Site C Clean Energy Project

Peace River Fish Community Monitoring Program (Mon-2)

Task 2a – Peace River Large Fish Indexing Survey

Construction Year 4 (2018)

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REPORT

Peace River Large Fish Indexing Survey

2018 Investigations (Mon-2, Task 2a)

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Executive Summary

The Site C Clean Energy Project (the Project), including Project construction, reservoir filling, and operation, could affect fish and fish habitat via three key pathways: changes to fish habitat (including nutrient concentrations and lower trophic biota), changes to fish health and fish survival, and changes to fish movement. These paths are examined in detail in Volume 2 of the Project's Environmental Impact Statement (EIS; BC Hydro 2013). The EIS makes both qualitative and quantitative predictions of fish production in the Peace River downstream of the Project.

Quantitative predictions of fish biomass downstream of the Project were generated as part of the EIS. For these predictions, each fish species was assigned to one of four groups: Group 1 consisted of large-bodied fish typically targeted by anglers (i.e., Burbot [*Lota lota*], Lake Trout [*Salvelinus namaycush*], Northern Pike [*Esox lucius*], Rainbow Trout [*Oncorhynchus mykiss*], and Walleye [*Sander vitreus*]); Group 2 included species considered "passage sensitive" (i.e., Arctic Grayling [*Thymallus arcticus*], Bull Trout [*Salvelinus confluentus*], and Mountain Whitefish [*Prosopium williamsoni*]); Group 3 included planktivorous species (i.e., Kokanee [*Oncorhynchus nerka*] and Lake Whitefish [*Coregonus clupeaformis*]); and Group 4 fish consisted of all remaining species (i.e., Northern Pikeminnow [*Ptychocheilus oregonensis*], sucker species, and small-bodied fish species). Relative to pre-Project estimates, the EIS predicted decreased biomass of Group 1 fishes over the short- (10 years) and long-term (greater than 30 years), increased biomass of Group 2 fishes over the short- and long-term, similar biomasses of Group 3 fishes over the short- and long-term, and decreased biomass of Group 4 fishes over the short- and long-term.

The objective of the Peace River Large Fish Indexing Survey (hereafter, Indexing Survey) is to validate EIS predictions and address uncertainties identified in the EIS regarding the Project's effects on fish in the Peace River. The status of the Indexing Survey's progress towards testing each of the applicable hypotheses listed in BC Hydro's Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP; BC Hydro 2015a) is presented in Table E1.

The Indexing Survey was initiated in 2015 and conducted annually (Golder and Gazey 2016, 2017, 2018). It is the continuation and expansion of two previous programs conducted using similar methods. These included BC Hydro's Large River Fish Indexing Program (2001–2007; P&E 2002; P&E and Gazey 2003; Mainstream and Gazey 2004–2008) and the Peace River Fish Index (2008–2014; Mainstream and Gazey 2009–2014; Golder and Gazey 2015).

In 2018, sampling for the Indexing Survey was conducted in six different sections of the Peace River mainstem: Section 1 near the town of Hudson's Hope, BC; Section 3 downstream of the Halfway River's confluence with the Peace River; Section 5 immediately downstream of the Site C damsite area; Section 6 downstream of the Pine River's confluence with the Peace River; Section 7 downstream of the Beatton River's confluence with the Peace River; and, Section 9 in the Many Islands area in Alberta. Section 2 (the Farrell Creek area), Section 4 (the Wilder Creek area), and Section 8 (the Pouce Coupe River area) were not sampled as part of the Indexing Survey; however, small portions of Section 8 were sampled during the Goldeye and Walleye Survey detailed below. All large-bodied fishes were monitored; however, the monitoring program focused on seven indicator species of most interest to regulatory agencies, comprising the following: Arctic Grayling, Bull Trout, Burbot, Goldeye (*Hiodon alosoides*), Mountain Whitefish, Rainbow Trout, and Walleye. Fish were captured by boat electroshocking and measured for length and weight. Ageing structures were collected from most fish and indicator species were marked with half-duplex (HDX) passive integrated transponder (PIT) tags. For species with sufficient mark-recapture data, population abundance was estimated using a Bayes sequential model (conducted by W.J. Gazey Research). For species without sufficient mark-recapture data, catch-rates were used to assess changes in relative abundance. Other fish population metrics analyzed included biomass, survival, length-at-age, and body condition. These metrics were compared to results from 2002 to 2017 and to select environmental parameters. In 2018, these parameters were limited to Peace River discharge and water temperature values; however, the list of parameters tested could be expanded during subsequent study years to include those deemed most likely to influence local fish populations (e.g., primary or secondary productivity, recreational angling pressure, water quality).

In response to low Goldeye catch during the Indexing Survey from 2015 to 2017, the Goldeye and Walleye Survey was implemented in the spring and summer of 2018 to increase catch rates. The Goldeye and Walleye Survey consisted of boat electroshocking surveys near the confluences of select Peace River tributaries (Six Mile and Eight Mile creeks, and the Alces, Beatton, Clear, Kiskatinaw, and Pouce Coupe rivers) that were known or suspected feeding areas for these species. Goldeye are seasonal residents that migrate upstream into the study area in the early spring to spawn. After spawning, Goldeye remain near the confluences of select tributaries to feed until water clarity increases, at which time, they migrate downstream to more turbid locations. The objective of the Goldeye and Walleye Survey was to catch these fish prior to their downstream migration. In 2018, the Goldeye and Walleye Survey was conducted in June and July.

Overall, results from 2018 indicated a stable fish population in the Peace River, with most species metrics falling within the ranges of values recorded during previous study years. Key results from the 2018 survey, which was conducted between 15 June and 19 July (Goldeye and Walleye Survey) and between 21 August and 4 October (Indexing Survey), as well as key trends observed over the 17-year monitoring period are summarized as follows:

- In 2018, water levels in the Peace River were within historical bounds (2002–2017) and near historical averages between early January and early July. From July until the end of 2018, discharge was more variable, and was lower than average for most of July, above or near historical highs for most of August, and lower than average for most of September. During the 2018 study period, flows were below the seasonal historical average for most of Sessions 1, 3, and 4, were above the seasonal historical average for most of Session 2 and increased from near historical lows to near historical highs over the course of Session 5. Overall, flows were substantially more variable during the 2018 study period compared to the 2017 study period.
- In 2018, water temperatures in the Peace River were warmer than historical averages from May to early September (e.g., 1°C to 2°C warmed than average in Section 1 and up to 4°C warmer than average in Section 3) and were at historic lows for the latter half of the Indexing Survey (e.g., up to 4°C lower than average in Section 3).

- Arctic Grayling abundance in Section 3 was estimated at 998 individuals. Credibility intervals surrounding this estimate were wide (95% Highest Probability Density = 70 and 3,300 individuals). Abundance in other sections could not be determined due to a lack of recaptured individuals (Arctic Grayling were not recaptured in any section other than Section 3). Overall, the 2018 abundance estimate of 998 individuals was higher than estimates generated in recent study years (e.g., 309 individuals in 2017 and 200 individuals in 2016) but were much lower than historical highs (i.e., approximately 3500 individuals in 2009). Catch rates were similar from 2016 to 2018 and length-frequency data did not suggest substantially higher abundances of any specific age-classes. All recaptured Arctic Grayling encountered in Section 3 in 2018 were recorded during Sessions 2 and 3 (n = 4) (i.e., recaptures were not encountered in Sessions 4 or 5) which influenced abundance estimates.
- Catch rates for Arctic Grayling generally declined from approximately 15 fish/km/h in 2007 to 5 fish/km/h in 2014, a decline of approximately 66% over 8 years. Catch rates increased to approximately 9 fish/km/h between 2014 and 2016, an increase of approximately 26%. Catch rates were similar in 2016, 2017, and 2018. The increase observed between 2014 and 2016 was likely spurred by strong recruitment from the 2014 brood year (i.e., spawning in spring 2014).
- Biomass estimates for Arctic Grayling could only be estimated for Sections 3 and 5 and could only be generated for these sections during some study years. During recent study years (i.e., 2016 to 2018) biomass estimates for Section 3 have ranged between a low of approximately 70 kg and a high of approximately 125 kg; biomass estimates could not be generated for Section 5 during these study years. Overall (all years combined), Arctic Grayling biomass was highest in 2007 (470 kg in Sections 3 and 5 combined).
- Overall, neither population abundance estimates nor catch-per-unit-effort suggested substantial or sustained changes in the abundance of Bull Trout between 2002 and 2018. Bull Trout population abundance estimates could only be generated for Sections 3 and 5 in 2018; however, the overall pattern of distribution among sections was consistent with previous study years.
- In 2018, Bull Trout body condition (1.019 K all sections combined) was higher than in 2017 (0.984 K all sections combined) and was the highest value recorded since 2014 (1.055 K all sections combined). Condition is typically highest in Section 1 (1.057 K in 2018) when compared to all other sections (1.007 K in 2018 for all other sections combined).
- Bull Trout biomass was estimated for Sections 3 and 5 during most study years, but estimates for other sections were sporadically generated. For Section 3, average biomass per year was 238 kg, but varied between a high of approximately 376 kg in 2012 and a low of 147 kg in 2018. For Section 5, biomass estimates were more stable among years, but generally lower compared to Section 3 estimates.
- Between 2002 and 2018, Burbot catch ranged between 0 and 13 individuals. Burbot catch was substantially higher in 2016 (n = 37). Burbot favour turbid water and the anomalously higher catch in 2016 may have been due in part to higher water turbidity levels in the downstream sections during the 2016 study period (33 cm average Secchi depth for Sections 6, 7, and 9 combined) compared to other study years when sampling was conducted in these sections (90 cm average Secchi depth for 2015, 2017, and 2018 combined).

- Population abundance estimates for Largescale Sucker (*Catostomus macrocheilus*) in 2018 were similar to previous study years, suggesting a stable population over the long-term. All estimates (years and sections) were uncertain due to wide credibility intervals. Largescale Sucker were only PIT-tagged during the 2015 to 2018 study years.
- Longnose Sucker (*Catostomus catostomus*) population abundance estimates were similar between 2015 and 2018, suggesting a stable population over this period.
- Longnose Sucker accounted for nearly all (greater than 99%) of the total sucker biomass in the Peace River. During all study years since 2015 (i.e., since all sections have been continuously sampled), Longnose Sucker biomass in Section 9 has been lower than all other sections.
- Goldeye were not captured during the 2018 Indexing Survey; however, two Goldeye were captured during the Goldeye and Walleye Survey. Both fish were adults based on their size. One fish (385 mm FL) was captured at the mouth of the Beatton River on 17 July and the second fish (375 mm FL) was captured at the mouth of the Pouce Coupe River on 19 July. Goldeye were not recorded prior to the 2015 Indexing Survey and were sporadically recorded between 2015 and 2018. Eight individuals were captured in 2016, the highest number caught in a single study year. In 2016, water turbidity was higher (average = 33 cm) compared to other years between 2015 and 2018 (average = 90 cm).
- Overall (all sections combined), 2018 Mountain Whitefish population abundance was estimated at 81,862 individuals and was higher for all sections when compared to 2017 estimates. Section 1 experienced the largest increase in abundance between 2017 (20,801 individuals; CI: 15,460 to 26,640 individuals) and 2018 (34,868 individuals; CI: 22,760 to 48,640 individuals) with some overlap in credibility intervals. The increase in abundance between 2017 and 2018 is supported by catch rate data, which increased by 42% between 2017 and 2018. Overall (all years combined), the Mountain Whitefish population in the Peace River has been stable since 2002, with the exception of a notable increase in 2010 that was due to strong recruitment from the 2007 brood year (i.e., spawning in fall 2006) and a notable increase in 2018 that was likely due to strong recruitment from the 2014 brood year.
- Results indicate that changes to electroshocker settings first implemented in 2014 have resulted in differences in selectivity for Mountain Whitefish, with relatively more small fish (i.e., fish less than 250 mm FL) and fewer large fish being caught from 2014 to 2018.
- For Sections 1, 3, and 5 combined, Mountain Whitefish biomass generally declined between 2005 and 2018; however, the biomass of Mountain Whitefish in Section 1 increased each year between 2014 and 2018.
- The Rainbow Trout catch in 2018 (n = 146) was within the range of catches recorded between 2015 and 2017 (range = 122 to 186). Rainbow Trout are more common (i.e., higher catch rates and represent a higher portion of the catch) in upstream sections, and are rarely recorded in downstream sections, which have only been sampled since 2015. Additional years of data are required to adequately identify long-term trends for this species.
- In 2018, Walleye abundance was estimated at 574 individuals for Section 7 and 1,952 individuals for Section 9. Credibility intervals were wide around both estimates. Insufficient data prevented the generation of abundance estimates for Walleye for most sections during most study years. Long-term trends in abundance were assessed using catch-rate data, which indicated gradually increasing abundance in downstream sections between 2015 and 2018.

- In its current form, the Indexing Survey is unlikely to yield high enough catches to produce reliable estimates of absolute abundance that are precise enough to detect changes over time for Burbot, Goldeye, Northern Pike, Rainbow Trout, Walleye, and White Sucker (*Catostomus commersonii*). For these species, catch rate data will be used to identify Project effects.

Data collected from 2002 to 2020 will represent the baseline, pre-Project state of the Peace River fish community. Management hypotheses will be statistically tested after the river diversion phase of construction (i.e., after 2020).

Table E1: Status of Peace River Large Fish Indexing Survey hypotheses after 2018 (Mon-2, Task 2a).

Mon-2 Management Question	Management Hypotheses Relevant to Task 2a	2018 Status
How does the Project affect fish in the Peace River between the Project and the Many Islands area in Alberta during the short (10 years after Project operations begin) and longer (30 years after Project operations begin) term?	**H_1:** Post-Project total fish biomass in the Peace River between the Project and the Many Islands area in Alberta will be less than pre-Project conditions (current = 37.42 t; at 10 years of operations = 30.78 t; >30 years of operations = 30.79 t).	The hypothesis has not been tested. Methodologies employed under Task 2a have been similar to those employed during pre-Project baseline studies. Data collected to date are consistent with baseline data and should allow comparisons between pre-Project data and data collected during construction and operation. Higher statistical certainty occurs with species with higher catch rates.
	H_2: Post-Project harvestable fish biomass in the Peace River between the Project and the Many Islands area in Alberta will be greater than pre-Project estimates of harvestable fish biomass (current = 13.93 t; at 10 years of operations = 18.77 t; >30 years of operations = 18.78 t).	The hypothesis has not been tested. Methodologies employed under Task 2a have been similar to those employed during pre-Project baseline studies. Data collected to date are consistent with baseline data and should allow comparisons between pre-Project data and data collected during construction and operation.
	H_3: Post-Project biomass of each fish species in the Peace River between the Project and the Many Islands area in Alberta will be consistent with biomass estimates in the EIS.	The hypothesis has not been tested. Methodologies employed under Task 2a have been similar to those employed during pre-Project baseline studies. Data collected to date are consistent with baseline data and should allow comparisons between pre-Project data and data collected during construction and operation for most fish species. For less common indicator species, most notably Burbot and Goldeye, it is likely that detecting changes in abundance or biomass will rely on indices such catch rate, as the survey in its current format is unlikely to generate abundance estimates from mark-recapture data.

Mon-2 Management Question	Management Hypotheses Relevant to Task 2a	2018 Status
	H_4: Changes in post-Project fish community composition in the Peace River between the Project and the Many Islands area in Alberta will be consistent with EIS predictions.	The hypothesis has not been tested. To date, diversity profiles show distinct differences in fish community structure between sample sections and in its current format, the survey is expected to provide data capable of testing this hypothesis.
	H_5: The fish community can support angling effort that is similar to baseline conditions.	The hypothesis has not been tested. The survey, in its current format, is expected to generate species abundance estimates of most harvestable fish species. These estimates, in conjunction with angling pressure data generated by the Peace River Creel Survey (Mon-2, Task 2c), will be used to test the hypothesis.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
ADMB	AD Model Builder
AIC	Akaike's Information Criterion
CJS	Cormack-Jolly-Seber
DELT	Deformities, Erosion, Lesions, and Tumor
EAC	Environmental Assessment Certificate
EIS	Environmental Impact Statement
FAHMFP	Fisheries and Aquatic Habitat Monitoring and Follow-up Program
FDS	Federal Decision Statement
FDX	Full-Duplex
GPP	Generator Powered Pulsator
HDX	Half-Duplex
HPD	Highest Probability Density
HSD	Honest Significant Difference
Indexing Survey	Peace River Large Fish Indexing Survey
Mon-2	Peace River Fish Community Monitoring Program
PCD	Peace Canyon Dam
PIT	Passive Integrated Transponder
Project	Site C Clean Energy Project
PUP	Park Use Permit
SIA	Stable Isotope Analysis
WLR	Water License Requirements

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1.0 INTRODUCTION

Potential effects of the Site C Clean Energy Project (the Project) on fish[1] and fish habitat[2] are described in Volume 2 of the Project's Environmental Impact Statement (EIS) as follows[3]:

> The Project has the potential to affect fish habitat in two ways. The Project may destroy fish habitat by placing a permanent physical structure on that habitat, or the Project may alter fish habitat by changing the physical or chemical characteristics of that habitat in such a way as to make it unusable by fish. Destruction or alteration of important habitats may be critical to the sustainability of a species population.
>
> The Project may affect fish health and survival. It may cause direct mortality of fish or indirect mortality of fish by changing system productivity, food resource type and abundance, and environmental conditions on which fish depend (e.g., water temperature).
>
> The Project may affect fish movement by physically blocking upstream and downstream migration of fish or by causing water velocities that exceed the swimming capabilities of fish, which results in hindered or blocked upstream migration of fish. Blocked or hindered fish movement has consequences to the species population. Fish may not be able to access important habitats in a timely manner or not at all (e.g., spawning habitats). Blocked fish movement may result in genetic fragmentation of the population.

Condition No. 7 of the Project's Provincial Environmental Assessment Certificate (EAC), Schedule B states the following:

> The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program [FAHMFP] to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP [Qualified Environmental Professional] or FLNRO [BC Ministry of Forests, Lands and Natural Resource Operations], to assess the need to adjust those measures to adequately mitigate the Project's effects.

Furthermore, the Project's Federal Decision Statement (FDS) states that a plan should be developed that addresses the following:

> Condition No. 8.4.3: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area (LAA); and
>
> Condition No. 8.4.4: an approach to monitor and evaluate the effectiveness of mitigation or offsetting measures and to verify the accuracy of the predictions made during the environmental assessment on fish and fish habitat.

The intent of the Peace River Large Fish Indexing Survey (hereafter, Indexing Survey), as described in Appendix C (Peace River Fish Community Monitoring Program; Mon-2) of the Project's FAHMFP (BC Hydro 2015a), is to "monitor the response of large-bodied fish species in the Peace River to the Project". Large-bodied fish species include Group 1 fishes (i.e., Burbot, Lake Trout, Northern Pike, Rainbow Trout), Group 2 fishes (i.e., Arctic Grayling, Bull Trout, Mountain Whitefish), and Group 3 fishes (i.e., Kokanee and Lake Whitefish) as well as the three Peace River sucker species (i.e., Largescale Sucker, Longnose Sucker, and White Sucker) and Northern Pikeminnow[4]. The Indexing Survey is designed to provide supporting data to address the EAC and FDS conditions detailed above. Specifically, the Indexing Survey represents Task 2a of the Peace River Fish Community Monitoring Program (Mon-2) within the FAHMFP.

---

[1] Fish includes fish abundance, biomass, composition, health, and survival.
[2] Fish habitat includes water quality, sediment quality, lower trophic levels (periphyton and benthic invertebrates), and physical habitat.
[3] EIS, Volume 2, Section 12.1.2 (BC Hydro 2013).
[4] EIS, Volume 2, Section 12.3.2.2 (BC Hydro 2013).

The Indexing Survey will monitor the response of large-bodied fish species to the Project over the short term (10 years after Project operations begin) and longer term (30 years after the Project operations begin) and focuses on collecting data that quantify the relative and absolute abundances and spatial distribution of seven indicator species. The seven indicator species included Arctic Grayling (*Thymallus arcticus*), Bull Trout (*Salvelinus confluentus*), Burbot (*Lota lota*), Goldeye (*Hiodon alosoides*), Mountain Whitefish (*Prosopium williamsoni*), Rainbow Trout (*Oncorhynchus mykiss*), and Walleye (*Sander vitreus*). These species were identified in local provincial management objectives (BC Ministry of Environment 2009; BC Government 2011) as species of interest to recreational anglers and harvested by Aboriginal groups, and were the focus of the Project's EIS effects assessment (BC Hydro 2013).

In 2008, BC Hydro implemented the Peace River Fish Index (GMSMON-2), an annual program designed to monitor Arctic Grayling, Bull Trout, and Mountain Whitefish populations in the Peace River downstream of Peace Canyon Dam (PCD) and their responses to instream physical works designed to improve fish habitat in select side channel areas (Mainstream and Gazey 2009–2014; Golder and Gazey 2015). Data collected under GMSMON-2 and its predecessor, the Peace River Fish Community Indexing Program (P&E 2002; P&E and Gazey 2003; Mainstream and Gazey 2004–2008), provide a continuous dataset for the fish community within the study area beginning in 2001 that can be compared to data collected during the current monitoring program (Golder and Gazey 2016–2018). Changes in methodologies, objectives, and study areas over 18 years of sampling limits the compatibility of some aspects of the dataset.

In 2018, the program collected various biological samples from select fish for potential analysis. These included tissue samples for stable isotope analysis (SIA), genetic, and mercury analyses, stomach contents for diet-related analyses, and hard structure samples (i.e., fin rays or otoliths) for microchemistry analysis. All samples were provided to BC Hydro and will be used to further characterize Peace River fish populations by other components of the Site C FAHMFP. The analysis and interpretation of these samples is not discussed in this report.

Field crews collected additional data at some sites to support offset effectiveness monitoring (Mon-2, Task 2d) related to the Project (BC Hydro 2015b, 2015c). Results associated with offset effectiveness monitoring are not presented or discussed in this report but are available under separate cover (e.g., Golder 2019).

1.1.1 Key Management Question

The overarching management question for the Peace River Fish Community Monitoring Program is as follows:

1) How does the Project affect fish in the Peace River between the Project and the Many Islands area in Alberta during the short (10 years after Project operations begin) and longer (30 years after Project operations begin) term?

1.2 Management Hypotheses

The Peace River Fish Community Monitoring Program's overarching management question will be addressed by testing a series of management hypotheses using predictions made in the Project's EIS. These predictions are summarized in Mon-2 of the FAHMFP as presented in the Table 1.

Management hypotheses detailed within the Peace River Fish Community Monitoring Program that will be tested using data collected during the Indexing Survey are as follows:

H_1: Post-Project total fish biomass in the Peace River between the Project and the Many Islands area in Alberta will be less than pre-Project conditions (current = 37.42 t; at 10 years of operations = 30.78 t; >30 years of operations = 30.79 t).

H_2: Post-Project harvestable fish biomass in the Peace River between the Project and the Many Islands area in Alberta will be greater than pre-Project estimates of harvestable fish biomass (current = 13.93 t; at 10 years of operations = 18.77 t; >30 years of operations = 18.78 t).

H_3: Post-Project biomass of each fish species in the Peace River between the Project and the Many Islands area in Alberta will be consistent with biomass estimates in the EIS.

H_4: Changes in post-Project fish community composition in the Peace River between the Project and the Many Islands area in Alberta will be consistent with EIS predictions.

H_5: The fish community can support angling effort that is similar to baseline conditions.

Table 1: Short and longer term predictions of fish biomass (t) for pre- and post-Project conditions for the Peace River from the Project to the Many Islands area in Alberta. Fish biomass is presented for the "Most Likely" scenario (plus a minimum to maximum range). Data were summarized from Mon-2 of the FAHMFP (BC Hydro 2015a).

Species Group	Species Name	Pre-Project Biomass (t)	Post-Project Biomass (t)			
			Short Term (in 10 Years)		Longer Term (> 30 Years)	
			Most Likely	Range	Most Likely	Range
1	Walleye	3.38	1.69	0.34–1.69	1.69	0.34–1.69
	Lake Trout	0.00	0.00	0.00–0.01	0.00	0.00–0.01
	Rainbow Trout	0.17	0.35	0.17–0.35	0.35	0.17–0.35
	Northern Pike	0.74	0.37	0.37–0.74	0.37	0.37–0.74
	Burbot	0.10	0.05	0.01–0.05	0.05	0.01–0.05
Group 1 Subtotal		**4.39**	**2.46**	**0.89–2.83**	**2.46**	**0.89–2.83**
2	Bull Trout	1.49	1.23	1.23–2.54	1.23	1.23–2.54
	Arctic Grayling	0.64	0.32	0.06–0.64	0.32	0.06–0.64
	Mountain Whitefish	7.38	14.74	14.74–14.74	14.74	14.74–14.74
Group 2 Subtotal		**9.50**	**16.29**	**16.03–17.91**	**16.29**	**16.03–17.91**
3	Kokanee	0.03	0.01	0.00–0.02	0.03	0.01–0.04
	Lake Whitefish	0.00	0.01	0.00–0.01	0.00	0.00–0.01
Group 3 Subtotal		**0.03**	**0.02**	**0.01–0.03**	**0.03**	**0.01–0.04**
Total Harvestable Fish Biomass		**13.93**	**18.77**	**16.94–20.78**	**18.78**	**16.94–20.79**
4	Sucker species	21.74	10.87	10.87–10.87	10.87	10.87–10.87
	Small-bodied Fish	0.87	0.70	0.43–0.87	0.70	0.43–0.87
	Northern Pikeminnow	0.87	0.44	0.26–0.52	0.44	0.26–0.52
Group 4 Subtotal		**23.49**	**12.01**	**11.57–12.27**	**12.01**	**11.57–12.27**
Total Fish Biomass		**37.42**	**30.78**	**28.50–33.05**	**30.79**	**28.50–33.06**

1.3 Study Objectives

The objective of the Indexing Survey is to validate predictions and address uncertainties identified in the EIS regarding the Project's effects on fish in the Peace River and to assess the effectiveness of fish and fish habitat mitigation measures. The purpose of the Indexing Survey is to monitor the response of large-bodied fish species in the Peace River to the construction and operation of the Project. The Indexing Survey will incorporate data previously collected during BC Hydro's WLR (Water License Requirements) Peace River Fish Index (GMSMON-2) and its predecessor the Peace River Fish Community Indexing Program. Objectives of GMSMON-2 (BC Hydro 2008), which also apply to the current Indexing Survey, are as follows:

1) Collect a time series of data on the abundance, spatial distribution, and biological characteristics of nearshore and shallow water fish populations in the Peace River that will build on previously collected data.

2) Build upon earlier investigations for further refinement of the sampling strategy, sampling methodology, and analytical procedures required to establish a long-term monitoring program for fish populations.

3) Identify gaps in data and knowledge of fish populations and procedures for sampling.

Field work for the Indexing Survey was conducted from late summer to early fall (i.e., mid-August to early October). Sampling was conducted during this time period for several reasons, including ensuring compatibility with historical datasets (Golder and Gazey 2018), increasing sampling efficiency by sampling when turbidity is typically low, and reducing potential sampling effects to Bull Trout by sampling when spawning Bull Trout are not present in the Peace River mainstem (i.e., when they are spawning in select tributaries). The mid-August to early October study period for the Indexing Survey occurs after most Goldeye and Walleye migrate downstream out of the study area. As such, Mon-2 included contingent sampling for these species as follows:

> If catch data from [2016] and [2017] suggest that the mid-August to late September time period will not yield sufficient data to monitor the Peace River Goldeye and Walleye populations (i.e., if less than 20 Goldeye or Walleye are captured during either study year), an additional field program will be implemented beginning in [2018] that focuses on these species. This contingent assessment will consist of boat electroshocking in the spring (i.e., mid-May to early June) near the confluences of major Peace River tributaries in Sections 7 and 8 (Mainstream 2012) as data indicate high Goldeye and Walleye catch-rates surrounding most tributary confluences in these sections during the spring season (Mainstream 2013a).

During all sessions and sections combined, 237 Walleye were captured in 2016 and 389 Walleye were captured in 2017; however, in 2016 and 2017, only 8 and 3 Goldeye, respectively, were captured. Due to the low numbers of Goldeye encountered, the contingent assessment was implemented in 2018.

1.4 Study Area and Study Period

The study area for the Indexing Survey includes an approximately 205 km section of the Peace River from near the outlet of PCD (river kilometre [River Km] 25 as measured downstream from WAC Bennett Dam) downstream to the Many Islands area in Alberta (River Km 230; Figure 1). The spatial extent of the program is consistent with the spatial boundaries for the effects assessment in the EIS, which was guided by physical modelling and fisheries studies.

The mainstem of the Peace River between PCD and the Many Islands area in Alberta was delineated into various sections (Table 2) using information provided by Mainstream (2012). The upstream extent of Section 5 was moved approximately 5 km downstream relative to Mainstream's classification to more closely align with the location of the Project, as described below. The most downstream approximately 2 km of the Pine River was included in the study area and sampled as part of Section 6. The most downstream approximately 0.5 km of the Beatton and Kiskatinaw rivers were included in the study area and sampled as part of Section 7. A summary of historical datasets by section, year, study period, and effort (number of days of sampling) is provided in Appendix B, Table B1.

Table 2: Location and distance from WAC Bennett Dam of Peace River sample sections as delineated by Mainstream (2012) with the exception of Section 5.

Section Number	Location	River Kilometre[a]		Number of Sites Sampled in 2018[c]
		Upstream	Downstream	
1a	Peace River Canyon area	20.4	25.0	0
1	Downstream end of Peace River Canyon to the Lynx Creek confluence area	25.0	34.0	15
2	Lynx Creek confluence area downstream to the Halfway River confluence area	34.0	65.8	0
3	Halfway River confluence area downstream to the Cache Creek confluence area	65.8	82.1	15
4	Cache Creek Confluence area downstream to the Moberly River confluence area	82.1	105.0	0
5[b]	Moberly River confluence area downstream to near the Canadian National Railway bridge	105.0	117.7	15
6	Pine River confluence area downstream to the Six Mile Creek confluence area	121.5	134.0	18
7	Beatton River confluence area downstream to the Kiskatinaw River confluence area	140.0	158.0	19
8	Pouce Coupe River confluence area downstream to the Clear River confluence area	174.0	187.7	0
9	Dunvegan West Wildland Provincial Park boundary downstream to Many Islands Park	217.5	231.0	16

[a] River Km values as measured from the base of WAC Bennett Dam (River Km 0.0).
[b] The upstream delineation of Section 5 was moved approximately 5 km downstream to more closely align with the location of the Project.
[c] Includes only fall sampling (27 August to 10 October) not the contingent assessment for Walleye and Goldeye in June and July.

As detailed in the FAHMFP, only Sections 1, 3, 5, 6, 7, and 9 (Appendix A, Figures A1 to A6, Table A1) were selected for long-term monitoring under the Indexing Survey. Sections 1 and 3 are situated upstream of the Project and are scheduled to be sampled during the current program until the reservoir filling stage of the Project's development in 2023. These sections will be sampled to monitor potential effects of construction (i.e., creation of the headpond and river diversion) on the Peace River fish community. Sections 5, 6, 7, and 9 are scheduled to be sampled annually during the current program until 2053.

Similar to study years 2015 to 2017, Sections 1a, 2, 4, and 8 were excluded from the 2018 Indexing Survey for several reasons, including the following: the limited amount of historical data available for these sections, the short lineal length of river they represent (Section 1a only), low historical catch rates (e.g., Mainstream 2010, 2011, 2013), and the similarity of their habitats relative to adjacent sections. Small portions of Section 8 near the Clear River and Pouce Coupe River confluences were sampled as part of the Goldeye and Walleye Survey (Section 1.4.1).

During most historical study years, the same sites were sampled within each section. Sites sampled in 2018 were identical to sites sampled in 2017 (Golder and Gazey 2018) with the exception of one site in Section 7. Site 07KIS01 was established and sampled during baseline studies (Mainstream 2010, 2011, 2013) and is situated within the boundaries of the Kiskatinaw River Protected Area. Under the *Park Act*, a Park Use permit (PUP) is required from BC Parks for research activities that take place within parks and protected areas. BC Hydro did not receive a PUP for the Kiskatinaw River Protected Area until 15 July 2018. As such, Site 07KIS01 was not sampled prior to the 2018 study year. The Kiskatinaw River is a known feeding area for Walleye and Goldeye (Mainstream 2010, 2011, 2013).

For the Indexing Survey, 98 sites were sampled within the six sections in 2018 (Appendix A, Figures A1 to A6). The length of sites varied from 220 to 1900 m and consisted of the nearshore area along a bank of the river. The two sites in the Pine River were 1000 and 1500 m in length, the two sites in the Beatton River were 430 and 600 m in length, and the one site in the Kiskatinaw River was 1240 m in length. Site descriptions and UTM locations for all 98 sites are included in Appendix A, Table A1. A sample is defined as a single pass through a site while boat electroshocking (see Section 2.1.4). Field crews sampled each site five times (i.e., five sessions) over the study period (Table 3). A sixth session was scheduled for 2018 but was cancelled due to permit conditions when mainstem water temperatures declined below 5°C (Permit Number FJ18-289670 Condition Number 12. “No electrofishing is to take place in waters below five degrees C.”).

Each sample session took between 6 and 12 days to complete. Each section within each session was sampled over 1 to 4 days (Table 3).

Table 3: Summary of boat electroshocking sample sessions conducted in the Peace River, 2018.

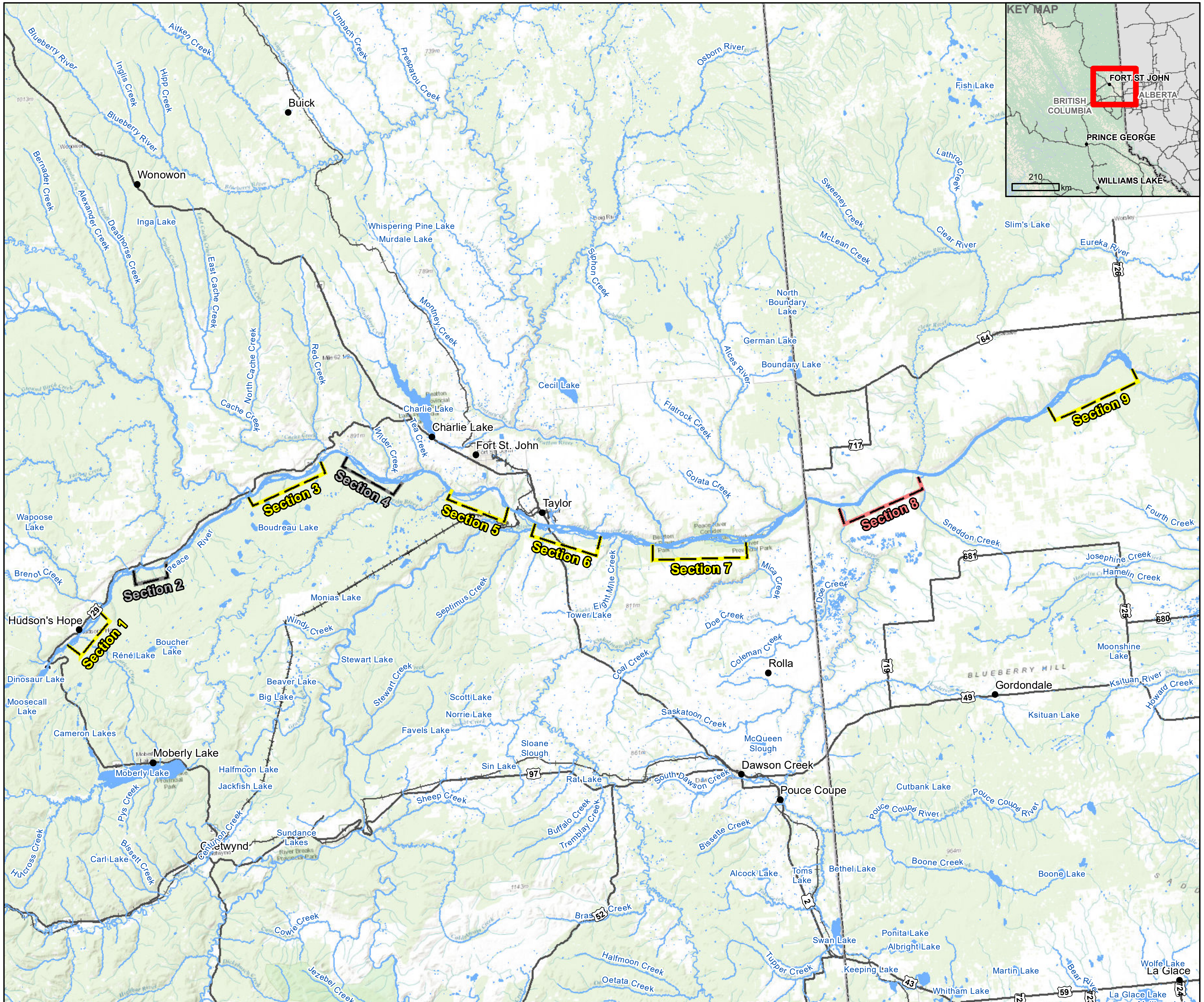
Session	Start Date	End Date	Section					
			1	3	5	6	7	9
1	27 Aug	7 Sep	27-28 Aug	28–31 Aug	30 Aug, 5-7 Sep	28–30 Aug	3-4 Sep	1-2 Sep
2	6 Sep	18 Sep	8-10 Sep	10-13 Sep	13-14 Sep	6-7, 9-10 Sep	10-12 Sep	17-18 Sep
3	15 Sep	23 Sep	19-20 Sep	20-22 Sep	20-22 Sep	15, 17-18 Sep	18-19, 21 Sep	23 Sep
4	24 Sep	29 Sep	24-25 Sep	25-27 Sep	27-28 Sep	24-26 Sep	26, 28-29 Sep	28-29 Sep
5	30 Sep	10 Oct	30 Sep, 2 Oct	30 Sep, 1-2 Oct	9-10 Oct	1, 3 Oct	3-4, 9 Oct	8 Oct

1.4.1 Goldeye and Walleye Survey

Two sessions were conducted as part of the contingent Goldeye and Walleye Survey. Session 1 was conducted on 15 and 16 June and Session 2 was conducted on 17 and 19 July (Table 4). This survey was limited to the confluence areas of major tributaries in Sections 7 and 8, including Six Mile Creek, Eight Mile Creek, the Beatton River (split into two sites), the portion of the Kiskatinaw River confluence outside the Kiskatinaw River Protected Area (see Section 1.4), the Alces River, the Pouce Coupe River, and the Clear River (Appendix A, Figures A7 to A9; Table A2). Sites at the Alces, Beatton, and Kiskatinaw River confluences were surveyed during both sessions. Sites at the Six Mile Creek and Eight Mile Creek confluences were only sampled during the first session. Due to low catch rates recorded during the first session and low water levels and poor site conditions at the time of the second session, these two sites were not sampled during the second session. Sites at the Pouce Coupe and Clear River confluences were only sampled during the second session. An Alberta Research License was not available at the time of the first session.

Table 4: Summary of boat electroshocking sample sessions conducted in the Peace River as part of the contingent Goldeye and Walleye Survey, 2018.

Session	Tributary						
	Section 7				Section 8		
	Six Mile Creek	Eight Mile Creek	Beatton River	Kiskatinaw River	Alces River	Pouce Coupe River	Clear River
1	16 June	16 June	15 June	15 June	15 June	-	-
2	-	-	17 July	17 July	17 July	19 July	19 July



LEGEND

- ● PLACE NAME
- DAM SECTION
- PROVINCIAL BOUNDARY
- WATERCOURSE
- WATERBODY
- RAILWAY
- ROAD

SAMPLING SECTIONS

- 1; 3; 5; 6; 7; 9
- 2; 4
- 8

0 10 20

1:625,000 METRES

REFERENCES
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CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
OVERVIEW OF THE PEACE RIVER LARGE FISH INDEXING SURVEY (MON-2, TASK 2A) STUDY AREA, 2018

CONSULTANT

GOLDER

YYYY-MM-DD	2020-05-12
DESIGNED	DF
PREPARED	CD
REVIEWED	DF
APPROVED	SR

PROJECT NO.	PHASE	REV.	FIGURE
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2.0 METHODS

2.1 Data Collection

2.1.1 Discharge

Hourly and five-minute discharge data were obtained from several different Water Survey of Canada[5] gauging stations. Data from Station 07EF001 (Peace River at Hudson Hope) were used to represent discharge in Section 1. Data from Station 07EF001 were combined with data from Station 07FA006 (Halfway River Near Farrell Creek) to represent discharge in Section 3. Data from Station 07FA004 (Peace River Above Pine River) were used to represent discharge in Section 5. Data from Station 07FD002 (Peace River Near Taylor) were used to represent discharge in Section 6. Data from Station 07FD010 (Peace River Above Alces River) were used to represent discharge in Section 7. Accurate discharge data for Section 9 were not available due to the locations of the nearest Peace River gauging stations relative to the inflow points of several large unmonitored tributaries.

2.1.2 Water Temperature

Hourly water temperatures for 2018 for the Peace River were obtained from the Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9) using Onset Tidbit™ temperature data loggers (Model #UTBI-001; accuracy ± 0.2°C). In this report, water temperature data from 2008 to 2018 from three different Peace River stations were used: Section 1 downstream of PCD (station pcnDN1); Section 3 downstream of the Halfway River's confluence with the Peace River (station halfDN2), and Section 5 downstream of the Moberly River's confluence with the Peace River (station mobDN1). Water temperature data were summarized to provide daily average temperatures. Spot measurements of water temperature were obtained using a handheld Oakton ECTestr 11 meter (resolution 0.1°C; accuracy ± 0.5°C) at all sample sites at the time of sampling and recorded in the Peace River Large Fish Indexing database.

2.1.3 Habitat Conditions

Habitat variables recorded at each site (Table 5) included variables recorded during previous study years (Golder and Gazey 2015, 2016, 2017, 2018) and variables recorded as part of other, similar BC Hydro programs on the Columbia River (i.e., CLBMON-16 [e.g., Golder et al. 2018a] and CLBMON-45 [e.g., Golder et al. 2018b]). These data were collected to provide a means of detecting changes in habitat availability or suitability in sample sites over time. Collected data were not intended to quantify habitat availability or imply habitat preferences.

The type and amount of instream cover for fish were qualitatively estimated at all sites. Water velocities were visually estimated and categorized at each site as low (less than 0.5 m/s), medium (0.5 to 1.0 m/s), or high (greater than 1.0 m/s). Water clarity was visually estimated and categorized at each site as low (less than 1.0 m depth), medium (1.0 to 3.0 m depth), or high (greater than 3.0 m depth). Where water depths were sufficient, water clarity was also estimated using a "Secchi Bar" that was manufactured based on the description provided by Mainstream and Gazey (2014). Mean and maximum sample depths were estimated by the boat operator based on the boat's sonar depth display.

