

## 2019-2020 Funded Projects



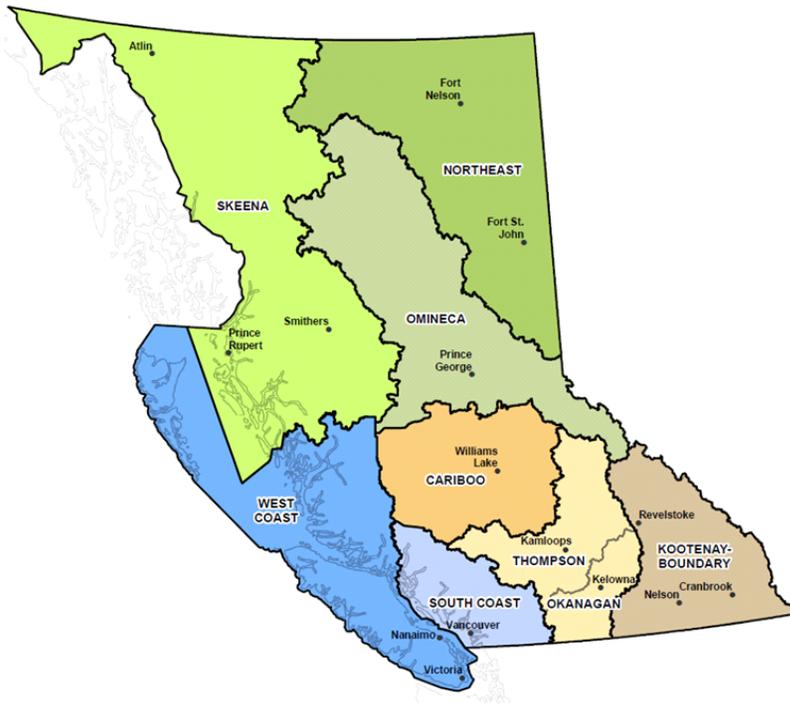
This table summarizes approved 2019-2020 funding allocations for technical committee projects.

### Supporting Committee: Large Lakes

# of Projects: 18

Status	Project	Title	Delivery Region	Allocated \$
Ongoing	L2003	Assessment of Cowichan Lake Cutthroat Trout	1- West Coast	27,140
Ongoing	L1901	Assessment of Horne Lake Cutthroat Trout	1- West Coast	22,464
Completed	L1912	Are Alouette Kokanee Actually Sockeye? Stock Identification of a Rare and Controversial Population	2 - South Coast	33,180
Completed	L2009	Alouette Reservoir Bull Trout Assessment	2 - South Coast	37,835
Completed	L2007	Kootenay Lake Predator Management	4 - Kootenay	32,500
Completed	L1604	Kootenay Lake Kokanee Recovery	4 - Kootenay	20,000
Ongoing	L2005	Lardeau and Duncan Juvenile Gerrard Assessment	4 - Kootenay	3,975
Completed	L1605	Quesnel Lake Exploitation Study – High Reward Tags	5 - Cariboo	5,500
Ongoing	L1805	Chilko Bull Trout Assessment	5 - Cariboo	3,000
Ongoing	L1804	Meziadin Lake Bull Trout Management	6 - Skeena	28,300
Completed	L2001	Powers Creek Fish Ladder	8 - Okanagan	24,970
Completed	L2010	AIS Northern Pike EDRRP	8 - Okanagan	6,850
Completed	L1609	Penticton Creek Restoration Initiative	8 - Okanagan	12,000
Ongoing	L1909	Skaha Lake Kokanee Assessment and Genetic Analysis	8 - Okanagan	12,700
Ongoing	L1907	Wood and Kalamalka Lake Kokanee Optimization	8 - Okanagan	23,491
Ongoing	L1906	Moberly Lake Trout Population Monitoring	7b - Peace	2,500
Completed	S1618	Development of a Fish Aging Laboratory to Support Provincial Objectives	Provincial	26,321
Ongoing	L2008	Provincial Stock Assessment Database (SAD)	Provincial	7,500
				330,226

## 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

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Project Categories	Allocated \$
Angler Effort, Catch & Satisfaction	\$60,291
Aquatic Invasive Species	\$6,850
Data Standards, Tools & Management	\$33,821
Habitat Maintenance, Restoration & Enhancement	\$36,970
Research & Development	\$33,180
Stock Assessment	\$106,614
Stock Recovery & Enhancement	\$52,500
	\$330,226

## **2019 - 2020 Project Summaries**

The following section provides a summary of activities of each project delivered in 2019-2020. In addition, the total expenditure to date is provided for all years of project delivery.





