Kootenay Lake Bull Trout Redd Counts 2019 Data Report

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Background

Bull Trout spawner abundance has been monitored by conducting redd counts in index streams of Kootenay Lake in 2011, 2013, 2015, and 2017, with partial surveys conducted in additional years since 2006 (Masse Environmental Consultants Ltd. 2016; Andrusak 2014; Andrusak and Andrusak 2012a; Andrusak 2010). The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) funded a contract to complete the redd counts in 2019 using the same methods as defined by Decker and Hagen (2008) and in the same index stream reaches as in previous years. As mentioned in the Services Agreement, the objective of the counts is to document adfluvial Bull Trout spawner distribution and abundance within Kootenay tributaries during the fall of 2019 as part of a long-term time series. These data will form part of the core monitoring program of the Kootenay Lake Nutrient Restoration Program. This data report summarizes the results of the 2019 Kootenay Lake Bull Trout Redd Counts conducted by Mountain Water Research in October for MFLNRORD.

Methods and Survey Sites

As an index of adult Bull Trout escapement the same methods established by Decker and Hagen (2008) of visual counting redds in the substrate that indicate spawning activity and egg deposition were used. Redd counts are one of the least expensive and least invasive adult population assessment methods and under appropriate conditions, can be precise indicators of abundance (Johnston et al. 2007).

Redd surveys were conducted by a crew of two people, each equipped with waders and polarized glasses, who walked downstream from the barriers parallel to one another on either side of the stream. All observed redds and spawners were enumerated, recorded and marked with a handheld GPS device for each survey area. Where possible, the sex and approximate fork length (visual estimate) of individual fish was also recorded. We assumed that females not associated with redds were unspawned females and would construct redds after the survey was completed. During each survey the water temperatures were measured using an alcohol thermometer and recorded twice throughout the day. Additional data collected during the surveys included water level (discharge; low, medium, high), water clarity, survey condition, and redd count reliability estimate. If an index area could not be completed in one day (typically, five kilometers can be surveyed in a day) the survey was resumed the following day.

As defined by Hagen and Decker (2008) there are three potential classifications for an excavation found by a survey crew: 1) natural stream scour 2) viable redd, 3) test dig. There are several characteristics that may be present to allow redds to be differentiated from natural scour:

- Circular, dish-shaped excavations in the creek bed material, accompanied by a gravel deposit beginning in the excavated pit and spilling out of it in a downstream direction
- The overall pit is broader than the area where gravel is deposited over the eggs
- A steep pit wall, with perched substrate that can be easily dislodged into the pit
- Bright and clean substrate, and sand deposited in the area of quiet water created by the upstream edge of the pit
- Tail stroke marks or excavation marks around the redd or alongside the front portion of the gravel deposit

Test digs are very similar to redds but are usually smaller in size, with a shorter and narrower mound of gravels around the downstream edge, and have no gravel deposit swept into the pit, which would indicate at least one egg deposition event.

Redd survey dates ranged from October 1st to October 18th (Table 1). Complete surveys from the migration barriers to the mouth (or downstream extent of spawning habitat) were conducted in all creeks listed in Table 1 except for Hamill Creek which was cancelled due to snow and high-water events. Poplar Creek was surveyed from the mouth to the canyon section (approximately 1km) and the crews cancelled the survey due to high-water and safety after attempting to survey above the canyon. The lowest reach of Crawford Creek was only partially surveyed due to high discharge from an overnight rain event, but the vast majority of Crawford Creek was successfully surveyed and the lower reach typically has no redds. A short boulder section of Midge Creek (approximately 1.3 km), which historically has very few redds, was also not surveyed due to darkness and safety. Access into the Midge and Seeman drainages was conducted by helicopter and crews camped overnight to complete the surveys. All the other tributaries surveyed were accessed by 4x4 truck or ATV. The Kaslo River and Coffee Creek were surveyed independently by MFLNRORD on October 1-3 and on October 16, 2019 respectfully.

Table 1. 2019 Kootenay Lake Bull Trout tributaries and redd count survey dates.

Tributary	Survey Date
Meadow Creek	October 1-2, 2019
Matt Creek (Meadow trib.)	October 2, 2019
Poplar Creek	October 3, 2019
Kaslo River (incl. Keen)	October 1-3, 2019 (MFLNRORD)
Midge Creek	October 9-12, 2019
Seeman Creek (Midge trib.)	Ocober 9-10, 2019
Wurttemberg (Seeman trib.)	October 9, 2019
Kutetl Creek (Midge trib.)	Ocober 9-10, 2019
Conway Creek (Midge trib.)	Ocober 11, 2019
Hughes Creek (Midge trib.)	Ocober 12, 2019
Cultus Creek	October 9-11, 2019
Laib Creek (Cultus trib.)	October 11, 2019
Crawford Creek	October 16-18, 2019
Coffee Creek	October 16, 2019 (MFLNRORD)
Canyon Creek (Crawford trib.)	October 17, 2019
Hooker Creek (Crawford trib.)	October 17, 2019
Houghton Creek (Crawford trib.)	October 17, 2019
Hamill Creek	Not Surveyed