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[5] Available for download at https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html.

Table 5: Habitat variables and boat electroshocker settings recorded at each site during each sample session during the Peace River Large Fish Indexing Survey, 2018.

Variable	Description
Date	The date the site was sampled
Time	The time the site was sampled
Estimated Flow Category	A categorical ranking of PCD discharge (high; low; transitional) at the time of sampling
Air Temp	Air temperature at the time of sampling (to the nearest 1°C)
Water Temp	Water temperature at the time of sampling (to the nearest 0.1°C)
Conductivity	Water conductivity at the time of sampling (to the nearest 10 µS/cm)
Secchi Bar Depth	The Secchi Bar depth recorded at the time of sampling (to the nearest 0.1 m)
Cloud Cover	A categorical ranking of cloud cover (Clear = 0-10% cloud cover; Partly Cloudy = 10-50% cloud cover; Mostly Cloudy = 50-90% cloud cover; Overcast = 90-100% cloud cover)
Weather	A general description of the weather at the time of sampling (e.g., comments regarding wind, rain, smoke, or fog)
Water Surface Visibility	A categorical ranking of water surface visibility (low = waves; medium = small ripples; high = flat surface)
Boat Model	The model of boat used during sampling
Range	The range of voltage used during sampling (high or low)
Percent	The estimated duty cycle (as a percent) used during sampling
Amperes	The average amperes used during sampling
Mode	The mode (AC or DC) and frequency (in Hz) of current used during sampling
Length Sampled	The length of shoreline sampled (to the nearest 1 m)
Time Sampled	The duration of electroshocker operation (to the nearest 1 second)
Netter Skill	A categorical ranking of each netter's skill level (1 = few misses; 2 = misses common for difficult fish; 3 = misses are common for difficult and easy fish; 4 = most fish are missed)
Observer Skill	A categorical ranking of each observer's skill level (1 = few misses; 2 = misses common for difficult fish; 3 = misses are common for difficult and easy fish; 4 = most fish are missed)
Mean Depth	The mean water depth sampled (to the nearest 0.1 m)
Maximum Depth	The maximum water depth sampled (to the nearest 0.1 m)
Effectiveness	A categorical ranking of sampling effectiveness (1 = good; 2 = moderately good; 3 = moderately poor; 4 = poor)
Water Clarity	A categorical ranking of water clarity (High = greater than 3.0 m visibility; Medium = 1.0 to 3.0 m visibility; Low = less than 1 m visibility)
Instream Velocity	A categorical ranking of water velocity (High = greater than 1.0 m/s; Medium = 0.5 to 1.0 m/s; Low = less than 0.5 m/s)
Instream Cover	The type (i.e., Interstices; Woody Debris; Cutbank; Turbulence; Flooded Terrestrial Vegetation; Aquatic Vegetation; Shallow Water; Deep Water) and amount (as a percent) of available instream cover
Crew	The field crew that conducted the sample
Sample Comments	Any additional comments regarding the sample

2.1.4 Fish Capture

Boat electroshocking was conducted at all sites along the channel margin, typically within a range of 0.5 to 2.0 m water depth. Each crew used Smith-Root high-output Generator Powered Pulsator (GPP 5.0) electroshockers (Smith-Root, Vancouver, WA, USA) operated from outboard jet-drive riverboats. The electroshocking procedure consisted of manoeuvring the boat downstream along the shoreline of each sample site. Field crews sampled large eddies (i.e., eddies longer than approximately two boat lengths) while travelling with the direction of water flow. Two crew members, positioned on netting platforms at the bow of each boat, netted stunned fish, while the third individual on each crew operated the boat and electroshocking unit. Netters attempted to capture all fish that were stunned by the electrical field. Captured fish were immediately placed into 175 L onboard live-wells equipped with freshwater pumps. Fish were netted one at a time and placed into the live-wells. Having more than one fish in a net at one time was avoided as much as possible. Fish that were positively identified but avoided capture were enumerated and recorded as "observed". Netters attempted to collect a random sample of fish species and sizes; however, netters focused their effort on less common fish species (e.g., Arctic Grayling) or life stages (e.g., immature Bull Trout) when they were observed. This approach was employed during previous study years (Mainstream and Gazey 2014; Golder and Gazey 2015–2018) and may cause an overestimate of the catch of these species and life stages; however, by maintaining this approach, the bias remains constant among study years.

Both the time sampled (seconds of electroshocker operation) and length of shoreline sampled (metres; Table 6) were recorded for each sample. The start and end location of each site was established prior to the start of the field program; however, if a complete site could not be sampled, the difference in distance between what was sampled and the established site length was estimated and recorded on the site form. This revised site length was used for that session in subsequent analyses. Reasons for field crews not being able to sample an entire site's length included public on shore, beavers swimming in a site, and shallow water depths preventing boat access.

Table 6: Number and lengths of sites sampled by boat electroshocking during the Peace River Large Fish Indexing Survey, 2018.[a]

Section	Number of Sites	Site Length (m)		
		Minimum	Average	Maximum
1	15	490	826	1200
3	15	950	1334	1900
5	15	120	861	1280
6	18	300	973	1500
7	19	220	906	1400
9	16	260	1001	1200

[a] Sites established and surveyed as part of the Goldeye and Walleye survey were excluded from this table. These sites ranged between 300 and 1240 m in length (average length = 737 m).

Each boat electroshocking unit was operated at a frequency of 30 Hz with pulsed direct current. Amperage was adjusted as needed to achieve the desired effect on fishes, which was the minimum level of immobilization that allowed efficient capture and did not cause undesired outcomes such as immediate tetany or visible hemorrhaging (Martinez and Kolz 2009). An amperage of 3.0 A typically produced the desired effect on fishes; however, amperage was set as low at 1.3 A and as high as 5.0 A at some sites based on local water conditions and the electroshocking unit employed.

The electroshocker settings used in 2014 to 2018 were different when compared to the settings employed during previous study years (Mainstream and Gazey 2004–2014). Prior to 2014 (i.e., the 2002–2013 epoch), higher frequencies and higher amperages were used. The settings used from 2014 to 2018 (i.e., the 2014–2018 epoch) resulted in less electroshocking-induced injuries on large-bodied Rainbow Trout in the Columbia River (Golder 2004, 2005) and align with recommendations by Snyder (2003) for pulsed direct current and low frequencies for adult salmonids. Reducing the impacts of sampling will help ensure the long-term sustainability of the monitoring program.

Although electrical output varies with water conductivity, water depth, and water temperature, field crews attempted to maintain electrical output at similar levels for all sites over all sessions.

2.1.5 Ageing

Scale samples were collected from all captured Arctic Grayling, Goldeye, Kokanee (*Oncorhynchus nerka*), Mountain Whitefish (with the exceptions detailed in Section 2.1.8), and Rainbow Trout. Fin ray samples were collected from all initially captured Bull Trout, Goldeye, Lake Trout (*Salvelinus namaycush*), Northern Pike (*Esox lucius*), and Walleye. Otoliths were collected opportunistically from fish that succumbed to sampling. Ageing structures (i.e., scales, fin rays, and/or otoliths) were collected in accordance with the methods outlined in Mackay et al. (1990). All ageing structure samples were stored in appropriately labelled coin envelopes and archived for long-term storage for BC Hydro.

Scales were assigned an age by counting the number of growth annuli present on the scale following procedures outlined by Mackay et al. (1990). Scales were temporarily mounted between two slides and examined using a microscope. Where possible, several scales were examined, and the highest quality scale was photographed using a 3.1-megapixel digital macro camera (Leica EC3, Wetzlar, Germany) and saved as a JPEG-type picture file. All scale images were linked to the Peace River Large Fish Indexing Database and provided to BC Hydro (referred to as Attachment A). All scales were examined independently by two experienced individuals, and ages were assigned. If the assigned ages differed between the two examiners, the sample was re-examined by a third examiner. If there was agreement between two of three examiners, then the consensus age was assigned to the fish. If there was not agreement between two of three examiners, then the fish was not assigned an age.

To continually increase the accuracy of ages assigned using fin rays, ageing methods are modified relative to previous study years based on lessons learned and literature reviews. These changes are described, where needed, in the following sections. Fin rays were coated in epoxy and allowed to dry. Once dried, a rotary sectioning saw with a diamond blade (Buehler IsoMet Low Speed Saw; Lake Bluff, Illinois) was used to create multiple cross-sections of each fin ray sample. The rotary sectioning saw allowed the thickness of cross-sections to be set to a standard width of 0.5 mm. This width allowed for maximum reflected or transmitted light to pass through the sections, making annuli more apparent when observed under a microscope (Watkins and Spencer 2009). In addition, the use of the rotary sectioning saw resulted in cross-sections with more polished surfaces (which reduced sanding and preparation time) compared to the jeweler's saw used prior to 2017 (Gesswein Canada; Toronto, Canada). The cross-sections were permanently mounted on a microscope slide using a clear coat nail polish and examined using a Leica S6D imaging microscope (Leica Microsystems Inc.; Concord, Canada). Where possible, several fin ray cross-sections were examined, and the cross-section with the most visible annuli was photographed with the microscope's integrated 3.1-megapixel digital macro camera (Leica EC3, Wetzlar, Germany). All fin ray cross sections were imaged using the maximum zoom possible.

Fin rays (excluding Walleye) were examined independently by two experienced individuals, and ages were assigned. If the assigned ages differed between the two examiners, the sample was re-examined by a third examiner. If there was agreement between two of three examiners, then the consensus age was assigned to the fish. If there was not agreement between two of three examiners, then the fish was not assigned an age. Based on length-at-age data collected from age-0 to age-2 Bull Trout in the Halfway River watershed (e.g., Golder 2018), ages assigned through fin ray analysis as part of the current project were underaged by one year. This result is likely because the fin ray cannot be collected close enough to the fish's body wall to capture the first annulus on the fin ray (i.e., the annulus closest to the focus of the fin ray). As such, one year was added to all assigned Bull Trout ages. Ages assigned to Bull Trout during previous years of this study and results from corresponding analyses should be interpreted with caution as the above correction was not implemented before 2018. Further, ageing results from historical study years that are presented in 2018 may deviate from results presented in the corresponding historical reports.

Preliminary age results for Bull Trout in 2018 indicated a substantial growth check on most structures between the third and fourth annuli. This growth check likely corresponded with the fish's migration from its rearing tributary to the Peace River mainstem. This growth check was initially classified as an annulus. As a result, one year was subtracted from all ages assigned to fish older than age-3. Subtracting one year from ages assigned to older individuals resulted in length-at-age data from 2018 that more closely aligned with known growth data recorded from inter-year recaptured individuals. A preliminary review of ages assigned to Bull Trout between 2016 (Golder 2017) and 2017 (Golder 2018) noted a similar growth check on most structures that may have erroneously been classified as annuli.

Between 2015 and 2017, Walleye fin rays were aged using methods detailed by Mackay et al. (1990). However, Watkins and Spencer (2009) detailed methods for ageing Walleye fin rays that were shown to be more accurate than the methods detailed by Mackay et al. (1990) for northern Walleye populations. As such, the methods detailed by Watkins and Spencer (2009) were employed in 2018 and are briefly described below. For fin rays collected from Walleye, each fin ray photograph was imported into ImageJ software (www.imagej.net) equipped with the Fiji microscope measurement tool plugin. This software allows the user to take measurements on microscope images. Prior to examining cross-section images in ImageJ, a calibration slide with a known length (i.e., a 1 mm scale with 0.01 mm divisions) was measured to set the scale for future measurements. For each imaged cross-section, the pelvic fin ray radius (PFRR) was measured in µm and the distance was plotted and saved on the cross-section image. The PFRR is the distance from the focus of the ray (i.e., the center of fin ray) to the end of the largest lobe of the ray. This measurement was then used to determine the radius distance from the focus to the first annulus using the following formula from Watkins and Spencer (2009):

(1) $$Sc = (PFRR \times L_1) / Lc$$

where Sc is the distance from the focus to the first annulus (in µm), PFRR is the pelvic fin ray radius (in µm), L_1 is the average fork length of a fish at age 1 (in mm), and L_c is the fork length of the fish when caught (in mm). The value of 188 mm was used for L_1 for all walleye cross-section calculations based on results provided by

Golder and Gazey (2018). Once Sc was determined for each cross-section, the distance was measured out on the imaged cross-section in ImageJ. The Sc value was also plotted and saved on the cross-section image. The closest annulus visible to the measured Sc was considered the first annulus and the subsequent annuli moving outwards towards the end of the largest lobe of the fin ray were counted to determine age. All fin ray images with plotted PFRR and Sc were examined independently by two experienced individuals. If the assigned ages differed between the two examiners, the sample was re-examined by a third examiner. If there was agreement between two of three examiners, then the consensus age was assigned to the fish. If there was not agreement between two of three examiners, then the sample was rejected and the fish was not assigned an age.

While assigning ages, examiners were aware of the species of each sample but did not have other information about the fish, such as body size or capture history.

Ages were assigned to all Arctic Grayling, Bull Trout, Northern Pike, and Rainbow Trout that were captured, except in cases where ageing structures were too poor quality to assign an age. In total, 690 Mountain Whitefish scale samples and 109 Walleye fin rays were analyzed, which represented 5.6% of the total number of Mountain Whitefish captured and 30.1% of the total number of Walleye captured in 2018. Ageing structures from Mountain Whitefish and Walleye aged in 2018 were from randomly selected, initially captured individuals. All Mountain Whitefish scale samples selected for ageing were collected during Session 1 of 2018 (27 August to 7 September). After Session 1, scale samples were only collected from Mountain Whitefish that also received a PIT tag. As a result, including scale samples collected after Session 1 in age related analyses results in larger (i.e., taggable) fish being overrepresented in the sample.

2.1.6 Stomach Content Collection

Stomach content samples were collected during the Indexing Survey and will be analyzed by the Peace River Fish Food Organisms Monitoring Program (Mon-7). Results associated with stomach content samples are not discussed in this report; however, sample collection methods are described below.

Stomach contents were collected using gastric lavage (Bowen 1989; Brosse et al. 2002; Baldwin et al. 2003; Budy et al. 2007) from a variety of size classes of Arctic Grayling, Mountain Whitefish, and Rainbow Trout. All samples were collected upstream of the BC-Alberta border (i.e., no samples were collected from Section 9). Samples were collected throughout the five-week study period. In total, 129 samples were collected from 38 Arctic Grayling, 50 Mountain Whitefish, and 41 Rainbow Trout.

Stomach contents were collected by gastric lavage using an apparatus modified from that described by Light et al. (1983). The apparatus consisted of a pressurised sprayer and wand fitted with a tubing adapter soldered to the adjustable spray nozzle from the bottle. Intravenous tubing and small diameter feeding tubes, both supplied by a veterinary office, were selected to match the size of the mouth opening of the fish.

The sprayer reservoir was filled with river water and pressurised using the hand pump. The free end of the tubing was inserted into the fish's mouth and gently inserted down into the stomach. The fish was held, head down, over a 250 µm mesh sieve to capture discharge during lavage. The flow of water was then opened using the flow control lever on the spray handle. The small diameter of the tubing served to regulate the flow at a pressure that did not damage the internal organs of the fish. Each fish's stomach was flushed with river water for approximately 30 seconds until the water exiting the fish's mouth ran clear. The tubing was gently extracted from the stomach and mouth with the water still flowing to ensure that all stomach contents were flushed from the buccal cavity.

Sampled fish were returned to the river. The collected sample was washed from the sieve into a sample container using as little water as possible and the remainder of the container was filled with 70–80% ethanol. The sample container was labelled and recorded in the database. At the end of the field program, all samples were provided to BC Hydro.

2.1.7 Mercury and Stable Isotope Sample Collection

Fish tissue samples for methylmercury and stable isotopes were collected during the Indexing Survey and provided to BC Hydro's Long-term Methylmercury Monitoring Program. Stable Isotope Analysis (SIA) samples will also be analyzed under other components of Mon-2. In 2018, mercury and SIA samples were collected during the Indexing Survey. Results associated with the analysis of these samples are not discussed in this report; however, sample collection methods are described below.

Mercury and SIA samples were collected based on protocols detailed in Baker et al. (2004) and in consultation with Azimuth Consulting Ltd. (Randy Baker pers. comm.). Both mercury and SIA samples were collected from the same fish (i.e., samples were paired with separate vials for mercury and SIA samples). Samples were collected from Burbot (*n* = 9), Bull Trout (*n* = 67), Lake Trout (*n* = 1), Longnose Sucker (*n* = 88), Mountain Whitefish (*n* = 72), Northern Pike (*n* = 23), Rainbow Trout (*n* = 24), and Walleye (*n* = 49).

To collect mercury and SIA samples, fish were placed into a 40 L tub with an anesthetic mixture. The anesthetic mixture consisted of clove oil and rubbing alcohol mixed at a ratio of 1:10, which was mixed with the water in the anesthetic bath at a rate of 5 mL per 10 L of water. Once the fish was anaesthetized, a few scales were removed from the left side of the fish just beneath the dorsal fin. Where the scales were removed, a 6 mm biopsy punch (Integra® Miltex®, 33-36, York, PA) was used to extract two tissue plugs, which were temporarily placed on a small plastic board. A small drop of Vetbond™ tissue adhesive (3M Canada, London, ON) was injected into each biopsy wound and the fish was returned to the livewell to recover. After recovery, fish were returned to the river. The biopsy tissue plugs were held with clean forceps and a clean stainless-steel scalpel was used to cut the outer skin off of the muscle of each tissue plug. One tissue plug was transferred into a single 6 mL plastic HDPE vial that was pre-labelled for mercury analysis. The second tissue plug was transferred into a second 6 mL HDPE vial that was pre-labelled for SIA analysis. Vial numbers were recorded in the database. If the sizes of plugs differed, the larger of the two plugs was put into the mercury vial. If a fish did not survive the procedure, it was processed according to the lethal sampling procedures detailed below.

For deceased fish, a stainless-steel filleting knife was used to remove a small fillet sample of muscle (approximately 10 to 15 g) from the left side of the fish. Care was taken to minimize collecting any bone or skin with the sample. The tissue sample was placed into a 125 mL Whirl Pac and labelled for mercury analysis. A second 5 to 10 g piece of tissue was placed into a second Whirl Pac and labelled for SIA analysis. Duplicate samples were collected from select mortalities for QA/QC purposes.

Collected tissue samples were placed on ice and transferred to a freezer at the end of each day. At the end of the field program, all collected mercury and SIA samples were provided to BC Hydro.

2.1.8 Fish Processing

A site form was completed at the end of each sampled site. Site habitat conditions and the number of fish observed were recorded before the start of fish processing for life history data (Table 7). All captured fish were enumerated and identified to species, and their physical condition and general health were recorded (i.e., any abnormalities were noted). For each captured fish, the severity of deformities, erosion, lesions, and tumor (DELT) were recorded based on the external anomalies' categories provided in Ohio EPA (1996). Data collected for each fish in 2018 were consistent with previous study years (e.g., Golder and Gazey 2018).

Fish were measured for fork length (FL) or total length (TL; for Burbot only), to the nearest 1 mm and weighed to the nearest 1 g using an A&D Weighing™ (San Jose, CA, USA) digital scale (Model SK-5001WP; accuracy ±1 g). Data were entered directly into the Peace River Large Fish Indexing Database (provided to BC Hydro as Attachment A) using a laptop computer. All sampled fish were automatically assigned a unique identifying number by the database that provided a method of cataloguing associated ageing structures.

Table 7: Variables recorded for each fish captured during the Peace River Large Fish Indexing Survey, 2018.

Variable	Description
Species	The species of fish
Age-Class	A general size-class for the fish (e.g., YOY <120 mm FL, Immature <250 mm FL, and Adult ≥250 mm FL)
Length	The fork length of the fish to the nearest 1 mm (total lengths were recorded for Burbot)
Weight	The weight of the fish to the nearest 1 g
Sex and Maturity	The sex and maturity of the fish (determined where possible through external examination)
Ageing Method	The type of ageing structure collected if applicable (i.e., scale, fin ray, otolith)
Tag Colour/Type	The type (i.e., T-bar anchor or PIT tag) or colour (for T-bar anchor tags only) of tag applied or present at capture
Tag Number	The number of the applied tag or tag present at capture
Tag Scar	The presence of a scar from a previous tag application
Fin Clip	The presence of an adipose fin clip (only recorded if present without a tag)
Condition	The general condition of the fish (i.e., alive, dead, or unhealthy)
Preserve	Details regarding sample collection (if applicable)
Comments	Any additional comments regarding the fish

All Arctic Grayling, Bull Trout, Burbot, Goldeye, Rainbow Trout, and Walleye that were greater than 149 mm in length and all Lake Trout, Largescale Sucker, Longnose Sucker, Mountain Whitefish, Northern Pike, and White Sucker that were greater than 199 mm in length and in good condition following processing were marked with a half-duplex (HDX) PIT tag (ISO 11784/11785 compliant) (Oregon RFID, Portland, OR, USA). Tags were implanted within the left axial muscle below the dorsal fin origin and oriented parallel with the anteroposterior axis of the fish. All tags and tag applicators were immersed in an antiseptic (Super Germiphene™; Brantford, ON, Canada) and rinsed with distilled water prior to insertion. The size of PIT tag implanted was based on the length of the fish and was the same as other FAHMFP monitoring programs in the Peace River, such as the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c) (Golder 2018):

- Fish between 150 and 199 mm FL received 12 mm long PIT tags (12.0 mm x 2.12 mm HDX+).
- Fish between 200 and 299 mm FL received 23 mm long PIT tags (23.0 mm x 3.65 mm HDX+).
- Fish greater than 300 mm FL received 32 mm long HDX PIT tags (32.0 mm x 3.65 mm HDX+).

HDX PIT tags were applied from 2016 to 2018; full-duplex (FDX) PIT tags were applied prior to 2016. All HDX PIT tags that have been applied as part of this program are compatible with the PIT arrays installed in the Halfway River watershed as part of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b; Ramos-Espinoza et al. 2018, 2019). In 2018, all fish of the targeted species and size were implanted with an HDX tag, including recaptured fish that had previously been implanted with a FDX PIT tag. FDX and HDX tags are incompatible with each other (i.e., they do not interfere with each other); therefore, fish that are double-tagged with both tag types are readable by both the PIT arrays and by handheld PIT tag readers.

PIT tags were read using a Datamars DataTracer FDX/HDX handheld reader (Oregon RFID, Portland, OR, USA). When fish that had both HDX and FDX tags were scanned, the HDX tag would most often be detected because of its longer read-range, but occasionally only the previous FDX tag was detected. In either case, the fish could be linked to their previous encounter histories in the Peace River Large Fish Indexing Database.

As was done during previous study years, a simplified processing method was used for the more common species during Session 5 (Session 6 was not conducted during the 2018 field season; Section 1.4). During Session 5, fish that did not have a PIT tag at capture were assigned a size category based on fork length (i.e., less than 150 mm, 150–199 mm, 200–299 mm, greater than or equal to 300 mm) and were released without recording lengths or weights, collecting scale samples, or implanting PIT tags. This allowed field crews to conduct the session over a shorter time period by reducing fish handling and fish processing time. During Session 5, this simplified fish processing procedure was used for Mountain Whitefish and all sucker species (Largescale Sucker, Longnose Sucker, and White Sucker). All other fish species were sampled using the full processing procedure.

To reduce the possibility of capturing the same fish at multiple sites in a single session, fish were released near the middle of the site where they were captured.

2.2 Data Analyses

2.2.1 Data Compilation and Validation

Data collected under the Indexing Survey were stored in the Peace River Large Fish Indexing Database, which contains historical data collected under the Large River Fish Indexing Program (P&E 2002; P&E and Gazey 2003; Mainstream and Gazey 2004–2008), the Peace River Fish Index (Mainstream and Gazey 2009–2014; Golder and Gazey 2015), and the Peace River Large Fish Indexing Survey (Golder and Gazey 2016–2018). The database is designed to allow most data to be entered directly by the crew while out in the field using Microsoft® Access 2010 software and contains several integrated features to ensure that data are entered correctly, consistently, and completely.

Various input validation rules programmed into the database checked each entry to verify that the data met specific criteria for that particular field. For example, all species codes were automatically checked upon entry against a list of accepted species codes that were saved as a reference table in the database; this feature forced the user to enter the correct species code for each species (e.g., Rainbow Trout had to be entered as “RB”; the database would not accept “RT”). Combo boxes were used to restrict data entry to a limited list of choices, which kept data consistent and decreased data entry time. For example, a combo box limited the choices for Cloud Cover to Clear, Partly Cloudy, Mostly Cloudy, or Overcast. The user had to select one of these choices, which decreased data entry time (e.g., by eliminating the need to type out “Partly Cloudy”) and ensured consistency in the data (e.g., by forcing the user to select “Partly Cloudy” instead of typing “Part Cloud” or “P.C.”). The database contained input masks that required the user to enter data in a pre-determined manner. For example, an input mask required the user to enter Sample Time in 24-hour short-time format (i.e., HH:mm:ss). Event procedures ensured data conformed to underlying data in the database. For example, after the user entered life history information for a particular fish, the database automatically calculated the body condition of that fish. If the body condition was outside a previously determined range for that species (based on the measurements of other fish in the database), a message box appeared on the screen informing the user of a possible data entry error. This allowed the user to double-check the species, length, and weight of the fish before it was released. The database also allowed a direct connection between the handheld PIT tag reader (Datamars DataTracer FDX/HDX reader) and the data entry form, which eliminated transcription errors associated with manually recording the 15-digit PIT tag numbers.

The database also included tools that allowed field crews to quickly query historical encounters of tagged fish while the fish was in-hand. This allowed the crew to determine if ageing structures, such as fin rays, had been previously collected from a fish or comment on the status of previously noted conditions (e.g., whether a damaged fin had properly healed). Quality Assurance/Quality Control (QA/QC) was conducted on the database before analyses. QA/QC included checks of capture codes and tag numbers for consistency and accuracy, checks of data ranges, visual inspection of plots, and removal of age-length and length-weight outliers, where applicable.

Various metrics were used to provide background information and descriptive summaries of fish populations. Although these summaries are important, not all of them are presented or specifically discussed in detail in this report. However, these metrics are provided in the appendices for reference purposes and are referred to when necessary to support or discount results of various analyses. Metrics presented in the appendices include the following:

- discharge and water temperature summaries (Appendix C, Figures C1 to C5)
- bank habitat classification types and site lengths by habitat type when applicable (Appendix D, Tables D1 and D2)
- habitat variables recorded at each sample site (Appendix D, Table D3)
- percent composition of the catch by study year by section (Appendix E, Tables E1 and E2)
- catch rates for all sportfish (Appendix E, Table E3) and non-sportfish (Appendix E, Table E4), 2018
- summary of captured and recaptured fish by species and session, 2018 (Appendix E, Table E5)
- length-frequency histograms, age-frequency histograms, length-weight regressions, body condition estimates, and catch curve estimates of mortality by year or section for Arctic Grayling, Bull Trout, Largescale Sucker, Longnose Sucker, Mountain Whitefish, Northern Pike, Rainbow Trout, Walleye, and White Sucker where applicable, 2002 to 2018 (Appendix F, Figures F1 to F46)

For all figures in this report, sites are ordered by increasing distance from WAC Bennett Dam (River Km 0.0) based on the upstream boundary of each site.

As detailed in Section 1.4 and Appendix B, Table B1, not all sections were sampled during all study years. For figures and statistics related to fish life history (i.e., length, weight, and age), analyses were supplemented, when feasible, with data collected in Sections 6, 7, and 9 under the Peace River Fish Inventory in 2009, 2010, and

2011 (Mainstream 2010, 2011, 2013). The Peace River Fish Inventory employed similar capture techniques during similar times of the year. Because effort differed between the Peace River Fish Inventory and the current program, these data were not included in figures or statistics related to effort or fish counts.

2.2.2 Population Abundance Estimates

A mark-recapture program was conducted on Arctic Grayling, Bull Trout, Largescale Sucker, Longnose Sucker, Mountain Whitefish, Northern Pike, Rainbow Trout, Walleye, and White Sucker during the 2018 study period. Although Northern Pike were tagged with the intention of including them in the mark-recapture program, there were insufficient tagged fish captured to generate abundance estimates for this species.

Similar to 2015–2017, PIT tags were applied to all Mountain Whitefish greater than or equal to 200 mm FL during Sessions 1 through 4. Prior to 2015 (i.e., prior to the Peace River Large Fish Indexing Survey), only fish greater than or equal to 250 mm FL were tagged with either T-bar anchor or PIT tags, depending on the study year. The inclusion of fish between 200 and 249 mm FL since 2015 has increased the number of tags available for recapture, thereby increasing the precision of future growth, survival, and abundance estimates. Furthermore, Mountain Whitefish in the 200 to 249 mm FL size range are large enough to fully recruit to the electroshocking gear while still being young enough to estimate ages based on fork lengths. The majority of these fish are age-2. Including age-2 fish capture data in future mark-recapture studies could allow the generation of survival and abundance estimates for specific brood years (i.e., the fall during which spawning occurred), which could be used to test for correlations with environmental conditions during early life history and help test the management hypotheses. To maintain consistency with analyses conducted during previous study years, Mountain Whitefish tagged between 200 to 249 mm FL were excluded from the 2018 population abundance models.

In the text that follows, frequent reference is made to the terms “capture probability” and “catchability”. Capture probability is defined as the probability of detecting (i.e., encountering) an individual fish given that it is alive during a sampling event (Otis et al. 1978). For the current study, a sampling event is a sampling day or session within a section (one to four sampling days; Table 3), dependent on the estimation model used. Catchability is defined as the proportion of the population that is captured by a defined unit of effort (Ricker 1975). Under these classical definitions, the two terms are not synonymous. For example, if the number of fish sampled was directly related to the level of effort employed, then sessions with different levels of effort on the same population may have exhibited similar catchabilities but different capture probabilities.

During Sessions 1 through 4, PIT tags were applied to all captured fish of appropriate size and species. In the final session (i.e., Session 5), simplified fish processing procedures were implemented, and PIT tags were not applied to untagged Mountain Whitefish, allowing additional capture effort and recapture of previously tagged fish, which improved the statistical confidence of the estimates. Overall, the program was successful in terms of the number of tags applied and recaptured for Mountain Whitefish but was less successful for all other species including Arctic Grayling, Bull Trout, Rainbow Trout, and sucker species. Therefore, the methods described (diagnostics, population estimation, catchability, and sampling power analyses) herein were comprehensively applied to Mountain Whitefish. Due to sparse data, only the closed population estimation methodologies without empirical diagnostics for model selection were applied for Arctic Grayling, Bull Trout, Rainbow Trout, Walleye, and the three sucker species.

2.2.2.1 Factors that Impact Population Abundance Estimates

The tagging program has some characteristics that must be considered with reference to the population estimation methodology and limitations of the subsequent estimates:

- Capture probability was likely heterogeneous (i.e., some fish were more likely to be caught than others) because of spatial distribution, reactions of the fish to the boat electroshocker, and netter experience (e.g., larger fish are generally easier to capture than small fish).
- Some fish may have been more or less prone to capture by the boat electroshocker because of their size (i.e., size selectivity). The larger the voltage gradient that the fish experiences across its body, the more susceptible it is to the electrical field. Therefore, a larger fish, with a corresponding larger voltage gradient, is more susceptible to capture than a smaller fish that experiences a relatively smaller voltage gradient.
- Tags were generally applied to fish greater than 250 mm; thus, estimates are only applicable to that portion of the population. For Arctic Grayling, individuals larger than 200 mm were tagged and estimates are for Arctic Grayling larger than 200 mm.
- Fish grew over the duration of the study such that fish recruited into the portion of the population greater than 250 mm while the study was being conducted. However, given the short duration of the study period (45 days), appreciable growth was not expected.
- Tagged fish could move to sections where capture probability may have been different because of possible differences in sample size (sampling effort), catchability, number of available tags for recapture, or the population size.
- Capture probability within a section could vary over time because of differences in catchability possibly generated by physical-biological interactions (e.g., varying water depths, water clarity).

To investigate these characteristics, capture behaviours of tagged Mountain Whitefish were examined. Length histograms of the fish tagged and recaptured were examined to reveal selectivity patterns generated by the presence of a tag. These patterns were further evaluated by comparing cumulative length distributions at release and recapture. Growth over the study period was examined by regressing the time at large (days) of a recaptured fish on the increment of growth (i.e., difference in length measured at release and recapture).

The movements of fish between sections during the 2018 study period were assessed through weighting the number of recaptured fish by sampling intensity. The distance travelled upstream or downstream between a fish's initial release and recapture was determined using the upstream River Km value for each of the 99 sample sites.

2.2.2.2 Empirical Model Selection

Apparent survival of Mountain Whitefish over the study period, which represents fish that survive and have not left the study area, was estimated with the Cormack-Jolly-Seber (CJS) model using MARK software (White 2006), consistent with previous study years. Unlike other open population models (e.g., Jolly-Seber), the CJS model allows for time-varying capture probability. Only tagged fish were used because their encounter histories were known. The encounter history for an individual fish was assigned to the section of first encounter regardless of the location of subsequent encounters. The CJS analysis was applied to several aggregations of survival and capture probabilities over time and sections. The best fitting model for survival is reported here and applied to the population estimation models.

The large number of recaptured Mountain Whitefish also allowed for an empirical evaluation of the change in catchability over the study period. Two models (constant versus time-varying catchability) were compared using the delta Akaike's information criterion (ΔAIC) adjusted to account for the number of parameters following Burnham and Anderson (2002). If the catchability is held constant, then the probability that an encountered fish is marked at sequence *t* (p_t) depends only on the proportion of the population that is marked, as follows:

(1) $$p_t = \frac{M_t}{M_t + U_t} = \frac{M_t}{N}$$

where M_t is the cumulative tags applied that are available for recapture at time *t*, U_t is the number of untagged fish in the population at time *t*, and *N* is the population size that is to be estimated. The number of cumulative tags available at time *t* was adjusted (estimated) for mortality following procedures detailed below (see Equation 6). Note that if catchability varies over time, but equally for tagged and untagged fish, then p_t does not change and still reflects the proportion of the population that is tagged. This is the formulation that is used in the Bayes sequential model presented below. If the catchability of tagged and untagged fish varies over the study period, then the probability that an encountered fish is tagged can be characterized as follows:

(2) $$p_t = \frac{M_t}{N \exp(b_t)} \text{ with the constraint that } \sum_t b_t = 0$$

where b_t is the logarithmic population deviation and will provide a better fit to the data. In the remainder of this document, all reference to "time-varying catchability" is as characterized by Equation 2. Equation 2 is also consistent with a change in population size (population change and time-varying catchability are confounded). The negative log-likelihoods (*L*) were computed for these models with an assumed binomial sampling distribution as follows:

(3) $$L \propto \sum_t \left[R_t \log_e(p_t) + (C_t - R_t) \log_e(1 - p_t) \right]$$

where R_t is the number of recovered tags in the sample of C_t fish taken at time *t*. Parameter estimates, standard deviations, and AIC values were calculated through the minimization of Equation 3 using AD Model Builder (Fournier et al. 2012) to implement the model. For these estimates, each sampling day after the first session was used as a sequence.

2.2.2.3 Bayes Sequential Model for a Closed Population

A Bayesian mark-recapture model for closed populations (Gazey and Staley 1986; Gazey 1994) was applied to the mark-recapture data. The Bayesian model was adapted to accommodate adjustments for apparent mortality, movement between sections, stratified capture probabilities, and sparse recaptures characteristic of Arctic Grayling and Bull Trout. The major assumptions of the model were as follows:

1) The population size in the study area did not change and was not subject to apparent mortality over the study period. Any apparent mortality was assumed to be constant over the study area and the study period and was specified (instantaneous daily mortality). Fish could move within the study area (i.e., to different sections); however, the movement was fully determined by the history of recaptured fish.
2) All fish in a stratum (day and section), whether tagged or untagged, had the same probability of being captured.
3) Fish did not lose their tags during the study period.
4) All tags were reported when encountered. If marks were not always detected, then a missed-tag detection rate could be specified in the model.

The following data were used by the Bayes sequential model to generate population abundance estimates:

- m_{ti} the number of tags applied in 2018, or tagged during a previous study year and encountered in 2018 during day t in section i
- c_{ti} the number of fish examined for tags during day t in section i
- r_{ti} the number of recaptured fish in the sample c_{ti}
- d_{ti} the number of fish removed or killed at recapture r_{ti}

A fish had to be greater than or equal to 250 mm FL (or 200 mm FL for Arctic Grayling) to be a member of m_{ti}. A fish was counted as examined (a member of c_{ti}) only if the fish was examined for the presence of a tag and met the length requirements outlined above. Untagged Mountain Whitefish captured in Session 5 were assigned size bins of “<150 mm FL”, “150 – 199 mm FL”, “200- 299 mm FL”, and “≥ 300 mm FL” as detailed in Section 2.1.8. To compute the number of fish ≥ 250 mm FL in each section, the “200 – 299 mm FL” bin was prorated based on the proportion of observed 250–299 mm FL fish captured in Sessions 1 to 4 in the associated section. A fish was counted as a recapture (r_{ti}) only if it was a member of the sample (c_{ti}), was a member of tags applied (m_{ti}), and was recaptured in a session later than its release session. A fish was counted as removed (d_{ti}) if it was not returned to the river, its tag was removed, or if the fish was deemed to be unlikely to survive.

The number of tags available for recapture, adjusted for movement, was determined by first estimating the proportion of tags released in section i moving to section j (p_{ij}), defined as follows:

$$\sum_{j} p_{ij} = 1$$

The movements of tagged fish were determined by their recapture histories corrected for sampling intensity as follows:

(4) $$\hat{p}_{ij} = \frac{\dfrac{w_{ij}}{\sum_t c_{tj}}}{\sum_j \dfrac{w_{ij}}{\sum_t c_{tj}}}$$

where w_{ij} is the total number of recaptures that were released in section *i* and recaptured in section *j* over the entire study period. The maximum number of releases available for recapture during day *t* in section *j* (m^*t_j) is then as follows:

(5) $$m^*_{tj} = \sum_i \hat{p}_{ij} m_{ti}$$

The typical closed population model assumptions (e.g., Gazey and Staley 1986) can be adjusted for mortality, emigration of fish from the study area, and the non-detection of a tag when a fish is recaptured. Thus, the number of tags available for recapture at the start of day *t* in section *i* (M_{ti}) consists of released tags in each section adjusted for removals (mortality and emigration) summed over time:

(6) $$M_{ti} = \sum_{v=1}^{t-h} (m^*_{vi} - d_{vi}) \exp\{(v + h - t)Q_i\}$$

where Q_i is the instantaneous daily rate of apparent mortality in the *i*-th region and *h* is the number of lags or mixing days (nominally set to three days).

The number of fish examined during day *t* in the *i*-th region (C_{ti}) does not require correction:

(7) $$C_{ti} = c_{ti}$$

Recaptured fish (R_{ti}) in the sample, C_{ti}, however, needed to be adjusted for the proportion of undetected tags (*u*) as follows:

(8) $$R_{ti} = (1 + u) r_{ti}$$

The corrected number of tags available, sampled, and recaptured (Equations 6, 7, and 8) were used in the model (Gazey and Staley 1986) to form the population abundance estimates. If apparent mortality is assumed ($Q_i > 0$ in Equation 6), then the population abundance estimates represent the mean population size weighted by the information (likelihood of recapture) contained in each sampling event during the study period.

Population size was estimated using a Microsoft Excel© spreadsheet model with macros coded in Visual Basic. The model has two phases. First, mark-recapture data were assembled by section under the selection criteria of minimum time-at-large (i.e., days) and minimum fork length (mm) specified by the user. Second, the user specified the sections to be included in the estimate, an annual instantaneous mortality rate, the proportion of undetected tagged fish, and the confidence interval percentage desired for the output. The model then assembled the adjusted mark-recapture data (Equations 6, 7, and 8) and followed Gazey and Staley (1986) using the replacement model to compute the population abundance estimates. Output included posterior distributions, the Bayesian mean, standard deviation, median, mode, equal-tailed credible interval, and the highest probability density (HPD) interval. For plots of abundance by year and section, the Bayes mean was used as the point estimate and the HPD interval was used as the 95% credibility interval. The interpretation is that the point estimate is the mean of the estimated distribution of true population size and there is a 95% chance that the true population size is within the credibility interval, given the observed mark-recapture data.

Population abundance estimates were generated for the six sections using tags applied at a start-date of 27 August 2018, a minimum length of 250 mm FL (200 mm FL for Arctic Grayling), daily instantaneous removal rate (which represented natural mortality, unobserved removals, and emigration) estimated using the CJS model, and an undetected tag rate of 0%. The total population abundance estimate for the study area was obtained by summing the section estimates (mean values). Confidence intervals for the total study area estimates were calculated invoking a normal distribution under the central limit theorem with a variance equal to the sum of the variances for the sections where a population abundance estimate was feasible. For Arctic Grayling, all tagged fish were used to increase the size of the dataset; however, population abundance estimates were only produced for Section 3, which had five recaptures (all other sections combined had three recaptures). Minimal population abundance estimates (i.e., the probability of *x* that the population size is at least *y*) were computed for Arctic Grayling following Gazey and Staley (1986).

2.2.2.4 Mountain Whitefish Synthesis Model

The Mountain Whitefish age-structured stochastic model that was developed by Gazey and Korman (2016) was updated to include 2018 data in addition to historical data collected between 2002 and 2017. The model synthesised length-at-age, incremental growth from release-recapture occurrences, length-frequency, and mark-recapture data.

The synthesis model evaluates the consistency of assumed population dynamics with historical data. Demographic parameter estimates are expected to be more accurate and precise than separate analyses (e.g., separate analyses of growth and abundance) because appropriate population dynamics and all available information are used by the model. A synthesis model can also provide an effective mechanism for monitoring a population. New data may require alterations to the model to improve the fit to the data, which enhances knowledge of population dynamics. Additionally, a synthesis model can assist impact assessment through identification of quantities that can be reliably predicted or identify additional data required to obtain reliable predictions.

A detailed mathematical description of the synthesis model is provided by Gazey and Korman (2016). The model currently focuses on Mountain Whitefish captured in Sections 1, 3, and 5 with no movement of Mountain Whitefish between the sections modelled. Major assumptions required to enable predictions were as follows:

- Fish enter the population (recruitment) each year at age-0 before the start of sampling in August.
- Ages assigned to age-0 fish through scale analysis are without error.
- Trends in growth track a von Bertalanffy curve with an assumed measurement error of length, individual variation of length, and environmental annual variation in mean length.
- Age-dependent survival is a simple power function of the expected length.
- The lengths of fish belonging to an age-class are normally distributed around their mean length.