## Alouette Reservoir Bull Trout Assessment

Status: Completed

Bull Trout (*Salvelinus confluentus*) are highly valued by anglers, as they can attain 'trophy' size and are relatively easy to catch. Within British Columbia, Bull Trout are blue-listed and the South Coast populations are identified as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). To protect the Bull Trout population in Alouette Reservoir, in the South Coast region of BC, the Province introduced a no retention fishing regulation for char in Alouette Reservoir; this was implemented in April 2015. At the time of the decision there was limited data on the population, but what was available indicated the spawning population was very low (> 30 individuals per year). While conservation concerns are high for this population and species, the lack of data makes any changes to fishing regulations difficult to justify.

To understand the status of Bull Trout in the Alouette Reservoir watershed, an assessment of the population and the system's productive capacity is required. To achieve this, the Ministry of Environment and Climate Change Strategy (ENV) partnered with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), BC Parks, and the Katzie First Nation. Habitat assessments were conducted on four of the main tributaries (Gold Creek, Moyer Creek, Viking Creek, and the Upper Alouette River) to examine factors that may be limiting Bull Trout production. This included the installation of temperature data loggers in all four tributaries.

The primary focus of the study, though, was Gold Creek, as it is a known Bull Trout spawning tributary and previous work suggested limited habitat availability and use of the other major tributaries. Bull Trout spawner snorkel swims were completed from August to mid-November according to methods used by Wilcox (2015) to assess migration and spawning. Additionally, juvenile abundance was assessed using nighttime snorkel survey methods as outlined in Decker et al. (2005). Suitable habitat in all tributaries was limited. Of note, Viking Creek was impacted by numerous road crossings and three culverts that were not fully functional; while no Bull Trout have been observed in this stream, it does support Cutthroat Trout. Within Gold Creek, Reach 3 (upper reach to a set of impassible falls at 3.8 km upstream) provided the best rearing (available cover mainly boulders) and spawning (gravel/small cobbles) habitat for Bull Trout.

Mean daily water temperatures remained below the 16°C threshold that has been shown to limit juvenile Bull Trout habitat with the exception of on Gold Creek on two days in August (16.2°C and 16.3°C). Maximum daily water temperatures exceeded the 16°C threshold in Gold Creek Daily in August numerous times but were not sustained at this temperature (range 18.9°C to 4.5°C from May to November). Similar temperatures were observed in the other tributaries (though the maximum temperatures were lower). During the migration and spawning period, water temperatures dropped to 12°C by mid-September and were at or below 9°C by early to mid-October. The peak count of Bull Trout spawners (n=50) was observed on September 30, 2019 and all but 1 spawner had left Gold Creek by November 13, 2019. Data from this study and 2018 may indicate a modest increase in the spawning population since the regulation change in 2015. During the juvenile Bull Trout snorkel surveys a total of 2840 m was surveyed (40% of the total available habitat in Gold Creek) with 18 Bull Trout juveniles observed. Overall, the linear density was 0.006 juveniles/m (or 0.6 juveniles/100 m), which is very low compared to other systems in BC. It is possible that juveniles migrate to the reservoir earlier than what would be typical for this species, due to the short migration distance, limited habitat availability and low productivity of Gold Creek.

Not only did this project help address key data needs for management, but it also provided excellent opportunities for outreach to the public, as the work was conducted in Golden Ears Provincial Park, a high-use area that receives over 615,000 visits annually. Outreach was achieved by posting an education display board along the hiking trail that follows Gold Creek to the lower falls. We recommend designing and implementing a robust long-term study to gain knowledge about the Alouette Reservoir Bull Trout population's traits and population status. The conservation combined with complex life history of this species necessitates a long-term assessment to understand the population and determine if the effects of regulation changes. Finally, following such investigations, a thorough review of potential conservation or habitat restoration options may be warranted.

## Kootenay Lake Kokanee Recovery

Status: Completed

Kootenay Lake has recently had a strong mismatch between predator and prey abundance, which has ultimately collapsed kokanee populations. In response to the collapse of kokanee in Kootenay Lake, the Kootenay Lake Action Plan was developed in 2015, which lays out actions and triggers for implementation for both kokanee and predator populations. Many recommended actions to recover kokanee were identified in the Action Plan, including this project, which addresses a strong short-term need to increase fry abundance in Kootenay Lake through supplementation. The objective of this project was to speed the recovery of Kootenay Lake kokanee stocks through supplementation of kokanee from outside of Kootenay Lake.

