

2023 Cultus Lake Smallmouth Bass Management Summary Report:

Pilot Year One of a 10-Year Suppression Plan

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Table of Contents

Acknowledgments.....	ii
List of Tables and Figures	iv
1.0 Introduction	1
1.1 Background and Objectives.....	1
2.0 Methodology.....	2
2.1 Nest Surveys & Destruction and Male Suppression.....	2
2.1.1 Nest Surveys & Destruction	2
2.1.2 Male Removal	2
2.2 Spring Marking and Recapture.....	2
2.2.1 Spring Marking.....	2
2.2.2 Recapture	3
2.3 Creel Survey and Online Voluntary Survey Methods	4
2.3.1 Creel Survey	4
2.3.2 Voluntary Online Survey Methods	4
3.0 Results	5
3.1 Nest Surveys & Destruction	5
3.2 Marking and Recapture.....	6
3.2.1 Marking	6
3.2.2 Recapture	8
3.3 Creel Survey and Voluntary Online Survey	9
3.3.1 Creel Survey	9
3.3.2 Voluntary Online Survey	12
4.0 Discussion and Recommendations	13
4.1 Nests Surveys and Destruction	13
4.2 Marking and Male Removal	13
4.3 Creel Surveys and Public Awareness of Invasive Species.....	13
6.0 Literature Cited	15

List of Tables and Figures

Table 1 Mean, minimum, and maximum weight and fork length of SMB captured during spring marking at Cultus Lake, BC.....	7
Table 2 GPS locations of nine acoustic receivers deployed on July 23 rd , 28 th , and August 23 rd , 2023 in Cultus Lake, BC.....	7
Table 3 Mean, minimum, and maximum weight and fork length of SMB captured during the Cultus Lake 2023 Pikminnow and SMB Derby.....	8
Table 4 Mean, minimum, and maximum weight and fork length of SMB captured during the three organised angling recapture sessions in the Cultus Lake, 2023.....	9
Table 5 The total number of days surveyed at each site and during each shift during the 2023 Cultus Lake SMB creel survey.....	9
Figure 1 Total smallmouth bass nests surveyed by date and lifestage at Cultus Lake, BC, May 16 th , 2023 – June 15 th , 2023.....	5
Figure 2 Map of smallmouth bass nests surveyed at Cultus Lake from May 16 th , 2023 – June 15 th , 2023. .	5
Figure 3 Total daily smallmouth bass catch by either angling or electroshocking at Cultus Lake, BC from June 1 st , 2023 – June 10 th , 2023.....	6
Figure 4 Total bass caught, PIT and acoustic tagged, recaptured, and killed at Cultus Lake, BC during spring marking June 1 st , 2023-June 10 th 2023.	6
Figure 5 Locations of nine acoustic receivers deployed on July 23 rd , 28 th , and August 23 rd , 2023 in Cultus Lake, BC.....	7
Figure 6 Fish catch totals from the Eastern Fraser Valley Lions Club Cultus Lake Pikeminnow and SMB Derby 2012-2023.	8
Figure 7 The percentage of angling groups using each site during the 2023 Cultus Lake SMB Creel Survey.	9
Figure 8 The percentage of angling groups surveyed during each shift time during the 2023 Cultus Lake SMB creel survey.....	10
Figure 9 The percentage of angling groups using each vessel type during the 2023 Cultus Lake SMB creel survey.....	10
Figure 10 The percentage of angling groups reporting each level of angling trip satisfaction during the 2023 Cultus Lake SMB creel survey.....	11
Figure 11 The percentage of participants in each age class during the 2023 Cultus Lake SMB creel survey.	11
Figure 12 The percentage of angling groups with invasive species education awareness during the 2023 Cultus Lake SMB creel survey.....	12
Figure 13 The percentage of angling groups preferred species to catch during the 2023 Cultus Lake SMB creel survey.	12

1.0 Introduction

1.1 Background and Objectives

With the introduction of smallmouth bass (*Micropterus dolomieu*; SMB) into Cultus Lake, BC in 2017 the BC Ministry of Water, Land and Resource Stewardship has been working collaboratively with the Department of Fisheries and Oceans and researchers from Simon Fraser University to determine ways to successfully approach smallmouth bass management at Cultus Lake.

The introduction of SMB is of particular concern given the presence of Cultus Lake Sockeye Salmon (*Oncorhynchus nerka*) (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status Endangered) and Cultus Lake Coastrange Sculpin (*Cottus aleuticus*) (Species at Risk Act (SARA) and COSEWIC status Threatened). Smallmouth bass are known to have negative impacts in other salmon-bearing habitats (Fayram and Sibley, 2000; Rieman et al., 1991) and diet analysis of smallmouth bass at Cultus Lake (Margetts, 2022) showed the presence of a range of native fish species. Anecdotal insight from long-term residents at Cultus Lake describes fewer observations of native fish activity in the lake (P. Lemp, Personal Communication, June 2023). In 2023 DFO biologists conducted beach seining around Cultus Lake as part of a regular fish monitoring program and found that native fish numbers were considerably lower than in years prior to suspected smallmouth bass introduction (L. Ponn, Personal Communication, June 2023). All of this suggests that the native fish community at Cultus Lake is vulnerable to negative impacts from smallmouth bass now residing in the lake.

When considering a larger scope, Sweltzer Creek, the outlet stream for Cultus Lake, feeds into the Chilliwack River which feeds into the Fraser River. This direct connection to the Fraser system poses the risk of smallmouth bass quickly populating other water bodies in the Fraser Valley which, although have a wide distribution of Largemouth bass (*Micropterus salmoides*), currently are still unpopulated by SMB. Although SMB pose a threat to native fish populations, they are also a highly prized sport fish (Carey, et al., 2011). With the high annual visitation to Cultus Lake and with increasing awareness of SMB presence in the lake, there is considerable risk of the Cultus Lake SMB population becoming the source population for anglers wanting to distribute smallmouth bass to other fishing locations.