- The oldest age-class represents all older fish and is subject to the same mortality (i.e., an absorbing age-class where the fish lives forever but the number of fish belonging to a cohort diminishes over time).
- The initial population size (i.e., 2002 for Sections 1 and 3, and 2004 for Section 5) of each age-class is set from that year's survival (i.e., stationary equilibrium age structure for the initial year).
- Selectivity of fish captured using boat electroshocking follows a logistic curve as a function of size for each sample section. Also, because of different electroshocker settings among study years, separate selectivity curves were applied for the epochs 2002–2013 and 2014–2018.
- The age composition of newly tagged fish reflects the available age composition of the untagged population.
- The population in a sample section is closed to additions or mortality (or tag loss) during each year's study period (28–45 days). Random movements of fish in and out of sections is permissible.
- Within-year capture probabilities are related to across-year capture probabilities through a simple power function.
- All tags are reported on recovery.

Parameter estimation was achieved through minimization of the model objective function, which consisted of multiple negative log-likelihood data components (function of predictions, observations, and assumed stochastic distributions). These components included length-at-age, incremental length, untagged length composition, tagged length composition, frequency of untagged binary bins (<250 mm FL and ≥250 mm FL), untagged captures, within year tag recaptures, across year tag recaptures, a recruitment prior, and two penalty functions to avoid the prediction of negative population values.

2.2.3 Catchability

If catchability is constant across years and sample sections, then indices of abundance such as catch rate (number of fish sampled per unit effort, CPUE) would be comparable. Handling time to process a fish, gear saturation, size selectivity by the sampling gear, and other variations in physical conditions can cause systematic bias in the relationship between CPUE and abundance (Hilborn and Walters 1992). Catchability coefficients (parameters relating abundance indices to actual abundance; Ricker 1975) were calculated using closed population assumptions, possibly subject to apparent mortality. If an index of abundance is applicable, then the coefficients should remain constant over study years and sections.

An estimate for the catchability coefficient for the *i*-th section was calculated following Ricker (1975) as follows:

$$\hat{q}_i = \frac{\sum_t C_{ti}}{E_i \cdot N_i} \quad (9)$$

where C_{ti} is from Equation 7, E_i is electroshocking effort (measured as hours of electroshocking or distance traveled), and N_i is the Bayes population abundance estimate for Section *i*, as described in Section 2.2.2.3 above. Given the number of fish sampled and effort data, the variance of the catchability coefficient was defined as follows:

$$Var(\hat{q}_i) = \left(\frac{\sum_t C_{ti}}{E_i} \right)^2 Var\left(\frac{1}{N_i} \right)$$

(10)

where the reciprocal of estimated abundance is distributed normally and can be estimated using the following expression (Ricker 1975):

$$Var\left(\frac{1}{N_i} \right) = \frac{\sum_t R_{ti}}{\left(\sum_t M_{ti} C_{ti} \right)^2}$$

(11)

2.2.4 Catch and Life History Data

Catch rates for each site were expressed as the number of fish captured per kilometre of shoreline sampled per hour of electroshocker operation (CPUE = no. fish/km-h). The CPUE for each session at each site was the sum of the number of fish captured per kilometre of shoreline sampled per hour of electroshocker operation. The average CPUE was calculated by averaging the CPUE from all sites and sessions. The standard error of the average CPUE was calculated using the square root of the variance of the CPUE from all sites for all sessions divided by the number of sampling events.

Length-frequencies were calculated using the statistical environment R, v. 3.5.1 (R Core Team 2018). Frequency plots were constructed for fork lengths by year, for all years combined (but plotted separately for each section), and by section within 2018. For all species, fork lengths were plotted using 10 mm bins. Similar to length-frequency, age-frequency plots were constructed by year, for all years combined (but plotted separately by section), and by section within 2018.

Fulton's body condition index (*K*; Murphy and Willis 1996) was calculated as follows:

(12) $$K = \left(\frac{W_t}{L^3}\right) \times 100{,}000$$

where W_t was a fish's weight (g) and L was a fish's fork length (mm). Body condition was plotted for all previous years by section. Mean condition values were estimated for each year and section combination, along with their respective 95% confidence intervals. These plots were constructed for most species.

Length-at-age data were used to construct three-parameter von Bertalanffy growth models (Quinn and Deriso 1999) for all species of interest:

(13) $$L(t) = L_\infty (1 - e^{-K(t - t0)})$$

where L_∞ is the asymptotic length of each species, K is the rate at which the fish approaches the asymptotic size (i.e., growth rate coefficient), and t_0 is the theoretical time when a fish has length zero. Non-linear modeling in R was used to estimate all three parameters of interest. Growth curves were estimated for each year (all sections combined) and separately for each section in 2018, where sample sizes were sufficient. For Bull Trout, the asymptotic length was fixed at 900 mm, because models estimating the value would not converge or gave impossibly large estimates (i.e., greater than 2000 mm), due to lack of very large fish in the sample. For Rainbow Trout, a two-parameter von Bertalanffy curve (i.e. with the t_0 parameter) was used because the full model would not converge due to small sample sizes.

For each study year *i*, the mean fork length of all study years excluding Year *i* was estimated, and the estimated mean was subtracted from the individual fork lengths sampled in Year *i*. The mean and 95% confidence intervals of the estimated differences in fork lengths were then calculated for each year.

Length-weight regressions (Murphy and Willis 1996) were calculated for all species of interest as follows:

(14) $$W = a \times L^b$$

where *W* is weight (g), *L* is fork length (mm), *a* is a constant, and *b* is the regression coefficient.

Catch curves (Ricker 1975) were used to estimate mortality of Arctic Grayling, Bull Trout, Mountain Whitefish, and Walleye using year-specific data. Sections 1, 3, 5 were combined into one curve for each species because these sections were consistently sampled between 2002 and 2018. Sections 6, 7, and 9 were combined into another curve for each species because these sections were only sampled from 2015 to 2018. In addition, 2018 data were used to construct section-specific catch curves; this was performed for Arctic Grayling, Bull Trout, Mountain Whitefish, and Walleye only, due to scarce age data for other species. Instantaneous total mortality (*Z*) was estimated using ordinary least squares regression of natural logarithm-transformed counts of fish at age, performed on the descending arm of the age distribution:

(15) $$\ln(N_t) = \ln(N_0) - Z \times t$$

where N_0 is the number of fish at the first age-class included in the catch curve analysis, *Z* is instantaneous total mortality, and *t* is time in years. Annual survival was then estimated as $S = e^{-Z}$. Annual mortality (*A*) was calculated as 1-*S*. Confidence intervals (95%) around the annual mortality estimates were calculated using the confidence intervals estimated during regression around *Z*, converting it to confidence intervals around *A* as described above. The catch curves used counts of fish for age-5 and older age-classes. Abundances of age-0 to age-4 fish were not used in catch curves because they were under-represented in the study area, likely because many individuals rear in tributaries, and the smaller age-classes were not fully recruited to the sampling gear.

Recaptured fish that had previously been tagged with T-bar anchor tags in earlier years of the program (2002 to 2004) were included in catch rates but were omitted from all length, weight, age, and growth analyses due to possible effects of the tag on growth (e.g., Mainstream and Gazey 2004, 2006). Within-year recaptures were also excluded from age, length, weight, and growth analyses but included in catch rates.

2.2.5 Diversity Profiles

Diversity profiles will eventually be used to monitor changes to the Peace River's fish community composition in response to the construction and operation of the Project. Specifically, profiles will be used to test hypothesis H_4 after the river diversion phase of construction.

Traditional indices of diversity, such as species richness, Shannon's index, or Simpson's index differ in how the relative abundance of species affects the index, which affects the degree to which less common versus common species are represented. A diversity profile is a method that plots the relationship between diversity and the degree to which relative abundance is represented (Leinster and Cobbold 2012). The response variable in a diversity profile is the “effective number of species”, which is the number of equally common species required to get a particular value of an index (Jost 2006). Effective numbers are recommended for comparisons of diversity because they allow intuitive and straightforward comparison of the number of species, instead of individual indices, which are more difficult to interpret and can be misleading due to non-linearity (Jost 2006; Chao et al. 2014). For instance, a community of eight equally common species has a Shannon index of 2.1 (calculated using natural log) and 8 effective species, whereas a community of 16 equally common species has a Shannon index of 2.8 and 16 effective species. The second community is twice as diverse as the first but appears only 33% more diverse using the Shannon index (2.7 vs. 2.1).

Diversity profiles also can take into account similarity between species when calculating diversity. Most measures of diversity do not take into account similarity between species, such that the diversity of a community of three trout species is equal to that of a community with a sculpin species, a trout species, and Walleye. However, most people would intuitively consider the latter community more diverse. Diversity profiles can account for diversity among species by assigning a similarity value between 0 and 1 for each pair of species, where a value of 1 indicates an equivalent species and a value of 0 indicates no similarity (Leinster and Cobbold 2012). Similarity values could be assigned based on any biologically criteria desired, such as genetic or functional similarity.

Diversity profiles were calculated using the following equation:

(16) $${}^{q}D^{\mathbf{Z}}(\mathbf{p}) = \left(\sum p_i \, (\mathbf{Zp})_i^{q-1}\right)^{1/(1-q)}$$

where *D* is the effective number of species, *p* is the relative abundance of the species present, *q* is the parameter representing the relative contribution of relative abundance data, and *Z* is the similarity matrix among species (Leinster and Cobbold 2012). A value of *q* = 0 represents no importance of relative abundance and is equivalent to a count of the number of species, often referred to as species richness. A value of *q* = 1 is equivalent to the Shannon index. Values less than 1 result in less common species being over-represented, and values greater than 1 result in common species being over-represented. Values on the right of a diversity profile (highest values of *q*) are insensitive to changes in less common species and values on the left are sensitive to less common species. The shape of diversity profiles can be used to interpret the community composition and compare composition between datasets. For instance, a flat profile indicates near equal abundance among species, whereas a steeper profile indicates more unequal abundance among species. Diversity profiles allow comparison of the number of effective species across the entire range of importance of less common to common species, instead of requiring the assumptions of a single diversity index. Diversity profiles have previously been used in a power analysis to assess the likelihood of detecting significant differences in community composition in the Peace River before and after Project construction (Ma et al. 2015).

Diversity profiles were calculated separately for each section for all years with available data. The analysis used captured fish of all species but excluded fish not identified to the species level (e.g., fish recorded as sculpin species or sucker species). For the species similarity matrix (*Z*), values were set to 1 for all “small fish” and for all sucker species, which treated each of these groups as one species. Values in the matrix were set to 0 for all pairs of species with the interpretation that all these pairs of species were equally and completely different. This was the same approach for species similarity developed by Ma et al. (2015). Diversity was not statistically compared between each section (e.g., t-test). Instead, the effective number of species is shown graphically to allow the reader to decide what magnitude of difference is biologically meaningful.

3.0 RESULTS

3.1 Physical Parameters

3.1.1 Discharge

Discharge in the Peace River is regulated by the operations at WAC Bennett Dam and PCD. In most years, total river discharge gradually decreases from January to early June, increases from early June to mid-July, remains near stable from mid-July to early October, and increases from early October to late December. In 2018, mean daily discharge in the Peace River (i.e., discharge through PCD) was within the historical range of the 2002–2017 period, with the exception of a period of high flows during the first half of August, when flows were above average and attained historical maximum mean daily discharge levels (Figure 2; Appendix C, Figure C1). During the 2018 study period, mean daily discharge was lower than average during late August, near average during early September, and approximately 500 m³/s below the typical average discharge of 1000 m³/s during the second half of September (Figure 2).

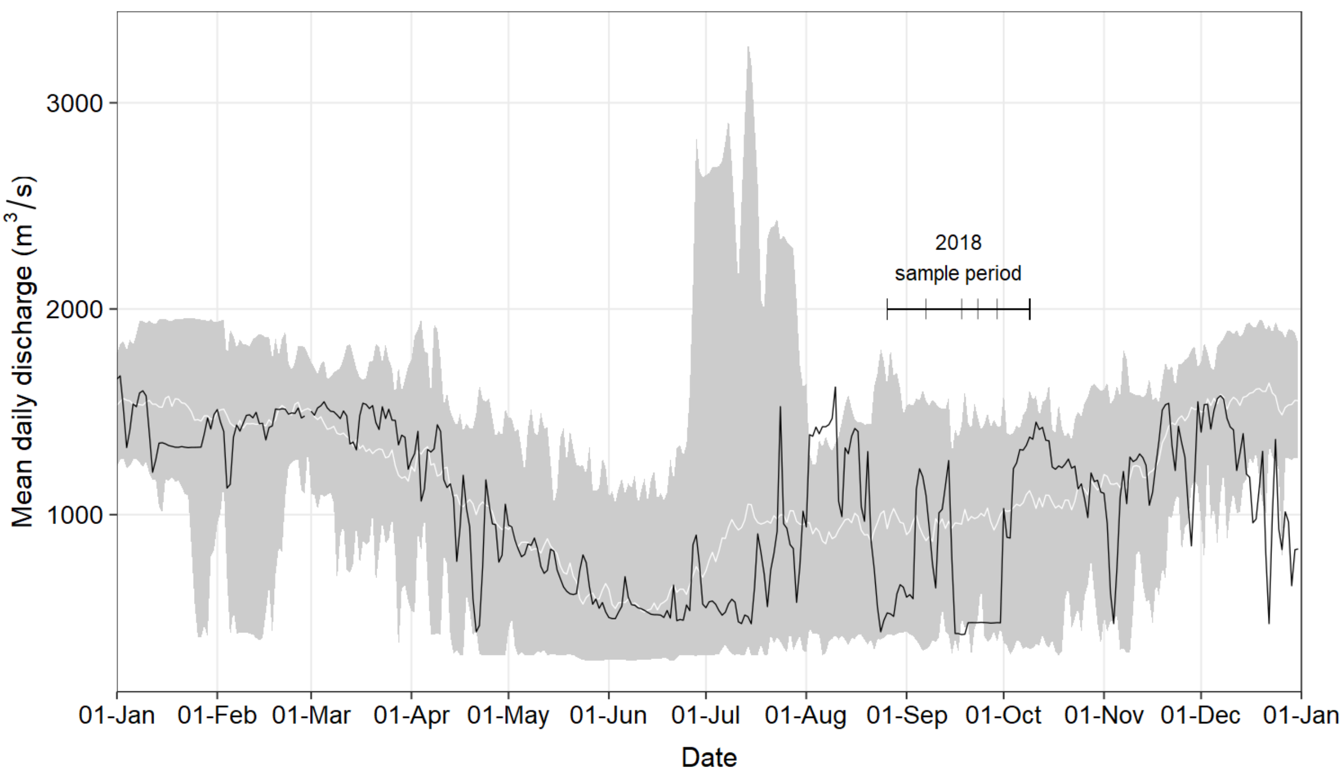

Figure 2: Mean daily discharge (m³/s) for the Peace River at Peace Canyon Dam, 2018 (black line). The shaded area represents minimum and maximum mean daily discharge values recorded at the dam from 2002 to 2017. The white line represents average mean daily discharge values over the same time period. Vertical lines on the sample period bar represent the approximate start and end times of each sample session.

During the 2018 study period, mean hourly discharge in the Peace River was variable and ranged from a high of more than 3000 m^3/s in Section 7 to a low of approximately 500 m^3/s in Section 1 (Figure 3). In all sections, sampling was conducted when discharge was between approximately 500 and 1600 m^3/s. Hourly discharge varied throughout the day during the first part of sampling in mid-August to mid-September and was lower, with no daily variability during the last part of sampling in mid- to late September (Figure 3).

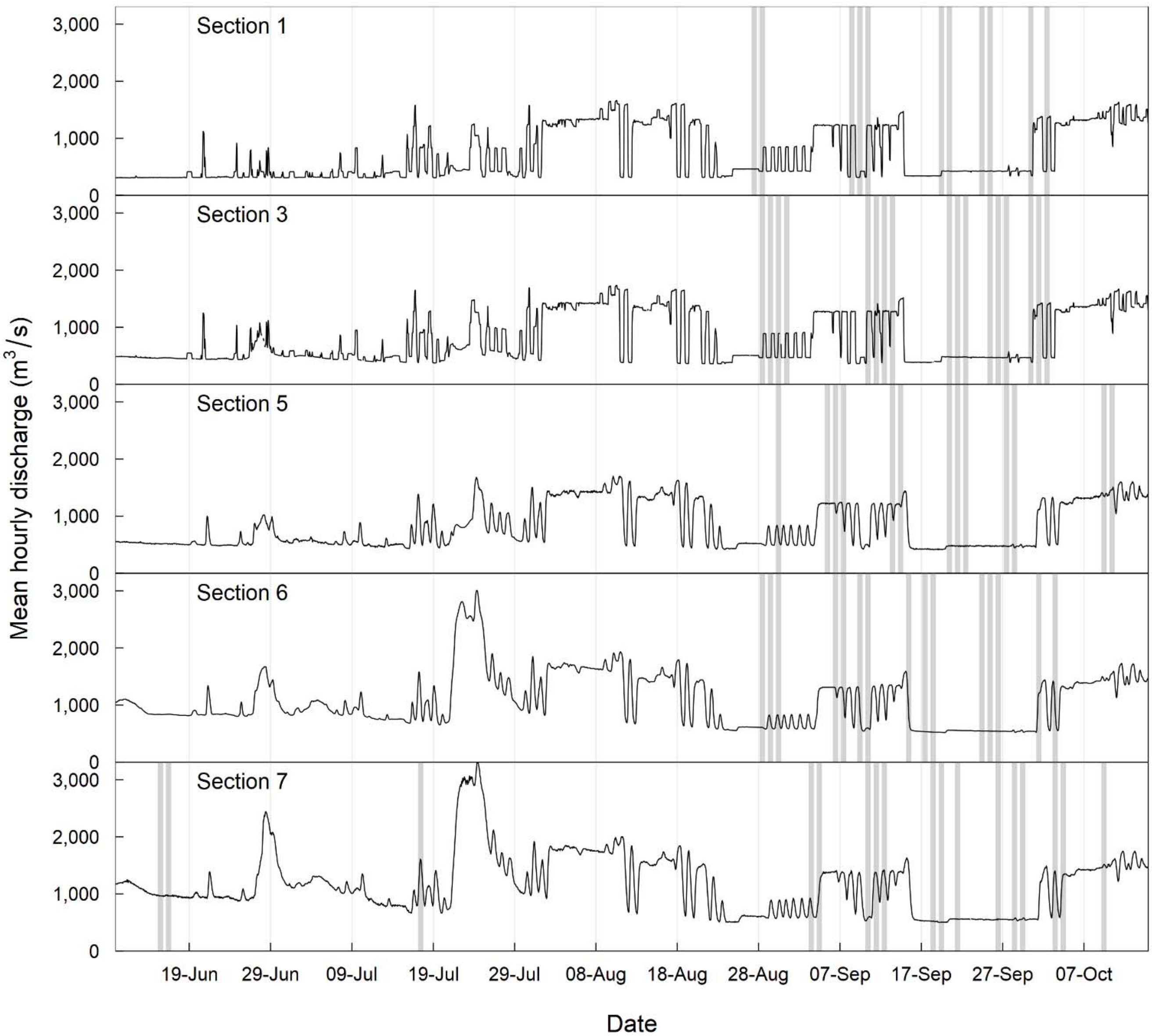

Figure 3: Sectional discharge in five-minute intervals for the Peace River, 9 June to 17 October 2018. The shaded areas represent the approximate timing of daily sampling (from 9:00 a.m. to 5:00 p.m.). Section 3 data represent approximate values as detailed in Section 2.1.1. Data for Section 9 are not available for the reasons provided in Section 2.1.1.

3.1.2 Water Temperature

During a typical study year, water temperatures are generally lower in Section 1 during the spring and summer and higher in Section 1 during the fall and winter compared to Sections 3 and 5 (Appendix C, Figure C2; DES 2017). During a typical year, Peace River water temperatures remain low (generally less than 2°C) from January to early April, gradually increase from early April to early August, and gradually decrease from early August to late December (Appendix C, Figures C3 to C5). In 2018, water temperatures remained low until late April and inclined from late April to mid August before declining to historical lows from mid-September to mid-November.

Mean water temperatures in the Peace River during the 2018 study period, as measured downstream of PCD and representative of water temperatures within Section 1, declined sharply from historical highs in mid-August to historical lows in mid-September. Water temperature remaining at historically low levels for the remainder of the 2018 study period (Figure 4).

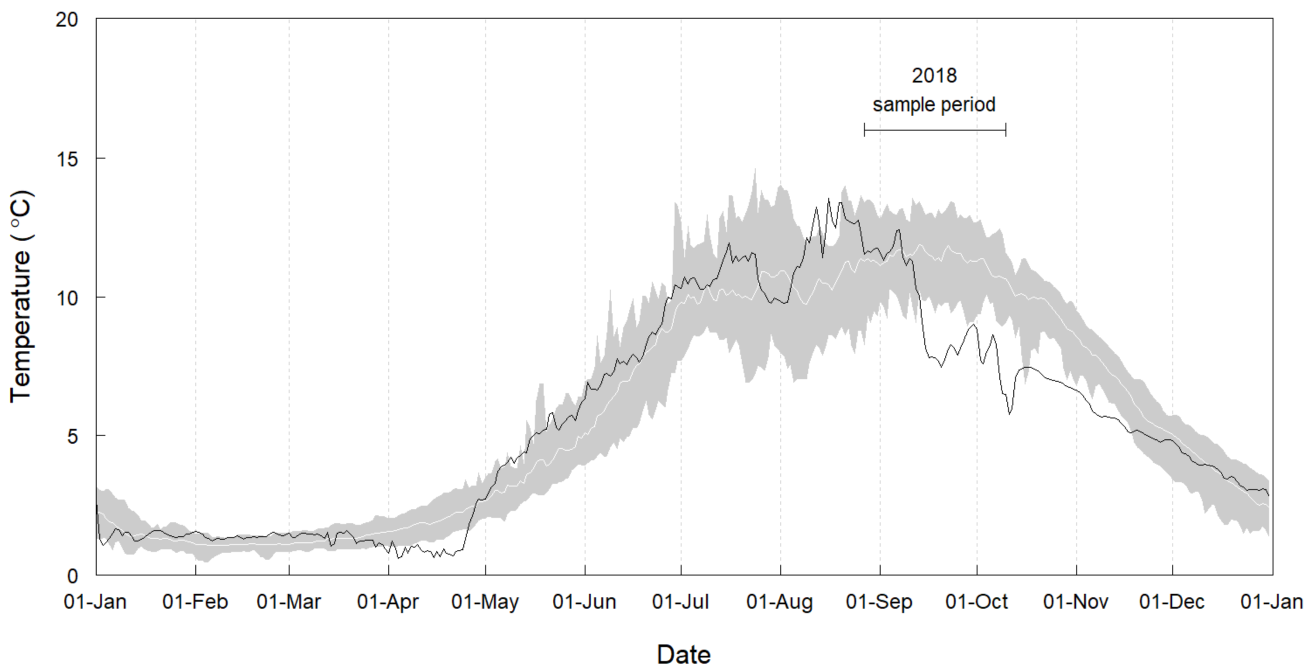

Figure 4: Mean daily water temperature (°C) for the Peace River recorded near the Peace Canyon Dam, 2018 (black line). The shaded area represents the minimum and maximum mean daily water temperature values recorded at that location between 2008 and 2017. The white line represents the average mean daily water temperature during the same time period. Data were collected under the Site C FAHMFP (Mon-8/9; DES 2019). Vertical lines on the sample period bar represent the approximate start and end times of each sample session.

Mean daily water temperature in the Peace River, as measured downstream of the confluence of the Peace and Halfway rivers, represents water temperatures in Sections 3. In 2018, mean water temperature at this location was near-average from January to May but greater than the historical maximum (approximately 2°C greater than average) in mid-May and mid-June (Figure 5). Mean daily water temperature was lower than the historical minimum for the majority of the study period in 2018. Mean water temperature declined sharply in early

September and was between 1°C and 5°C colder than the historical average until mid-October. During the study period in 2018, mean water temperatures were approximately 1°C to 2 °C colder in Section 3 than Section 1, which may be due to colder Halfway River discharge.

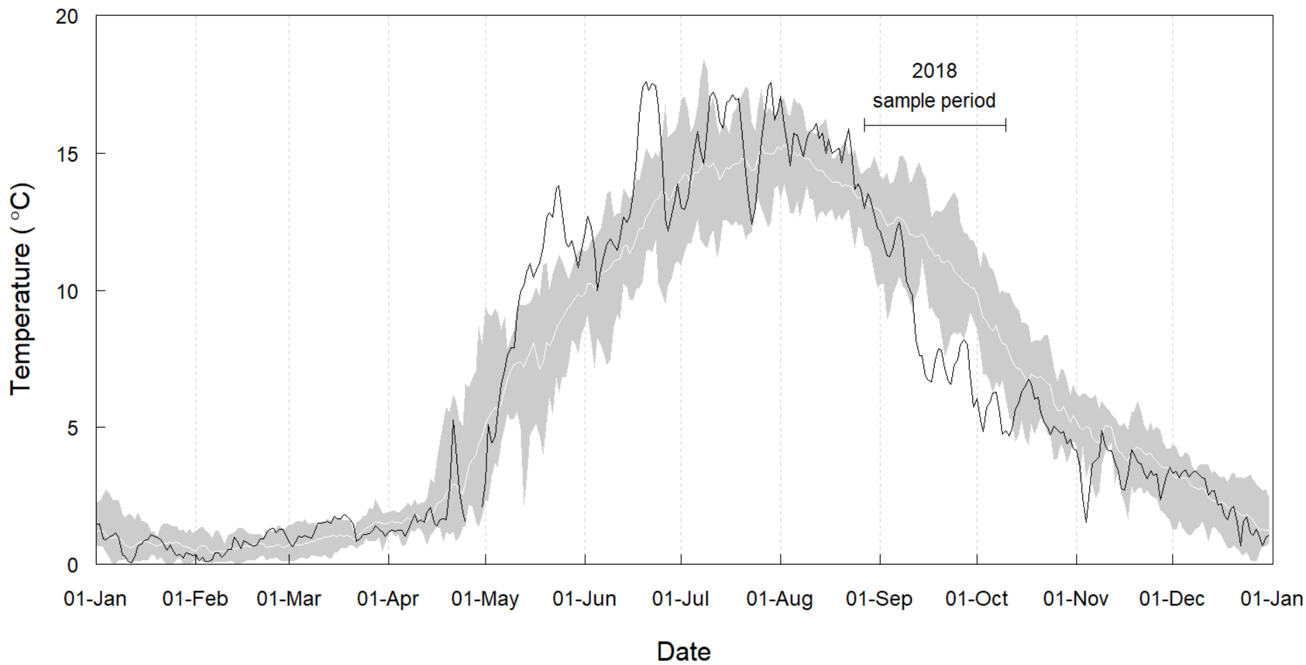

Figure 5: Mean daily water temperature (°C) for the Peace River recorded near the Halfway River confluence, 2018 (black line). The shaded area represents the minimum and maximum mean daily water temperature values recorded at that location between 2008 and 2017. The white line represents the average mean daily water temperature during the same time period. Data were collected under the Site C FAHMFP (Mon-8/9; DES 2019). Vertical lines on the sample period bar represent the approximate start and end times of each sample session.

Mean daily water temperature in the Peace River, as measured below the confluence of the Peace and Moberly rivers, represents water temperatures in Section 5. Trends in water temperature in Section 5 were similar to those in Section 3, with warmer than average temperature in mid-May and mid-June, and means values 1°C to 4°C colder than average in early September to mid-October (Figure 6). During the sampling period in 2018, mean water temperature in the Peace River was approximately 1°C to 2°C warmer in Section 5 than Section 3, which was likely due to the contribution of warmer water from the Moberly River.

For Section 6, continuous water temperature data are not available prior to 2017; however, over the course of the 2017 study period, water temperatures recorded at the time of sampling in Section 6 generally declined from a high of approximately 15.3°C to a low of approximately 4.0°C (Appendix D, Table D3).

For Sections 7 and 9, continuous water temperature data are not available; therefore, data for these two sections are limited to spot temperature readings taken at the time of sampling. In 2017, daily average spot temperature readings in Section 7 gradually declined over the study period from a high of 11.8°C to a low of 2.2°C.
In Section 9, daily average spot temperature readings gradually declined over the study period from a high of 12.0°C to a low of 4.2°C.

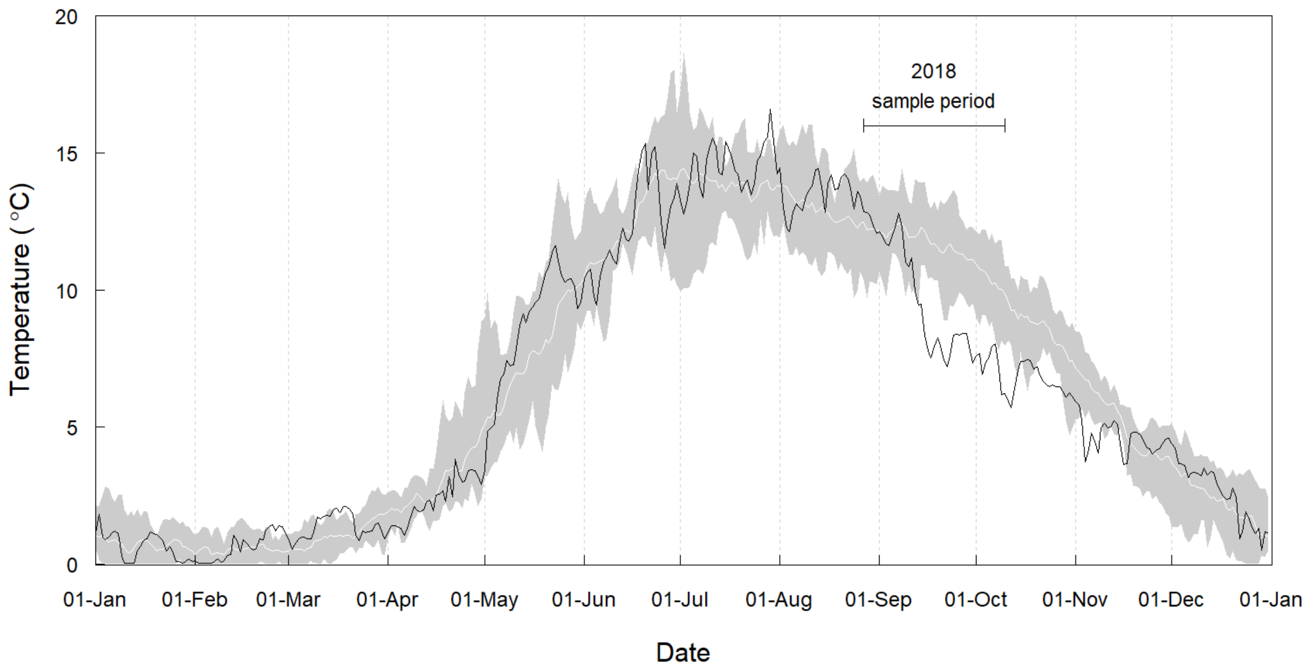

Figure 6: Mean daily water temperature (°C) for the Peace River recorded near the Moberly River confluence, 2018 (black line). The shaded area represents the minimum and maximum mean daily water temperature values recorded at that location between 2008 and 2017. The white line represents the average mean daily water temperature during the same time period. Data were collected under the Site C FAHMFP (Mon-8/9; DES 2017). Vertical lines on the sample period bar represent the approximate start and end times of each sample session.

3.1.3 Habitat Variables

Mainstream (2012) provides a description of fish habitat available in the study area. Habitat variables collected at each site during the present study are provided in Appendix D, Table D3 and are also included in the Peace River Large Fish Indexing Database (Attachment A). In Sections 1, 3, and 5, each site was categorized into various habitat types using their bank habitat type as assigned by R.L.&L. (2001) and the presence or absence of physical cover as assigned by P&E and Gazey (2003). The Bank Habitat Type Classification System is summarized in Appendix D, Table D2. Bank habitat types and the presence or absence of physical cover have not been classified and are not available for Sections 6, 7, and 9. Sampling locations and habitat classifications (when available) are detailed in Appendix A, Table A1 and are illustrated in Appendix A, Figures A1 to A6. Locations sampled as part of the Goldeye and Walleye Survey are detailed in Appendix A, Table A2 and are illustrated in Appendix A, Figures A7 and A8. Site lengths were calculated using ArcView® GIS software (ESRI Canada, Toronto, ON, Canada). Overall, habitat data recorded during the 2018 Indexing Survey did not suggest any substantial changes to fish habitat in any sections when compared to 2017 data.

3.2 General Characteristics of the Fish Community

In 2018, 16,934 fish from 23 different species were captured in the Peace River (Table 8). These values do not include fish that were observed but avoided capture and do not include intra-year recaptured individuals. Catch was greatest in Section 3 (34% of the total catch) and lowest in Section 9 (5% of the total catch; Table 8). To align with classifications presented in the Site C EIS (Golder et al. 2012), each fish species was placed into one of four groups. Group 1 consisted of large-bodied fish typically targeted by anglers (i.e., Burbot, Lake Trout, Northern Pike, Rainbow Trout, Walleye), Group 2 included species considered "passage sensitive" (i.e., Arctic Grayling, Bull Trout, and Mountain Whitefish), Group 3 included planktivorous species (Kokanee and Lake Whitefish), and Group 4 fish consisted of all remaining species (i.e., Northern Pikeminnow, sucker species, and small-bodied fish species). Group 2 fish were most common and comprised 68% of the total catch, with Mountain Whitefish representing 98% of the overall group. Group 4 fish were the second most abundant group and comprised 27% of the total catch. The bulk of the Group 4 catch were sucker species (93%). Group 1 fish contributed 3% to the total catch and was dominated by Walleye (64% of the Group 1 catch) and Rainbow Trout (27% of the Group 1 catch). Group 2 fish were infrequently captured, with catch largely limited to the upstream sections of the study area. While encountered, the following species each comprised less than 1% of the total catch (in declining order of abundance): Slimy Sculpin, Arctic Grayling, Reside Shiner, Northern Pike, Trout-perch, Lake Chub, Burbot, Kokanee, Flathead Chub, Longnose Dace, Prickly Sculpin, Spottail Shiner, Lake Whitefish, Yellow Perch, and Lake Trout. In general, cold-water species (as defined by Mainstream 2012), such as Bull Trout, Mountain Whitefish, and Rainbow Trout, were more common in upstream sections of the study area and cool-water species (Mainstream 2012), such as Northern Pike and Walleye, were more common in the downstream sections of the study area (Table 8).

Arctic Grayling, Bull Trout, and Mountain Whitefish were consistently captured between 2002 and 2018 in Sections 1, 3, and 5; therefore, changes in catch-rates over time were compared for these species (Figure 7). Changes in catch rates of other species over time were not compared. Arctic Grayling catch rates declined between 2011 and 2014, increased slightly between 2015 and 2016 and remained stable between 2016 and 2018; confidence intervals overlapped for most estimates. Higher variability in the Arctic Grayling catch coupled with one less sample session in 2018 resulted in wider confidence intervals in 2018 relative to 2017. Mountain Whitefish catch rates were stable between 2002 and 2010, increased substantially in 2011, and decreased between 2011 and 2014 (Figure 7). Catch rates of Mountain Whitefish were low from 2014 to 2017, but increased from 154 fish/km/h in 2017 to 219 fish/km/h in 2018 (an increase of approximately 42%). When compared to Arctic Grayling and Mountain Whitefish, Bull Trout catch rates were relatively stable between 2002 and 2018, ranging from a low of 7.1 fish/km/h in 2006 to a high of 11.9 fish/km/h in 2011. The catch rate of Bull Trout in 2018 (9.3 fish/km/h) was similar to the average catch rate recorded for this species over the previous 16 years (average = 8.8 fish/km/h between 2002 and 2017).

From 2015 to 2018, catch rates for Arctic Grayling were generally lower in Sections 6, 7, and 9 (average = 6.1 fish/km/h; not presented) when compared to catch rates recorded in Sections 1, 3, and 5 over the same time period (7.8 fish/km/h). Similar patterns were recorded for Bull Trout (an average of 5.8 fish/km/h in Sections 6, 7, and 9 [not presented] and an average of 9.1 fish/km/h in Sections 1, 3, and 5) and Arctic Grayling (an average of 67.8 fish/km/h in Sections 6, 7, and 9 [not presented] and an average of 184.5 fish/km/h in Sections 1, 3, and 5).

Table 8: Number of fish caught by boat electroshocking and their frequency of occurrence in sampled sections of the Peace River, 27 August to 10 October 2018.

Group[a]	Species	Section												All Sections		
		1		3		5		6		7		9				
		n[b]	%[c]	n[b]	%[c]	n[b]	%[c]	n[b]	%[c]	n[b]	%[c]	n[b]	%[c]	n[b]	%[c]	%[d]
1	Burbot					4	7	5	7	2	1	2	4	13	2	<1
	Lake Trout									1	1			1	<1	<1
	Northern Pike	1	2	3	3	14	24	6	8	7	4	3	6	34	6	<1
	Rainbow Trout	63	98	66	71	11	19	2	3	4	2			146	27	1
	Walleye			24	26	29	50	59	82	180	93	49	91	341	64	2
Group 1 Subtotal		64	100	93	100	58	100	72	100	194	100	54	100	535	100	3
2	Arctic Grayling	3	<1	36	1	10	1	5	<1	1	<1			55	<1	<1
	Bull Trout	56	3	76	2	36	2	27	1	14	1	6	2	215	2	1
	Mountain Whitefish	2,076	97	4,154	97	1,605	97	2,137	99	968	98	379	98	11,319	98	67
Group 2 Subtotal		2,135	100	4,266	100	1,651	100	2,169	100	983	100	385	100	11,589	100	68
3	Kokanee	4	100	5	83	2	100							11	79	<1
	Lake Whitefish			1	17			2	100					3	21	<1
Group 3 Subtotal		4	100	6	100	2	100	2	100	0	0	0	0	14	100	0
4	Flathead Chub			2	<1	1	<1	1	<1	4	<1	3	1	11	<1	<1
	Lake Chub			5	<1			6	<1	7	1	5	1	23	<1	<1
	Largescale Sucker	28	19	247	18	109	22	231	19	181	16	71	16	867	18	5
	Longnose Dace							4	<1			1	<1	5	<1	<1
	Longnose Sucker	93	62	994	73	325	65	893	74	858	75	301	69	3,464	72	20
	Northern Pikeminnow			40	3	8	2	26	2	36	3	13	3	123	3	1
	Prickly Sculpin	2	1	2	<1	1	<1							5	<1	<1
	Redside Shiner	3	2	33	2	8	2	4	<1	6	1			54	1	<1
	Slimy Sculpin	11	7	21	2	21	4	6	<1					59	1	<1
	Spottail Shiner					2	<1	3	<1					5	<1	<1
	Trout-perch					12	2	9	1	12	1			33	1	<1
	White Sucker	13	9	14	1	13	3	30	2	34	3	41	9	145	3	1
	Yellow Perch					2	<1							2	<1	<1
Group 4 Subtotal		150	100	1,358	100	502	100	1,213	100	1,138	100	435	100	4,796	100	27
All species		2,353	14	5,723	34	2,213	13	3,456	20	2,315	14	874	5	16,934	100	100

[a] Based on the groupings detailed in Golder et al. (2012)[6].

[b] Includes fish captured and identified to species; does not include fish that avoided capture or within-year recaptured fish.

[c] Percent composition within each fish group.

[d] Percent composition of the total catch.

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[6] EIS, Volume 2, Appendix P Part 3 (BC Hydro 2013).

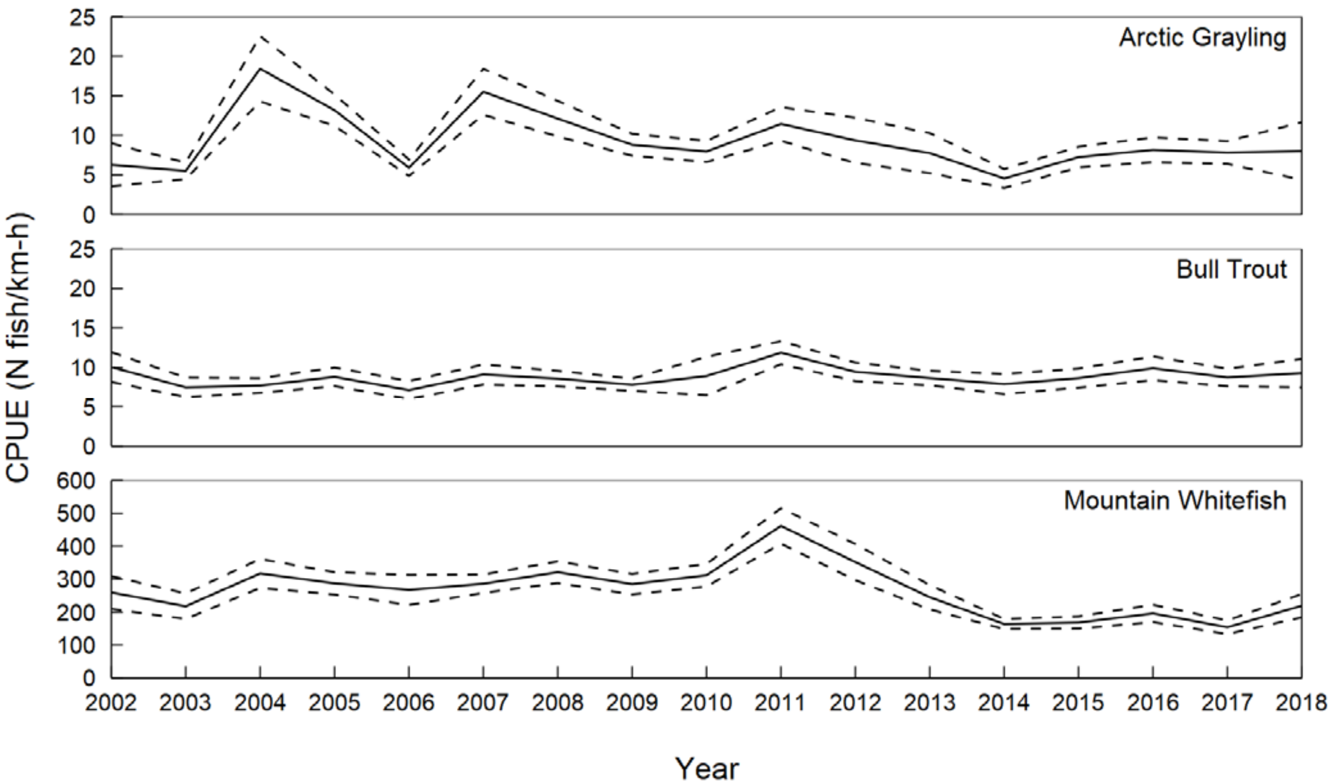

Figure 7: Mean annual catch rates (CPUE) for Arctic Grayling, Bull Trout, and Mountain Whitefish captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River combined, 2002 to 2018. The dashed lines denote 95% confidence intervals. Analysis included captured fish only and all size-cohorts combined. Sections 6, 7, and 9 were excluded as these sections were not consistently sampled prior to 2016. Note the different Y-axis scales.