The majority of this project was delivered directly by FFSBC (egg collection and incubation). In 2015-2019, egg collection activities followed FFSBC brood station collection methods, including data management, biological collection requirements and donor stock conservation measures. The number of eggs collected and incubated annually depended on egg availability and supply. Between 2015-2019, egg plants occurred every fall in the Meadow Creek Spawning Channel (MCSC). Additionally, fed fry were released into the MCSC and Crawford Creek in the spring of 2016, 2017, and 2019. Methods for planting eggs included digging transects of artificial redds across the width of the MCSC, and burying the eggs using either plywood boxes, perforated tubes, or PVC pipe.

In 2016, the methods were refined based on egg survival estimates that were determined through qualitative observations and comparisons of egg volume before and after emergence. A fence was installed at the downstream end of the transects to preclude wild spawners from accessing the upper legs of the channel. This ensured that fry that were enumerated from egg plants and wild fry were indexed separately. Throughout this project, approximately 23.5 million eyed eggs and fry were stocked into the MCSC and Crawford Creek. Stocking efforts contributed 10-66% of the overall egg supply annually, and over 13 million fall fry.

Since stocking began, in combination with other actions, the kokanee population in Kootenay Lake has shown some improvements. Recent data shows that kokanee escapement doubled in 2019 (30,000 spawners in 2018 to 65,000 spawners in 2019) and is projected to rise to 88,000 spawners in 2020. Age 1-2 kokanee survival has doubled since 2017, and there has been a recent reduction in the predator:kokanee biomass ratio. Additionally, modest increases in total catch of rainbow trout between 2017/18 and 2018/19 license years may indicate positive signs of kokanee recovery. Despite these positive indicators towards recovery, the total catch of rainbow trout from all size classes, in-lake kokanee biomass and age 0-1 kokanee remain low, indicating that predator demand still outstrips prey supply. Spawner returns in 2019 (60,000) likely produced approximately 25 million eggs, and the excess egg supply from stocked sources in 2020 is projected to be low. A wild egg supply of 25 million and an estimated low stocked egg supply, combined with sustained low in-lake biomass and low age 0-1 kokanee survival, suggests that future kokanee recovery efforts on Kootenay Lake should focus on predator reduction.

Although kokanee recovery takes time and relies on a more complex suite of actions that are not part of this project, this project helped maintain a suitable egg supply since 2015, which is critical to kokanee recovery in Kootenay Lake. There were no short-term recreational benefits achieved from this project, but this project was a component of future kokanee recovery success and will likely maintain and improve wild and enhanced fish stocks to support recreational fishing opportunities in the future.



## Lardeau and Duncan Juvenile Gerrard Assessment

Status: Ongoing

The recent collapse of Kootenay Lakes' Kokanee population has had a severe impact on the Gerrard Rainbow Trout population. Expectedly, abundance, size and condition of fish in the sport fishery and returning spawners have also declined. However, the current status provides a unique opportunity to assess population dynamics at low abundance and assist with developing biological reference points (BRPs) for the stock. Development of BRPs will improve fisheries management associated with stock abundance needed for conservation and management. Lastly, development of a framework (harvest and/or abundance based) will provide critical thresholds that that can provide insight and information for adaptive management at various stock levels.

Spawner escapements at Gerrard using area under the curve (AUC) from daily counts have provided an index of abundance since 1961. Since 2006 juvenile monitoring of has occurred, with the exception of 2015, providing an information on recruitment. Combined, juvenile recruitment and spawning stock information provide the necessary data in developing a stock recruitment relationship for the Gerrard population.

In 2018 and 2019, age 1 abundance for the Lardeau and Duncan rivers was estimated to be 97,967 (95% CRI 67,939-142,639) and 28,296 (95% CRI 18,564-41,642), respectively. The large variation in recruitment from 2018 to 2019 is a result of large changes in total spawner returns and fluctuations in egg deposition related to variation in size at maturity associated with food limitations related to collapse of Kokanee. The 2018 and 2019 juvenile recruitment estimates are the progeny from the 2017 and 2018 spawn of Gerrard Rainbow Trout was estimated to be 252 and 153 AUC, respectively. These escapement estimates are well off the record highs of >1,500 AUC observed in 2012 and are some of the lowest recorded since 1961. Data analysis fitted a Beverton Holt stock-recruit (SR) curve for Gerrard Rainbow Trout based on river recruit and spawner data converted to egg production. Preliminary results suggest no appreciable increase in recruitment in the age 1 juvenile abundance

at egg deposition above 1,000,000. Information on the maximal reproductive rate (the number of spawners per spawner at low abundance without fishing indicates the Gerrard stock has a high degree of resilience. The maximum reproductive rate (not accounting for fishing mortality) increased from around 12.5 adults per recruit (logtransformed ~2.5 adults per recruit) in the early to mid-2000s to over 30 adults per recruit (log-transformed ~3.5 adults per recruit) in 2007 before dropping to under 5 adults per recruit (log-transformed ~1.6 adults per recruit) in 2010. The Gerrard stock appears to indicate time variation in in-lake survival that alters the productivity of the stock over time.