Results & Discussion

The survey conditions of all the completed tributaries ranged from poor to excellent in 2019. Most of Poplar Creek, and Hamill Creek were not surveyed due to high water and poor conditions. The survey conditions, water temperatures, and redd count reliability can be found in Table 2 below. A total of 261 Bull Trout redds were enumerated in 2019 (Table 3) during this study. In addition, a total of 203 Bull Trout redds were enumerated in the Kaslo River watershed (S. Arndt pers. comm.). Total counts of redds for all survey years since 2006 can be found in Table 4. The total redd estimate in the surveyed index streams in 2019 was the lowest on record when compared to the redd counts since 2006 (Table 4). Heavy rain events in September of 2019 may have influenced the reliability of the redd counts due to redd flattening and silting over from high discharge and as a result the counts are likely low due to poor observer efficiency. The crews did note that some redds were silted over and flattened in both the

Midge drainages and Crawford Creek in 2019. A heavy rain event on October 17th increased the discharge in Crawford Creek so significantly that the survey was cancelled on October 18th after only a partial survey of the lower section (Figure 1).

Rain events and increased discharge prior to the redd counts being conducted each year raises the discussion about the reliability of the time series data and observer efficiency. Survey conditions at the time of the redd surveys in October may be good or even excellent because the September high-water events have subsided, but many redds may have been obscured.

Criteria for survey cut-off, similar to the Bull Trout redd count studies on the Arrow Lakes Reservoir (Hagen 2012), has yet to be established for the Kootenay Lake Bull Trout tributaries and as a result some year's data may be unreliable or low due to missed redds that were silted over or flattened. The MFLNRORD is currently looking into whether the time series data may have been influenced by high discharge and preliminary results suggest that 2013, 2018, and 2019 are likely low counts as result of high discharge (S. Arndt, Pers. Comm.). It is also likely that some of the survey streams (i.e., glacial systems like Hamill Creek, and high gradient systems like Coffee Creek) are more prone to sedimentation and rapid high-water events from heavy rain. Having a cut-off threshold for when the surveys should be cancelled is important in order to minimize under counting of redds that have been obscured by the movement of streambed material from high-water events (Hagen 2012). Determining the cut-off threshold will require water level monitoring at key Water Survey Canada real-time stations during spawning in September prior to and during the redd counts in October. Cancelling the redd counts based on poor conditions and low redd identification reliability is an acceptable practice.

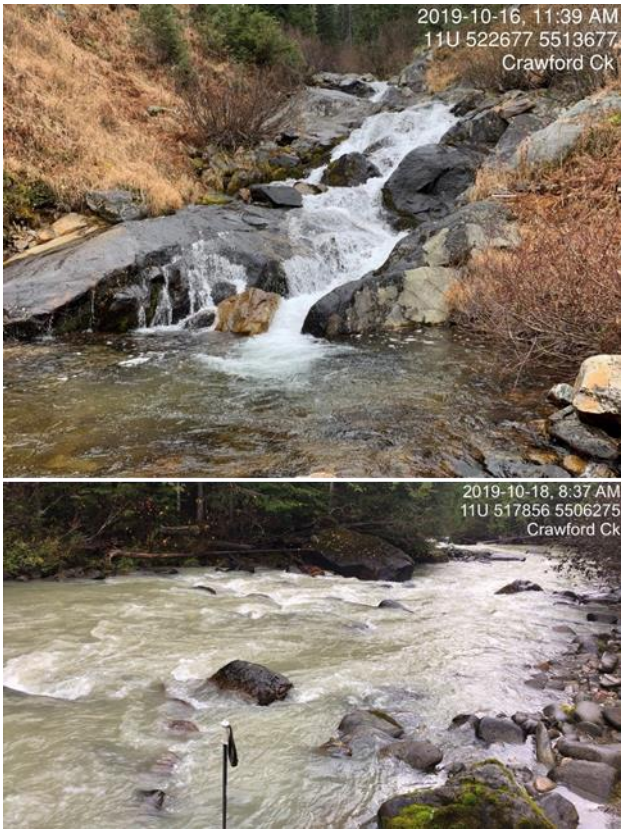

Figure 1. Crawford Creek before and after a heavy rain event on October 17th, 2019. The upper reach (October 16th) depicts great survey conditions and the lower reach (October 18th) depicts poor survey conditions following the rain event. The photos show how quickly the water levels can change and how redd counts can be jeopardized from water clarity and siltation.

