

## 2022-2023 Funded Projects



This table summarizes approved 2022-2023 funding allocations for technical committee projects.

### Supporting Committee: Large Lakes

# of Projects: 18

Status	Project #	Title	Delivery Region	Allocated \$
Delivered	L2003	Assessment of Cowichan Lake Cutthroat Trout	1- West Coast	29,330
Delivered	L2103	Chilliwack Bull Trout Assessment - HRT	2 - South Coast	3,300
Delivered	R2310	Thompson Region Wild Stock Guardian Program (shared with R)	3 - Thompson	20,000
Delivered	L2301	Kootenay lake Kokanee Recovery	4 - Kootenay	78,450
Delivered	L2203	Koocanusa kokanee enumeration - (shared with SL)	4 - Kootenay	6,856
Delivered	L2105	Quesnel Lake Exploitation - HRT	5 - Cariboo	5,500
Delivered	L2304	Horsefly River Stock Evaluation	5 - Cariboo	11,300
Delivered	L2302	Meziadin Lake Bull Trout Management - Supplement	6 - Skeena	15,000
Delivered	L2205	Omineca Angler and non-Angler Preference and Diversity Survey (shared with LL and R)	7a - Omineca	5,833
Delivered	L2204	Omineca Burbot Fisheries Study	7a - Omineca	24,300
Delivered	L2210	Penticton Creek Restoration	8 - Okanagan	29,330
Delivered	L2208	MCRI Monitoring and Restoration Planning	8 - Okanagan	24,897
Delivered	L2209	Sugar Lake Bull Trout Assessment - HRT	8 - Okanagan	3,000
Delivered	L2306	Wood/Kalamalka Lake Fishery Optimization	8 - Okanagan	41,995
Delivered	L2307	Williston Fish ID Signs	7b - Peace	1,500
Delivered	L2305	Moberly Lake Assessment	7b - Peace	9,800
Delivered	L2303	Charlie Lake Fall Walleye Index Netting	7b - Peace	4,180
Delivered	L2101	Genomic tools for Kokanee stock assesment and broodstock ID in changing environments (shared with LL)	Provincial	26,350
				340,921

## Delivery Region Locations



1. Region 1 West Coast
2. Region 2 South Coast
3. Region 3 Thompson
4. Region 4 Kootenay Boundary
5. Region 5 Cariboo
6. Region 6 Skeena
7. Region 7a Omineca
8. Region 7b North East (Peace)
9. Region 8 Okanagan

image credit: frontcounterbc.com

Large Lakes Funded Project Categories	Allocated \$
Angler Effort, Catch & Satisfaction	\$68,795
Compliance & Outreach	\$1,500
Guardian Programs	\$20,000
Habitat Maintenance, Restoration & Enhancement	\$54,227
Research & Development	\$32,183
Stock Assessment	\$85,766
Stock Recovery & Enhancement	\$78,450
	\$340,921

## **2022-2023 Project Summaries**

The following section provides a summary of activities of each project delivered for this fiscal year. In addition, the total expenditure to date is provided for all years of project delivery.

## Assessment of Cowichan Lake Cutthroat Trout

Status: Delivered Tracking # L2003 Year 4 of 5

### Executive Summary:

This project will estimate natural and fishing mortality of cutthroat trout in Cowichan Lake using a combination of high-reward floy-tags together with long-lived acoustic transmitters. The combination of telemetry data and high-reward tags is a relatively recent development and is a powerful tool for separating fishing mortality from total mortality. Together, this information will be used to support an age-structured yield-per recruit analysis to evaluate the sustainability of the current exploitation rate, the suitability and effectiveness of current regulations, and the simulation of alternative regulatory approaches.

During October 2022, this project successfully captured 167 cutthroat trout at Cowichan Lake using trap-nets and angling - 47 of these fish received acoustic, high-reward and pit tags, while 37 of the fish received only high-reward and pit tags. Acoustic tags were deployed fairly evenly across a stratified matrix of size-class and spatial lake area. In 2022, we also deployed high-reward floy tags into 62 adfluvial rainbow trout that were incidentally captured and implanted nine of them with acoustic tags (recovered from angler-recovered fish or available from other projects). This value-added and opportunistic activity may provide insights into the species' movements and angler-use at nominal incremental cost.

In January 2023, we successful seasonal deployed acoustics receivers into six key spawning streams and Cowichan Lake outlet.

At the time of reporting, fourteen high-reward tags from cutthroat trout have been recaptured and reported to our office for this year.

## Chilliwack Bull Trout Assessment - HRT

Status: **Delivered** Tracking # **L2103** Year **3** of **5**

### Executive Summary:

The proposal seeks to address data gaps for the conservation and management of Bull Trout within BC, especially within the core area of Lower Fraser Ecological Drainage Unit (EDU). The purpose is to achieve a desired outcome that supports increased angler opportunity and long-term stock conservation. Consistent with the Provincial Bull Trout Management Plan (2015), over-exploitation was identified as one of the highest threats to Bull Trout in BC.