3.3 Arctic Grayling

3.3.1 Biological Characteristics

During the 2018 survey, 55 Arctic Grayling were captured (i.e., excluding within-year recaptures). Arctic Grayling were captured in all sections except Section 9 (3 in Section 1, 36 in Section 3, 10 in Section 5, 5 in Section 6, 1 in Section 7). Fewer Arctic Grayling were captured in 2018 (n = 55) than in 2017 (n = 87) but the distribution among sections was similar, with the majority of Arctic Grayling captured in Sections 3 and 5 (Table 8). Fork lengths ranged between 81 and 374 mm; weights ranged between 5 and 679 g.

Scale samples were analyzed from all captured Arctic Grayling; however, ages could not be assigned to 9 of the 55 samples. Assigned ages ranged between age-0 and age-3, but age-1 Arctic Grayling (i.e., the 2017 brood year) were not captured.

The number of Arctic Grayling by age-class (Table 9) and length-frequencies (Figure 8) indicate that both juvenile (age-0; < 120 mm FL) and older (age-2+) age-classes are present in the study area. Age-1 Arctic Grayling were not encountered in 2018. Historical length-frequency data (Appendix F, Figure F1) showed a variety of length groupings during most study years. The length distribution did not overlap between age-2 and age-3 Arctic Grayling but did overlap between age-3 and age-4 individuals (Table 9).

Table 9: Average fork length, weight, and body condition by age for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Age	Fork Length (mm)			Weight (g)			Body Condition (K)		
	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]
0	91	-	1	7	-	1	0.93	-	1
1	-	-	-	-	-	-	-	-	-
2	250 ± 16	227 – 267	7	195 ± 46	145 – 276	7	1.23 ± 0.11	1.11 – 1.45	7
3	335 ± 17	305 – 369	23	486 ± 66	356 – 622	23	1.29 ± 0.07	1.16 – 1.42	23
4	354 ± 18	322 – 374	15	573 ± 81	434 – 679	15	1.29 ± 0.06	1.13 – 1.41	15

[a] Number of individuals sampled.

The interpretation of age-frequency distributions of Arctic Grayling by section was limited due to the low number of captured and aged individuals in most sections (Figure 9). Most of the Arctic Grayling were age-3 or age-4. Arctic Grayling considered to be age-0 based on fork length (<120 mm; Figure 8) or scale ageing (Figure 9) were captured in Sections 6 and 7 but not in Sections 1, 3, or 5. Data suggest strong recruitment originating from the 2014 brood year, which is indicated by a large percentage of age-1 individuals in 2015, age-2 individuals in 2016, age-3 individuals in 2017, and age-4 in 2018 (Figure 9; Appendix F, Figure F3).

The von Bertalanffy growth curve in 2018 showed that mean length-at-age and growth of Arctic Grayling were within the range observed in other years (Figure 10). Greater predicted asymptotic length in some years, such as 2003 and 2006, may have been related to small sample sizes or ageing error for some older fish (>age-5), rather than real differences in growth among years. Length-at-age varied across years and showed no discernible trends among age classes or study years (Figure 11). The mean length of age-2 fish was approximately 30 mm lower than average in 2018 and the length of the single age-0 Arctic Grayling captured in 2018 was approximately 20 mm lower than average. This suggests smaller length-at-age of younger age-classes of Arctic Grayling in 2018 than previous years.

Length-weight regressions for Arctic Grayling had small sample sizes for most sections, which prevented meaningful comparisons among individual sections (Figure 12). There was little difference in length-weight regressions for Sections 1, 3, and 5 combined compared to Sections 6, 7, and 9 combined for years where data were available for all these sections (2014 to 2018; Appendix F, Figure F5). Length-weight slopes and the predicted weight at mean length were not statistically compared in 2018 because 2018 results were very similar to 2017 results and statistical comparisons conducted in 2017 were uninformative due to the small sample sizes for many years and age-classes of Arctic Grayling (see Golder and Gazey 2018).

The body condition (*K*) of Arctic Grayling captured in 2018 ranged between 1.11 and 1.45 for age-2 to age-4 individuals and was lower (0.93) for the one age-0 individual captured (Table 9). There was little variation in mean body condition between 2002 and 2018 in any sections (Figure 13).

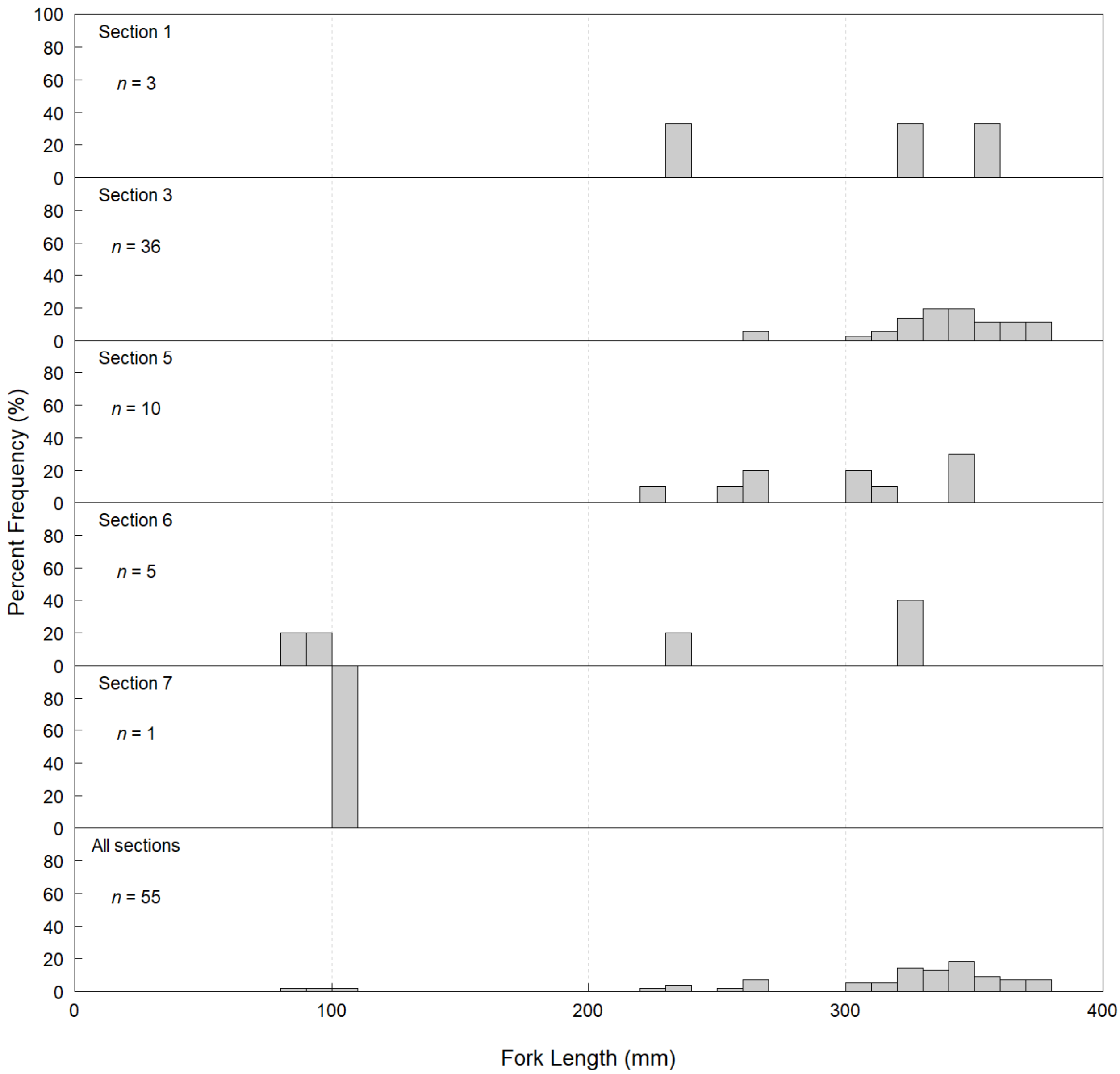

Figure 8: Length-frequency distribution for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

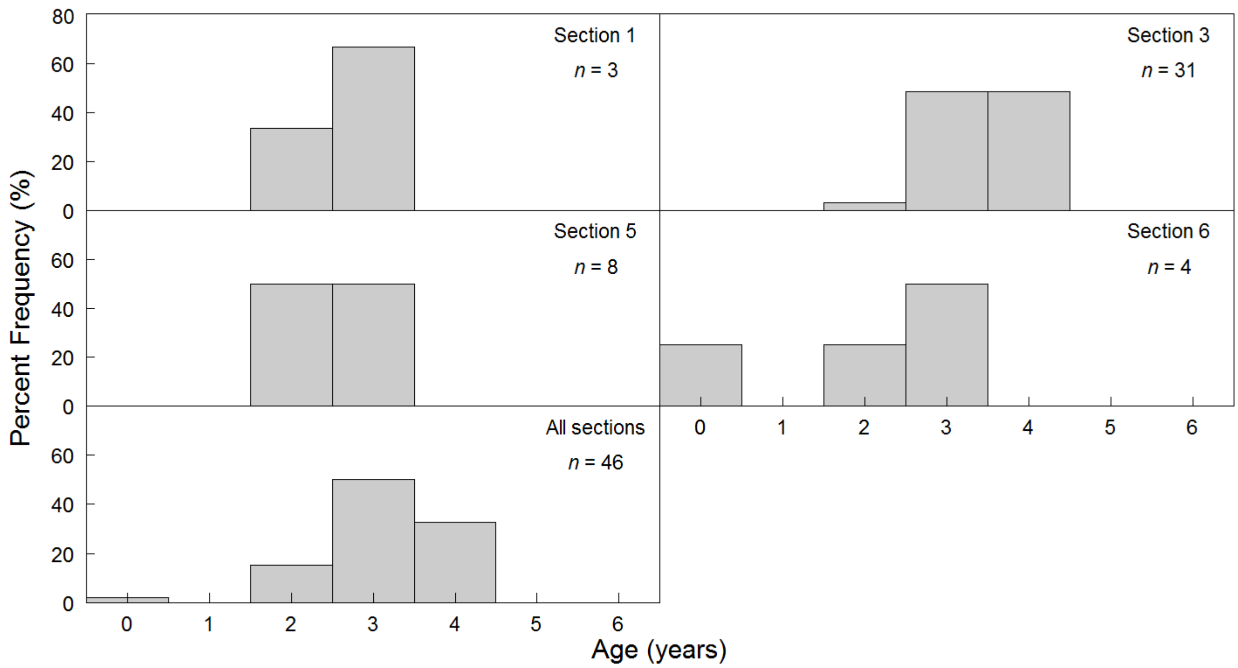

Figure 9: **Age-frequency distributions for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.**

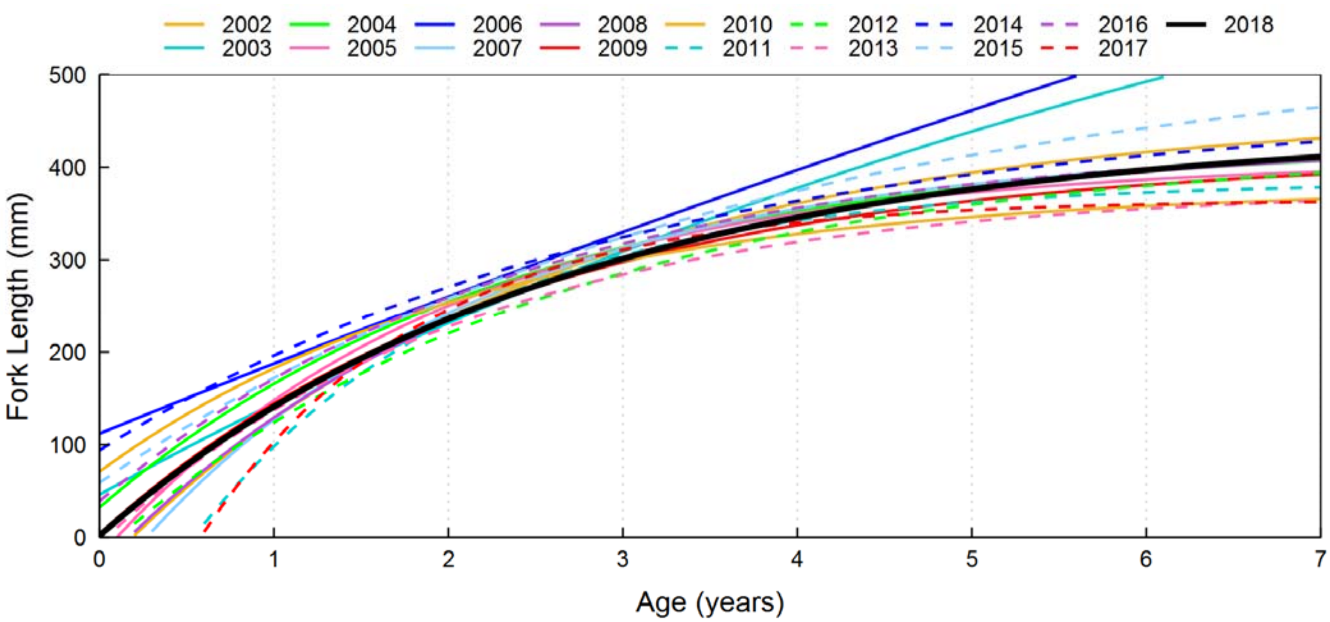

Figure 10: **von Bertalanffy growth curves for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.**

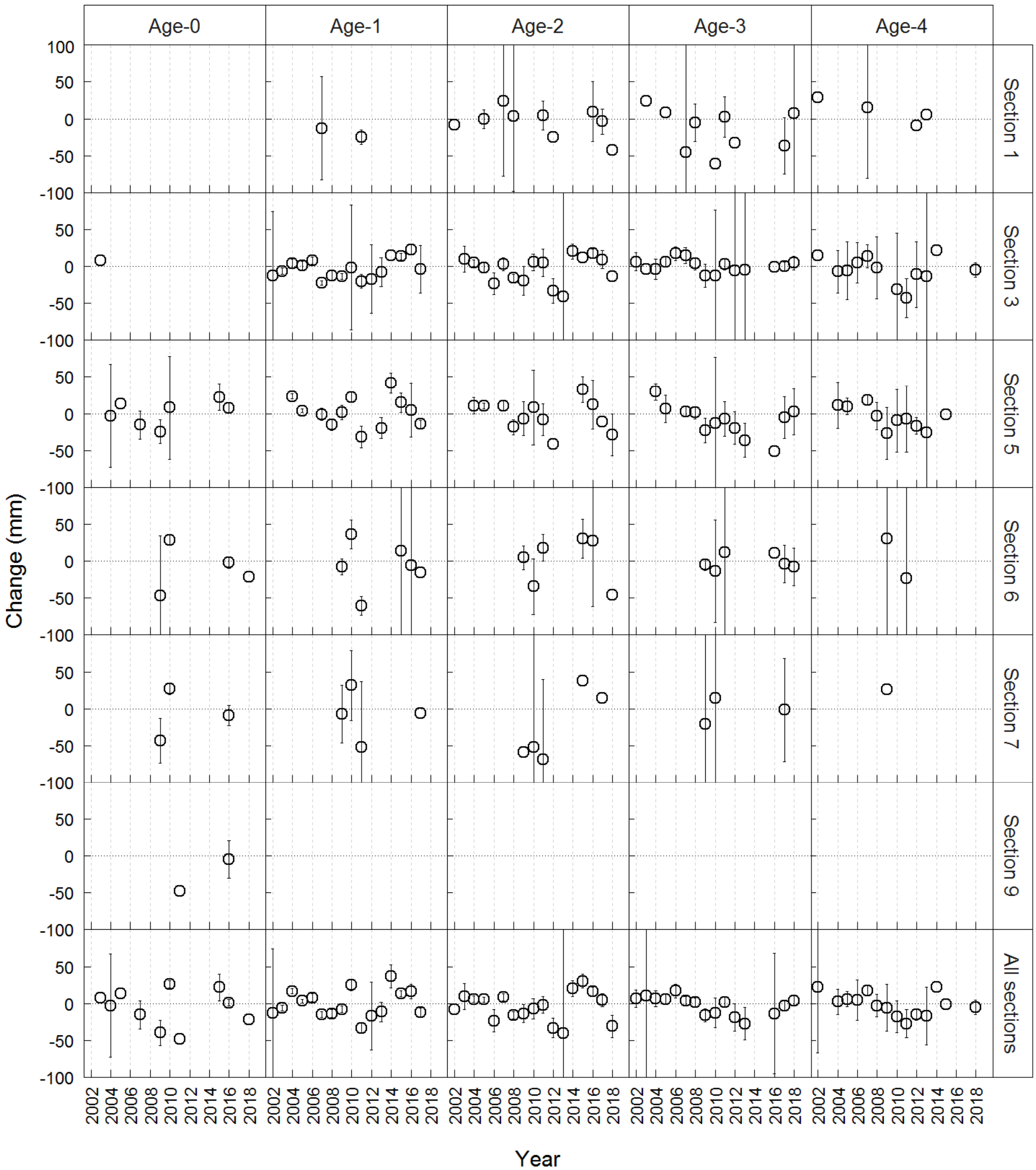

Figure 11: Change in mean length-at-age for Arctic Grayling captured by boat electroshocking in the Peace River, 2002 to 2018. Change is defined as the difference between the annual estimate and the estimate of all years combined. Error bars represent 95% confidence intervals. For Sections 6, 7, and 9, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

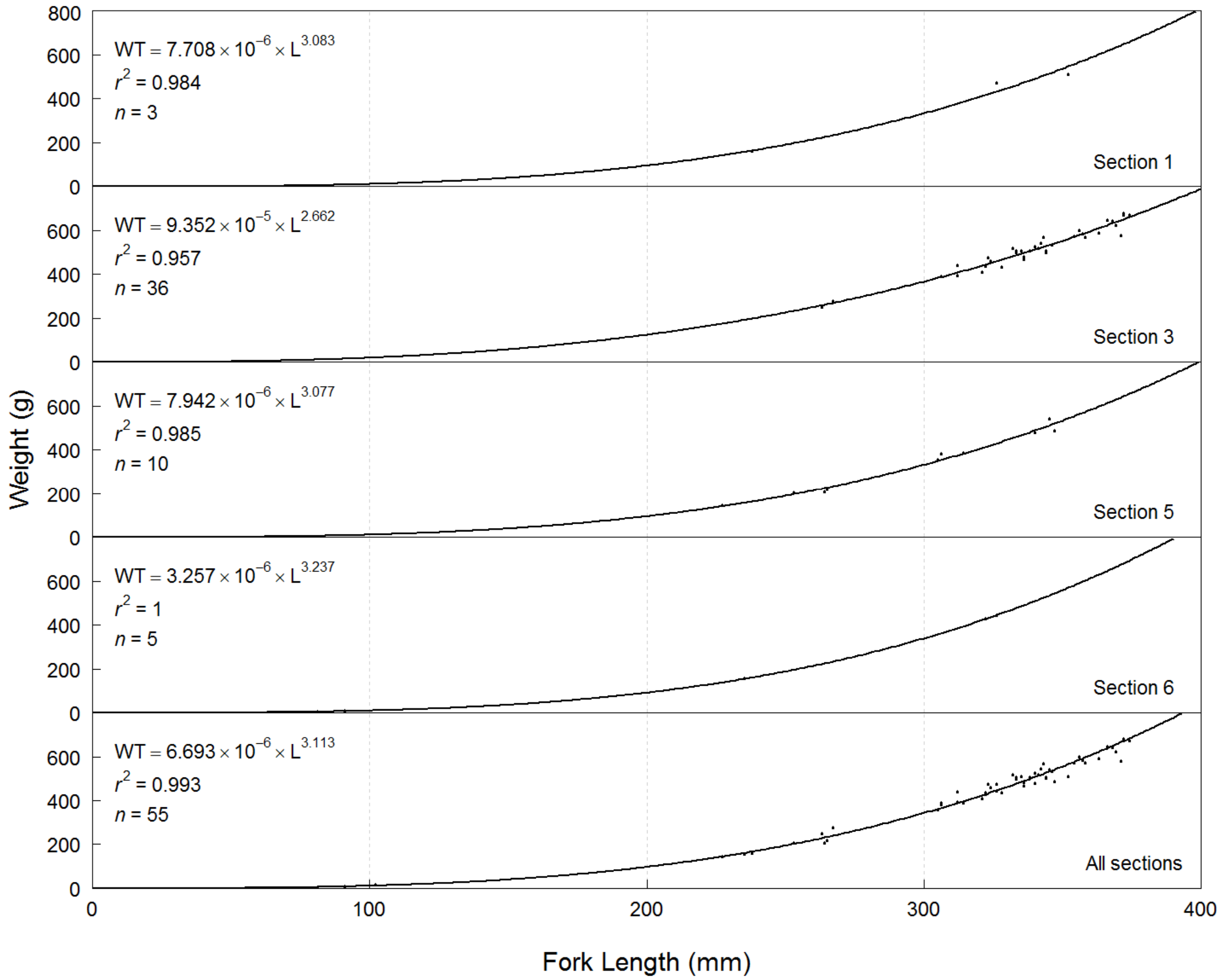

Figure 12: Length-weight regressions for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

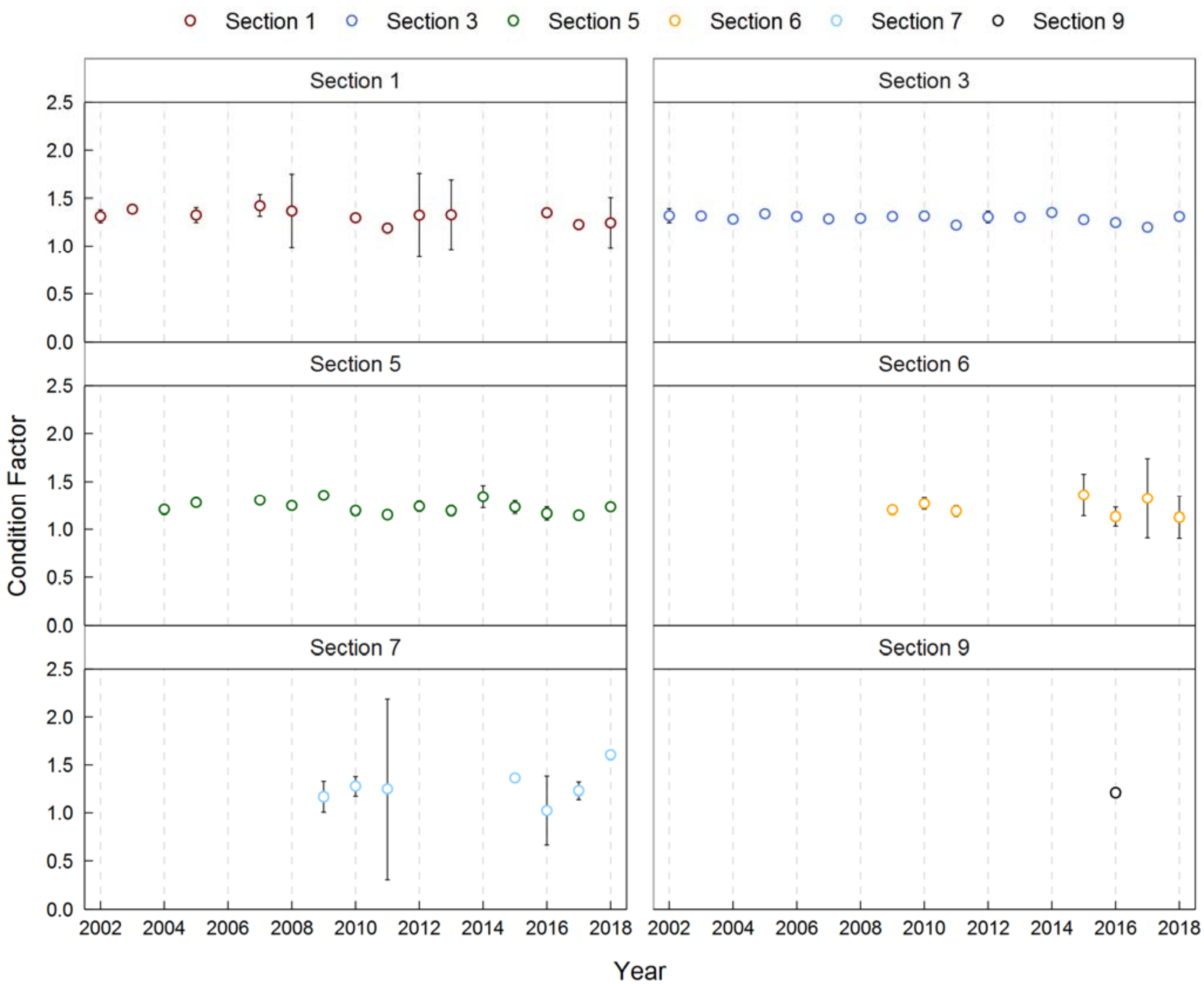

Figure 13: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. For Sections 6 and 7, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

3.3.2 Abundance and Spatial Distribution

A thorough description of the population abundance analysis conducted by W.J. Gazey Research is provided in Appendix G. The text below represents a summary of key findings and conclusions drawn from results provided in Appendix G.

Abundance estimates for Arctic Grayling were generated for Section 3 only, where the mean estimate was 998 individuals with a 95% credible interval of 70 to 3,300 (Table 10). Abundance estimates were not generated for other sections due to the low number of tagged and recaptured individuals. The minimal population estimate indicated that there was 95% probability of at least 160 Arctic Grayling in Section 3 (Appendix G, Figure G10).

For Section 3, the abundance estimate of Arctic Grayling was similar in 2016, 2017, and 2018 but the larger credible interval in 2018 indicated greater uncertainty in the estimate (Figure 14).

Of the 57 Arctic Grayling captured in 2018 (including two recaptures), 84% were captured at sites with physical cover and 5% were captured at sites without physical cover; the remaining 11% were captured from sites where the presence of cover was not assessed by P&E and Gazey (2003). Overall, capture data from all study years combined indicate that Arctic Grayling are common in Sections 3, 5 and 6 and present in small numbers in Sections 1, 7, and 9. No recaptured Arctic Grayling were observed to move between sections in 2018.

Table 10: Population abundance estimates generated using the Bayes sequential model for Arctic Grayling captured by boat electroshocking in Section 3 of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
3	998	250	70	3,300	987	98.9

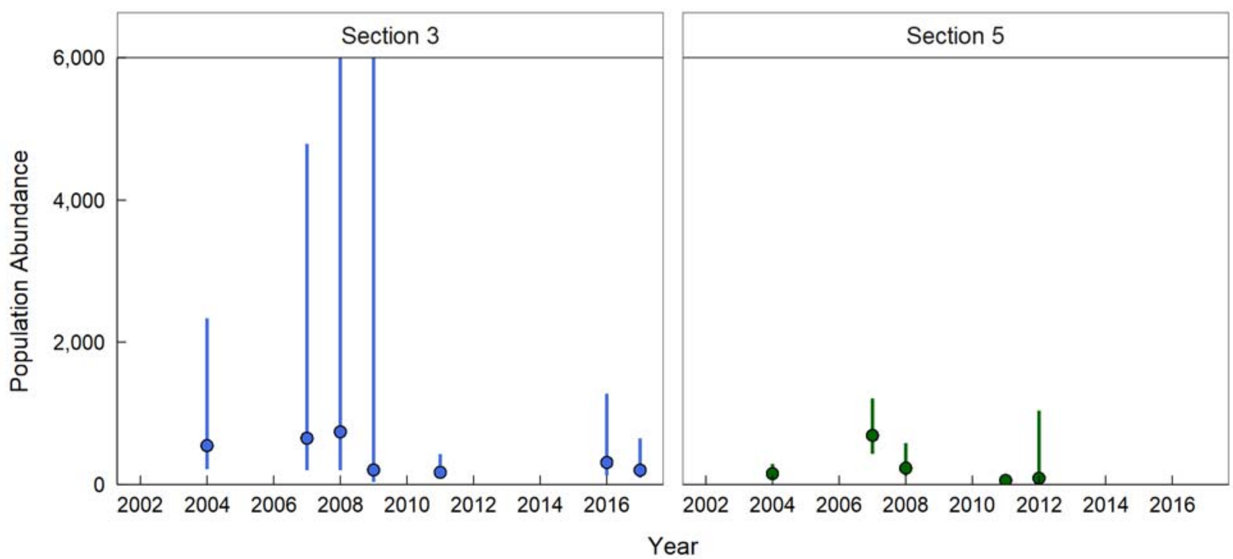

Figure 14: Population abundance estimates (means with 95% credibility intervals) for Arctic Grayling captured by boat electroshocking in Sections 3 and 5 of the Peace River, 2002–2018 (for years with sufficient data to enable population estimates). Vertical bars represent the 95% highest probability density interval.

3.4 Bull Trout

3.4.1 Biological Characteristics

During the 2018 survey, 215 Bull Trout were initially captured (i.e., excluding within-year recaptures; Table 8) and measured for length and weight. Fewer Bull Trout were captured in Sections 7 (*n* = 14) and 9 (*n* = 6) compared to Sections 1, 3, 5, and 6 (*n* = 27–76). Fork lengths ranged between 155 and 927 mm, and weights ranged between 35 and 9930 g. Fin ray samples were analyzed from all captured individuals; ages were successfully assigned to 132 individuals, ranging from age-3 to age-11 (Table 11).

Table 11: Average fork length, weight, and body condition by age for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Age	Fork Length (mm)			Weight (g)			Body Condition (K)		
	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]
3	199 ± 27	155 – 234	8	84 ± 43	35 – 160	7	1.00 ± 0.11	0.91 – 1.25	7
4	289 ± 32	242 – 389	63	252 ± 109	132 – 578	63	0.99 ± 0.09	0.82 – 1.29	63
5	379 ± 37	323 – 472	17	580 ± 238	336 – 1044	17	1.02 ± 0.07	0.91 – 1.18	17
6	442 ± 50	352 – 505	19	932 ± 295	472 – 1522	18	1.05 ± 0.12	0.89 – 1.30	18
7	518 ± 44	439 – 641	14	1528 ± 678	807 – 2692	14	1.03 ± 0.10	0.91 – 1.33	14
8	671 ± 70	488 – 845	5	3086 ± 1603	1438 – 5273	4	1.18 ± 0.10	1.07 – 1.29	4
9	552 ± 145	513 – 604	3	1900 ± 531	1338 – 2394	3	1.11 ± 0.14	0.99 – 1.26	3
10	609 ± 47	575 – 642	2	2072 ± 465	1743 – 2401	2	0.91 ± 0.01	0.91 – 0.92	2
11	720	-	1	4381	-	1	1.17	-	1

[a] Number of individuals sampled.

Length-frequency histograms suggest similar size distributions between sections in the study area (Figure 15). Approximately half of the Bull Trout captured (51%) were between 200 and 400 mm FL, which is consistent with historical results (Appendix F, Figures F7 and F8) and indicative of the use of the area by subadults during the study period. Only seven Bull Trout less than or equal to 200 mm FL were captured in 2018. Smaller Bull Trout (i.e., less than approximately 200 mm FL) rear in select Peace River tributaries (Mainstream 2012) and are less common in the mainstem. Fish larger than 500 mm FL represented 24% of the Bull Trout catch, which indicates that adult Bull Trout are also present in study area during the late summer to fall. However, during the study period, large, sexually mature Bull Trout are less abundant than subadults in the Peace River mainstem because many adults are spawning in tributaries (mainly in the Halfway River watershed; Mainstream 2012). Some of the adult Bull Trout captured during the 2018 survey appeared to be in post-spawning condition.

Age-frequency histograms indicated that age-4 is the most common age-class of Bull Trout captured (Figure 16). Most juvenile Bull Trout do not enter the Peace River mainstem until age-3 or age-4 after rearing in Peace River tributaries (Golder 2018). The age-3 Bull Trout captured during the 2018 survey were large enough (between 155 and 234 mm FL; *n* = 8) to be effectively sampled by the boat electroshocker, indicating that this age-class is not being missed by the sampling gear but is present in low numbers. Age distributions did not differ substantially by section, with most of the available age-classes being present in most sections and habitats during the 2018 survey.

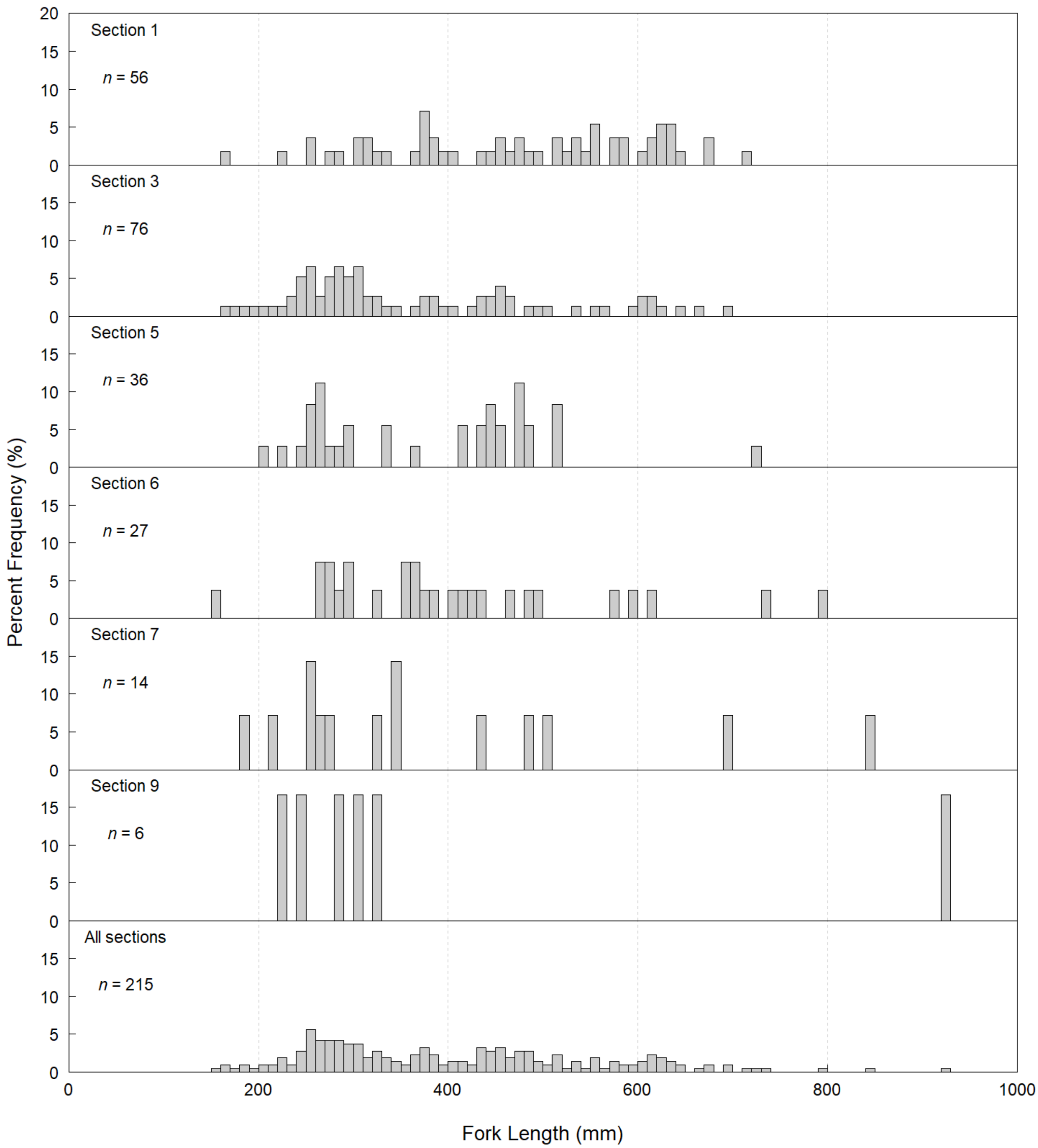

Figure 15: Length-frequency distributions for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

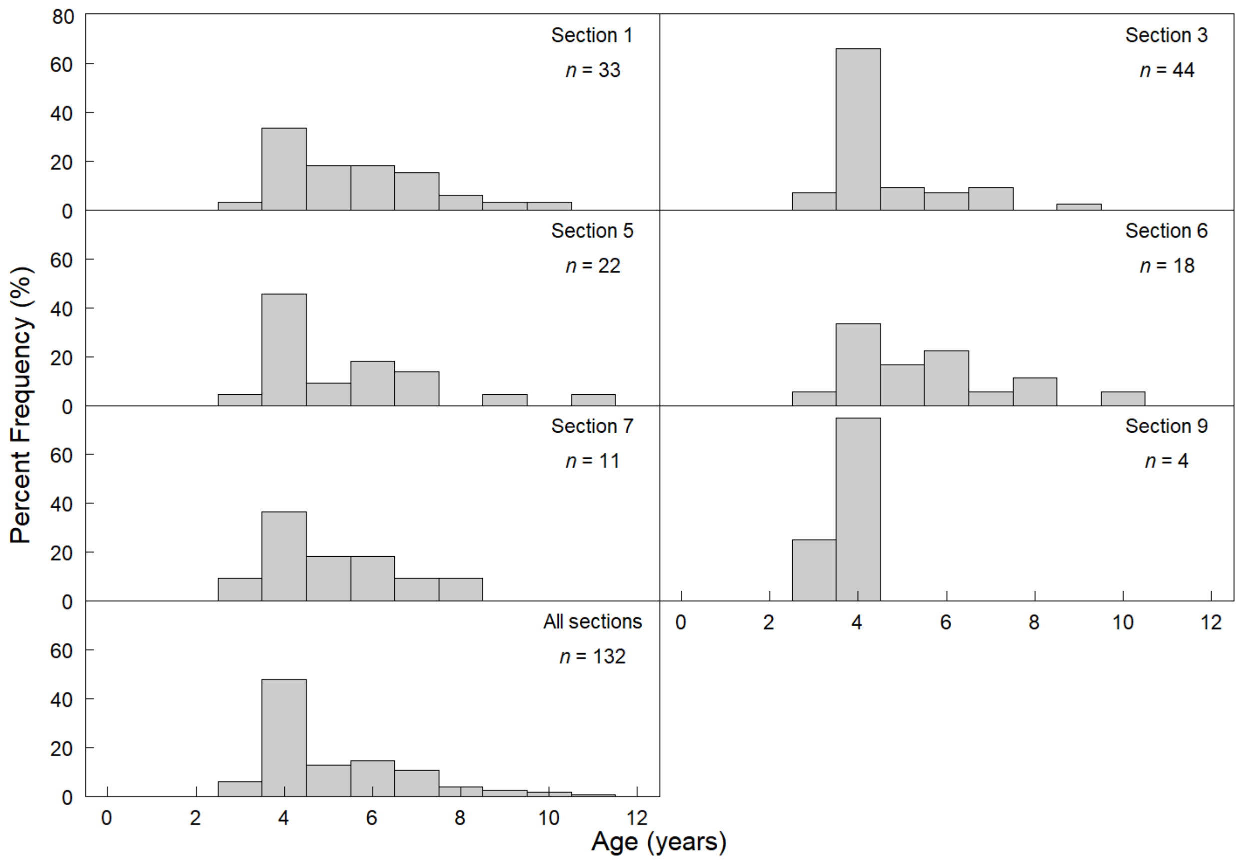

Figure 16: Age-frequency distributions for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

The absence of distinct modes in length-frequency histograms (Figure 15; Appendix F, Figures F7 and F8) suggests that Bull Trout grow slowly after migrating into the Peace River from their natal streams. Slow growth of Bull Trout in the study area is supported by average length-at-age (Table 11) and von Bertalanffy growth analyses (Figure 17). In 2018, there was little difference in growth among sections (Figure 17). Bull Trout growth among years was not compared for the reasons detailed in Section 2.1.5.

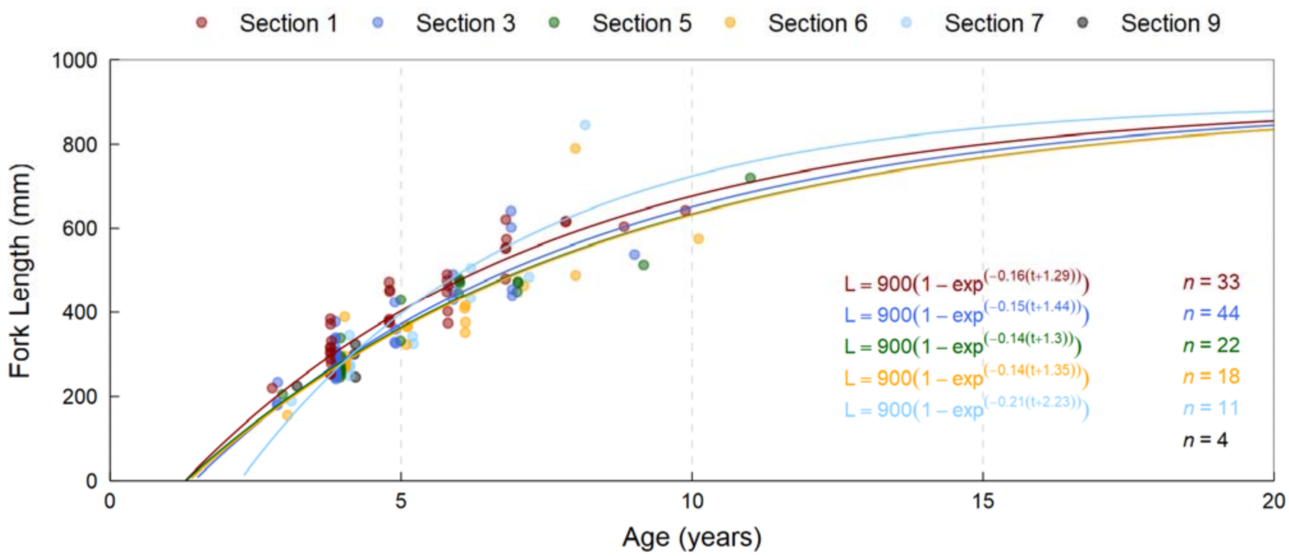

Figure 17: von Bertalanffy growth curve for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Mean body condition (*K*) increased from 2002 to 2010, particularly in Sections 1, 3, and 5 (Figure 18). In general, body condition was lower between 2015 and 2018 than during earlier years of the program. For instance, in Section 3, mean body condition ranged from 1.01 to 1.09 between 2002 and 2014, and between 0.97 and 1.02 between 2015 and 2018. In 2018, mean body condition increased slightly, after several years of lower or declining estimates in 2015 to 2017 (Sections 1 to 6). Mean body condition in Sections 7 and 9 have been variable over the last four years (i.e., since these sections were added to the program in 2015). During most study years, body condition estimates were greater for Section 1 (approximately 1.05 to 1.15) than the other sections (approximately 0.95 to 1.07).