In 2023, a 10-year suppression plan was developed by researchers at Simon Fraser University. With the goal of maximizing protection for the native fish community as well as maximizing support from the angling community, a modelling experiment was designed to simulate the outcome of ten unique SMB suppression strategies. These strategies combined practical management efforts including SMB nest destruction, SMB male removal, and increased clarity and restrictions in SMB fishing regulations (Van Poorten et al., 2023).

In the spring 2023, year one of the suppression plan was piloted. Based on the results of the modelling analysis, the 2023 field season plan included nest surveys & destruction and male removal where the goal was to suppress population growth through the objectives of further identifying where smallmouth bass are spawning at Cultus Lake, destroying nests, and terminating smallmouth bass in all life stages that were encountered.

In addition to these suppression strategies three monitoring programs were initiated: spring SMB marking, a creel survey, and a voluntary online survey. The goals of spring marking, which included inserting both PIT and acoustic tags, were to explore the effectiveness of SMB suppression by different

methods and to help observe the population change over time. The goals of the creel survey were to establish proportions of captured SMB harvested by anglers, provide data needed to run estimation models in future years, and to help to improve estimations of angling pressure on SMB. Additional goals of the creel survey and also the voluntary online survey were to determine the state of knowledge of SMB at Cultus Lake, educate the public on the implications of SMB in the lake, understand angler utility for fish in the lake, and predict changes in suppression-related behavior.

The following report details the above management actions and presents results of the 2023 field season as well as offers a discussion and recommendations for the 2024 field season.

2.0 Methodology

2.1 Nest Surveys & Destruction and Male Suppression

2.1.1 Nest Surveys & Destruction

Smallmouth bass nest surveys were conducted from May 16th to June 15th, 2023, with the aim of 1-3 surveys per week. Each survey included 1-2 snorkeling swimmers followed by a safety and data collection person on shore or by kayak. The snorkelers swam transects following the shoreline 1-4 m deep, depending on visibility. Snorkelers looked for nest signs such as excavated gravel pits 0.1 m – 0.5 m in diameter and territorial adult males. At each nest the GPS location, depth of nest, diameter of nest, presence of guarding male, adjacent structure, and activity completed were recorded. Activities included observations or nest destruction. Nest destruction was completed by excavating the gravel using a garden rake. Once most of the nest's lifestage were fry, and after fry were observed dispersing from the nest area, surveys were discontinued to focus on other project priorities.

Survey location priority was given to the Main Beach/Sunnyside Campground area where SMB are known to spawn (Margetts, 2022). Other exploratory surveys were done in areas where potential nests had been identified by boat during spring marking.

2.1.2 Male Removal

Due to time constraints and resource limitations male removal efforts were not included in the 2023 field season.

2.2 Spring Marking and Recapture

2.2.1 Spring Marking

Electrofishing was conducted for ten hours daily from June 1st – 10th, 2023. Equipment included an 1875 SK Haborcraft boat with a 5.0 GPP onboard electrofisher unit. The boat also housed a holding tank which was filled with lake water each morning and the temperature monitored throughout the day to ensure the held fish were not lacking oxygen. The crew included the boat/electrofisher operator and 1-2 long-pole dip netters who stood at the bow of the boat. The team moved in a clockwise direction around the lake covering the nearshore area from approximately 1-5 m in depth. The operator controlled the electrofisher current application, while the dip netters observed fish activity and selectively removed SMB from the water, collecting and then transferring them into the holding tank. Any non-SMB fish were left in the water to recover undisturbed.

While electroshocking was in progress a second boat and crew were conducting fish processing. SMB being held in the electrofishing boat were transferred into an aerated holding tank on the processing

boat where a crew of 2-3 people conducted fish processing. Fish processing included measuring the length and weight, scanning for PIT tags with a Biomark HPR lite PIT tag reader, and visually scanning for acoustic tag incisions, and removing a selection of 5 scales which were pressed into a scale booklet for future analysis. If no preexisting PIT tags were found a new PIT tag was injected into the ventral side of the body, anterior to the pelvic fins. The fish was then scanned with a Biomark HPR lite PIT tag reader and the tag number was recorded. After day one a size class distribution was determined and from this a selection of 25 fish representing all age classes were used for acoustic tag insertion. Vemco V13 and V9 69 kHz acoustic tags were used to accommodate the different sized fish. The acoustic tag surgery was conducted by trained DFO staff and fish health was inspected by a qualified vet. Fish were anesthetized using a clove oil-ETHO-water solution. A scalpel was used to make a small incision slightly off center of the fish's ventral line, anterior to the anus. The tag was inserted forward into the fish body. The incision was closed with two stitches using a needle and suture line. Throughout the surgery, fresh lake water was pumped over the mouth and gills of the fish. Once the surgery was complete fish were held in an aerated recovery tank until safe for release.

Angling marking was completed by two avid anglers, Nick Basok and Peter Buck. The anglers fished for 6-8 hours per day beginning at 7:30 am and during the same days as electrofishing. The anglers processed and PIT tagged their catch via the same process described above or, when time allowed, would pass their catch onto the DFO boat for processing.

Acoustic receivers were deployed by boat with the assistance of DFO staff. Array set up included two cinderblock weights chained together and connected to braided line leading up to a 1.0-2.5 m subsurface float. Floats were labelled with DFO contact information. Acoustic receivers were either mounted directly to the braided line, aiming for 20-25 m depth or secured into steel cages mounted directly on top of the cinderblock weights.