In many cases, over-exploitation was strongly associated with regional regulations and consistent high levels of effort. The MFLNRO Fisheries Program Plan (in draft) and Provincial Bull Trout Management Plan (2015) both identify that managers are expected to evaluate trade-offs between fisheries values and socio-economic objectives. Managers can potentially make better decisions if they have access to reliable, quantitative assessment information which is often lacking for many Bull Trout fisheries in BC. In summary, the goal of this proposal seeks to; 1) address conservation concerns 2) improve opportunity and quality of recreational fishery (increased participation and satisfaction) 3) obtain further information on the Bull trout populations in the Lower Fraser EDU (size, age at maturity, growth) 4) maintain long-term sustainability of the fishery through appropriate regulatory options and effectiveness monitoring and 5) direct collaboration and engagement with stakeholders in meeting their requests. We propose conducting a combined tag-return and access point creel census to; 1) assess relative exploitation rates in current recreational fishery and 2) compare the empirical information from tagging data information from the ASM model to make regulatory recommendations prior the next regulation cycle (i.e. 2024) 3) assess improvements to recreational fishery after regulation changes. Stakeholders have requested that a science-based assessment occur prior to any regulatory change. Our approach is also supported by earlier work conducted by Taylor (2005) in which similar recommendations were proposed. Such recommendations are supported by the Provincial Bull Trout Management Plan (2016) and findings detailed in Johnston et. al. (2012) for this life history type.

Tagging work was conducted in spring 2022 but delayed significantly due to the ongoing COVID-19 pandemic. Nevertheless, a total of 23 Bull Trout were captured and 15 have been high reward tagged in 2022. Capture bull Trout ranged in size from 30-71 cm, averaging 52 cm. Bull Trout tagging was conducted on Chilliwack Lake April and May. The delay in starting the tagging program due to COVID delayed the capture of Bull Trout in the spring. Importantly, as indicated in the proposal the use of the sonar was crucial in finding the Bull Trout aggregations at the outlet and inlet areas of the lake as they foraged on salmon juveniles (spring) and eggs (fall). To date, five high reward tags were returned in 2022. Creel census was implemented in the spring of 2022, funded by HCTF.

Creel census commenced on May 16, 2022 and concluded on October 16, 2022. A total of 36 days were surveyed in this time period. Results from the creel census were unavailable at the time of writing this continuing proposal.

## Thompson Region Wild Stock Guardian Program (shared with R)

Status: Delivered Tracking #R2310 Year 1 of 1

### Executive Summary:

The Thompson-Nicola Region is widely known for its recreational angling opportunities not only for rainbow trout, but also for other wild stock species such as lake trout, bull trout, kokanee, whitefish and burbot, some of which have thought to have grown in popularity throughout the region. Due to the remoteness and lake access to these fisheries, size of the waterbodies, and limited capacity of regional biologists and enforcement agencies (Conservation Officers and DFO Fisheries Officers) make it challenging to actively engage and monitor these fisheries. The Thompson Region Wild Stock Guardian project was initiated to try and fill that presence gap on these wild stock fisheries to engage with anglers providing fisheries stewardship and fostering compliance while also collecting angling information that could help identify the state of the fishery, current fishing experience, and the fishery effort. Over the course of the spring, summer and fall fisheries the TR guardian conducted 387 angler surveys on large lakes fisheries (57%) and rivers/streams fisheries (43%), with a reported 2077 angling hours and a total of 1185 fish reported caught (all species combined). Fly fishing was the most popular fishing type with 244 anglers and found the highest use came from out of region BC residents (49%), with an overall 7.5% non-compliance rate from all fisheries combined. Rainbow trout were the most targeted species amongst anglers throughout all fisheries and fishing seasons. Adams Lake was the only fishery where lake trout and kokanee were identified by anglers as their target species, fewer than expected anglers were targeting char (both lake trout and bull trout) and kokanee, with even fewer targeting burbot and white fish.

## Koocanusa kokanee enumeration - (shared with SL)

Status: Delivered Tracking # L2203 Year 2 of 5

### Executive Summary:

Kokanee are a keystone species in the novel upper Kootenay ecosystem, recently colonizing the Koocanusa Reservoir, and spawning throughout the upper Kootenay watershed. This population supports a popular kokanee fishery, Bull Trout fishery, and egg collections for the provincial stocking program of kokanee. At the inception of this study in 1996, an aerial enumeration was completed throughout the Upper Kootenay River watershed to identify the streams supporting the highest numbers of spawning Kokanee. A total of 7 streams were selected for long-term monitoring, including the Lussier River, which is often the most important spawning stream, and a major collection egg collection area for the Freshwater Fisheries Society of BC. This project will continue the long-term monitoring of the Koocanusa kokanee spawning population.

The overall objectives of this project are to continue monitoring of Koocanusa spawners in the Lussier River and up to six other index sites according to long-term methods. Data will be used to determine the sustainability of the current and future FFSCB egg collection practices to inform future egg collection guidance.

By comparing the stock and recruitment data for control streams and the historic dataset to the Lussier River, we will be able to determine if there are recruitment effects of the current egg collection protocols, and make recommendations for future egg collection guidance specific to the Lussier River and a more generic assessment of how current egg collection guidance impacts recruitment and future egg supply in wild, feral large lake kokanee populations in general. The data will also be useful in more generic monitoring of the Koocanusa kokanee population, which may help with management of Bull Trout or kokanee in the future.