In 2018, length-weight regressions were similar to historical study years (Appendix F, Figure F9); however, results were not statistically tested in 2018. Golder and Gazey (2018) conducted statistical comparisons on data collected between 2002 and 2017. The results also suggested similar length-weight relationships between sections (Figure 19).

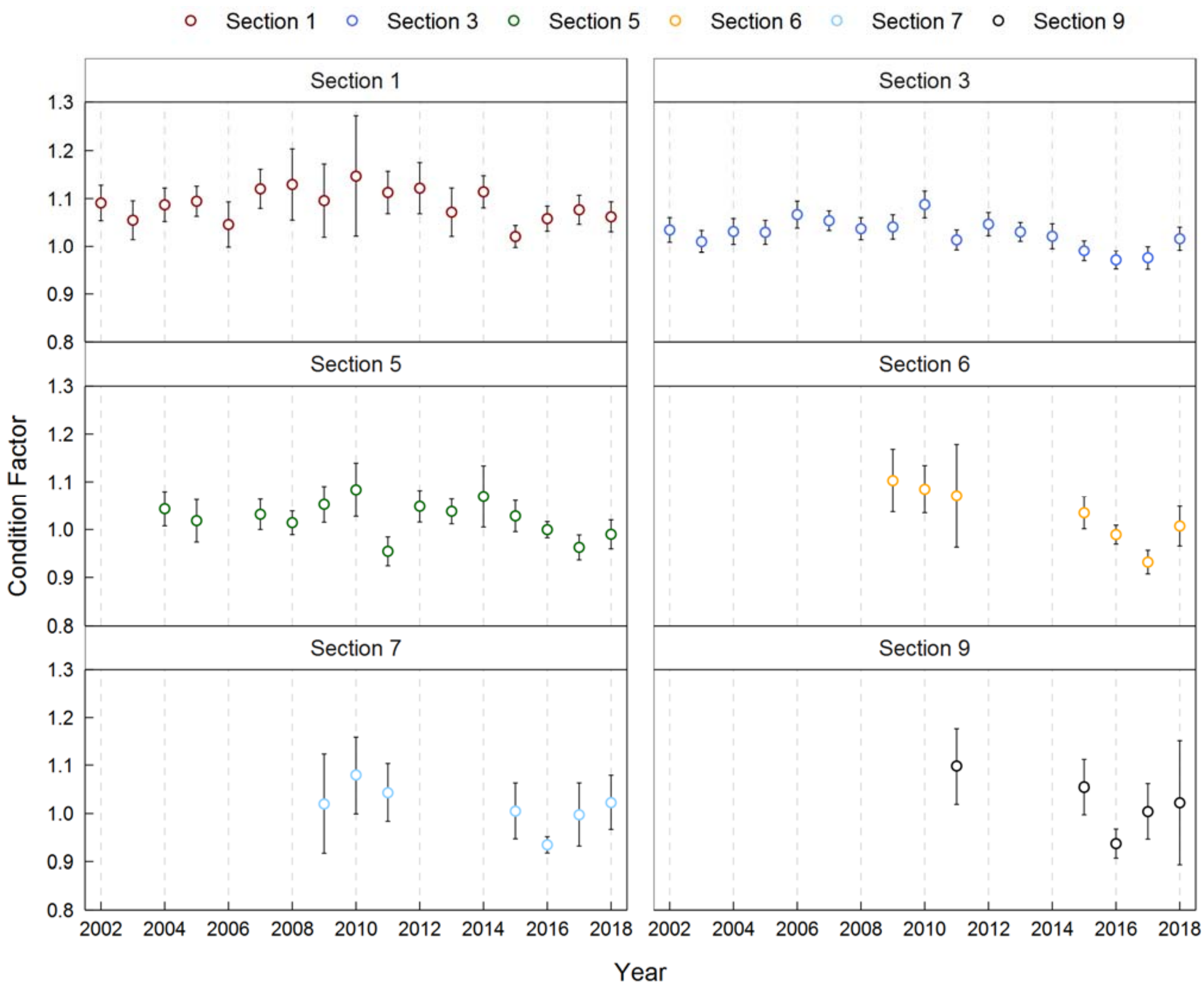

Figure 18: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. For Sections 6, 7, and 9, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

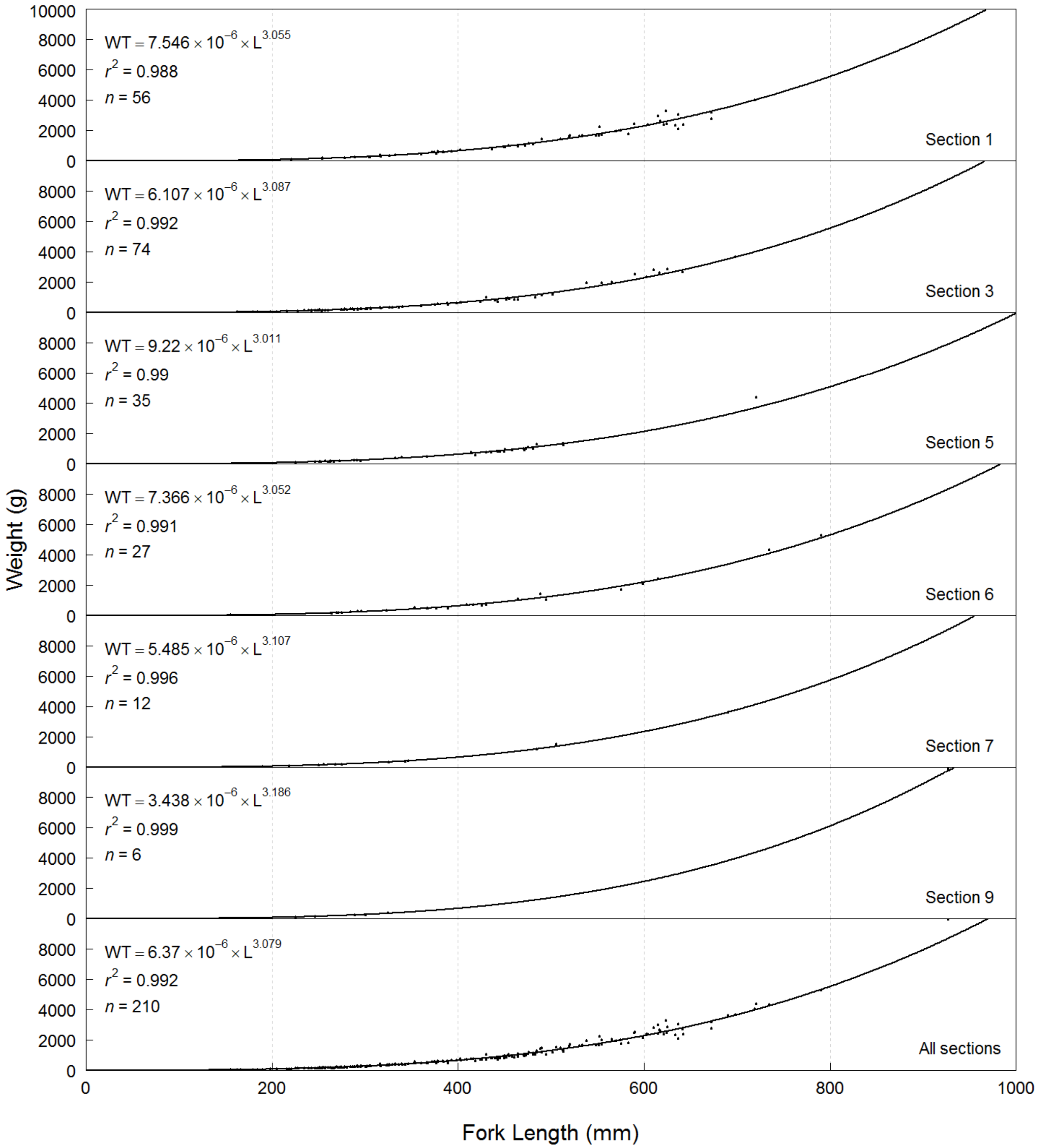

Figure 19: Length-weight regressions for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

3.4.2 Abundance and Spatial Distribution

A thorough description of the population abundance analysis conducted by W.J. Gazey Research is provided in Appendix G. The text below represents a summary of key findings and conclusions drawn from results provided in Appendix G.

In 2018, abundance estimates of Bull Trout were possible for Sections 3 and 5 but not for the other sections (Table 12). The estimate (mean with 95% credible interval) was greater in Section 3 (253 fish; 113–440 fish) than Section 5 (128 fish; 38–275 fish). There were 21 within-year recaptures of Bull Trout in 2018. One fish released in Section 5 was recaptured in Section 6. All other recaptures were located in the same section as their initial capture.

Table 12: Population abundance estimates generated using the Bayes sequential model for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
3	253	201	113	440	95	37.4
5	128	80	38	275	79	61.9
Total	381		139	623	123	32.4

In 2018, the Section 3 abundance estimate (253 fish; 113–440 fish) was lower than 2017 (621 fish; 208–1,239 fish) but similar to other study years such as 2016, 2014, and 2013 (point estimates of between 224 and 237 fish; Figure 20). In Section 5, the abundance estimate in 2018 (128 fish; 38–275 fish) was lower than in 2015 to 2017 (point estimates of 142 to 206 fish) but greater than 2014 (59 fish; 19–123 fish), although credible intervals overlapped for all of these years. In Section 1, a population estimate could not be calculated in 2018 but abundance estimates ranged from 240 to 734 Bull Trout in other years. In 2015, Bull Trout abundance in Section 6 was substantially higher when compared to Sections 7 and 9 (Figure 20). This pattern of distribution was not evident in other years.

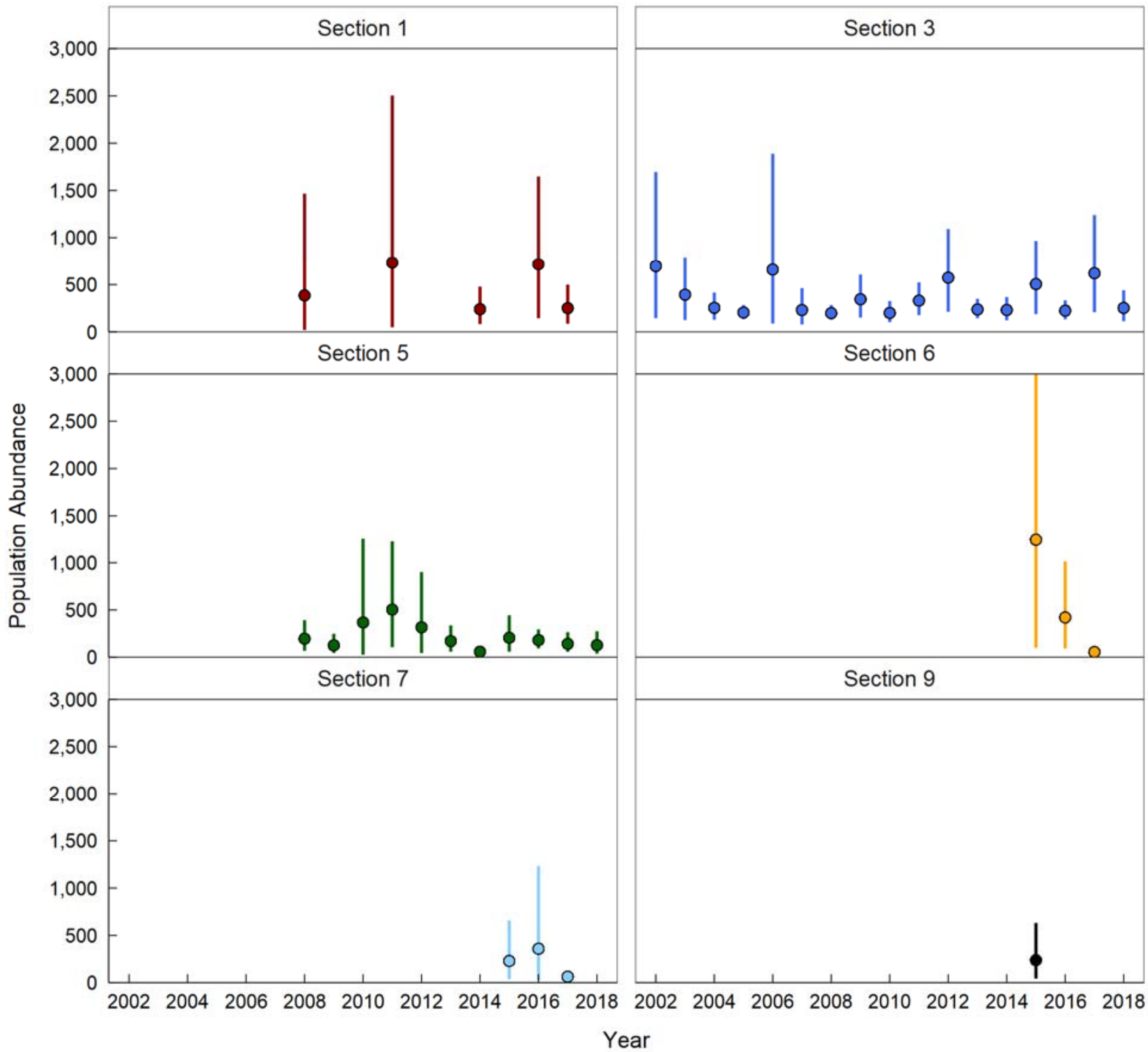

Figure 20: Population abundance estimates (means with 95% credibility intervals) generated using the Bayes sequential model for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 2002–2018.

3.5 Burbot

In 2018, 13 Burbot were captured and an additional ten Burbot were observed but not captured.
Overall encounters (i.e., captured plus observed fish) in 2018 (*n* = 23) were the second highest on record, after the 2016 study year (*n* = 60). The number of Burbot encountered was 10 or less in all other years. Burbot are a cool-water species (Mainstream 2012) and were encountered in Section 5 (*n* = 9), Section 6 (n = 9), Section 7 (*n* = 3), and Section 9 (*n* = 2) in 2018. Low catches in years before 2015 were likely related to limited sampling in Sections 6 to 9. Total lengths ranged between 82 and 601 mm, and weights ranged between 4 and 889 g.

Ageing structures were not collected from Burbot. Three Burbot captured in 2018 were less than 100 mm FL and were likely age-0 based on growth rates in other systems (e.g., Bailey 2011; Bonar et al. 2000).

The small number of age-0 Burbot encountered (<100 mm; Figure 21) and the variable catch rates between years suggest that the area is primarily used by subadults and adults during the study period and that densities may vary with habitat conditions. Average secchi depth across all sections and sessions combined was lower in 2016 (64 cm) when compared other years between 2014 and 2018 (104 to 139 cm; Attachment A). Thefore, greater Burbot catch in 2016 than in other years could have been due to greater catchability due to high water clarity, or greater abundance of Burbot in the study area, or both.

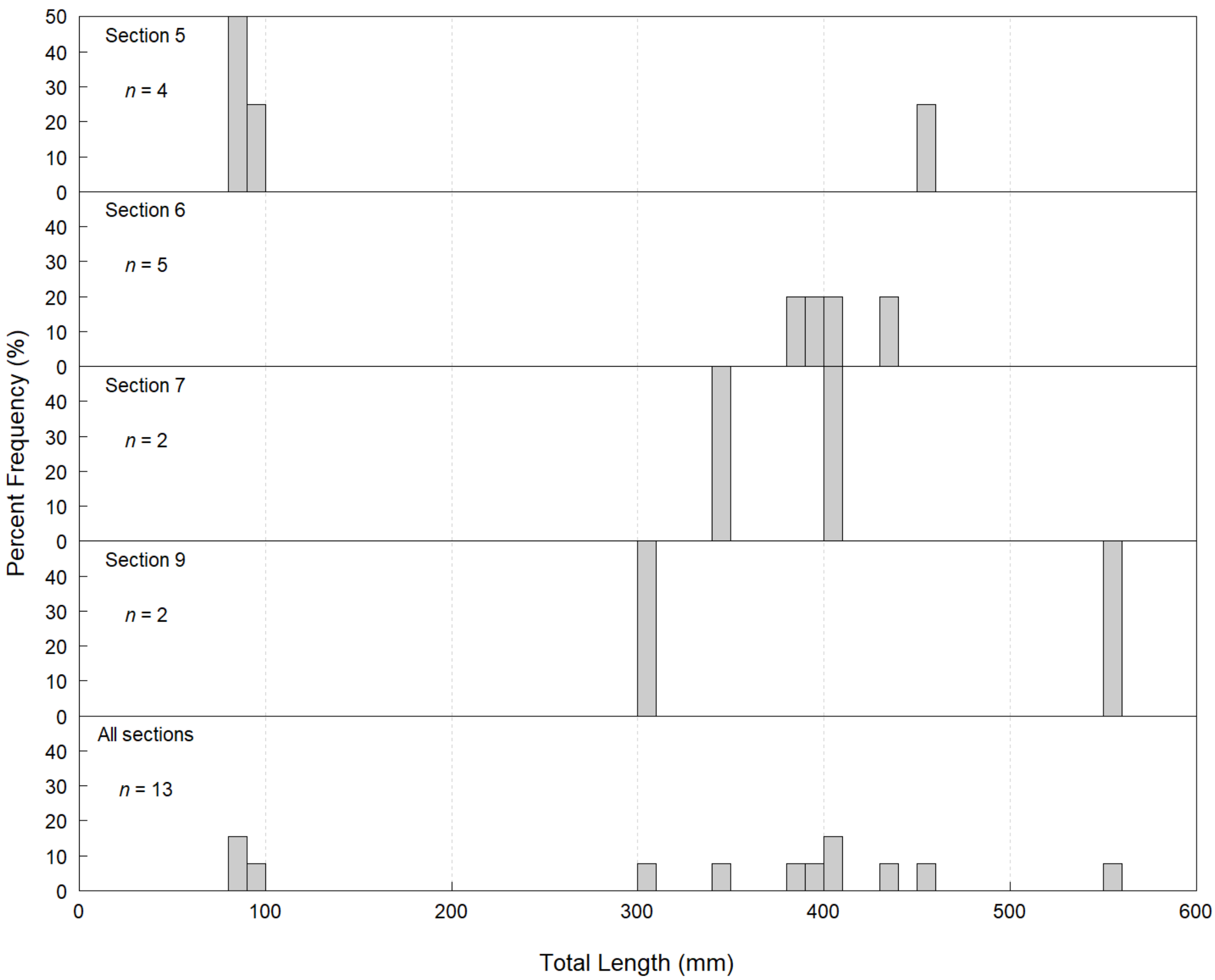

Figure 21: Length-frequency distributions for Burbot captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

All of the Burbot captured during the 2018 survey except for the age-0 fish were implanted with PIT tags; none were subsequently recaptured. Population abundance estimates were not generated for Burbot due to the low number of tagged and recaptured fish. Burbot catch rates varied substantially between 2015 and 2018.

3.6 Goldeye

Goldeye were not captured during the 2018 Indexing Survey (27 August to 10 October); however, one adult Goldeye was observed but not captured in Section 6 at the 06PIN01 site on 28 August 2018. Historically, Goldeye are typically only present in downstream sections of the study area (i.e., downstream of Section 3).

Two Goldeye were captured during the spring/summer Goldeye and Walleye Survey (Table 13). One was captured near the mouth of the Beatton River (Site 07BEA01) on 17 July 2019 and one was captured near the mouth of the Pouce Coupe River (Site 08POC01) on 19 July 2019. Both Goldeye were adults (375 mm and 385 mm). Only one fish was successfully aged (age-11). Secchi depths of less than 50 cm during the survey indicated good visibility for observing and netting fish at the time of sampling. The data suggest that Goldeye are present in small numbers in the downstream portion of the study are in June and July, as has been shown in the fall of previous study years. Additional results from the Goldeye and Walleye survey are provided in Section 3.14.

Table 13: Fork length, weight, body condition, and age of Goldeye captured by boat electroshocking during the Goldeye and Walleye survey, 15–16 June and 17–19 July 2018.

Section	Fork Length (mm)	Weight (g)	Body Condition (*K*)	Age
7	375	642	1.22	11
8	385	623	1.09	n/a

3.7 Largescale Sucker

3.7.1 Biological Characteristics

During the 2018 survey, 867 Largescale Sucker were initially captured (i.e., excluding within-year recaptures; Table 8). Of these 867 fish, 789 were measured for length and weight. Fork lengths ranged between 89 and 592 mm, and weights ranged between 10 and 2453 g.

Length-frequency histograms for Largescale Sucker suggest some differences in length distribution among sections (Figure 22). Small fish (i.e., 100–400 mm FL) comprised the greatest percentage of the catch in Sections 3 and 9, whereas large fish (i.e., 400–600 mm FL) were the greatest percentage of the catch in Sections 1 and 5. This finding is consistent with 2015 to 2017 study results (Golder and Gazey 2016–2018).

In 2018, the length-weight relationship for Largescale Sucker (Figure 23) was similar to historical study years (Appendix F, Figures F23); however, results were not statistically compared in 2018. Statistical results from 2017 (Golder and Gazey 2018) showed significant differences in length-weight regression slopes between some years, but did not suggest any consistent or sustained trends over time.

Mean body condition (K) in 2018 was near the long-term average in Sections 1 and 3 and declined from 2015 to 2018 in Sections 5, 6 and 7 (Figure 24). For example, mean body condition declined from 1.34 in 2015 to 1.23 in 2018. As was observed for some other species, the mean body condition of Largescale Sucker was greater in Section 1 (K = 1.31) than all other sections downstream (K = 1.22 to 1.26).

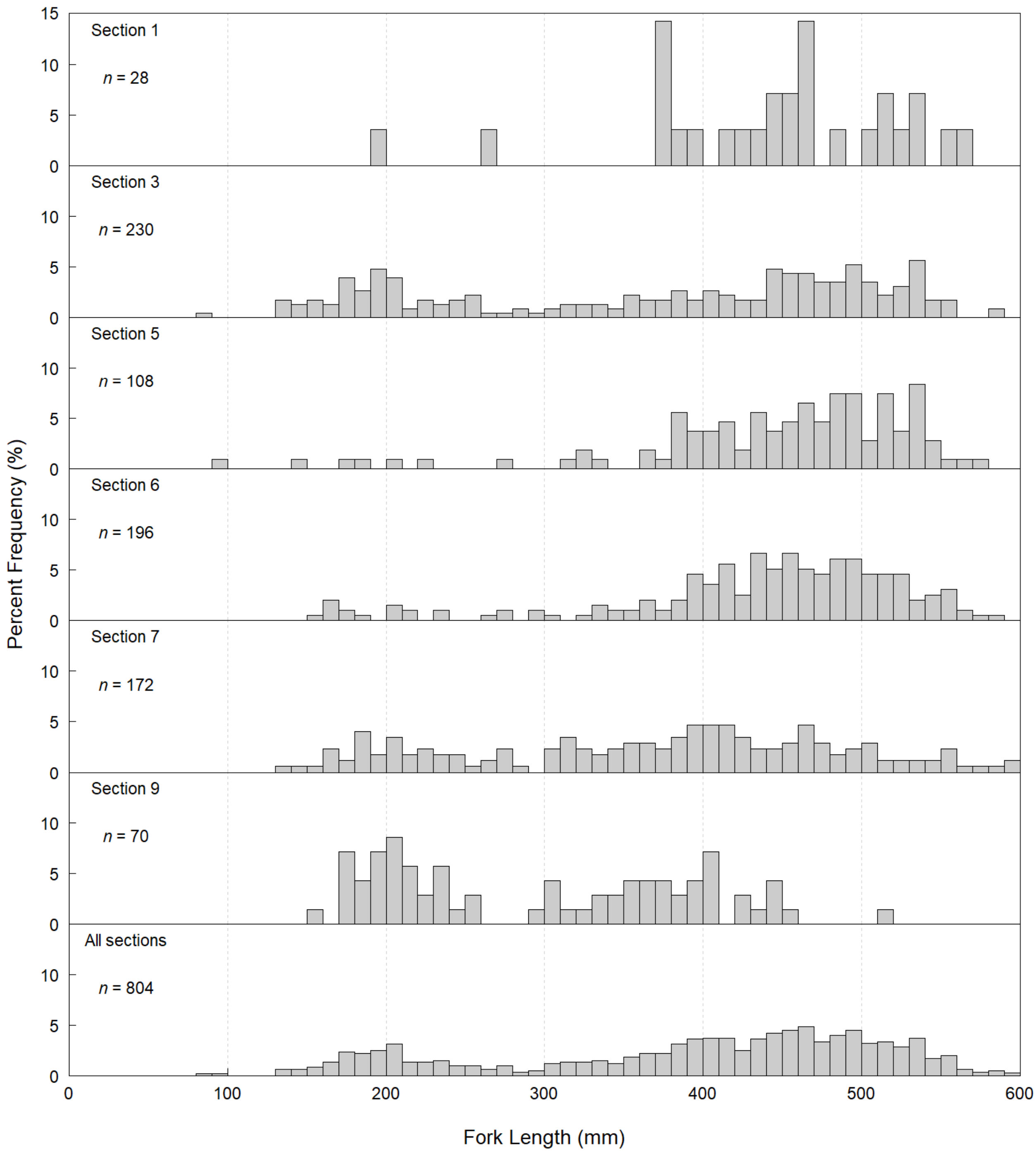

Figure 22: Length-frequency distributions for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

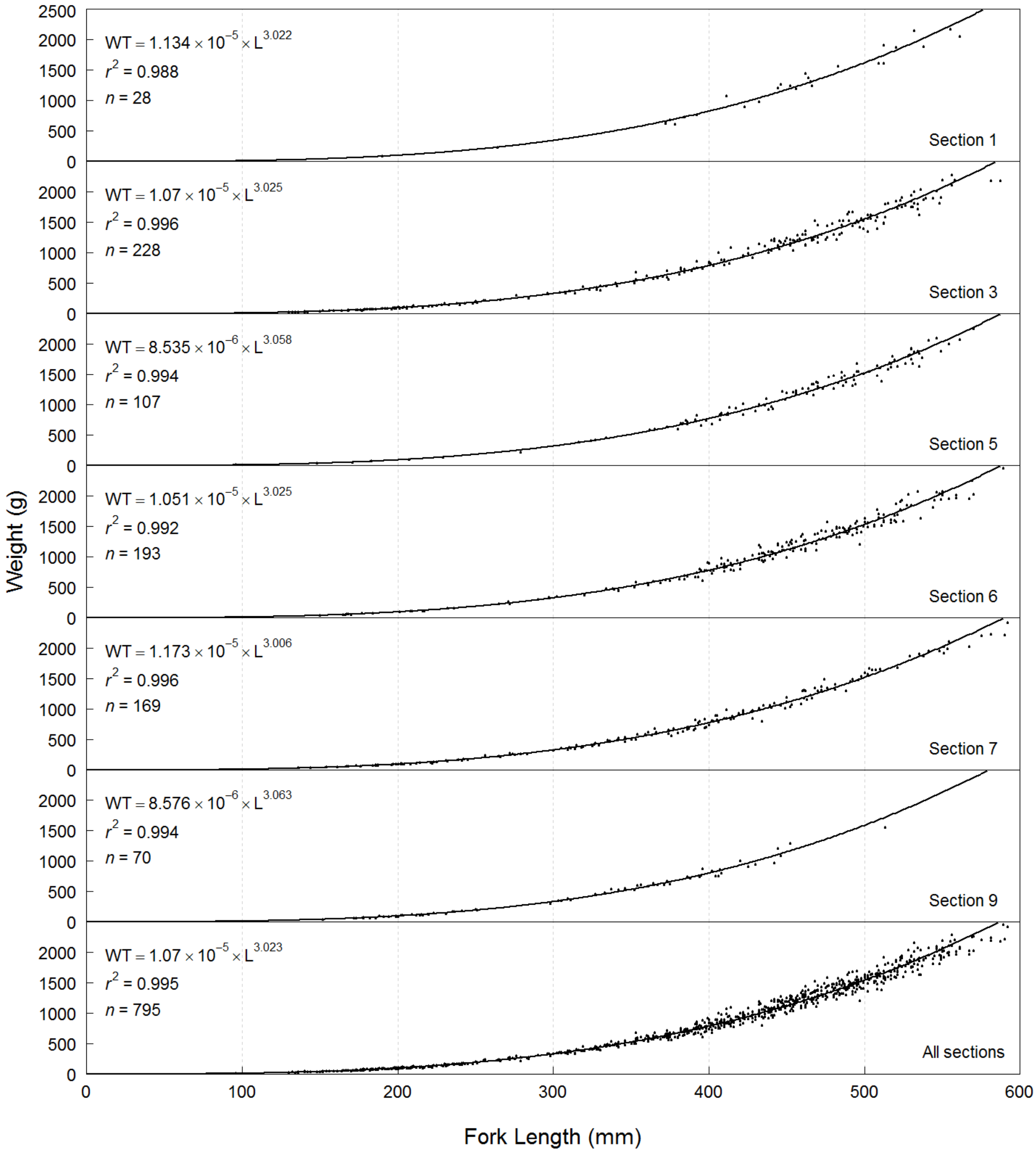

Figure 23: Length-weight regressions for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

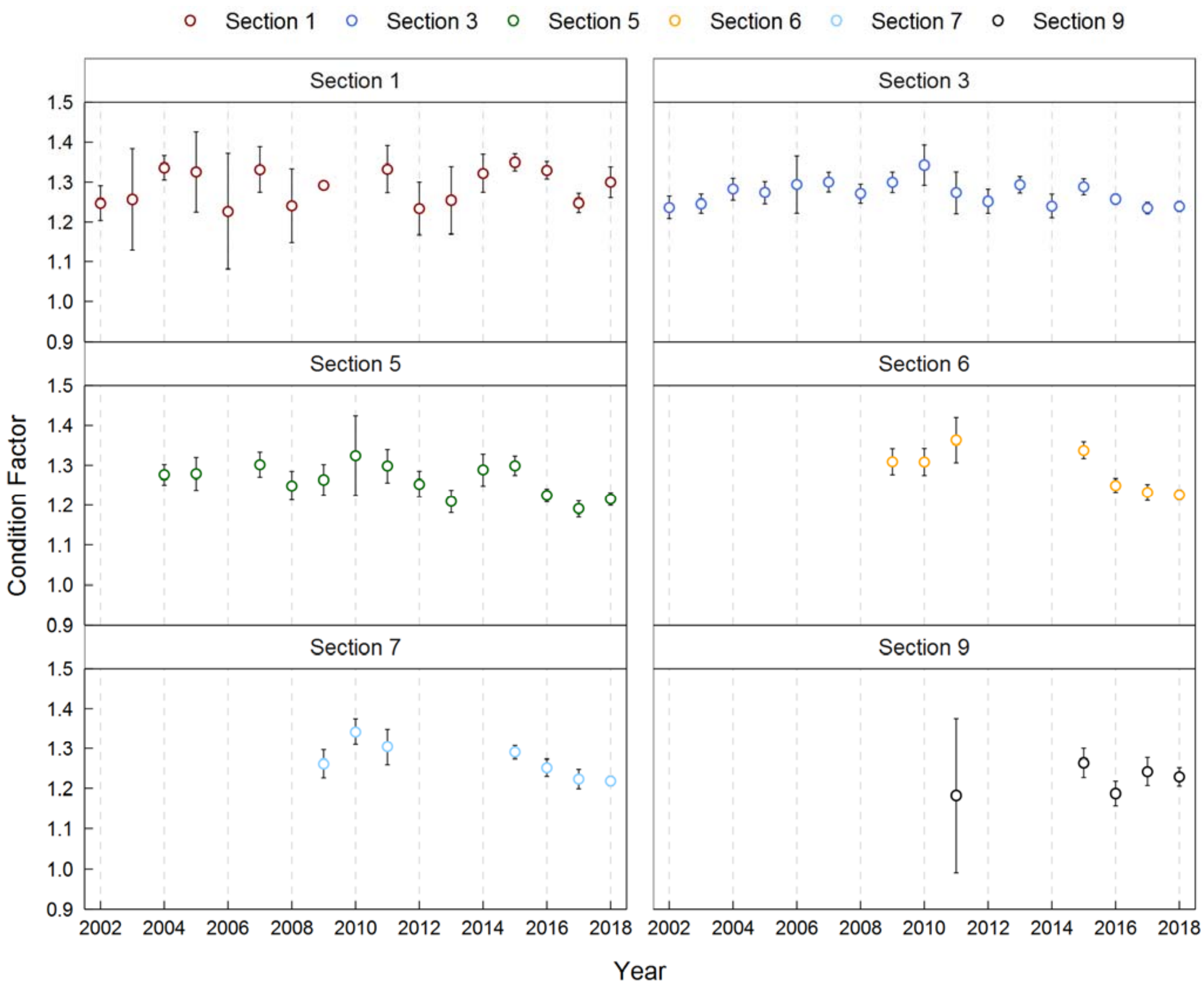

Figure 24: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. For Sections 6, 7, and 9, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

3.7.2 Abundance and Spatial Distribution

Low numbers of recaptures of Largescale Sucker in 2018 in Section 1 (n = 0), Section 5 (n = 2), and Section 9 (n = 3) prevented the calculation of population abundance estimates for these sections. The abundance estimate (mean with 95% credible interval) was similar in Section 3 (5,738 fish; 1,750–11,750 fish) and Section 6 (4,695 fish; 1,425–9,625 fish) but lower in Section 7 (713 fish; 375–1,125 fish; Table 14). Mean population estimates were greater in 2017–2018 than in 2015–2016 in Sections 3 and 6 (Figure 25). In contrast, abundance estimates decreased from 2015 to 2018 in Section 7. Abundance estimates were not available for years prior to 2015 because this species was not marked prior to 2015. Only 1 of the 37 Largescale Sucker captured twice in 2018 was recaptured in a different section than it was initially tagged and released.

Table 14: Population abundance estimates generated using the Bayes sequential model for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
3	5,738	3,875	1,750	11,750	3,076	53.6
6	4,695	3,150	1,425	9,625	2,577	54.9
7	713	625	375	1,125	198	27.8
Total	11,146		3,271	19,021	4,018	36.0

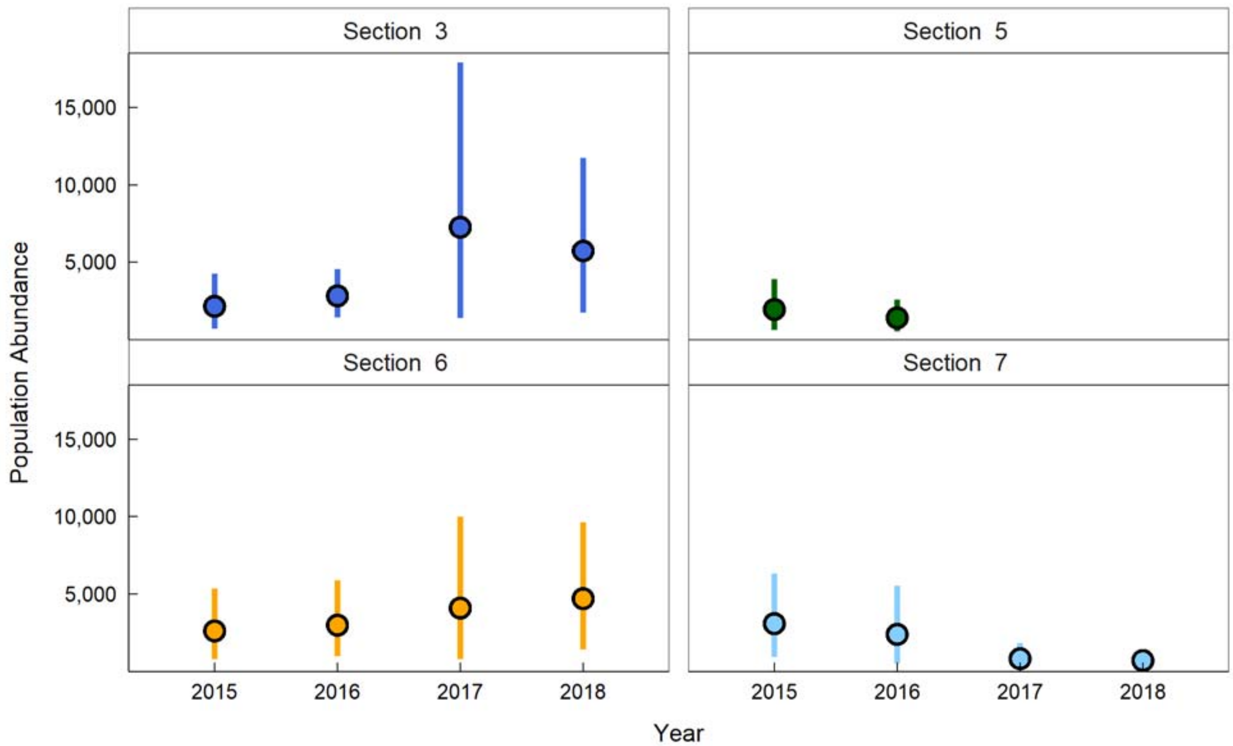

Figure 25: Population abundance estimates (with 95% credibility intervals) generated using the Bayes sequential model for Largescale Sucker captured by boat electroshocking in Sections 3, 5, 6, and 7 of the Peace River, 2015–2018.

3.8 Longnose Sucker

3.8.1 Biological Characteristics

During the 2018 survey, 3,464 Longnose Sucker were initially captured (i.e., excluding within-year recaptures; Table 8). Of these 3,464 fish, 3,202 were measured for length and weight. Fork lengths ranged between 58 and 549 mm, and weights ranged between 4 and 1870 g.

For Longnose Sucker, a lack of distinct modes in length-frequency histograms for most sections suggest that the sample comprised multiple age-classes with overlapping length distributions (Figure 26). Most captured Longnose Sucker were between 350 and 450 mm FL in all sections in 2018, a result consistent with previous study years (Appendix F, Figure F20). The full range of fork lengths from 60 to 500 mm were present in all sections, suggesting that all age classes were present throughout the study area. As in previous years, Section 9 had a slightly greater percentage of small (i.e., less than 250 mm FL) Longnose Sucker compared to other sections (e.g., Sections 1 and 5) that had a greater percentage of large Longnose Sucker (Figure 26).

There was no consistent trend over time in the body condition of Longnose Sucker (Figure 27). Similar to the trend observed in Largescale Sucker (Figure 24), there was declining condition in Longnose Sucker with increasing distance downstream of PCD, with higher condition recorded in Section 1 (K = 1.26 in 2018) and lower condition recorded in Section 9 (K = 1.21 in 2018). The lower condition in Section 9 may be partially related to fish size, as small suckers, which are more abundant in Section 9, typically have lower condition values than larger individuals. Fulton's condition factor assumes isometric growth (i.e., no changes in shape with increasing size) and if fish become more rotund with increasing length (i.e., positive allometry and values of b greater than 3.0 in the weight-length relationship), then condition factor increases with increasing length (Blackwell et al. 2000).

In 2018, the length-weight relationship for Longnose Sucker (Figure 28) was similar to historical study years (Appendix F, Figures F21); however, statistical comparisons were not conducted in 2018. Statistical comparisons conducted in 2017 (Golder and Gazey 2018) showed significant differences in length-weight regression slopes between some years; however, the results did not suggest any consistent or sustained trends over time.
There were differences in the length-weight relationship among sections, with Sections 1 and 3 having greater slope values (b parameter) than sections further downstream (Figure 28), suggesting that Longnose Sucker increased in weight with increasing length at a faster rate in Sections 1 and 3 compared to other sections.