2.2.2 Recapture

Cultus Lake Pikeminnow and Smallmouth Bass Derby

The Eastern Fraser Valley Lions Club hosts an annual Father's Day Pikeminnow fishing derby at Cultus Lake. Since SMB introduction into Cultus the derby, catch results have been shifting from exclusively pikeminnow to nearly half the catch being SMB (Figure 6). SMB catch results in 2023 were used as an opportunity to gather concentrated recapture data from the June 1st – 10th marking session.

The 2023 derby event was held on Saturday June 17th from dawn until 2:00 pm with all catch needing to be submitted to the measuring station by 12:00 pm. Each SMB that was submitted was weighted, measured, scanned for PIT tags with a Biomark HPR lite PIT tag reader, and visually scanned for acoustic tag incisions.

Angling Recapture

On August 1st, 10th, and 21st 2023 anglers Nick Basok and Peter Buck contributed information from their recreational SMB angling trips to our recapture data. For each trip, any SMB captured were weighted, measured, and scanned for PIT tags with a Biomark HPR lite PIT tag reader, and visually scanned for acoustic tag incisions.

2.3 Creel Survey and Online Voluntary Survey Methods

2.3.1 Creel Survey

Annual assessments of the total fishing effort, harvest rates, harvest size, and catch rate of SMB at Cultus Lake, British Columbia were captured via standard access-point creel surveys. All bass retained by surveyed anglers were processed which included measuring length and weight, scanning for PIT tags with a Biomark HPR lite PIT tag reader, and visually scanning for acoustic tag incisions.

Creel survey data collection followed the standard British Columbia protocol. Catch and fish data was collected on iPads into a custom generated form in the Numbers App.

Site and Schedule

Three survey sites were designated at Cultus Lake:

1. Main Beach and Sunnyside Campground
2. Jade Bay Boat Launch and Entrance Bay Day Use Area
3. Maple Bay Boat Launch and Maple Bay Day Use Area

These sites were selected based on known angling activity at Cultus Lake. Main Beach and Sunnyside Campground have a dense dock system that both residents and visitors use to fish from. A trail along the beach allowed for quick access and good visibility of use. Both the Cultus Lake Marina and Sunnyside Campground boat launches were monitored, Main Beach is open year-round, and Sunnyside Campground is open from the 2nd Sunday in April until September 30th. Jade Bay Boat Launch is open 07:00 am until dusk year-round and Entrance Bay Day Use Area is open from 07:00 am until dusk March 31st - October 15th. Monitoring between areas was done by the connection trail along the beach. Similarly, Maple Bay Boat Launch and Maple Bay Day Use Area are open from 07:00 am until dusk March 31st - October 15th and monitoring between the two areas was done by the connection trail along the beach. Although surveys were scheduled outside some of the sites open times, these areas were still accessible by walk-ins.

The survey was run from July 2nd – October 28th, 2023. Survey dates were randomly selected and based on an average of 14 survey days per month: half on weekdays and half on weekends/statutory holidays. Each of these days included a 4–5-hour shift, one of three timing options:

1. 07:00 – 11:00
2. 11:00 – 16:00
3. 16:00 – 21:00

Site and shift selection for each day were also randomly selected for each survey day.

INSTANTANEOUS COUNT OF EFFORT (ICE)

Midway through each shift an instantaneous count of effort (ICE) was conducted. Using binoculars, the ICE included a count of the total number of angling boats, shore, and dock anglers currently at the lake, taken from distinct viewing sites at the lake.

3.3.2 Voluntary Online Survey Methods

The voluntary online survey was designed and built in collaboration between Simon Fraser University and the BC Ministry of Water, Lands, and Resource Stewardship and was initiated in the fall of 2023.

3.0 Results

3.1 Nest Surveys & Destruction

A total of 108 nests were surveyed: 14 with eggs, 8 with alevin, 24 with fry, and 62 empty (Figure 1). The presence of males guarding nests decreased as the lifestage developed with 86% being guarded in the egg stage, 63% in the alevin stage, 44% in the fry stage, and 28% on empty nests. Most of the nests were in the Main Beach/Sunnyside Campground area however empty nests in high density were also found during exploratory surveys along the east shore between Maple Bay and Spring Bay (Figure 2). All nests encountered were destroyed.

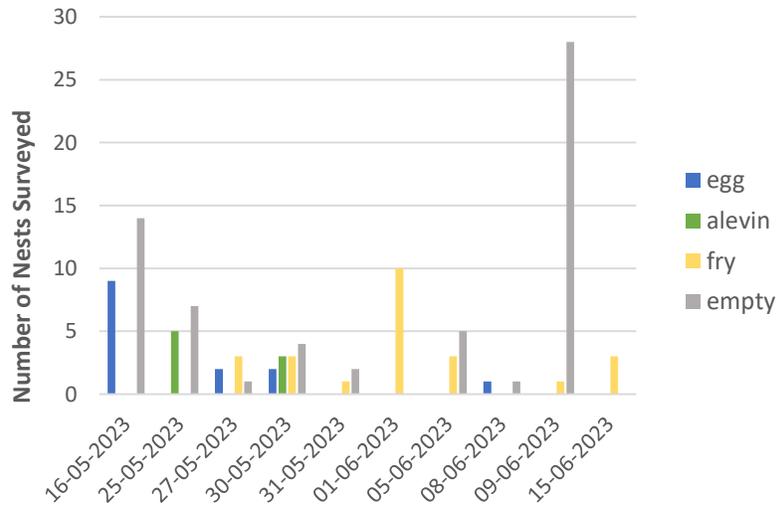


Figure 1 Total smallmouth bass nests surveyed by date and lifestage at Cultus Lake, BC, May 16th, 2023 – June 15th, 2023.

