Site C Clean Energy Project

Peace River Fish Community Monitoring Program (Mon-2)

Task 2e – Peace River Tributaries Walleye Spawning and Rearing Use Survey

Construction Year 8 (2022)

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Walleye Spawning and Rearing Use Survey (Mon-2, Task 2e) 2022

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Purpose and Objectives

As per the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[1]), "the purpose of the Peace River Tributaries Walleye Spawning and Rearing Use Survey is to assess the habitat characteristics of spawning and rearing areas in the Beatton and Kiskatinaw rivers that are used by the Peace River Walleye population. Data collected under the survey will be provided to the Site C Tributary Mitigation Opportunities Evaluation Program to advise potential future habitat enhancement opportunities for Walleye in these tributaries."

The objectives of this study were to:

1. Summarize the movements of pre-spawn, radio-tagged Walleye (*Sander vitreus*) in the Beatton River.
2. Identify potential Walleye spawning areas based on the movement of radio-tagged fish.
3. Describe the habitat characteristics at potential Walleye spawning locations.
4. Confirm juvenile Walleye rearing locations based on juvenile capture.
5. Describe the habitat characteristics in rearing areas situated immediately downstream of potential spawning areas by larval and juvenile Walleye. Habitat attributes will be measured in these areas.

Study Area

The 2022 study area was comprised of the lower 89 km of the mainstem Beatton River from the Milligan Creek Road Bridge down to the confluence with the mainstem Peace River (Figure 1). The Beatton River drains into the Peace River from the north approximately 37 km downstream of Site C and 25 km upstream of the BC/AB border. To be consistent with previous BC Hydro studies in the Beatton River (Mainstream 2013, Smith et al. 2022), we stratified our findings into four major reaches that were delineated based on physical habitat characteristics (Table 1). The location of river kilometre (rkm) markers used in this report were derived from GIS vectors that followed the thalwegs of the Beatton River, with markers counting upwards starting at the junction with the Peace River (rkm 0 is at the river mouth).

Study Period

Ten mobile-tracking surveys were conducted by helicopter between 29 April and 3 June 2022 (Appendix B). During this period, discharge in the Beatton River ranged from 82.4 to 684 m^3/s (Figure 2).

Surveys to assess spawning habitat characteristics in the Beatton River were conducted on 2 and 3 June 2022, when discharge in the Beatton River averaged 330 and 280 m^3/s, respectively.

Field effort to capture juvenile Walleye in the Beatton River, and to assess rearing habitat characteristics, occurred in two bouts, one from 30 June to 1 July, and the other from 27 to 28 July 2022. Discharge during these periods ranged from 147 to 183 m^3/s.

[1] Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at https://www.sitecproject.com/document-library/environmental-management-plans-and-reports.

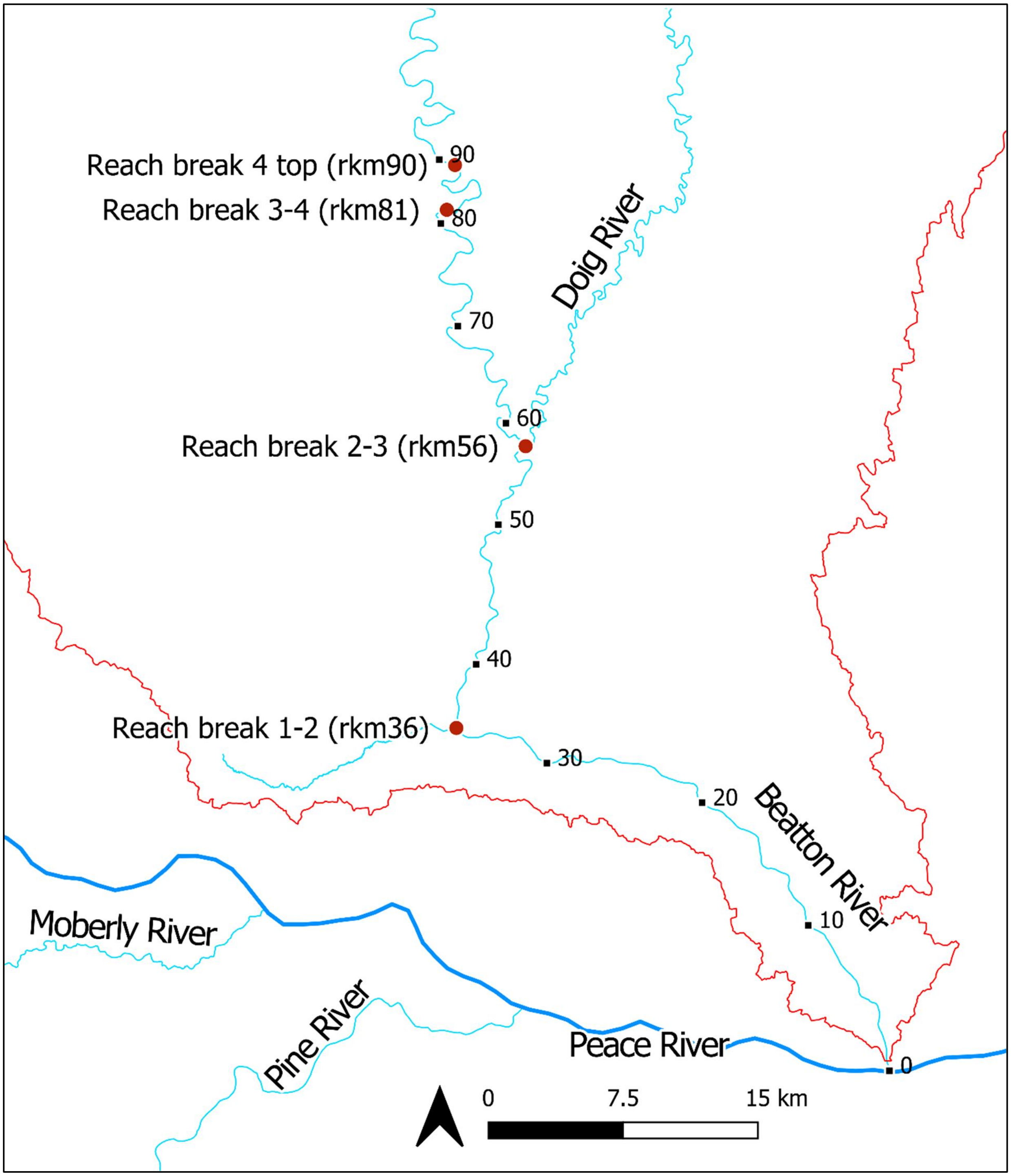

Figure 1. Study area in the Beatton River extending from the mouth (rkm 0) up to the Milligan Creek Road Bridge (rkm 89), 2022. Every 10th rkm is marked. The 'Beatton River Watershed' mobile tracking zone (starting at 0.5 km from the mouth) is shown in red.

Table 1. Reach designations of the Beatton River as adapted from Mainstream (2013).

Reach	Description	Dominant Channel Form	Gradient (m/km)	Dominant Bed Material	Location	Length (km)
1	Frequent riffle complexes interspersed with extended runs with some flats; flats becoming predominant in last 4 km	Regular meanders; occasionally confined	1.2	sands, gravels, cobbles	rkm 36 to 0	36
2	Frequent riffle complexes interspersed with extended runs; some flats	Irregular meanders at the upstream end, shifting to regular meanders; frequently confined	1.8	cobbles, boulders	rkm 56 to 36	20
3	Dominated by runs interspersed with riffles and some rapids	Irregular meanders; frequently confined	1.9	cobbles, boulders	rkm 81 to 56	25
4	Dominated by runs and occasional flats; interspersed with some riffle complexes	Irregular meanders; occasionally confined	1	sands, cobbles, boulders	rkm 89 to 81	8

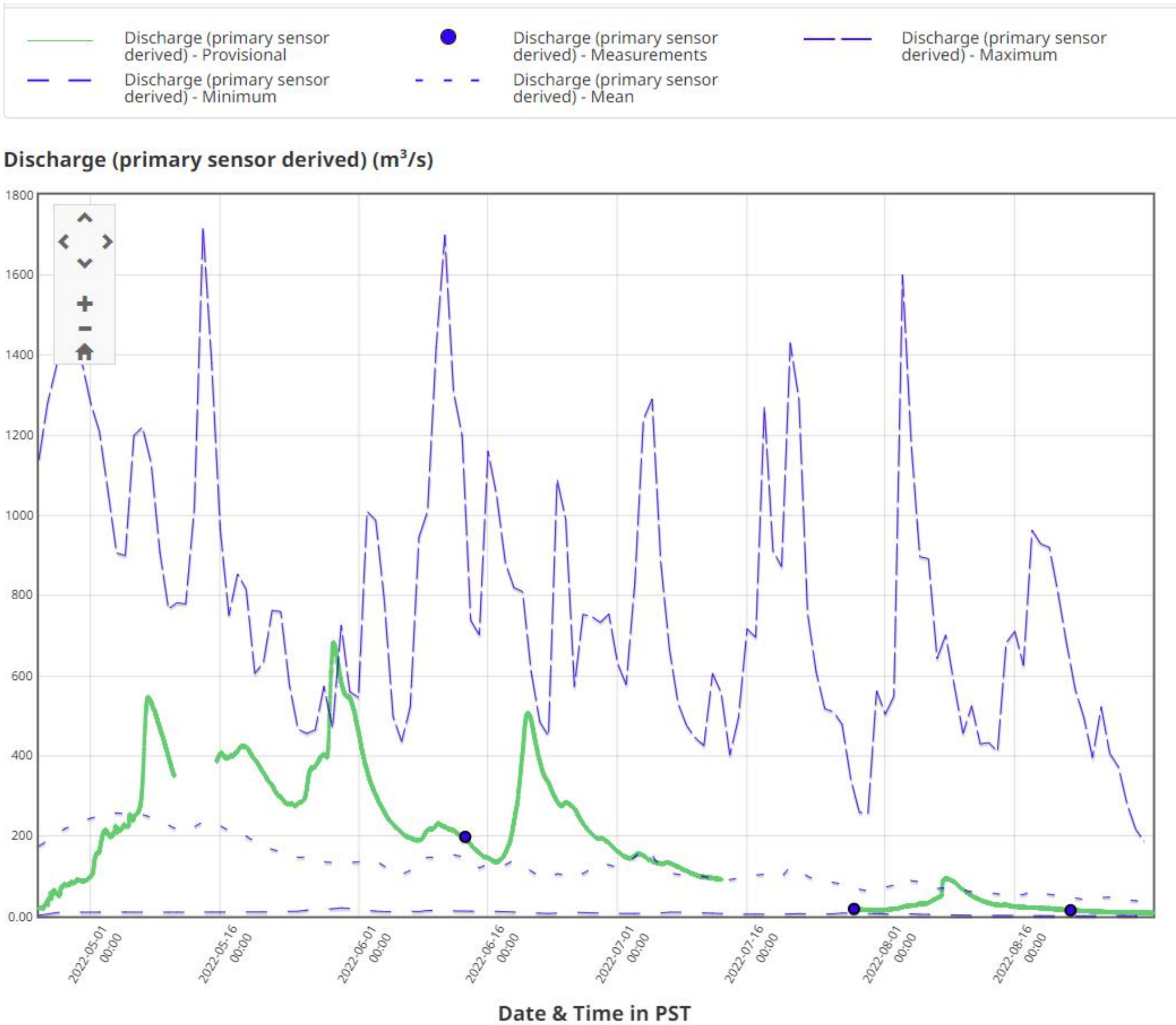

Figure 2. Discharge of the Beatton River near Fort St. John (Water Survey of Canada hydrometric station 07FC001) from 25 April to 31 August 2022. Data were provided at 5-minute intervals. Image was captured from the Water Survey of Canada (WSC) webpage (wateroffice.ec.gc.ca) in September 2022. Note that these discharge data are listed as provisional by the WSC.

Figure 3. Twin-engine helicopter equipped with a single H-antenna mounted on the nose for conducting mobile-tracking surveys in the Beatton River, 2021-2022.

Methods

Walleye Movements and Identifying Potential Spawning Areas

Past studies, as summarized in Mainstream (2012) and ESSA et al. (2020), have identified the Beatton River as a source of recruitment for Peace River Walleye, and the Kiskatinaw River as a suspected recruitment source. Peace River telemetry studies (e.g., AMEC and LGL 2008a,b,c) have shown that the majority of Walleye presumably spawning in the Beatton River congregate at the river mouth in early-mid April, migrate as far as 30-50 km upstream to spawning areas from around late April through June, and then return to the mouth of the Beatton River. Previous studies did not extensively sample for Walleye in the Kiskatinaw River, but it was assumed that spawning movements, if any, would be similar in timing to those in the Beatton River. No surveys were conducted in the Kiskatinaw River in 2022 based on the lack of detections of radio-tagged Walleye in that river in 2021 (Smith et al. 2022). The 2022 pre-season plan was to conduct mobile-tracking surveys only in the Beatton River from late April to early June at a frequency of one survey every four days (10 surveys total). The goal of this effort was to track the movements of radio-tagged Walleye and to identify potential spawning areas. During the surveys, there were 121 adult radio-tagged Walleye available for detection, including 61 that were radio-tagged in the Peace River between 24 August and 6 October 2020 (65 fish released, but 4 were expected to have expired batteries), and 60 released between 26 August and 23 September 2021 (Hatch et al. 2022).

For each survey, a twin-engine helicopter was equipped with one H-antenna mounted on the nose (Figure 3). Shielded coaxial cable (RG-58) was used to connect the antennas to two SRX800-MD receivers in the cabin, where each receiver scanned only one of the two transmitter frequencies (i.e., 149.360 and 149.400

MHz). Surveys were flown at low elevation (<50 m) and relatively slow air speeds (<100 km/h). As soon as a radio-tagged Walleye was detected, air speed was reduced to 50 km/h or slower to ensure precise tag locations were recorded for each fish. A GPS signal was fed directly into the SRX800 receivers (producing geo-referenced detection data), and a handheld GPS unit was run to store a complete track of the survey route. The receiver clock was synchronized with the GPS unit prior to each flight. The approximate position and identity of each detected radio tag (tagged fish) was recorded manually on a datasheet by the field crew, as a backup to the electronic systems. Prior to the first survey, a test tag was used to qualitatively confirm detection range at altitude, and test receiver gain settings.

The SRX800 receivers and GPS unit were downloaded after each day, and the data were sent electronically to the office staff for processing. Detections from each day were filtered to remove noise, and erroneous detections from codes that were not associated with active tags. Then, the highest-powered detection of each unique tag was selected, and the timestamp and geographic coordinates of that detection were used to represent that fish's location during the time of the flight survey. Thus, at the end of each flight, each unique tag appeared once in the resulting datafile, on a line containing its ID (frequency, code, species), a timestamp, latitude, longitude, and power reading associated with the highest power detection event, as well as the number of times it was detected during the flight.

The geo-referenced data were processed using a Python script in ArcGIS that outputted the name of the river/creek in which the detection was located, and a rkm reading. The post-processed data were uploaded into the Site C Fish Movement Assessment Database and processed (see Hatch et al. 2023) to put each new mobile detection in the context of all other detections from that fish.

When processing telemetry data from the Site C Fish Movement Assessment in general (see Hatch et al. 2023), we did not assume that detections within 0.5 km of the mouth of a tributary were committed to continuing upstream. This is because many of these detections could theoretically be of fish that are actually in the Peace River mainstem yet *appear* to be within a tributary as a result of the position of the aircraft, the timing of tag transmissions relative to the motion of the aircraft, or, to a lesser extent, the sampling error of the GPS device (which typically had better than 50 m accuracy). As such, the mobile-tracking zones associated with tributary areas were set to start 0.5 km from their junction with the larger river to which they join (this can be seen in Figure 1). Since the movement data were processed in this way, it was most straightforward to restrict Walleye movement analyses to detections that were > 0.5 km upstream from the mouth of the Beatton River. Thus, tributary entrance was defined by passing that 0.5 km threshold.