In 2022, flights were completed on September 21 and 22. The 7 index streams were flown, for a total count of 50,455 kokanee spawners. This spawner abundance is 42% of the pre-study 10-year average spawner abundance (120,711), and 49% of the median spawner abundance (102,950). The Lussier River spawner abundance was 47% of the total watershed spawner abundance, which is similar to the pre-study 10 year average (48%).

## Kootenay lake Kokanee Recovery

Status: Delivered Tracking # L2301 Year 1 of 1

### Executive Summary:

Kokanee populations in Kootenay Lake have collapsed in the past eight years. As part of the approach to recovering kokanee stocks, the Ministry formed an advisory team that provided action recommendations to recover kokanee populations and produced the Kootenay Lake Action Plan, which lays out actions and triggers for implementation for both kokanee and predator populations. In an annual program review in fall 2021, the advisory team agreed that the Kootenay Lake Angler Incentive Program (KLAIP) is an important tool to reduce in-lake predation pressure on kokanee immediately in order to support juvenile kokanee survival and should be continued in 2022-2023. The team also agreed that the KLAIP should be coupled with ongoing predator monitoring aimed to provide the key data and analysis necessary to guide timely implementation of effective actions to accelerate short-term recovery of kokanee stocks in Kootenay Lake. The objective of this project was to recover kokanee and large piscivore populations in Kootenay Lake. Specifically, reduce bull trout and rainbow trout in-lake abundance by an additional harvest that is similar, or higher, to that of the 2021-2022 KLAIP. Additionally, conduct piscivore monitoring that will include the collection of bull trout and rainbow trout samples to analyse lake-wide changes in Gerrard abundance indices as well as diet, and age structure.

The KLAIP required anglers harvesting a bull trout or rainbow trout from Kootenay Lake to submit the fish head in exchange for a draw ticket. The draw ticket entered the angler into a monthly draw to win two \$500 gift certificates, as well as the first grand prize draw to win a 2022 Polaris Range Side by Side on November 1, 2022 and the second grand prize draw to win a 2022 well-equipped Ford F150 Tremor on June 1, 2022. Corporate program sponsors contributed discounted products and fishing accessories. An experienced angling guide captured and collected rainbow trout and bull trout in the main body of Kootenay Lake for the piscivore monitoring program. Analysis of diet data and collection of genetic samples, age structures, morphometric measurements, biological sampling, and other related sampling was completed at the end of the angling season. A total of 5,474 fish were collected through the KLAIP by March 1, 2023. Approximately 7,102 rainbow trout and bull trout are forecasted to be removed from Kootenay Lake by the end of the program. Based on these estimates, the 2022-2023 program will harvest ~50% less and ~16% more than the total 2020-2021 and 2021-2022 KLAIP harvest, respectively, and ~16% more than the average baseline harvest in Kootenay Lake between 2017-2019 prior to the launch of the KLAIP. Increased prize value, and program outreach and education could explain increased catch in the 2022-2023 program relative to the 2021-2022 program. The latter is supported by the KLAIP creel data results, which show an increase in program awareness and participation from 75%, and 69% in the 2020-2021 and 2021-2022 programs, respectively, to 98% in the 2022-2023 program. Recent predator consumption modeling suggests the 2022-23 KLAIP will reduce in-lake kokanee consumption by approximately 8%, which is higher than any other non-KLAIP predator management action implemented to date. This indicates that the KLAIP continues to be the most effective tool for reducing in-lake predator consumption of kokanee, and recent improvements in kokanee age 1-2 survival and high forecasted 2023 kokanee spawner escapement suggest the KLAIP likely had a meaningful contribution towards kokanee recovery in Kootenay Lake. A total of 1,070 rod hours were expended during the piscivore monitoring program, for a total catch of 194 fish (157 rainbow trout and 37 bull trout). Diet data was collected from stomach samples of all fish captured in 2022. Overall, bull trout diet was dominated by kokanee (98.8%) and rainbow trout diet was comprised of kokanee (41.7%), mysis (20.9%), insects (16.2%), zooplankton (12.2%), unknown (6.9%) and other fish (2.0%). Evaluation of age and genetics data was in process at the time of reporting and will be included in the final technical report from this project. Diet data from the piscivore monitoring program indicates that kokanee presence in both rainbow trout and bull trout diets has progressively increased since 2020, with highest observed kokanee proportions in diet for both species in 2022 since the beginning of the program in 2015. These data suggest feeding conditions for both species has improved and could indicate that the kokanee to predator ratio continues to increase in Kootenay Lake and could be trending in the right direction for kokanee recovery.

Although kokanee recovery takes time and relies on a more complex suite of actions not entirely part of this project, this project provided key data to guide Kootenay Lake Action Plan implementation and focused on



reducing predators which was outlined as a key recovery action to restore kokanee populations in Kootenay Lake. The KLAIP had direct, short term recreation benefits including increasing angler satisfaction, improving diversity of angling opportunities and expanding opportunities for shared stewardship of Kootenay Lake. This project, as a component of future kokanee recovery success, will also likely maintain and improve wild and enhanced fish stocks to support future recreational fishing opportunities.