Table 2. 2019 Kootenay Lake Bull Trout Redd Survey Sections, Conditions and Water Temperatures.

System	Date	Section	Crew	Water Temp Start ◦C	Water Temp Finish ◦C	Discharge	Water Clarity	Survey Conditions	Reliability of Redd Counts	Comments
Meadow	01-Oct-19	Lower	AI, CL	5.6	5.6	Moderate	Clear	Good	Good	Excellent visibility of redds. Survey was conducted upstream.
Meadow	02-Oct-19	Upper	AI, CL	5.1	5.8	Moderate	Clear	Good	Good	Good visibility of redd. Reliable count.
Meadow (Matt)	02-Oct-19	Upper to mouth	AI, CL	5.1	5.6	Moderate	Clear	Good	Good	Good visibility of redd. Reliable count.
Poplar	03-Oct-19	Mouth to Canyon	AI, CL	5.6	5.6	High	Clear	Poor	Nil	Unsurveyable due to high water. Surveyed 1.5 km approx - No redds
Midge (Seeman)	09-Oct-19	Upper	AI, JR	0.0	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Seeman (Wurttemberg)	09-Oct-19	Barrier to Mouth	AI, JR	1.0	1.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Midge (Kutetl)	09-Oct-19	Upper	SH,RP	1.6	2.6	Low	Clear	Excellent	Excellent	Excellent visibility of redds.
Midge (Seeman)	10-Oct-19	Lower to mouth	AI, JR	0.5	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Midge (Kutetl)	10-Oct-19	Lower to mouth	SH,RP	4.6	4.6	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Midge	10-Oct-19	Barrier to Seeman	SH,RP	0.2	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain. 1.3 km to mouth unsurveyed.
Midge	10-Oct-19	Seeman to Conway	AI, JR	2.0	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Cultus	09-Oct-19	Upper	JB,CL	1.8	1.3	Moderate	Clear	Excellent	Excellent	Moderately high water with recent rain. No Redds
Midge (Conway)	11-Oct-19	Barrier to Mouth	AI, JR	1.0	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Midge (Hughes)	12-Oct-19	Barrier to Mouth	Al, JR	1.0	1.0	Low	Clear	Good	Good	No Redds
Midge	12-Oct-19	Conway to 7km	AI, JR	1.0	2.0	Moderate	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain. Includes Side-Channels.
Cultus	11-Oct-19	Mid	JB,CL	5.1	5.4	Moderate	Clear	Excellent	Excellent	Moderately high water with recent rain. No Redds
Cultus (Laib)	11-Oct-19	Barrier to Mouth	JB,CL	0.5	0.5	Moderate	Clear	Excellent	Excellent	Moderately high water with recent rain. No Redds
Midge	12-Oct-19	Lower to mouth	AI, JR	5.1	5.3	Moderate	Clear	Excellent	Excellent	Moderately high water with recent rain. No Redds
Cultus	10-Oct-19	Lower to mouth	JB,CL	3.0	3.8	Low	Clear	Excellent	Excellent	Excellent visibility of redds moderately high water with recent rain
Crawford	16-Oct-19	Upper	AI, CT	3.0	5.0	Low	Clear	Excellent	Adequate	Good visibility of redds. Reliable count. Some redds faded from previous high water
Crawford	17-Oct-19	Mid	AI, CT	4.5	5.0	Moderate	Clear	Good	Adequate	Good visibility of redds. Reliable count. Some redds faded from previous high water
Crawford (Canyon)	17-Oct-19	Lower	Al, CT	4.5	5.0	Moderate	Turbid	Poor	Poor	Moderately high water with recent rain. No Redds. Very Turbid.
Crawford (Hooker)	17-Oct-19	Mouth to Barrier	AI, CT	4.5	4.5	Moderate	Clear	Good	Adequate	Good visibility of redds. Reliable count at time of survey.
Crawford (Houghton)	17-Oct-19	Barrier to Mouth	AI, CT	4.5	4.5	Moderate	Clear	Good	Adequate	Good visibility of redds. Reliable count at time of survey.
Crawford	18-Oct-19	Lower	AI, CT	5.0	5.0	High	Turbid	Poor	Nil	No Redds and Unsurveyable due to overnight rain and turbidity. Surveyed a couple of sections.
Hamill	n/a	n/a	n/a	Not surveyed in 2019 due to high water and environmental conditions.						

***Crew:** AI= Al Irvine, CL= Crystal Lawrence, JR= Jimmy Robbins, SH= Stefan Himmer, RP= Rachel Pennell, JB= Jeremy Baxter; CT= Clint Tarala

Coffee Creek was surveyed by the MFLNRORD on October 16, 2019 under Adequate survey conditions after a high-water event. The Kaslo River was surveyed the first week of October, 2019 by MFLNRORD as part of a separate study. Data files of redd and fish locations (GPS coordinates), stream temperature, crew names, and other details were provided to the MFLRORD as a separate deliverable.