To find potential spawning sites, we examined the sequential detections of individuals to look for cessation of upstream movement (recurring detections of an individual in one place over time), which could indicate arrival at a desired location (e.g., Eiler et al. 1992). Where individual fish did not show repeated detection in a single place, we assumed their destination was their farthest upstream location, a standard procedure for fish migrating upstream into a spawning river (similar to Yanusz et al. 2018). For each flight, we looked for potential aggregations by examining the collective detection locations of all the slow or stopped individuals.

Migration speeds (km/d) for individual fish were calculated by dividing the distance traveled between surveys by the length of time between surveys.

Walleye Spawning Habitat Assessment

The crew attempted to assess each potential spawning area to sample the habitat characteristics. Due to limited road access, a three-person crew used a helicopter to access most of the potential spawning sites (three were accessed by truck), and those without a safe nearby helicopter landing zone were not sampled. In rivers, Walleye are known to spawn in riffles, rapids, and areas of faster current (e.g., Hartley and Kelso 1991), but flow conditions and safety concerns precluded sampling habitat across the entire cross-section of the river channel, so the crew focused on nearshore areas that were safely accessible by foot. A variety of habitat parameters were measured at each potential spawning location (see Appendix A for datasheet templates and field definitions), including:

- Date, time, and geodetic location
- Water temperature (± 0.1ºC), pH (± 0.1), and conductivity (± 1% FS, µS/cm) were measured with a portable meter (Hanna Instruments Model HI9811-5)
- Water clarity was visually estimated and scored using a categorical ranking (either turbid, moderately turbid, lightly turbid, or clear)
- Velocity (m/s, averaged over 30 s) was measured in areas that were safely accessible on foot (at 1 to 50 m from the bank, depending on the site, see Appendix C) using a current meter (Swoffer Model 2100)
- Bankfull and wetted channel widths (m) were measured with a rangefinder
- Substrate composition, embeddedness, and compaction
- Available fish cover (%)
- Dominant instream and bank habitat type.

Juvenile Walleye Rearing Habitat Assessment

A two-person crew used a beach seine to sample for young-of-the-year (YOY) Walleye in 2022. All sampling was done under and in accordance with Fish Collection Permits FJ21-620914 and FJ22-708612. Sampling was focused in areas that were downstream of potential spawning locations (as identified by tracking radio-tagged adult Walleye, see above). Since habitat for YOY Walleye is one of the least studied aspects of Walleye biology (Bozek et al. 2011), we endeavoured to sample an array of habitat types (i.e., pool, riffle, run, flat) in the Beatton River to ensure a diverse coverage of all potential rearing areas, and also included habitats in the Peace River near the Beatton mouth.

The beach seine was 13.4 m long and 1.5 m deep with 6.3 mm stretched mesh (44 ft long, 5 ft deep, 0.25 inch mesh). The net was typically set perpendicular to the current and dragged a short distance (13-39 m, average 24 m; Appendix D) downstream before being hauled to shore. Multiple sets were conducted at most sites. Crews rated set effectiveness for each site as either good, moderately good, moderately poor, or poor (see Appendix D). All fish captured were transferred from the seine net to a holding bucket.

All captured fish were held in an aerated holding bucket prior to sampling. Since the goal was to sample as many sites as possible to find YOY Walleye, the value of making numerous sets outweighed that of identifying, counting, measuring, and weighing fish from any given set when no Walleye were present. Nevertheless, to allow for CPUE calculation and biosampling, there were sets (typically the first three at any site) for which all fish were identified to species, and all were measured for length (to the nearest 1 mm), and (if not too windy or rainy) weighed (to the nearest 0.1 g; see Appendix A for sample datasheet). Total length was measured for sculpins (Cottidae) and fork length was measured for all other species. At one site (BS-22-13) without Walleye, the number of individuals captured was too high to fully process all the fish without incurring unnecessary stress- and holding-related mortalities, so the fish were identified and counted without measuring or weighing any of them. After a few representative sets were performed at each site, ancillary sets were completed to try to find YOY Walleye – for these sets the habitat and bycatch data were not recorded.

Depending on their size and species, some of the captured fish were scanned for PIT tags, and PIT tags were injected into some of the untagged fish that were in good condition. The species and size criteria were based on those used for the Site C Reservoir Tributary Fish Population Indexing Survey (Golder 2020), which included Arctic Grayling, Burbot, Bull Trout, and Rainbow Trout over 80 mm. When PIT tags were to be implanted, the sizes (i.e., models) of the tags used were again based on fish length criteria (Golder 2020).

Habitat parameters measured at each sampling site were mostly the same as those recorded during the spawning component (see Appendix A for sample datasheet).

Results

Walleye Movements and Potential Spawning Areas

Ten mobile-tracking surveys were conducted between 29 April and 3 June 2022 along the mainstem of the Beatton River, covering from the mouth up to rkm 89 (Milligan Creek Road Bridge), although one survey (7 May) stopped at rkm 52 (Appendix B) based on in-situ decisions from the field crew. Thirty-six radio-tagged adult Walleye were detected within the Beatton River across all ten surveys. The detected Walleye had originally been tagged and released at a wide variety of locations both upstream and downstream of the Project, including Sections 1, 3, 5, 6 and 7 (Table 2). The detected fish, when released in 2020 or 2021, measured between 273 and 736 mm FL (average 447.1 mm), and weighed between 210 and 5,075 g (average 1,174.4 g; Table 2). Seven of these fish were never detected upstream of rkm 1.5 of the Beatton River (Table 2, Appendix B), including the smallest observed fish (273 mm FL, 210 g). The remaining 29 Walleye did not differ significantly in length ($F_{1,34} = 0.0003$, $P = 0.98$) or weight ($F_{1,34} = 0.009$, $P = 0.92$) from the fish that did not proceed past rkm 1.5. The number of tags detected upstream of the first 0.5 km ranged from 10 (on 2 and 10 May) to 29 (26 May; Table 3). The detection efficiency of the Beatton River overflights was 95% (Table 3), having detected 186 of a possible 195 detection events upstream of the river mouth across the ten mobile tracking surveys (the 7 May flight ended at rkm 52, thereby missing the three upstream most fish, but these were not counted against the detection efficiency of the flights). High detection efficiencies were expected given the method of flying required to pinpoint potential spawning locations.

Based on their most upstream detection location, seven radio-tagged Walleye never moved upstream of rkm 1.5 (stayed in the lower areas of Reach 1), 24 fish made it to the upper areas of Reach 1 (rkm 1.8-36), two fish moved into Reach 2, two fish made it to Reach 3, and one was detected in Reach 4 (Table 3). The 29 fish that were tracked upstream of rkm 1.5 included nine that were also upstream of rkm 1.5 in 2021. From the 29 radio-tagged Walleye that were tracked at or upstream of rkm 1.5 from 29 April to 3 June 2022, we identified 21 potential spawning sites (rkm 2.0-86.0; Figure 4) – the other eight fish either did not provide adequate data to make an assessment (n=4), were still moving upstream at the time of the last mobile survey (n = 3), or only moved in a downstream direction (n=1, Table 3).

Table 2. Release information for the radio-tagged Walleye detected in the Beatton River during mobile-tracking surveys conducted from 29 April to 3 June 2022. See appendices in Golder and Gazey (2020) for locations of release sites. All tags were manufactured by Lotek, model NTF-6-2. Also, shown for fish tagged in 2020 is whether or not they were detected in the Beatton River in 2021.

Tag ID	Tag Channel	Tag Code	Tag Pulse Rate (s)	Release Date	Release Time	Release Site	Fish Length (mm)	Fish Weight (g)	Passed rkm 1.5	In Beatton in 2021
521	3	160	9.2	24 Sep 2019	15:44:00	07BEA01	482	1,274	Y	Y
736	3	519	9.2	28 Aug 2020	11:12:20	0609	679	3,226		Y
744	3	521	9.2	29 Aug 2020	11:52:44	07BEA01	496	1,490	Y	Y
779	3	537	9.4	8 Sep 2020	11:12:06	06PIN02	531	1,426	Y	Y
820	3	622	9.8	15 Sep 2020	15:10:00	0312	379	638	Y	Y
830	3	644	9.8	17 Sep 2020	11:16:49	06PIN01	610	2,876	Y	Y
837	3	588	9.6	18 Sep 2020	09:50:00	0103	434	930	Y	Y
857	3	653	9.8	20 Sep 2020	17:38:00	0301	413	744	Y	Y
863	3	576	9.6	21 Sep 2020	12:15:15	0610	325	297	Y	Y
866	3	572	9.6	21 Sep 2020	14:02:19	0609	425	793		
889	3	571	9.4	23 Sep 2020	14:52:20	OEMMS	406	697	Y	Y
910	3	494	9.2	25 Sep 2020	11:28:32	0708	451	973		Y
969	3	700	5.0	10 Sep 2021	17:17:00	07BEA01	407	797	Y	n/a
971	3	702	5.0	10 Sep 2021	15:21:00	06SC036	422	806	Y	n/a
982	3	713	5.0	10 Sep 2021	11:12:00	0607	395	650	Y	n/a
985	3	716	5.0	10 Sep 2021	17:04:00	07BEA01	428	1,013	Y	n/a
1006	5	108	9.2	23 Sep 2021	15:06:00	07BEA01	394	809	Y	n/a
1011	5	113	9.2	22 Sep 2021	11:32:00	07BEA02	462	1,203	Y	n/a
1014	5	116	9.2	21 Sep 2021	16:31:00	0607	474	1,054	Y	n/a
1113	5	215	9.8	2 Sep 2021	16:55:00	06PIN02	415	738	Y	n/a
1116	5	218	9.8	2 Sep 2021	14:33:00	0601	373	609	Y	n/a
1123	5	225	9.2	27 Aug 2021	14:33:00	0603	338	426	Y	n/a
1127	5	229	9.2	31 Aug 2021	12:32:00	0712	400	621	Y	n/a
1129	5	231	9.2	27 Aug 2021	10:44:00	06PIN02	512	1,604	Y	n/a
1131	5	233	9.2	3 Sep 2021	17:38:00	0609	466	1,194		n/a
1136	5	238	9.2	30 Aug 2021	10:59:00	07BEA02	640	3,629	Y	n/a
1144	5	246	9.2	30 Aug 2021	11:09:00	07BEA02	736	5,075	Y	n/a
1150	5	252	9.4	27 Aug 2021	17:32:00	0605	462	969	Y	n/a
1152	5	254	9.4	11 Sep 2021	10:10:00	07BEA02	436	923	Y	n/a
1156	5	258	9.4	27 Aug 2021	17:23:00	0605	455	864	Y	n/a
1167	5	269	9.4	16 Sep 2021	10:32:00	0701	478	1,276	Y	n/a
1172	5	274	9.4	16 Sep 2021	12:06:00	07BEA01	273	210		n/a
1227	5	329	9.8	27 Aug 2021	14:33:00	0603	342	457	Y	n/a
1234	5	336	9.8	2 Sep 2021	17:00:00	06PIN02	437	841		n/a
1241	5	343	9.8	11 Sep 2021	11:33:00	0708	326	398	Y	n/a
1244	5	346	9.8	27 Aug 2021	15:55:00	0604	395	749		n/a

Table 3. Location (river kilometre, rkm) of radio-tagged Walleye detected in the Beatton River during mobile-tracking surveys conducted from 29 April to 3 June 2022, by reach of most upstream detection, tag ID, and survey date. Bold numbers indicate the most upstream detection for each fish. Cells shaded in blue were considered as part of cluster of detections that lent evidence to there being possible spawning activity, and the value in red was the most representative (e.g., central) of the possible spawning location of each fish (three fish that were still moving upstream at the time of the last mobile survey have their tag ID shown in red). Detections within 0.5 km of the mouth are labelled as "mouth". Missed detections are labelled as such. Blank cells indicate where the fish was known (from its complete detection history) not to be in the Beatton River. Entrance and departure dates were determined using the fixed-station receiver at the mouth of the river, and other detection data.

Reach	Tag ID	Entrance Date (for fish > 1.5 rkm)	Location of Tag Detection (rkm), by Survey Date										Departure Date (for fish > 1.5 rkm)
			29 Apr	2 May	7 May	10 May	14 May	17 May	22 May	26 May	30 May	3 Jun	
1 (rkm 0.0-1.5)	736	-								0.6			-
	866	-	0.7	0.6				0.7		0.7			-
	910	-					1.1						-
	1131	-						0.8					-
	1172	-	0.6										-
	1234	-					0.6	1.5		0.8			-
	1244	-					1.1	0.9	0.9	1.3	0.7	1.0	-
1 (rkm 1.5-36)	521	12 May 2022					2.8	4.7	5.8	miss	5.4	4.9	11 Jun 2022
	744	14 May 2022					mouth	1.9	4.2	10.4	10.1		2 Jun 2022
	779	10 May 2022				mouth	1.2	1.3	2.4	4.8	4.9	4.7	10 Jun 2022
	820	> 14 May 2022										11.3	unknown
	889	2 May 2022		mouth	miss	mouth	mouth	4.6	5.7	6.3	3.8	2.8	14 Jun 2022
	969	12 May 2022					4.4	8.7	11.8	23.7	23.3	24.2	7 Jul 2022
	971	21 May 2022							0.9	1.8			28 May 2022
	982	> 23 Sep 2021	2.0	2.0	1.6	1.7	0.8	0.7	mouth	mouth			28 May 2022
	985	12 May 2022					2.5	6.4	14.6	29.2	31.2	33.2	9 Jul 2022
	1006	21 May 2022							1.9	7.4	5.3		3 Jun 2022
	1011	12 May 2022					4.6	9.7	16.5	28.3	27.6	31.9	24 Jun 2022
	1014	12 May 2022					4.4	5.3	12.3	27.9	27.9	28.7	12 Jun 2022
	1113	> 5 Oct 2021	0.8	0.7	0.6	1.1	0.7	2.0	3.4	17.1	15.9	19.9	16 Jun 2022
	1123	20 Sep 2021	33.4	32.1	31.7	32.1	31.6	32.2	32.1	32.2	29.5	22.4	19 Jun 2022
	1127	12 May 2022					1.3	2.0	5.3	5.3	5.2	5.5	10 Jun 2022
	1129	12 May 2022					2.0	2.1	10.4	20.1	19.7	20.8	26 Jun 2022
	1136	12 May 2022					4.9	10.5	13.7	29.2	24.9	23.4	4 Jun 2022
	1144	20 May 2022							1.9				24 May 2022
	1150	12 May 2022					2.3	4.8	4.8	4.9	1.9	mouth	3 Jun 2022
	1152	27 May 2022									23.0	mouth	3 Jun 2022
	1156	14 May 2022					mouth	2.1	2.6	15.3	14.6	16.0	15 Jun 2022
	1167	6 May 2022			1.0	miss	3.5	3.4	1.8	2.7	2.1		2 Jun 2022
	1227	29 Apr 2022	1.4	1.2	1.1	1.3	2.0	2.4	3.6	8.3	8.6	8.2	15 Jun 2022
	1241	12 May 2022					2.4	4.4	7.8	21.0	20.4	20.4	24 Jun 2022
2 (rkm 36-56)	857	26 Apr 2021	miss	27.9	27.7	27.4	27.2	28.7	34.3	36.0	32.8	33.9	11 Jun 2022
	1116	11 Sep 2021	44.6	44.5	miss	43.6	43.7	39.3	36.6	36.6	30.3	18.7	10 Jun 2022
3 (rkm 56-81)	830	27 Sep 2021	59.9	miss	n/a	59.7	miss	59.5	59.5	59.2	53.5	33.6	6 Jun 2022
	863	1 May 2021	73.7	73.8	n/a	miss	72.9	72.9	73.1	74.4	73.2	72.7	Did not
4 (rkm 81-90)	837	29 Apr 2021	85.8	86.0	n/a	86.2	77.9	miss	55.9	53.4	53.8	53.5	Did not
No. Tags Beyond Mouth			11	10	11	10	24	28	27	29	26	22	198