## Quesnel Lake Exploitation - HRT

**Status:**      **Delivered**                      **Tracking # L2105**                      **Year**    **3**            **of**    **5**

### **Executive Summary:**

The large rainbow trout, bull trout and lake trout of Quesnel Lake support an economically important sport fishery but little is known about the proportion of the populations annually captured by anglers. In response to declining size of rainbow trout, very restrictive regulations were implemented for the Quesnel Lake fishery in 2002. Research conducted since that time suggests the decline in size of rainbow trout was largely due to a reduction in kokanee numbers, which is the primary prey species for Quesnel Lake trout. However, the kokanee population has increased substantially over the last decade and anecdotal reports from the angling public indicate trout densities have also increased in recent years. Given increasing trout populations, there may be an opportunity to increase angling opportunity in Quesnel Lake.

This project was initiated in 2015 to support the ongoing Quesnel Lake exploitation study, through the administration of high rewards (i.e., \$100) to anglers who captured marked rainbow trout, lake trout, or bull trout in Quesnel Lake. The objective of this component of the study is to evaluate current exploitation rates for each species, which will be used to inform development of sustainable angling regulations. The use of high reward tags provides an incentive for anglers to report recaptured fish as well as improve public interest and participation in the study. High rewards were administered to 17 anglers in 2022. An additional 95 high reward tags are planned to be distributed next season to improve sample size. It is anticipated that tagged rainbow trout will remain within the system for 1-2 years, which will result in recaptures being submitted throughout the full term of this specific project (i.e., Project L2105). Exploitation rates for each species will be evaluated over a total period of 8 years, which accounts for two full sockeye cycles, to improve our understanding of exploitation rates and associated variability.

This project achieved project objectives for the 2022 season and continues to be on track to meet overall project goals.

## Horsefly River Stock Evaluation

Status: Delivered Tracking # L2304 Year 1 of 3

### Executive Summary:

This project serves to enhance information collected and increase confidence levels on currently HCTF funded Horsefly River enumeration study. The Horsefly enumeration study is giving the first recorded escapement estimates of Quesnel Lake spawner abundance of 600-800 fish above 50cm. The study uses mark recapture relationship between marked (acoustic tagged) and unmarked fish being recaptured at the mouth of the Horsefly River. The HCTF funded project has other objectives such as identifying habitat use and spawner distributions within a designate fisheries' sensitive watershed (Horsefly watershed). FFSCB funding, however, focuses on increasing the confidence of spawner estimates by increasing effort on tag recovery. Run timing of the Horsefly spawning population has been found to be more variable than previously though making tag recovery more challenging than thought. Peak run timing has varied from late March to late April making it difficult to predict optimum netting (tag recovery times). Extending the sampling period by 10 calendar days should significantly increase the ability to get tag returns and increase the confidence in the population estimate. This can only be completed in the next 2 years as a significant number of acoustically tagged fish are available that in future will no longer exist.

## Meziadin Lake Bull Trout Management - Supplement

Status: Delivered Tracking # L2302 Year 1 of 1

### Executive Summary:

Final report delayed

## Omineca Burbot Fisheries Study

Status: **Delivered** Tracking # **L2204** Year **2** of **3**

### Executive Summary:

Overall project objectives

The Omineca Burbot Fisheries Study seeks to establish baseline estimates of population status and exploitation rates of burbot, a generally understudied species, within three lakes in the Omineca region of BC. The anticipated outcomes of this project are to (1) estimate exploitation rate for burbot at Carp Lake using high-reward and no-reward tags combined with a creel survey, (2) examine spatial patterns in burbot capture rates based on analyses of trap set data, and (3) establish annual indices of burbot population structure at Carp Lake and Fraser Lake.

In year 1, fieldwork commenced at Fraser Lake, where we developed and standardized capture and tagging methods, deployed an acoustic array of about 40 receivers, and tagged 44 burbot with high-reward or no-reward Floy tags. Of these 44 burbot, 20 were also implanted with acoustic transmitters.

In year 2, a main focus was to apply methods for monitoring burbot to other lakes in the Omineca Region by expanding the tag-return study to Carp Lake and Cluculz Lake, BC. The objective was to deploy about 50 high-reward and standard tags at each lake, and to determine angler activity and exploitation rates at the three lakes using tag-recovery approaches. At Fraser Lake, the goal was to collect data from and maintain the acoustic receiver array, and deploy 10 - 20 additional acoustic tags to monitor burbot habitat use.

### Progress in Year 2

In the spring and fall of 2022, we continued fieldwork at Fraser Lake and started burbot tagging-and-release at Carp Lake. At Fraser Lake, we captured and tagged 29 burbot over the months of April - June, of which 16 were tagged with both acoustic and Floy tags, and 13 were given Floy tags only. One burbot was recaptured from the 2021 cohort by the research team. At Carp Lake, we captured and tagged 115 burbot over 10 days in May/June and 5 days in October. All burbot at Carp Lake were tagged only with Floy tags for the angler tag-return program. We have received two reports of tagged (high-reward) burbot by anglers at Carp Lake.

We attempted to trap and tag burbot at Cluculz Lake but were unsuccessful due to extremely low catch rates (1 burbot tagged over 3 days of effort / 49 trap sets). We plan to focus only on Carp Lake in Year 3 due to higher capture success at this lake.

### Data collected

At both Fraser and Carp Lakes, we recorded lengths and weights of all tagged burbot, giving us data on the size distribution of burbot by lake and year. We observed a greater range in both lengths and weights of burbot at Carp Lake compared to Fraser Lake (across both years), with several burbot weighing over 5000g and with lengths of 900 mm or more, a size class not observed at Fraser Lake during this project to date. Burbot length and weight frequency histograms, and mean length and weight values for each lake by year, are shown in the Appendix (1).

