ON) and British Columbia (BC) guidelines, as stipulated in the original RFQ (BC Ministry of Environment, Lands and Parks 1997; Sandstrom et al. 2013). The ON guidelines were used to develop a relatively robust fish sampling program for this project, while also ensuring underlying compliance with BC methods and standards.

Although the BC methods and standards do provide a description of equipment and methods, the recommended level of effort for fish inventory programs of this type is generally lacking relative to the ON guidelines. The ON guidelines provide good direction with respect to an appropriate level of effort for completion of a relatively comprehensive fish inventory using gill nets for lakes. These guidelines are generally based on lake size, bathymetry (depth stratum), and main target species under consideration. The ON guidelines also define gill net specifications, with large mesh nets (NA1) targeting angler harvested freshwater species and small mesh nets (ON2) targeting smaller fish species and size classes.

The BC standards recommend application of multiple fish sampling methods, such as minnow traps (BC Ministry of Environment, Lands and Parks 1997). This recommendation was incorporated into the field program design.

### 2.2 Consultation

Communications between the CRD and the Victoria City Rowing Club (VCRC) informed the sampling program design. Sampling locations were placed to avoid unnecessary disturbance of VCRC rowing lanes (Victoria City Rowing Club 2016), and rowers were informed by the CRD prior to the field program of the sampling program dates, location and general purpose. Following discussions between CRD and Hemmera, sampling locations were designed to avoid public use areas including areas of Beaver Lake shoreline, Hamsterly Beach in Elk Lake, Elk Lake waterski beach and boat launch area, the fishing pier at the north end of Elk Lake, and water intake locations.

Information received from CRD biologists highlighted concerns regarding provincially red-listed Western painted turtle (*Chrysemys picta bellii*, Pacific coast population), which are present in Elk and Beaver Lakes (Engelstoft and Ovaska 2016). Western painted turtles may be found in shallow bays with abundant aquatic vegetation; areas with concentrations of this species (as identified in Engelstoft and Ovaska (2016)) were actively avoided during preparation of the gill netting site plan. Furthermore, the survey crew looked for any evidence of turtles during field work activities (in particular, during setting of gill nets) with the intention of modifying netting sites if necessary to reduce risk of turtle interception/drowning. No turtles of any species were observed and therefore no modifications to set locations were applied.

Concerns from the CRD over the potential for accidental capture and resultant drowning of amphibians (e.g., red-legged frog, *Rana aurora aurora*) and Western painted turtle (*Chrysemys picta bellii*) in minnow traps resulted in traps being floated to maintain an air-water interface.

## 2.3 Field Program

The field program took place from August 21 to 25, 2017. The timing was chosen to align with the recommended optimal timing for sampling in the ON guidelines, when surface waters reach at least 18°C. The sampling program was also timed to avoid fall stocking events, to reduce sampling bias as well as any unnecessary impacts on stocked rainbow trout. A fish collection permit (No.: NA17-277471; Inventory – August 14, 2017 to September 15, 2017) was obtained by Hemmera prior to the start of the field program (BC MFLNRO 2017).

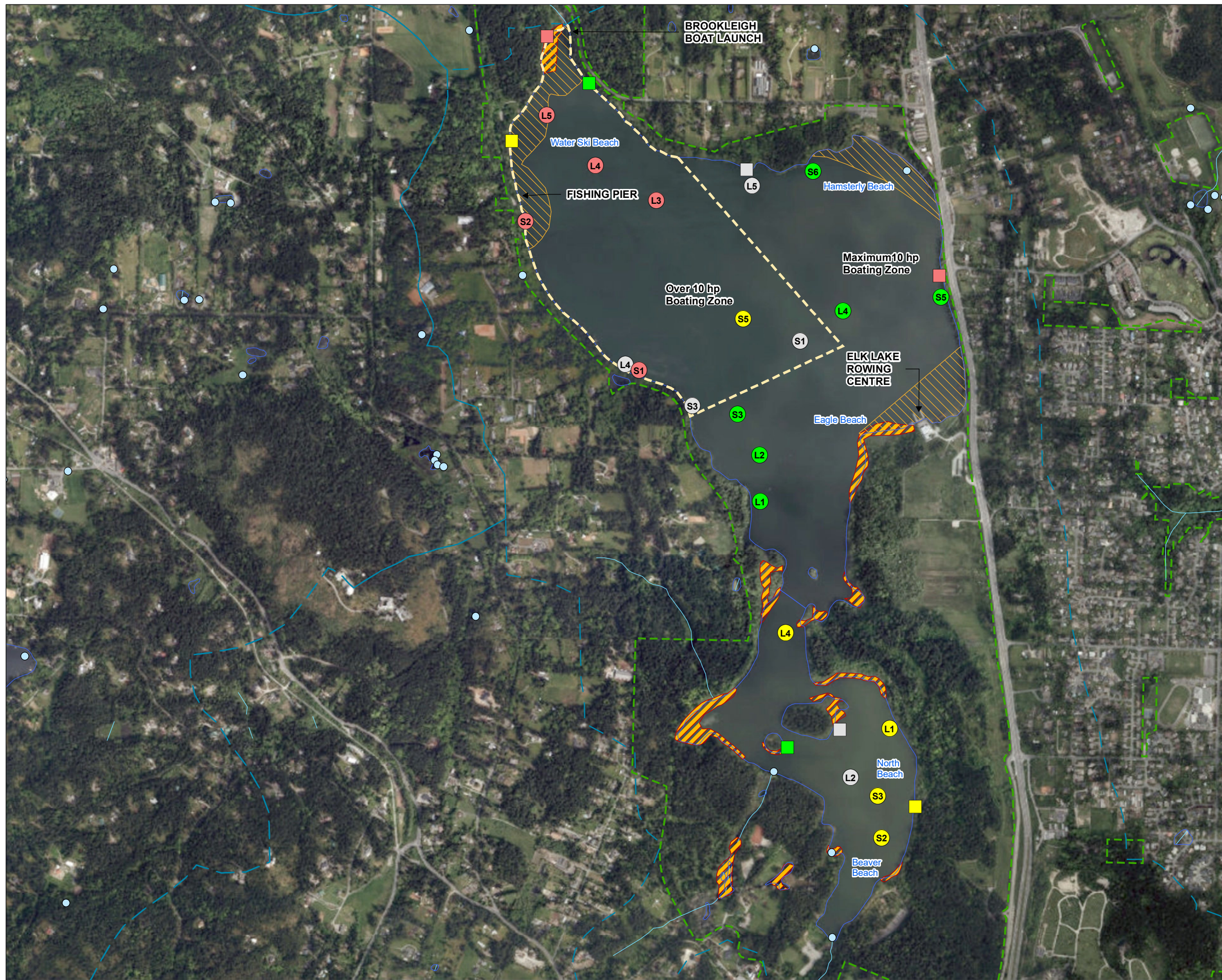
### 2.3.1 Fish Sampling

Fish sampling was conducted using gill nets and minnow traps, in order to characterize the fish community. Locations of sampling sites are shown in **Figure 1**. Hemmera provided all equipment necessary to perform fish sampling, including but not limited to a 12' aluminum boat, depth sounder, YSI dissolved oxygen/temperature meter, Secchi disc, GPS unit, large mesh gill nets, small mesh gill nets, minnow traps, storage tubs, field forms and other sampling equipment. Gill nets used for the field program consisted of:

- 3 large mesh nets (NA1, 49.6 m long, with 8 mesh sizes per gang x 3.1 m panels x 2 gangs; mesh sizes: 38, 51, 64, 76, 89, 102, 114, and 127 stretch mm); and
- 3 small mesh nets (ON2, 25.0 m long, with 5 mesh sizes per gang x 2.5 m panels x 2 gangs; mesh sizes: 13, 19, 25, 32, and 38 stretch mm).

Since the lakes are connected by a shallow channel and Beaver Lake is not considered to have any morphological characteristics which may set it apart as a discrete waterbody (Nordin 1981), the field program considered both lakes as one unit. Elk and Beaver lakes comprise a total area of approximately 246 ha, falling into the 50-500 ha lake size category defined by the broad-scale fish community monitoring methods that were applied (Sandstrom et al. 2013). The level of recommended effort was partly determined by this combined lake size. A total of four depth strata defined in the aforementioned methods characterize Elk Lake: 1 to 3 m, 3 to 6 m, 6 to 12 m and 12 to 20 m. Beaver Lake is divided into 2 depth strata: 1 to 3 m and 3 to 6 m. Given that the target species from the ON guidelines vary from species relevant to these lakes, the “variable” allocation of effort that was applied resulted in the following allocation of effort (net sets) for large and small mesh nets, as shown in **Table 2.1**.

Gill Net and Minnow Trap Locations



Legend

- Park Boundaries
- No-Gill Netting Area
- Lakes
- Watershed Boundary
- No Harvest Locations
- Points of Diversion- Surface Intakes (Active License)
- Boating Speed Zone Boundary
- Streams

Netting Sample Locations

- Netting Sample Location, 21/08/2017
- Netting Sample Location, 22/08/2017
- Netting Sample Location, 23/08/2017
- Netting Sample Location, 24/08/2017

Small Net

Large Net

Minnow Trap Locations

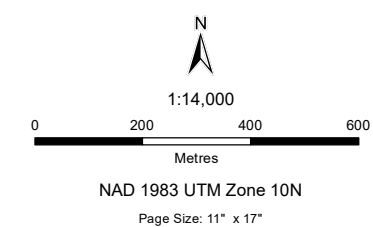
- Minnow Trap, 21/08/2017
- Minnow Trap, 22/08/2017
- Minnow Trap, 23/08/2017
- Minnow Trap, 24/08/2017

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. No-gill netting areas encompass key human recreation sites and include 100m buffers (approximate) to these sites/locations.

Sources

- Layer Name: GeoBC, Capital Regional District
- Aerial Image: Capital Regional District, 2015



**Table 2.1 Allocation of Gill Net Effort**

Date	Retrieved	Set	Depth Stratum (m)							
			1-3		3-6		6-12		12-20	
			Small	Large	Small	Large	Small	Large	Small	Large
21/08/17	-	5	1	1	-	1	-	1	1	-
22/08/17	5	5	-	1	1	1	1	-	1	-
23/08/17	5	6	1	1	1	-	1	1	-	1
24/08/17	6	5	1	-	1	1	-	1	-	1
25/08/17	5	-	-	-	-	-	-	-	-	-
Totals	21	21	3	3	3	3	2	3	2	2

**Note:** Large = large mesh (North American - NA1) and Small = small mesh (Ontario - ON2) gillnets.

Small and large mesh gill nets were set in Elk Lake and Beaver Lake over the course of four days (**Photo 1**). To ensure that all depth strata and net mesh sizes were represented in the sampling program, five nets were set each day by boat, with the exception of August 23, 2017 when six nets were set. The depth sounder was used to ascertain the desired depth for each set location.



**Photo 1 Gill Net Deployment**

Gill nets were set in Beaver Lake in three locations, and a single set was in Beaver Channel. The remaining 17 sets were in Elk Lake. Gill net set locations were guided by the original plan, with some modifications applied to further minimize potential interactions with other lake users (e.g., rowers and fishers) and minimize potential entanglement with partially submerged woody debris. In at least one case, an originally planned net location was not in a correct depth stratum and needed to be relocated. **Photo 1** shows gill nets being deployed by boat. All gill nets used were sinking nets, attached to labeled floats. Labels included a general description of the sampling program, with reference to the fish sampling permit. Gill nets had sinking lines, as well as 2 lb. fishing weights to ensure that the sinking lines were resting on the lake bottom and to minimize net drift. After setting each net, location coordinates were taken with a GPS unit at the midpoint of each set net. Nets were set in late afternoon or early evening, allowed to soak overnight, and retrieved the following morning. Set locations are described in **Table 2.2** and shown in **Figure 1**. **Photo 2** shows a gill net being retrieved, with captured fish (primarily largemouth bass) clearly visible.



**Photo 2** Retrieving Gill Nets

**Table 2.2 Gill Net Set Locations**

Date	Set	General Location	Northing	Easting
21/08/2017	S1	Elk Lake central	5375095	470802
21/08/2017	L2	Beaver Lake central	5373457	470991
21/08/2017	S3	Elk Lake central west shore	5374660	4705001
21/08/2017	L4	Elk Lake central west shore	5375007	470147
21/08/2017	L5	Elk Lake central north shore	5375678	470622
22/08/2017	L1	Elk Lake west shore	5373675	471215
22/08/2017	S2	Beaver Lake central south	5373230	471108
22/08/2017	S3	Beaver Lake central deep	5373388	471093
22/08/2017	L4	Channel	5374000	470747
22/08/2017	S5	Elk Lake central south	5375179	470588
23/08/2017	L1	Elk Lake central south	5374493	470652
23/08/2017	L2	Elk Lake north of L1	5374667	470650
23/08/2017	S3	Elk Lake north of L2	5374820	470567
23/08/2017	L4	Elk Lake central east	5375209	470963
23/08/2017	S5	Elk Lake central near highway	5375260	471331
23/08/2017	S6	Elk Lake near Hamsterly Beach	5375732	470850
24/08/2017	S1	Elk Lake northwest side, south	5374990	470188
24/08/2017	S2	Elk Lake south of fishing pier	5375544	469772
24/08/2017	L3	Elk Lake central, near deepest point	5375623	470263
24/08/2017	L4	Elk Lake north shore central	5375754	470034
24/08/2017	L5	Elk Lake north end	5375942	469851

**Notes:** Nets: 'S' denotes small mesh net, 'L' denotes large mesh net. Coordinates are in NAD83, UTM Zone 10N

A total of 10 baited Gee-type minnow traps were set in nearshore locations each day from August 21 to 24, to supplement gill net sampling. Similar to the gill nets, each trap was labelled with a sampling program description and reference to the fish sampling permit. Traps were retrieved on subsequent days following an overnight set (i.e., a total of 40 traps were set and retrieved over the five-day program). Each minnow trap was baited with a tin of cat food. As previously noted, the traps were set with floats at the request of the CRD, to reduce the potential for by-catch of amphibians and Western painted turtles. A total of 25 minnow traps were set in Elk Lake, and 15 traps were set in Beaver Lake. Minnow trap locations are described in **Table 2.3**, and the approximate locations of the trap groups are shown in **Figure 1**. A minnow trap with float attached to a submerged stump is shown in **Photo 3**. Fish captured in minnow traps were identified to species and length measurements were taken. Captured fish were subsequently released.

**Table 2.3 Minnow Trap Locations**

Date Set	Minnow Traps	General Location	Northing	Easting
21/08/2017	1-5	Beaver Lake, along east side of large island	5373636	470951
21/08/2017	6-10	Elk Lake north shore, west of Hamsterly Beach	5375738	470602
22/08/2017	11-15	Beaver Lake, east shore	5373346	471235
22/08/2017	16-20	Elk Lake, north of fishing pier	5375845	469720
23/08/2017	21-25	Beaver Lake, along east shore of small island	5373568	470755
23/08/2017	26-30	Elk Lake, north end, east side	5376062	470010
24/08/2017	31-35	Elk Lake, north end, west side in lilies/weeds	5376237	469852
24/08/2017	36-40	Elk Lake, east side near highway	5375340	471325

**Notes:** Coordinates are in NAD83, UTM Zone 10N. Northing and Easting denote approximate midpoint location of sets of 5 minnow traps.



**Photo 3 Minnow trap deployment**



Fish captured in gill nets were biologically processed on-site each day after all nets were retrieved (**Photo 4**). Fish were identified to species, with the exception of bullhead which were identified to genus (*Ameiurus* spp.). Fork length and total length (nearest 1 mm) and weight (nearest 1 g) were recorded and representative photos of captured fish were taken. More detailed biological data were recorded for key sportfish species (i.e., carp, largemouth bass, smallmouth bass, pumpkinseed sunfish, rainbow trout and yellow perch) where possible. After processing, remains were transported to the Hartland Landfill for subsequent composting.



**Photo 4 Onshore fish processing station, Set ID 2108-L5**

Scales were collected from a representative number of carp, largemouth bass, smallmouth bass, yellow perch and rainbow trout for subsequent aging, to better understand fish community structure. Scales were inserted into labeled envelopes and sent to a qualified aging specialist for aging.

### 2.3.2 Water Quality Profiles

Water quality profiles were taken at two locations in Elk Lake and one location in Beaver Lake, targeting the deepest areas of each lake. These locations were intended to approximate water quality monitoring stations, as identified by the CRD. A depth sounder was used to locate the deepest areas of the lake and UTM coordinates were taken with a GPS unit. A Secchi disc was initially used to determine water clarity, and a YSI meter was used to measure dissolved oxygen (mg/L), temperature (°C) and pH at one metre intervals, in addition to 0.5 m below water surface.

### 3.0 RESULTS

#### 3.1 Literature Review

Historical information includes anecdotal accounts of fish introductions to Elk and Beaver Lakes. Earliest introductions were likely to have included carp and bullhead (*Ameirus* spp.), in the early 1900s (Clifford and Guiguet 1958). Clifford and Guiguet (1958) relate an anecdotal report of bullhead being thrown into Beaver Lake from the windows of a train that ran between Sidney and Victoria at the turn of the 20<sup>th</sup> century. Brown bullhead (*Ameirus nebulosus*) were reported as introduced to southern Vancouver Island between Victoria and Nanaimo while black bullhead were reported as introduced to lakes in the BC Interior (Scott and Crossman (1998).

Smallmouth bass were likely introduced after 1923, from other lakes in the area, and pumpkinseed sunfish were likely accidentally introduced along with bass fry; however, largemouth bass or yellow perch were not recorded as present in south Vancouver Island lakes in the 1950s or before that time (Clifford and Guiguet 1958).

Fisheries inventory reports which document work conducted in Elk and Beaver Lakes between 1973 and 2001 were identified during a search of EcoCat (BC Ministry of Environment 2017). Results of these surveys are summarized in **Table 3.1**. The surveys conducted in the 1970s sampled primarily non-native species. Two prickly sculpin and a number of other “General sculpins” (species not recorded) were sampled in 1973, and cutthroat trout were sampled from 1973 to 1976. The survey conducted in 2001 was the first of those reviewed to report yellow perch. However, Runciman and Leaf (2009) note that the first report of yellow perch on Vancouver Island was a few years earlier in 1997, cited in Hatfield and Pollard (2006) as a University of BC museum record of yellow perch found in Elk and Beaver Lakes. No carp were reported in the surveys reviewed, which may represent a bias against carp captures in floating gill nets (referring to the primary methods applied in the past). The majority of the catch in 1973 consisted of bullhead, while the catch in 1975 and 1976 consisted primarily of pumpkinseed. In contrast, the catch in 2001 in one floating gill net and one sinking gill net consisted mainly of rainbow trout. Specific set locations are not reported in these documents.