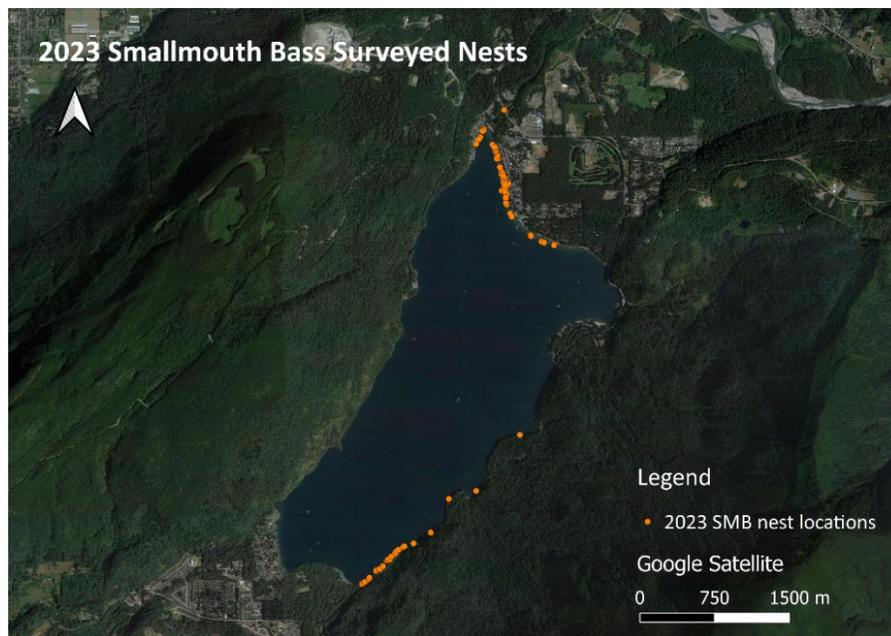


Figure 2 Map of smallmouth bass nests surveyed at Cultus Lake from May 16th, 2023 – June 15th, 2023.

3.2 Marking and Recapture

3.2.1 Marking

Throughout the marking session the electroshocking crew made four circuits of the lake. A total of 982 SMB were captured, 41 of these were recaptures and 39 were mortalities (Figure 3 and Figure 4). A total of 903 SMB were PIT tagged and 25 were also acoustic tagged, all of these were released.

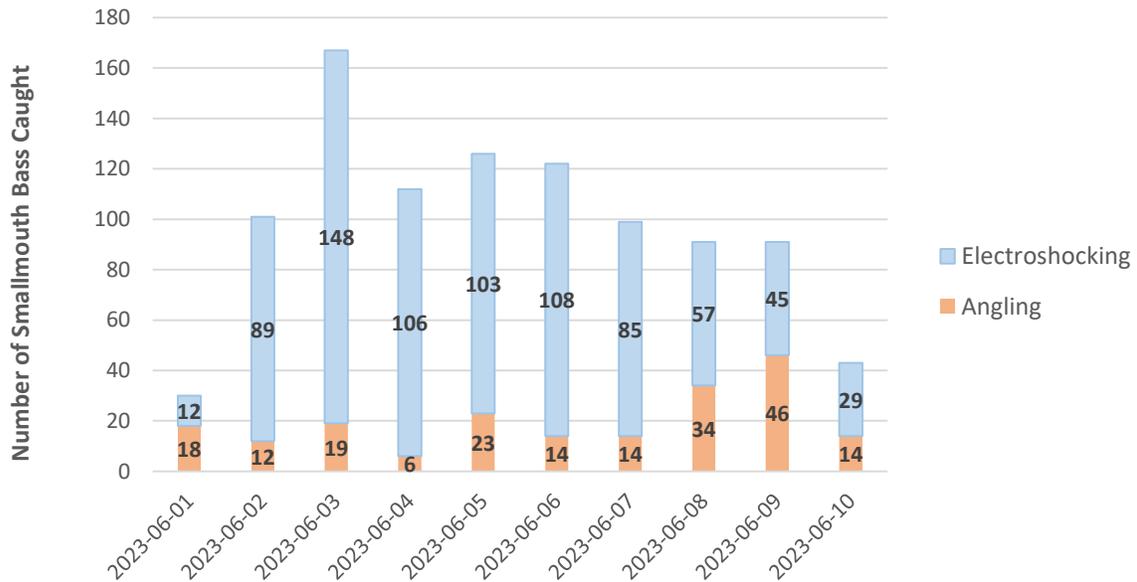


Figure 3 Total daily smallmouth bass catch by either angling or electroshocking at Cultus Lake, BC from June 1st, 2023 – June 10th, 2023.