With the catch data from our research team's trapping efforts, I have shown the locations of burbot trapping effort within each lake, and summarized capture rates (as CPUE, in burbot/trap hour) by lake, year, and zone within each lake in Appendix (2).

We monitored lake water temperature and dissolved oxygen concentration at Fraser Lake using data logger strings deployed in the spring of 2021 and again in the spring of 2022. These loggers were only deployed over the ice-free months and therefore give us time-series data for temperature and DO over May-October for Years 1 and 2. Environmental data is described in more detail and time-series data for several locations and depths are presented in Appendix (3).

Acoustic-tagged burbot were monitored throughout 2021 and 2022. Acoustic tracking allowed for observation of the changes in burbot temperature and depth indicating habitat use, using Innovasea acoustic transmitters detected by the acoustic receiver array. The acoustic detection data also indicates burbot survival and mortality by revealing individuals that stopped changing depth and/or moving between receiver detections ranges throughout the tracking period.

#### Next Steps

In Year 3, objectives are to estimate survival and exploitation of burbot at Carp Lake. We aim to tag about 150 burbot with additional high-reward and no-reward tags at Carp Lake where catch rates have been highest, over a 4-week trapping period in the spring of 2023. The numbers of burbot released and recovered between spring and fall sessions in 2022 and 2023 will be used in analyses using a twice-per-year tag recovery model to estimate survival and fishing mortality rates, and the high-reward tag method along with planned creel surveys during the fishing season will allow for estimates of tag-reporting rate by anglers. Together, the tag returns and creel surveys give us information on the angling activity and catch rates at Carp Lake, how, when and where recreational anglers fish for burbot, and the survival and exploitation rates of burbot in this fishery.

## Omineca Angler and non-Angler Preference and Diversity Survey (shared with LL and R)

Status: Delivered Tracking # L2205 Year 2 of 3

### Executive Summary:

The purpose of my study is threefold: to assess anglers' satisfaction with their recreational fishing experiences; to understand anglers' and non-anglers' perceptions and experiences of drivers and constraints to recreational fishing participation; and to provide insight for fisheries management about creating inclusive recreational spaces based on non-angler responses, current angler preferences, and their levels of satisfaction. To address these aims, I have conducted 3 out of the 6 proposed focus group interviews with anglers and non-anglers and have conducted 4 individual interviews with Community Champions. Community Champions are avid anglers and/or have additional expert insight into the topics of gender, race, and sexuality. Once the interviews are completed, transcribed, and analyzed, I will circulate a digital survey to the Omineca Region to assess anglers' and non-anglers' fishing preferences, drivers of participation, leisure constraints, and barriers to access, equity, and inclusion.

Objective 1: Contextualize drivers of participation as well as inclusionary and exclusionary practices (i.e., language and discourse, social groups, gatekeeping, gear and equipment) in recreational fishery in the region.

Completed in June 2022 with writeup of Literature Review.

Objective 2: Characterize the current demographic and angler satisfaction in the region.

This is ongoing as I conduct the interviews and survey.

Objective 3: Identify inclusionary and exclusionary practices as well as constraints and opportunities to encourage current non-anglers (and/or non-avid anglers) participation in regional recreational fisheries.

Data collection through interviews and focus groups to date have begun to highlight: a desire among fishers to be welcoming, the possibility of asymmetrical perception of the problem, specific constraints and opportunities facing identity groups, expressions of racism and sexism among fishers, as well as general perceptions of fishing among non-fishers.

Ongoing: Ethics Review Board (ERB) approval was received in December 2022 and recruiting for interviews and focus groups began at that time. The recruitment poster was sent to 16 local groups/organizations and was hung at UNBC and local shops in Prince George, and it has been shared repeatedly and broadly via social media. I recruited in person at the 2023 BHA & TWS Ice Fishing Derby at Eena Lake, and at a Spruce City Wildlife Society meeting. I have organized and conducted four interviews with Community Champions and held three focus groups. Interviews have been approximately 45 minutes and focus groups have been approximately 1.5 hours in duration. In total, I have engaged 14 people, and have transcribed all interviews and focus groups, resulting in roughly 8 hours of recording and 123 pages of narrative data so far. Thematic analysis of transcripts has begun to compile and track recurring themes and examine them in relation to the literature reviewed.

## MCRI Monitoring and Restoration Planning

Status: **Delivered** Tracking # **L2208** Year **2** of **2**

### Executive Summary:

Mission Creek is the primary spawning tributary for Okanagan Lake kokanee and rainbow trout, which support the most important recreational fishery in the Okanagan. Mission Creek has been severely impacted by land development activities, and a corresponding decline in fish production and Okanagan Lake recreational fishery values. Recovery of the stream spawning kokanee population has been the top priority for the Region 8 Fisheries Program for more than 2 decades.

Mission Creek Restoration Initiative (MCRI) which was formed in 2003, is focused on contributing to the recovery of Okanagan Lake fish stocks through a long term phased approach to development and implementation of restoration projects aimed at restoring valuable fish habitat within lower Mission Creek. Under the guidance of the multi-stakeholder MCRI Steering Committee, MCRI has achieved considerable progress, including delivery of the Phase 1 large scale fish and riparian habitat restoration project.