Based on the degree of resiliency from the stock, the limit reference point (LRP) for the Gerrard stock is defined as a spawner abundance of 108 AUC ( $S_{(0.5R_{max})}$ ) and/or egg deposition of 326,000 ( $E_{(0.5R_{max})}$ ) and defined as the spawner abundance or egg deposition that produces 50% of the maximum recruitment, known as the half saturation constant. Based on the defined reference point, it appears that egg deposition ( $E_{(0.5R_{max})}$ ) has fallen below the LRP since 2015.

The work follows priority actions and objectives outlined in FWCPs Large Lake Action Plan and Species of Interest Action Plan; including research and acquisition of critical population information and monitoring and evaluation of species. These actions follow under objectives 1); ensure a productive and diverse aquatic; ecosystem and 2) provide sustainable use opportunities. As well, Sub-objectives include 1); maximizing them viability of indicator species and 2) optimize fishery values.

<b>Tracking No.</b>	<b>L2005</b>	<b>Year</b>	<b>1</b>	<b>of</b>	<b>2</b>	<b>Total Spent to Date</b>	<b>\$3,577</b>
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## Powers Creek Fish Ladder

Status: Completed

Powers Creek is an important spawning tributary for Okanagan Lake kokanee and rainbow trout stocks. A fish ladder was installed approximately 0.8 km upstream from the mouth in 1986, in order to provide fish passage past a rock obstruction to valuable upstream spawning grounds. In the spring of 2018, the Okanagan Region experienced historic freshet flows and flooding. The Powers Creek fish ladder was destroyed, cutting off access to 1.8 km of prime spawning habitat for Okanagan Lake fish stocks.

Okanagan Lake supports an economically important sport fishery, garnering > 15,000 angler days/ year and \$3,765,000 in annual revenue (Okanagan regional spawner enumeration database 2018; FFSCB Economic Impact Report, 2013). The stream spawning kokanee grow to between 33-65 cm in size, and are the fish primarily targeted in the recreational fishery (vs the smaller shore spawning ecotype). Powers Creek supports approximately 5% of the Okanagan Lake kokanee production. It also acts as a key spawning tributary for Okanagan Lake rainbow trout stocks.

Annual spawner enumeration surveys have indicated that Okanagan Lake stream spawning kokanee stocks are continuing to decline (H. Ward, 2018 pers. comm.; 2018 COSEWIC review). As such, efforts are being made to protect fish stocks and habitat, wherever possible. Replacement of the Powers Creek fish ladder was needed to maintain fish access to valuable upstream spawning grounds and ensure conservation of these wild stocks. Without a suitable fishway, the kokanee population in Okanagan Lake may continue to deteriorate and the recreational fishery could be eventually closed.

Engineered design drawings prepared by the Province for the original fishway (Wells, 1986), were used to reconstruct the new ladder. Use of the 1986 drawings reduced overall engineering fees and provided a significant cost savings beneath the project. Instream was completed in August 2019 and included site isolation, fish salvage, dewatering, removal of remnant pieces of the original ladder, construction of the new ladder, site restoration and clean up. Monitoring was subsequently conducted to enumerate kokanee spawner returns, as well as fish passage & jump success at the new structure. A total of 1533 kokanee returned to Powers Creek in 2019, of which 215 (14%) spawned upstream of the new fish ladder. Jump success was evaluated at the top weir only and ranged btw 27-71%. Variation in success was likely due to higher than normal attraction flow over the rock on the south side of the slot.

Total project cost = \$131,599. In addition to FFSCB support, partner funding was received from HCTF, the City of West Kelowna and the Mysis fishery. Conservation and recreational benefits generated as a result of this project include longevity of Okanagan Lake fish stocks and the sport fishery for kokanee and rainbow trout.