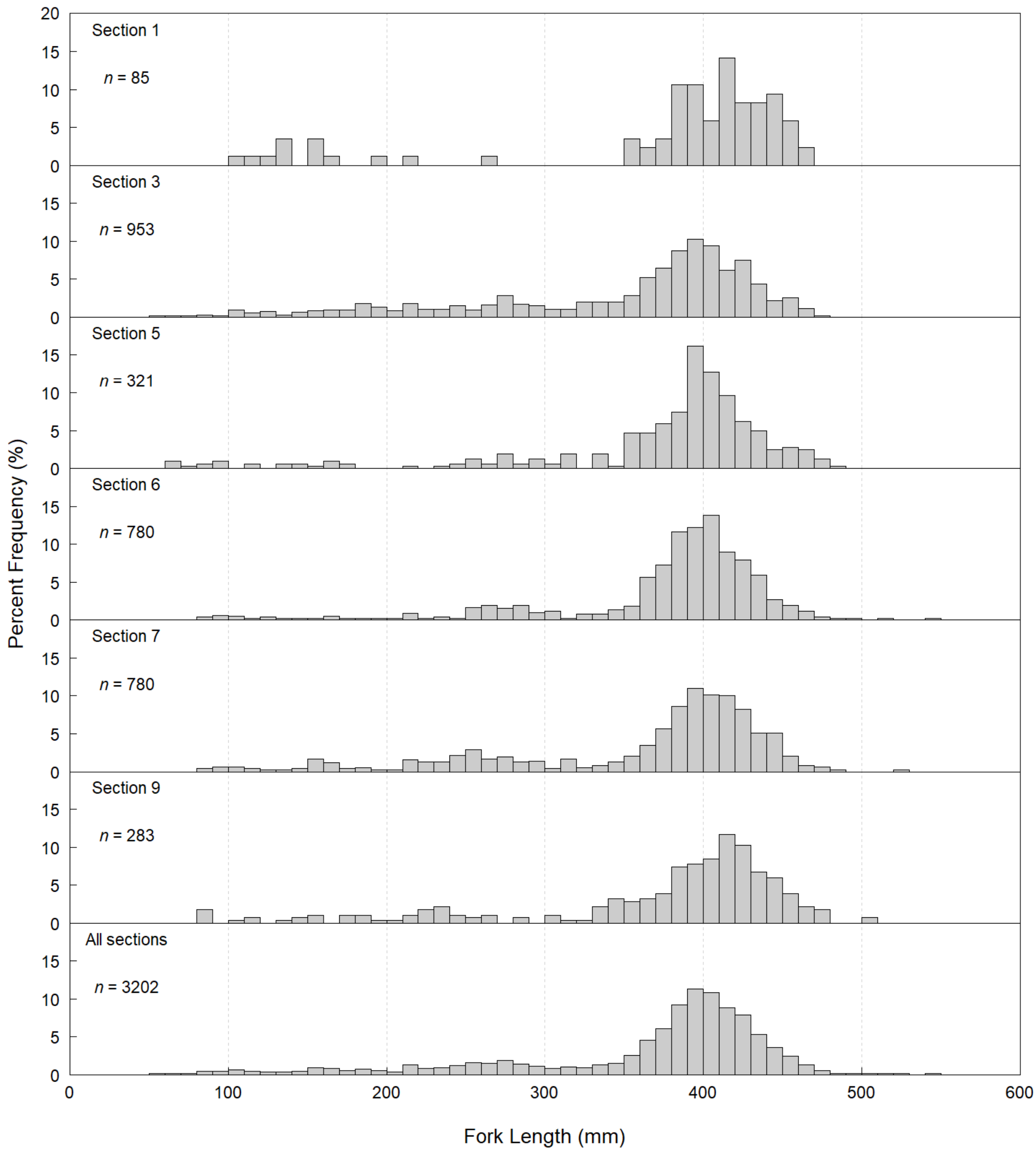

Figure 26: Length-frequency distributions for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

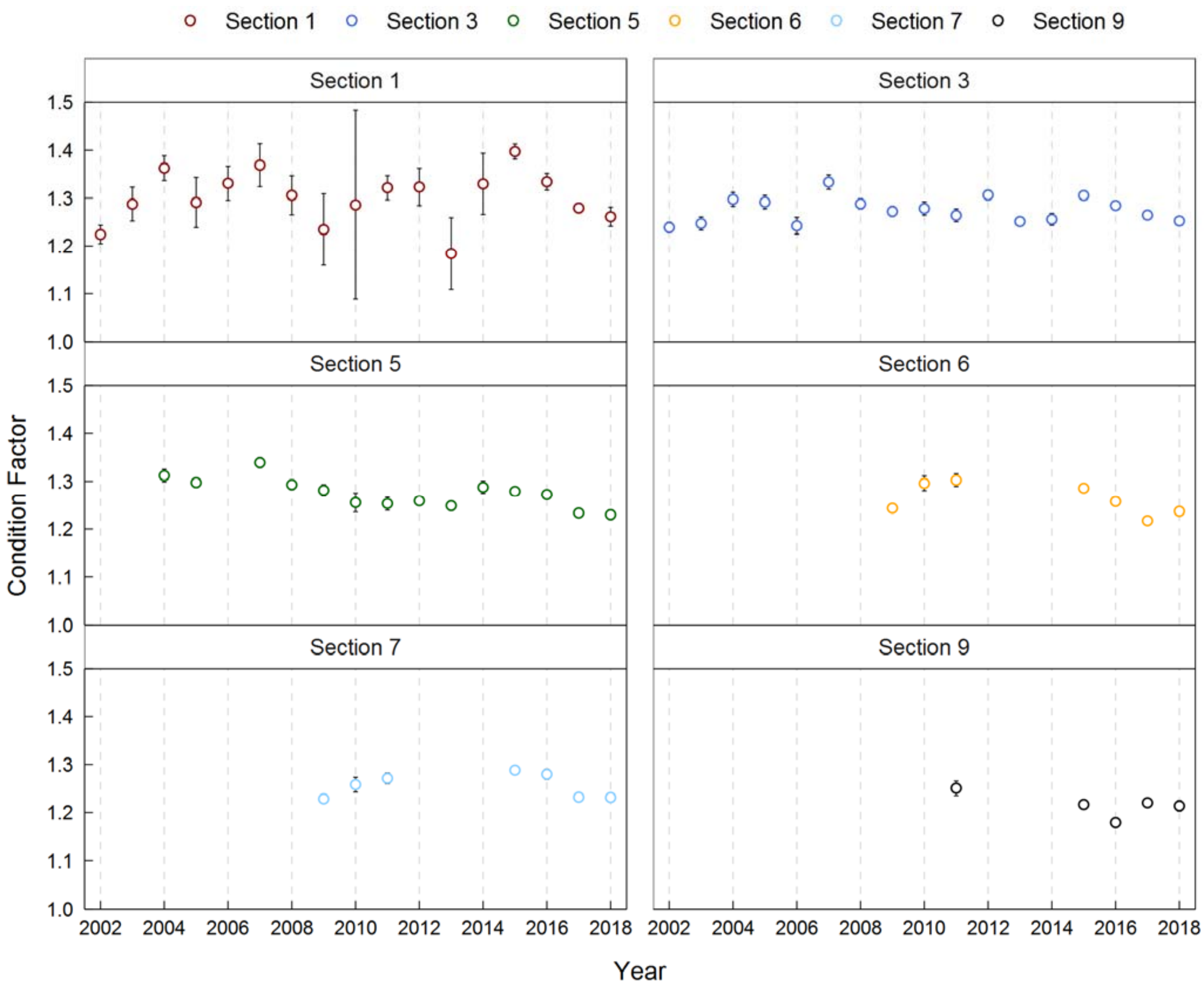

Figure 27: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2017. For Sections 6, 7, and 9, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

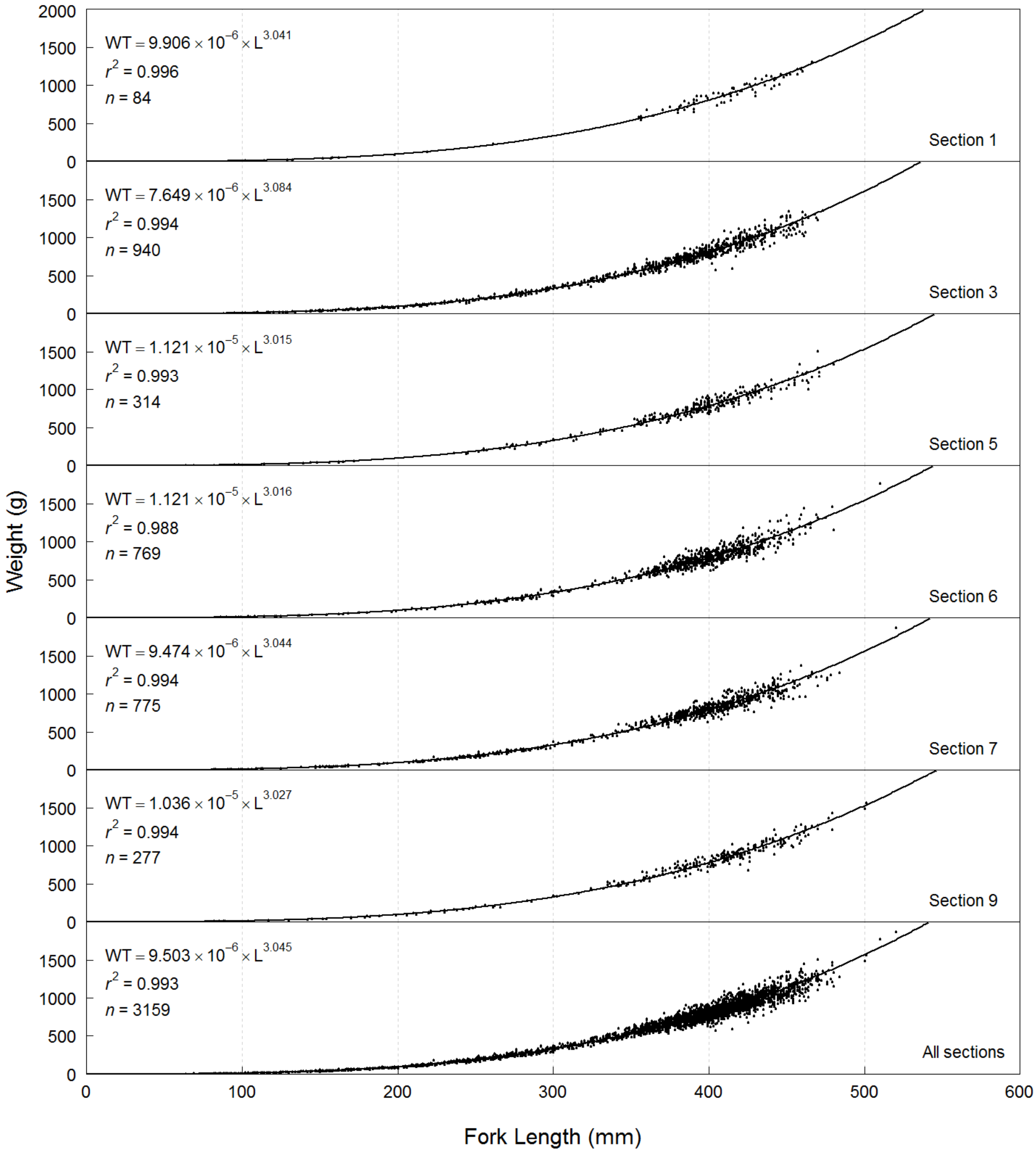

Figure 28: Length-weight regressions for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

3.8.2 Abundance and Spatial Distribution

In 2018, abundance estimates of Longnose Sucker were possible for Sections 3, 6, and 7 but not for Sections 1, 5, and 9 (Table 15). The abundance estimates (mean with 95% credible interval) were similar in Section 3 (13,959 fish; 7,830–21,280 fish) and Section 6 (13,264 fish; 8,760–18,360 fish) and greater in Section 7 (17,091 fish; 9,880–25,650 fish).

Population abundance estimates for Longnose Sucker are available from 2015 to 2018 but not from prior years because this species was not marked before 2015. Estimates suggested declining abundance between 2015 and 2017 in Section 9, with too few recaptures to estimate abundance in 2018. In Section 3, the mean population estimate in 2018 (approximately 14,000 fish) was greater than previous years (all less than 10,000 fish), although the credible intervals for these estimates overlapped. Abundance estimates in Sections 1, 5, 6 and 7 did not suggest any sustained trends between 2015 and 2018. Of the Longnose Sucker captured more than once in 2018, 12% (11 of 95 individuals) were recaptured in a different section than where they were initially tagged and released. All of these individuals moved downstream between recaptures.

Table 15: Population abundance estimates generated using the Bayes sequential model for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
3	13,959	12,350	7,830	21,280	3,630	26.0
6	13,264	12,370	8,760	18,360	2,537	19.1
7	17,091	15,290	9,880	25,650	4,174	24.4
Total	**44,314**		**32,387**	**56,241**	**6,085**	**13.7**

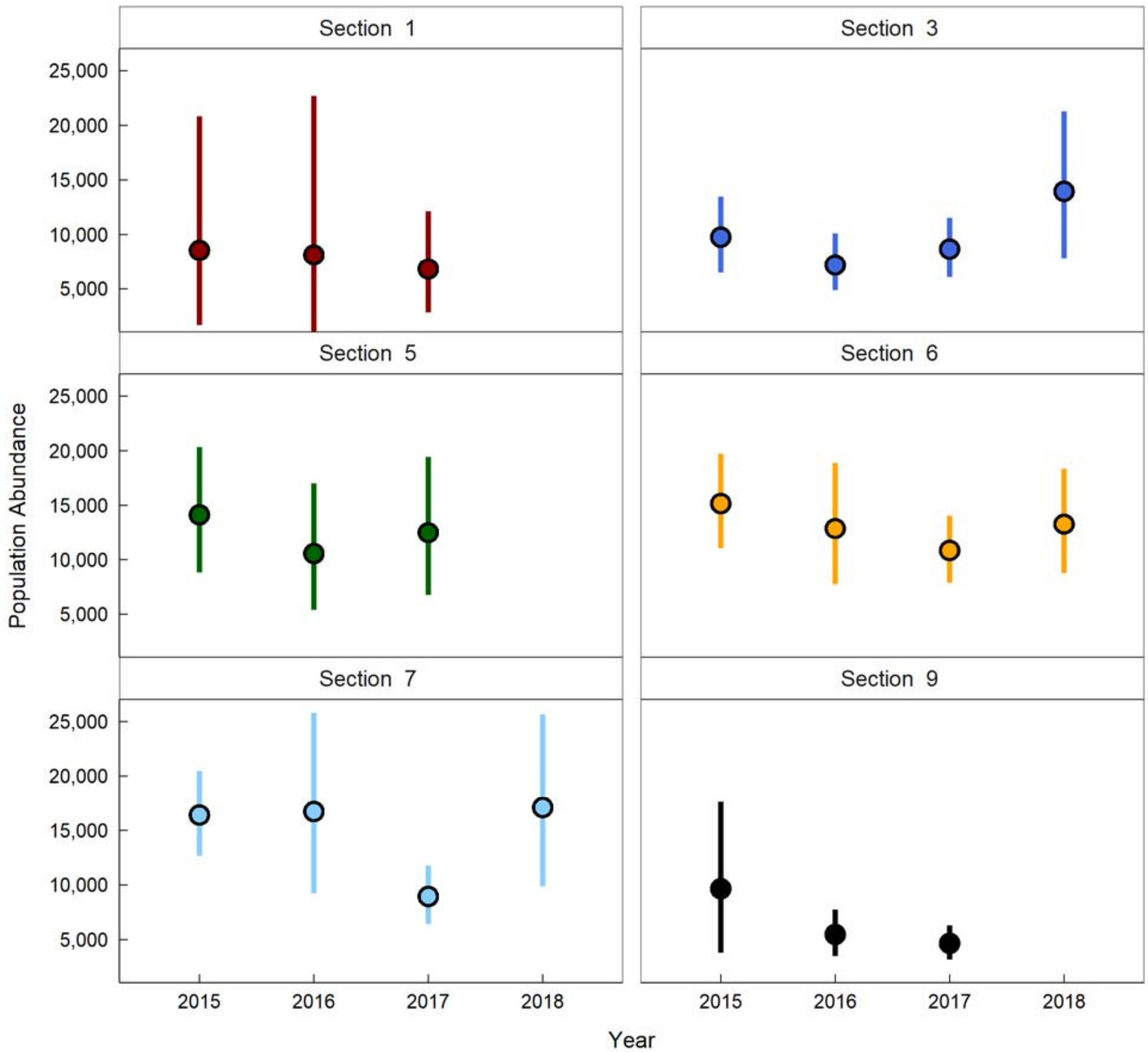

Figure 29: Population abundance estimates (with 95% credibility intervals) generated using the Bayes sequential model for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 2015–2018.

3.9 Mountain Whitefish

3.9.1 Biological Characteristics

During the 2018 survey, 11,319 Mountain Whitefish were initially captured (i.e., excluding within-year recaptures) and 9,340 of these were measured for length and weight. Fork lengths ranged between 61 and 505 mm FL, and weights ranged between 3 and 1460 g. Scale samples were analyzed from 685 individuals; ages ranged between age-0 and age-12. Length, weight, and body condition by age-class are summarized in Table 16.

For Mountain Whitefish, the length-frequency histogram (Figure 30) showed discrete modes for age-0 (70-110 mm FL) and age-1 (150–200 mm FL) age-classes. All older age-classes appeared to have overlapping length distributions. Based on these and similar data from previous study years, growth slows considerably after approximately age-3 for this species, most likely due to fish reaching sexual maturity. In 2018, Sections 3 and 7 had the greatest percentage of age-0 Mountain Whitefish, although this age-class was present in all sections. The length-frequency of each age class captured in upstream (Sections 1, 3, 5) and downstream (Sections 6, 7, and 9) sections of the study area overlapped and were essentially identical (Figure 31). Overall, low numbers of age-0 Mountain Whitefish were captured in 2018 (Figure 31), which was consistent with previous study years (Appendix F, Figures F13 and F14) and likely due to age-0 Mountain Whitefish being too small to fully recruit to the boat electroshocker (Mainstream and Gazey 2014; Golder et al. 2016a, 2016b). In 2018, approximately 8% of the Mountain Whitefish captured were age-1. In most years, age-1 individuals comprised a small percentage of the Mountain Whitefish catch (less than 10%), although a greater percentage age-1 fish were encountered in some study years, such as 2014 (23% of catch) and 2015 (20% of catch; Appendix F, Figures F13 and F14).

Table 16: Average fork length, weight, and body condition by age for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Age	Fork Length (mm)			Weight (g)			Body Condition (K)		
	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]
0	88 ± 9	67 – 100	21	7 ± 2	4 – 12	19	1.07 ± 0.21	0.79 – 1.37	19
1	169 ± 9	149 – 189	49	51 ± 9	36 – 75	46	1.06 ± 0.11	0.81 – 1.25	46
2	209 ± 8	188 – 223	43	100 ± 14	68 – 130	43	1.10 ± 0.10	0.86 – 1.26	43
3	258 ± 18	222 – 305	136	203 ± 47	105 – 349	135	1.16 ± 0.10	0.94 – 1.45	135
4	280 ± 22	228 – 334	177	252 ± 58	116 – 400	177	1.14 ± 0.10	0.87 – 1.47	177
5	308 ± 22	262 – 353	87	318 ± 59	201 – 460	87	1.08 ± 0.10	0.73 – 1.29	87
6	332 ± 21	291 – 382	75	389 ± 75	263 – 616	75	1.05 ± 0.11	0.81 – 1.34	75
7	340 ± 29	298 – 402	52	431 ± 111	281 – 728	52	1.08 ± 0.12	0.85 – 1.38	52
8	372 ± 26	323 – 434	30	509 ± 112	333 – 768	29	0.98 ± 0.11	0.77 – 1.18	29
9	380 ± 15	364 – 402	7	555 ± 99	452 – 688	7	1.00 ± 0.07	0.91 – 1.10	7
10	426 ± 19	400 – 453	5	835 ± 114	739 – 1028	5	1.08 ± 0.09	0.95 – 1.20	5
11	412 ± 3	410 – 414	2	719	-	1	1.01	-	1
12	439	-	1	812	-	1	0.96	-	1

[a] Number of individuals sampled.

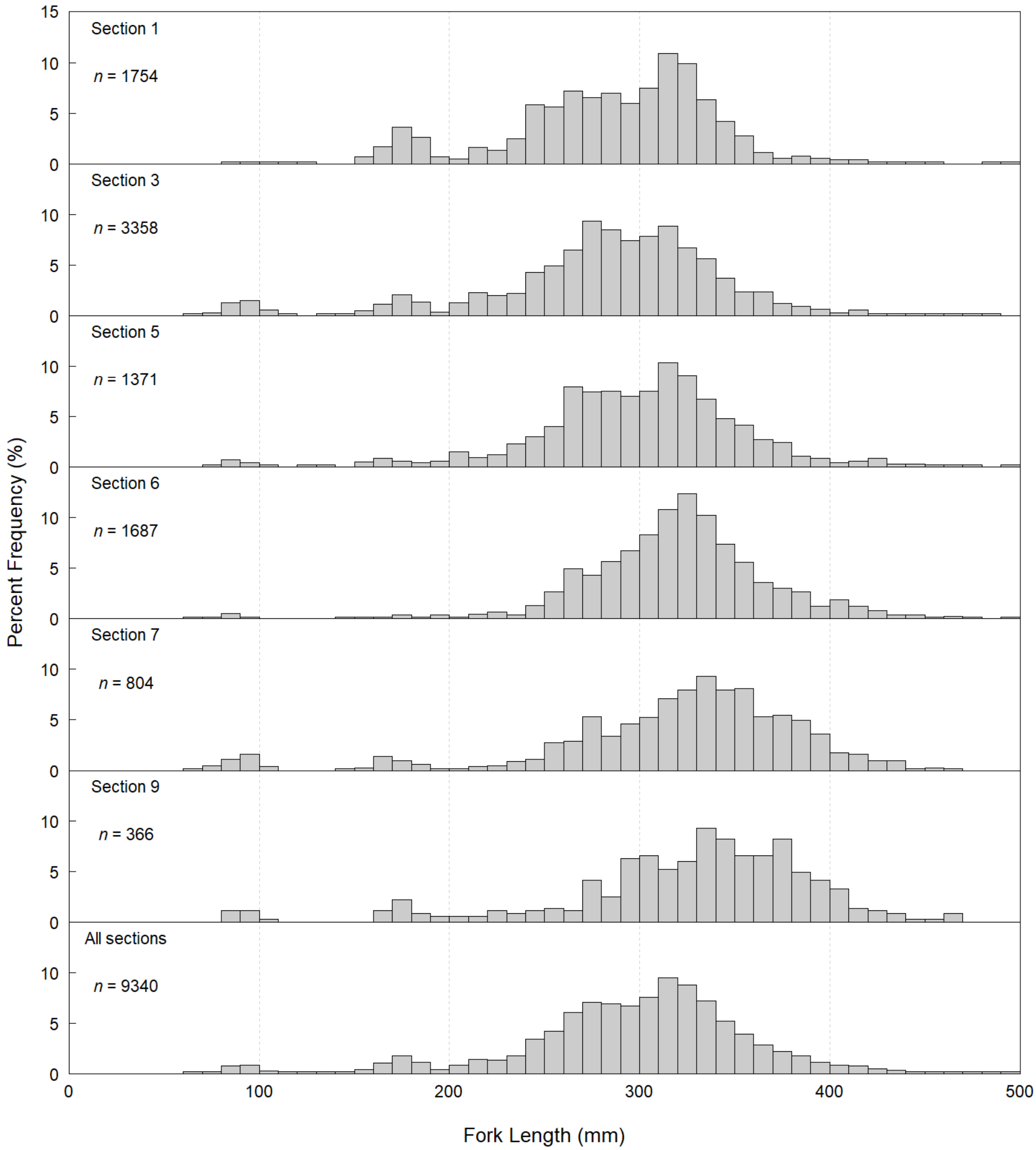

Figure 30: Length-frequency distributions for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

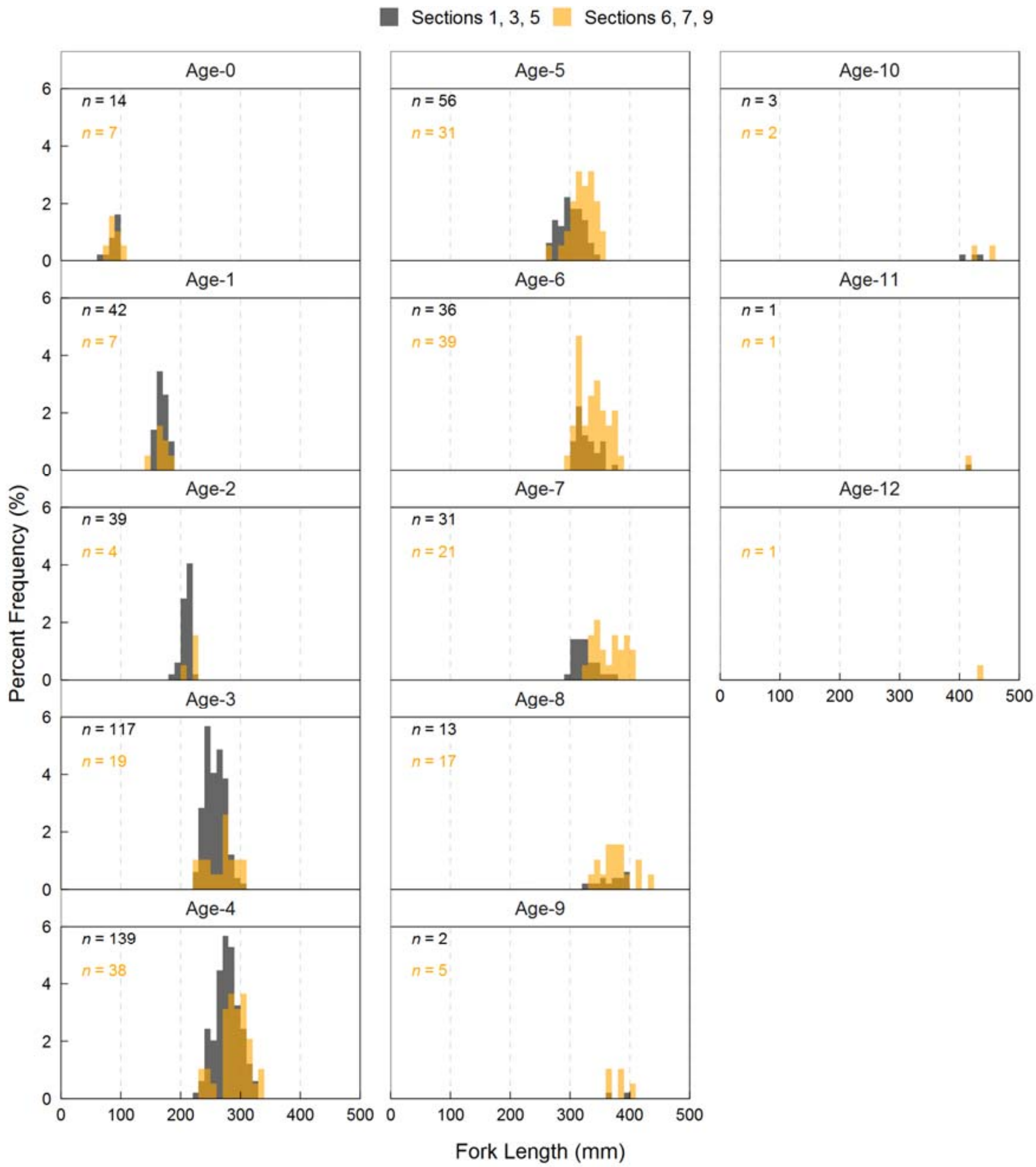

Figure 31: Length-at-age frequency distributions for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

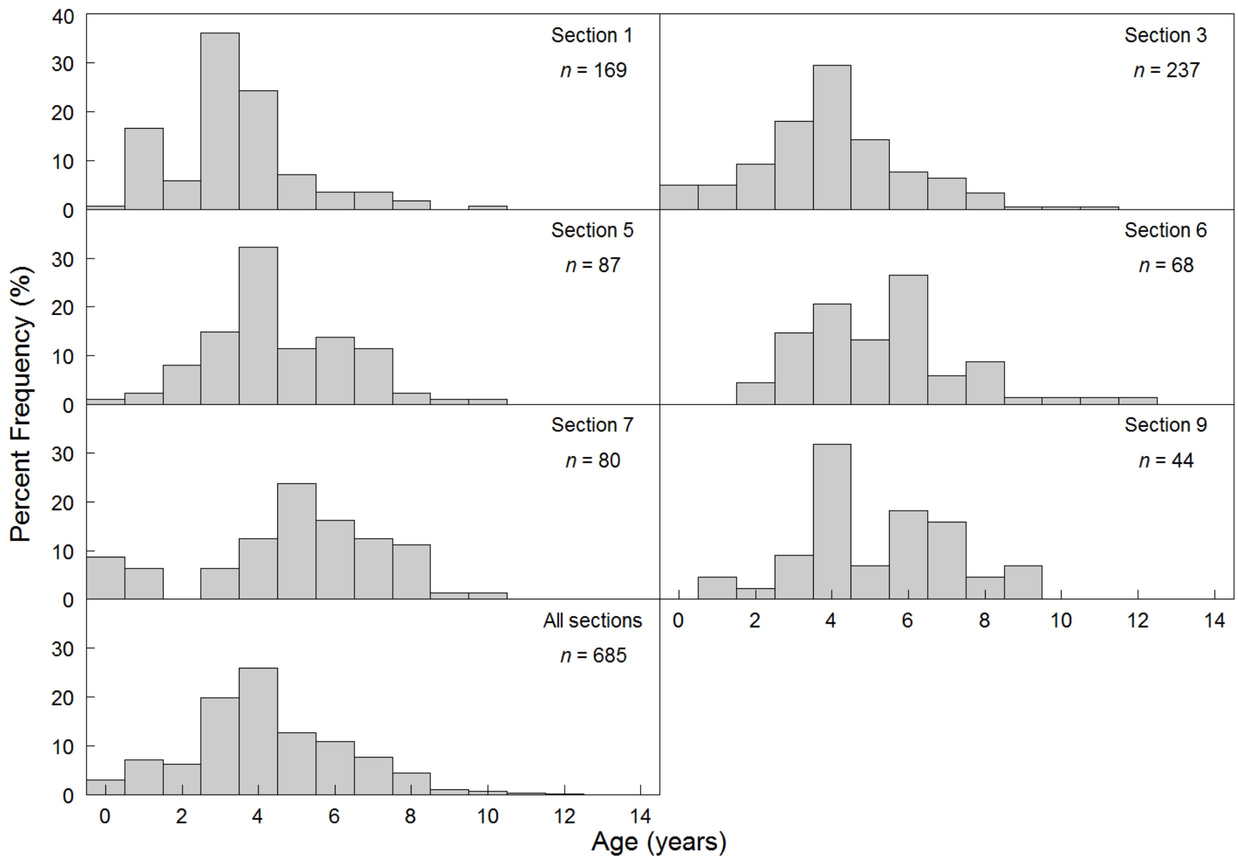

Figure 32: Age-frequency distributions for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

The annual growth of Mountain Whitefish in the study area, as assessed using the von Bertalanffy growth curve, was similar among sections (Figure 33). The different curve for Section 6 (i.e., greater asymptotic length and greater size of age-0) was likely related to the lack of young individuals (age-0 and age-1) captured in this section, rather than a true difference in growth rate. The growth curve in 2018 suggested a similar growth rate to all other study years (Figure 34). The lower asymptotic length suggested by the 2014 curve was likely related to very few older individuals in the sample that year (only 1 Mountain Whitefish older than age-8). Consistent among years, Mountain Whitefish in the study area exhibit rapid growth until approximately age-3; thereafter, growth slows considerably (Figure 35 and Figure 36).

The average change in length-at-age analysis for Mountain Whitefish (Figure 35) was limited to individuals younger than age-5 due to the slow growth, wide range of lengths recorded, and unknown precision of ages assigned to older individuals. Overall (all sections combined), the age-2 through age-4 age-classes grew to a larger size in 2014, 2015, and 2016 when compared to previous years. Confidence intervals between 2014 and 2016 did not overlap with 2013 confidence intervals, with a difference of approximately 10 to 20 mm in length-at-age, depending on the age group, relative to the 14-year average. Mean length-at-age of age-1 Mountain Whitefish was more than 20 mm below average in 2017 but returned to near-average values in 2018.

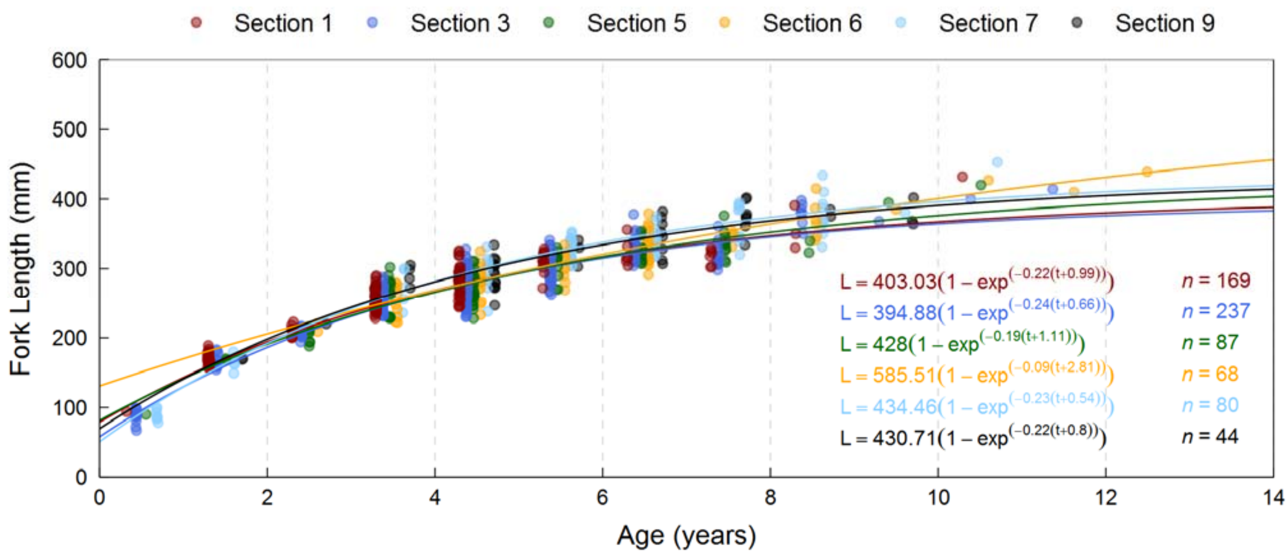

Figure 33: von Bertalanffy growth curve for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

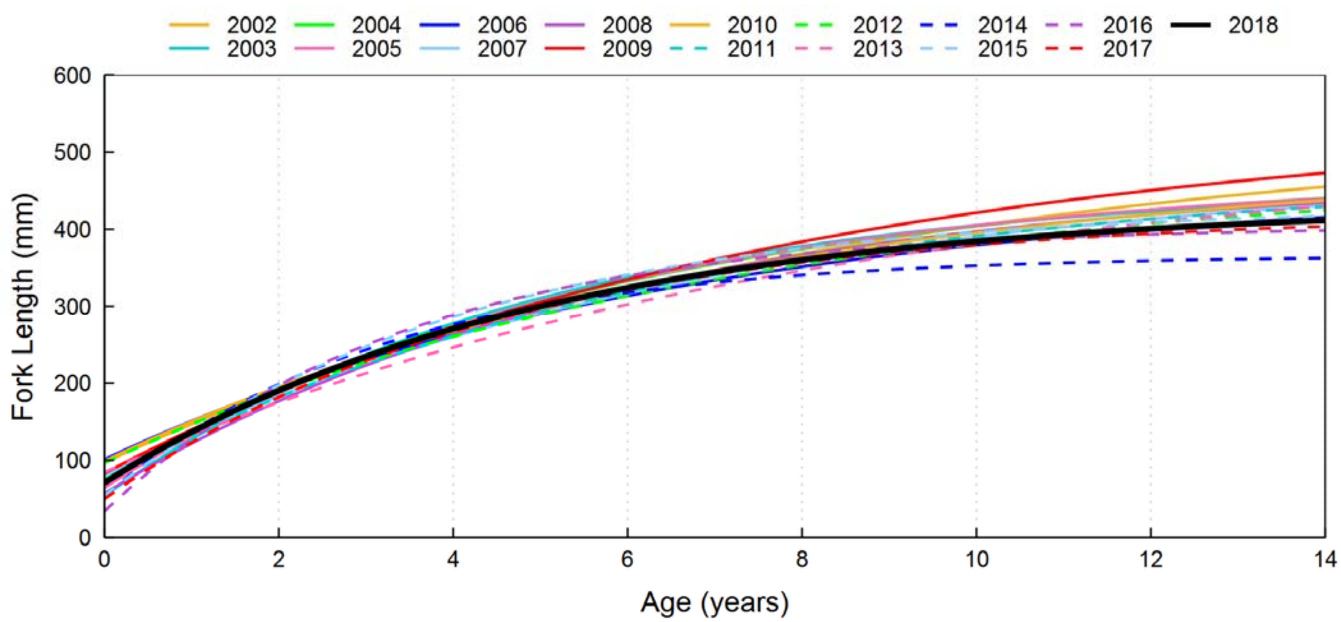

Figure 34: von Bertalanffy growth curve for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.

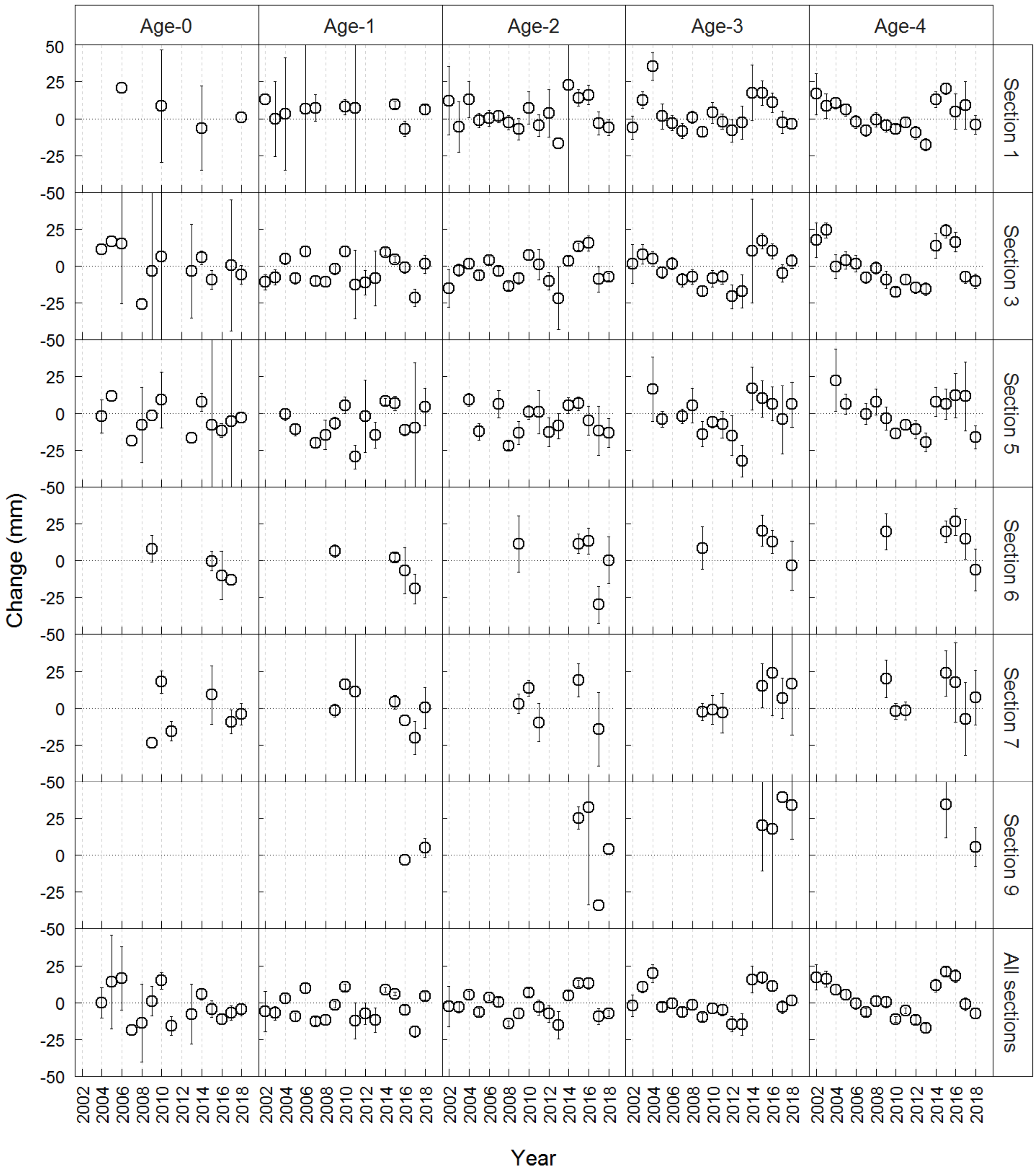

Figure 35: Change in mean length-at-age for Mountain Whitefish captured by boat electroshocking during the Peace River Fish Index, 2002 to 2018. Change is defined as the difference between the annual estimate and the estimate of all years and sections combined. Error bars represent 95% confidence intervals. For Sections 6 and 7, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

Historically, high mean body condition (*K*) was recorded for Mountain Whitefish from 2003 to 2010 and from 2014 to 2015, whereas lower body condition was recorded in 2002 and from 2011 to 2013. Body condition declined from 2015 to 2017 but increased to near-average values in 2018 (Figure 36). Mean body condition of Mountain Whitefish generally decreased from upstream to downstream, with the greatest mean body condition in Section 1 (approximately 1.06 to 1.27) and the lowest body condition in Section 9 (0.98 to 1.11; Appendix F, Figure 18). Compared to Arctic Grayling (Figure 13) and Bull Trout (Figure 18), Mountain Whitefish body condition was typically more variable among study years (Figure 36).

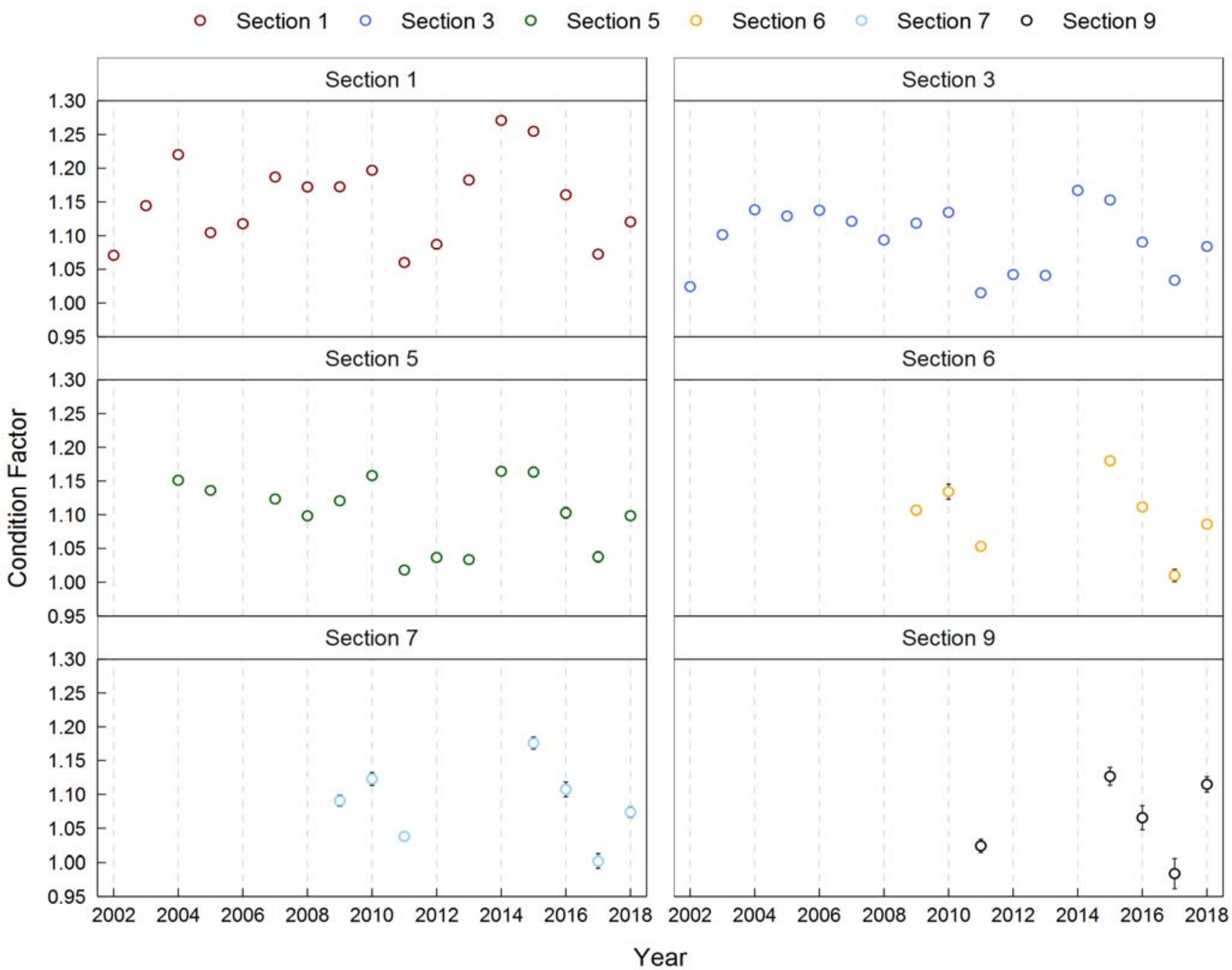

Figure 36: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. For Sections 6, 7, and 9, the analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013).

Length-weight regressions had exponents (i.e., exponentiated slopes from the log-log regression) close to 3.0 in most years (Figure 37; Appendix F, Figure F15), which suggests isometric growth and no changes in body shape with increasing size. Pairwise comparisons of length-weight regressions between years and sections were not conducted in 2018. Analyses conducted in 2017 (Golder and Gazey 2018) showed some statistically significant differences in the length-weight relationship among years and sections, but the differences were generally minor and did not indicate any long-term patterns or trends.