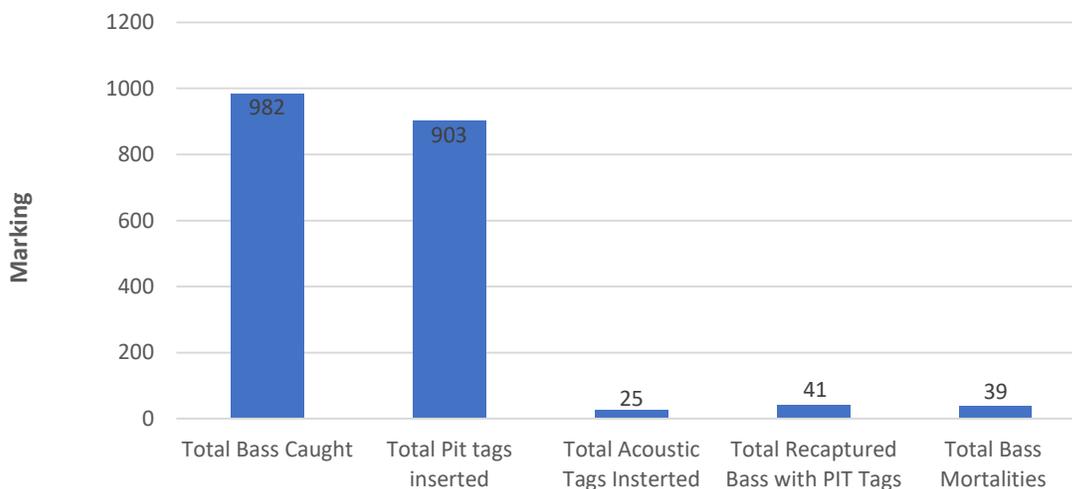


Figure 4 Total bass caught, PIT and acoustic tagged, recaptured, and killed at Cultus Lake, BC during spring marking June 1st, 2023-June 10th 2023.

During the marking session mean SMB weight and length were 85 g and 143 mm respectively, with a range in size from 25 -1100 g and 58-396 mm (Table 1).

Table 1 Mean, minimum, and maximum weight and fork length of SMB captured during spring marking at Cultus Lake, BC.

	mean	min	max
weight (g)	85	25	1100
fork length (mm)	143	58	396

Eight acoustic receivers were deployed in June and one receiver was deployed in August (Figure 5, Table 2). Arrays R1, R2, R3, R4, and R5 were nearshore with R1 and R2 secured in a cage on lake bottom and R3, R4 and R5 suspended at 6-8 m depth. Arrays R6, R7, and R8 were deepwater deployments, suspended at 20-25m deep. R9 was deployed just downstream of the DFO fish gate on Sweltzer creek, secured in a cage on creek bottom.

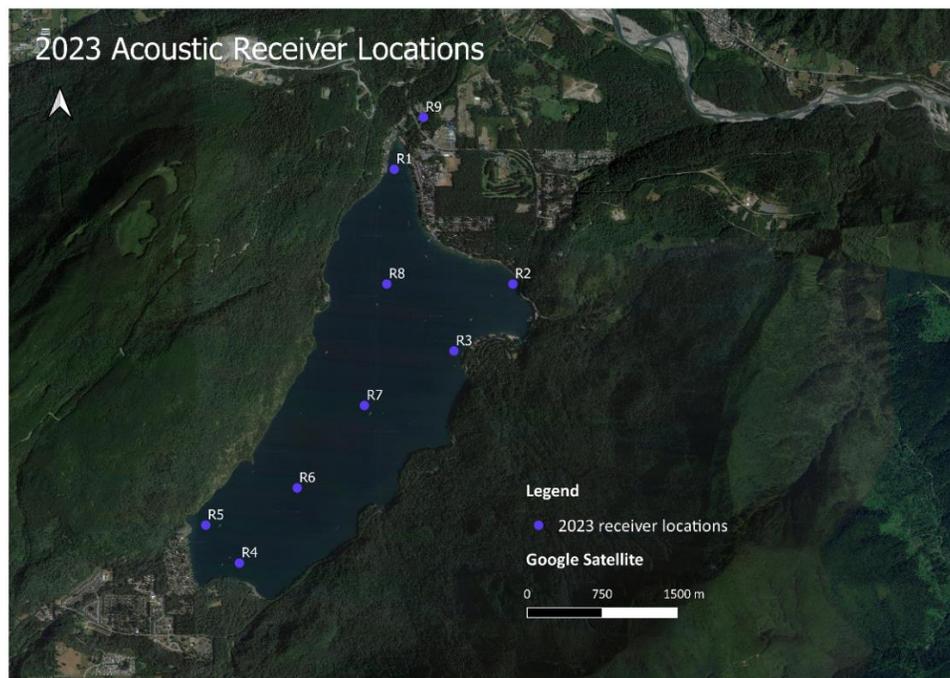


Figure 5 Locations of nine acoustic receivers deployed on July 23rd, 28th, and August 23rd, 2023, in Cultus Lake, BC.

Table 2 GPS locations of nine acoustic receivers deployed on July 23rd, 28th, and August 23rd, 2023, in Cultus Lake, BC.

receiver name	deployment date	latitude	longitude
R1	2023-06-23	49°04.396' N	121°58.931' W
R2	2023-06-23	49°03.780' N	121°57.958' W
R3	2023-06-28	49°03.420' N	121°58.441' W
R4	2023-06-28	49°02.280' N	122°00.201' W
R5	2023-06-28	49°02.484' N	122°00.477' W
R6	2023-06-23	49°02.684' N	121°59.727' W
R7	2023-06-23	49°03.127' N	121°59.175' W
R8	2023-06-23	49°03.780' N	121°58.992' W
R9	2023-08-23	49°04.675' N	121°58.691' W

All nine acoustic receivers were retrieved for data download in October 2023 and redeployed in approximately the same locations immediately after download was complete.

Brief analysis of this data shows that a total of 282,947 detections were made from 37 unique acoustic tags (transmitters): 21 from the 2023 spring marking session and the 15 presumably from transmitter deployments during the graduate work by Wendy Margetts from 2020-2022. Of the 25 tags deployed during the 2023 spring marking, two fish were not detected but had been removed during the 2023 Cultus Lake Derby. The other two undetected fish have no record of removal from any of the recapture data received to date. Two other tagged fish were removed by a local angler at dock 17 on July 25th and 28th, 2023 and prior to this were both regularly detected at station R1.