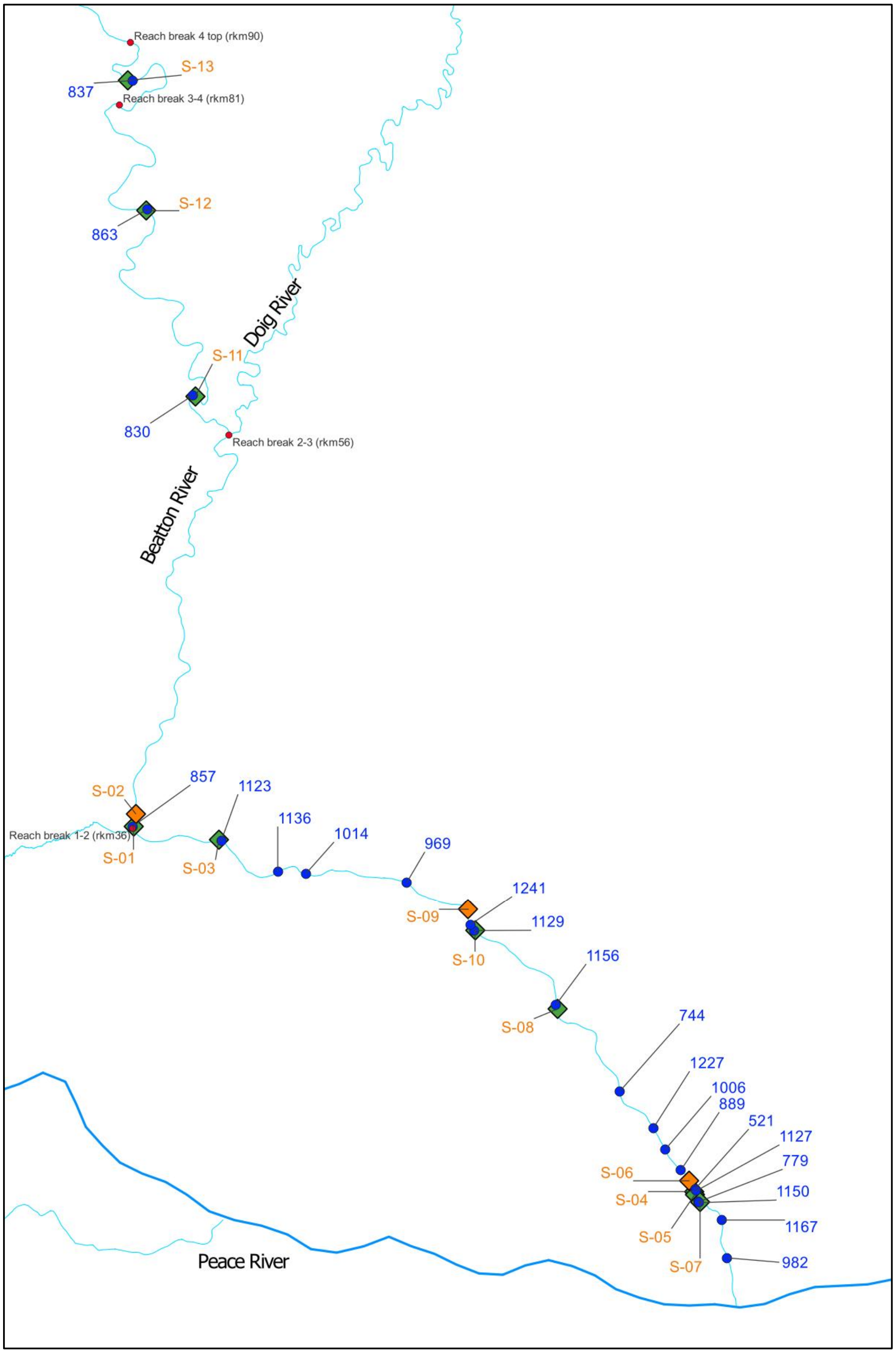

Figure 4. Potential spawning locations for 21 radio-tagged Walleye (blue circles, labelled by Tag ID) based on their detection data during mobile-tracking surveys conducted from 29 April to 3 June 2022. Also shown: 13 sites (S-01 to S-13) where spawning habitat characteristics were sampled on 2-3 June (green diamonds for sites that are within 200 m of a potential spawning location, otherwise orange).

Beatton River entrance timing is shown in Table 3 for the 29 fish that eventually passed rkm 1.5. For some fish, the exact entrance timing could be calculated using data collected by the fixed-station receiver located at the mouth of the Beatton River (see Hatch et al. 2023), whereas others either entered without being detected by that receiver, or did so during the winter (see dates in Table 3) when the station was demobilized. Entrance was in late-April or early May of 2021 for three fish (they spent a full year in the Beatton River), and was in late September or early October 2021 for another five fish. The remaining 21 fish entered in April or May 2022, including one on 29 April, one each on 2, 6 and 10 May, a large push of ten fish entering on 12 May, three on (or around) 14 May, and four on or after 20 May. Of the 29 radio-tagged Walleye that eventually passed rkm 1.5, nine were already upstream of the Beatton mouth on the first survey on 29 April, including 7 that had already passed rkm 1.5 before the first flight.

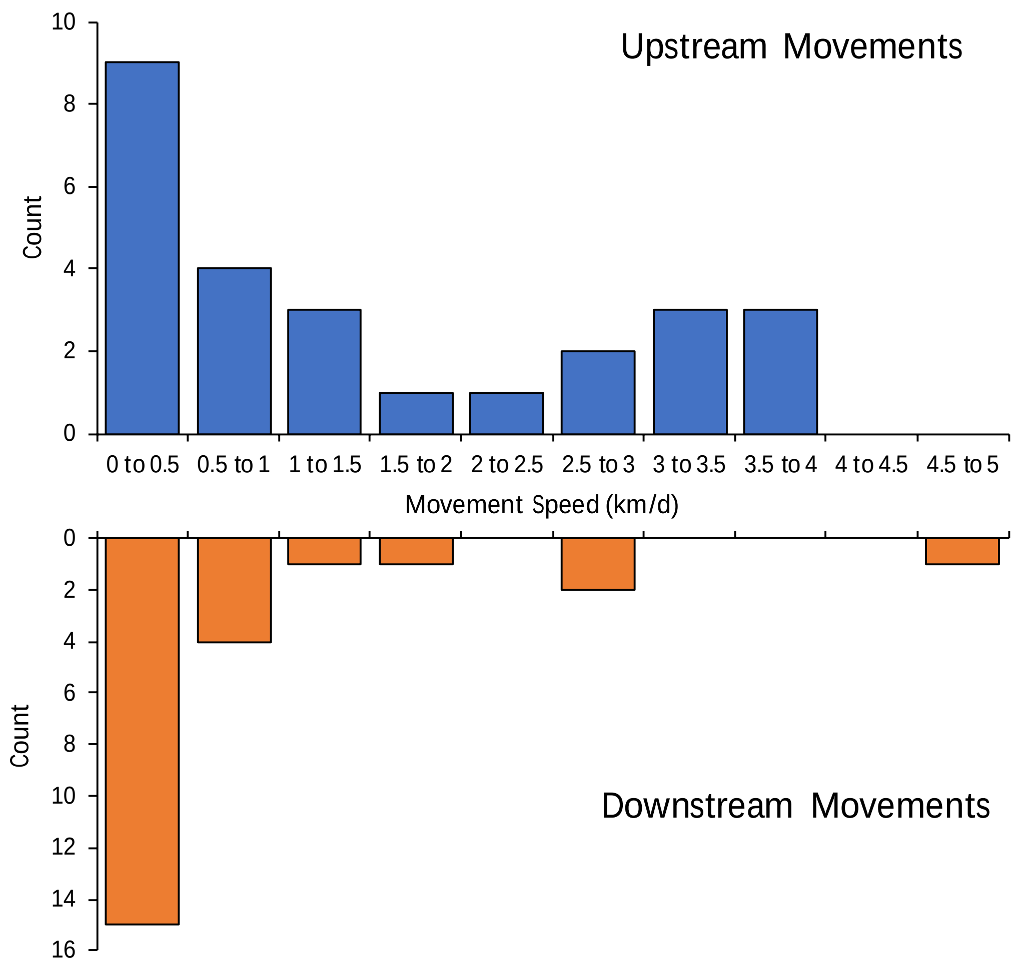

Figure 5. Distribution of maximum observed movement speeds for 29 radio-tagged Walleye that may have spawned in the Beatton River upstream of rkm 1.5 during tracking in the Beatton River from 29 April to 3 June 2022. Movements in the upstream direction are shown in the upper panel; those in the downstream direction are shown below the horizonal axis on the lower panel.

Other than Walleye, there were three radio-tagged fish detected in the Beatton River. One Bull Trout has seemingly shed its tag in the Beatton River since October 2020 (it was detected at rkm 46 during all ten mobile tracks in 2021 and on 6 of 10 surveys in 2022). One Mountain Whitefish, detected on all 10 surveys, was found to be moving downstream in the Beatton (at rkm 11 on 29 April and 2 May, at rkm 4.9 on 7 May, at rkm 3.9 on 10 May, and then around rkm 3.4 from 14 May to 3 June). One Rainbow Trout was detected between rkm 14 and rkm 15 from 29 April until 17 May, after which it moved into the Peace River mainstem (detected on the Beatton mouth fixed station on 21 May).

By the time the last survey occurred on 3 June, there still remained 22 radio-tagged Walleye in the Beatton River, all but one upstream of rkm 1.5. Three of these fish were still moving upstream, being detected farther upstream on 3 June than they were on 30 May. Using data from the mobile surveys, coupled with the fixed station at the mouth of the river, it is estimated that one fish departed on 24 May, two on 28 May, two on 2 June, and three on 3 June; whereas the others remained in the Beatton beyond the end of the mobile tracking survey period (five departed in the week of 4 to 10 June, seven from 11 to 17 June, three from 18 to 24 June, one on 26 June, and two from 7-9 July). Two of the radio-tagged Walleye had not been detected exiting the Beatton River as of January 2023 (Table 3).

The fastest upstream migration speed between surveys was 3.9 km/day (Tag ID 1014 moved from rkm 12.3 to rkm 27.9 between the 22 and 26 May surveys). The fastest downstream migration speed within the Beatton River was 4.9 km/d (Tag ID 830 moved from rkm 53.5 to rkm 33.6 between the 30 May and 3 June surveys). Maximum speeds for each of the 29 potential spawners are shown in Figure 5.

Walleye Spawning Habitat Assessment

Thirteen potential spawning sites were assessed for habitat characteristics on 2 and 3 June 2022 (Figure 4; Table C-1). At that time, potential spawning sites were determined from tag detection histories through May 26. However, aerial-tracking surveys continued through to 3 June, so any potential spawning sites that were determined using data from after May 26 were not sampled. Conversely, there were sites that were on the list initially, but which were removed after analyzing the mobile tracking data from after May 26; this resulted in the field crew sometimes sampling sites superfluously. Of the 13 sites sampled for habitat characteristics, ten were in close proximity (≤200 m away) to a potential spawning site (seven in Reach 1 two in Reach 3, and one in Reach 4; Figures C-1 to C-13), and three were superfluous sites that were 500 m or farther downstream of a potential spawning site (two in Reach 1, and one in Reach 2). Sampling sites that were >500 m from a potential spawning location may not be representative of spawning habitat, and are shown for comparative purposes, but subsequent results focus on the ten sites sampled near a potential spawning site.

Fourteen habitat measurements were recorded at the ten sites that were in close proximity to a potential spawning site (multiple measurements were taken at some sites). Water temperatures ranged from 11.7 to 15.4°C, pH ranged from 7.0 to 7.4, conductivity ranged from 80 to 120 µs/cm, water velocities ranged from 0.25 to 0.85 m/s (measured 2 to 46 m from shore at depths of 0.45 to 1.15 m), and the water was turbid (Table C-1). Bankfull and wetted widths ranged from 84 to 150 m and 64 to 147 m, respectively. All of the sites sampled were in runs with little to no cover for fish, and all but one was in eroding bank habitat. Substrate composition was mainly cobble and gravel (two sites had notable boulder presence, and one was dominated by sand/silt). Substrate embeddedness was mostly low (7 sites), though it was medium at two sites and high at one site. Compaction was low at five sites, medium at two sites, and high at three sites.

Juvenile Walleye Rearing Habitat Assessment

From 30 June to 1 July, and from 27 to 28 July 2022, 21 beach seine sites (three in the Peace River mainstem near the Beatton mouth, 14 in Reach 1, two in Reach 2, and two in Reach 3) were sampled for juvenile Walleye (Figure 6; Table D-1). No sampling was conducted in Reach 4. In all, nine Walleye were captured during the sampling program over four sites, including one at site BS-22-01 (30 June, Peace River at rkm 143.0), one at BS-22-04 (30 June, Beatton rkm 4.7), one at BS-22-12 (27 July, Peace River at rkm 143.1), and six at site BS-22-14 (27 July, Beatton rkm 1.0). None of the Walleye were YOY. Walleye sizes ranged from 172 mm FL (possibly age 1) to 610 mm FL, and six of the Walleye measured between 296 and 419 mm FL. All of the Walleye were scanned for PIT tags. One fish (381 mm, caught at site 22-14 at Beatton rkm 1.0 on 27 July) was a recapture of a previously tagged fish, and a PIT tag was implanted into each of the other eight Walleye. One Walleye was caught in an ancillary set (the fourth haul at site BS-22-14), and is not included in the CPUE calculations.

In total, 691 fish were caught and identified to species, including 335 Flathead Chub *Platygobio gracilis*, 133 Redside Shiner *Richardsonius balteatus*, 126 Longnose Sucker *Catostomus catostomus*, 68 Longnose Dace *Rhinichthys cataractae*, 9 Walleye, 7 Lake Chub *Couesius plumbeus*, 5 Trout-perch *Percopis omiscomaycus*, 2 Mountain Whitefish *Prosopium williamsoni*, 2 Largescale Sucker *Catostomus macrocheilus*, and 1 each of Goldeye *Hiodon alosoides*, Northern Pike *Esox lucius*, Spoonhead Sculpin *Cottus ricei*, and Slimy Sculpin *Cottus cognatus* (Table 4; Table D-2; Table D-3). No Goldeye, Northern Pike, or Mountain Whitefish were caught in the 30 June to 1 July session, and no Largescale Sucker, or sculpins were caught in the 27-28 July session. In Reaches 2 and 3, only Flathead Chub, Lake Chub, and Longnose Dace were caught. No Arctic Grayling, Burbot, Bull Trout, or Rainbow Trout were captured, thus no other fish beside the Walleye were scanned for PIT tags, and no new tags were applied.

Despite no YOY Walleye being captured, habitat characteristics were recorded for all of the sites sampled (Table D-1; Figures D-1 to D-21). During the 30 June to 1 July session, water temperatures ranged from 17.1 to 19.2°C, conductivity ranged from 70 to 110 µs/cm, pH ranged from 7.5 to 7.6, and the water was turbid. During the 27-28 July session, water temperatures ranged from 18.2 to 26.2°C, conductivity ranged from 120 to 290 µs/cm, pH ranged from 7.1 to 8.2, and the water was moderately turbid to turbid. Water velocities ranged from 0 to 0.93 m/s when measured at depths ranging from 0.21 to 1.34 m. Substrates were composed largely of gravel and cobble (three sites were dominated by silt or sand and silt, and one by boulders), with embeddedness and compaction running the gamut from low to high levels. Runs, riffles, pools, flats and backwaters were sampled.