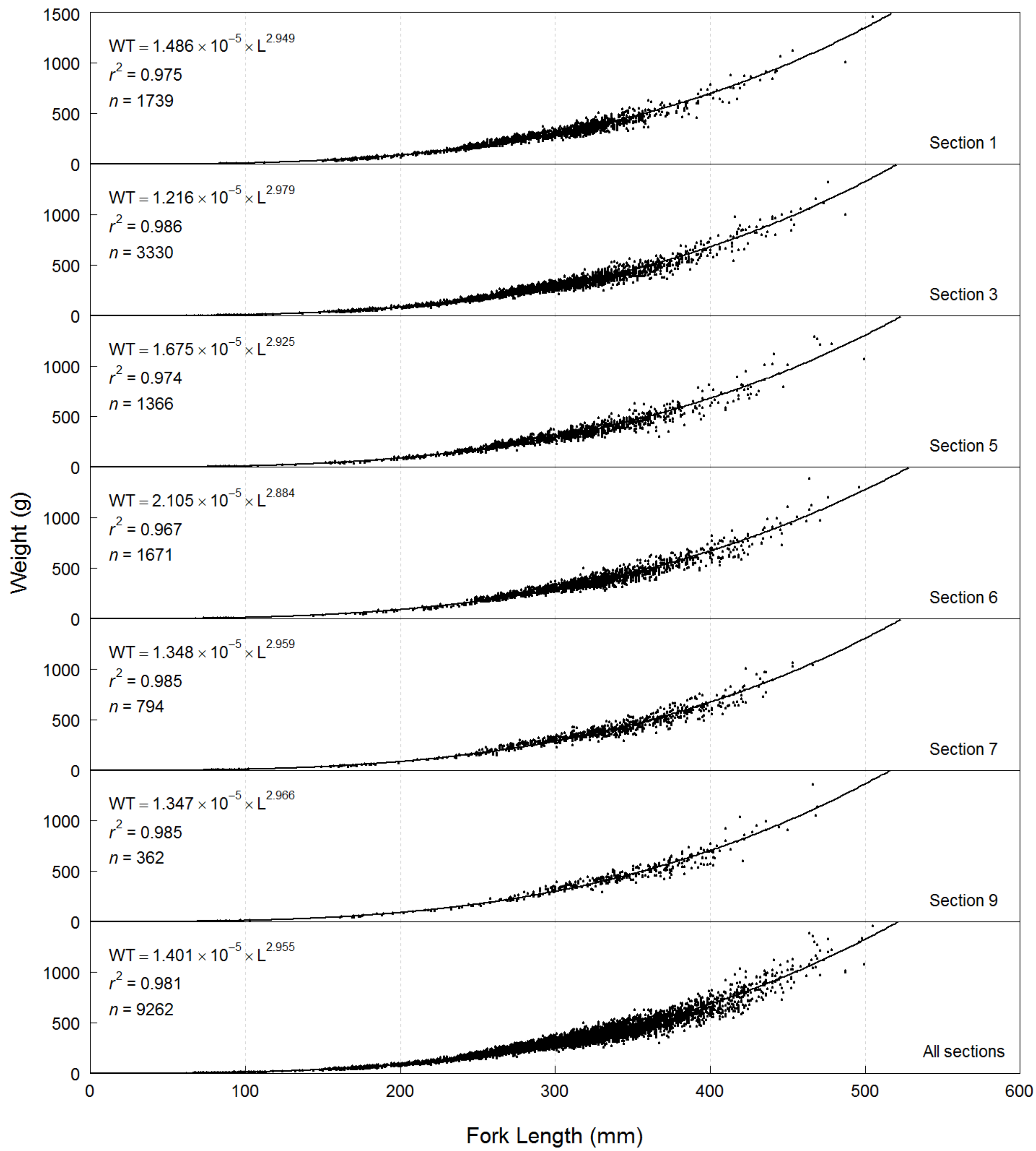

Figure 37: Length-weight regressions for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

3.9.2 Abundance and Spatial Distribution

Appendix G provides a thorough description of the Mountain Whitefish population abundance analysis conducted by W.J. Gazey Research. The text below represents a summary of key findings and conclusions drawn from the results provided in Appendix G. Population estimates were restricted to data collected from fish implanted with PIT tags that were equal to or larger than 250 mm FL; mark-recapture data from fish between 200 and 249 mm FL were excluded from the population abundance analysis to maintain consistency with previous study years.

In 2018, the mean population estimate of Mountain Whitefish was greatest in Section 1 (34,868 fish), intermediate in Sections 3, 5, and 6 (10,674 to 15,058 fish), and lower in Sections 7 and 9 (5,968 and 2,042 fish; Table 17). Population estimates are available for all years since 2002 in Sections 1, 3, and 5 (Figure 38). In Section 1, the population estimate in 2018 was greater than all previous years. In Sections 3 and 5, the population estimate in 2018 was similar to most previous years. In Sections 6, 7 and 9, population estimates are only available from 2015 to 2018 and suggest relatively little variability in abundance during this period.

Abundance estimates in Figure 38 that were deemed to have substantive assumption violations are labelled in the figure as suspect. In 2004 the estimates appeared valid; however, very low water likely concentrated the fish from locations that were not sampled in other years. Similarly, the estimates for 2010 and 2011 are the largest on record and coincide with low water levels. In 2016, the abundance estimate for Section 1 was similarly high and low water levels impeded sampling during Session 3. Results for 2014 were atypical in that water levels were low but population abundance estimates were near a historical low. The reliability of the 2018 population estimates is discussed in Section 4.3.2.

Table 17: Population abundance estimates generated using the Bayes sequential model for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
1	34,868	32,450	22,760	48,640	6,795	19.5
3	15,058	14,970	13,510	16,650	800	5.3
5	10,674	10,420	8,500	12,990	1,157	10.8
6	13,252	13,090	11,290	15,320	1,032	7.8
7	5,968	5,770	4,560	7,500	760	12.7
9	2,042	1,880	1,300	2,900	423	20.7
Total	**81,862**		**68,007**	**95,717**	**7,069**	**8.6**

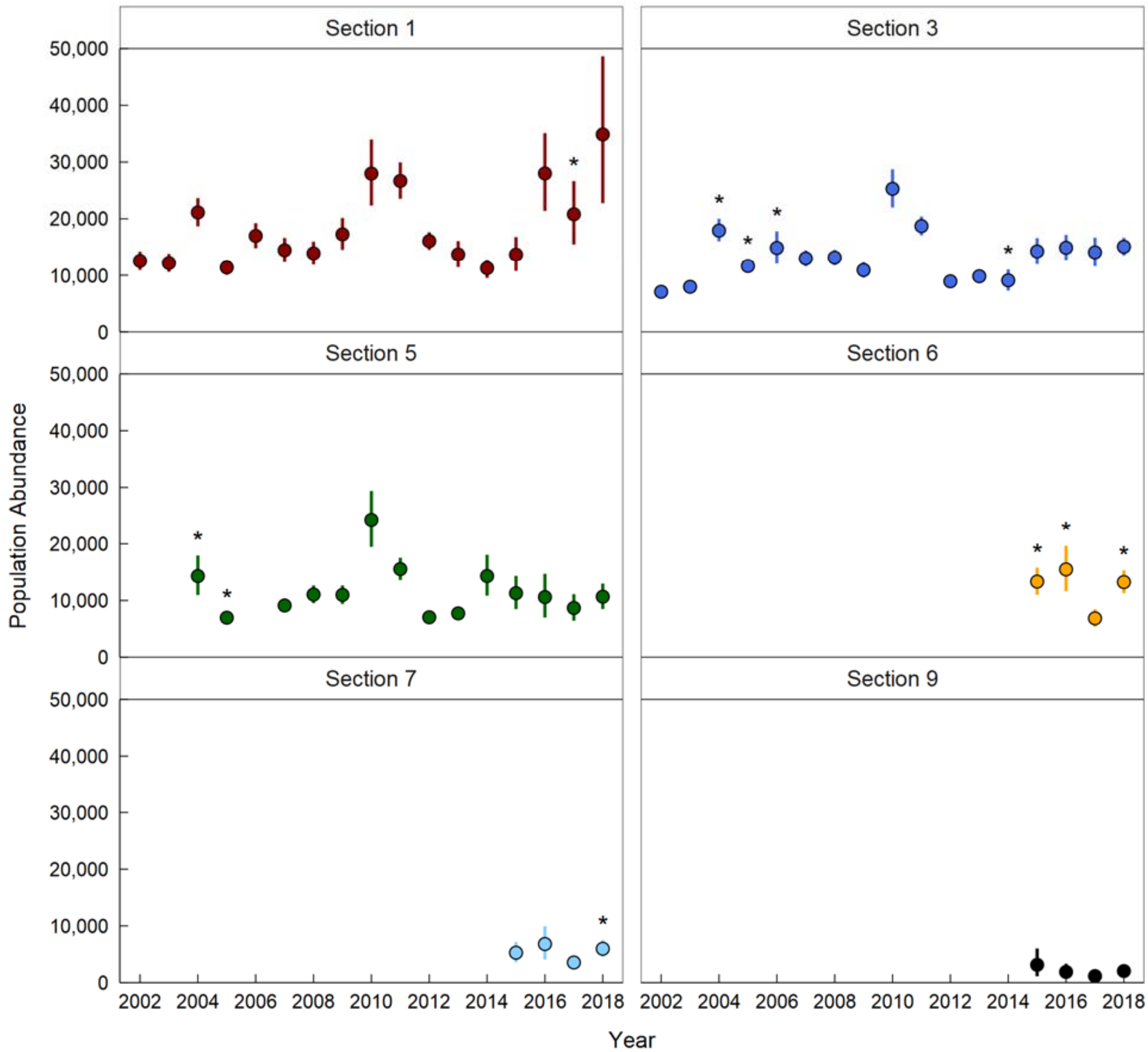

Figure 38: Population abundance estimates (with 95% credibility intervals) generated using the Bayes sequential model for Mountain Whitefish captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002–2018. Stars denote suspect estimates due to assumption violations.

The reliability of the above estimates depends on the validity of the model assumptions described in Section 2.2.2. Several modelling outputs were examined to assess the model assumptions and are discussed below.

Comparison of Mountain Whitefish length distributions between length at initial capture and subsequent recapture events in 2018 found that the recapture frequency of smaller fish (200–275 mm FL) was lower than that of larger fish (i.e., larger than 275 mm FL). Consistent with past studies, though not statistically significant, smaller fish (i.e., 250–275 mm FL) appeared to be under-represented in the recaptures in all sections, with fish between 200 and 250 mm FL being even more under-represented in the recaptures.

Growth (i.e., the increment in length of recaptured fish as a function of time-at-large) was statistically significant in 2018 ($P<0.05$); however, the mean increment of a recaptured fish was only 0.16 mm over the average time at large (9.65 days). Therefore, the number of unmarked fish entering the population (i.e., fish greater than 250 mm FL) through growth during the study period (termed growth recruitment) was expected to be negligible.

Mountain Whitefish exhibited some movement between sections in 2018 (overall, 7.2% of fish moved). In general, the fish exhibited high site fidelity within a section between release and recovery. The CJS analysis revealed no apparent mortality (survival not significantly different than 1.0) of tagged Mountain Whitefish during the 2018 study.

The test for time-varying catchability among sessions in 2018 resulted in substantially better fit for time-varying catchability in Section 3 ($P < 0.001$), while constant catchability fit better or almost as well in all other sections. The logarithmic population deviation estimates displayed little trend over time except for Section 7, which trended upward over time.

If the assumptions of the population abundance model are valid, then the sequential posterior probability plots are expected to stabilize around a common mode. In 2018, these sequential probability plots revealed converged distributions for all sections except Sections 6 and 7 (Appendix G, Figures G8 to G13). This suggests that one or more of the model assumptions are not valid for Sections 6 and 7 and there is greater uncertainty associated with the estimates for these sections than in other sections. Between 2015 and 2018 (i.e., years when abundance estimates were generated for Sections 6 and 7), model assumptions were not valid for Section 6 in all years except 2017. For Section 7, 2018 was the first year in which assumptions were not valid.

3.9.2.1 Mountain Whitefish Synthesis Model

Appendix H provides a summary of the data input into the Mountain Whitefish synthesis model, as well as the model results. The synthesis model fit to the data was generally good. One exception was that across-year recaptures were underestimated for Section 5 for session-year observations greater than 25 recaptures. Figure 39 compares synthesis model and Bayes sequential model estimates by section and year and Table 18 presents the parameter estimates. Synthesis model and Bayes sequential model estimates were similar in most years, with the synthesis model typically yielding slightly higher estimates. Selectivity was flatter (i.e., more consistent selectivity across size classes) from 2014 to 2017 when compared to 2002 to 2013 (i.e., a higher preference for smaller fish; Appendix H, Figure H11), likely due to modifications to the boat electroshocker settings that were implemented in 2014. Recruitment estimates were not precise and exhibited large variation among study years (Appendix H, Figure H14).

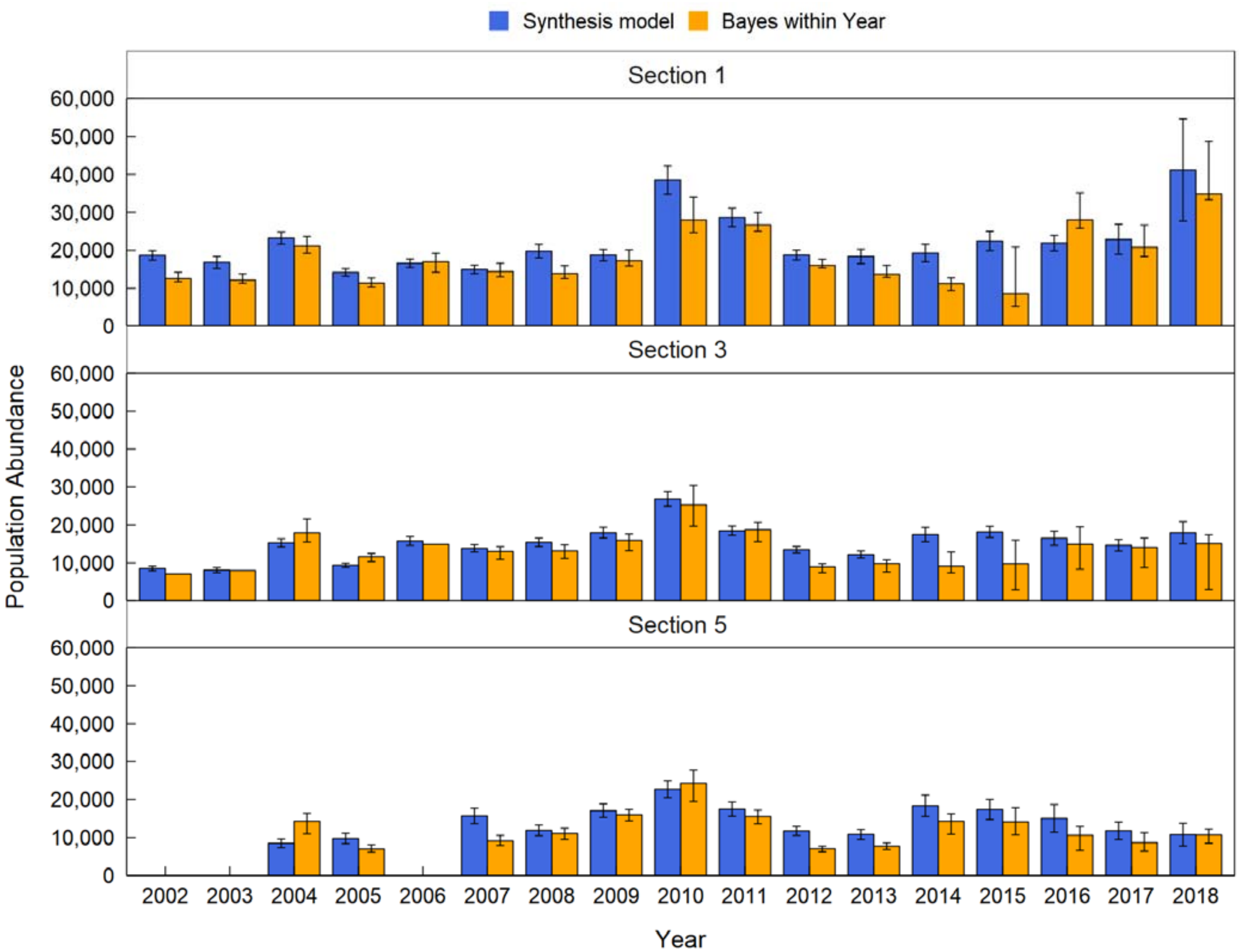

Figure 39: Comparison of Mountain Whitefish population abundance estimates based on the synthesis model and the Bayes sequential model by section and year. Bayesian error bars are the 95% highest probability density interval and the synthesis model error bars are ±2 standard errors.

Table 18: Synthesis model parameter estimates and associated standard errors, 2018.

Parameter	Year	Section 1		Section 3		Section 5	
		Estimate	SE	Estimate	SE	Estimate	SE
Nuisance length-at-age							
Length age-10 (mm)		327.3	4.4	333.6	3.6	356.1	6.4
Growth coefficient		0.371	0.018	0.314	0.011	0.267	0.014
Individual length SD (mm)		26.4	0.8	30.2	0.7	33.6	1.2
Growth							
Length age-0 (mm)		100.3	2.7	103.8	1.2	94.4	1.2
Growth coefficient		0.197	0.005	0.145	0.004	0.155	0.006
Individual length SD (mm)		27.0	0.6	44.8	1.1	42.2	1.4
Length age-10 (mm)	2003	294.1	2.2	296.4	2.7		
	2004	312.2	1.6	346.5	2.5		
	2005	283.0	1.7	301.9	2.3	313.7	3.2
	2006	294.7	1.8	339.0	2.4		
	2007	291.5	1.8	310.4	2.1	344.3	3.2
	2008	307.3	1.8	300.9	2.0	323.6	3.2
	2009	292.8	1.8	298.9	2.5	325.5	2.9
	2010	308.8	1.9	310.8	2.4	321.8	2.8
	2011	288.2	1.5	281.8	1.8	292.4	2.4
	2012	279.0	1.5	268.7	1.8	277.0	2.6
	2013	287.9	1.8	270.6	1.9	281.5	2.5
	2014	332.9	2.1	328.9	2.6	328.4	3.1
	2015	329.3	2.3	321.6	2.5	319.9	3.8
	2016	309.2	2.2	297.8	2.3	300.1	4.5
	2017	295.9	2.1	281.9	2.2	291.4	3.6
	2018	306.8	2.6	301.8	2.3	298.0	3.9
Selectivity							
Mid length bin (10 mm increments)	2002-13	28.9	0.30	31.4	0.50	34.9	0.68
	2014-18	31.2	0.80	66.5	59.88	475.8	
Slope	2002-13	1.8	0.05	2.9	0.08	3.7	0.16
	2014-18	2.4	0.18	13.1	4.58	14.5	2.28
Asymptotic Survival (logit)	2002-04	-1.162	0.046	-1.298	0.033		
	2005-07	-0.906	0.058	-1.319	0.052	-0.917	0.048
	2008-10	-1.342	0.089	-1.216	0.054	-1.965	0.138
	2011-13	0.025	0.072	-0.474	0.052	-0.504	0.105
	2014-15	-28.549		-42.093		-2.235	0.574
	2016-17	-2.877	1.496	-1.603	0.278	-1.066	0.386
Recruitment ($\log_e$)	2002	11.62	0.15	11.12	0.13		
	2003	11.63	0.48	13.81	0.14		
	2004	13.25	0.32	10.41	0.70	12.90	0.20
	2005	13.75	0.25	12.50	0.62	14.17	0.28
	2006	12.34	0.57	13.89	0.20	13.34	0.34
	2007	12.17	0.56	10.08	0.62	10.64	0.67
	2008	12.73	0.35	9.99	0.58	10.32	0.50
	2009	11.49	0.55	9.84	0.57	9.96	0.55
	2010	11.43	0.56	10.23	0.64	10.44	0.57
	2011	11.85	0.64	12.79	0.27	10.62	0.68
	2012	13.91	0.34	11.18	0.53	12.32	0.35
	2013	12.81	0.39	9.38	0.49	10.14	0.58
	2014	11.08	0.46	8.78	0.35	9.80	0.47
	2015	11.09	0.53	8.31	0.41	9.70	0.45
	2016	12.16	0.55	8.44	0.45	9.48	0.48
	2017	12.09	0.69	8.19	0.47	8.76	0.50
	2018	12.20	0.74	9.50	0.43	9.23	0.52
Miscellaneous							
Capture probability coefficient		0.0406	0.0097	0.0370	0.0106	0.0796	0.0168
Negative binomial dispersion coefficient		1.75	0.10	2.58	0.14	2.83	0.19

3.10 Northern Pike

3.10.1 Biological Characteristics

During the 2018 survey, 34 Northern Pike were initially captured (i.e., excluding within-year recaptures) and 33 of these were measured for length and weight. Fork lengths ranged between 132 and 860 mm FL, weights ranged between 14 and 5470 g, and body condition (*K*) ranged between 0.5 and 0.9. Fin rays were collected from all captured Northern Pike; however, fin rays were not analyzed to assign ages in 2018 because ageing results from previous years were highly variable and considered unreliable. According to Mackay et al. (1990), cleithra are the preferred structures for ageing Northern Pike, but their collection would require lethal sampling, which was not compatible with the study objectives.

Length-frequency data indicated relatively even percentages of Northern Pike between 150 and 850 mm FL, suggesting that a wide range of age-classes are present in the study area (Figure 40). In many previous years, the majority of Northern Pike captured during the survey were adults and relatively few individuals smaller than 400 mm were captured; however, in 2018, 16 of the 34 Northern Pike recorded (47%) were less than 400 mm FL (Appendix F, Figures F27 and F28).

Length-weight relationships for Northern Pike in 2018 indicate positive allometric growth (b less than 3.0), where fish become more rotund as they increase in length (Figure 41). Sample sizes were small in all years and sections, but the limited data did not suggest any large differences in the length-weight relationship among years or sections (Appendix F, Figure F29). The mean body condition (*K*) of Northern Pike in 2018 ranged between 0.7 and 0.8 for all size-classes and sections and was consistent with mean body condition recorded during recent study years (Figure 42).

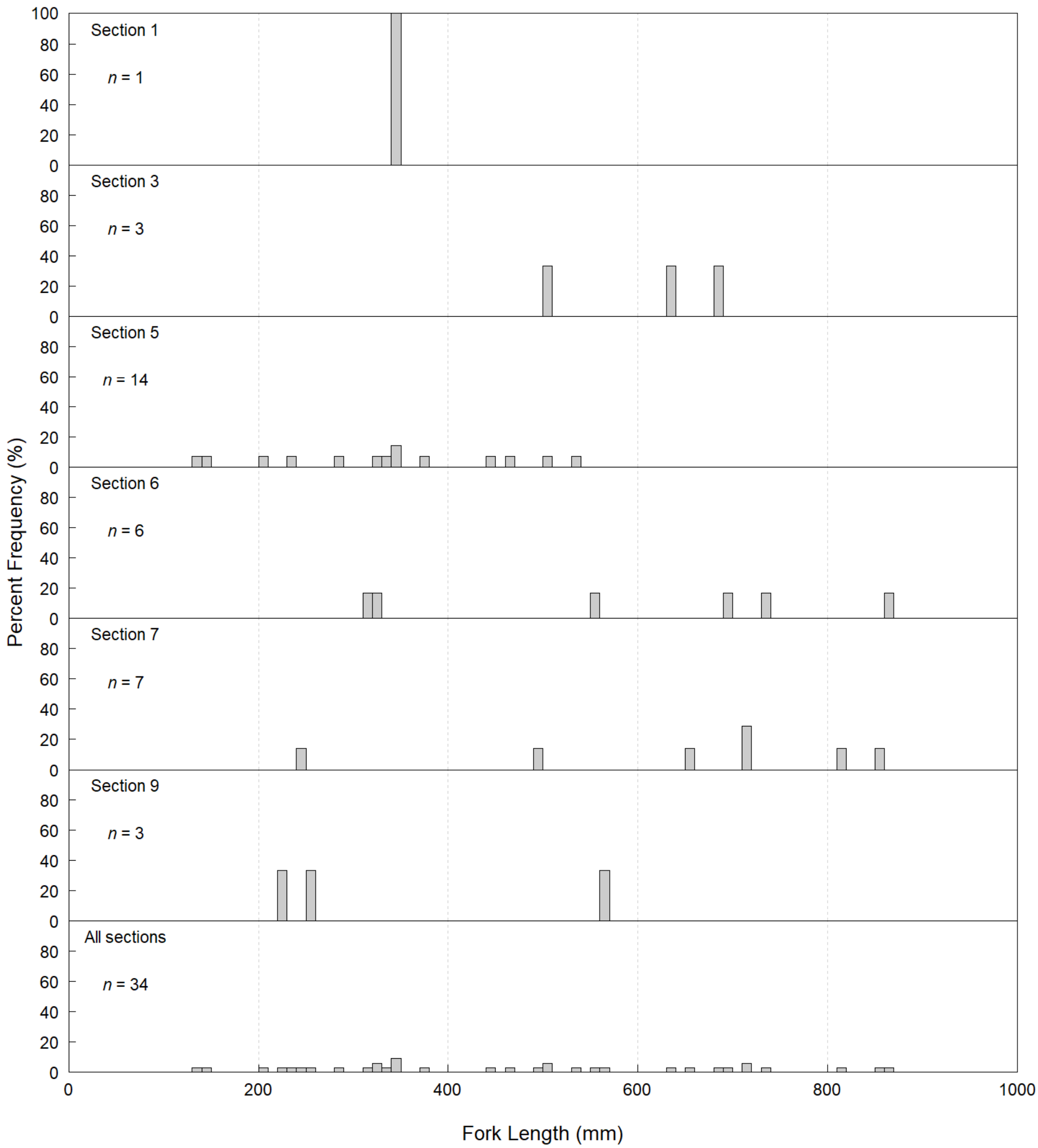

Figure 40: Length-frequency distributions for Northern Pike captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

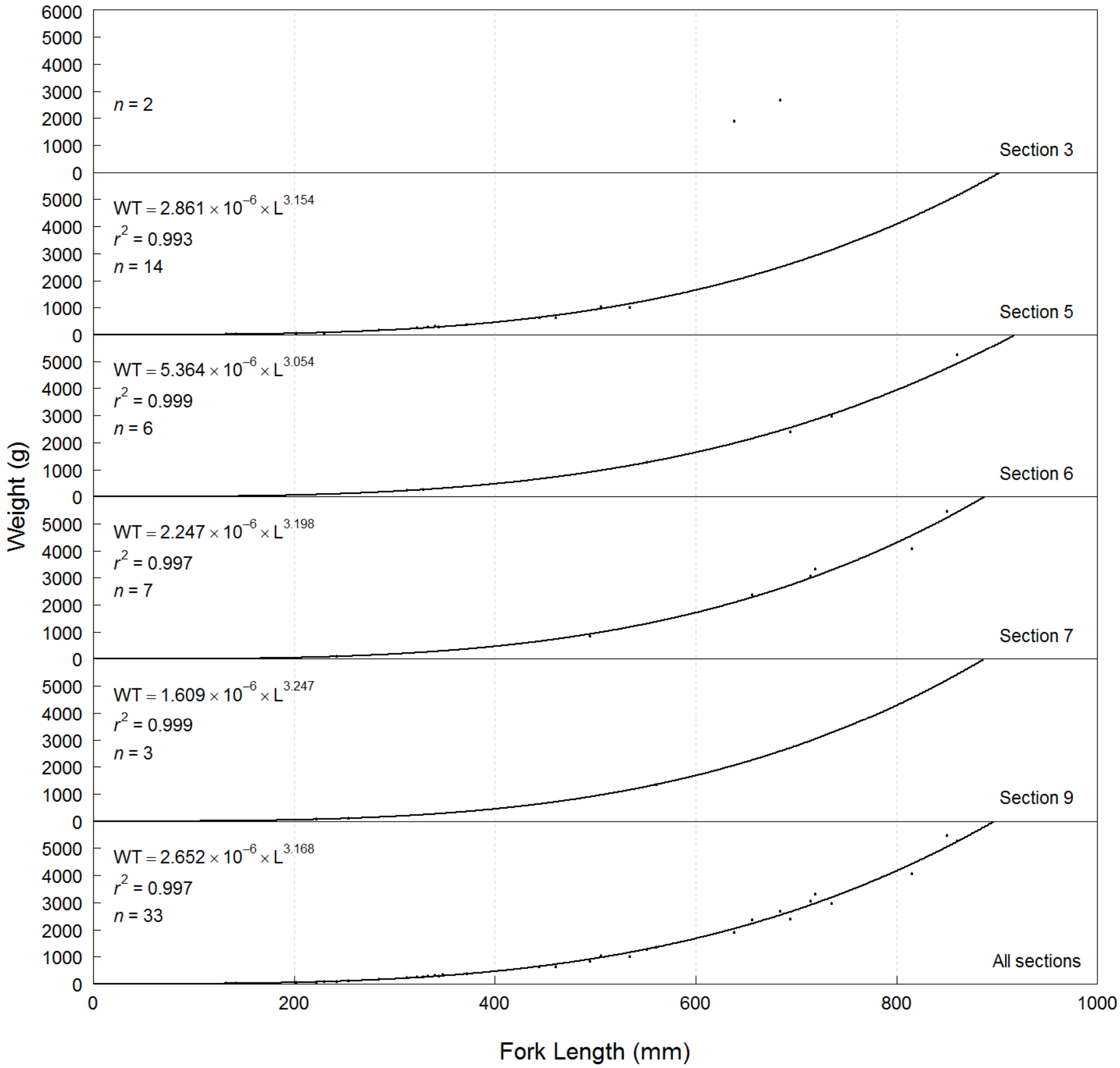

Figure 41: Length-weight regressions for Northern Pike captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

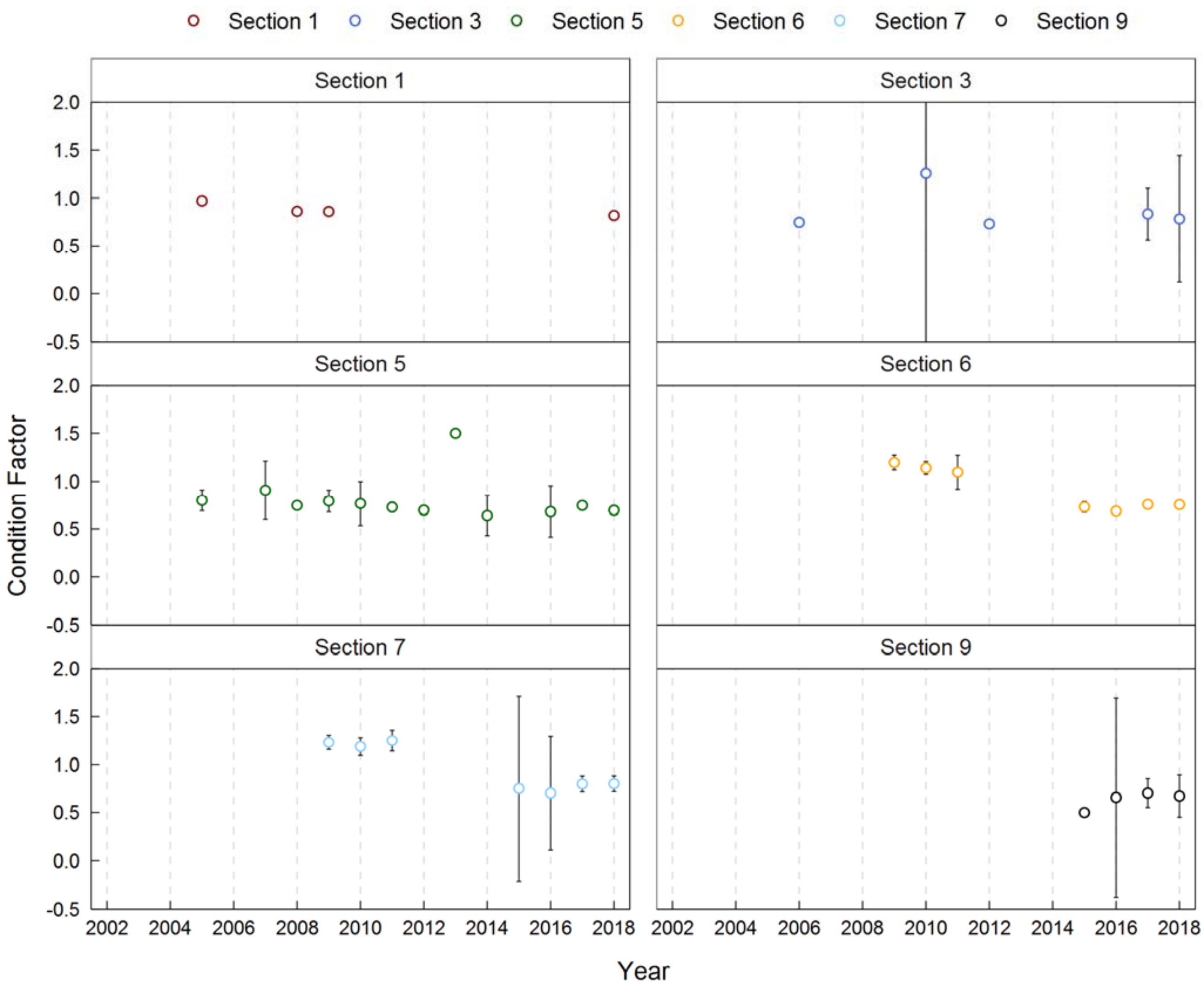

Figure 42: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Northern Pike captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. For Sections 6, 7, and 9, analysis was supplemented with data collected during boat electroshocking surveys conducted during the late summer to fall period of 2009, 2010, and 2011 by Mainstream (2010, 2011, 2013). The 95% CI of Section 3 values in 2010 extends from -1.14 to 3.66.

3.10.2 Abundance and Spatial Distribution

In total, 31 of the 34 Northern Pike captured during the 2018 survey were implanted with PIT tags; none of them were recaptured. Since 2015 (i.e., since sampling has been conducted in all six sections), 106 Northern Pike have been captured. Of those 106 fish, 40 have been recorded in Section 6. The remaining fish have been recorded in Section 5 (*n* = 27), Section 7 (*n* = 22), Section 9 (*n* = 10), Section 3 (*n* = 5), and Section 1 (*n* = 1). Northern Pike are infrequently captured in Section 1 and before the single individual was captured in this section in 2018, this species had not been recorded in Section 1 since 2009 (Mainstream and Gazey 2010). These data suggest a preference for the downstream portions of the study area for this species. Small sample sizes and lack of recaptures of Northern Pike prevented the generation of absolute abundance estimates for this species. Catch rate data suggest increased Northern Pike abundance in 2017 and 2018 relative to 2015 and 2016.

A single Northern Pike was captured in Section 8 during the 2018 Goldeye and Walleye Survey.

3.11 Rainbow Trout

3.11.1 Biological Characteristics

During the 2018 survey, 146 Rainbow Trout were initially captured (i.e., excluding within-year recaptures) and 143 of these individuals were measured for length and weight. Ages were assigned to 117 Rainbow Trout based on scale analyses. Ages ranged from age-1 to age-7. Fork lengths ranged between 72 and 477 mm and weights ranged between 24 and 1296 g (Table 19). Body condition (*K*) ranged between 0.77 and 1.63.

Table 19: Average fork length, weight, and body condition by age for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Age	Fork Length (mm)			Weight (g)			Body Condition (K)		
	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]
1	163 ± 23	127 – 198	28	53 ± 24	24 – 109	27	1.13 ± 0.11	0.91 – 1.40	27
2	208 ± 20	177 – 242	34	108 ± 30	63 – 159	33	1.17 ± 0.08	1.03 – 1.39	33
3	311 ± 47	239 – 379	19	376 ± 170	149 – 755	19	1.17 ± 0.08	1.06 – 1.39	19
4	346 ± 26	302 – 388	17	495 ± 116	345 – 666	17	1.17 ± 0.08	1.07 – 1.34	17
5	391 ± 32	360 – 477	17	695 ± 198	493 – 1240	17	1.15 ± 0.13	0.92 – 1.48	17
6	348	-	1	476	-	1	1.13	-	1
7	356	-	1	470	-	1	1.04	-	1

[a] Number of individuals sampled.

Most of the Rainbow Trout captured were between 150 and 400 mm FL (Figure 43). The length-frequency histogram (Figure 43) and length-at-age data (Table 19) suggest that the length distributions of age-1 and age-2 Rainbow Trout overlapped, and that only one age-0 Rainbow Trout (72 mm FL) was captured in 2018. Age-1 and age-2 Rainbow Trout were the most common age-class in the study area (Figure 44). Similar to previous study years, age-0 Rainbow Trout were not common in 2018, likely because this age-class remains in natal streams for their first year and have not yet migrated into the Peace River mainstem at the time of sampling.

The von Bertalanffy model suggested similar growth rates for Sections 1 and 3 but growth curves could not be estimated for other sections because of small sample sizes (Figure 45). Comparison of von Bertalanffy curves among years suggested slower growth in 2018 when compared to 2016 and 2017, as indicated by lower length-at-age of age-1 to age-4 Rainbow Trout. Many years had small sample sizes, especially for the youngest and oldest age classes, and poor fit of the von Bertalanffy model, which may explain differences in annual growth curves rather than actual differences in growth rates.

Mean body condition was generally similar among all years and sections, with overlapping confidence intervals for most estimates (Figure 47). However, in Sections 1 and 3, mean body condition decreased from 2012 to 2017. The length-weight relationship in 2018 had a b value close to 3.0, suggesting isometric growth (Figure 48). Sample sizes were too small for meaningful comparisons of length-weight relationship among sections (Figure 48). Differences in the relationship were not statistically compared in 2018. Statistical results from 2017 (Golder and Gazey 2018) suggested little change in the length-weight relationship of Rainbow Trout over time or among sections.