**Table 3.1 Select Previous Fisheries Inventory Work Identified in Elk and Beaver Lakes**

Survey Month and Year	Gear Used	Species Captured	Notes	Reference
October, 1973	4 floating gill nets	Brown bullhead Cutthroat trout Pumpkinseed sunfish Prickly sculpin Sculpins (General) Smallmouth bass	Majority of catch (340) comprised of brown bullhead, followed by pumpkinseed (59), smallmouth bass (28), cutthroat trout (9). Two prickly sculpin caught.	Burns and Klein 1973
January, 1975	2 floating gill nets	Cutthroat trout Rainbow trout Pumpkinseed sunfish Brown bullhead Smallmouth bass	Catch was 77.5% sunfish Stocked trout comprised 14.5% of catch	MacLachlan and Foubister 1975

Survey Month and Year	Gear Used	Species Captured	Notes	Reference
May, 1976	4 floating gill nets	Cutthroat trout Rainbow trout Pumpkinseed sunfish Brown bullhead Smallmouth bass	Majority of catch comprised of pumpkinseed, followed by stocked rainbow trout Only 1 smallmouth bass captured	Burns and Tredger 1976
April, 2001	1 floating and 1 sinking gill net	Rainbow trout Brown bullhead Smallmouth bass Yellow perch	Majority of catch comprised of rainbow trout, followed by smallmouth bass and bullhead. Two yellow perch captured. Most fish were captured in sinking net.	Rimmer and Barlak 2001

Source: EcoCat 2017

In 2003, a creel survey of recreational angling use was conducted in five Victoria area lakes, including Elk and Beaver Lakes (MJL Environmental Consultations 2003). Fish species reported in the creel survey included three native species (i.e., cutthroat trout, threespine stickleback and prickly sculpin) and eight non-native species (i.e., rainbow trout, smallmouth bass, pumpkinseed, black bullhead, brown bullhead, yellow perch, carp and largemouth bass). The report noted that largemouth bass had been reported by anglers but was previously unconfirmed as present in Elk and Beaver Lakes by fisheries agencies (MJL Environmental Consultations 2003).

First observation dates are not recorded for largemouth bass occurrences on Vancouver Island, and provincial records contain no accounts of authorized largemouth bass stocking in the Vancouver Island Region. In addition, generic “Bass/Sunfish (General)” stocking records for this region do not include any of the waterbodies where largemouth bass have been reported. Together with the physical isolation of Elk, Prospect and Fuller lakes, this suggests their largemouth bass populations originated through independent, unauthorized introductions (Runciman and Leaf 2009).

Artificial tire reefs were installed in Elk Lake in 1987 on the eastern shoreline, near the Patricia Bay Highway and in about 7.7 to 9.2 m of water. The objective of reef installation was to enhance the production of smallmouth bass. Field surveys completed in 1990 reported prickly sculpin on the newly installed reefs, and crayfish numbers were also noted to be substantial. The steep contours and gravel substrates along the eastern shoreline were reported as a known area of bass spawning (Griffith 1990).

The Freshwater Fisheries Society of BC stocks Elk and Beaver Lakes with sterile rainbow trout in spring and fall (Freshwater Fisheries Society of BC 2017). The current stocking rate is approximately 14,000 Fraser Valley 3N CA annually, consisting of 7,000 fish in spring stocking and 7,000 in fall stocking events. Approximately 5,000 Blackwater River AF3N Ye are stocked annually (spring only), as well as some surplus fry when available (Sylvestri 2014).

Elk Lake is reported to be the most heavily fished lake on Vancouver Island (Habitat Conservation Trust Foundation 2014). Angler days have increased from 8,995 in 1986 to 14,362 days in 2011 (Sylvestri 2014). In 2017, the following daily quotas applied to recreational fishing on Elk and Beaver Lakes:

- 4 trout, with not more than one over 50 cm in length;
- 4 bass (largemouth and smallmouth, combined);
- 20 yellow perch; and
- 25 crayfish (BC Ministry of Forests, Lands and Natural Resource Operations 2017).

Daily quotas do not apply to other fish species that may be caught by recreational anglers within these lakes (i.e., carp, pumpkinseed sunfish, and brown bullhead) (BC MFLNRO 2017).

Other aquatic species reported as present in Elk and Beaver Lakes include red-legged frog (*Rana aurora aurora*) and Western painted turtle (Pacific coast population: *Chrysemys picta* pop. 1). Red-legged frogs are provincially blue-listed (S3: Special Concern, December 2016), and designated as a Species of Special Concern (January 2005) under the *Species at Risk Act* (SARA) (BC Conservation Data Centre 2017a). Western painted turtles (Pacific coast population) are provincially red-listed (S2: Imperiled, January 2012), and are federally designated as Endangered under SARA (BC Conservation Data Centre 2017b).

Signal crayfish (*Pacifcastacus leniusculus*) are a native species also previously reported as present in Elk and Beaver Lakes (Bondar et al. 2005).

Highly invasive American bullfrogs are also present in lakes in the Victoria area, including Elk and Beaver Lakes (CRD 2017).

## 3.2 Fish Sampling

Fish sampling during the August 2017 field program consisted of:

- A total of 21 gill net sets, for a combined 330 hours of soak time; and
- A total of 40 minnow trap sets, for a combined 869 hours of soak time.

### 3.2.1 Gill Netting

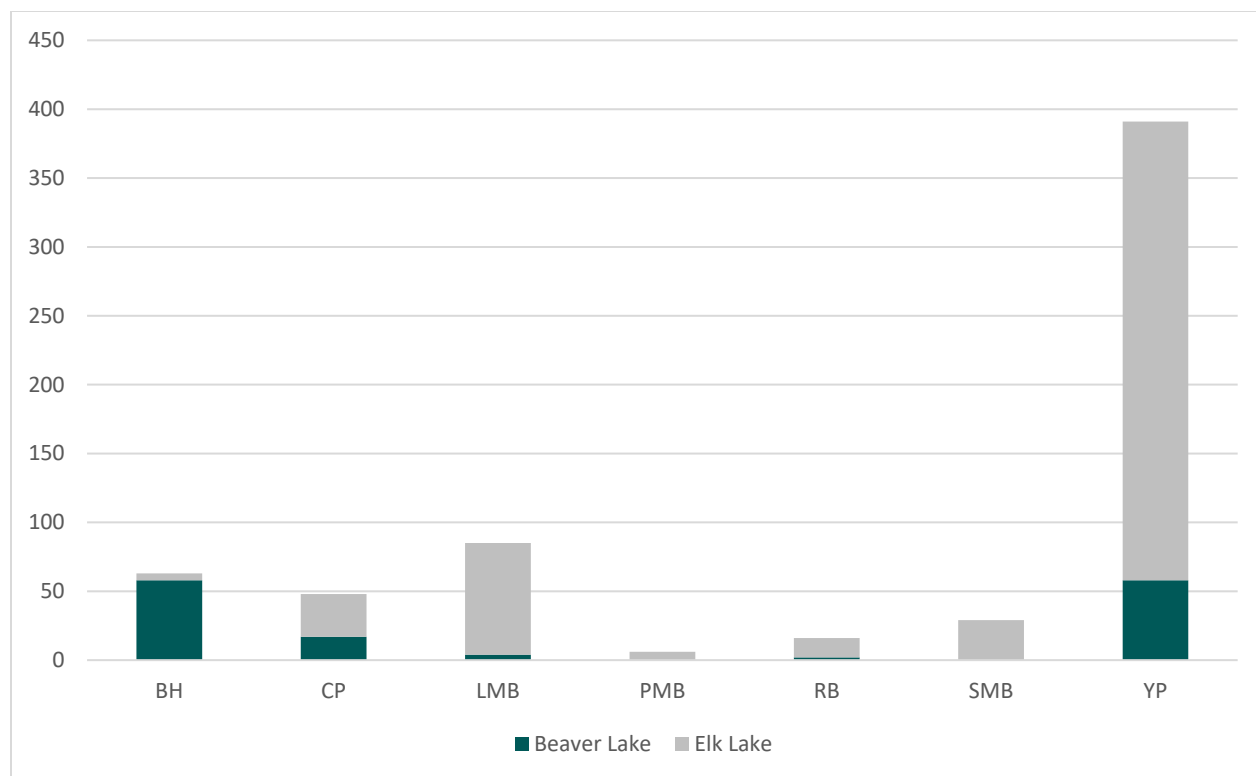
Fish were captured in 16 of 21 gill net sets. No native species were captured or observed by the survey crew, with the exception of two signal crayfish captured incidentally (August 24th, Set L5). The total catch by species is provided in Table 3.2, along with percentage of the total catch by species, net ID, general location and depth range. Of the five nets with zero fish captured, four locations were set in deep water in Elk Lake (>12 m) and the remaining set was in deep water in Beaver Lake (>5 m). One set on August 24th (S2) was over an area with a large sunken tree that was not observed by the survey crew. This net successfully captured fish, but became tangled during retrieval; although salvaged it was not reusable. The total gill net catch by species and lake is shown in **Table 3.2** and **Figure 2**. The single set in Beaver Channel included in the Beaver Lake subtotals in **Figure 2**. Raw data by set is provided in **Appendix A**.

**Table 3.2 Total Gill Net Catch**

Date	Set ID	Location	Depth Range (m)	BH	CP	LMB	PMB	RB	SMB	YP	TOTAL
21/08	S1	Elk Central	12-13	0	0	0	0	0	0	0	0
	L2	Beaver Central	5-6	0	0	0	0	0	0	0	0
	S3	Elk central west shore	1-1.5	0	0	10	1	0	3	34	48
	L4	Elk central west shore	1-2	0	2	10	0	0	2	5	19
	L5	Elk central north shore	3-5	0	5	29	0	0	1	9	44
22/08	L1	Elk east shore	2-3	1	14	1	0	0	0	22	38
	S2	Beaver central south	3.5-4.5	30	0	0	0	1	0	49	80
	S3	Beaver central	6	0	0	0	0	1	0	1	2
	L4	Channel	2.5	28	17	4	0	0	0	8	57
	S5	Elk central south	13	0	0	0	0	0	0	0	0
23/08	L1	Elk central south	1-2.5	0	3	10	0	0	0	9	22
	L2	Elk north of L1	6-7.5	1	5	3	0	3	0	58	70
	S3	Elk north of L2	8	0	0	0	0	5	0	1	6
	L4	Elk central east	12.5	0	0	0	0	0	0	0	0
	S5	Elk central near Hwy	1-3	0	0	7	2	0	0	76	85
	S6	Elk near Hamsterly	3-6	2	0	1	0	0	4	38	45
24/08	S1	Elk NW side south	1-2.5	0	0	5	2	0	0	54	61
	S2	Elk south of fishing pier	3-6	0	0	5	1	0	4	23	33
	L3	Elk central	14.5-16.5	0	0	0	0	0	0	0	0
	L4	Elk north shore central	3.5-5.5	0	2	0	0	0	14	0	16
	L5	Elk north end	6-8.2	1	0	0	0	6	1	4	14
Total catch by species				63	48	85	6	16	29	391	640
Percentage of catch (%)				9.8	7.5	13.3	0.9	2.5	4.5	61.1	100

**Notes:** Set ID: 'S' denotes small mesh net, 'L' denotes large mesh net. BH = Black/brown bullhead *Ameiurus* spp., CP = carp, LMB = largemouth bass, PMB = pumpkinseed sunfish, RB = rainbow trout, SMB = smallmouth bass, YP = yellow perch. Not shown: incidental catch of 2 signal crayfish on August 24 (Set L5).

Yellow perch were by far the most abundant species sampled by gill netting, representing 61.1 % of the total catch of 640 fish. Yellow perch heavily dominated the total catch in 8 sets at a wide range of depths (1 m to 6 m). Largemouth bass were also well represented at 13.3 % of the total catch, followed by bullhead (9.8 %), carp (7.5 %) smallmouth bass (4.5%) and rainbow trout (2.5 %). Only 6 pumpkinseed (0.9 %) were sampled in gill nets, and all were sampled in Elk Lake sets.



**Figure 2 Total gill net catch by species and lake**

Although Elk and Beaver Lake were treated as a single waterbody in the field program design, the results showed that the catch in each lake varied in terms of dominant species captured (**Figure 2**). Bullhead dominated the gill net catch in Beaver Lake; the vast majority of bullhead were captured in the Beaver Lake and Beaver Channel sets. Bullhead and yellow perch comprised the majority of the gillnet catch in Beaver Lake, while the set in Beaver Channel was comprised primarily of bullhead and carp. No pumpkinseed or smallmouth bass were captured in Beaver Lake (**Table 3.2**).

In Elk Lake, yellow perch dominated the total catch, followed by largemouth bass. The survey crew observed that largemouth bass were primarily captured in nearshore sets, while smallmouth bass and rainbow trout were primarily captured in depths of between 3 m and 8 m.

Length and weight measurements of sampled fish are summarized in **Table 3.3**. The largest fish captured by length and weight were carp, with a mean length and weight of 40.9 cm and 1234.5 g, respectively. Sampled smallmouth bass were notably larger than largemouth bass; smallmouth bass had a mean length of 27.9 cm and weighed an average of 583.5 g, while largemouth bass were an average length of 19.4 cm and weighed an average of 155.3 g. Yellow perch had a mean length of 14.0 cm and mean weight of 47.7 g. Length-weight relationships as well as length frequency histograms for bullhead, carp, largemouth bass, smallmouth bass and yellow perch are provided in **Appendix B**.

Fish maturity was identified on-site for 94 fish. Stocked (sterile) rainbow trout had undeveloped gonads, as expected, and sex was not determined. The twelve carp that were examined were considered to be maturing or mature, with roughly equal males and females represented in the catch. Of the five females

identified, three were mature with roe or developing eggs. All 57 of the largemouth bass examined had immature gonads, and the 18 smallmouth bass that were examined were immature (7) or maturing (11). Yellow perch maturity was not assessed, given the inherent challenges in identification that apply to this species and the relatively high number of small size classes.

Stomach contents were examined on-site for 91 fish, and are summarized below.

- All carp with stomach contents had green, brown, or black muddy material, apparently dominated by benthic sediments.
- Largemouth bass stomachs contained fish and, in some cases, invertebrate remains, with weed fragments. When recognizable, fish remains were identified as bass or yellow perch.
- The majority of rainbow trout stomachs contained a milky fluid, while three trout had recently eaten invertebrates (possibly Chironomidae); a few of the larger rainbow trout had fish remains in their stomachs (apparently yellow perch).
- Most smallmouth bass stomachs that were examined were empty or contained fluid. Three smallmouth bass had digested fish remains (unidentified species) in their stomachs.
- Efforts to find stomach remains in yellow perch stomachs were unsuccessful.

**Table 3.3 Summary of Length and Weight Measurements**

Species	Total	Mean Length (cm)	Standard Deviation (Length)	Minimum Length	Maximum Length	Mean Weight (g)	Standard Deviation (Weight)	Minimum Weight	Maximum Weight
BH	63	21.6	3.3	10.4	28.9	128.3	55.0	13	280
CP	48	40.9	10.1	15.8	53.0	1234.5	681.1	240	2190
LMB	85	19.4	6.2	7.7	43.5	155.3	244.4	1	1590
PMB	6	8.1	1.2	7.0	9.8	8.4	4.2	4	15
RB	16	36.8	9.0	23.0	52.0	678.8	502.0	111	1890
SMB	29	27.9	10.8	7.4	48.0	583.5	571.7	5	2200
YP	391	14.0	4.5	1.0	25.7	47.7	50.0	1	276

**Notes:** BH = Black/brown bullhead *Ameiurus* spp., CP = carp, CRAY = signal crayfish, LMB = largemouth bass, PMB = pumpkinseed sunfish, RB = rainbow trout, SMB = smallmouth bass, YP = yellow perch. BH length uses total length, all others use fork length. Measurements were not taken for decomposed or partially eaten fish. Only lengths were measured for released fish. Weights were measured to nearest gram.

### 3.2.2 Minnow Trapping

A total of 40 minnow traps were set over the course of 4 days, with 25 traps set in Elk Lake and 15 traps set in Beaver Lake. A total of 92 juvenile fish were captured in 16 of 40 traps. Traps with fish captures were typically located in areas with lilies and high weed density, near submerged logs and adjacent to shorelines. Fish captures by minnow trapping were higher in Beaver Lake than in Elk Lake. No amphibians or turtles were captured in minnow traps.

Fish captured in minnow traps included:

- A total of 76 juvenile pumpkinseed sunfish, ranging in fork length from 28 mm to 70 mm;
- 11 juvenile yellow perch, ranging in fork length from 44 mm to 47 mm; and
- 5 juvenile largemouth bass, ranging in fork length from 36 mm to 51 mm.

### 3.2.3 Combined Results

Combined results of all fish sampled during the 2017 field program are shown in **Table 3.4**. Juvenile pumpkinseed dominated minnow trap captures. With both sampling methods included, pumpkinseed represent the 3<sup>rd</sup> most abundance fish species (11.2%), after yellow perch (54.9%) and largemouth bass (12.3%). Including minnow traps as a supplementary sampling method may provide a more complete characterization of the fish assemblage in Elk and Beaver Lakes.

**Table 3.4 Total Combined Catch by Species**

Species	Catch by Gill Net	Catch by Minnow Trap	Combined Catch	Percentage of Total Catch (%)
BH	63	0	63	8.6
CP	48	0	48	6.6
LMB	85	5	90	12.3
PMB	6	76	82	11.2
RB	16	0	16	2.2
SMB	29	0	29	4.0
YP	391	11	402	54.9
TOTAL	640	92	732	100

### 3.2.4 Fish Aging

Age analysis of fish scales was conducted for a total of 100 fish, comprised of 12 carp, 28 largemouth bass, 14 rainbow trout, 21 smallmouth bass, and 25 yellow perch. Of the total scale samples analysed, 85% were estimated to be in fair condition for analysis and 15% were in good condition (North/South Consultants 2017). Age data presented in **Table 3.5** shows that the 12 carp that were aged ranged from 3 to 8 years, and most (n=8) carp were aged 7 or 8 years. Largemouth bass ranged from 0 to 9 years in age, and the majority of the fish in the sample (n=20) were 2 or 3 years old. Smallmouth bass ranged from 1 to 11 years, half of which were in younger age classes of 3 to 4, although the two oldest fish that were aged from any scale samples taken were smallmouth bass (age 10 and 11). Stocked rainbow trout ranged from 2 years to 8 years, with most fish aged between 3 and 5 years. The yellow perch were primarily aged 2 to 3 years old, with a range of 1 to 7 years.