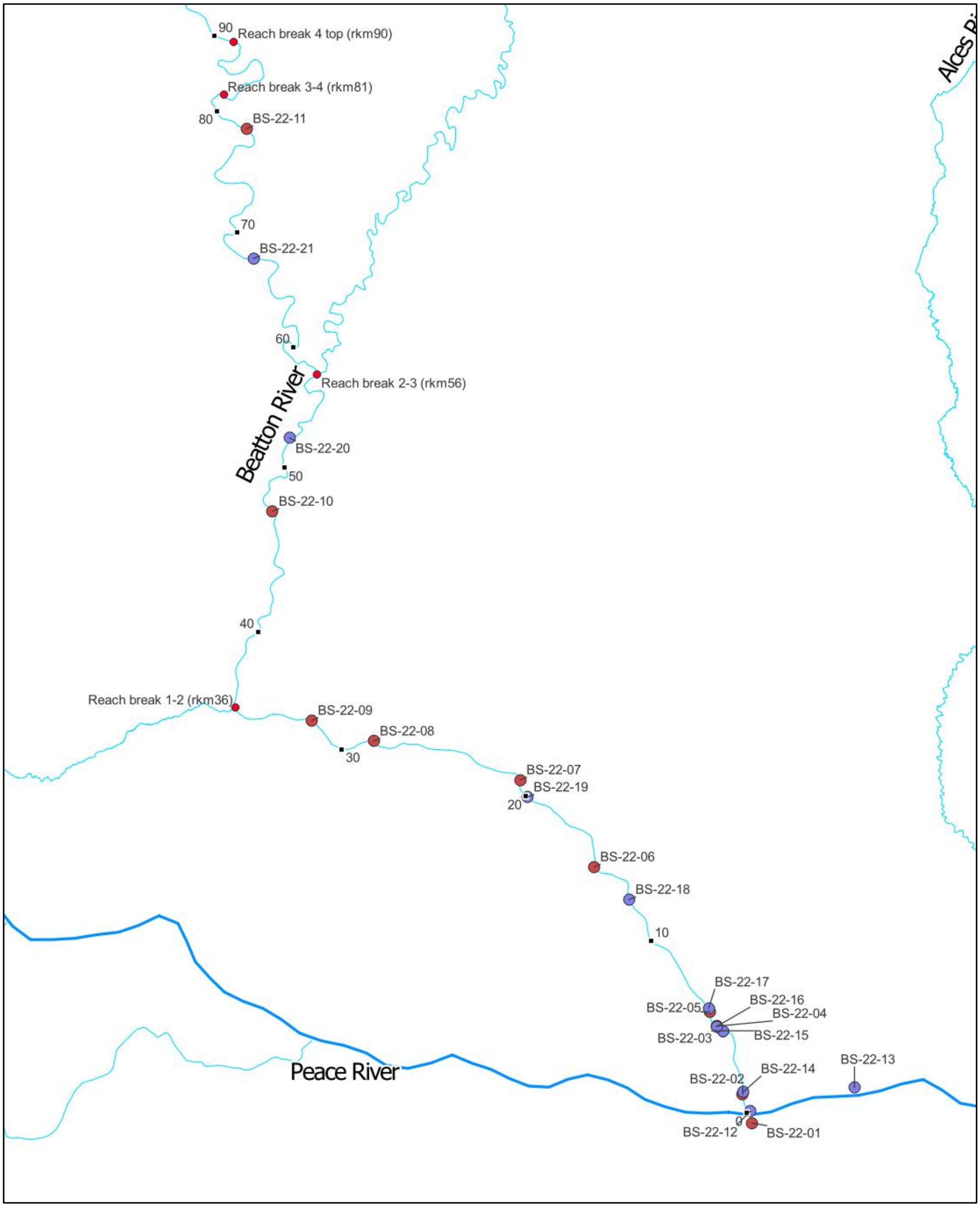

Figure 6. Locations of 21 beach seine sites that were sampled for juvenile Walleye in and around the Beatton River from 30 June to 1 July (red) and from 27-28 July 2022 (purple). Reach breaks and every 10th RKM also shown.

Table 4. Biological information collected from fish captured in the Beatton River from 30 June to 1 July, or from 27-28 July 2022. * Note that max and mean weights were likely underestimated because the largest fish were not weighed (the scale had a maximum measurable weight of 200 g).

30 June – 1 July (Fish counted / biosampled from 32 sets at 11 sites)

		Length (mm)				Weight (g)			
Species	Catch	Min	Max	Mean	n	Min	Max *	Mean *	n
Walleye	2	296	319	307.5	2				0
Largescale Sucker	2	236	425	330.5	2	156.6	156.6	156.6	1
Longnose Sucker	11	33	410	135.5	11	0.8	145.2	33.9	6
Flathead Chub	29	26	153	73.3	29	2.3	39.4	12.5	18
Lake Chub	1	83	83	83.0	1	6.8	6.8	6.8	1
Longnose Dace	49	24	101	38.0	49	1.3	13.6	4.8	8
Redside Shiner	3	23	33	28.7	3				0
Trout-perch	3	45	48	46.0	3	1.4	1.4	1.4	1
Spoonhead Sculpin	1	58	58	58.0	1				0
Slimy Sculpin	1	68	68	68.0	1	2.3	2.3	2.3	1

27 – 28 July (Fish counted / biosampled from 26 sets as 10 sites)

		Length (mm)				Weight (g)			
Species	Catch	Min	Max	Mean	n	Min	Max *	Mean *	n
Goldeye	1	425	425	425.0	1				0
Northern Pike	1	285	285	285.0	1				0
Walleye	7	172	610	368.3	7	44.7	44.7	44.7	1
Longnose Sucker	115	106	560	422.4	14	13.2	13.2	13.2	1
Flathead Chub	306	41	208	78.6	62	0.8	44.8	10.7	27
Lake Chub	6	36	76	53.0	6	1.1	4.5	3.4	3
Longnose Dace	19	20	33	30.3	7				0
Redside Shiner	130	35	95	50.7	11	0.7	9.2	2.2	10
Trout-perch	2	65	65	65.0	1	3.4	3.4	3.4	1
Mountain Whitefish	2	36	36	36.0	1				0

Discussion

Walleye Movements and Identifying Potential Spawning Areas

The mobile telemetry data suggest that adult Walleye used the Beatton River for spawning in the spring of 2022, as was the case in 2021 (Smith et al. 2022). At the time of the survey, there were 121 adult radio-tagged Walleye available for detection, of which 36 (30%) were detected within the Beatton River during the ten mobile-tracking surveys between 29 April and 3 June 2022. In total, 29 Walleye (24%) were tracked upstream of rkm 1.5 in 2022. Similar results were found in 2021 when 21% of the available tags were detected in the Beatton River (from 1 May to 7 June 2021), with 19 (15%) tracked upstream of rkm 1.5 (Smith et al. 2020). These findings were supported by previous radio-telemetry studies (2005-2007, 2019-2020) which documented Walleye movements from the Peace River into the Beatton River (AMEC & LGL 2008a,b,c, 2009; Hatch et al. 2020, 2021). During these studies, radio-tagged Walleye were detected congregating near the mouth of the Beatton River from March to mid-May, moving upstream in the Beatton River in May, and then returning to the Peace River by June.

In 2022, radio-tagged Walleye were tracked up to rkm 86.2 in Reach 4. In all, 21 potential spawning sites were identified, including one in Reach 4, two in Reach 3, and 18 in Reach 1. A similar distribution of potential spawning sites was found in 2021, although no fish were tracked into Reach 4 (only as far as rkm 69.8 in Reach 3; Smith et al. 2022). A boat-electrofishing survey conducted in late July 2012 captured adult Walleye in all four reaches (Mainstream 2013), but given the timing, that survey was likely sampling resident fish, whereas our tracking was focused on migratory fish that were tagged in the Peace River mainstem.

The timing of the mobile-tracking surveys in 2021 and 2022 may not have covered the full extent of the Walleye spawning period in the Beatton River. In 2021, no Walleye that were identified as potential spawners were at their most upstream position on the first survey, indicating that tracking started during the migratory period, and not prior to the commencement of spawning itself. By contrast, in 2022 there were three fish that were already in their most upstream position when the survey started on 29 April. Moreover, there were five fish in 2021 and three in 2022 that were still moving upstream at the time of the last survey, suggesting the possibility that radio-tagged Walleye may have spawned farther upstream than at the sites identified during the tracking flights.

The suspected spawning locations that were identified in 2021 and 2022 were distributed widely over the available space. Several clusters of two radio-tagged fish were observed. In 2021, Tag IDs 504 and 837 were at rkm 45.6-45.7, and Tag IDs 779 and 902 were at rkm 33.7-33.9. In 2022, Tag IDs 1241 and 1129 were at rkm 20.1-20.4, Tag ID 521 and 1127 were at rkm 5.3-5.4, and Tag IDs 779 and 1150 were at rkm 4.8. Also, the location for Tag ID 890 in 2021 was the same as that for Tag ID 1167 in 2022 (rkm 3.5-3.6). These results are suggestive of Walleye spawning aggregation areas, but there were no obvious clusters of more than two radio-tagged fish, which hampers any generalized conclusions. In terms of site fidelity, only one fish (Tag ID 857) was tracked to the same location (rkm 35.9-36.0) in both years, whereas repeat spawning behaviours were observed for 47% of individuals (i.e., 9 of the 19 potential spawners tracked in 2021 were again in the Beatton River during the spawning period in 2022). And while individual Walleye's fidelity to specific sites has been observed in some systems (e.g., Crowe 1962), the wide distribution of potential spawning sites and the general lack of a single or a few clusters of radio-tracked fish in the Beatton River may indicate that spawning habitat is broadly available. As seen during the overflights, and based on the measurements taken at the sampled sites, the Beatton River is not particularly variable, and nothing stood out as different about the locations that were identified from the telemetry data.

Mobile-tracking surveys were conducted frequently (approximately every 4 days) via a slow-moving helicopter to obtain reasonably precise potential spawning locations. Despite being a suitable method for tracking fish in a large and relatively remote river, there were limitations. Mainly, the location of spawning had to be inferred from periodic detection data, which did not confirm fish behaviour (e.g., migrating vs. holding vs. spawning). Also, the tracking methods used could only identify the position of a tagged fish to within approximately 50 to 100 m of its actual location. Since multiple instream habitat types can be found within a 50 to 100 m river section, at this resolution, it was difficult to match the exact instream habitat type with the estimated spawning location. For better information, oviduct tags have been used to estimate timing and location of spawning (e.g., Binder et al. 2014), but this technique would have required dedicated individual animals to have been captured and tagged, which was beyond the scope of this study.

Walleye Spawning Habitat Assessment

Gravel and cobbles are the preferred spawning substrate for Walleye in rivers (McPhail 2007), although spawning has been documented in other habitats (e.g., Chalupnicki et al. 2010). Based on our Beatton River habitat assessments, conducted on 27 and 28 May 2021, and on 2 and 3 June 2022, radio-tagged Walleye possibly spawned downstream of rkm 86.0 in areas dominated by gravel and cobble substrates (Table C-1; Smith et al. 2022).

The tracking study area ended at rkm 89, and in 2022, a possible spawning location was identified in Reach 4 at rkm 86.0. In 2021, the farthest upstream location for a potential spawning area was located at rkm 69.8 in Reach 3 (Smith et al. 2022). However, in both 2021 and 2022, it appeared that some tagged fish continued their upstream migration after the last mobile-tracking survey. Reaches 3 and 4 contained confined sections with faster-moving water and larger substrates, but there were still sections within each reach containing suitable substrate and water velocities for Walleye spawning. Catches of adult Walleye in the upper section of Reach 3 and in Reach 4 in 2012 support this possibility (Mainstream 2013).

The potential spawning sites surveyed in the Beatton River in 2021 had relatively slow water velocities (≤0.85 m/s; Table C-1, Smith et al 2022) in the nearshore areas that could be safely sampled. While faster currents are generally associated with suitable Walleye spawning substrates (see Bozek et al. 2011), spawning has also been documented in shallow, slow-velocity habitat (Chalupnicki et al. 2010), and even in areas inundated by terrestrial vegetation (Holzer and Von Ruden 1982, as cited in Bozek et al. 2011). Nevertheless, the flows measured for this study were likely underestimates of those found in all the available microhabitats of our study sites (e.g., areas in the middle of the channel), given that measurements could only be taken in areas that could be safely waded by field personnel. The temperatures recorded when our crews were sampling ranged from 12.1 to 12.8°C in 2021 (Smith et al. 2022) and from 11.7 to 15.4°C in 2022 (Table C-1) which were mostly in the known range for Walleye spawning (peaks typically at 4°C to 14°C; Bozek et al. 2011). The pH measured at our sites ranged from 8.0 to 8.3 in 2021 (Smith et al. 2022) and from 7.0 to 7.4 in 2022 (Table C-1), which is within the ideal range for reproduction and incubation of eggs (i.e., from 6.0 to 9.0; e.g., Holtze and Hutchinson 1989, Bergerhouse 1992). The turbidity observed at our sampling sites was consistent with the negative phototaxis observed by Walleye in general (Bulkowski and Meade 1983).

Juvenile Walleye Rearing Habitat Assessment

No YOY Walleye were captured in the Beatton River during beach seine fishing conducted from 30 June to 1 July, or from 27 to 28 July 2022 (Table D-1), despite having sampled habitat types with the gear that has successfully yielded YOY Walleye in the past (e.g., Mainstream 2010, 2011). The beach seine used in 2022 was 7.9 m (26 feet) longer than that used in 2021, increasing the effectiveness of the capture gear. Indeed, 12 other fish species of various size classes (including the size class of YOY Walleye) were captured (Table 4), indicating that the method was successful for capturing fish. Moreover, the geographic scope of the sampling was expanded in 2022 to include areas in the Peace River mainstem near the mouth of the Beatton, without success (adult Walleye were caught, but no YOY). Golder Associates, while boat electrofishing as part of Mon-2's Contingent Goldeye and Walleye Surveys, found similar results, having caught no YOY Walleye at the mouths of Section 7 and 8 tributaries, despite having sampled as late as mid-July in some years (Golder and Gazey 2019, 2020, Golder 2021).

The Juvenile Walleye Rearing Habitat Assessment in 2021 found a result similar to that described in this report: no YOY Walleye were captured in beach seines or by electrofishing in the Beatton River (Smith et al. 2022). Smith et al. (2022) posited that the lack of YOY Walleye in their catch may have been a result of mistimed fishing effort (17 to 19 August 2021), and they conjectured that the fish may have started moving downriver and out of the Beatton by mid June. The conjecture was based on a few lines of evidence, including 1) a prediction from microchemical analysis that 91% of Walleye with natal habitat in the Beatton River will have moved downstream into the Peace River during their first summer (Christensen 2020); and 2) published incubation periods for Walleye eggs that predicted incubation times of 9.5 to 11 days, and exogenous feeding likely starting ~5 days after hatch (McPhail 2007). The conjecture by Smith et al. (2022) appeared to be corroborated by the lack of YOY Walleye captured in late-July 2012 by electrofishing (size range 177 -578 mm FL, Mainstream 2013) along with the successful capture of YOY Walleye in the Peace River by beach seine in July 2009 (14-25 July, Mainstream 2010) and 2010 (6-21 July, Mainstream 2011). It was because of these previous results that we changed the timing of our habitat rearing assessments in 2022 to be earlier in the summer, and to include areas in the mainstem near the Beatton confluence. It may however be notable that flows for the second half of June 2022 were well above the historic mean, which may have flushed out juveniles prior to sampling at the end of June and start of July.

After two years of study, the field team collected habitat data from 32 sites in and near the Beatton River, sampling a portion (usually the nearshore area of one bank) of 3.17 linear km of the river length (4% of the length in the study area). Within the study area, the data suggest that the river is generally turbid, with depositional or erosional banks and little fish cover, but includes a variety of instream habitats, substrates, wetted widths, depths, and velocities. Sampling over this variety of environments did not yield any YOY Walleye, but does not mean that YOY Walleye never occur in these habitats. Not catching YOY Walleye could be a function of timing; i.e., Beatton River YOY Walleye migrate immediately following the hatch and thus sampling in 2022 was still too late, or may have resulted from stochasticity related to the small overall portion of the river sampled.

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Appendices

Appendix A. Datasheets Templates and Definitions

Table A-1. Definition of datasheet fields.