MCRI Phase 2 is aimed at conserving and restoring additional priority creek sections with a goal of completing this for the entire length of lower Mission Creek. Significant progress has been achieved including development of the Lower Mission Creek Habitat Conservation and Restoration Plan (finalized in Year 1 of this project) which identifies long term restoration recommendations with conceptual restoration designs which form the basis for development of engineered designs for on-the-ground implementation.

Year 2 of this 2 year project was focused on 2 objectives:

- Continue monitoring a series of fish/fish habitat parameters according to standard methodology to assess habitat quantity and quality, and associated fish utilization over time.
- Contribute to Phase 2 habitat conservation and restoration implementation for lower Mission Creek through development of an engineered design for restoring a priority reach as directed by the Lower Mission Creek Habitat Conservation and Restoration Plan.

In addition to the objectives described above, the following activities were undertaken through funding support from outside funding sources (\$0 FFSCB):

- Finalize and release the Lower Mission Creek Habitat Conservation and Restoration Plan (attached). This document will provide long term guidance for achieving MCRI's key goal of restoring Okanagan Lake kokanee and rainbow trout stocks.
- Monitoring stability and functionality of restoration structures as well as channel geomorphic conditions according to established flood protection standards and restoration objectives.
- Continue utilizing a MCRI Coordinator/Project Manager to ensure all aspects of Phase 1 and Phase 2 related project planning/delivery, and MCRI Steering Committee function are managed to provide maximum benefits
- Delivery of Outreach and communication services to highlight MCRI and supporting organizations

All components of this 2 year project were successfully completed according to the specified schedule and budget with the exception of the 2022/23 effectiveness monitoring. This activity was cancelled due to low 2022 spring freshet flows which resulted in minimal change to channel and restoration structure form and function, and the limited value this data would add to the existing long term data base. On this basis, it was decided the allocated funding would provide higher value supporting the expanded engineered design objective.

Over the long term, this project will be an important contributor toward the #1 fisheries management issue in

the Okanagan - recovery of Okanagan Lake fish stocks and the associated recreational fishery.

## Sugar Lake Bull Trout Assessment - HRT

**Status:**      **Delivered**                      **Tracking # L2209**                      **Year**    **3**            **of**    **5**

### **Executive Summary:**

The current status of bull trout in the Upper Shuswap River drainage is unknown. Recent anecdotal evidence, and limited historical data, suggests that the bull trout population may be in decline. This project will assess the status of the bull trout population in the Upper Shuswap drainage and identify appropriate management options and angling regulations to address conservation concerns and maintain a sustainable quality fishery.

Project objectives are to:

- Determine the status of bull trout and implement a long-term strategy to detect changes in relative abundance.
- Identify, map and evaluate spawning habitat characteristics, potential limitations and disturbances
- Determine angler exploitation
- Evaluate the meta-population structure within the Thompson EDU
- Assess the current angling regulations and identify appropriate management actions to conserve native bull trout stocks and sustain a quality char fishery.

Project objectives will be achieved through a combination of stock assessment, high reward tagging (mark-recapture), habitat assessment, redd surveys, creel census, genetic sampling, and education & outreach over 5 years. High reward tags will be used in combination with Floy tags to determine angler exploitation (Obj. #3). A minimum of 50 fish, over 350 mm in length, will be captured and tagged each year. A local guide outfitter will be used to facilitate sampling logistics and increase the number of fish caught. Angling and tagging will be conducted by Provincial fisheries biologists.

This project will help answer provincial uncertainties needed for the conservation and management of Bull trout within the core area of the Thompson Ecological Drainage Unit (EDU). It will also provide critical information required for the regional management of the Sugar Lake fishery and bull trout population.

## Penticton Creek Restoration

Status: Delivered Tracking # L2210 Year 2 of 4

### Executive Summary:

The Penticton Creek Restoration Committee has been working over a decade to restore and protect an important fish-bearing tributary to Okanagan Lake and Columbia Basin that flows through the urban core of the City of Penticton in southern British Columbia. Penticton Creek has been severely altered and degraded due to flood control works but offers exceptional potential for increased fish production based on water availability and historical fish use. This large-lakes project will build on the restoration work of the committee (funded through partners) and measure the effectiveness of different restoration approaches during extensive restoration works implemented in the summers of 2021 to 2023. This project will provide critical information to the committee on how to best design restorations to ensure maximum possible long term fish production from the stream.

Specifically, the project will:

- Complete large-scale habitat restoration of 266m of concrete flume and impassable drop structure, including the creation of 11 pool/riffle combinations (with 2 pools exceeding 1m in depth), and complete removal of a bridge.
- Use the Restoration and Innovation Reach as a learning opportunity to improve realized fish benefits for future restoration within Penticton creek and beyond. As well as for public education and the value of these projects and Penticton Creek specifically.
- Understand the microhabitat use patterns by Kokanee in riffle-pool habitat restoration and how that varies with engineered design specs.
- Understand micro features that enhance gravel retention in high gradient, low width systems (boulder clusters, pool design specifics, diverting thalweg)