**Table 3.5 Length of Fish in each Age Group**

Species	Age (Years)											
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+
	Mean fork length of fish in each age group (cm) (Number of fish in parenthesis)											
CP	-	-	-	27.0 (1)	28.3 (2)	-	49.0 (1)	47.7 (5)	46.3 (3)	-	-	-
LMB	7.7 (1)	-	19.7 (14)	19.2 (6)	26.0 (2)	33.8 (3)	-	37.0 (1)	-	43.5 (1)	-	-
RB	-	-	27.3 (1)	31.2 (5)	36.8 (2)	41.7 (3)	47.5 (2)	-	52.0 (1)	-	-	-
SMB		15.9 (4)	19.4 (1)	30.0 (5)	29.5 (5)	39.0 (1)	35.0 (1)	40.0 (1)	-	46.0 (1)	48.0 (1)	42.5 (1)
YP	-	9.9 (1)	14.0 (12)	18.0 (9)	20.5 (1)	23.0 (1)	-	13.5 (1)	-	-	-	-

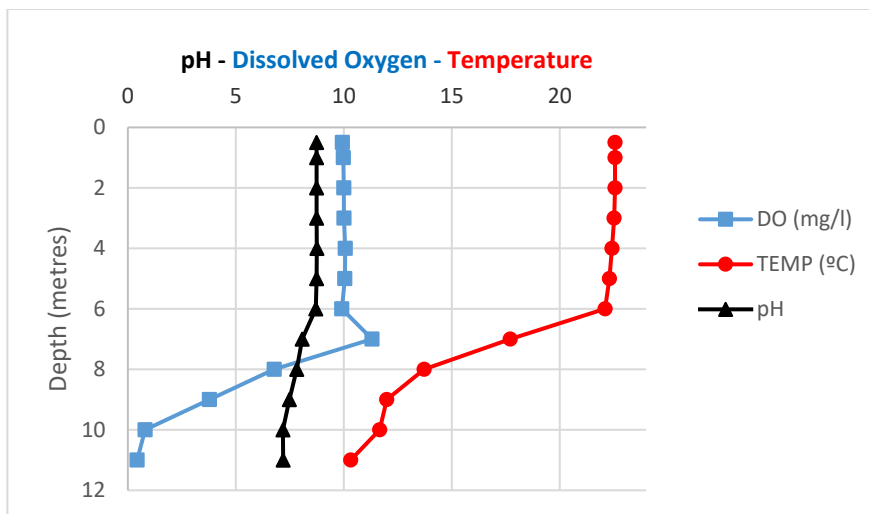
Source: North/South Consultants 2017

### 3.3 Water Quality Profiles

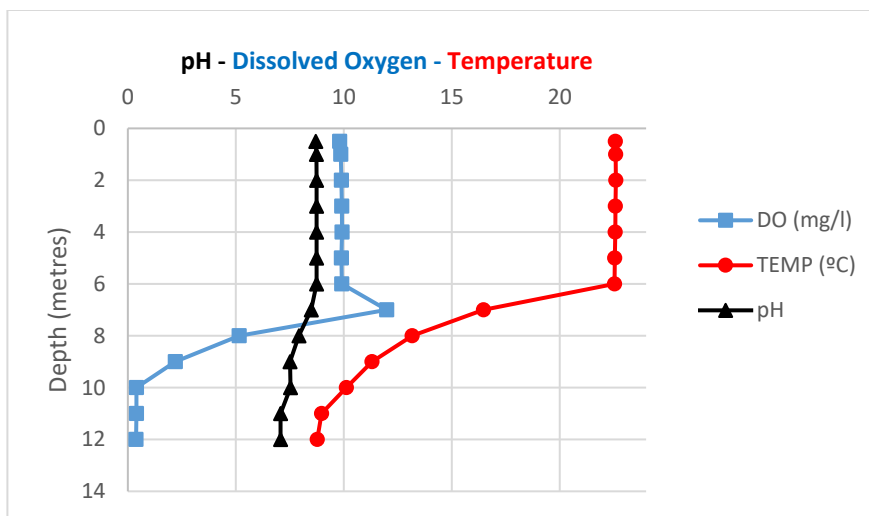
Water quality profiles from the three sites sampled in Elk and Beaver Lakes are shown in **Figure 3**. Detailed water quality data is provided in **Appendix A**. **Figure 3a** and **Figure 3b** show thermal stratification in Elk Lake, with temperature remaining fairly constant with increasing depth, up to a clearly defined thermocline at approximately 6 m. From 6 m to 8 m in depth, water temperature decreases by 8.4 °C at Elk Site 1 and 9.4 °C at Elk Site 2. Maximum lake depth was approximately 12 m at Elk Site 1 and 13 m at Elk Site 2. Secchi depth was determined to be approximately 6 m at both Elk Lake sites.

At Beaver Site 1 (**Figure 3c**), temperature began to decrease rapidly at approximately 3 m in depth. Maximum lake depth was approximately 5.5 m at this site. The survey crew noted that water visibility was low in Beaver Lake, and Secchi depth was observed to be only 1.6 m at Beaver Site 1.

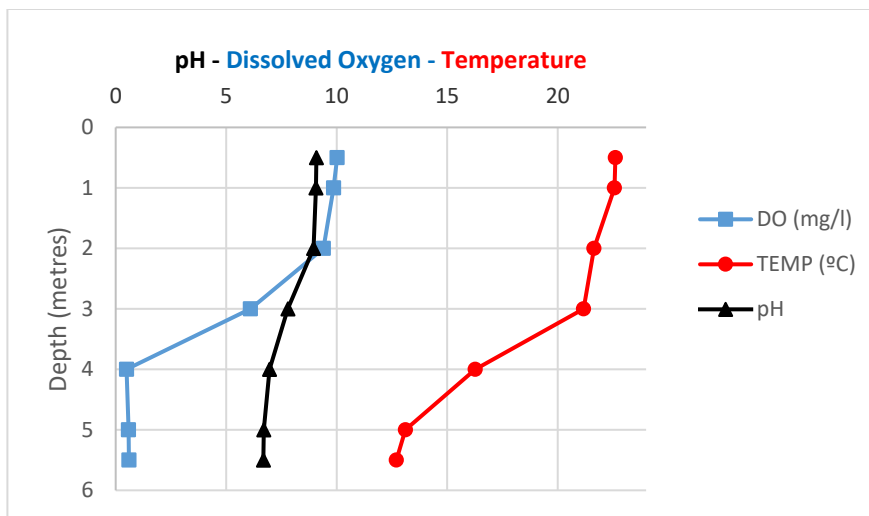
a) Elk Site 1



b) Elk Site 2



c) Beaver Site 1



**Figure 3 Water Quality Profiles at Three Sites in Elk and Beaver Lakes**

Dissolved oxygen (DO) in the epilimnion at both Elk Lake sites was approximately 9.9 mg/L. DO was observed to increase slightly at both sites at 7 m in depth, then decrease rapidly with depth (**Figure 3a**, **Figure 3b**). The hypolimnion was virtually anoxic.

A similar trend in DO was observed at the Beaver Lake Site No.1 (**Figure 3c**). At 2 m in depth, DO began to decline rapidly and water at 4 m depth was nearly anoxic (0.5 mg/L). DO was observed to increase slightly with decreasing depth, to 0.6 mg/L at 5.5 m.

In Elk Lake, pH values decreased slightly with depth. pH values were approximately 8.7 at 0.5 m in depth, decreasing to 7.2 at 11 m at Site 1 and 7.0 at 12 m at Site 2. Water in Beaver Lake ranged from 9.1 pH at 0.5 m depth to 6.7 pH at 5.5 m.

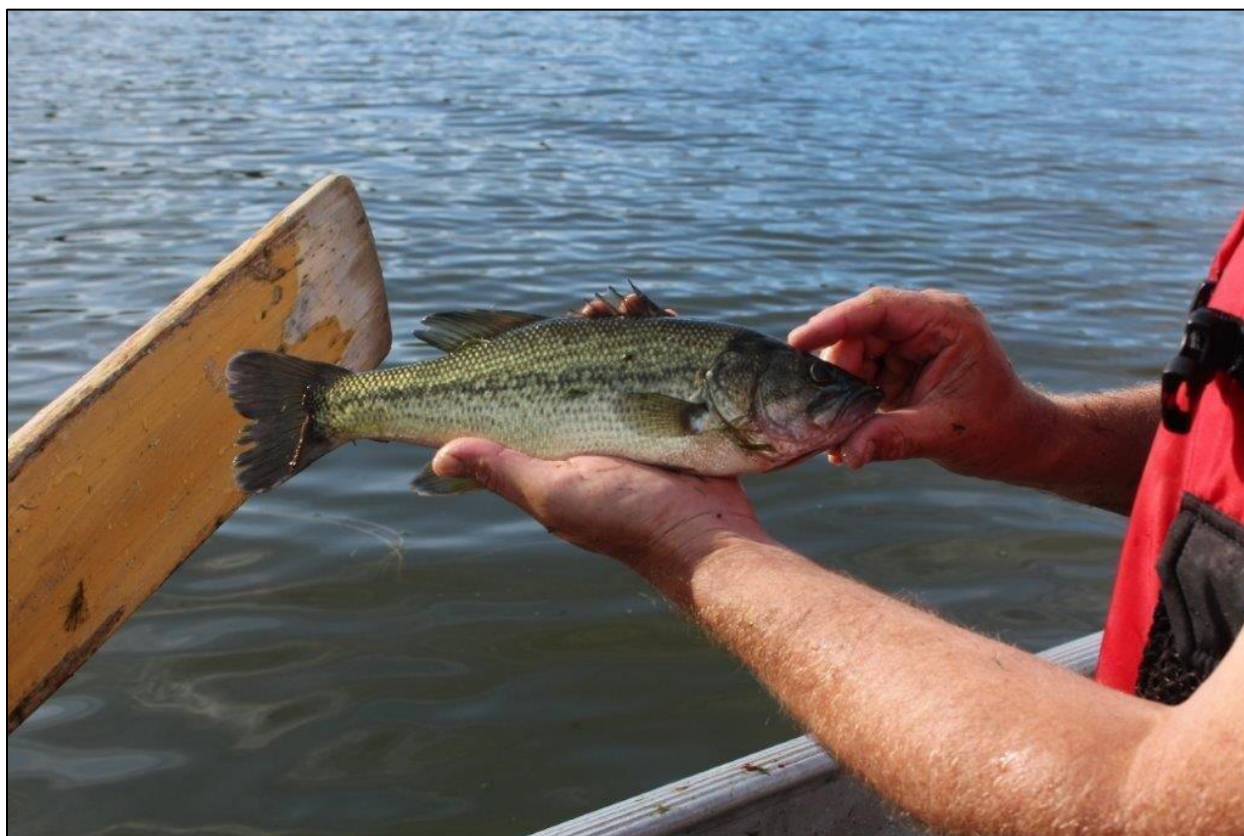
## 4.0 DISCUSSION

Yellow perch were the dominant species sampled in gill nets overall. An example of smaller size class yellow perch retrieved from a gill net is shown in **Photo 5**. The 2017 survey results contrast with the results of previous surveys in the 1970s and 2001 which did not report any yellow perch captured. The results of the 2017 field program suggest that yellow perch may currently be the dominant species in Elk Lake in terms of abundance and potentially also biomass. Yellow perch are a small, short-lived and highly fecund forage fish species, typically living a maximum of 7 to 10 years and maturing between 1 and 4 years of age (Roberge et al. 2001, Wydosky & Whitney 2003). Female yellow perch grow to a larger size than males, and females may produce between 10,000 and 50,000 eggs at a time (Simpson and Wallace 1982). Yellow perch are tolerant of low dissolved oxygen conditions, temperature and pH (Holtan 1990), and are therefore likely to be resilient to seasonal changes in temperature and water chemistry in Elk and Beaver Lakes. Furthermore, it is apparent that yellow perch would be more tolerant of seasonal constraints (e.g., warmer water temperatures and lower DO levels) than some other key species in these lakes (e.g., rainbow trout). The results of the field program also suggest that yellow perch are likely to be a key food source for piscivorous fishes; perch (and/or bass) remains were found in largemouth bass stomachs in the 2017 field program. Both smallmouth and largemouth bass are opportunistic predators, and are known to consume yellow perch and pumpkinseed (Kerr and Grant 2000, Scott and Crossman 1998). It is also noted that some of the larger rainbow trout appeared to have yellow perch remains in their stomachs. Young smallmouth bass may compete with juvenile yellow perch, although the two species commonly coexist in North American lakes (Brown et al. 2009a).



**Photo 5** Numerous smaller yellow perch, taken from a gill net set in Elk Lake

Largemouth bass were the second most abundant fish species captured in gill nets in the 2017 field program (13.3% of the total catch) and were captured in both lakes. Largemouth bass are more tolerant of a range of water chemistry (e.g., DO of >3.0 mg/L) and temperature than smallmouth bass, and can be successful in smaller, more shallow lakes (< 6 m) with low to moderate water clarity, abundant aquatic vegetation and muddy substrate (Lasenby and Kerr 2002). The 2017 sampling design may have been unintentionally biased towards the netting of largemouth over smallmouth bass, with a larger number of sets located in areas with vegetation. However, largemouth bass may also be outcompeting smallmouth bass in Elk and Beaver Lakes. Scott and Crossman (1998) noted that smallmouth bass do not grow as fast or as large as largemouth bass, and the more constrained habitat requirements of smallmouth bass may be factors contributing to lower numbers of smallmouth captured in the 2017 field program. A largemouth bass is shown in **Photo 6**.



**Photo 6** Largemouth Bass

Bullhead were dominant in the Beaver Lake and Beaver Channel sets, which is similar to the 1973 survey results which reported large numbers of bullhead (**Table 3.1**). Few bullhead were captured in Elk Lake. Bullhead captured in gill nets are considered likely to be brown bullhead, since black bullhead are not known to be present on Vancouver Island (see Roberge et al. 2001, Scott and Crossman 1973). In general, bullhead are bottom feeders and are typically found in shallow, warm ponds and small lakes with abundant aquatic vegetation (Scott and Crossman 1998), which describes Beaver Lake. Brown bullhead can tolerate turbid conditions and high water temperatures (< 36°C), and can survive low DO better than most fish species (Roberge et al. 2001). A bullhead that had been captured in a gill net set in Beaver Lake, along with a small rainbow trout, is shown in **Photo 7**.



**Photo 7 Untangling bullhead from a gill net in Beaver Lake**

The majority of carp captured in 2017 were in two gill net sets: nearshore in Elk Lake, and in Beaver Channel. Carp are documented as thriving generally in aquatic ecosystems that have been altered by humans, and require shallow, warmer water with muddy bottoms and abundant vegetation for foraging and spawning (Badiou & Goldsborough 2006). Swee and McCrimmon (1966) stated that adult carp tend to stay within 3 m of water during late summer and fall. Carp can also negatively affect aquatic ecosystems by increasing turbidity through sediment resuspension, during foraging activities (Badiou & Goldsborough 2006). The survey crew noted that carp were generally captured in depths less than 5 m, although some were also captured in 6 to 7.5 m of depth. When captured, carp rolled in the gill nets and were difficult to extract; **Photo 8** shows carp and bass tangled in a gill net.



**Photo 8 Untangling Carp and Bass from Gill Net**

No smallmouth bass were captured in Beaver Lake, and smallmouth bass made up a small percentage (4.5%) of the total catch (Beaver and Elk lakes). Lasenby and Kerr (2002) note that habitat requirements differ between smallmouth and largemouth bass. Smallmouth bass tend to thrive in larger lakes with deep, clear waters (< 6 m) and rivers, have a lower tolerance for low DO (prefers > 6 mg/L) and turbidity and do not tend to be associated with aquatic vegetation (Lasenby and Kerr 2002, Mueller 2002). In Elk Lake, the survey crew observed that smallmouth bass tended to be captured along with rainbow trout in deeper waters with less aquatic vegetation, while largemouth bass were more likely to be captured in nearshore sets with aquatic vegetation and submerged logs nearby.

**Photo 9** shows the connection between the spiny and soft parts of the dorsal fin of a typical smallmouth bass; in largemouth bass, this connection is more clearly notched. The upper jaw of smallmouth bass also extends roughly even with the eye, whereas on largemouth bass the upper jaw extends past the eye (Brown et al. 2009a). Largemouth bass also typically have a dark lateral stripe (**Photo 6**) (Brown et al. 2009b).



**Photo 9 Smallmouth Bass**

Only six pumpkinseed were captured in gill nets in the 2017 field program. Pumpkinseed habitat is typically shallow, vegetated areas of lakes (Roberge et al. 2001). Pumpkinseed comprised the majority (83 %) of juvenile fishes (<70mm) that were captured in minnow traps in both lakes, generally in areas with dense weeds and/or lily pads. Pumpkinseed typically prefer clear water and abundant vegetation (Jordan et al. 2009). As a forage fish, pumpkinseed are likely consumed by all piscivorous fishes including largemouth and smallmouth bass (Kerr and Grant 2000). Largemouth bass consume pumpkinseed eggs, fry and juveniles, and yellow perch are also known to predate on pumpkinseed (Jordan et al. 2009). Minnow traps were floated rather than placed on the lake bottom in order to reduce potential by-catch and mortality of amphibians or turtles; therefore, the efficacy of minnow traps to capture representative juvenile, smaller size class and/or more benthic fishes may have been reduced.





**Photo 10 Rainbow Trout**

Stocked rainbow trout were captured in both lakes, with the majority captured in 6 to 8 m depth sets in Elk Lake. Scott and Crossman (1998) note that rainbow trout tend to stay in moderately deep water, in depths that correspond to the 18°C isotherm and DO of > 3 mg/L. Water quality profiles from Elk Lake do show optimum depths for trout at approximately 6 to 8m, below which DO falls to less than 3 mg/L, and where temperatures are cooler than surface water temperature of 22°C. Rainbow trout are described as opportunistic feeders, eating plankton, crustaceans, insects, snails and leeches. Lake Washington rainbow trout consumed *Daphnia* spp., prickly sculpin and yellow perch (Kerr and Grant 2000) and some of the larger rainbow trout appeared to have been predated upon yellow perch. However, rainbow trout may be largely restricted to the thermocline in late summer, which would presumably influence both their appetite and diet (**Figure 3**).

No native species were observed in the 2017 field program, in contrast to surveys conducted in the 1970s which reported cutthroat trout and sculpins in the catch. The survey crew expected to capture prickly sculpin in gill nets or minnow traps, since this species is reported as present in Elk and Beaver Lakes; however, no sculpin were captured. Fish salvage work that was conducted in 2014 at the outlet of Beaver Lake to the Colquitz River recorded a small number (n=4) of prickly sculpin sampled in minnow traps, which contrasted to higher captures in the river (LGL Limited 2014). Presumably, Colquitz River has higher quality habitat for sculpin than Beaver Lake. In addition, ongoing predation on sculpin by piscivorous fishes in the lakes may be a contributing factor to the 2017 field program. In addition to predation by smallmouth and largemouth bass, adult yellow perch may consume sculpin. Yellow perch have been documented consuming sculpins in Lake Washington in Washington State (Costa 1979).

## 5.0 RECOMMENDATIONS

This study provides fish and fish habitat baseline data, which can be used by lake and parkland managers to support ongoing management of these lakes and associated fisheries resources. As an updated and comprehensive baseline established with a relatively rigorous methodology based on the ON guidelines, it provides useful information with respect to the existing fish communities within the lakes. As with any fish inventory program, however, the resultant data should be considered within the context of potential sampling biases and other factors. Furthermore, it should be understood that the fish community is comprised of a diversity of primarily non-native species, including some which have only been present for a few decades. It is therefore reasonable to assume that this fish community will continue to change in coming years, with or without any management decisions or actions.

Recommendations for potential follow-up for CRD are provided with the understanding that CRD is responsible for management of the Elk/Beaver Lake Regional Park, while Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) fisheries biologists are responsible for fisheries management decisions, including fish stocking and the setting of fisheries regulations. Furthermore, MFLNRO staff work with the Freshwater Fisheries Society of British Columbia (FFSBC) to implement trout stocking.

Recommendations provided below are intentionally limited to those types of works and activities that more likely overlap with CRD's parkland management role, rather than those that are expected to be MFLNRO's role to identify and implement.

- Further investigate methods and approaches to improve water quality conditions within Elk and/or Beaver lakes, to benefit a broader range of fish species including stocked trout (i.e., improved DO levels, through aeration).
- Continue to implement the submerged weed control program, not only to maintain a diversity of recreational uses (e.g., rowing and boating), but also as a broad means of helping manage non-native species (e.g., yellow perch).
- Implement follow-up fish sampling programs, consistent with the methodology applied in this 2017 study and when appropriate:
  - consistent with ON guidelines, repeat the study methodology at least once per decade; and
  - should aeration or other techniques be applied to improve water quality conditions in the lake(s), consider repeating the methodology within 3-5 years after such a program is initiated.
- Conduct interim fish sampling to further investigate the status of native fish species within these lakes (e.g., threespine stickleback and prickly sculpin):
  - implement focused fish sampling methodologies (e.g., submerged minnow traps); and
  - manage potential risk of amphibian by-catch/mortality by deploying submerged baited minnow traps, at depth and/or during winter months.
- Given the prevalence of yellow perch and other invasive non-native fish in these lakes and recognizing the ongoing and not insignificant risk of unauthorized dispersal to other lakes in the CRD and beyond, continue to work with MFLNRO and others to educate anglers and other users about the ecological, economic and social risks:
  - work the Capital Region Invasive Species Partnership to profile and highlight these lakes; and pilot Elk and Beaver lakes as a targeted location for proactive education and “reach out” activities, with respect to aquatic invasive species.
  - include other aquatic species (e.g., Eurasian water-milfoil, American bullfrog, and red-eared slider) in any educational materials or initiatives.