Parameter	Description
Walleye Spawning Habitat Sampling	
Tag Code	Unique tag code(s) of radio-tagged Walleye tracked to this location
UTM	GPS coordinates of sample site (zone, easting, northing)
Temp.	Water temperature measured at the sample site (± 0.1°C)
pH	pH measured at the sample site (± 0.1)
Cond.	Conductivity at the sample site (µS/cm; ± 2% full scale)
Clarity	Categorical ranking of water clarity (turbid, moderately turbid, lightly turbid, clear)
Depth	Water depth measured at a given distance from shore (m)
Velocity	Water velocity measured at a given distance from shore (m/s)
Instream Habitat	Instream habitat type (flat, pool, riffle, run, backwater)
Bank Habitat	Bank habitat type (armoured, canyon, depositional, erosional)
Fish Cover	Percent estimate of available fish cover (e.g., overhead cover, inriver rock/boulders, vegetation)
D90	Average size of substrate material in the 90th percentile (cm)
Substrate Composition	Percent estimate of substrate composition (organics, silt, sand, gravel, cobble, boulder, bedrock)
Embeddedness	Degree to which rock substrates are surrounded and/or covered by fines (low, moderate, high)
Compaction	Degree of substrate looseness, or its ability to be moved during high flow (low, moderate, high)
Photo ID	File number of site photos
Walleye Rearing Habitat Sampling (Page 1)	
Site ID	Unique identifier for each beach seine (BS) and electrofishing (EF) site
UTM-Upstream	GPS location of upstream end of sample site
UTM-Downstream	GPS location of downstream end of sample site
Electrofishing	
Mode/Freq	Mode (AC/DC) and frequency (Hz) used at site
Amps	Current (A) used at site
Volts	Voltage (V) used at site
Sample Length	Length of habitat sampled (m)
Sample Time	Sample effort (s)
Beach Seining	
Haul Dist	Length of habitat sampled (m), which may be the sum of multiple hauls
Effectiveness	Classification of haul effectiveness (good, mod. good, mod. poor, poor)
Catch Summary	Tally of the number of fish of each species captured at the site
Walleye Rearing Habitat Sampling (Page 2)	
Species	Species code of fish
FL	Fork length (mm)
Wt	Weight (g)
Scanned?	Indication of whether the fish was scanned for a PIT tag (yes/no)
PIT Type Applied	Type of PIT tag applied to an untagged fish (12, 23, or 32 mm)
PIT # Applied	Unique PIT tag number applied to an untagged fish
PIT # Recap	Unique PIT tag number of a tagged fish (i.e., recapture)

Table A-2. Common and scientific names of fish species captured in the Beatton River, 2022.

Group	Common Name	Scientific Name	Code
Sportfish	Goldeye	*Hiodon alosoides*	GE
	Northern Pike	*Esox lucius*	NP
	Walleye	*Sander vitreus*	WP
Suckers	Largescale Sucker	*Catostomus macrocheilus*	CSU
	Longnose Sucker	*Catostomus catostomus*	LSU
Minnows and Trout-perch	Flathead Chub	*Platygobio gracilis*	FHC
	Lake Chub	*Couesius plumbeus*	LKC
	Longnose Dace	*Rhinichthys cataractae*	LNC
	Redside Shiner	*Richardsonius balteatus*	RSC
	Trout-perch	*Percopsis omiscomaycus*	TP
Sculpins	Spoonhead Sculpin	*Cottus ricei*	CRI
	Slimy Sculpin	*Cottus cognatus*	CCG
Whitefish	Mountain Whitefish	*Prosopium williamsoni*	MW

Walleye Spawning Habitat Sampling - LGL Limited (EA4105)

Sheet _______ of _______

Date	Time		Crew	
Stream			Tag Code	
UTM:	Z	E	N	
WATER CONDITIONS				
Temp.	pH		Cond.	
Clarity:	Turbid	Moderately turbid	Lightly turbid	Clear
Depth:	Near	Mid	Far	
Velocity:	Near	Mid	Far	
HABITAT CHARACTERISTICS				
Instream habitat:	Flat	Pool	Riffle	Run	Backwater
Bank habitat:	Armoured	Canyon	Depositional	Erosional
Fish cover (%):				

SUBSTRATE

D90	1	2	3	4	5	6	7	8	9	10	Avg

Substrate Comp (%)	Org	Silt	Sand	Grav	Cob	Bou	Bed

Embeddedness: L M H | Compaction: L M H

Photo ID			
	D/S	LB-to-RB	
	U/S	RB-to-LB	

COMMENTS

Date	Time		Crew	
Stream			Tag Code	
UTM:	Z	E	N	
WATER CONDITIONS				
Temp.	pH		Cond.	
Clarity:	Turbid	Moderately turbid	Lightly turbid	Clear
Depth:	Near	Mid	Far	
Velocity:	Near	Mid	Far	
HABITAT CHARACTERISTICS				
Instream habitat:	Flat	Pool	Riffle	Run	Backwater
Bank habitat:	Armoured	Canyon	Depositional	Erosional
Fish cover (%):				

SUBSTRATE

D90	1	2	3	4	5	6	7	8	9	10	Avg

Substrate Comp (%)	Org	Silt	Sand	Grav	Cob	Bou	Bed

Embeddedness: L M H | Compaction: L M H

Photo ID			
	D/S	LB-to-RB	
	U/S	RB-to-LB	

COMMENTS

Figure A-1. Walleye Spawning Habitat Sampling datasheet, 2022.

Walleye Rearing Habitat Sampling - LGL Limited (EA4105)

Sheet _______ of _______

Date				Time				Crew			
Stream				Site ID (eg, BS-01, EF-03)							
UTM-Upstream:		Z				E				N	
UTM-Downstream:		Z				E				N	
WATER CONDITIONS											
Temp.				pH				Cond.			
Clarity:	Turbid	Moderately turbid		Lightly turbid		Clear					
Depth:	1/4:			1/2:				3/4:			
Velocity:	1/4:			1/2:				3/4:			
HABITAT CHARACTERISTICS											
Instream habitat:	Flat	Pool	Riffle	Run	Backwater						
Bank habitat:	Armoured	Canyon	Depositional	Erosional							
Fish cover (%):											
SUBSTRATE											
D90	1	2	3	4	5	6	7	8	9	10	Avg
Substrate Comp (%)	Org	Silt	Sand	Grav	Cob	Bou	Bed				
Embeddedness:	L	M	H	Compaction:	L	M	H				
Photo ID	D/S	LB-to-RB									
	U/S	RB-to-LB									

ELECTROFISHING	BEACH SEINING		
Mode/Freq (AC/DC, Hz):	Haul 1 Dist. (m):		
Amps (avg):	Haul 2 Dist. (m):		
Volts (V):	Haul 3 Dist. (m):		
Sample Length (m):	Effectiveness:	Good	Mod. Poor
Sample Time (s):		Mod. Good	Poor

CATCH SUMMARY		
Walleye		
Flathead chub		
Lake chub		
Longnose dace		
Pikeminnow		
Trout-perch		

COMMENTS:

Date				Time				Crew			
Stream				Site ID (eg, BS-01, EF-03)							
UTM-Upstream:		Z				E				N	
UTM-Downstream:		Z				E				N	
WATER CONDITIONS											
Temp.				pH				Cond.			
Clarity:	Turbid	Moderately turbid		Lightly turbid		Clear					
Depth:	1/4:			1/2:				3/4:			
Velocity:	1/4:			1/2:				3/4:			
HABITAT CHARACTERISTICS											
Instream habitat:	Flat	Pool	Riffle	Run	Backwater						
Bank habitat:	Armoured	Canyon	Depositional	Erosional							
Fish cover (%):											
SUBSTRATE											
D90	1	2	3	4	5	6	7	8	9	10	Avg
Substrate Comp (%)	Org	Silt	Sand	Grav	Cob	Bou	Bed				
Embeddedness:	L	M	H	Compaction:	L	M	H				
Photo ID	D/S	LB-to-RB									
	U/S	RB-to-LB									

ELECTROFISHING	BEACH SEINING		
Mode/Freq (AC/DC, Hz):	Haul 1 Dist. (m):		
Amps (avg):	Haul 2 Dist. (m):		
Volts (V):	Haul 3 Dist. (m):		
Sample Length (m):	Effectiveness:	Good	Mod. Poor
Sample Time (s):		Mod. Good	Poor

CATCH SUMMARY		
Walleye		
Flathead chub		
Lake chub		
Longnose dace		
Pikeminnow		
Trout-perch		

COMMENTS:

Figure A-2. Walleye Rearing Habitat Sampling datasheet, Page 1, 2022.

Walleye Rearing Habitat Sampling - LGL Limited (EA4105) Date:________________________ Page ______ of _______

Site ID	Species	FL (mm)	Wt (g)	Scanned? (Y/N)	PIT Type Applied (12, 23, 32 mm)	PIT # Applied (#)	PIT Recap (#)	Comment

Figure A-3. Walleye Rearing Habitat Sampling datasheet, Page 2, 2022.

Appendix B. Mobile-tracking Survey Coverage & Tag Locations

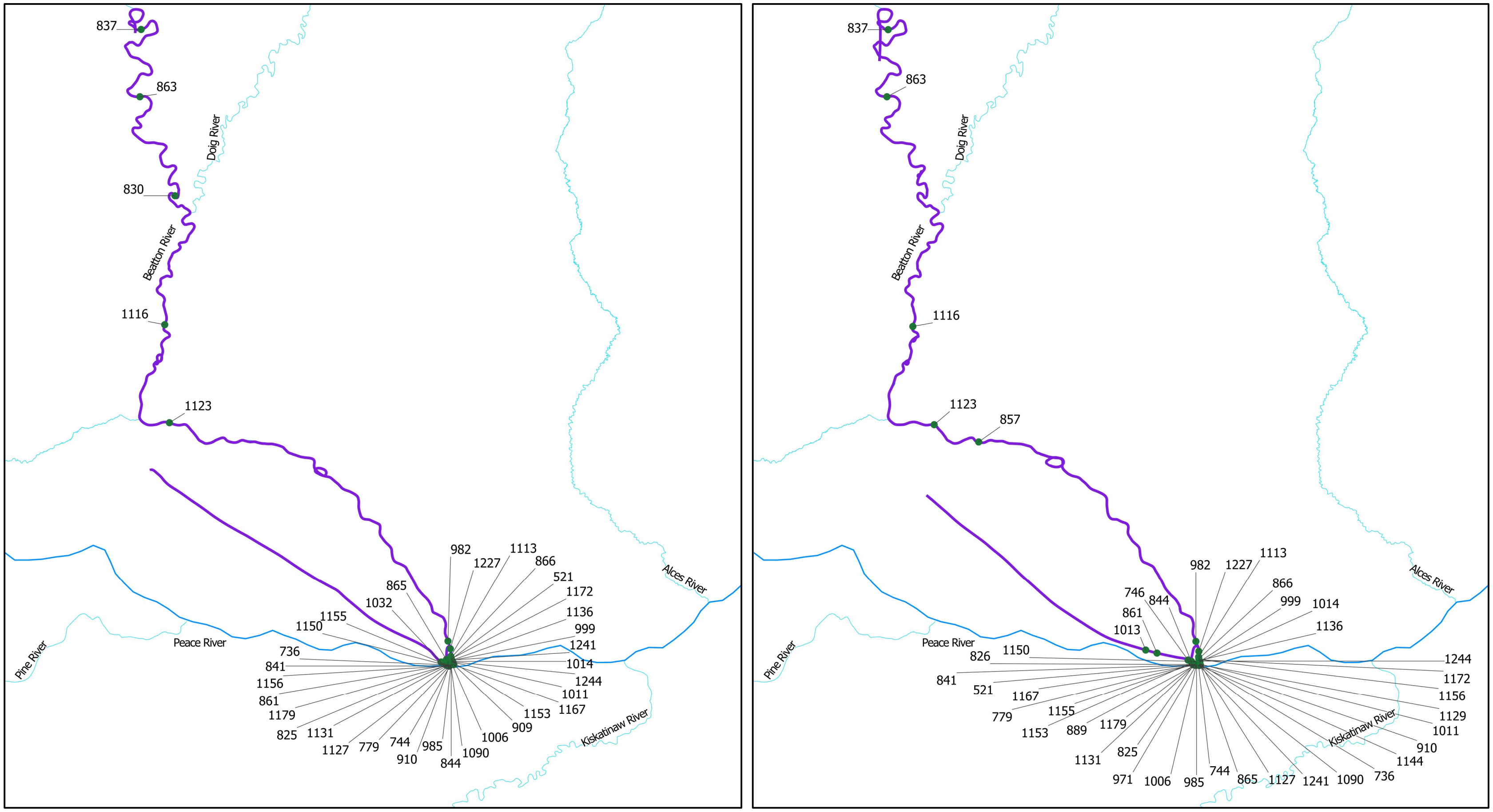


Figure B-1. Flight path and location of radio-tagged Walleye detected in the Beatton and Kiskatinaw rivers during the mobile-tracking surveys on 29 April (left) and 2 May (right) 2022.

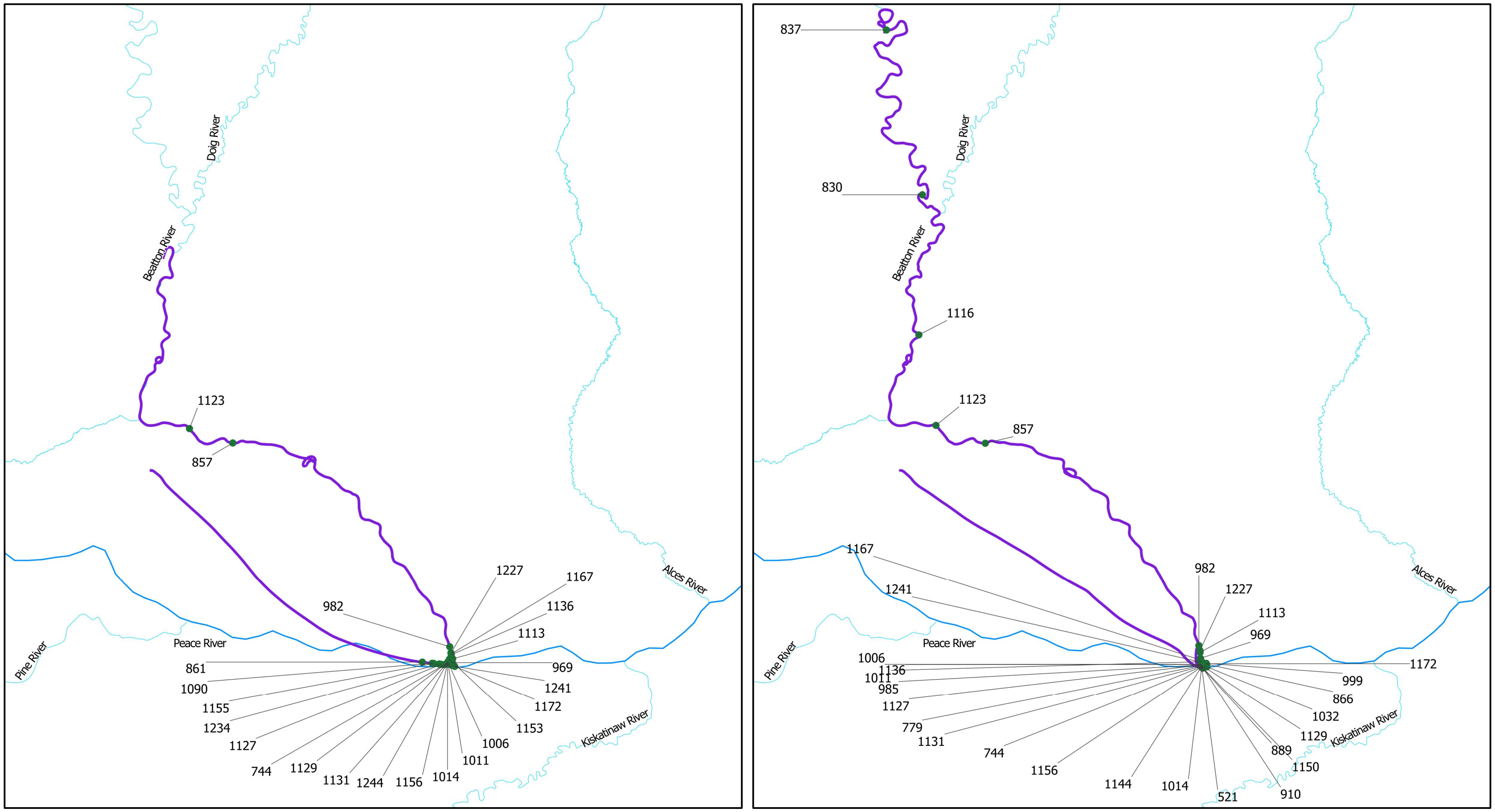


Figure B-2. Flight path and location of radio-tagged Walleye detected in the Beatton and Kiskatinaw rivers during the mobile-tracking surveys on 7 May (left) and 10 May (right) 2022.