Table 3. **2019 Kootenay Lake tributaries Bull Trout redd count results. The table does not include the counts from the Kaslo River. Complete counts (2006-2019) can be found in Table 4.**

Kootenay Lake Tributary	Total Redds (includes uspawned females)
Meadow Creek	*21*
Meadow Creek (Matt)	*17*
Meadow Creek Total	**38**
Poplar Creek Total	**0**
Coffee Creek Total	**16**
Midge Creek	*29*
Midge Creek (Seeman)	*40*
Seeman Creek (Wurttemberg)	*7*
Midge Creek (Kutetl)	28
Midge Creek (Conway)	1
Midge Creek (Hughes)	0
Midge Creek Total	**105**
Cultus Creek (Laib)	0
Cultus Creek	11
Cultus Creek Total	**11**
Crawford Creek	91
Crawford Creek (Canyon)	0
Crawford Creek (Hooker)	0
Crawford Creek (Houghton)	0
Crawford Creek Total	**91**
Hamill Creek	**not surveyed**
TOTAL	**261**

Note: Coffee Creek redd counts were collected and provided by MFLNRORD

Table 4. Kootenay Lake tributaries Bull Trout redd count totals for all survey years since 2006. Data provided by the MFLNRORD.

Stream Name	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Upstream Flip Bucket Fish Count - Duncan Dam	**372**	**371**	**531**	**725**	**1200**	**742**	**424**	**991**	**180**	**215**	**101**	**480**	**unknown**	**unknown**
Hamill Creek (incl. Clint Creek)	*ns*	*ns*	*ns*	*ns*	*ns*	*223*	*ns*	*ns*	*ns*	*20*	*ns*	*363*	*126*	*ns*
Poplar Creek	*ns*	*ns*	*ns*	*ns*	*ns*	*53*	*ns*	*29*	*ns*	*6*	*ns*	*32*	*ns*	*0*
Meadow Creek (incl. Matt)	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*215*	*ns*	*29*	*ns*	*57*	*ns*	*38*
North Arm tributaries - Total	**-**	**-**	**-**	**-**	**-**	**incomplete**	**-**	**incomplete**	**-**	**55**	**-**	**452**	**incomplete**	**incomplete**
Crawford Creek (incl. tribs)	*ns*	*ns*	*190*	*283*	*184*	*210*	*200*	*257*	*ns*	*53*	*ns*	*161*	*94*	*91*
Kaslo River - mainstem and tribs.	*326*	*499*	*528*	*565*	*464*	*458*	*437*	*327*	*122*	*153*	*361*	*387*	*280*	*156*
Kaslo River - Keen Creek	*104*	*137*	*169*	*153*	*94*	*92*	*83*	*77*	*22*	*92*	*48*	*142*	*65*	*47*
Kaslo River - Total	**430**	**636**	**697**	**718**	**558**	**550**	**520**	**404**	**144**	**245**	**409**	**529**	**345**	**203**
Coffee Creek	*ns*	*ns*	*ns*	*ns*	*ns*	*92*	*102*	*31*	*18*	*16*	*ns*	*30*	*12*	*16*
Central tributaries (North Arm) - Total	**incomplete**	**incomplete**	**incomplete**	**incomplete**	**incomplete**	**852**	**822**	**692**	**incomplete**	**314**	**incomplete**	**720**	**451**	**310**
Midge Creek - mainstem & Kutetl Creek	*ns*	*ns*	*ns*	*ns*	*ns*	*216*	*ns*	*79*	*ns*	*67*	*ns*	*69*	*62*	*68*
Midge Creek - Seeman (incl. Wurttenberg Creek)	*ns*	*ns*	*ns*	*ns*	*ns*	*169*	*ns*	*39*	*ns*	*62*	*ns*	*102*	*135*	*47*
Midge Creek - Conway Creek	*ns*	*ns*	*ns*	*ns*	*ns*	*16*	*ns*	*13*	*ns*	*0*	*ns*	*23*	*12*	*1*
Midge Total - Total	**-**	**-**	**-**	**-**	**-**	**401**	**-**	**131**	**-**	**129**	**-**	**194**	**209**	**116**
Cultus Creek (incl. Laib Creek)	*ns*	*ns*	*ns*	*104*	*ns*	*50*	*ns*	*25*	*ns*	*3*	*ns*	*25*	*ns*	*11*
South Arm tributaries - Total	**-**	**-**	**-**	**incomplete**	**-**	**451**	**-**	**156**	**-**	**132**	**-**	**219**	**incomplete**	**127**

ns: not surveyed.
incomplete: indicates a year where not all streams were surveyed (partial survey).

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