## 6.0 CLOSURE

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

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## 7.0 REFERENCES

### 7.1 Literature Cited

- Badiou, P.H.J., and L.G. Goldsborough. 2006. Northern range expansion and invasion by the Common Carp, *Cyprinus carpio*, of the Churchill River system in Manitoba. *Canadian Field-Naturalist* 120(1): 83–86.
- Bondar, C.A., Zhang, Y. and Richardson, J.S. 2005. The conservation status of the freshwater crayfish, *Pacifastacus leniusculus*, in British Columbia, Canada. Ministry of Land, Water and Air Protection Management Report 117.
- British Columbia Conservation Data Centre. 2017a. Species Summary: *Rana aurora*. B.C. Ministry of Environment. Retrieved from: <http://a100.gov.bc.ca/pub/eswp/>. Accessed October 2017.
- British Columbia Conservation Data Centre. 2017b. Species Summary: *Chrysemys picta* pop. 1. B.C. Ministry of Environment. Retrieved from: <http://a100.gov.bc.ca/pub/eswp/> Accessed October 2017.
- British Columbia Ministry of Environment, Lands and Parks. 1997. Fish Collection Methods and Standards (Version 4.0). Retrieved from: <https://www.for.gov.bc.ca/hts/risc/pubs/aquatic/fishcol/index.htm>. Accessed: September 2017.
- British Columbia Ministry of Environment. 2017. EcoCat, the Ecological Reports Catalogue. Retrieved from <http://a100.gov.bc.ca/pub/acat/public/welcome.do>. Accessed: October 2017.
- British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2017. 2017-2019 Freshwater fishing regulations synopsis – complete. Retrieved from: <http://www.env.gov.bc.ca/fw/fish/regulations/> . Accessed: September 2017.
- British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2017. Fish Collection Permit No.: NA17-277471 (Inventory – August 14, 2017 to September 15, 2017), issued to Nina Barton of Hemmera.
- Brown, T.G., Runciman B., Pollard, S., Grant, A.D.A., and Bradford, M.J. 2009a. Biological synopsis of smallmouth bass (*Micropterus dolomieu*). *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2887: v + 50 p.
- Brown, T.G., Runciman, B., Pollard, S., and Grant, A.D.A. 2009b. Biological synopsis of largemouth bass (*Micropterus salmoides*). *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2884: v + 27 p.
- Burns, J. and B. Klein. 1973. A Reconnaissance Survey of Elk Lake (Island) 1973 01978QUES. EcoCat: BC Ministry of Environment. Retrieved from: <http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=6865>. Accessed: October 2017.
- Burns, J. and \_\_\_ Tredger. 1976. A Reconnaissance Survey of Elk Lake 00214VICT (1976) 00214VICT. Retrieved from: <http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=6840>. Accessed: October 2017.

- Capital Regional District. 2017. Invasive Species. Retrieved from: <https://www.crd.bc.ca/education/our-environment/concerns/invasive-species>. Accessed: October 2017.
- Carl, G. Clifford and C. J. Guiguet. 1958. Alien Animals in British Columbia. British Columbia Provincial Museum, Department of Education, Handbook No. 14. Victoria, BC.  
<http://ibis.geog.ubc.ca/biodiversity/efauna/AlienSpeciesinBritishColumbiaHistoricalRecords.html#FishFrogs>. Accessed: October 2017.
- Costa H.H. 1979. The food and feeding chronology of yellow perch (*P. flavescens*) in Lake Washington. 64: (6) 783-793.
- Engelstoff, C. and K. Ovaska. 2016. Guide to Aquatic Weed Harvester Operators – Langford Lake and Elk-Beaver Lake 2013. 23 p.
- Freshwater Fisheries Society of BC. 2017. Fish Stocking Report: Beaver, Elk Lakes. Retrieved from: <https://www.gofishbc.com/Stocked-Fish.aspx#fish-stocking>. Accessed: October 2017.
- Griffith, R.P. 1990. Evaluation of Artificial Tire Reefs Installed to Enhance Smallmouth Bass Production in Selected Vancouver Island Lakes. Prepared for Fisheries Section, BC Ministry of Environment in association with the BC Conservation Foundation. Retrieved from [http://a100.gov.bc.ca/appsdata/acat/documents/r36870/Artificial\\_Reefs\\_SMB\\_1990\\_1371760677629\\_78651f1e55320af724c3913692965ad2f851d418cea94099c3c6ba5e16f0fc18.pdf](http://a100.gov.bc.ca/appsdata/acat/documents/r36870/Artificial_Reefs_SMB_1990_1371760677629_78651f1e55320af724c3913692965ad2f851d418cea94099c3c6ba5e16f0fc18.pdf) Accessed: October 2017.
- Habitat Conservation Trust Foundation. 2014. Elk Lake enhancement project [Web log post]. Retrieved from: <http://www.hctf.ca/communications/blog/entry/elk-lake-enhancement-project>. Accessed: September 2017.
- Hatfield, T. and Pollard, S. 2006. Non-native Freshwater Fish Species in British Columbia: Biology, Biotic Effects, and Potential Management Actions. Prepared for Freshwater Fisheries Society of British Columbia, Victoria, BC. Draft, October 2006. *Cited in:* Runciman, J.B., and Leaf, B.R. 2009. A review of yellow perch (*Perca flavescens*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), walleye (*Sander vitreus*) and northern pike (*Esox lucius*) distributions in British Columbia. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2882: xvi + 123 p.
- Holms, G.B. 1996. State of water quality of Elk and Beaver Lakes 1986-1995. Retrieved from <http://www.env.gov.bc.ca/wat/wq/quality/wqeb/wqeb.html>. Accessed: October 2017.
- Holtan P. 1990. Yellow perch (*Perca flavescens*). Wisconsin Dept. of Natural Resources Bureau of Fisheries Management.
- Jordan, C., Backe, N., Wright, M.C., and Tovey, C.P. 2009. Biological synopsis of pumpkinseed (*Lepomis gibbosus*). *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2886: iv + 16 p.

- Kerr, S. J. and R. E. Grant. 2000. Ecological Impacts of Fish Introductions: Evaluating the Risk. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario. 473 p. Retrieved from: [http://www.mnr.gov.on.ca/mnr/stocking2002/EcolImpacts\\_opt.pdf](http://www.mnr.gov.on.ca/mnr/stocking2002/EcolImpacts_opt.pdf). Accessed: September 2017.
- Lasenby, T. A. and S. J. Kerr. 2000. Bass transfers and stocking: An annotated bibliography and literature review. Fish and Wildlife Branch, Ontario Ministry of Natural Resources. Peterborough, Ontario. 207 p. + appendices.
- LGL Limited. 2014. Beaver Lake/Colquitz River Fish Salvage NA14-152702. Retrieved from <http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=48484>. Accessed: October 2017.
- MacLachlan and \_\_\_ Foubister. 1975. Gill Net Recovery Elk Lake 00214VICT. Retrieved from: <http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=21995>. Accessed: October 2017.
- MJL Environmental Consultants. 2003. Recreational Angling Use Survey: Elk/Beaver Lake; Durrance Lake; Thetis Lake; Langford Lake; Prospect Lake- November 1, 202 to May 31, 2003. Prepared for Fish and Wildlife Science and Allocation Section, BC Ministry of Water, Land and Air Protection.
- Mueller, K. 2002. Habitat association of introduced smallmouth bass and native signal crayfish of Lake Whatcom, Washington. *Journal of Freshwater Ecology* 17: 13-18.
- Nordin, R.N. 1981. Preliminary Report on the Use of Elk Lake as a Balancing Reservoir for Irrigation: Possible Effects on Limnology, Water Quality, and Fisheries. Aquatic Studies Branch. 17 p. Retrieved from <http://www.env.gov.bc.ca/wat/wq/public/wqar.html>. Accessed: September 2017.
- North/South Consultants. 2017. Fish aging results of Elk/Beaver fish inventory study. Received September 2017.
- Province of British Columbia. 2017a. Fish Inventory Summary System (FISS). Fish inventory data query: Elk-Beaver, Beaver-Elk (BC Watershed Code 920-79700). Retrieved from: <http://a100.gov.bc.ca/pub/fig/viewSingleWaterbody.do>. Accessed: September 2017.
- Province of British Columbia. 2017b. Habitat Wizard. Retrieved from: <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/habitatwizard> Accessed: October 2017.
- Rimmer, S and R. Barlak. 2001. Ministry of Environment, Lands and Parks - Fisheries Branch Survey Elk-Beaver Lakes. Retrieved from: [http://a100.gov.bc.ca/appsdata/acat/documents/r48700/ElkBeaver2001\\_1435102666031\\_5101730415.pdf](http://a100.gov.bc.ca/appsdata/acat/documents/r48700/ElkBeaver2001_1435102666031_5101730415.pdf). Accessed: October 2017.
- Roberge M., Slaney T., and C.K. Minns. 2001. Life history characteristics of freshwater fishes occurring in British Columbia, with major emphasis on lake habitat requirements. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2574. 200 pp.

- Runciman, J.B., and Leaf, B.R. 2009. A review of yellow perch (*Perca flavescens*), smallmouth bass: (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), walleye (*Sander vitreus*) and northern pike (*Esox lucius*) distributions in British Columbia. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2882: xvi + 123 p
- Sandstrom, S, M. Rawson and N. Lester. 2013. Manual of Instructions for Broad-scale Fish Community Monitoring; using North American (NA1) and Ontario Small Mesh (ON2) Gillnets. Ontario Ministry of Natural Resources. Peterborough, Ontario. Version 2013.2 35 p. + appendices.
- Scott, W.B. and E.J. Crossman, 1998. *Freshwater fishes of Canada*. Oakville (Ontario, Canada): Galt House Publications. 966 p.
- Silvestri, S. 2014. Small lake fisheries management: Elk/Beaver Lake [Presentation slides]. Presented to the Victoria Golden Rods and Reels Society, Victoria, BC. Provided by the Victoria Golden Rods and Reels Society, September 2017.
- Simpson J, Wallace R. 1982. *Fishes of Idaho*. University of Idaho Press. Moscow, Idaho. (2) 197-202.
- Swee, U.B., and H.R. McCrimmon. 1966. Reproductive biology of the carp, *Cyprinus carpio* L., in Lake St. Lawrence, Ontario. *Trans. Am. Fish. Soc.* 95(4): 372-380.
- Rimmer, S. and R. Barlak. 2001. A reconnaissance survey of Elk and Beaver Lake. Fisheries Branch, Ministry of Environment Lands and Parks. Retrieved from:  
[http://a100.gov.bc.ca/appsdata/acat/documents/r48700/ElkBeaver2001\\_1435102666031\\_5101730415.pdf](http://a100.gov.bc.ca/appsdata/acat/documents/r48700/ElkBeaver2001_1435102666031_5101730415.pdf). Accessed: October 2017.
- Victoria City Rowing Club. 2016. Map showing Main Flow Pattern for Rowers, Safety, and Hazards. Provided by CRD, September 2017.
- Wydoski R.S., Whitney R.R. 2003. *Inland Fishes of Washington*. University of Washington Press. Seattle Washington. p.193-198.

# PHOTOGRAPHS





**Photo P1.** Signage installed by the CRD, advising of fish inventory efforts (08/21/17)



**Photo P2.** Floating minnow trap installed on edge of lily pads in Elk Lake (08/22/17)



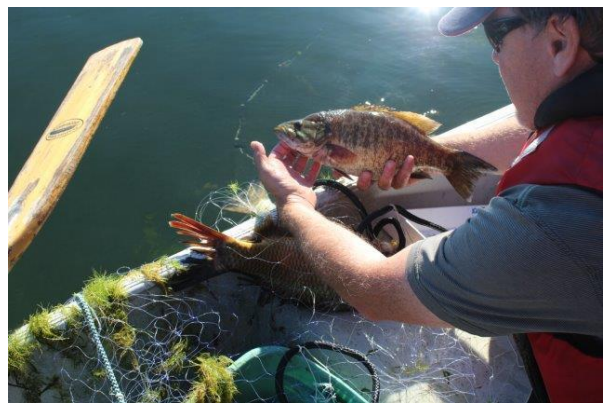
**Photo P3.** Gill net retrieval underway in Elk Lake, showing large catch of fish (08/22/17)



**Photo P4.** Yellow perch being removed from gill net in Elk Lake (08/22/17)



**Photo P5.** Largemouth bass removed from gill net in Elk Lake, with missing tail; signs of scavenging (08/22/17)



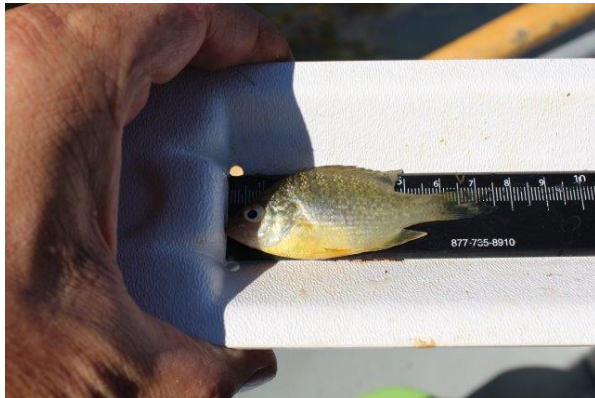
**Photo P6.** Smallmouth bass removed from gill net in Elk Lake, with common carp still tangled (08/22/17)



**Photo P7.** Fish samples from gill net set 2108-S3 laid out on table and ready for processing (08/22/17)



**Photo P8.** Fish samples from gill net set 2108-L4 ready for processing (08/22/17)



**Photo P9.** Pumpkinseed sunfish retrieved from a minnow trap that had been placed in Beaver Lake (08/22/17)



**Photo P10.** Minnow traps re-deployed for another overnight trapping effort; Beaver Lake (08/22/17)



**Photo P11.** Picking fish samples from net set in Beaver Lake; catch dominated by small yellow perch (08/23/17)



**Photo P12.** Bullhead retrieved from gill net set in Beaver Lake (08/23/17)



**Photo P13.** Common carp retrieved from a gill net set in Beaver Lake (08/23/17)



**Photo P14.** Floating minnow traps set on edge of small island in northwest corner of Beaver Lake (08/23/17)



**Photo P15.** Gill net set 2208-S2 fish samples on table and ready for processing (08/23/17)



**Photo P16.** Small catch (n=2) from gill net set 2208-S3 on processing table (08/23/17)



**Photo P17.** Fish samples from gill net set 2208-L1 prepped for processing (08/23/17)



**Photo P18.** Fish samples from gill net set 2208-L4 on table and ready for processing (08/23/17)



**Photo P19.** Picking small fish from finer mesh gill net panel (08/24/17)



**Photo P20.** One of the largest rainbow trout sampled by gill netting efforts, taken in Elk Lake (08/24/17)



**Photo P21.** Smaller fish (mostly pumpkinseed sunfish) in minnow trap from Beaver Lake (08/24/17)



**Photo P22.** Juvenile largemouth bass captured during minnow trapping in Beaver Lake (08/24/17)



**Photo P23.** Gill net set 2308-S3 fish samples laid out on table for processing (08/24/17)



**Photo P24.** Fish remains (likely yellow perch) from rainbow trout stomach; gill net set 2308-S3 (08/24/17)



**Photo P25.** Gill net set 2308-S5 fish samples on table, in preparation for processing (08/24/17)



**Photo P26.** Gill net set 2308-S6 fish samples prepped for processing (08/24/17)



**Photo P27.** Closeup view of smallmouth bass from gill net set 2308-S6, including juvenile bass (08/24/17)



**Photo P28.** Fish captured with gill net set 2308-L1, laid out on table for processing (08/24/17)



**Photo P29.** Gill net set 2308-L2 fish samples laid out on table for processing (08/24/17)



**Photo P30.** Retrieval of a gill net from Elk Lake on the final survey day (08/25/17)



**Photo P31.** Sample bucket with fish (mostly yellow perch) picked from gill net in Elk Lake (08/25/17)



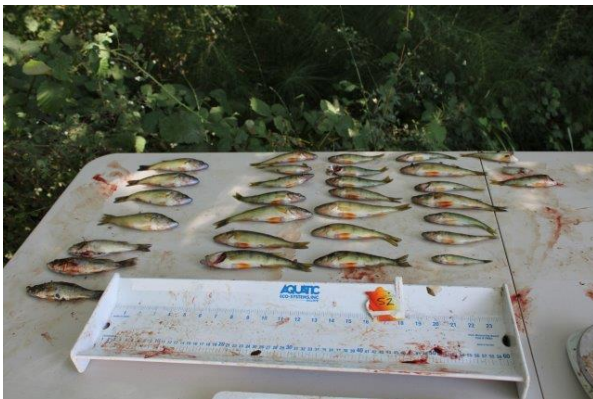
**Photo P32.** Smallmouth bass captured in gill net set 2408-L4 in Elk lake (08/25/17)