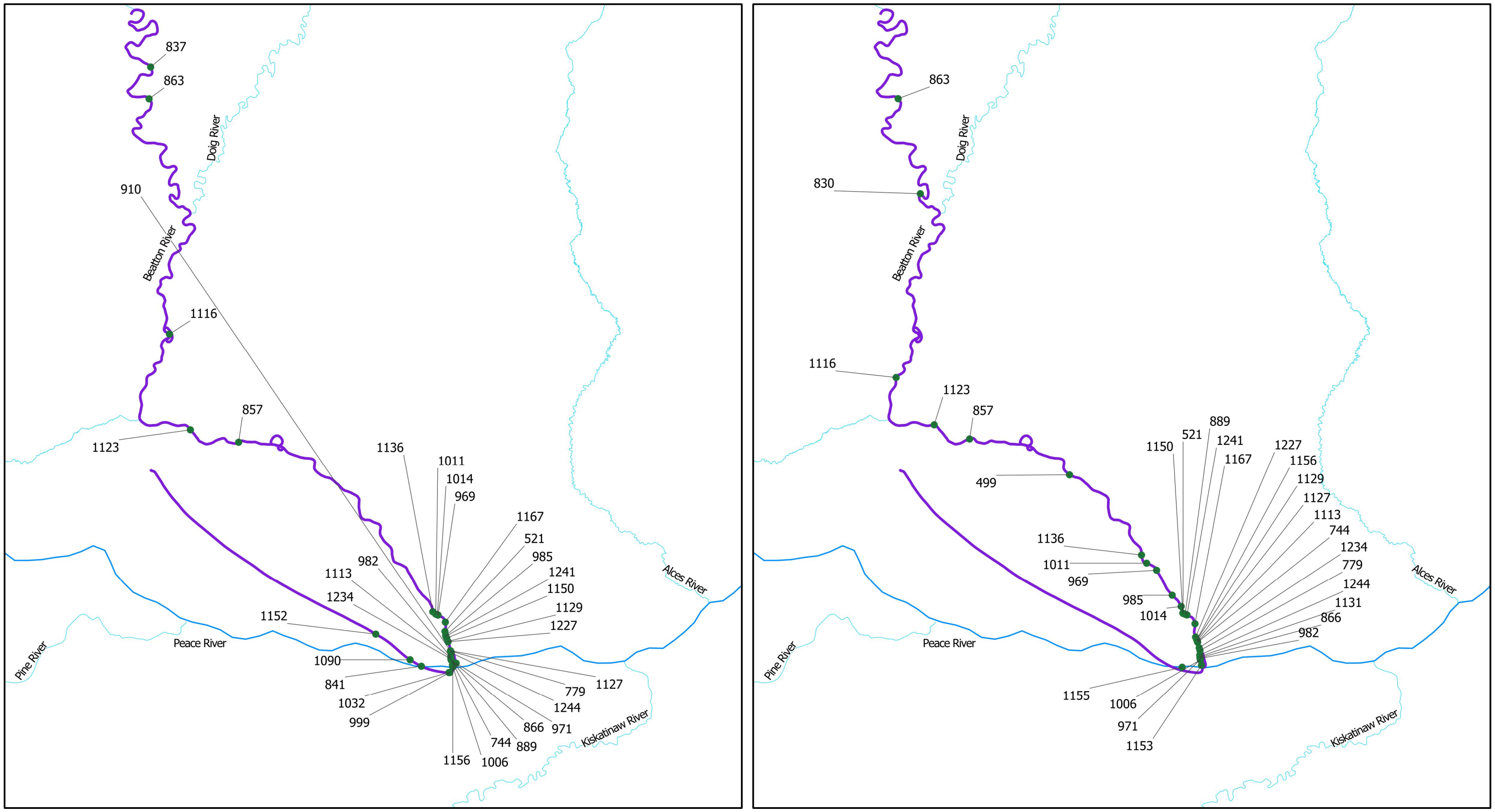


Figure B-3. Flight path and location of radio-tagged Walleye detected in the Beatton and Kiskatinaw rivers during the mobile-tracking surveys on 14 May (left) and 17 May (right) 2022.

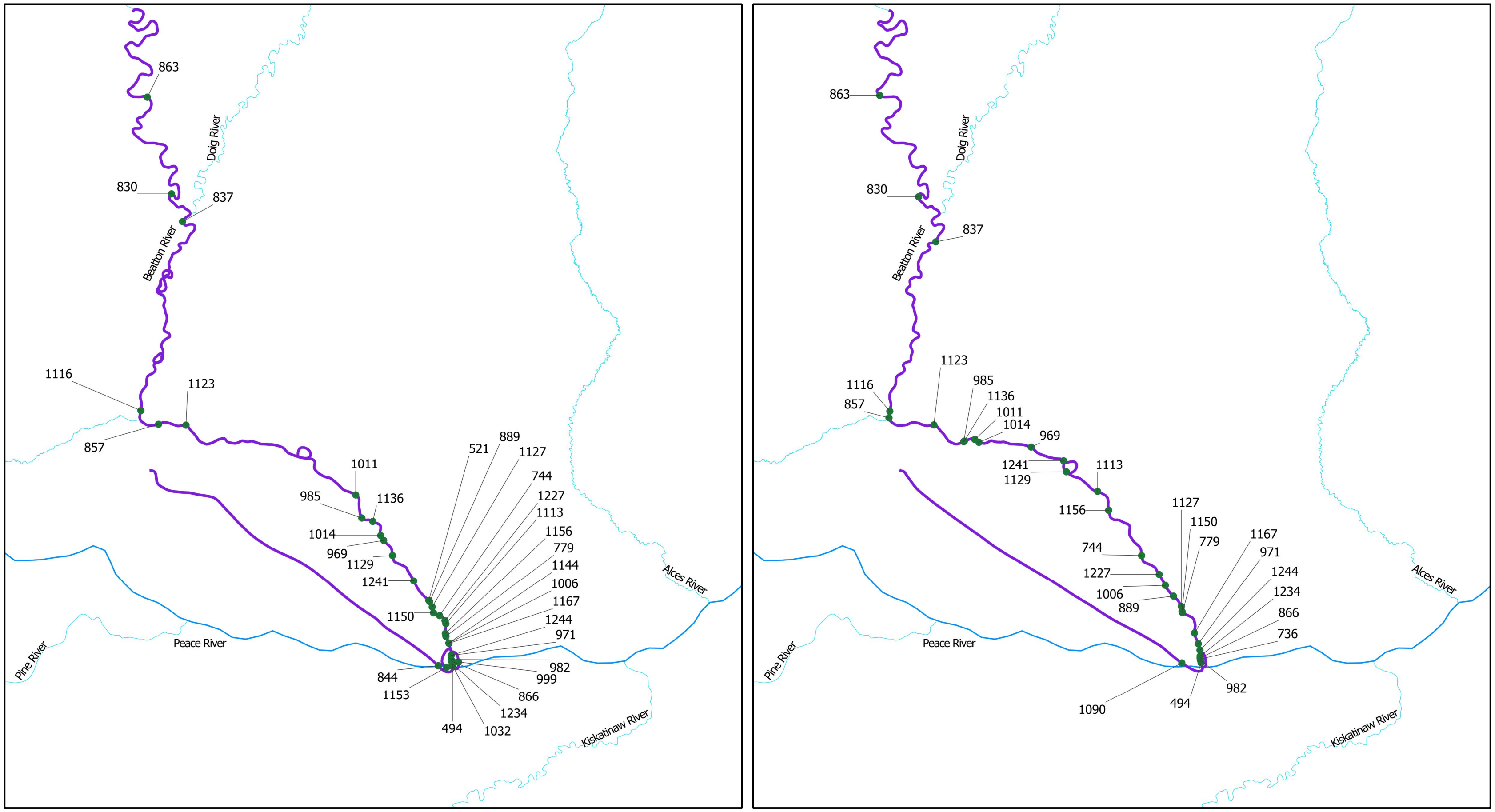


Figure B-4. Flight path and location of radio-tagged Walleye detected in the Beatton River during the mobile-tracking surveys on 22 May (left) and 26 May (right) 2022.

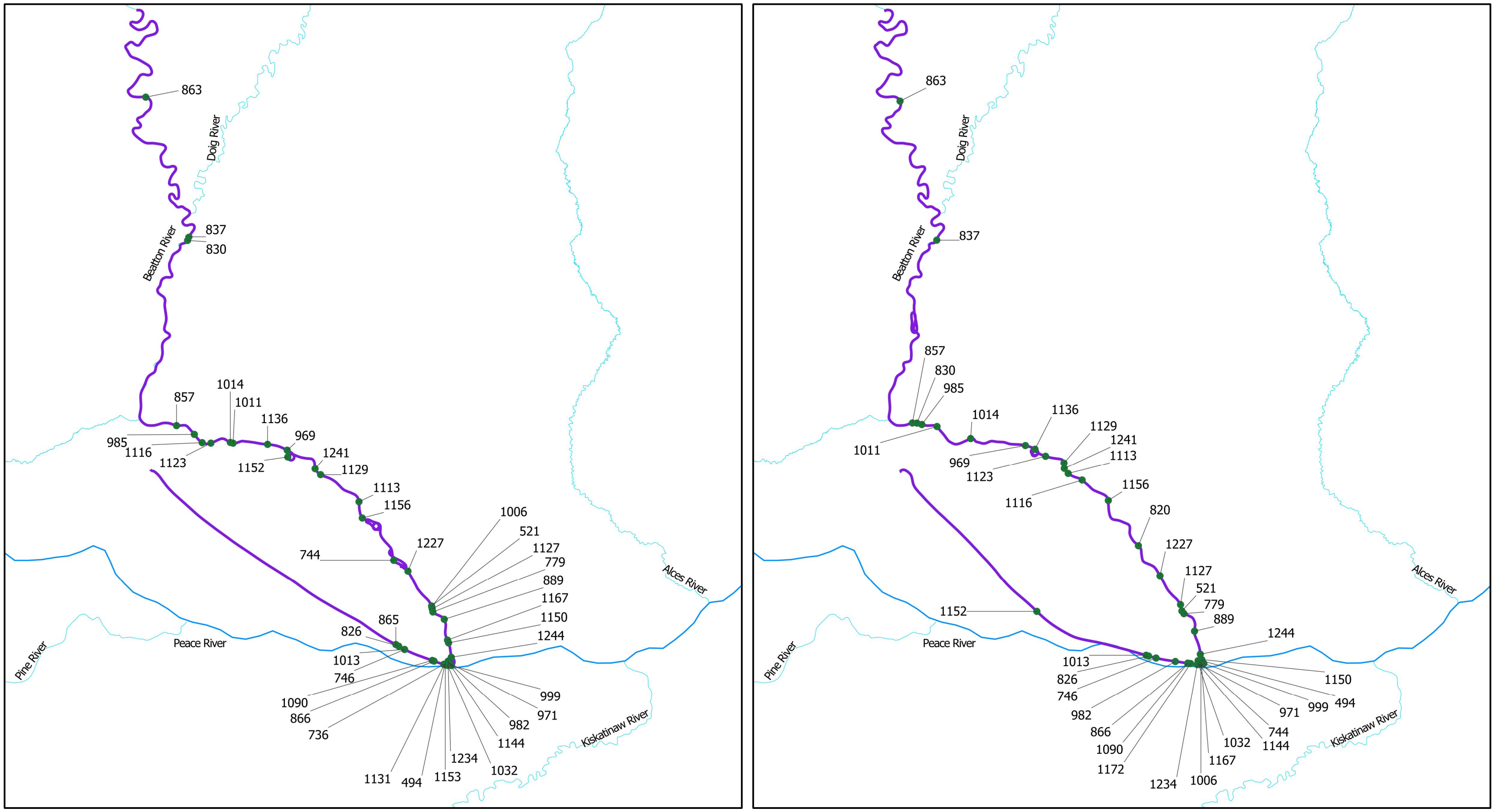


Figure B-5. Flight path and location of radio-tagged Walleye detected in the Beatton River during the mobile-tracking surveys on 30 May (left) and 3 June (right) 2022.

Appendix C. Spawning Habitat Assessment Data

Table C-1. Spawning habitat assessment data collected on the Beatton River, 2-3 June 2022. See Table A1 for substrate names. NR = not recorded.

							Water Conditions						
Site ID	Reach	River km	Tag ID	Latitude	Longitude	Sample Date	Dist. from bank (m)	Depth (m)	Temp. (ºC)	Vel. (m/s)	pH	Cond.	Clarity
Sites Sampled Where a Tagged Fish's Potential Spawning Location Was Nearby (<= 200 m away)													
S-01	1	36.0	857	56.2843	-120.7398	2 Jun	4	0.45	11.7	0.45	7	90	Turbid
							9	0.75	11.7	0.66	7	90	Turbid
S-03	1	32.2	1123	56.2774	-120.6856	2 Jun	2	1.15	11.9	0.61	7	80	Turbid
S-04	1	5.3	1127	56.1389	-120.3980	3 Jun	17	0.90	13.7	0.31	7.3	100	Turbid
							28	1.00	13.7	0.85	7.3	100	Turbid
							27	0.80	14	0.56	7.3	90	Turbid
S-05	1	5.2	1227	56.1378	-120.3979	3 Jun	46	0.70	14	0.53	7.3	90	Turbid
S-07	1	4.7	1150	56.1349	-120.3949	3 Jun	NR	1.10	13.4	0.58	7.4	100	Turbid
S-08	1	15.1	1156	56.2077	-120.4764	3 Jun	NR	1.10	13.8	0.25	7.4	120	Turbid
S-10	1	20.0	1129	56.2380	-120.5255	3 Jun	17	1.00	14.2	0.55	7.4	110	Turbid
S-11	3	59.6	830	56.4359	-120.6793	3 Jun	NR	0.75	14.4	0.64	7.2	80	Turbid
S-12	3	73.1	863	56.5033	-120.7021	3 Jun	10	0.45	15.4	0.38	7.4	80	Turbid
							25	0.85	15.4	0.62	7.4	80	Turbid
S-13	4	86.1	837	56.5502	-120.7075	3 Jun	15	0.85	14.6	0.43	7.3	80	Turbid
Sites Sampled Where a Tagged Fish's Potential Spawning Location Was Not Nearby (500+ m away)													
S-02	2	36.6	1116	56.2888	-120.7378	2 Jun	1	0.90	11.6	0.66	7.1	90	Turbid
S-06	1	5.8	521	56.1428	-120.4009	3 Jun	NR	0.95	13.2	0.52	7.4	100	Turbid
S-09	1	21.0	1241	56.2457	-120.5289	3 Jun	22	0.80	14.3	0.50	7.3	90	Turbid

Table C-1. Continued.