3.2.2 Recapture

Cultus Lake Pikeminnow and Smallmouth Bass Derby

During the 2023 derby 239 bass were processed and 24 found to have PIT tags and two with acoustic tags. SMB captured during the pikeminnow and bass derby, had a mean weight and length of 141 g and 201 mm with a range in size from 16 -1206 g and 98-405 mm (Table 3).

Table 3 Mean, minimum, and maximum weight and fork length of SMB captured during the Cultus Lake 2023 Pikminnow and SMB Derby.

	Mean	min	Max
weight (g)	141	16	1206
fork length (mm)	201	98	405

Derby catch results contributed by the Eastern Fraser Valley Lions Club from 2016-2023 show SMB catch to have been only 1 in 2018, 28 in 2019, 210 in 2022 (Figure 6).

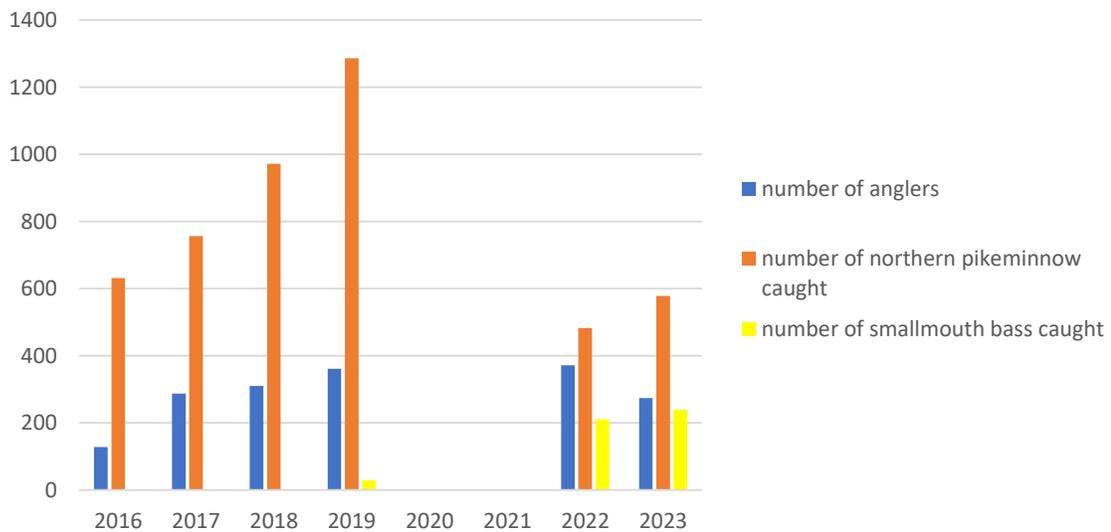


Figure 6 Fish catch totals from the Eastern Fraser Valley Lions Club Cultus Lake Pikeminnow and SMB Derby 2012-2023.

Angling Recapture

Throughout the three angling recapture sessions, 186 SMB were caught, eight with PIT tags. SMB captured had a mean weight and length of 144 g and 212 mm respectively and ranged in size from 26 - 1220 g and 130-435 mm (Table 4).

Table 4 Mean, minimum, and maximum weight and fork length of SMB captured during the three organised angling recapture sessions in the Cultus Lake, 2023.

	mean	min	Max
weight (g)	144	26	1220
fork length (mm)	212	130	435

3.3 Creel Survey and Voluntary Online Survey

3.3.1 Creel Survey

Forty nine creel surveys were conducted from July 2nd – October 28th, 2023. There were 17 survey days held at sites 1 and 3, and 15 survey days at site 2 (Table). There were also 16 surveys held during shifts 1 and 3, and 17 during shift 2.

Table 5 The total number of days surveyed at each site and during each shift during the 2023 Cultus Lake SMB creel survey.

	site	shift
1	17 days	16 days
2	15 days	17 days
3	17 days	16 days

The following data was summarized by a percentage of the total angler groups of which there were 96. Angler group use at each site was 32.29%, 37.5%, and 30.21% at sites 1, 2, and 3 respectively (Figure 7).

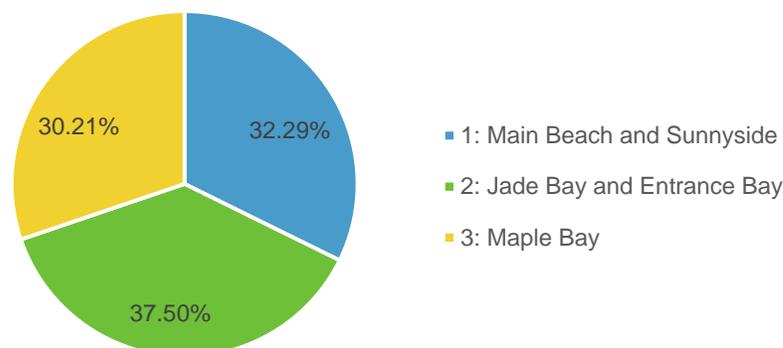


Figure 7 The percentage of angling groups using each site during the 2023 Cultus Lake SMB Creel Survey.

Angler group use during each shift was 20.83%, 44.79%, and 34.38% during shifts 1, 2, and 3 respectively (Figure 8).

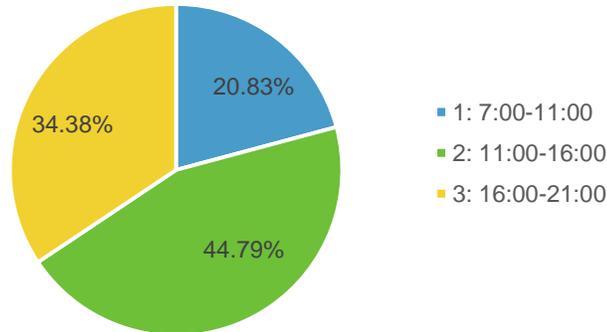


Figure 8 The percentage of angling groups surveyed during each shift time during the 2023 Cultus Lake SMB creel survey.