## Wood/Kalamalka Lake Fishery Optimization

Status: **Delivered** Tracking # **L2306** Year **1** of **1**

### Executive Summary:

The kokanee fishery on Wood Lake is the Okanagan's most popular large lake and it operates at a high exploitation rate. Kokanee abundances in the lake have experienced large fluctuations over the past decades as a result of poor in-lake survival and lack of access to critical spawning habitat (i.e. water shortages in Middle Vernon Creek). In 2011, the kokanee population crashed, resulting in closure of the recreational fishery. The sport fishery was subsequently reopened in 2013. Continuing to track changes in the kokanee population is critical to maximizing angling opportunities, while ensuring stock conservation thresholds are met. Annual creel and stock assessment data is required in order to monitor the population status and make in-season decisions regarding management of sport fishery. Kalamalka Lake is also a primary wild stock kokanee fishery in the Okanagan and produces some of the largest sized kokanee in the region. It is connected to Wood Lake via a short (<100m) channel, which many anglers use to travel between lakes. Angling regulations on Kalamalka Lake stagnant for many years, and limited stock assessment data existed to support the quota (i.e., 2 fish per day). Monitoring is required to determine the effectiveness of current regulations, while ensuring stock conservation thresholds are met.

The objectives of this study are to 1) assess kokanee population abundance and monitor trends over time, 2) operate a fish fence on Coldstream Creek to estimate the expansion factor for stream visual survey counts, 3) estimate angler effort, satisfaction and exploitation rate, 4) optimize water management in order to provide consistent flows to spawning habitat in Middle Vernon Creek, and 5) collect data to support the opening and/or in-season regulation of the fishery.

Methods used to assess the Wood Lake and Kalamalka Lake kokanee populations included a visual stream and shore spawner counts, hydro-acoustic and trawl surveys (ATS), biological sampling (i.e., length, maturation, size at age, growth rate, tissue samples for genetic structure). A fish fence was operated on Coldstream Creeks to calibrate visual stream spawner counts. Tissue samples were taken and submitted to the University of British Columbia Okanagan Campus for genetic ecotype assignment. Angler effort, catch and exploitation data was collected through annual creel surveys. Finally, hydrological monitoring was conducted on Middle Vernon Creek to support in-season water management decisions. Data analysis and reporting was conducted by regional biologists.

The Wood Lake 2022 kokanee escapement (12,347 fish) was the 3rd lowest return on record since the crash in 2012 and regional managers are concerned for the sustainability of the fishery. The 2022 enumeration estimates are equivalent to the enumeration count for 2021 (12,462). There was a 3x increase in the 2022 fry population, estimated at 128,081 kokanee compared to the year prior. The age 1-3 population was estimated at 93,821 kokanee which was an increase by 20,000 from the year prior suggesting good egg to fry survival and manageable in-lake water conditions for the kokanee. Angler effort on Wood Lake in 2022 was 7,757 angler days per year and ranged between 5,365-12,360 angler days per year (2017-2022). Harvest rates in 2022 were 19,548 and ranged from 5,444 in 2018 (launch access closures) to a maximum of 34,825 in 2020. To contrast, Kalamalka continues to produce good enumeration estimates with 11,063 stream spawners and 8,000 shore spawners in 2022 and can support the 5 fish a day quota.

During the course of this 6-year FFBC funded project, variations in bag limit have been needed to maximize recreational opportunity without overharvest of the fishery. The Wood Lake kokanee daily quota was increased in 2019 from 2 per day to 5. At the time, total escapement of kokanee in Wood Lake was 17,622 (2018) and had strong returns previous years (45,513 and 42,017 kokanee spawners in 2016 and 2017, respectively). Harvest estimates with pre-fishery spawner values suggested the fishery was underexploited and offered greater opportunity for anglers. Effort had stayed high on Wood Lake. Low fry populations were observed in 2021 suggesting random stochastic environmental impacts may be impacting the in-lake population and a likely temp/O<sub>2</sub> squeeze had impacted Wood Lake in 2020. Therefore, the Wood Lake daily kokanee retention limit was reduced to 3 fish a day for the 2022 angling season and will continue for the 2023-25 synopsis.

The water management strategy implemented proved effective in maintaining adequate flows for fish in Middle Vernon Creek during the kokanee spawning period and kokanee were even observed in Upper Vernon Creek. Regional managers are pleased with progress after 2021 when the Ministry had to in act the Federal Fish Act to ensure fish-friendly flows during spawning in MVC. Long-term solutions are current underway in a collaborative Water Use Plan with the DLC that will maintain fish-friendly flows and allow water availability with all stakeholders.

This project brought direct benefits to anglers by maximizing harvest opportunity while maintaining a quality kokanee fishery. Through stringent monitoring, managers have been able to implement changes to ensure the fishery sustainable for future generation. Wood lake operates at a high exploitation rate that needs to be balanced with the extreme environmental variability it experiences. Future management needs to consider enhanced collaboration with The District of Lake Country to ensure fish-friendly flows are maintained in Middle Vernon Creek. To keep the fishery operating, annual escapement, juvenile survival, and exploitation need to be continuously monitored.