**Photo P33.** Signal crayfish captured during gill netting (gill net set 2408-L5) in Elk lake (08/25/17)



**Photo P34.** Gill net set 2408-S1, with fish samples laid out on table for processing (08/25/17)



**Photo P35.** Gill net set 2408-S2 fish samples prepped for processing (08/25/17)



**Photo P36.** Fish samples from gill net set 2408-L4, placed on table for processing (08/25/17)



**Photo P37.** Measuring length of a common carp, from gill net set 2408-L4 (08/25/17)



**Photo P38.** Gill net set 2408-L5 fish samples laid out on table for processing (08/25/17)



**Photo P39.** Deploying secchi disc in Elk Lake on the final day of fieldwork (08/25/17)



**Photo P40.** Taking water quality measurements with YSI meter in Elk Lake(08/25/17)

# **APPENDIX A**

## **Field Data**



**Gill Net Data**

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
e.g. 2108-S1-YP-001	Code	#	D/L	cm	cm	g	M/F/U	Y/N	Y/N		
2108-S3-SMB-001	SMB	1	L	17.5	20	-	-	-	N	-	Released
2108-S3-SMB-002	SMB	2	L	12.5	13	-	-	-	N	-	Released
2108-S3-SMB-003	SMB	3	L	20.5	21	-	-	-	N	-	Released
2108-S3-LMB-004	LMB	4	D	15	15.5	49	U	-	N	Fish - highly digested	
2108-S3-LMB-005	LMB	5	D	14.5	15.5	51	U	-	N	U	
2108-S3-LMB-006	LMB	6	D	14.5	15.5	53	U	-	N	U	
2108-S3-LMB-007	LMB	7	D	17.5	18	83	M	Imm	N	Empty	
2108-S3-LMB-008	LMB	8	D	15.5	16.5	52	F	Imm	N	Fish - highly digested	
2108-S3-LMB-009	LMB	9	D	17.5	18	72	U	-	N	U	
2108-S3-LMB-010	LMB	10	D	15	15.5	49	F	Imm	N	U	
2108-S3-LMB-011	LMB	11	D	15.5	16.5	57	F	Imm	N	U	
2108-S3-LMB-012	LMB	12	D	15.5	16	48	U	-	Y	Empty	
2108-S3-LMB-013	LMB	13	D	15.5	16	57	F	Imm	Y	U/Fish?	
2108-S3-PMB-001	PMB	1	D	-	-	4	-	-	N	-	
2108-S3-YP-001	YP	1	D	20	20.5	102	M	-	Y	Empty	
2108-S3-YP-002	YP	2	D	9	10	9	-	-	N	-	
2108-S3-YP-003	YP	3	D	10	11	9	-	-	N	-	
2108-S3-YP-004	YP	4	D	10	11	10	-	-	N	-	
2108-S3-YP-005	YP	5	D	1	2	2	-	-	N	-	
2108-S3-YP-006	YP	6	D	-	-	-	-	-	N	-	
2108-S3-YP-007	YP	7	D	13.5	14	32	-	-	N	-	
2108-S3-YP-008	YP	8	D	18	19	24	-	-	N	-	
2108-S3-YP-009	YP	9	D	13.5	14	31	-	-	N	-	
2108-S3-YP-010	YP	10	D	9.5	10	9	-	-	N	-	
2108-S3-YP-011	YP	11	D	13.5	14	28	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2108-S3-YP-012	YP	12	D	-	-	-	-	-	N	-	
2108-S3-YP-013	YP	13	D	12.5	13	23	-	-	N	-	
2108-S3-YP-014	YP	14	D	13.5	14	29	-	-	N	-	
2108-S3-YP-015	YP	15	D	10.5	11	15	-	-	N	-	
2108-S3-YP-016	YP	16	D	13.5	14	28	-	-	N	-	
2108-S3-YP-017	YP	17	D	13	13.5	24	-	-	N	-	
2108-S3-YP-018	YP	18	D	12.5	13	26	-	-	Y	-	
2108-S3-YP-019	YP	19	D	10	10.5	12	-	-	N	-	
2108-S3-YP-020	YP	20	D	10.5	11	15	-	-	N	-	
2108-S3-YP-021	YP	21	D	11.5	12	20	-	-	N	-	
2108-S3-YP-022	YP	22	D	11	12	16	-	-	N	-	
2108-S3-YP-023	YP	23	D	13.5	12.5	30	-	-	N	-	
2108-S3-YP-024	YP	24	D	11.5	10.5	21	-	-	N	-	
2108-S3-YP-025	YP	25	D	12	12.5	19	-	-	N	-	
2108-S3-YP-026	YP	26	D	10	10.5	13	-	-	N	-	
2108-S3-YP-027	YP	27	D	15	16.5	46	-	-	N	-	
2108-S3-YP-028	YP	28	D	20.5	21.5	115	-	-	N	-	
2108-S3-YP-029	YP	29	D	18.5	19	76	-	-	N	-	
2108-S3-YP-030	YP	30	D	21.5	22.5	130	-	-	N	-	
2108-S3-YP-031	YP	31	D	21	22	112	-	-	N	-	
2108-S3-YP-032	YP	32	D	18.5	19.5	91	-	-	N	-	
2108-S3-YP-033	YP	33	D	18.5	19.5	90	-	-	N	-	
2108-S3-YP-034	YP	34	D	23	24	144	U	-	Y	Not found.	
2108-L4-SMB-001	SMB	1	L	20	20.5	-	-	-	-	-	Released
2108-L4-LMB-002	LMB	2	D	30	31	446	M	Imm	N	Fish remains (highly digested)	
2108-L4-SMB-003	SMB	3	D	48	51	2200	F	Maturing eggs	Y	U	
2108-L4-LMB-004	LMB	4	D	37	39	1120	M	Imm	Y	Fish remains (highly digested)	
2108-L4-LMB-005	LMB	5	D	18	18.5	98	M	Imm	N	Fish remains (highly digested)	
2108-L4-LMB-006	LMB	6	D	16.5	17	74	M	Imm	N	U	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2108-L4-LMB-007	LMB	7	D	22	22.5	159	F	Imm	N	U	
2108-L4-LMB-008	LMB	8	D	21	21.5	148	U	-	N	Empty	
2108-L4-LMB-009	LMB	9	D	15.5	16	57	F	Imm	N	U	
2108-L4-LMB-010	LMB	10	D	15.5	16	58	F	Imm	N	U	
2108-L4-LMB-011	LMB	11	D	17	17.5	72	F	Imm	N	U	
2108-L4-LMB-012	LMB	12	D	17.5	18	70	F	Imm	Y	Fish, inverts, weed fragments	
2108-L4-YP-001	YP	1	D	14.5	15.5	37	U	-	N	U	
2108-L4-YP-002	YP	2	D	19.5	20.5	94	U	-	N	Not found	
2108-L4-YP-003	YP	3	D	21.5	22	131	F	Imm	N	Not found	
2108-L4-YP-004	YP	4	D	15.5	16.5	46	U	-	N	Not found	
2108-L4-YP-005	YP	5	D	18.5	20	79	F	Imm	Y	Not found	
2108-L4-CP-001	CP	1	D	46.5	49	1420	M	Mature	Y	Brown goo	
2108-L4-CP-002	CP	2	D	47	51	1730	F	Maturing	N	Brown goo	
2108-L5-CP-001	CP	1	D	49	54	1950	M	developing	N	Green goo	
2108-L5-CP-002	CP	2	D	44.5	49	1480	F	maturing	Y	Empty	
2108-L5-CP-003	CP	3	D	44.5	45.5	-	M	mature	N	Black goo	Damaged in net - not weighed
2108-L5-CP-004	CP	4	D	49	53.5	1830	F	maturing eggs	Y	Black goo	
2108-L5-CP-005	CP	5	D	46	51	1520	M	maturing	Y	Brown goo	
2108-L5-LMB-001	LMB	1	D	36.5	37.5	770	M	Imm	Y	Empty	
2108-L5-LMB-002	LMB	2	D	43.5	45	1590	M	Imm	Y	Empty	
2108-L5-LMB-003	LMB	3	D	33	35	610	M	Imm	Y	Empty	
2108-L5-LMB-004	LMB	4	D	38	40	810	M	Imm	N	Empty	
2108-L5-LMB-005	LMB	5	D	32	33.5	590	M	Imm	Y	Fish (perch or bass)	
2108-L5-LMB-006	LMB	6	D	29.5	30.5	420	M	Imm	N	Empty	
2108-L5-LMB-007	LMB	7	D	20	20.5	118	U	Imm	Y	Empty	
2108-L5-LMB-008	LMB	8	D	25.5	27	295	F	Imm	N	Fish, invert remains	
2108-L5-LMB-009	LMB	9	D	19	19.5	97	F	Imm	N	U	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2108-L5-LMB-010	LMB	10	D	25	26	246	F	Imm	N	U	
2108-L5-LMB-011	LMB	11	D	19.5	20.5	98	M	Imm	Y	-	
2108-L5-LMB-012	LMB	12	D	19	19.5	92	F	Imm	N	U/Fish?	
2108-L5-LMB-013	LMB	13	D	-	-	85	U	-	N	Fish	No tail (eaten)
2108-L5-LMB-014	LMB	14	D	19	19.5	103	F	Imm	Y	Fish (digested)	
2108-L5-LMB-015	LMB	15	D	18.5	19	88	F	Imm	N	Empty	
2108-L5-LMB-016	LMB	16	D	18.5	19	86	U	-	N	Empty	
2108-L5-LMB-017	LMB	17	D	18.5	19	87	U	-	N	Empty	
2108-L5-LMB-018	LMB	18	D	18	18.5	86	F	Imm	N	Empty	
2108-L5-LMB-019	LMB	19	D	20	20.5	109	U	-	Y	U	
2108-L5-LMB-020	LMB	20	D	19	19.5	100	M	Imm	N	Empty	
2108-L5-LMB-021	LMB	21	D	18.5	19	91	U	-	N	U	
2108-L5-LMB-022	LMB	22	D	18	18.5	91	F	Imm	N	Fish	
2108-L5-LMB-023	LMB	23	D	-	-	78	F	Imm	N	Fish	Tail eaten
2108-L5-LMB-024	LMB	24	D	18.5	19	84	F	Imm	N	Empty	
2108-L5-LMB-025	LMB	25	D	18.5	19.5	97	F	Imm	N	Fish remains	
2108-L5-LMB-026	LMB	26	D	19.5	20	113	M	Imm	N	Empty	
2108-L5-LMB-027	LMB	27	D	-	-	92	F	Imm	N	Empty	Tail eaten
2108-L5-LMB-028	LMB	28	D	17.5	18.5	90	F	Imm	N	U	
2108-L5-LMB-029	LMB	29	D	-	-	82	U	-	N	Yellow fluid	Tail eaten
2108-L5-SMB-030	SMB	30	D	32	32.5	577	F	Maturing	N	Empty	
2108-L5-YP-001	YP	1	D	14.5	15	37	U	-	Y	U	
2108-L5-YP-002	YP	2	D	18.5	19.5	93	U	-	Y	U	
2108-L5-YP-003	YP	3	D	19.5	20.5	93	F	Imm	N	U	
2108-L5-YP-004	YP	4	D	13.5	24.5	183	U	-	Y	Not found	
2108-L5-YP-005	YP	5	D	11	11.5	110	U	-	N	Empty	
2108-L5-YP-006	YP	6	D	20	21	100	U	-	N	Inverts	
2108-L5-YP-007	YP	7	D	13.5	14	31	U	-	N	Not found	
2108-L5-YP-008	YP	8	D	13	14	185	U	-	N	Not found	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2108-L5-YP-009	YP	9	D	19	20	92	U	-	N	Not found	
2208-L1-LMB-001	LMB	1	D	31.5	32	520	M	Imm	Y	Fish remains - highly digested	
2208-L1-BH-001	BH	1	D	21.2	21.5	112	-	-	N	-	
2208-L1-YP-001	YP	1	D	22.7	23	87	-	-	N	-	
2208-L1-YP-002	YP	2	D	25.5	26.3	249	-	-	N	-	
2208-L1-YP-003	YP	3	D	24	24.5	227	-	-	N	-	
2208-L1-YP-004	YP	4	D	24.5	25.1	207	-	-	N	-	
2208-L1-YP-005	YP	5	D	15.2	15.5	41	-	-	N	-	
2208-L1-YP-006	YP	6	D	22.4	23	166	-	-	N	-	
2208-L1-YP-007	YP	7	D	20.4	21	117	-	-	N	-	
2208-L1-YP-008	YP	8	D	22.7	23.3	171	-	-	N	-	
2208-L1-YP-009	YP	9	D	22.6	23	178	-	-	N	-	
2208-L1-YP-010	YP	10	D	22.4	23	165	-	-	N	-	
2208-L1-YP-011	YP	11	D	16.8	17.2	54	-	-	N	-	
2208-L1-YP-012	YP	12	D	21	21.6	125	-	-	N	-	
2208-L1-YP-013	YP	13	D	15.6	16.2	53	-	-	N	-	
2208-L1-YP-014	YP	14	D	25.7	26	276	-	-	N	-	
2208-L1-YP-015	YP	15	D	22	22.8	146	-	-	N	-	
2208-L1-YP-016	YP	16	D	25	26	271	-	-	N	-	
2208-L1-CP-001	CP	1	D	52	56	2130	-	-	N	-	
2208-L1-YP-017	YP	17	D	20	20.7	104	-	-	N	-	
2208-L1-YP-018	YP	18	D	18.2	28.8	80	-	-	N	-	
2208-L1-YP-019	YP	19	D	17.2	18.2	78	-	-	N	-	
2208-L1-YP-020	YP	20	D	19.5	20	106	-	-	N	-	
2208-L1-YP-021	YP	21	D	23.2	23.8	200	-	-	N	-	
2208-L1-YP-022	YP	22	D	21.9	22.2	155	-	-	N	-	
2208-L1-CP-002	CP	2	D	26	28.6	322	-	-	N	-	
2208-L1-CP-003	CP	3	D	27.2	30	399	-	-	N	-	
2208-L1-CP-004	CP	4	D	15.8	18.9	343	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-L1-CP-005	CP	5	D	27.6	29.9	362	-	-	N	-	
2208-L1-CP-006	CP	6	D	27.7	30.6	371	-	-	N	-	
2208-L1-CP-007	CP	7	D	28	31	410	-	-	Y	-	
2208-L1-CP-008	CP	8	D	29	32	422	-	-	N	-	
2208-L1-CP-009	CP	9	D	47	52	1730	-	-	N	-	
2208-L1-CP-010	CP	10	D	47	52	1610	-	-	N	-	
2208-L1-CP-011	CP	11	D	48	53	1780	-	-	N	-	
2208-L1-CP-012	CP	12	D	48	50	1500	-	-	N	-	
2208-L1-CP-013	CP	13	D	44	49	1440	-	-	N	-	
2208-L1-CP-014	CP	14	D	44	48	1310	-	-	N	-	
2208-S2-YP-001	YP	1	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-002	YP	2	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-003	YP	3	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-004	YP	4	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-005	YP	5	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-006	YP	6	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-007	YP	7	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-008	YP	8	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-009	YP	9	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-010	YP	10	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-011	YP	11	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-012	YP	12	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-013	YP	13	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-014	YP	14	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-015	YP	15	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-016	YP	16	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-017	YP	17	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-018	YP	18	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-019	YP	19	D	-	-	-	-	-	N	-	Partial remains

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-S2-YP-020	YP	20	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-021	YP	21	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-022	YP	22	D	-	-	-	-	-	N	-	Partial remains
2208-S2-YP-023	YP	23	D	10.4	10.9	16	-	-	N	-	
2208-S2-YP-024	YP	24	D	11.9	12.1	20	-	-	N	-	
2208-S2-YP-025	YP	25	D	12	12.5	19	-	-	N	-	
2208-S2-YP-026	YP	26	D	10.7	11.3	14	-	-	N	-	
2208-S2-YP-027	YP	27	D	10.8	11.4	16	-	-	N	-	
2208-S2-YP-028	YP	28	D	10.9	11.6	17	-	-	N	-	
2208-S2-YP-029	YP	29	D	11.9	12.3	19	-	-	N	-	
2208-S2-YP-030	YP	30	D	11.3	11.7	19	-	-	N	-	
2208-S2-YP-031	YP	31	D	12.1	12.6	22	-	-	N	-	
2208-S2-YP-032	YP	32	D	12.4	12.9	23	-	-	N	-	
2208-S2-YP-033	YP	33	D	12.4	12.7	23	-	-	N	-	
2208-S2-YP-034	YP	34	D	11.4	11.9	19	-	-	N	-	
2208-S2-YP-035	YP	35	D	11.7	12.1	20	-	-	N	-	
2208-S2-YP-036	YP	36	D	10.7	11	14	-	-	N	-	
2208-S2-YP-037	YP	37	D	10.1	10.6	12	-	-	N	-	
2208-S2-YP-038	YP	38	D	12	12.7	21	-	-	N	-	
2208-S2-YP-039	YP	39	D	10.2	10.6	12	-	-	N	-	
2208-S2-YP-040	YP	40	D	10.8	11.3	16	-	-	N	-	
2208-S2-YP-041	YP	41	D	10.5	11	16	-	-	N	-	
2208-S2-YP-042	YP	42	D	12.5	12.9	23	-	-	N	-	
2208-S2-YP-043	YP	43	D	12	12.6	23	-	-	N	-	
2208-S2-YP-044	YP	44	D	11.4	11.9	17	-	-	N	-	
2208-S2-YP-045	YP	45	D	10.5	11	16	-	-	N	-	
2208-S2-YP-046	YP	46	D	11.7	12	20	-	-	N	-	
2208-S2-YP-047	YP	47	D	11.9	12.2	19	-	-	N	-	
2208-S2-YP-048	YP	48	D	11.7	12.2	19	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-S2-YP-049	YP	49	D	9.9	10.9	13	-	-	N	-	
2208-S2-BH-001	BH	1	D	10.4	10.6	13	-	-	N	-	
2208-S2-BH-002	BH	2	D	16.1	16.4	54	-	-	N	-	
2208-S2-BH-003	BH	3	D	21	21.4	127	-	-	N	-	
2208-S2-BH-004	BH	4	D	19.7	20.1	101	-	-	N	-	
2208-S2-BH-005	BH	5	D	19.4	19.6	88	-	-	N	-	
2208-S2-BH-006	BH	6	D	20.4	20.8	103	-	-	N	-	
2208-S2-BH-007	BH	7	D	21.5	21.6	147	-	-	N	-	
2208-S2-BH-008	BH	8	D	17.4	17.6	60	-	-	N	-	
2208-S2-BH-009	BH	9	D	20.7	21.1	105	-	-	N	-	
2208-S2-BH-010	BH	10	D	18.7	18.9	89	-	-	N	-	
2208-S2-BH-011	BH	11	D	19	19.4	87	-	-	N	-	
2208-S2-BH-012	BH	12	D	19	19.3	101	-	-	N	-	
2208-S2-BH-013	BH	13	D	21.9	22.1	141	-	-	N	-	
2208-S2-BH-014	BH	14	D	18.5	18.7	76	-	-	N	-	
2208-S2-BH-015	BH	15	D	20.1	20.3	92	-	-	N	-	
2208-S2-BH-016	BH	16	D	20	20.4	109	-	-	N	-	
2208-S2-BH-017	BH	17	D	20.5	21	103	-	-	N	-	
2208-S2-BH-018	BH	18	D	20.5	21	123	-	-	N	-	
2208-S2-BH-019	BH	19	D	28.9	29.3	95	-	-	N	-	
2208-S2-BH-020	BH	20	D	22	22.4	132	-	-	N	-	
2208-S2-BH-021	BH	21	D	18.6	19	73	-	-	N	-	
2208-S2-BH-022	BH	22	D	19.2	19.4	113	-	-	N	-	
2208-S2-BH-023	BH	23	D	18.4	18.8	91	-	-	N	-	
2208-S2-BH-024	BH	24	D	20.6	21	122	-	-	N	-	
2208-S2-BH-025	BH	25	D	18.6	18.8	92	-	-	N	-	
2208-S2-BH-026	BH	26	D	17.9	18.3	81	-	-	N	-	
2208-S2-BH-027	BH	27	D	19.7	20	91	-	-	N	-	
2208-S2-BH-028	BH	28	D	19.4	19.6	85	-	-	N	-	



Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-S2-BH-029	BH	29	D	19	19.4	87	-	-	N	-	
2208-S2-BH-030	BH	30	D	16.9	17.3	67	-	-	N	-	
2208-S2-RB-001	RB	1	D	23	23.4	111	U	-	N	white fluid	
2208-S3-YP-001	YP	1	D	12.5	12.7	23	-	-	N		
2208-S3-RB-001	RB	1	D	27.3	28	191	U	U	Y	Fluid	
2208-L4-CP-001	CP	1	D	53	57	240	-	-	N	-	
2208-L4-CP-002	CP	2	D	50.5	54	2190	-	-	N	-	
2208-L4-YP-001	YP	1	D	18	18.5	82	-	-	N	-	
2208-L4-YP-002	YP	2	D	18	19	85	-	-	N	-	
2208-L4-YP-003	YP	3	D	18	19	81	-	-	N	-	
2208-L4-YP-004	YP	4	D	18.5	19	79	-	-	N	-	
2208-L4-YP-005	YP	5	D	18	18.6	73	-	-	Y	-	
2208-L4-BH-001	BH	1	D	26.5	27	267	-	-	N	-	
2208-L4-BH-002	BH	2	D	23	23.5	155	-	-	N	-	
2208-L4-BH-003	BH	3	D	25	25.4	216	-	-	N	-	
2208-L4-BH-004	BH	4	D	24	24.5	162	-	-	N	-	
2208-L4-BH-005	BH	5	D	28.5	29.1	280	-	-	N	-	
2208-L4-CP-003	CP	3	D	45	49.5	1550	-	-	N	-	
2208-L4-CP-004	CP	4	D	46.5	51	1520	-	-	N	-	
2208-L4-CP-005	CP	5	D	50	54.5	2190	-	-	Y	-	
2208-L4-BH-006	BH	6	D	27.5	27.8	260	-	-	N	-	
2208-L4-BH-007	BH	7	D	21	21.1	122	-	-	N	-	
2208-L4-BH-008	BH	8	D	22.1	22.3	126	-	-	N	-	
2208-L4-BH-009	BH	9	D	21.3	21.5	104	-	-	N	-	
2208-L4-BH-010	BH	10	D	20.8	20.9	99	-	-	N	-	
2208-L4-BH-011	BH	11	D	23.7	23.9	152	-	-	N	-	
2208-L4-BH-012	BH	12	D	23.6	23.9	155	-	-	N	-	
2208-L4-BH-013	BH	13	D	19.9	20.1	81	-	-	N	-	
2208-L4-BH-014	BH	14	D	21.8	22.1	124	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-L4-BH-015	BH	15	D	21.8	22	121	-	-	N	-	
2208-L4-BH-016	BH	16	D	21.3	21.5	108	-	-	N	-	
2208-L4-BH-017	BH	17	D	24.8	25.1	160	-	-	N	-	
2208-L4-BH-018	BH	18	D	27.4	28	260	-	-	N	-	
2208-L4-BH-019	BH	19	D	26.2	26.4	230	-	-	N	-	
2208-L4-BH-020	BH	20	D	24	24.2	160	-	-	N	-	
2208-L4-BH-021	BH	21	D	26.5	26.8	170	-	-	N	-	
2208-L4-BH-022	BH	22	D	24.9	25.2	169	-	-	N	-	
2208-L4-BH-023	BH	23	D	22	22.3	139	-	-	N	-	
2208-L4-BH-024	BH	24	D	22	22.2	128	-	-	N	-	
2208-L4-BH-025	BH	25	D	24.1	24.3	160	-	-	N	-	
2208-L4-BH-026	BH	26	D	24.4	24.6	158	-	-	N	-	
2208-L4-BH-027	BH	27	D	21.9	22.1	125	-	-	N	-	
2208-L4-BH-028	BH	28	D	25.1	25.3	167	-	-	N	-	
2208-L4-YP-006	YP	6	D	19.5	19.9	98	-	-	N	-	
2208-L4-YP-007	YP	7	D	19.7	20.2	111	-	-	N	-	
2208-L4-YP-008	YP	8	D	21.8	22.4	133	-	-	N	-	
2208-L4-LMB-001	LMB	1	D	18.2	18.6	89	-	-	N	-	
2208-L4-LMB-002	LMB	2	D	18.2	18.4	90	-	-	Y	-	
2208-L4-LMB-003	LMB	3	D	18.5	19	88	-	-	N	-	
2208-L4-LMB-004	LMB	4	D	24	24.9	205	-	-	N	-	
2208-L4-CP-006	CP	6	D	52	57	2150	-	-	N	-	
2208-L4-CP-007	CP	7	D	46	50	1730	-	-	N	-	
2208-L4-CP-008	CP	8	D	28	41	400	-	-	N	-	
2208-L4-CP-009	CP	9	D	27	30	340	-	-	N	-	
2208-L4-CP-010	CP	10	D	27	30	340	-	-	Y	-	
2208-L4-CP-011	CP	11	D	25	28	260	-	-	N	-	
2208-L4-CP-012	CP	12	D	29	31.5	400	-	-	N	-	
2208-L4-CP-013	CP	13	D	28.5	30.5	350	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2208-L4-CP-014	CP	14	D	27.5	30.5	350	-	-	N	-	
2208-L4-CP-015	CP	15	D	28.5	31.5	410	-	-	Y	-	
2208-L4-CP-016	CP	16	D	47	52	1660	-	-	N	-	
2208-L4-CP-017	CP	17	D	48	52	1430	-	-	N	-	
2308-L1-YP-001	YP	1	D	13.9	14.2	39	-	-	N	-	
2308-L1-YP-002	YP	2	D	16.2	16.8	55	-	-	N	-	
2308-L1-YP-003	YP	3	D	14.5	15.1	38	-	-	N	-	
2308-L1-YP-004	YP	4	D	19.5	20.2	101	-	-	N	-	
2308-L1-YP-005	YP	5	D	16.3	16.8	56	-	-	N	-	
2308-L1-YP-006	YP	6	D	19.5	20.1	84	-	-	N	-	
2308-L1-YP-007	YP	7	D	15.2	15.5	48	-	-	N	-	
2308-L1-YP-008	YP	8	D	20	20.8	109	-	-	N	-	
2308-L1-YP-009	YP	9	D	20.4	21	121	-	-	N	-	
2308-L1-LMB-001	LMB	1	D	16.4	17	59	F	Imm	N	Unidentified	
2308-L1-LMB-002	LMB	2	D	16	16.7	61	-	-	N	-	
2308-L1-LMB-003	LMB	3	D	15.5	16	50	F	Imm	N	-	highly decomposed
2308-L1-LMB-004	LMB	4	D	16.1	16.4	69	M	Imm	Y	highly digested fish remains	
2308-L1-LMB-005	LMB	5	D	16.6	17.1	65	-	-	N	-	
2308-L1-LMB-006	LMB	6	D	16.3	16.9	55	U	-	N	Not found	
2308-L1-LMB-007	LMB	7	D	15.2	15.7	57	F	Imm	Y	None visible	
2308-L1-LMB-008	LMB	8	D	17.4	18	76	F	Imm	N	Unidentified	
2308-L1-LMB-009	LMB	9	D	17.4	17.7	81	F	Imm	Y	None found	
2308-L1-LMB-010	LMB	10	D	14.9	15.5	51	-	-	N	-	
2308-L1-CP-001	CP	1	D	48	52.5	1670	F	Mature with roe	N	Brown goo	
2308-L1-CP-002	CP	2	D	44	49	1340	M	-	N	Mostly empty	
2308-L1-CP-003	CP	3	D	48.5	53	1740	M	Maturing	Y	green-brown goo	
2308-L2-CP-001	CP	1	L	-	-	-	-	-	-	-	Lost from net
2308-L2-RB-001	RB	1	D	30	31	210	U	-	Y	Fluid	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-L2-RB-002	RB	2	D	48.5	50	1280	F	-	Y	fish remains - poss. 2 perch	
2308-L2-RB-003	RB	3	D	41.5	44	830	F?	Imm	Y	milky fluid	
2308-L2-LMB-001	LMB	1	D	20.4	21	134	M	Imm	Y	unidentified	
2308-L2-BH-001	BH	1	D	24.7	25	160	-	-	N	-	
2308-L2-CP-002	CP	2	D	47.5	52	1760	M	Mature	N	green goo	
2308-L2-CP-003	CP	3	D	51.5	55	2190	M	Mature	Y	-	
2308-L2-CP-004	CP	4	D	48	52	1760	F	Developing eggs	N	brown goo	
2308-L2-CP-005	CP	5	D	47.5	52	1710	M	-	N	greenish goo	
2308-L2-YP-001	YP	1	D	17.3	18.2	69	-	-	N	-	
2308-L2-YP-002	YP	2	D	13.7	14.2	35	-	-	N	-	
2308-L2-YP-003	YP	3	D	17.2	17.7	87	-	-	N	-	
2308-L2-YP-004	YP	4	D	21.5	22.2	126	-	-	N	-	
2308-L2-YP-005	YP	5	D	14	14.6	36	-	-	N	-	
2308-L2-YP-006	YP	6	D	13.5	14.4	40	-	-	N	-	
2308-L2-YP-007	YP	7	D	14.3	14.8	40	-	-	N	-	
2308-L2-YP-008	YP	8	D	14.5	15	40	-	-	N	-	
2308-L2-YP-009	YP	9	D	14.8	15.4	45	-	-	N	-	
2308-L2-YP-010	YP	10	D	13.5	14.2	36	-	-	N	-	
2308-L2-YP-011	YP	11	D	14.3	16.2	46	-	-	N	-	
2308-L2-YP-012	YP	12	D	14.5	14.1	34	-	-	N	-	
2308-L2-YP-013	YP	13	D	17.4	18.1	68	-	-	N	-	
2308-L2-YP-014	YP	14	D	13.9	14.5	37	-	-	N	-	
2308-L2-YP-015	YP	15	D	14.2	14.8	39	-	-	N	-	
2308-L2-YP-016	YP	16	D	13.5	14.6	38	-	-	N	-	
2308-L2-YP-017	YP	17	D	14.6	14.9	39	-	-	N	-	
2308-L2-YP-018	YP	18	D	17.2	17.9	56	-	-	N	-	
2308-L2-YP-019	YP	19	D	16.6	17.1	62	-	-	N	-	
2308-L2-YP-020	YP	20	D	14.5	15	45	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-L2-YP-021	YP	21	D	13.5	14.1	33	-	-	N	-	
2308-L2-YP-022	YP	22	D	14.6	15.1	44	-	-	N	-	
2308-L2-YP-023	YP	23	D	13.9	14.5	38	-	-	N	-	
2308-L2-YP-024	YP	24	D	14	14.6	35	-	-	N	-	
2308-L2-YP-025	YP	25	D	15.9	16.5	58	-	-	N	-	
2308-L2-YP-026	YP	26	D	13.5	14.2	35	-	-	N	-	
2308-L2-YP-027	YP	27	D	13.5	14	32	-	-	N	-	
2308-L2-YP-028	YP	28	D	14.6	15.3	44	-	-	N	-	
2308-L2-YP-029	YP	29	D	12.5	13.1	28	-	-	N	-	
2308-L2-YP-030	YP	30	D	13.5	14.2	35	-	-	N	-	
2308-L2-YP-031	YP	31	D	12.9	13.5	31	-	-	N	-	
2308-L2-YP-032	YP	32	D	14.5	15	40	-	-	N	-	
2308-L2-YP-033	YP	33	D	14	14.6	39	-	-	N	-	
2308-L2-YP-034	YP	34	D	14	14.8	39	-	-	N	-	
2308-L2-YP-035	YP	35	D	13	13.6	32	-	-	N	-	
2308-L2-YP-036	YP	36	D	14.7	15.1	41	-	-	N	-	
2308-L2-YP-037	YP	37	D	13.6	14.1	33	-	-	N	-	
2308-L2-YP-038	YP	38	D	13.5	14.1	35	-	-	N	-	
2308-L2-YP-039	YP	39	D	13.7	14.4	34	-	-	N	-	
2308-L2-YP-040	YP	40	D	14.1	14.1	38	-	-	N	-	
2308-L2-YP-041	YP	41	D	13.9	14.5	36	-	-	N	-	
2308-L2-YP-042	YP	42	D	14.2	14.7	36	-	-	N	-	
2308-L2-YP-043	YP	43	D	13	13.7	34	-	-	N	-	
2308-L2-YP-044	YP	44	D	13.7	14.3	34	-	-	N	-	
2308-L2-YP-045	YP	45	D	14.7	15.2	40	-	-	N	-	
2308-L2-YP-046	YP	46	D	14.5	15	38	-	-	N	-	
2308-L2-YP-047	YP	47	D	14	14.6	39	-	-	N	-	
2308-L2-YP-048	YP	48	D	15.6	17.2	63	-	-	N	-	
2308-L2-YP-049	YP	49	D	18.2	19	83	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-L2-YP-050	YP	50	D	13.2	13.7	31	-	-	N	-	
2308-L2-YP-051	YP	51	D	14.5	14.9	39	-	-	N	-	
2308-L2-YP-052	YP	52	D	14.1	14.7	38	-	-	N	-	
2308-L2-YP-053	YP	53	D	14.3	14.6	39	-	-	N	-	
2308-L2-YP-054	YP	54	D	18.5	19.1	80	-	-	N	-	
2308-L2-YP-055	YP	55	D	17.7	18.2	67	-	-	N	-	
2308-L2-YP-056	YP	56	D	20.5	21.1	111	-	-	N	-	
2308-L2-YP-057	YP	57	D	19.8	20.4	98	-	-	N	-	
2308-L2-YP-058	YP	58	D	23.5	24	186	-	-	N	-	
2308-L2-LMB-002	LMB	2	D	18.5	19	95	-	-	N	-	
2308-L2-LMB-003	LMB	3	D	19.7	20.2	124	-	-	N	-	
2308-S3-YP-001	YP	1	D	-	-	-	-	-	-	-	
2308-S3-RB-001	RB	1	D	45	47.5	940	U	-	Y	Fish remains - spiny rayed	
2308-S3-RB-002	RB	2	D	42	43.5	880	U	-	Y	Fluid	
2308-S3-RB-003	RB	3	D	41.5	44	970	U	-	Y	Fish remains - yellow perch	
2308-S3-RB-004	RB	4	D	52	54.5	1890	U	-	Y	Empty	
2308-S3-RB-005	RB	5	D								Lost during pull
2308-S5-LMB-001	LMB	1	D	8.4	8.6	7	-	-	N	-	
2308-S5-YP-001	YP	1	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-002	YP	2	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-003	YP	3	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-004	YP	4	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-005	YP	5	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-006	YP	6	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-007	YP	7	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-008	YP	8	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-009	YP	9	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-010	YP	10	D	-	-	-	-	-	-	-	No head/gillnet damage

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-S5-YP-011	YP	11	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-012	YP	12	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-013	YP	13	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-YP-014	YP	14	D	-	-	-	-	-	-	-	No head/gillnet damage
2308-S5-PMB-001	PMB	1	D	7	7.5	6	-	-	-	-	Heavily destroyed/eaten
2308-S5-LMB-002	LMB	2	D	16	16.5	56	M	Imm	Y	Yellow fluid	
2308-S5-LMB-003	LMB	3	D	19.5	20	113	M	Imm	Y	Heavily digested fish remains	
2308-S5-LMB-004	LMB	4	D	15	15.5	45	F	Imm	N	None	
2308-S5-LMB-005	LMB	5	D	16.5	17.1	63	U	Imm	N	None	
2308-S5-LMB-006	LMB	6	D	17.5	18	71	M	Imm	N	None	
2308-S5-LMB-007	LMB	7	D	18.4	19	86	M	Imm	N	Not identified	
2308-S5-YP-015	YP	15	D	21.9	22.8	154	-	-	N	-	
2308-S5-YP-016	YP	16	D	17	17.9	67	-	-	N	-	
2308-S5-YP-017	YP	17	D	11.8	12.3	20	-	-	N	-	
2308-S5-YP-018	YP	18	D	16.2	16.9	52	-	-	N	-	
2308-S5-YP-019	YP	19	D	19.5	21.1	91	-	-	N	-	
2308-S5-YP-020	YP	20	D	17.5	18.4	70	-	-	N	-	
2308-S5-YP-021	YP	21	D	20.5	21.1	98	-	-	Y	-	
2308-S5-YP-022	YP	22	D	19	19.7	80	-	-	N	-	
2308-S5-YP-023	YP	23	D	19.5	20.4	95	-	-	N	-	
2308-S5-YP-024	YP	24	D	16.9	17.7	57	-	-	N	-	
2308-S5-YP-025	YP	25	D	17.7	18.3	68	-	-	N	-	
2308-S5-YP-026	YP	26	D	16.9	17.4	54	-	-	N	-	
2308-S5-YP-027	YP	27	D	16.3	16.8	52	-	-	N	-	
2308-S5-YP-028	YP	28	D	17.6	18.2	72	-	-	Y	-	
2308-S5-YP-029	YP	29	D	18.3	18.7	69	-	-	N	-	
2308-S5-YP-030	YP	30	D	18.3	19	74	-	-	N	-	
2308-S5-YP-031	YP	31	D	13.6	14.3	28	-	-	N	-	
2308-S5-YP-032	YP	32	D	10.8	11	16	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-S5-YP-033	YP	33	D	12.5	13	19	-	-	N	-	
2308-S5-YP-034	YP	34	D	9.9	10.6	12	-	-	N	-	
2308-S5-YP-035	YP	35	D	9.9	10.3	11	-	-	N	-	
2308-S5-YP-036	YP	36	D	5.9	6.3	2	-	-	N	-	
2308-S5-YP-037	YP	37	D	10.7	11.4	14	-	-	N	-	
2308-S5-YP-038	YP	38	D	10.8	11.4	14	-	-	N	-	
2308-S5-PMB-002	PMB	2	D	9.8	10.3	15	-	-	N	-	
2308-S5-YP-039	YP	39	D	10.5	11	15	-	-	N	-	
2308-S5-YP-040	YP	40	D	10.2	10.7	12	-	-	N	-	
2308-S5-YP-041	YP	41	D	12	12.8	21	-	-	N	-	
2308-S5-YP-042	YP	42	D	6.5	6.7	3	-	-	N	-	
2308-S5-YP-043	YP	43	D	5.8	6	1	-	-	N	-	
2308-S5-YP-044	YP	44	D	5.3	5.4	1	-	-	N	-	
2308-S5-YP-045	YP	45	D	5.9	6.1	2	-	-	N	-	
2308-S5-YP-046	YP	46	D	5.4	5.7	2	-	-	N	-	
2308-S5-YP-047	YP	47	D	5.7	5.9	2	-	-	N	-	
2308-S5-YP-048	YP	48	D	5.8	6.1	2	-	-	N	-	
2308-S5-YP-049	YP	49	D	5.8	6	1	-	-	N	-	
2308-S5-YP-050	YP	50	D	6.4	6.8	3	-	-	N	-	
2308-S5-YP-051	YP	51	D	5.4	5.6	2	-	-	N	-	
2308-S5-YP-052	YP	52	D	6.2	6.4	2	-	-	N	-	
2308-S5-YP-053	YP	53	D	6.3	6.5	2	-	-	N	-	
2308-S5-YP-054	YP	54	D	5.7	6.1	2	-	-	N	-	
2308-S5-YP-055	YP	55	D	5.8	6	2	-	-	N	-	
2308-S5-YP-056	YP	56	D	5.4	5.6	1	-	-	N	-	
2308-S5-YP-057	YP	57	D	5.7	6	2	-	-	N	-	
2308-S5-YP-058	YP	58	D	5.5	5.8	1	-	-	N	-	
2308-S5-YP-059	YP	59	D	4.8	5.3	1	-	-	N	-	
2308-S5-YP-060	YP	60	D	6.3	6.5	3	-	-	N	-	



Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-S5-YP-061	YP	61	D	6.1	6.5	2	-	-	N	-	
2308-S5-YP-062	YP	62	D	5.5	5.9	2	-	-	N	-	
2308-S5-YP-063	YP	63	D	5.6	5.9	2	-	-	N	-	
2308-S5-YP-064	YP	64	D	5.4	5.6	2	-	-	N	-	
2308-S5-YP-065	YP	65	D	5.8	6.3	2	-	-	N	-	
2308-S5-YP-066	YP	66	D	5.9	6.4	2	-	-	N	-	
2308-S5-YP-067	YP	67	D	5.9	6.3	2	-	-	N	-	
2308-S5-YP-068	YP	68	D	5.4	5.7	2	-	-	N	-	
2308-S5-YP-069	YP	69	D	5.8	6.1	1	-	-	N	-	
2308-S5-YP-070	YP	70	D	5.4	5.8	2	-	-	N	-	
2308-S5-YP-071	YP	71	D	5.6	5.9	2	-	-	N	-	
2308-S5-YP-072	YP	72	D	5.3	5.6	1	-	-	N	-	
2308-S5-YP-073	YP	73	D	8.3	9.1	7	-	-	N	-	
2308-S5-YP-074	YP	74	D	11.6	12.1	20	-	-	N	-	
2308-S5-YP-075	YP	75	D	13.5	14.1	29	-	-	N	-	
2308-S5-YP-076	YP	76	D	13.4	14	31	-	-	Y	-	
2308-S6-SMB-001	SMB	1	L	-	-	38	-	-	-	-	Large fish - released live
2308-S6-BH-001	BH	1	D	17.8	18	76	-	-	N	-	
2308-S6-BH-002	BH	2	D	18.9	19.1	79	-	-	N	-	
2308-S6-LMB-001	LMB	1	D	16.9	17.2	71	-	-	N	-	
2308-S6-SMB-002	SMB	2	D	7.4	7.6	5	-	-	N	-	
2308-S6-SMB-003	SMB	3	D	15.3	16	57	U	-	Y	Not found	
2308-S6-SMB-004	SMB	4	D	19.4	20	113	-	-	Y	-	
2308-S6-YP-001	YP	1	D	-	-	84	-	-	-	-	bitten, no length meas.
2308-S6-YP-002	YP	2	D	16.7	17.5	58	-	-	N	-	
2308-S6-YP-003	YP	3	D	18.9	19.9	94	-	-	N	-	
2308-S6-YP-004	YP	4	D	19.5	20	91	-	-	N	-	
2308-S6-YP-005	YP	5	D	20.5	21.1	102	-	-	N	-	
2308-S6-YP-006	YP	6	D	18.2	18.8	77	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-S6-YP-007	YP	7	D	10.8	11.1	13	-	-	N	-	
2308-S6-YP-008	YP	8	D	-	-	88	-	-	-	-	bitten, no length meas.
2308-S6-YP-009	YP	9	D	15.2	15.6	42	-	-	N	-	
2308-S6-YP-010	YP	10	D	19.4	20.2	94	-	-	N	-	
2308-S6-YP-011	YP	11	D	12.6	13.1	20	-	-	N	-	
2308-S6-YP-012	YP	12	D	11.5	12.1	19	-	-	N	-	
2308-S6-YP-013	YP	13	D	10.7	12.2	21	-	-	N	-	
2308-S6-YP-014	YP	14	D	10.5	11	14	-	-	N	-	
2308-S6-YP-015	YP	15	D	13.5	14.1	32	-	-	N	-	
2308-S6-YP-016	YP	16	D	12.6	13.1	23	-	-	N	-	
2308-S6-YP-017	YP	17	D	11.7	12.2	20	-	-	N	-	
2308-S6-YP-018	YP	18	D	13.5	14	31	-	-	N	-	
2308-S6-YP-019	YP	19	D	13.8	14.2	37	-	-	N	-	
2308-S6-YP-020	YP	20	D	11.8	12.2	20	-	-	N	-	
2308-S6-YP-021	YP	21	D	13.6	14.1	29	-	-	N	-	
2308-S6-YP-022	YP	22	D	11.9	12.4	20	-	-	N	-	
2308-S6-YP-023	YP	23	D	10.8	11.6	16	-	-	N	-	
2308-S6-YP-024	YP	24	D	13.2	13.6	28	-	-	N	-	
2308-S6-YP-025	YP	25	D	12.8	13.4	24	-	-	N	-	
2308-S6-YP-026	YP	26	D	17.5	18.1	65	-	-	N	-	
2308-S6-YP-027	YP	27	D	17.7	18.7	70	-	-	N	-	
2308-S6-YP-028	YP	28	D	13	13.6	30	-	-	N	-	
2308-S6-YP-029	YP	29	D	18.2	18.9	75	-	-	N	-	
2308-S6-YP-030	YP	30	D	12.5	13	24	-	-	N	-	
2308-S6-YP-031	YP	31	D	17.5	18.2	62	-	-	N	-	
2308-S6-YP-032	YP	32	D	13.6	14.4	32	-	-	N	-	
2308-S6-YP-033	YP	33	D	12.1	12.7	23	-	-	N	-	
2308-S6-YP-034	YP	34	D	9.3	9.8	9	-	-	N	-	
2308-S6-YP-035	YP	35	D	12.5	13.2	29	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2308-S6-YP-036	YP	36	D	12	12.6	25	-	-	N	-	
2308-S6-YP-037	YP	37	D	-	-	-	-	-	-	-	no data, partially eaten
2308-S6-YP-038	YP	38	D	-	-	-	-	-	-	-	no data, partially eaten
2408-S1-PMB-001	PMB	1	D	7.9	8.2	9	-	-	N	-	
2408-S1-PMB-002	PMB	2	D	7.6	8	8	-	-	N	-	
2408-S1-LMB-001	LMB	1	D	-	-	1	-	-	N	-	
2408-S1-LMB-002	LMB	2	D	7.7	8.1	6	-	-	Y	-	
2408-S1-LMB-003	LMB	3	D	16.5	17.2	56	F	Imm	Y	None found	
2408-S1-LMB-004	LMB	4	D	16.3	16.9	70	U	-	Y	None found	
2408-S1-LMB-005	LMB	5	D	18.9	19.5	91	M	Imm	Y	None found	
2408-S1-YP-001	YP	1	D	-	-	-	-	-	N	-	
2408-S1-YP-002	YP	2	D	-	-	-	-	-	N	-	
2408-S1-YP-003	YP	3	D	-	-	-	-	-	N	-	
2408-S1-YP-004	YP	4	D	-	-	-	-	-	N	-	
2408-S1-YP-005	YP	5	D	-	-	-	-	-	N	-	
2408-S1-YP-006	YP	6	D	-	-	-	-	-	N	-	
2408-S1-YP-007	YP	7	D	-	-	-	-	-	N	-	
2408-S1-YP-008	YP	8	D	-	-	-	-	-	N	-	
2408-S1-YP-009	YP	9	D	-	-	-	-	-	N	-	
2408-S1-YP-010	YP	10	D	5.1	5.5	1	-	-	N	-	
2408-S1-YP-011	YP	11	D	5.2	5.5	1	-	-	N	-	
2408-S1-YP-012	YP	12	D	9.8	10.2	11	-	-	N	-	
2408-S1-YP-013	YP	13	D	9.5	10.4	12	-	-	N	-	
2408-S1-YP-014	YP	14	D	11.3	11.6	17	-	-	N	-	
2408-S1-YP-015	YP	15	D	10.6	11.2	14	-	-	N	-	
2408-S1-YP-016	YP	16	D	11.3	11.6	17	-	-	N	-	
2408-S1-YP-017	YP	17	D	12	12.5	21	-	-	N	-	
2408-S1-YP-018	YP	18	D	-	-	12	-	-	N	-	
2408-S1-YP-019	YP	19	D	10.8	11.2	17	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2408-S1-YP-020	YP	20	D	13.3	14	28	-	-	N	-	
2408-S1-YP-021	YP	21	D	13.5	14	28	-	-	N	-	
2408-S1-YP-022	YP	22	D	11.5	12.2	18	-	-	N	-	
2408-S1-YP-023	YP	23	D	11.4	12	18	-	-	N	-	
2408-S1-YP-024	YP	24	D	12.1	12.8	21	-	-	N	-	
2408-S1-YP-025	YP	25	D	11	11.4	14	-	-	N	-	
2408-S1-YP-026	YP	26	D	11.6	12	18	-	-	N	-	
2408-S1-YP-027	YP	27	D	10	10.5	12	-	-	N	-	
2408-S1-YP-028	YP	28	D	12.8	13.3	24	-	-	N	-	
2408-S1-YP-029	YP	29	D	16.5	17	52	-	-	N	-	
2408-S1-YP-030	YP	30	D	13.2	13.8	26	-	-	N	-	
2408-S1-YP-031	YP	31	D	16.5	17.4	59	-	-	N	-	
2408-S1-YP-032	YP	32	D	12	12.4	20	-	-	N	-	
2408-S1-YP-033	YP	33	D	16	16.5	48	-	-	N	-	
2408-S1-YP-034	YP	34	D	17.7	18.3	69	-	-	N	-	
2408-S1-YP-035	YP	35	D	14	14.5	31	-	-	N	-	
2408-S1-YP-036	YP	36	D	17.4	18.2	63	-	-	N	-	
2408-S1-YP-037	YP	37	D	16.6	17.2	54	-	-	N	-	
2408-S1-YP-038	YP	38	D	16.5	17.1	53	-	-	N	-	
2408-S1-YP-039	YP	39	D	16.2	16.8	48	-	-	N	-	
2408-S1-YP-040	YP	40	D	13.2	13.6	27	-	-	N	-	
2408-S1-YP-041	YP	41	D	17.5	18.2	58	-	-	N	-	
2408-S1-YP-042	YP	42	D	11.9	12.4	19	-	-	N	-	
2408-S1-YP-043	YP	43	D	20.5	21.4	107	-	-	N	-	
2408-S1-YP-044	YP	44	D	17.9	18.4	68	-	-	N	-	
2408-S1-YP-045	YP	45	D	11.6	12.1	19	-	-	N	-	
2408-S1-YP-046	YP	46	D	14.7	15.2	36	-	-	N	-	
2408-S1-YP-047	YP	47	D	19.4	20.1	86	-	-	N	-	
2408-S1-YP-048	YP	48	D	12.4	13.1	24	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2408-S1-YP-049	YP	49	D	10.9	11.3	15	-	-	N	-	
2408-S1-YP-050	YP	50	D	11.9	12.3	18	-	-	N	-	
2408-S1-YP-051	YP	51	D	11.3	11.9	17	-	-	N	-	
2408-S1-YP-052	YP	52	D	14.9	15.7	44	-	-	N	-	
2408-S1-YP-053	YP	53	D	17.7	18.3	64	-	-	N	-	
2408-S1-YP-054	YP	54	D	17.6	18.3	71	-	-	N	-	
2408-S2-SMB-001	SMB	1	L	42	-	-	-	-	-	-	Released
2408-S2-SMB-002	SMB	2	D	16.8	17.5	64	U	-	Y	Juvenile crayfish	
2408-S2-LMB-001	LMB	1	D	16.9	17.5	76	U	-	Y	Fish remains, heavily digested	
2408-S2-LMB-002	LMB	2	D	17.5	18.1	70	F	Imm	Y	Inverts (Daphnia?)	
2408-S2-LMB-003	LMB	3	D	16.5	17.1	61	M	Imm	Y	Empty	
2408-S2-LMB-004	LMB	4	D	16.8	17.3	60	M	Imm	Y	-	
2408-S2-SMB-003	SMB	3	D	16	16.5	53	U	-	Y	Fluid	
2408-S2-SMB-004	SMB	4	D	15.5	16.1	52	F	Imm	Y	Unknown	
2408-S2-LMB-005	LMB	5	D	16.4	17	57	F	Imm	Y	Unknown	
2408-S2-YP-001a	*YP	1	D	-	-	-	-	-	N	-	No head
2408-S2-YP-002a	*YP	2	D	-	-	-	-	-	N	-	No head
2408-S2-PMB-001	PMB	1	D	-	-	-	-	-	N	-	Partially eaten
2408-S2-YP-001	YP	1	D	13.5	14.3	32	-	-	N	-	
2408-S2-YP-002	YP	2	D	19	20	68	-	-	N	-	
2408-S2-YP-003	YP	3	D	17.4	18	57	-	-	N	-	
2408-S2-YP-004	YP	4	D	18.6	19.5	74	-	-	N	-	
2408-S2-YP-005	YP	5	D	14.1	15	35	-	-	N	-	
2408-S2-YP-006	YP	6	D	14.5	15.6	39	-	-	N	-	
2408-S2-YP-007	YP	7	D	13	13.7	28	-	-	N	-	
2408-S2-YP-008	YP	8	D	12.9	13.6	24	-	-	N	-	
2408-S2-YP-009	YP	9	D	11.9	12.6	21	-	-	N	-	
2408-S2-YP-010	YP	10	D	12.3	12.6	22	-	-	N	-	
2408-S2-YP-011	YP	11	D	14.6	15.2	32	-	-	N	-	

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2408-S2-YP-012	YP	12	D	9.9	10.4	10	-	-	Y	-	
2408-S2-YP-013	YP	13	D	15.9	16.8	48	-	-	Y	-	
2408-S2-YP-014	YP	14	D	15.9	16.5	47	-	-	Y	-	
2408-S2-YP-015	YP	15	D	18.1	18.9	66	-	-	Y	-	
2408-S2-YP-016	YP	16	D	12.8	13.8	24	-	-	Y	-	
2408-S2-YP-017	YP	17	D	13.1	13.9	26	-	-	Y	-	
2408-S2-YP-018	YP	18	D	17.9	18.5	63	-	-	Y	-	
2408-S2-YP-019	YP	19	D	13.3	14.1	28	-	-	Y	-	
2408-S2-YP-020	YP	20	D	17.4	18	60	-	-	Y	-	
2408-S2-YP-021	YP	21	D	12	13	23	-	-	Y	-	
2408-L4-SMB-001	SMB	1	D	25.8	26.7	238	M	Imm	Y	Empty	
2408-L4-SMB-002	SMB	2	D	24.6	25.7	237	M	Imm	Y	Empty	
2408-L4-SMB-003	SMB	3	D	26.4	27.3	299	M	Imm	Y	Empty	
2408-L4-SMB-004	SMB	4	D	27.3	28.9	354	M	Imm	Y	Empty	
2408-L4-SMB-005	SMB	5	D	33	34.5	620	M	Imm	Y	Empty	
2408-L4-SMB-006	SMB	6	D	32.5	33	640	F	Developing	Y	Fish remains - very digested	
2408-L4-SMB-007	SMB	7	D	32.5	33.5	520	F	Maturing	Y	Fish remains	
2408-L4-SMB-008	SMB	8	D	35	37	780	F	Developing	Y	Fish remains - very digested	
2408-L4-SMB-009	SMB	9	D	31.5	33	550	M	Imm	Y	Fluid	
2408-L4-SMB-010	SMB	10	D	35	37.5	840	M	Maturing	Y	Fluid	
2408-L4-SMB-011	SMB	11	D	39	41.5	1120	F	Maturing	Y	Empty	
2408-L4-SMB-012	SMB	12	D	40	43	1250	F	Maturing	Y	Fluid	
2408-L4-SMB-013	SMB	13	D	46	49	1610	M	Maturing	Y	Empty	
2408-L4-SMB-014	SMB	14	D	42.5	45	1380	M	Maturing	Y	Fluid	
2408-L4-CP-001	CP	1	D	46.5	52	1590	U	-	Y	-	
2408-L4-CP-002	CP	2	D	45.5	50.5	1460	U	-	Y	-	
2408-L5-CRAY-001	CRAY	1	L	-	-	-	-	-	-	-	Released. No chelipeds
2408-L5-CRAY-002	CRAY	2	L	-	-	-	-	-	-	-	Released

Unique ID	Species	Fish Number	Fate	FLEN	TLEN	RWT	Sex	Gonads	Scales?	Stomach Contents	Comments
2408-L5-YP-001	YP	1	D	16.1	16.6	43	-	-	Y	-	
2408-L5-YP-002	YP	2	D	14.4	15.1	35	-	-	Y	-	
2408-L5-YP-003	YP	3	D	14.7	15.4	39	-	-	Y	-	
2408-L5-YP-004	YP	4	D	15.3	15.9	41	-	-	Y	-	
2408-L5-BH-001	BH	1	D	26.1	26.9	250	-	-	N	-	
2408-L5-SMB-001	SMB	1	D	29	30.5	407	F	Maturing	Y	Empty	
2408-L5-RB-001	RB	1	D	28.5	29.5	290	U	-	Y	Empty	
2408-L5-RB-002	RB	2	D	30.5	31.5	330	U	-	Y	Inverts (Chiron.)	
2408-L5-RB-003	RB	3	D	32	33.5	400	U	-	Y	Inverts (Chiron.)	
2408-L5-RB-004	RB	4	D	35	36	500	U	-	Y	Fluid	
2408-L5-RB-005	RB	5	D	28.5	29.5	280	U	-	Y	Inverts - very full (Chiron.)	
2408-L5-RB-006	RB	6	D	46.5	49.5	1080	M	Undeveloped	Y	Inverts (Chiron.)	

**Minnow Trap Data**

Trap Number	Date set	Date retrieved	Waypoint	UTM (Zone 10U)	Depth	Set time	Retrieval time	Soak Time	Species count	FLEN range or average	Comments	Location
			WP	E; N	m	24h	24h	soak time	Code:#	spp code: mm		
MT1	21/08/2017	22/08/2017	3	0470963E; 5373676N	2	18:00	16:15	22:15	-	-		Beaver Lake east of larger island
MT2	21/08/2017	22/08/2017	4	0470969E; 5373651N	2.5	18:05	16:25	22:20	PMB:3	35 - 40		Beaver Lake east of larger island
MT3	21/08/2017	22/08/2017	5	0470951E; 5373636N	2.5	18:12	16:34	22:22	YP:1	45		Beaver Lake east of larger island
MT4	21/08/2017	22/08/2017	6	0470906E; 5373594N	2	18:17	16:38	22:21	PMB:1	70		Beaver Lake east of larger island
MT5	21/08/2017	22/08/2017	7	0470898E; 5373588N	2.5	18:22	16:40	22:18	YP:1	50		Beaver Lake south of larger island
MT6	21/08/2017	22/08/2017	8	0470643E; 5375728N	1.5	19:35	15:45	20:10	0	-	cat tin food gone. Trap suspended from logs	N shore Elk, west of Hamsterly Beach
MT7	21/08/2017	22/08/2017	8	0470643E; 5375728N	1.5	19:35	15:50	20:15	0	-	some cat food left. Trap suspended from logs	N shore Elk, west of Hamsterly Beach
MT8	21/08/2017	22/08/2017	9	0470602E; 5375738N	1	19:35	15:52	20:17	0	-	some cat food left.	N shore Elk, west of Hamsterly Beach
MT9	21/08/2017	22/08/2017	10	0470569E; 5375743N	1.5	19:35	15:55	20:20	0	-	some cat food left.	N shore Elk, west of Hamsterly Beach
MT10	21/08/2017	22/08/2017		0470551E; 5375752N	1.5	19:35	15:59	20:24				N shore Elk, west of Hamsterly Beach
MT11	22/08/2017	23/08/2017	-	0471232E; 5373367N	-	17:35	10:32	16:57	PMB:9	38		E shore Beaver
MT12	22/08/2017	23/08/2017	-	0471232E; 5373367N	-	17:37	10:34	16:57	PMB:2	31, 36	south side of shore	E shore Beaver
MT13	22/08/2017	23/08/2017	-	0471235E; 5373346N	-	17:40	10:35	16:55	PMB:1	36	south side of shore	E shore Beaver



Trap Number	Date set	Date retrieved	Waypoint	UTM (Zone 10U)	Depth	Set time	Retrieval time	Soak Time	Species count	FLEN range or average	Comments	Location
MT14	22/08/2017	23/08/2017	-	0471235E; 5373346N	-	17:41	10:28	16:47	PMB:2	37	north side of shore by weeding machine	E shore Beaver
MT15	22/08/2017	23/08/2017	-	0471235E; 5373346N	-	17:43	10:30	16:47	PMB:2	36, 28	north side of shore by weeding machine	E shore Beaver
MT16	22/08/2017	23/08/2017	-	0469725E; 5375764N	-	19:35	18:25	22:50	0	-		Elk Lake N of fishing pier
MT17	22/08/2017	23/08/2017	-	0469720E; 5375804N	-	19:37	18:30	22:53	0	-		Elk Lake N of fishing pier
MT18	22/08/2017	23/08/2017	-	0469720E; 5375845N	-	19:40	18:33	22:53	0	-		Elk Lake N of fishing pier
MT19	22/08/2017	23/08/2017	-	0469731E; 5375895N	-	19:42	18:35	22:53	0	-		Elk Lake N of fishing pier
MT20	22/08/2017	23/08/2017	-	0469731E; 5375895N	-	19:45	18:37	22:52	0	-		Elk Lake N of fishing pier
MT21	23/08/2017	24/08/2017	-	0470755E; 5373568N	surface	10:15	11:30	25.45	PMB:6; LMB:1	PMB: 35; LMB: 36	retrieval time approximate - after L4 retrieved	Beaver, E side of smaller island
MT22	23/08/2017	24/08/2017	-	0470755E; 5373568N	surface	10:15	11:30	25.45	LMB:2	39, 43		Beaver, E side of smaller island
MT23	23/08/2017	24/08/2017	-	0470755E; 5373568N	surface	10:15	11:30	25.45	0	-	Not near weeds	Beaver, E side of smaller island
MT24	23/08/2017	24/08/2017	-	0470736E; 5373591N	surface	10:20	11:30	25.40	0	-	Blue-green algae obs.	Beaver, E side of smaller island
MT25	23/08/2017	24/08/2017	-	0470736E; 5373591N	surface	10:20	11:30	25.40	LMB:2; YP:3; PMB:16	LMB:51, 36; YP:14-15; PMB:31-36	Weeds	Beaver, E side of smaller island
MT26	23/08/2017	24/08/2017	-	0470010E; 5376062N	surface	18:35	18:31	23:56	0	-	Weeds below, trap suspended from logs	Elk Lake, north end east side