Of these groups 65.63% were angling off the docks, 17.71% were angling from boat and 16.67% were angling from shore (Figure 9).

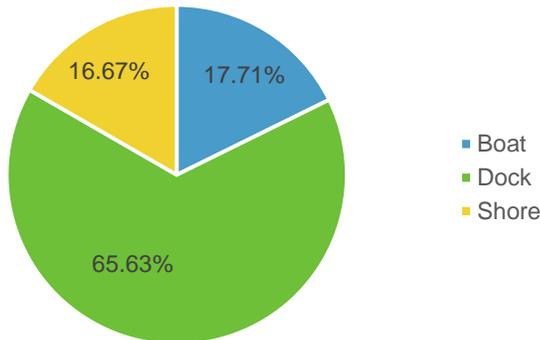


Figure 9 The percentage of angling groups using each vessel type during the 2023 Cultus Lake SMB creel survey.

Of the 96 angling groups interviewed, fishing experience satisfaction was determined for 63. Of these, 15.87% were not satisfied, 68.25% were satisfied, and 15.87% were very satisfied (Figure 10).

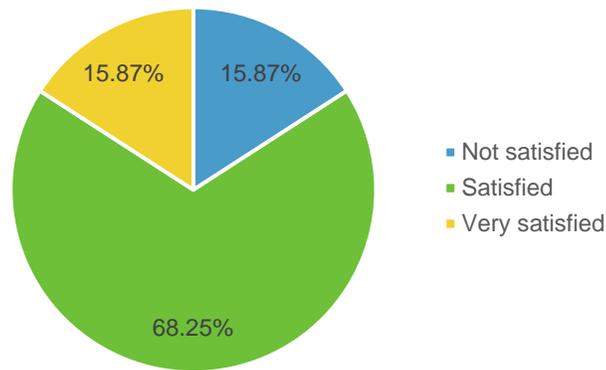


Figure 10 The percentage of angling groups reporting each level of angling trip satisfaction during the 2023 Cultus Lake SMB creel survey.

Of the 153 anglers surveyed, 147 were residents, 3 were non-residents, and 3 chose not to participate in the survey. Of the 150 participating anglers, 47 were under 16 years of age, 101 were ages 16-65, and 2 were older than 65 years (Figure 11).

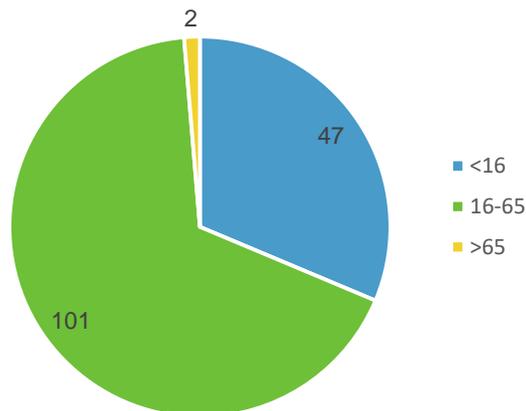


Figure 11 The percentage of participants in each age class during the 2023 Cultus Lake SMB creel survey.

Three invasive species education awareness questions were asked during the creel survey interview (Figure 12). Of the 93 angling groups who responded, 81% were aware of the illegal introduction of SMB into Cultus Lake, 77% were aware that the movement of live fish and using live fish for bait is illegal, and 49% were aware of the Clean, Drain, Dry practices.

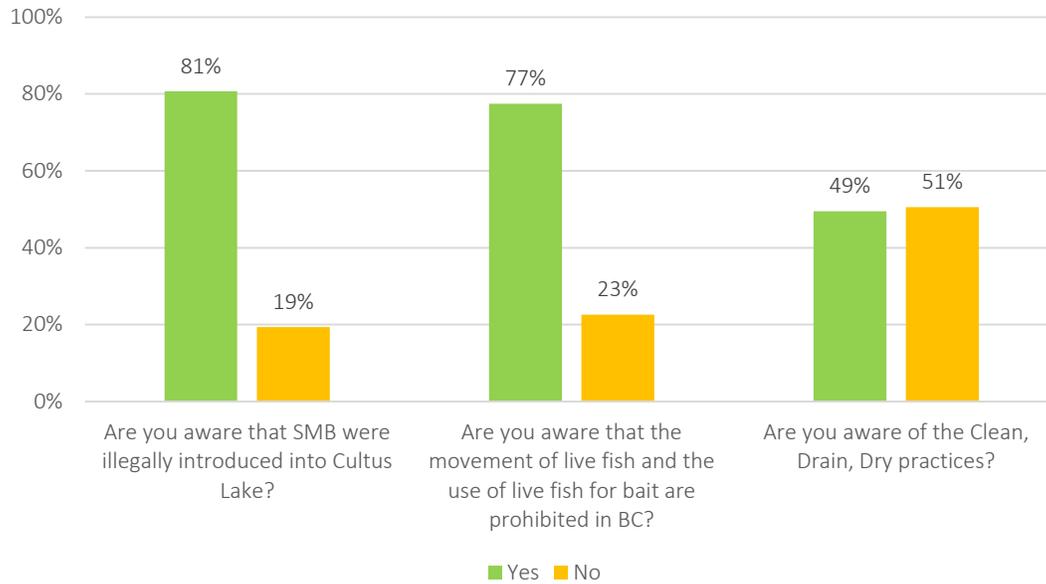


Figure 12 The percentage of angling groups with invasive species education awareness during the 2023 Cultus Lake SMB creel survey.