Site ID	Dist. from bank (m)	Habitat Conditions: Instream Habitat	Bank Habitat	Fish cover (%)	Bankfull Width (m)	Wetted Width (m)	Substrate Composition (%): Org	Silt	Sand	Grav	Cob	Bou	Bed	Embed-dedness	Comp-action
Sites Sampled Where a Tagged Fish's Potential Spawning Location Was Nearby (<= 200 m away)															
S-01	4	Run	Erosional	0%	117	117	0	0	0	20	80	0	0	Low	Low
	9	Run	Erosional	0%	117	117	0	0	0	20	80	0	0	Low	Low
S-03	2	Run	Erosional	2%	92	92	0	50	50	0	0	0	0	High	Low
S-04	17	Run	Erosional	0%	137	134	0	0	0	30	70	0	0	Low	Low
	28	Run	Erosional	0%	137	134	0	0	0	30	70	0	0	Low	Low
	27	Run	Erosional	0%	150	147	0	0	0	40	60	0	0	Low	Low
S-05	46	Run	Erosional	0%	150	147	0	0	0	40	60	0	0	Low	Low
S-07	NR	Run	Erosional	0%	98	87	0	0	0	30	60	0	0	Low	Medium
S-08	NR	Run	Erosional	0%	139	95	0	5	5	5	80	5	0	Medium	High
S-10	17	Run	Erosional	0%	113	92	0	0	20	40	40	0	0	Medium	High
S-11	NR	Run	Canyon	1%	84	64	0	0	0	0	60	40	0	Low	High
S-12	10	Run	Erosional	0%	127	103	0	0	5	20	70	5	0	Low	Medium
	25	Run	Erosional	0%	127	103	0	0	5	20	70	5	0	Low	Medium
S-13	15	Run	Erosional	3%	94	83	0	0	5	5	30	60	0	Low	Medium
Sites Sampled Where a Tagged Fish's Potential Spawning Location Was Not Nearby (500+ m away)															
S-02	1	Run	Erosional	0%	111	111	0	0	40	50	10	0	0	High	Low
S-06	NR	Run	Erosional	0%	113	106	0	0	0	10	80	10	0	Low	Medium
S-09	22	Run	Erosional	0%	151	91	0	0	0	5	90	5	0	Low	Medium

Downstream view

Upstream view

Across

Substrate

Figure C-1. Site S-01, rkm 36.0, Reach 1 (2 June 202).

Downstream view

Upstream view

Across

Substrate

Figure C-2. Site S-02, rkm 36.6, Reach 2 (2 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-3. Site S-03, rkm 32.2, Reach 1 (2 June 2022).

Downstream view

Upstream view

Across

NR

Substrate

Figure C-4. Site S-04, rkm 5.3, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

NR

Substrate

Figure C-5. Site S-05, rkm 5.2, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

NR

Substrate

Figure C-6. Site S-06, rkm 5.8, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

NR

Substrate

Figure C-7. Site S-07, rkm 4.7, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-8. Site S-08, rkm 15.1, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-9. Site S-09, rkm 21.0, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-10. Site S-10, rkm 20.0, Reach 1 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-11. Site S-11, rkm 59.6, Reach 3 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-12. Site S-12, rkm 73.1, Reach 3 (3 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure C-13. Site S-13, rkm 86.1, Reach 4 (3 June 2022).

Appendix D. Rearing Habitat Assessment Data

Table D-1. Rearing habitat assessment data collected from 30 June to 1 July and from 27-28 July 2022. See Tables A1 and A2 for substrate names and species abbreviations.

			Coordinates			Water Conditions						Habitat Conditions		
Site ID	Reach	River km	Latitude	Longitude	Sample Date	Temp. (ºC)	pH	Cond.	Clarity	Depth (m)	Vel. (m/s)	Instream Habitat	Bank Habitat	Fish cover (%)
BS-22-01	Peace River		56.0929	-120.3737	30 Jun	18.3	7.5	100	Turbid	0.23	0.35	Run	Depositional	0%
BS-22-02	1	0.9	56.1052	-120.3790	30 Jun	18.8	7.5	100	Turbid	0.30	0.17	Run	Depositional	0%
BS-22-03	1	4.3	56.1325	-120.3900	30 Jun	18.5	7.5	100	Turbid	0.50	0.93	Run	Depositional	0%
BS-22-04	1	4.7	56.1346	-120.3945	30 Jun	18.9	7.5	90	Turbid	0.48	0.20	Pool	Depositional	0%
BS-22-05	1	5.5	56.1409	-120.3987	30 Jun	19.2	7.5	90	Turbid	0.45	0.35	Run	Erosional	0%
BS-22-06	1	14.9	56.2055	-120.4777	1 Jul	17.6	7.5	90	Turbid	0.27	0.26	Flat	Depositional	0%
BS-22-07	1	20.9	56.2445	-120.5284	1 Jul	18	7.5	100	Turbid	0.55	0.41	Riffle/Pool	Depositional	0%
BS-22-08	1	28.4	56.2654	-120.6373	1 Jul	18	7.5	80	Turbid	0.35	0.01	Pool	Depositional	0%
BS-22-09	1	32.0	56.2761	-120.6830	1 Jul	17.8	7.6	80	Turbid	0.43	0.44	Riffle	Depositional	0%
BS-22-10	2	46.9	56.3652	-120.7008	1 Jul	17.3	7.6	80	Turbid	0.85	0.41	Run	Canyon	0%
BS-22-11	3	78.3	56.5267	-120.6987	1 Jul	17.1	7.5	70	Mod. Turbid	0.60	0.18	Backwater	Erosional	0%
BS-22-12	Peace River		56.0979	-120.3741	27 Jul	21.2	7.8	150	Mod. Turbid	0.35	0.39	Run	Depositional	0%
BS-22-13	Peace River		56.1043	-120.2942	27 Jul	18.2	8.2	120	Mod. Turbid	0.35	0	Backwater	Depositional	0%
BS-22-14	1	1	56.1061	-120.3786	27 Jul	26.2	8.2	150	Mod. Turbid	0.45	0.18	Flat	Depositional	0%
BS-22-15	1	4.3	56.1325	-120.3897	27 Jul	25.3	7.7	150	Mod. Turbid	0.4	0.42	Run	Depositional	0%
BS-22-16	1	4.7	56.1345	-120.3947	28 Jul	22	7.1	290	Turbid	1.34	0	Pool	Depositional	0%
BS-22-17	1	5.7	56.1425	-120.3995	28 Jul	23.4	7.8	150	Mod. Turbid	0.21	0.35	Run	Depositional	0%
BS-22-18	1	12.3	56.1907	-120.4530	28 Jul	24.8	7.8	150	Mod. Turbid	0.4	0.19	Run	Depositional	10%
BS-22-19	1	19.9	56.2370	-120.5240	28 Jul	25.1	7.8	160	Turbid	0.5	0.13	Run	Depositional	0%
BS-22-20	2	51.5	56.3956	-120.6838	28 Jul	24.5	7.8	150	Turbid	0.4	0.27	Run	Depositional	0%
BS-22-21	3	67.4	56.4719	-120.7008	28 Jul	26.2	7.9	140	Mod. Turbid	0.4	NR	Run	Depositional	0%

Table D-1. Continued.

Site ID	Substrate Composition (%) Org	Silt	Sand	Grav	Cob	Bou	Bed	Embed--dedness	Comp-action	Beach Seine Total Haul Dist (m)	Effectiveness	Catch Summary (# fish) WP	GE	LSU	CSU	FHC	LKC	LNC	RSC	TP	NP	CCG	CRI	MW
BS-22-01	0	0	20	70	10	0	0	Low	Medium	56	Mod. Good	1	0	5	0	10	0	12	0	1	0	1	0	0
BS-22-02	0	5	20	55	20	0	0	High	Medium	73	Mod. Good	0	0	2	0	1	0	10	0	1	0	0	0	0
BS-22-03	0	5	10	10	70	5	0	High	Medium	67	Mod. Good	0	0	2	0	1	1	6	0	0	0	0	0	0
BS-22-04	0	5	10	10	65	10	0	High	Medium	49	Mod. Good	1	0	1	0	0	0	1	2	0	0	0	0	0
BS-22-05	0	0	10	10	50	30	0	High	High	91	Mod. Good	0	0	0	1	1	0	5	0	0	0	0	0	0
BS-22-06	0	0	10	10	70	10	0	High	Medium	101	Mod. Good	0	0	1	1	6	0	10	0	0	0	0	0	0
BS-22-07	5	85	10	0	0	0	0	High	Low	106	Mod. Poor	0	0	0	0	3	0	1	0	0	0	0	0	0
BS-22-08	0	5	10	20	60	5	0	Medium	Medium	74	Mod. Good	0	0	0	0	5	0	1	1	1	0	0	0	0
BS-22-09	0	0	5	10	70	15	0	Medium	Medium	75	Mod. Poor	0	0	0	0	0	0	1	0	0	0	0	1	0
BS-22-10	5	40	10	5	10	30	0	High	Low	65	Mod. Poor	0	0	0	0	1	0	0	0	0	0	0	0	0
BS-22-11	5	50	40	5	0	0	0	High	Low	80	Mod. Good	0	0	0	0	1	0	2	0	0	0	0	0	0
BS-22-12	0	5	10	15	70	0	0	Medium	Medium	67	Mod. Good	1	0	0	0	11	1	4	2	0	0	0	0	1
BS-22-13	0	10	25	60	0	5	0	High	Medium	15	Good	0	0	101	0	244	0	12	119	1	0	0	0	1
BS-22-14 *	0	0	10	70	20	0	0	Low	High	60	Good	5 *	0	10	0	1	0	0	1	1	1	0	0	0
BS-22-15	0	0	5	10	25	60	0	Medium	Medium	57	Mod. Poor	0	0	0	0	2	0	0	0	0	0	0	0	0
BS-22-16	0	80	10	10	0	0	0	High	Low	45	Mod. Poor	0	0	0	0	3	0	1	8	0	0	0	0	0
BS-22-17	0	5	10	20	65	0	0	Low	High	81	Good	0	1	1	0	0	0	0	0	0	0	0	0	0
BS-22-18	0	5	10	20	50	15	0	Low	Medium	83	Mod. Good	0	0	3	0	6	1	1	0	0	0	0	0	0
BS-22-19	0	0	5	15	65	15	0	Low	Medium	43	Mod. Poor	0	0	0	0	4	1	0	0	0	0	0	0	0
BS-22-20	0	0	10	40	45	5	0	Low	Medium	53	Good	0	0	0	0	2	0	0	0	0	0	0	0	0
BS-22-21	0	25	25	20	30	0	0	Low	Medium	45	Good	0	0	0	0	33	3	1	0	0	0	0	0	0

* a sixth WP was caught in an additional haul that was not part of the CPUE calculations

Table D-2. Biological information collected from fish captured in the Beatton River from 30 June to 1 July, and from 27-28 July 2022. See Table A2 for species abbreviations. ERR = weight was higher than scale maximum. * After 3 hauls at each site, additional sets were made from which and only Walleye were measured.

Date	Site ID	Species	FL (mm)	Wt (g)
30 Jun	BS-22-01A	CCG	68	2.3
30 Jun	BS-22-01A	FHC	72	3.3
30 Jun	BS-22-01A	FHC	64	3.1
30 Jun	BS-22-01A	FHC	26	
30 Jun	BS-22-01A	FHC	35	
30 Jun	BS-22-01A	FHC	63	2.4
30 Jun	BS-22-01A	FHC	32	
30 Jun	BS-22-01A	FHC	36	
30 Jun	BS-22-01A	FHC	33	
30 Jun	BS-22-01A	FHC	46	
30 Jun	BS-22-01A	FHC	39	
30 Jun	BS-22-01A	LNC	28	
30 Jun	BS-22-01A	LNC	28	
30 Jun	BS-22-01A	LNC	31	
30 Jun	BS-22-01A	LNC	31	
30 Jun	BS-22-01A	LNC	34	
30 Jun	BS-22-01A	LNC	24	
30 Jun	BS-22-01A	LNC	28	
30 Jun	BS-22-01A	LNC	29	
30 Jun	BS-22-01A	LNC	26	
30 Jun	BS-22-01A	LNC	27	
30 Jun	BS-22-01A	LNC	29	
30 Jun	BS-22-01A	LNC	32	
30 Jun	BS-22-01A	LSU	42	0.8
30 Jun	BS-22-01A	LSU	48	1.2
30 Jun	BS-22-01A	LSU	43	
30 Jun	BS-22-01A	LSU	59	1.8
30 Jun	BS-22-01A	LSU	33	
30 Jun	BS-22-01A	TP	48	1.4
30 Jun	BS-22-01B	WP	319	ERR
30 Jun	BS-22-02A	FHC	63	2.4
30 Jun	BS-22-02A	LNC	31	
30 Jun	BS-22-02A	LNC	28	
30 Jun	BS-22-02A	LNC	29	
30 Jun	BS-22-02A	LNC	31	
30 Jun	BS-22-02A	LNC	31	
30 Jun	BS-22-02A	LNC	28	
30 Jun	BS-22-02A	LNC	27	
30 Jun	BS-22-02A	LNC	26	
30 Jun	BS-22-02A	LNC	25	
30 Jun	BS-22-02A	LNC	45	
30 Jun	BS-22-02A	LSU	325	ERR
30 Jun	BS-22-02A	LSU	37	
30 Jun	BS-22-02A	TP	45	
30 Jun	BS-22-03A	FHC	56	2.3
30 Jun	BS-22-03A	LKC	83	6.8
30 Jun	BS-22-03A	LNC	49	1.3
30 Jun	BS-22-03A	LNC	68	3.5
30 Jun	BS-22-03A	LNC	101	13.6
30 Jun	BS-22-03A	LNC	52	
30 Jun	BS-22-03A	LNC	68	
30 Jun	BS-22-03A	LNC	73	4.8
30 Jun	BS-22-03A	LSU	70	3.4
30 Jun	BS-22-03A	LSU	187	51
30 Jun	BS-22-04A	LNC	26	
30 Jun	BS-22-04A	LSU	410	ERR
30 Jun	BS-22-04A	RSC	33	
30 Jun	BS-22-04A	RSC	30	
30 Jun	BS-22-04C	WP	296	ERR
30 Jun	BS-22-05A	CSU	425	ERR
30 Jun	BS-22-05A	FHC	122	18.3
30 Jun	BS-22-05A	LNC	58	2.2
30 Jun	BS-22-05A	LNC	45	
30 Jun	BS-22-05A	LNC	32	
30 Jun	BS-22-05A	LNC	24	
30 Jun	BS-22-05A	LNC	48	
1 Jul	BS-22-06A	CSU	236	156.6
1 Jul	BS-22-06A	FHC	126	21.1
1 Jul	BS-22-06A	FHC	133	23.5
1 Jul	BS-22-06A	FHC	129	20.5
1 Jul	BS-22-06A	FHC	127	20.6
1 Jul	BS-22-06A	FHC	134	27.5
1 Jul	BS-22-06A	FHC	128	21.4
1 Jul	BS-22-06A	LNC	33	
1 Jul	BS-22-06A	LNC	34	
1 Jul	BS-22-06A	LNC	36	
1 Jul	BS-22-06A	LNC	36	
1 Jul	BS-22-06A	LNC	39	
1 Jul	BS-22-06A	LNC	28	
1 Jul	BS-22-06A	LNC	28	
1 Jul	BS-22-06A	LNC	33	
1 Jul	BS-22-06A	LNC	65	3.7
1 Jul	BS-22-06A	LNC	29	
1 Jul	BS-22-06A	LSU	237	145.2
1 Jul	BS-22-07A	FHC	34	
1 Jul	BS-22-07A	FHC	37	
1 Jul	BS-22-07A	FHC	153	39.4
1 Jul	BS-22-07A	LNC	27	
1 Jul	BS-22-08A	FHC	37	
1 Jul	BS-22-08A	FHC	73	3
1 Jul	BS-22-08A	FHC	33	
1 Jul	BS-22-08A	FHC	71	3.3
1 Jul	BS-22-08A	FHC	69	3.5
1 Jul	BS-22-08A	LNC	35	3.1
1 Jul	BS-22-08A	RSC	23	
1 Jul	BS-22-08A	TP	45	
1 Jul	BS-22-09A	CRI	58	
1 Jul	BS-22-09A	LNC	85	6.5
1 Jul	BS-22-10A	FHC	79	5.1
1 Jul	BS-22-11A	FHC	77	4.8
1 Jul	BS-22-11A	LNC	31	
1 Jul	BS-22-11A	LNC	31	
27 Jul	BS-22-12A	FHC	69	3.5
27 Jul	BS-22-12A	FHC	47	1.7

Table D-2. Continued.