Trap Number	Date set	Date retrieved	Waypoint	UTM (Zone 10U)	Depth	Set time	Retrieval time	Soak Time	Species count	FLEN range or average	Comments	Location
MT27	23/08/2017	24/08/2017	-	0470010E; 5376062N	surface	18:38	18:32	23:54	0	-	Weeds below, trap suspended from logs	Elk Lake, north end east side
MT28	23/08/2017	24/08/2017	-	0470010E; 5376062N	surface	18:40	18:35	23:55	0	-	Weeds below, trap suspended from logs	Elk Lake, north end east side
MT29	23/08/2017	24/08/2017	-	0470010E; 5376062N	surface	18:45	18:37	23:52	0	-	Weeds below, trap suspended from logs	Elk Lake, north end east side
MT30	23/08/2017	24/08/2017	-	0470010E; 5376062N	surface	18:50	18:39	23:49	0	-	Weeds below, trap suspended from logs	Elk Lake, north end east side
MT31	24/08/2017	25/08/2017	30	0469852E; 5376237N	surface	18:42	17:10	22:28	YP:4	44	Dense weeds and lily pads, south of boat launch	Elk Lake, north end west side
MT32	24/08/2017	25/08/2017	30	0469852E; 5376237N	surface	18:43	17:10	22:27	0	-	Dense weeds and lily pads, south of boat launch	Elk Lake, north end west side
MT33	24/08/2017	25/08/2017	31	0469852E; 5376237N	surface	18:45	17:10	22:25	PMB:3	31-59	Dense weeds and lily pads, south of boat launch	Elk Lake, north end west side
MT34	24/08/2017	25/08/2017	31	0469852E; 5376237N	surface	18:46	17:10	22:24	PMB:6; YP:1	PMB:36, YP:46	Dense weeds and lily pads, south of boat launch	Elk Lake, north end west side
MT35	24/08/2017	25/08/2017	32	0469852E; 5376237N	surface	18:48	17:10	22:22	PMB:25; YP:1	PMB: 36, YP: 47	Dense weeds and lily pads, south of boat launch	Elk Lake, north end west side
MT36	24/08/2017	25/08/2017	27	0471325E; 5375340N	surface	19:20	16:50	21:30	0		By highway (rock wall)	Elk Lake, east side

Trap Number	Date set	Date retrieved	Waypoint	UTM (Zone 10U)	Depth	Set time	Retrieval time	Soak Time	Species count	FLEN range or average	Comments	Location
MT37	24/08/2017	25/08/2017	27	0471325E; 5375340N	surface	19:21	16:50	21:29	0		By highway (rock wall)	Elk Lake, east side
MT38	24/08/2017	25/08/2017	28	0471325E; 5375340N	surface	19:23	16:50	21:27	0		By highway (rock wall)	Elk Lake, east side
MT39	24/08/2017	25/08/2017	28	0471325E; 5375340N	surface	19:24	16:50	21:26	0		By highway (rock wall)	Elk Lake, east side
MT40	24/08/2017	25/08/2017	29	0471325E; 5375340N	surface	19:26	16:50	21:24	0		By highway (rock wall)	Elk Lake, east side

**Water Quality Field Data**

Project	1877-003	Elk Lake Site WQ-E1	(WP 25)							
Matrix	Surface water									
Entered By	Nina Barton									
Date Entered	31/08/2017	359								
Form Version										
Sample ID	Sample Date	Location ID	Sample Time	Field Depth Below Water	Field Depth Below Water	Field pH	Field Temperature	Field Dissolved Oxygen	Field Turbidity	Field Notes
e.g. SW06-100	YYYY-MM-DD	UTM	HH24:MM	m	ft	pH	°C	mg/l	NTU	text
WQ-E1-001	25/08/2017	0470709E; 5375323N	16:00	0.5		8.74	22.56	9.94	N/A	
WQ-E1-002	25/08/2017	0470709E; 5375323N	16:05	1		8.74	22.56	9.98		
WQ-E1-003	25/08/2017	0470709E; 5375323N	16:08	2		8.74	22.56	10		
WQ-E1-004	25/08/2017	0470709E; 5375323N	16:10	3		8.74	22.52	10.01		
WQ-E1-005	25/08/2017	0470709E; 5375323N	16:12	4		8.75	22.42	10.07		
WQ-E1-006	25/08/2017	0470709E; 5375323N	16:14	5		8.74	22.3	10.05		
WQ-E1-007	25/08/2017	0470709E; 5375323N	16:16	6		8.7	22.1	9.91		Secchi depth = 6.3 m
WQ-E1-008	25/08/2017	0470709E; 5375323N	16:18	7		8.07	17.71	11.31		
WQ-E1-009	25/08/2017	0470709E; 5375323N	16:20	8		7.82	13.72	6.78		
WQ-E1-010	25/08/2017	0470709E; 5375323N	16:22	9		7.48	11.99	3.78		
WQ-E1-011	25/08/2017	0470709E; 5375323N	16:24	10		7.18	11.66	0.8		
WQ-E1-012	25/08/2017	0470709E; 5375323N	16:30	11		7.19	10.32	0.43		Max depth = 12m

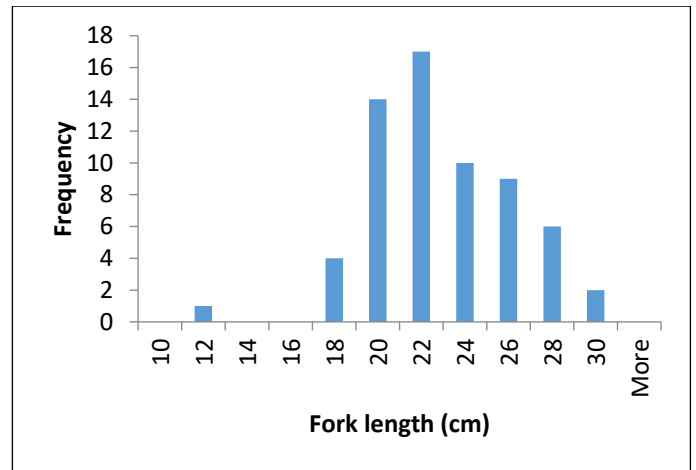
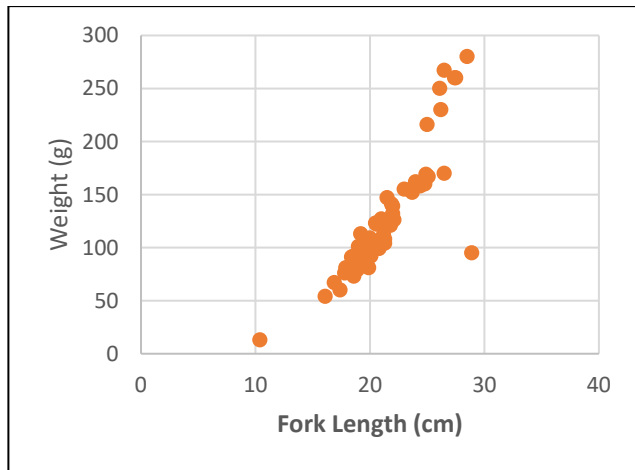
Project	1877-003	Elk Lake Site WQ-E2	(WP 26)							
Matrix	Surface water									
Entered By	Nina Barton									
Date Entered	31/08/2017	351								
Form Version										
Sample ID	Sample Date	Location ID	Sample Time	Field Depth Below Water	Field Depth Below Water	Field pH	Field Temperature	Field Dissolved Oxygen	Field Turbidity	Field Notes
<b>e.g. SW06-100</b>	YYYY-MM-DD	UTM Zone 10U	HH24:MM	M	ft	pH	°C	mg/l	NTU	text
WQ-E2-001	25/08/2017	0470223E; 5375640N	16:35	0.5		8.7	22.58	9.81	N/A	
WQ-E2-002	25/08/2017	0470223E; 5375640N	16:38	1		8.73	22.59	9.86		
WQ-E2-003	25/08/2017	0470223E; 5375640N	16:40	2		8.74	22.6	9.89		
WQ-E2-004	25/08/2017	0470223E; 5375640N	16:42	3		8.74	22.58	9.91		
WQ-E2-005	25/08/2017	0470223E; 5375640N	16:44	4		8.74	22.57	9.92		
WQ-E2-006	25/08/2017	0470223E; 5375640N	16:46	5		8.74	22.55	9.89		
WQ-E2-007	25/08/2017	0470223E; 5375640N	16:48	6		8.74	22.54	9.91		Secchi depth = 6.0 m
WQ-E2-008	25/08/2017	0470223E; 5375640N	16:50	7		8.49	16.47	11.99		
WQ-E2-009	25/08/2017	0470223E; 5375640N	16:52	8		7.92	13.17	5.16		
WQ-E2-010	25/08/2017	0470223E; 5375640N	16:54	9		7.51	11.31	2.2		
WQ-E2-011	25/08/2017	0470223E; 5375640N	16:56	10		7.53	10.12	0.4		
WQ-E2-012	25/08/2017	0470223E; 5375640N	16:58	11		7.07	8.97	0.4		
WQ-E2-013	25/08/2017	0470223E; 5375640N	17:00	12		7.07	8.77	0.38		Max depth = 13m

<b>Project</b>	1877-003	<b>Beaver Lake Site WQ-B1</b>	(WP 24)							
<b>Matrix</b>	<b>Surface water</b>									
<b>Entered By</b>	Nina Barton									
<b>Date Entered</b>	31/08/2017	326								
<b>Form Version</b>										
<b>Sample ID</b>	<b>Sample Date</b>	<b>Location ID</b>	<b>Sample Time</b>	<b>Field Depth Below Water</b>	<b>Field Depth Below Water</b>	<b>Field pH</b>	<b>Field Temperature</b>	<b>Field Dissolved Oxygen</b>	<b>Field Turbidity</b>	<b>Field Notes</b>
<b>e.g. SW06-100</b>	YYYY-MM-DD	UTM	HH24:MM	M	ft	pH	°C	mg/l	NTU	text
WQ-B1-001	25/08/2017	0471047E; 5373415N	15:44	0.5		9.08	22.61	10.02	N/A	
WQ-B1-002	25/08/2017	0471047E; 5373415N	15:42	1		9.06	22.57	9.86		
WQ-B1-003	25/08/2017	0471047E; 5373415N	15:40	2		8.95	21.64	9.4		Secchi depth = 1.56 m
WQ-B1-004	25/08/2017	0471047E; 5373415N	15:38	3		7.79	21.17	6.1		
WQ-B1-005	25/08/2017	0471047E; 5373415N	15:37	4		6.96	16.27	0.49		
WQ-B1-006	25/08/2017	0471047E; 5373415N	15:35	5		6.7	13.11	0.58		
WQ-B1-007	25/08/2017	0471047E; 5373415N	15:30	5.5		6.68	12.7	0.6		Max depth = 6m

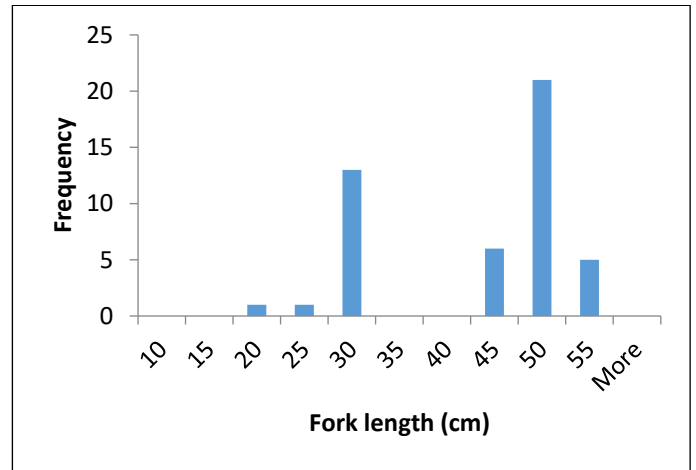
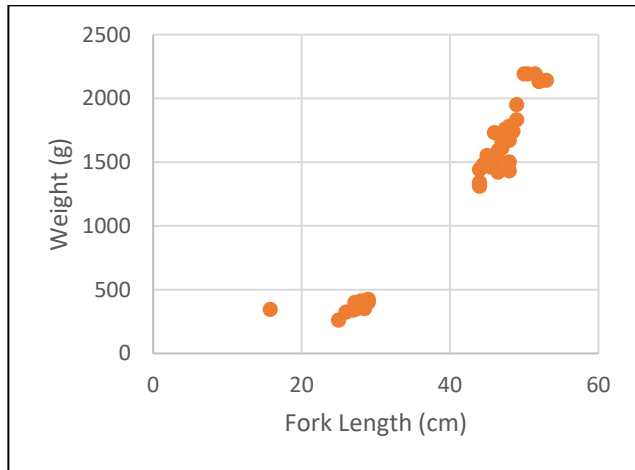
# **APPENDIX B**

## **Length-Weight Relationships and Length Frequency Histograms**

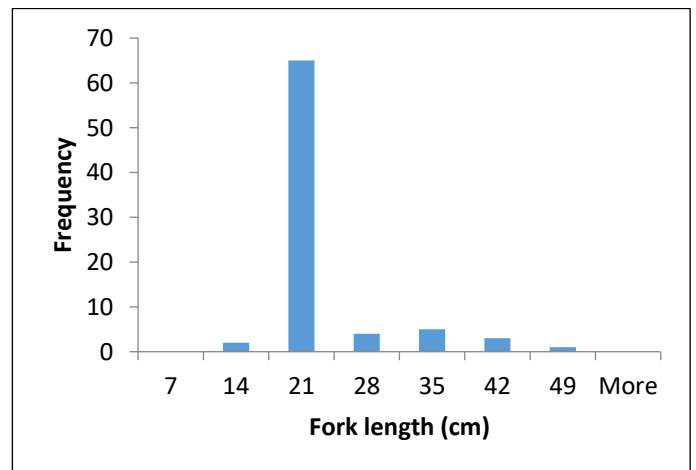
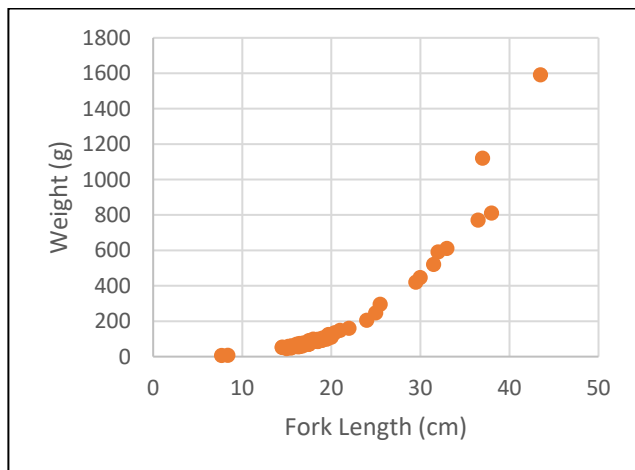
**Bullhead**



**Carp**

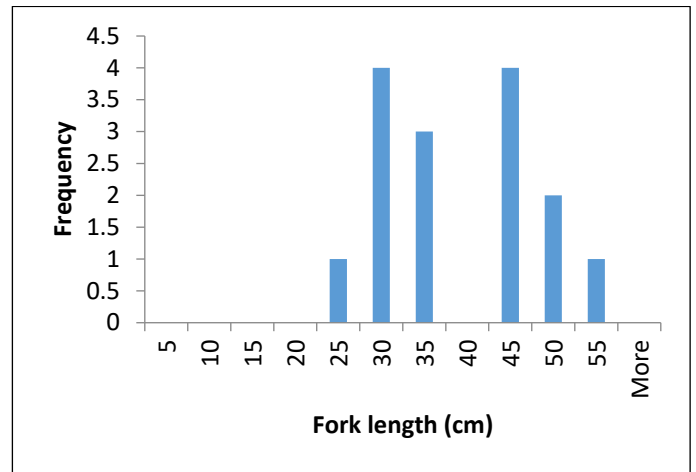
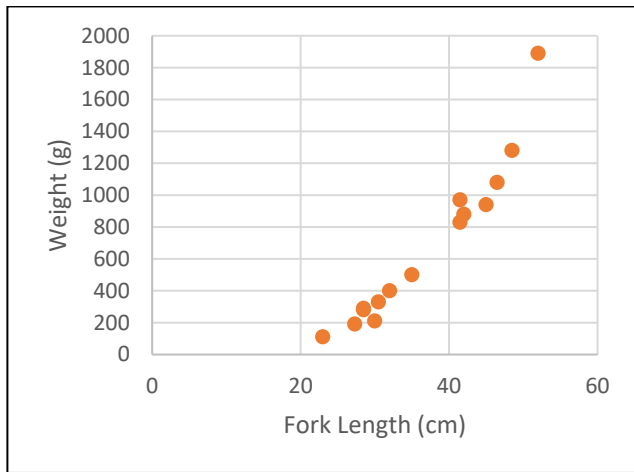


**Largemouth bass**

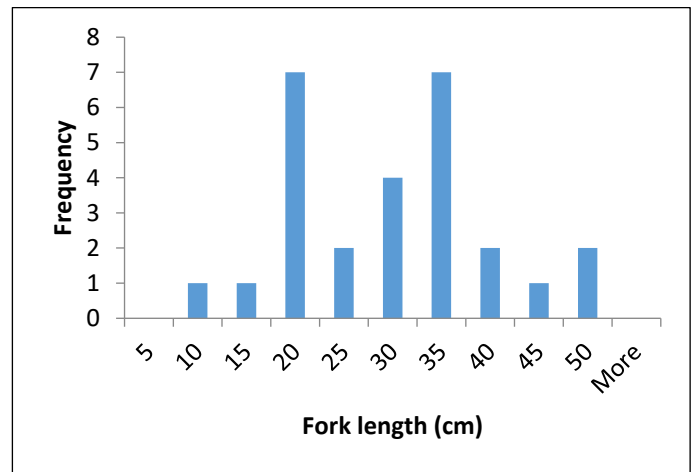
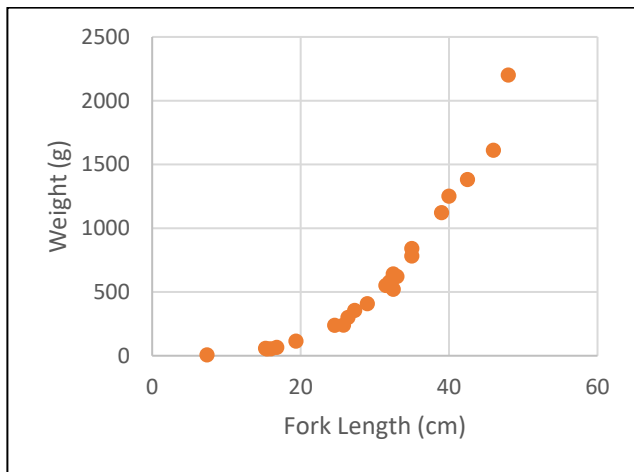




**Rainbow trout**



**Smallmouth bass**



**Yellow perch**