### Charlie Lake Fall Walleye Index Netting

**Status:**      **Delivered**                      **Tracking # L2303**                      **Year**    **1**            **of**    **1**

#### **Executive Summary:**

Fall Walleye Index Net (FWIN) sampling was conducted on Charlie Lake between September 19-23, 2022 following the protocol outlined in Morgan (2002). A total of 326 fish were captured representing 5 species. Catch data for all species and previous surveys are summarized in Table 1. The total catch consisted of 64 % walleye (n= 243), 14% yellow perch (n=53), 12% white sucker (n=47), 9% northern pike (n=34), and 2 burbot during the survey. ). Mature walleye catch rates were comparable to previous years, indicating stability in terms of mature walleye persistence within the lake. Northern pike catches were higher than observed in previous years. Charlie Lake should continue to be monitored every 3 to 5 years to ensure that harvest is remaining sustainable.

### Moberly Lake Assessment

**Status:**      **Delivered**                      **Tracking # L2305**                      **Year**    **1**            **of**    **3**

#### **Executive Summary:**

The project objective for the Moberly Assessment is to follow similar sampling methodologies from Brendan Anderson's initial survey identifying spawning shoals in Moberly Lake in 2005. Since then, the three shoals have been used to estimate population growth, however this data is currently 17 years old and potentially new or undiscovered shoals exist in Moberly Lake where spawning could be occurring. 15 radio telemetry tags are scheduled to be installed in Moberly lake trout, with spawning surveys to occur with a Yagi antenna array during peak spawning in October. This tracking would also coincide with the spawning shoal mark recapture project that has been occurring since 2006. In June 2022, two lake trout were captured and implanted with radio telemetry transmitters. Surgeries appeared successful and fish recovered well. However, catch rates were low in gillnets potentially due to a recent melt which caused the lake to become turbid. A second sampling event in August was scheduled, but above average warm weather caused stressful conditions for captured Lake trout and sampling was only completed for one day. The Mark recapture spawning survey and associated tracking did not occur in 2022 due to an extreme wind event which caused the capsizing of the fisheries boat.

## Williston Fish ID Signs

**Status:** Delivered      **Tracking #** L2307      **Year** 1      **of** 1

### Executive Summary:

During the Williston Creel on the Peace reach in 2021, there were multiple instances of misidentification of Bull Trout as Lake Trout. Furthermore, there were multiple discussions between anglers as to how them apart, as well as the proper common name used for Bull Trout within the region. The British Columbia Government Communication and Public Engagement Branch was utilized for the creation of the signs. Each region in the province was asked if they were facing other misidentification issues, and signs were also created for those waterbodies. Using the images from the freshwater fishing synopsis, signs were created which also had the Report a Poacher or Polluter contact number, as well as the FFSCB logo. 4 separate signs were created highlighting different identification issues throughout the province. 5 signs were installed at primary access points to Williston Reservoir, and digital copies of all created signs were sent to each region for use.

## Genomic tools for Kokanee stock assessment and broodstock ID in changing environments (shared with LL)

Status: Delivered Tracking # L2101 Year 2 of 2

### Executive Summary:

Kokanee represent one of BC's most important freshwater recreational fisheries, and are also an important prey species supporting piscivore fisheries. However, wild Kokanee populations have a long history of being highly volatile, leading to substantial recreational fishery consequences. As Kokanee represent a species of strategic importance for supporting lucrative recreational fisheries, the need to ramp up hatchery production of stocks robust to changing environments is a high priority. This urgency is further punctuated by the collapse of the Meadow Creek stock, which was the historical source for stocking throughout western North America. Accordingly, the key management issue is that Kokanee will continue to be stocked within recovery initiatives as well as purely to support small lakes recreational fisheries. In either case, we need to have a better understanding of how stocking different Kokanee sources could influence wild stock recovery and/or of fishery quality.

This project is led by UBC researchers, with DFO and University of California researchers as co-applicants. The Province of BC (MoF), the Freshwater Fisheries Society of BC (FFSBC) and Parks Canada are end-user collaborators. The project is funded in majority through Genome BC's GeneSolve program, with financial and in-kind contributions from MoF and FFSBC. The project is focussed on improving our understanding of the kokanee genome, developing cost effective genetic assessment tools to identify discrete stocks and their specific adaptations, and identifying stocks with the highest likelihood to succeed in a changing environment (relevant to both wild stock and hatchery stock productivity/outcomes). These tools will have broad utility in furthering our understanding of wild stock systems and how our management actions affect outcomes related to fisheries and conservation/ecosystem function. The project will also contribute to hatchery stock development, which is intended to improve brood source productivity potential as the impacts of climate change intensify. Ultimately, the project will further our understanding of the Kokanee genome and genotype/phenotype relationships that will have a lasting impact on understanding and prioritizing critical wild populations and habitats.

The project was intended to span 2 years. Year 1 activities were completed as planned and involved characterizing sequence and structural genomic variation from 224 whole genomes from 22 lakes from British Columbia and Yukon. Analysis integrated standing genetic variation, genotype-environment associations and climate modeling to assess climate change vulnerability. The results of this work are nearing completion and will result in two primary literature publications. Year 2 activities focused on physiological genomics and involved successful field-based respirometry and thermal tolerance experiments conducted on Mission and Coldwater Creek populations. The key outputs of Activity 2 will include physiological characterization of Kokanee related to environmental stress, as well as a high-throughput Kokanee Fit-Chip containing curated biomarker assays to determine how environmental conditions affect physiologically important stock specific metrics. However, COVID related laboratory backlogs have resulted in a one-year (no cost) delay in completing these outputs.