Date	Site ID	Species	FL (mm)	Wt (g)
27 Jul	BS-22-12A	FHC	54	1.8
27 Jul	BS-22-12A	FHC	49	0.8
27 Jul	BS-22-12A	FHC	57	2.2
27 Jul	BS-22-12A	FHC	56	1.6
27 Jul	BS-22-12A	FHC	208	ERR
27 Jul	BS-22-12A	FHC	47	1
27 Jul	BS-22-12A	FHC	45	0.9
27 Jul	BS-22-12A	FHC	94	8.2
27 Jul	BS-22-12A	FHC	80	6.4
27 Jul	BS-22-12A	LKC	73	4.5
27 Jul	BS-22-12A	LNC	33	
27 Jul	BS-22-12A	LNC	32	
27 Jul	BS-22-12A	LNC	33	
27 Jul	BS-22-12A	LNC	31	
27 Jul	BS-22-12A	RSC	45	1
27 Jul	BS-22-12A	RSC	95	9.2
27 Jul	BS-22-12B	MW	36	
27 Jul	BS-22-12B	WP	320	ERR
27 Jul	BS-22-14A	FHC	146	35.4
27 Jul	BS-22-14A	LSU	560	ERR
27 Jul	BS-22-14A	LSU	509	ERR
27 Jul	BS-22-14A	LSU	490	ERR
27 Jul	BS-22-14A	LSU	500	ERR
27 Jul	BS-22-14A	LSU	460	ERR
27 Jul	BS-22-14A	LSU	420	ERR
27 Jul	BS-22-14A	LSU	385	ERR
27 Jul	BS-22-14A	LSU	440	ERR
27 Jul	BS-22-14A	LSU	415	ERR
27 Jul	BS-22-14A	LSU	370	ERR
27 Jul	BS-22-14A	NP	285	ERR
27 Jul	BS-22-14A	RSC	35	
27 Jul	BS-22-14A	TP	65	3.4
27 Jul	BS-22-14A	WP	419	ERR
27 Jul	BS-22-14A	WP	381	ERR
27 Jul	BS-22-14A	WP	316	ERR
27 Jul	BS-22-14B	WP	360	ERR
27 Jul	BS-22-14B	WP	610	ERR
27 Jul	BS-22-14D *	WP	172	44.7
27 Jul	BS-22-15C	FHC	136	26.6
27 Jul	BS-22-15C	FHC	139	27.5
27 Jul	BS-22-16A	RSC	43	0.7
28 Jul	BS-22-16A	FHC	41	
28 Jul	BS-22-16A	FHC	85	6.6
28 Jul	BS-22-16A	FHC	85	5.8
28 Jul	BS-22-16A	LNC	20	
28 Jul	BS-22-16A	RSC	43	0.8
28 Jul	BS-22-16A	RSC	57	3.1
28 Jul	BS-22-16A	RSC	42	0.7
28 Jul	BS-22-16A	RSC	42	0.9
28 Jul	BS-22-16A	RSC	47	1.1
28 Jul	BS-22-16A	RSC	61	3.1
28 Jul	BS-22-16A	RSC	48	1.1
28 Jul	BS-22-17A	LSU	445	ERR
28 Jul	BS-22-17B	GE	425	ERR
28 Jul	BS-22-18A	FHC	49	1.2

Date	Site ID	Species	FL (mm)	Wt (g)
28 Jul	BS-22-18A	FHC	52	1.5
28 Jul	BS-22-18A	FHC	49	1.4
28 Jul	BS-22-18A	FHC	47	0.9
28 Jul	BS-22-18A	FHC	59	2.1
28 Jul	BS-22-18A	FHC	88	7.7
28 Jul	BS-22-18A	LKC	76	4.5
28 Jul	BS-22-18A	LNC	30	
28 Jul	BS-22-18A	LSU	490	ERR
28 Jul	BS-22-18A	LSU	324	ERR
28 Jul	BS-22-18A	LSU	106	13.2
28 Jul	BS-22-19B	FHC	87	5.7
28 Jul	BS-22-19B	FHC	150	36.5
28 Jul	BS-22-19B	FHC	80	5.2
28 Jul	BS-22-19B	FHC	161	44.8
28 Jul	BS-22-19B	LKC	50	1.1
28 Jul	BS-22-20B	FHC	143	28.3
28 Jul	BS-22-20B	FHC	129	23.6
28 Jul	BS-22-21B	FHC	47	
28 Jul	BS-22-21B	FHC	148	
28 Jul	BS-22-21B	FHC	48	
28 Jul	BS-22-21B	FHC	41	
28 Jul	BS-22-21B	FHC	83	
28 Jul	BS-22-21B	FHC	48	
28 Jul	BS-22-21B	FHC	82	
28 Jul	BS-22-21B	FHC	79	
28 Jul	BS-22-21B	FHC	83	
28 Jul	BS-22-21B	FHC	46	
28 Jul	BS-22-21B	FHC	144	
28 Jul	BS-22-21B	FHC	70	
28 Jul	BS-22-21B	FHC	42	
28 Jul	BS-22-21B	FHC	45	
28 Jul	BS-22-21B	FHC	88	
28 Jul	BS-22-21B	FHC	93	
28 Jul	BS-22-21B	FHC	72	
28 Jul	BS-22-21B	FHC	62	
28 Jul	BS-22-21B	FHC	49	
28 Jul	BS-22-21B	FHC	76	
28 Jul	BS-22-21B	FHC	44	
28 Jul	BS-22-21B	FHC	52	
28 Jul	BS-22-21B	FHC	41	
28 Jul	BS-22-21B	FHC	84	
28 Jul	BS-22-21B	FHC	88	
28 Jul	BS-22-21B	FHC	84	
28 Jul	BS-22-21B	FHC	78	
28 Jul	BS-22-21B	FHC	51	
28 Jul	BS-22-21B	FHC	89	
28 Jul	BS-22-21B	FHC	47	
28 Jul	BS-22-21B	FHC	75	
28 Jul	BS-22-21B	FHC	85	
28 Jul	BS-22-21B	FHC	77	
28 Jul	BS-22-21B	LKC	37	
28 Jul	BS-22-21B	LKC	36	
28 Jul	BS-22-21B	LKC	46	
28 Jul	BS-22-21B	LNC	33	

Table D-3. Taxon-specific catch and CPUE (fish per m^2) for beach seine sets conducted in potential juvenile Walleye habitat from 30 June to 1 July, and from 27-28 July 2022. See text for Reach designations. See Table A2 for species abbreviations.

Site ID	Reach	River km	Date	Haul	Total Haul Dist (m)	Area Sampled (m^2)	WP		GE		LSU		CSU		FHC		LKC		LNC		RSC		TP		NP		CCG		CRI		MW		All species	
							No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
BS-22-01	Peace River		30 Jun	A	24	321.6	0	0.000	0	0.000	5	0.016	0	0.000	10	0.031	0	0.000	12	0.037	0	0.000	1	0.003	0	0.000	1	0.003	0	0.000	0	0.000	29	0.090
				B	16	214.4	1	0.005	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.005
				C	16	214.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-02	1	0.9	30 Jun	A	23	308.2	0	0.000	0	0.000	2	0.006	0	0.000	1	0.003	0	0.000	10	0.032	0	0.000	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	14	0.045
				B	22	294.8	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	28	375.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-03	1	4.3	30 Jun	A	39	522.6	0	0.000	0	0.000	2	0.004	0	0.000	1	0.002	1	0.002	6	0.011	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	10	0.019
				B	28	375.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-04	1	4.7	30 Jun	A	23	308.2	0	0.000	0	0.000	1	0.003	0	0.000	0	0.000	0	0.000	1	0.003	2	0.006	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	4	0.013
				B	13	174.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	13	174.2	1	0.006	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.006
BS-22-05	1	5.5	30 Jun	A	31	415.4	0	0.000	0	0.000	0	0.000	1	0.002	1	0.002	0	0.000	5	0.012	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	7	0.017
				B	29	388.6	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	31	415.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-06	1	14.9	1 Jul	A	35	469.0	0	0.000	0	0.000	1	0.002	1	0.002	6	0.013	0	0.000	10	0.021	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	18	0.038
				B	33	442.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	33	442.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-07	1	20.9	1 Jul	A	37	495.8	0	0.000	0	0.000	0	0.000	0	0.000	3	0.006	0	0.000	1	0.002	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	4	0.008
				B	39	522.6	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	30	402.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-08	1	28.4	1 Jul	A	36	482.4	0	0.000	0	0.000	0	0.000	0	0.000	5	0.010	0	0.000	1	0.002	1	0.002	1	0.002	0	0.000	0	0.000	0	0.000	0	0.000	8	0.017
				B	18	241.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	20	268.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-09	1	32.0	1 Jul	A	28	375.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	1	0.003	0	0.000	2	0.005
				B	26	348.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	21	281.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-10	2	46.9	1 Jul	A	18	241.2	0	0.000	0	0.000	0	0.000	0	0.000	1	0.004	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.004
				B	21	281.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	26	348.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000

Site ID	Reach	River km	Date	Haul	Total Haul Dist (m)	Area Sampled (m^2)	WP		GE		LSU		CSU		FHC		LKC		LNC		RSC		TP		NP		CCG		CRI		MW		All species	
							No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
BS-22-11	3	78.3	1 Jul	A	22	294.8	0	0.000	0	0.000	0	0.000	0	0.000	1	0.003	0	0.000	2	0.007	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	3	0.010
				B	23	308.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	35	469.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-12	Peace River		27 Jul	A	20	268.0	0	0.000	0	0.000	0	0.000	0	0.000	11	0.041	1	0.004	4	0.015	2	0.007	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	18	0.067
				B	22	294.8	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.003	2	0.007
				C	25	335.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-13	Peace River		27 Jul	A	15	201.0	0	0.000	0	0.000	101	0.502	0	0.000	244	1.214	0	0.000	12	0.060	119	0.592	1	0.005	0	0.000	0	0.000	0	0.000	1	0.005	478	2.378
BS-22-14	1	1.0	27 Jul	A	20	268.0	3	0.011	0	0.000	10	0.037	0	0.000	1	0.004	0	0.000	0	0.000	1	0.004	1	0.004	1	0.004	0	0.000	0	0.000	0	0.000	17	0.063
				B	21	281.4	2	0.007	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	2	0.007
				C	19	254.6	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-15	1	4.3	27 Jul	A	18	241.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				B	17	227.8	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	22	294.8	0	0.000	0	0.000	0	0.000	0	0.000	2	0.007	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	2	0.007
BS-22-16	1	4.7	28 Jul	A	17	227.8	0	0.000	0	0.000	0	0.000	0	0.000	3	0.013	0	0.000	1	0.004	8	0.035	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	12	0.053
				B	15	201.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	13	174.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-17	1	5.7	28 Jul	A	25	335.0	0	0.000	0	0.000	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.003
				B	35	469.0	0	0.000	1	0.002	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	1	0.002
				C	21	281.4	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-18	1	12.3	28 Jul	A	33	442.2	0	0.000	0	0.000	3	0.007	0	0.000	6	0.014	1	0.002	1	0.002	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	11	0.025
				B	28	375.2	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				C	22	294.8	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-19	1	19.9	28 Jul	A	20	268.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				B	23	308.2	0	0.000	0	0.000	0	0.000	0	0.000	4	0.013	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	5	0.016
BS-22-20	2	51.5	28 Jul	A	17	227.8	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				B	16	214.4	0	0.000	0	0.000	0	0.000	0	0.000	2	0.009	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	2	0.009
				C	20	268.0	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
BS-22-21	3	67.4	28 Jul	A	22	294.8	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
				B	23	308.2	0	0.000	0	0.000	0	0.000	0	0.000	33	0.107	3	0.010	1	0.003	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	37	0.120

Downstream view

Upstream view

Across

NR

Substrate

Figure D-1. Site BS-22-01, Beatton Mouth (30 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-2. Site BS-22-02, rkm 0.9, Reach 1 (30 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-3. Site BS-22-03, rkm 4.3, Reach 1 (30 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-4. Site BS-22-04, rkm 4.7, Reach 1 (30 June 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-5. Site BS-22-05, rkm 5.5, Reach 1 (30 June 2022).

Downstream view

Upstream view

Across

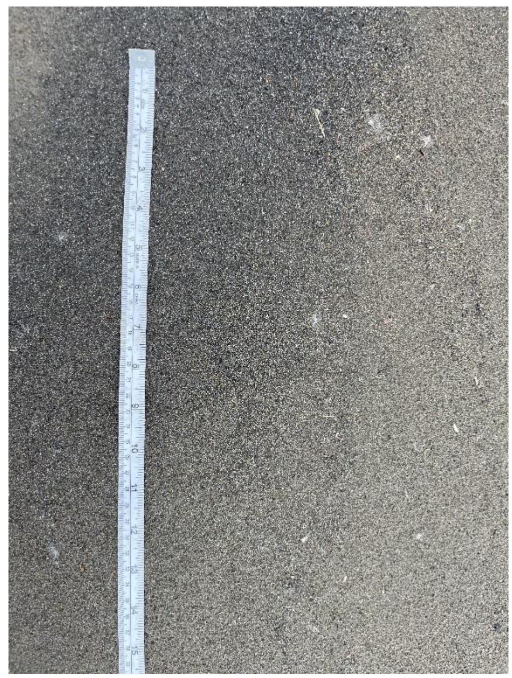
Substrate

Figure D-6. Site BS-22-06, rkm 14.9, Reach 1 (1 July 2022).

Downstream view

Upstream view

Across



Substrate

Figure D-7. Site BS-22-07, rkm 20.9, Reach 1 (1 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-8. Site BS-22-08, rkm 28.4, Reach 1 (1 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-9. Site BS-22-09, rkm 32.0, Reach 1 (1 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-10. Site BS-22-10, rkm 46.3, Reach 2 (1 July 2022).

Downstream view

Upstream view

Across

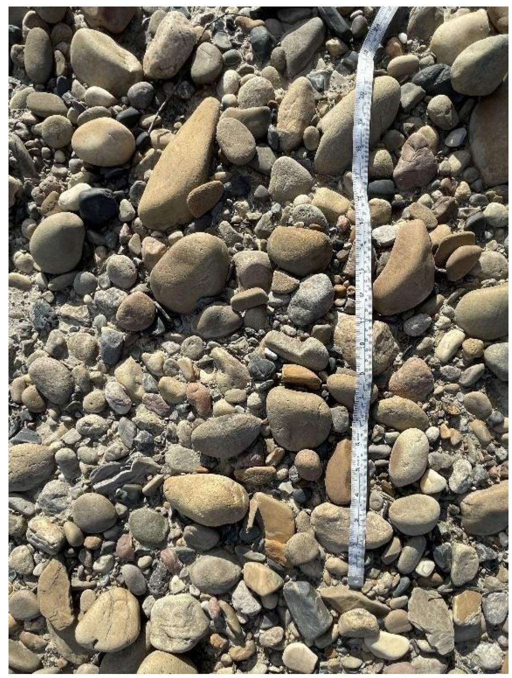
Substrate

Figure D-11. Site BS-22-11, rkm 78.3, Reach 3 (1 July 2022).

Downstream view

Upstream view

Across



Substrate

Figure D-12. Site BS-22-12, Beatton Mouth (27 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-13. Site BS-22-13, Beatton Mouth (27 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-14. Site BS-22-14, rkm 1.0, Reach 1 (27 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-15. Site BS-22-15, rkm 4.3, Reach 1 (27 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-16. Site BS-22-16, rkm 4.7, Reach 1 (28 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-17. Site BS-22-17, rkm 5.7, Reach 1 (28 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-18. Site BS-22-18, rkm 12.3, Reach 1 (28 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-19. Site BS-22-19, rkm 19.9, Reach 1 (28 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-20. Site BS-22-20, rkm 51.5, Reach 2 (28 July 2022).

Downstream view

Upstream view

Across

Substrate

Figure D-21. Site BS-22-21, rkm 67.4, Reach 3 (28 July 2022).