<b>Tracking No.</b>	<b>L2001</b>	<b>Year</b>	<b>1</b>	<b>of</b>	<b>1</b>	<b>Total Spent to Date</b>	<b>\$24,970</b>
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## AIS Northern Pike EDRRP

Status: Completed

In 2018, we received 2 reports of northern pike (*Esox lucius*) sighted in Christina Lake, BC. Christina Lake drains in a southerly direction into the Kettle River, and flows across the Canada/US border into the Upper Columbia. Northern pike are present in the Kettle River, approximately 10 km downstream of the Canada/US border (Holly McLellan, pers. comm. 2018). An intensive removal program is currently underway by Washington Department of Fish and Wildlife (WDFW) and the Confederated Tribes of the Colville Indian Reservation (Colville's) to halt the advance of this voracious predator and reduce the impacts on native populations in the US (Bill Baker, WDFW, pers. comm. 2018). To date, northern pike have not been detected in Canadian waters and may have been incorrectly identified. Christina Lake supports an economically important sport fishery, garnering > 4,000 angler days/ year and >\$1M in angler revenue (FLNRORD 2018).

The intent of this project was to confirm the presence, distribution, and scale of impact of northern pike in the Canadian portion of the Kettle River drainage & Christina Lake. The secondary objective was to conduct a feasibility analysis to determine the most appropriate management response to mitigate impacts on resident stocks and maintain a quality fishery.

In December 2018, a transboundary meeting was held to discuss concerns and develop a coordinated Northern Pike management approach. A combination of targeted eDNA sampling, boat electrofishing and angling was identified and subsequently used to confirm northern pike presence and distribution within Canadian waters. A feasibility analysis was also initiated to determine the most appropriate control measures/options. Awareness of management concerns was communicated to the public & angling community via stakeholder meetings, CLSS news articles and signage.

eDNA analysis of water samples was conducted at 2 labs in 2019 and revealed similar results; no evidence of Northern Pike was detected in Christina Lake, Christina Creek or Canadian waters of the Kettle River. Gill netting, angling and electrofishing efforts in Christina Lake also did not reveal any evidence of Northern Pike. Interestingly, however, the angling report received in 2018, was confirmed in 2019. Follow-up discussions with the angler confirmed the pike was harvested at the time of capture and not released back into the lake.

Recreational benefits generated as a result of this project include conservation & protection of resident stocks, improved quality of the wild stock rainbow trout fishery, enriched angler opportunity/experience, and enhanced angler satisfaction. This project helped improve fishing quality and angler satisfaction by:

- Maintaining angling opportunities.
- Responding to AIS reports promptly and aggressively,
- Ensuring northern pike are managed appropriately, and
- Determining whether management actions will help maintain native stocks and the quality of the fishery.

Christina Lake will continue to be monitored for Northern Pike in 2020. The feasibility analysis for a resistance weir for Christina creek will be completed. AIS/Environmental protection messaging will also

<b>Tracking No.</b>	<b>L2010</b>	<b>Year</b>	<b>1</b>	<b>of</b>	<b>1</b>	<b>Total Spent to Date</b>	<b>\$5,000</b>
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## Moberly Lake Trout Population Monitoring

Status: Ongoing

Moberly Lake is the largest natural Lake Trout lake in the Northeast Region (2943 ha) and has two First Nation reserves located on its shoreline as well as numerous residences. Lake Trout are one of the top predators in Moberly Lake and historically they supported a high use recreational fishery and First Nations sustenance fishery. Currently, the lake trout population is collapsed and adult abundance remains critically low. Lake Trout recreational harvest has been closed since 2005, and fishing on the lake during the fall spawning period has been closed since 2008.

The collapsed Lake Trout population in Moberly Lake currently experiences a bottleneck at some juvenile life stage that limits recruitment of juveniles to the adult population. The objective of this project is to evaluate the success of recovery stocking events from 2012, 2014, and 2016. Additionally, this work also continues a long-term mark-recapture program on the spawning shoal that provides essential information to help estimate population abundance, recruitment and survival of the remnant adult population.

In 2019, we conducted tooth-entanglement gillnetting on the spawning shoals from Sept. 30 to Oct. 4. Lake Trout are marked with a combination of adipose fin clips, PIT tags and floy tags. A fin ray clip is taken from all new Lake Trout caught in the nets. As in other years, there were no fish mortalities during the sampling in 2019. In total, 55 unique Lake Trout were caught, of which 38 were males, which exceeded our target of 30 males for an updated population estimate with reasonable error bounds. Of these Lake Trout, 39 were recaptures, 15 were new fish and one was lost from the net before it could be measured. As with previous years, none of the Lake Trout caught on the spawning shoals were the hatchery stocked individuals. Updated analyses of the markrecapture population estimate and characterization of the remnant population is currently ongoing.

<b>Tracking No.</b>	<b>L1906</b>	<b>Year</b>	<b>2 of 3</b>	<b>Total Spent to Date</b>	<b>\$5,084</b>
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