When asked what their preferred species to catch was, 44% of angling groups responded with “anything”, 18% responded with SMB specifically and 18% responded SMB and other species, 4% responded northern pikeminnow, and 15% responded trout and char (Figure 13).

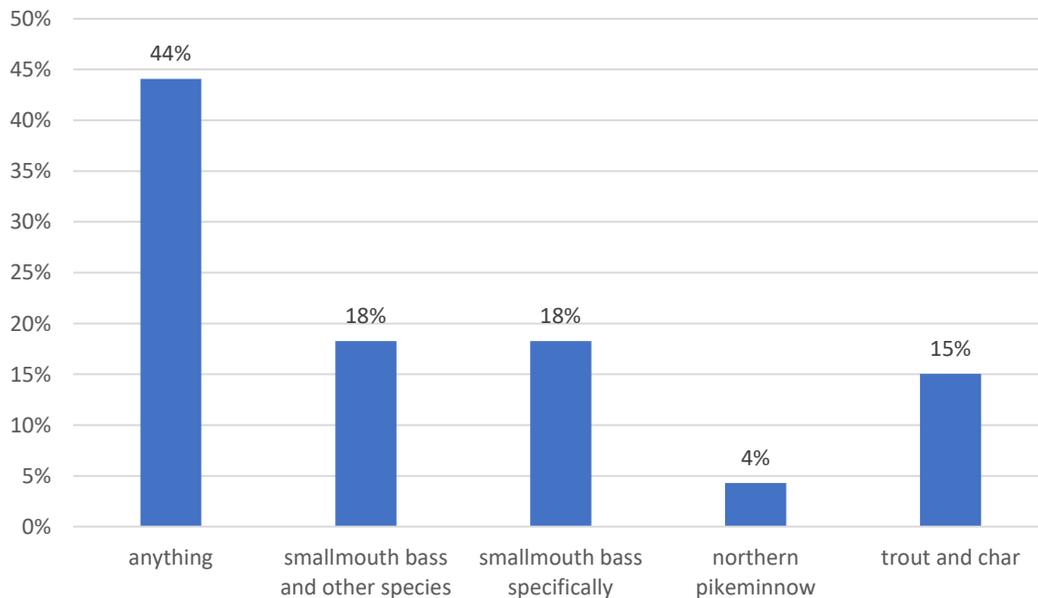


Figure 13 The percentage of angling groups preferred species to catch during the 2023 Cultus Lake SMB creel survey.

3.3.2 Voluntary Online Survey

Results from the voluntary online survey were not available during the time of this report.

4.0 Discussion and Recommendations

4.1 Nests Surveys and Destruction

With the warm spring experienced in 2023 the timing of the nest surveys was not ideal; when surveys began, spawning was already happening, and this did not leave adequate time to thoroughly survey known spawning areas as well as explore new areas before fry dispersal. It is recommended that nest survey begin earlier in the spring, attempting to begin surveying when surface water temperature reaches 15°C.

For more accurate nest density information, it is recommended that a system for marking nests be used. This is especially important in the Main Beach/Sunnyside Campground areas where repeated surveys occur, and repeated individual nest recording is likely. As nests can be less than a meter apart, even unique GPS locations will not be able to clarify repeated nests. Leaving a small painted rock with a numeric identifier onto the nest after first encounter would allow surveyors to recognize previously surveyed nests. This type of tracking would also help to monitor how quickly the bass are moving through their lifestage and how effective destruction efforts are. For example, if a nest with eggs was marked and destroyed, when revisited later any life still existing on the nest would give a sense of how effective the destruction methods were.

4.2 Marking and Male Removal

As with the time of nest surveys, the warm spring experienced in 2023 also compromised the timing of spring marking. The late start resulted in missing spawning staging, a time when both males and females are nearshore, preparing for spawn. To avoid this in 2024, it is recommended that the program design be spread over a longer period. Ideally, the program would run for two days per week over five weeks rather than for ten consecutive days. Not only would this capture more of the spawning activity it would also help to buffer unseasonal warm or cold weather. Additionally, as seen in Figure 3, the electroshocking SMB catch dropped from day 6-10. This may be explained by captured fish retreating to deeper water to recover. If there is five days of recovery between electroshocking sessions catch rates may improve.

Although time constraints did not allow for male removal during spawning surveys it was observed that removing males during the spring marking session would be the most efficient approach. Although angling has been one recommended approach to male removal, Figure 3 shows that electroshocking efforts resulted in greater catch than angling efforts. Splitting captured fish use during spring marking, primarily the electroshocking portion, between marking and removal would help to accomplish both goals of this project.

4.3 Creel Surveys and Public Awareness of Invasive Species

Knowing that SMB come nearshore to spawn in the spring it is likely that angler activity at Cultus Lake would increase at this time. It is recommended that creel surveys begin in late March or early April to capture this activity.

As was determined by the creel survey, 81% of anglers at Cultus Lake are aware of the introduction of SMB (Figure 12). Education signs are a great way to raise public awareness and all the boat launches at Cultus Lake have existing signs. Seeing such high angler usage of the docks (Figure 9) day use areas of the lake that do not currently have SMB education signs would benefit from the public education

opportunity. Additionally, with the confirmed presence of pumpkinseed (*Lepomis gibbosus*) in Cultus Lake the new signs should include both SMB and pumpkinseed information. It is recommended that new signs be added to Maple Bay and Entrance Bay Day use areas and the existing signs at Main Beach, Sunnyside Boat Launch and the Cultus Lake Marina be upgraded to include pumpkinseed information.

6.0 Literature Cited

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