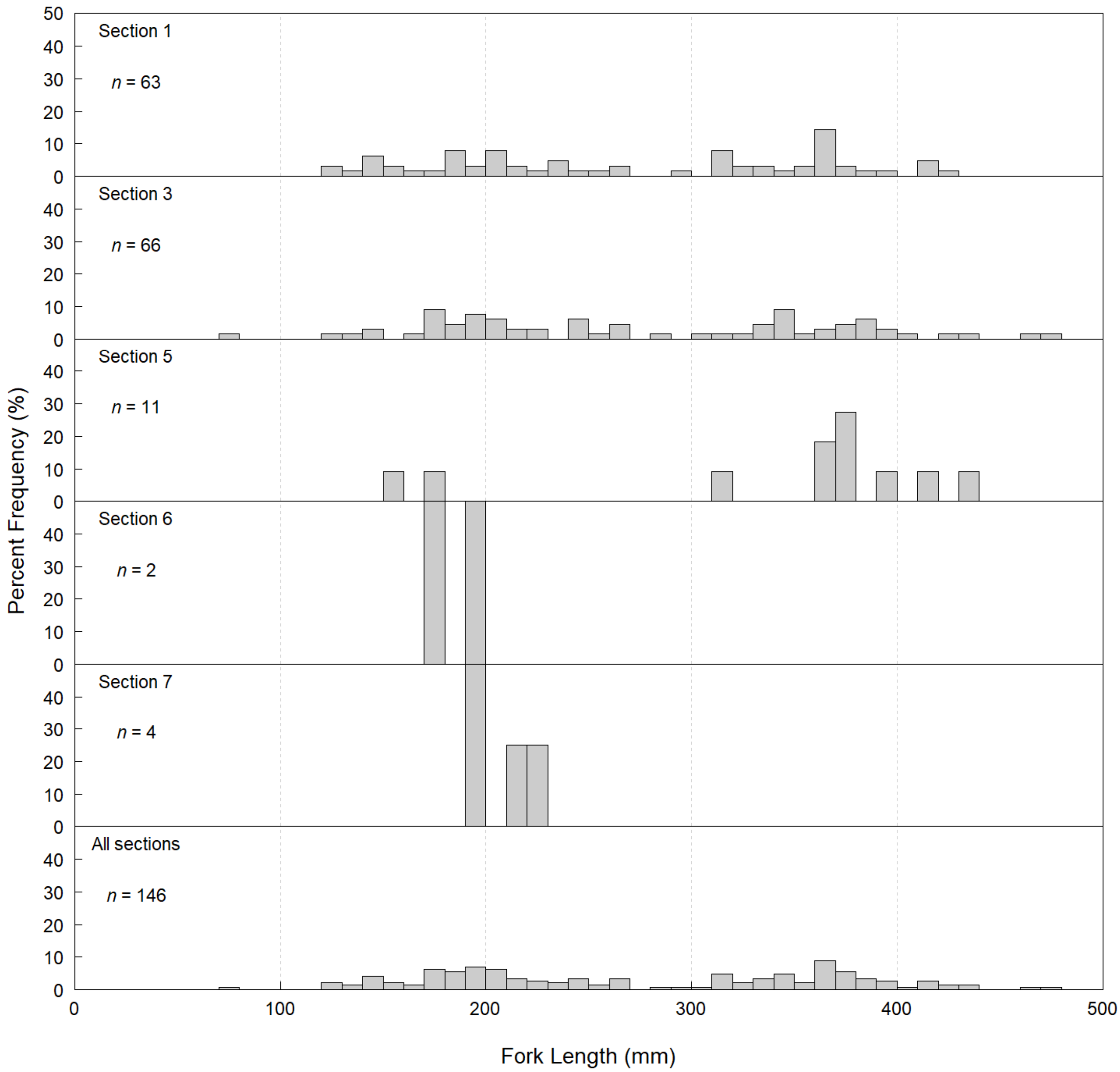

Figure 43: Length-frequency distributions for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

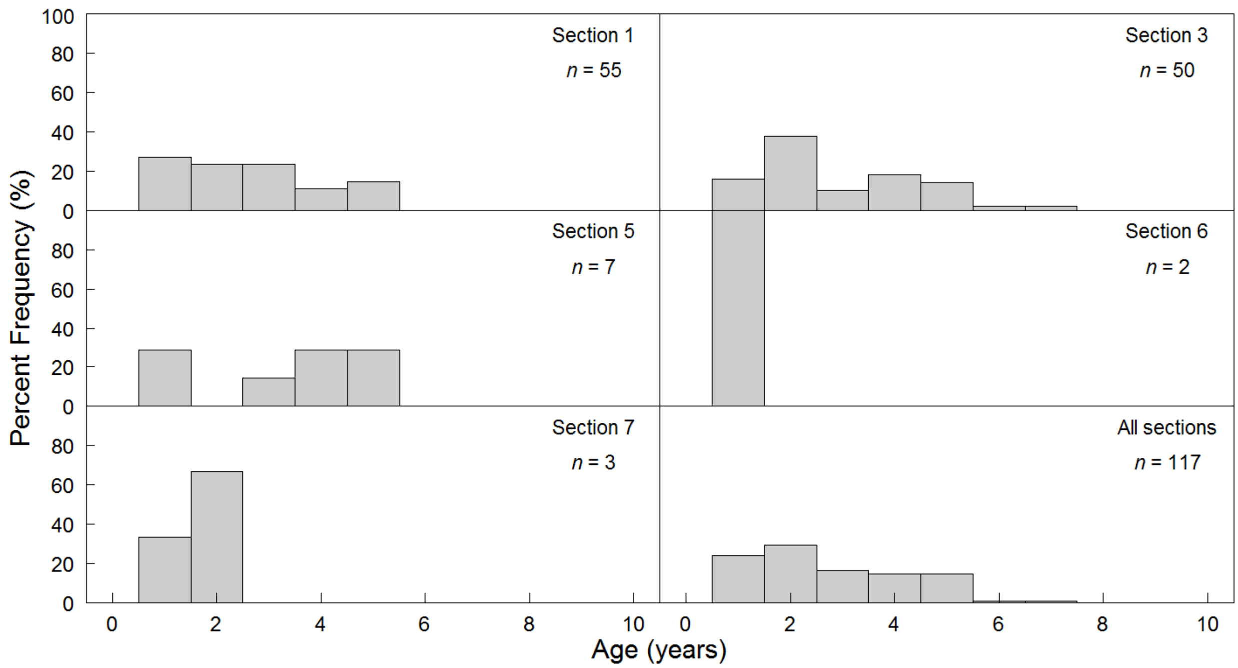

Figure 44: Age-frequency distributions for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

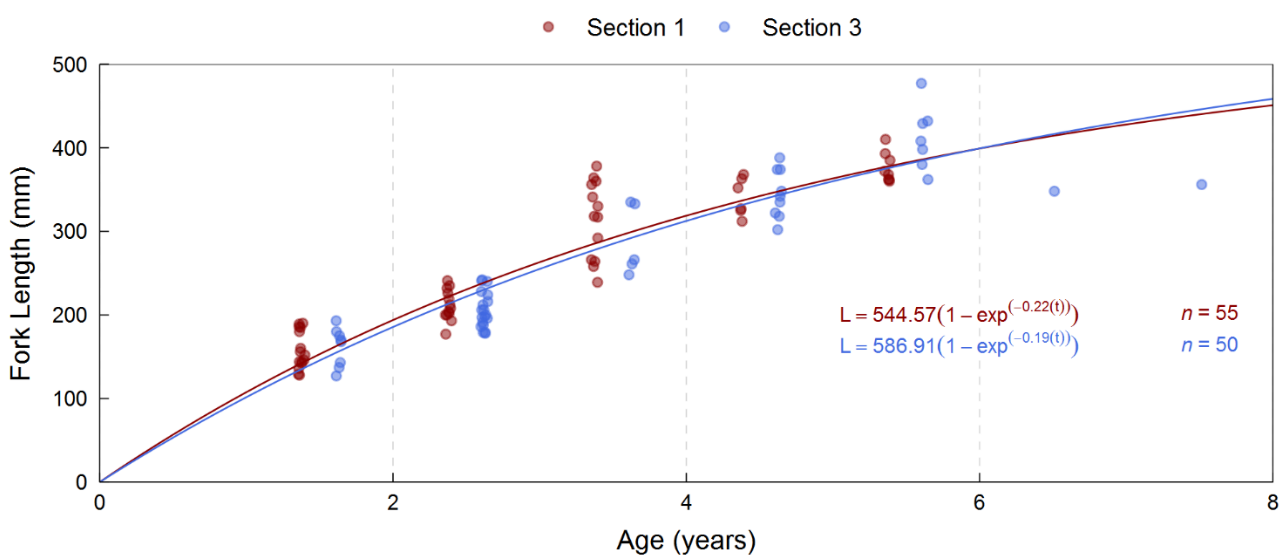

Figure 45: von Bertalanffy growth curve for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

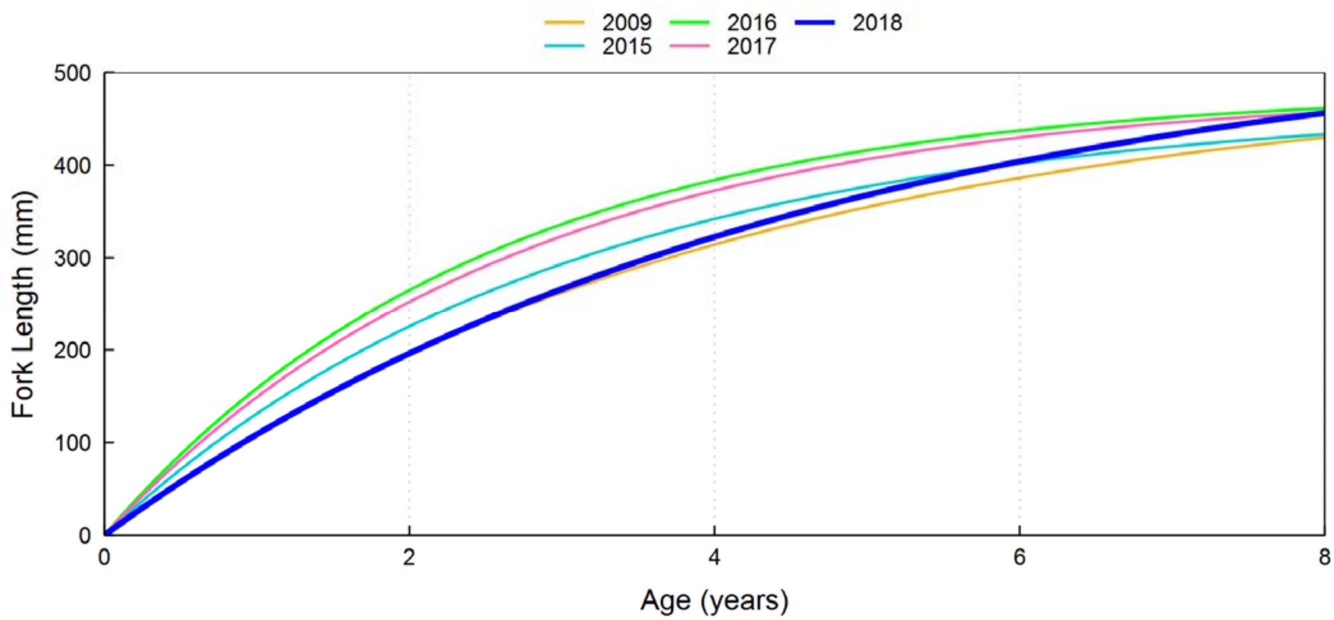

Figure 46: von Bertalanffy growth curve for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 2009 to 2018.

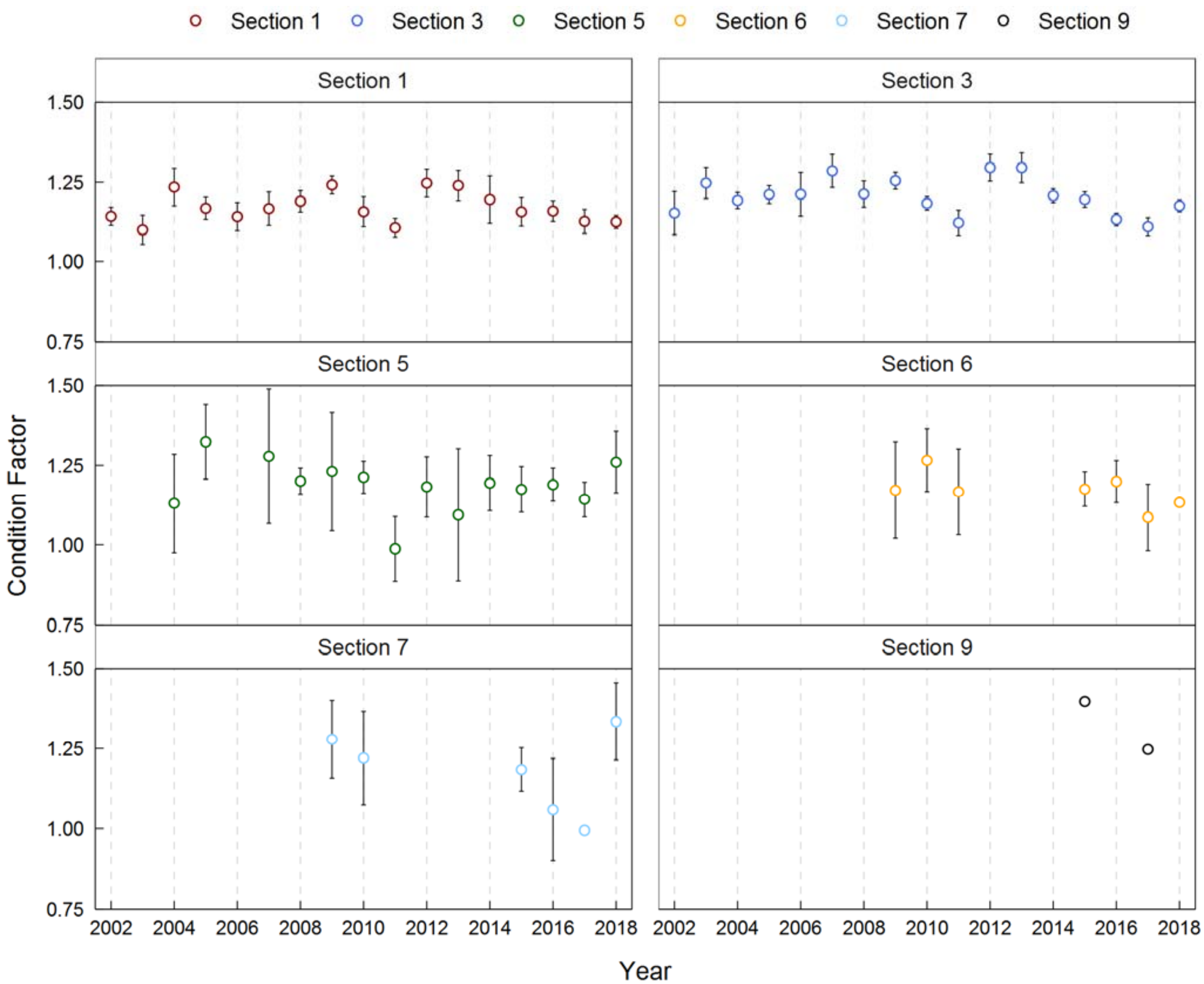

Figure 47: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.

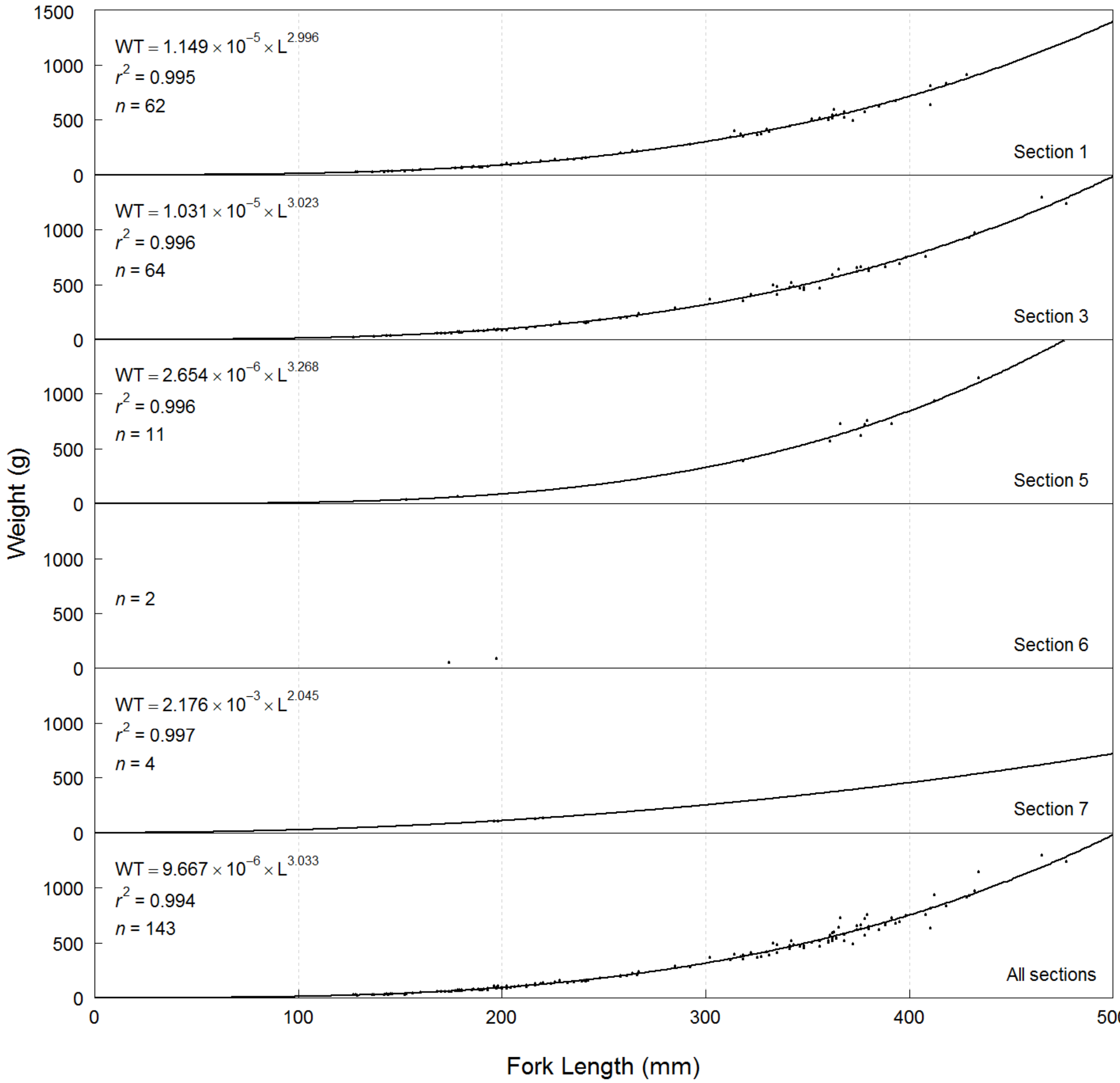

Figure 48: Length-weight regressions for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

3.11.2 Abundance and Spatial Distribution

In 2018, 88% of the Rainbow Trout catch was recorded in the upstream two sections (43% in Section 1 and 45% in Section 3; Table 8). Rainbow Trout were in low abundance in the downstream four sections. This distribution pattern is consistent with historical study years (Attachment A).

Of the 146 Rainbow Trout captured during the 2018 survey, 137 were implanted with PIT tags. Of those 137 fish, 11 were subsequently recaptured. Eight of the recaptured fish were recorded in Section 3, two recaptured fish were recorded in Section 5, and one was recaptured in Section 6. Movement between sections between recaptures was not observed.

There were sufficient recapture data to produce population abundance estimates for Sections 3 and 5 only. The population estimate (mean with 95% credible interval) was greater in Section 3 (106 fish; 45–195 fish) than Section 5 (23 fish; 9–52 fish). The abundance of Rainbow Trout varied among years since 2016 within Sections 3 and 5 (Figure 49); however, the large and overlapping confidence intervals reflect uncertainty in the estimates due to small sample sizes.

Table 20: Population abundance estimates generated using the Bayes sequential model for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
3	106	79	45	195	45	42.0
5	23	13	9	52	14	60.4
Total[a]	**128**	**102**	**61**	**218**	**45**	**35.1**

[a] Calculated from the joint distribution of Section 3 plus Section 5.

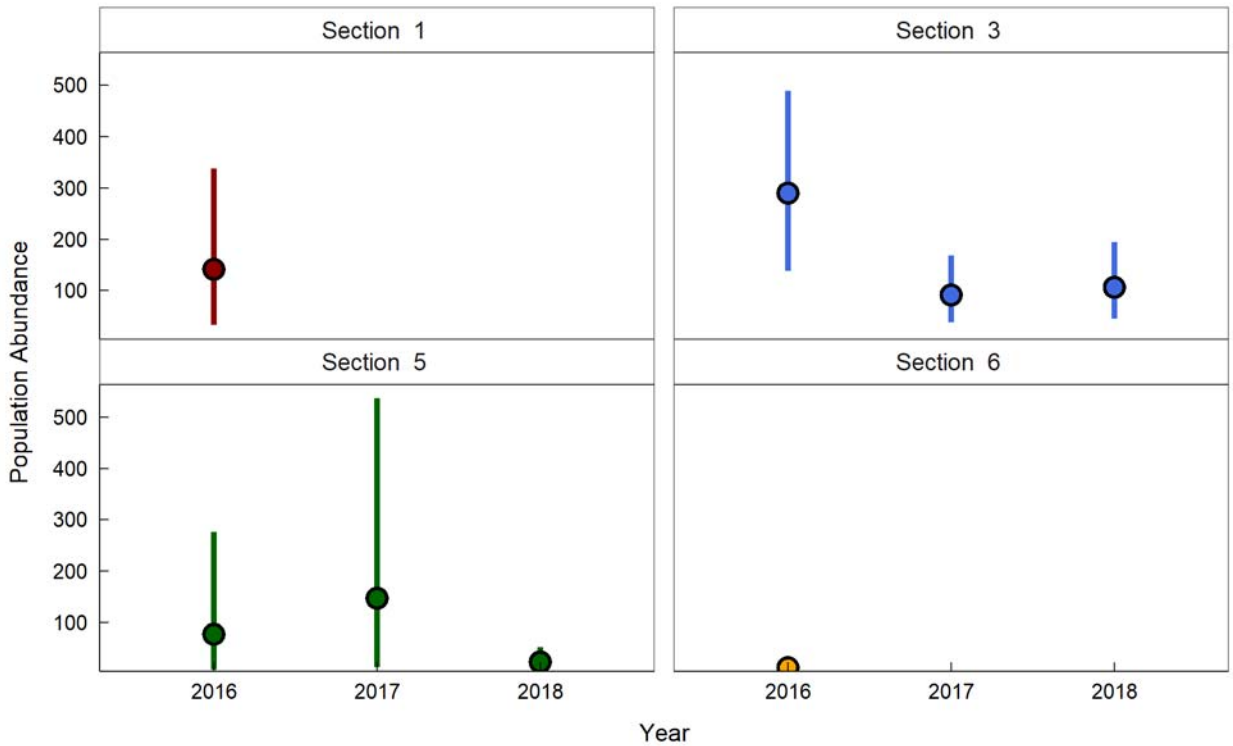

Figure 49: Population abundance estimates (with 95% credibility intervals) generated using the Bayes sequential model for Rainbow Trout captured by boat electroshocking in Sections 1, 3, 5, and 6 of the Peace River, 2016–2018.

3.12 Walleye

3.12.1 Biological Characteristics

During the 2018 survey, 341 Walleye were initially captured (i.e., excluding within-year recaptures) and 340 of these were measured for length and weight. Ages were assigned to 108 Walleye based on analysis of fin rays. For fish assigned an age, fork lengths ranged between 118 and 646 mm, weights ranged between 16 and 2794 g, and body condition (*K*) ranged between 0.87 and 1.35 (Table 21). Ages of Walleye ranged from age-0 to age-14. Modes representing age-0 and age-1 age-classes were evident in the length-frequency histogram.
After approximately age-2, length ranges overlapped adjacent age-classes (Figure 50; Figure 51).

Table 21: Average fork length, weight, and body condition by age for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Age	Fork Length (mm)			Weight (g)			Body Condition (K)		
	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]	Average ± SD	Range	*n*[a]
0	137 ± 27	118 – 156	2	27 ± 16	16 – 38	2	0.99 ± 0.02	0.97 – 1	2
1	214 ± 30	196 – 249	3	100 ± 44	74 – 151	3	0.98 ± 0.03	0.95 – 1.01	3
2	270 ± 23	254 – 286	2	198 ± 36	172 – 223	2	1 ± 0.07	0.95 – 1.05	2
3	347 ± 33	316 – 390	7	491 ± 140	352 – 690	7	1.15 ± 0.06	1.08 – 1.26	7
4	339 ± 19	296 – 360	15	442 ± 77	276 – 563	15	1.13 ± 0.07	1.02 – 1.27	15
5	377 ± 30	328 – 426	23	608 ± 146	389 – 940	23	1.12 ± 0.1	0.87 – 1.32	23
6	413 ± 30	366 – 470	20	816 ± 206	518 – 1273	20	1.14 ± 0.12	0.87 – 1.35	20
7	442 ± 23	401 – 482	12	959 ± 184	677 – 1329	12	1.1 ± 0.07	0.97 – 1.19	12
8	477 ± 32	442 – 510	4	1262 ± 326	891 – 1620	4	1.14 ± 0.12	1.03 – 1.31	4
9	490 ± 30	451 – 542	10	1351 ± 279	987 – 1835	10	1.13 ± 0.05	1.04 – 1.21	10
10	515 ± 10	502 – 525	5	1522 ± 207	1311 – 1786	5	1.11 ± 0.11	1 – 1.23	5
11	552	-	1	1860	-	1	1.11	-	1
12	560 ± 57	520 – 600	2	2109 ± 969	1424 – 2794	2	1.15 ± 0.2	1.01 – 1.29	2
13	646	-	1	2748	-	1	1.02	-	1
14	600	-	1	2594	-	1	1.20	-	1

[a] Number of individuals sampled.

The majority of Walleye captured (322 out of 341 individuals; 94%) were longer than 250 mm FL. The majority of Walleye were between age-4 and age-9 (Figure 52), suggesting that the study area is primarily used by adults during the sampling period. Consistent with previous years, all small Walleye (i.e., fish less than approximately 250 mm FL corresponding to the age-0 and age-1 cohorts) were encountered in downstream sections; small Walleye were not encountered in Sections 1, 3, and 5 (Appendix F, Figures F35 and F36).

Growth curves estimated using the von Bertalanffy method suggested that the oldest and largest Walleye captured had not yet reached the asymptotic size (Figure 53). Lack of very large Walleye in the length-at-age data can bias estimates of the mean asymptotic size, but the estimates of approximately 700 to 800 mm FL (Figure 53) seem reasonable based on the largest fish captured during this program (736 mm) and the biology of the species (McPhail 2007). Comparison of growth curves among years suggest some differences, such as 2009 when growth ceased at age-10 compared to the continued growth between age-10 and age-13 observed in 2018 (Figure 54). These differences could be explained by real changes in growth conditions, but are more likely due to changes and bias in ageing methods and data over time.

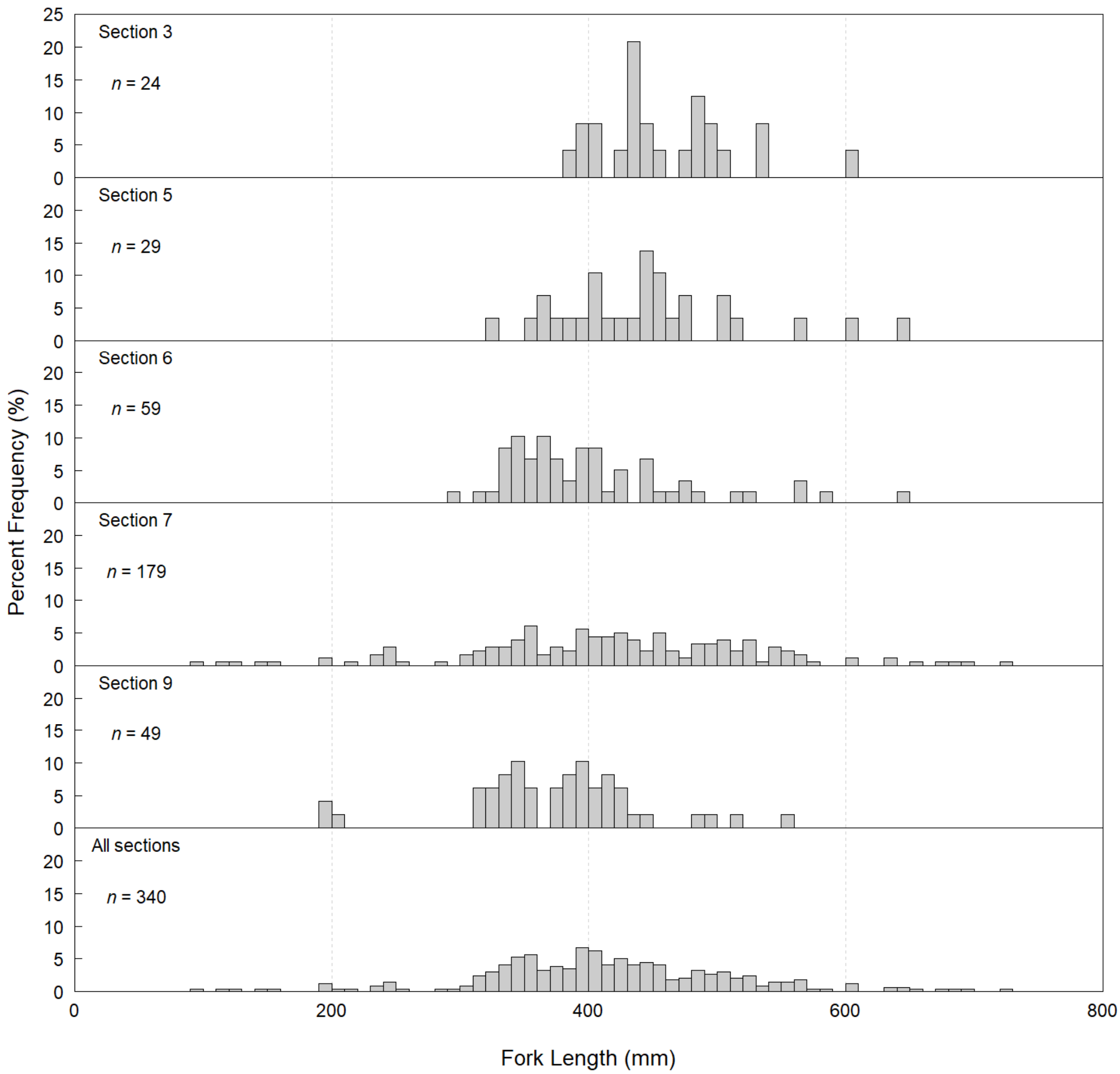

Figure 50: Length-frequency distributions for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

Mean body condition varied little among years and sections (Figure 55; Appendix F, Figure F42). The length weight-relationship was also similar among sections (Figure 56) and years (Appendix F, Figure F39), with typical values of b of 3.1. One exception was that in 2017 and 2018, the length-weight regression suggested that large Walleye weighed less at a given length (i.e., a smaller value of b) in Sections 6, 7, and 9 than in Sections 1, 3, and 5 (Appendix F, Figures F38 and F39).

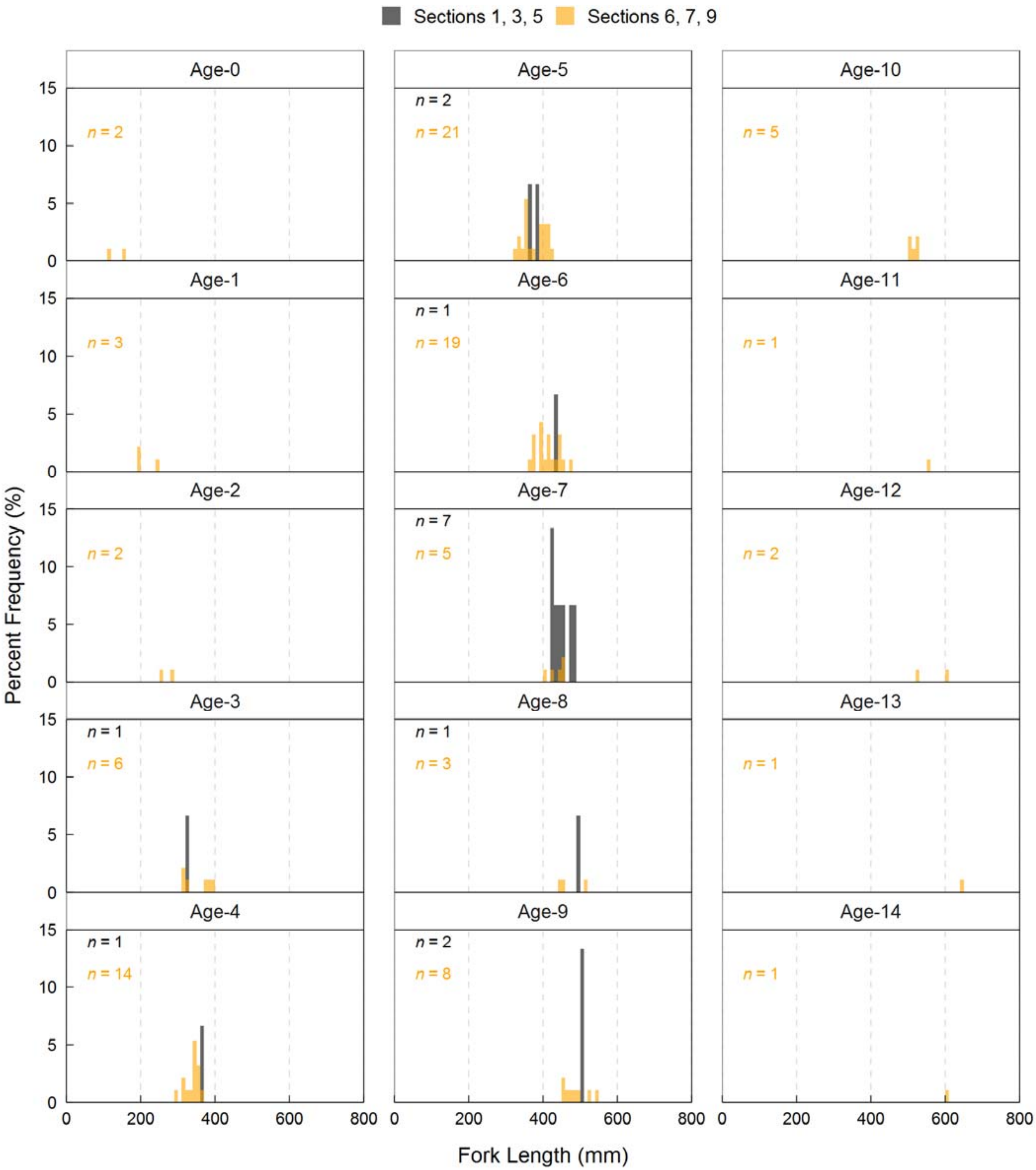

Figure 51: Length-at-age frequency distributions for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

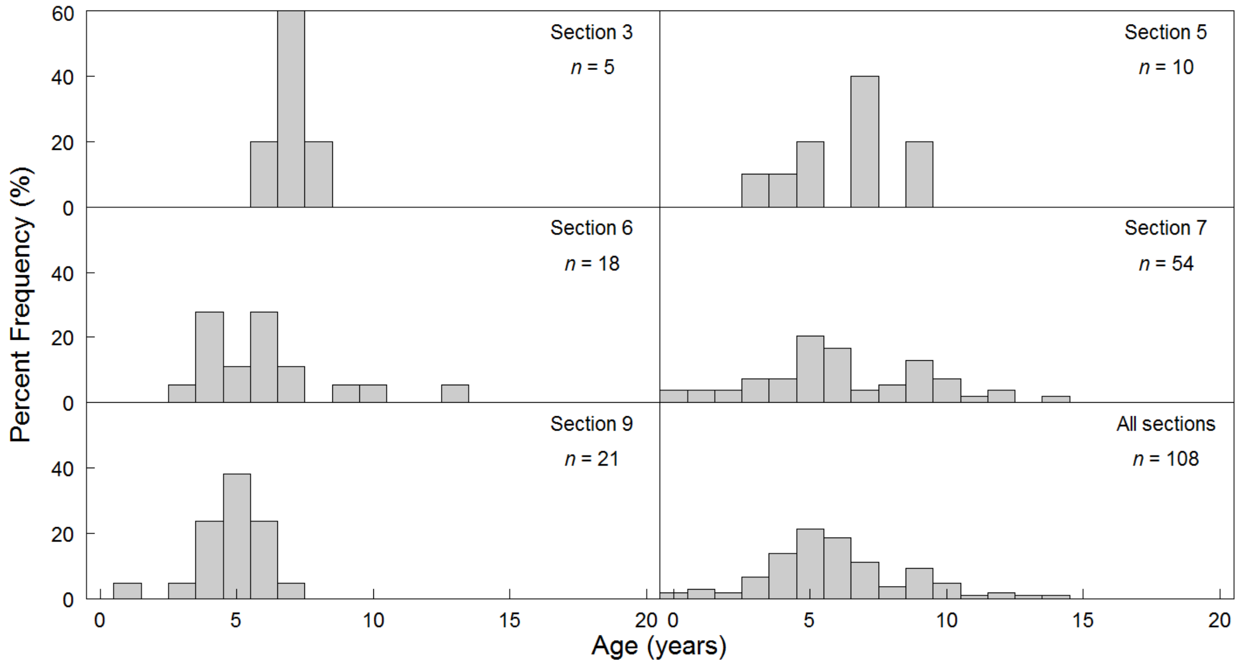

Figure 52: Age-frequency distributions for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

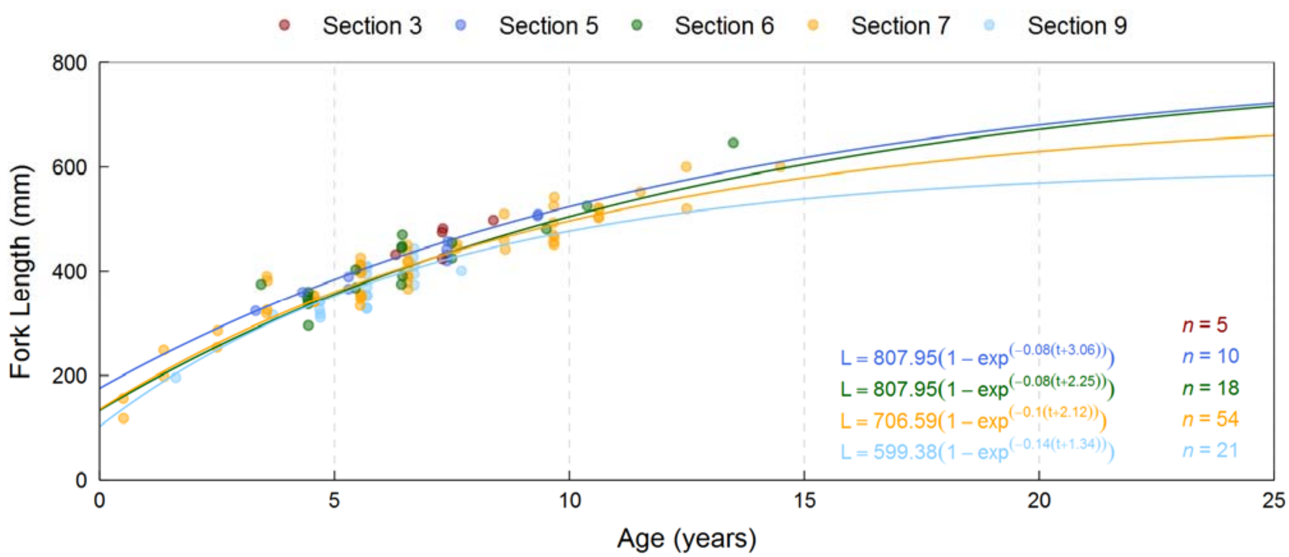

Figure 53: von Bertalanffy growth curve for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

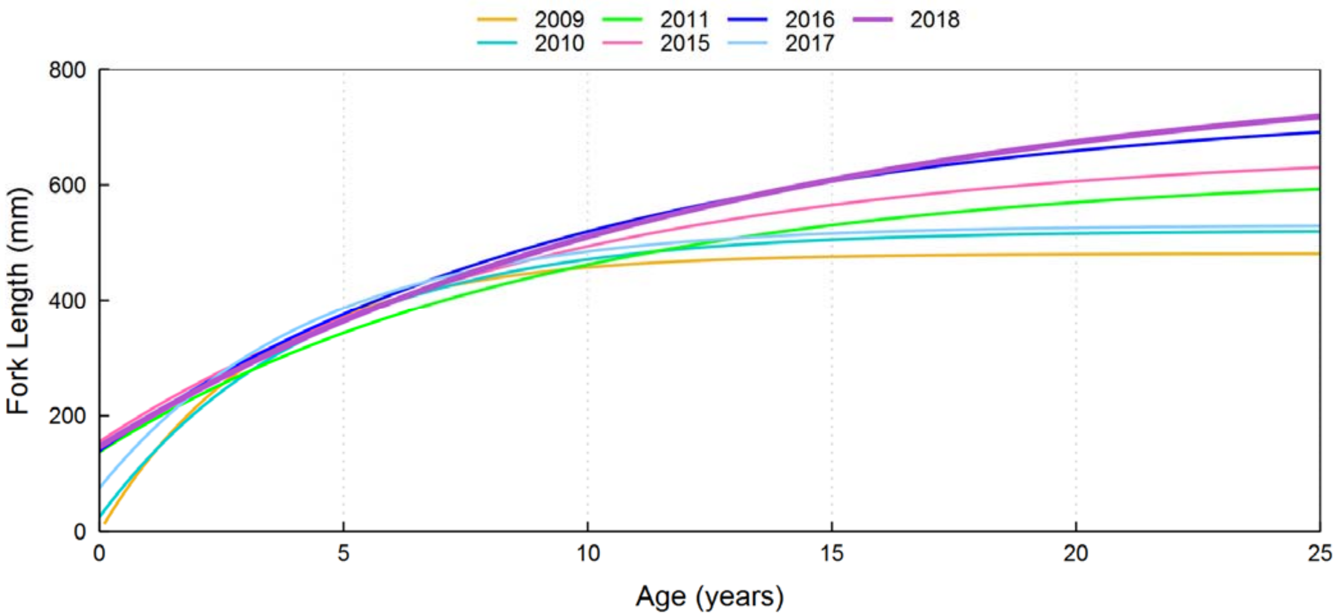

Figure 54: von Bertalanffy growth curve for Walleye captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.

Overall (both sessions combined), 22 Walleye were recorded during the Goldeye and Walleye Survey conducted in June and July 2018. These fish ranged between 275 and 662 mm FL in length and between 231 and 3391 g in weight. Of the 22 Walleye captured during the Goldeye and Walleye, 7 were aged, ranging between age-4 and age-14. Length and age data indicate similar uses of the area by this species during the early to mid-summer season as the mid-summer to early fall season. Walleye spawn in the spring when water temperatures are around 5°C (Nelson and Paetz 1992). None of the Walleye captured during the Goldeye and Walleye Survey were in spawning condition. For all size classes combined, body condition (*K*) was lower for Walleye recorded during the Goldeye and Walleye Survey (average = 1.06; range: 0.81 to 1.31) when compared to those recorded during the Indexing Survey (average = 1.13; range: 0.87 to 1.42). Additional results from the Goldeye and Walleye Survey are provided in Section 3.14.

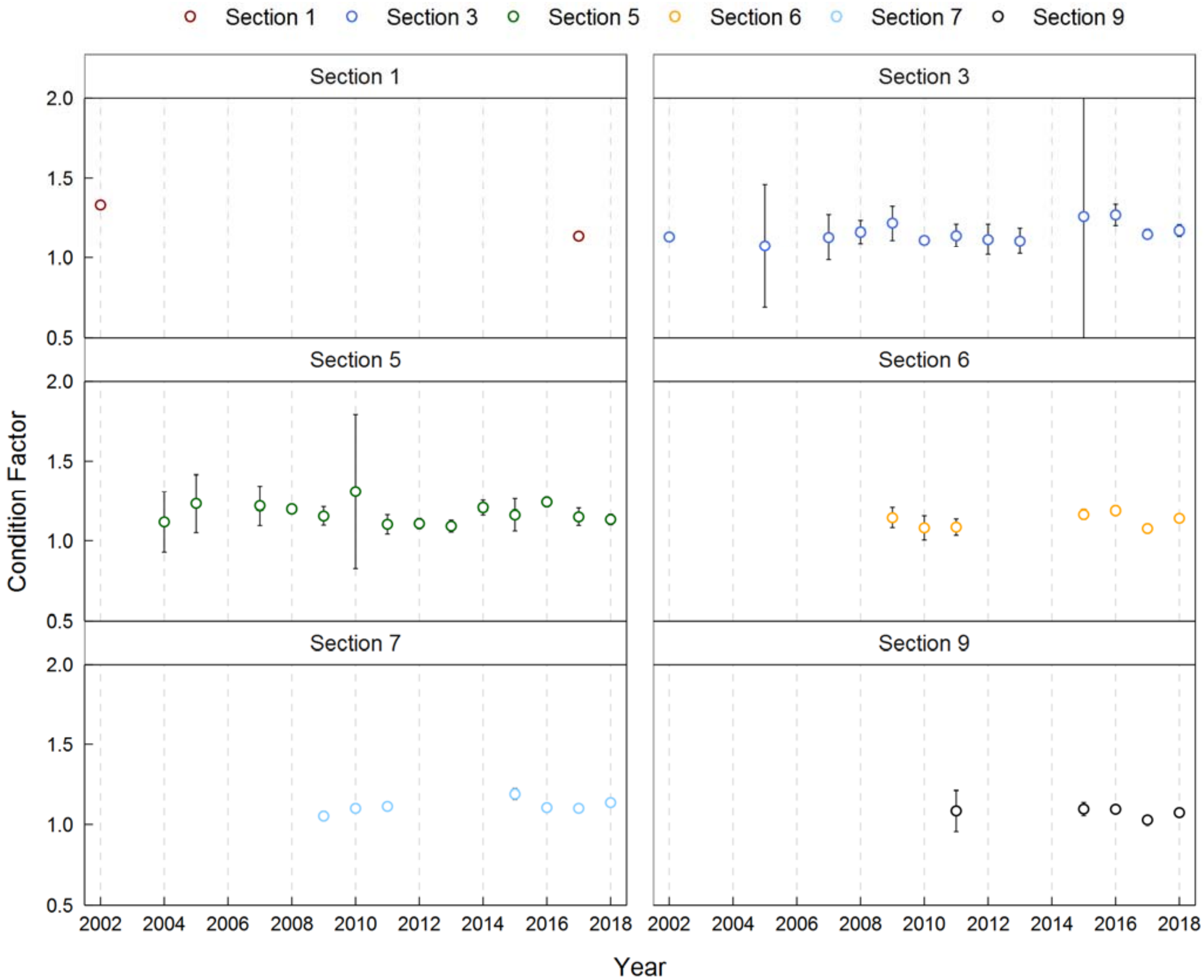

Figure 55: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for Walleye captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. The 95% CI of Section 3 values in 2015 extends from -0.39 to 2.91.

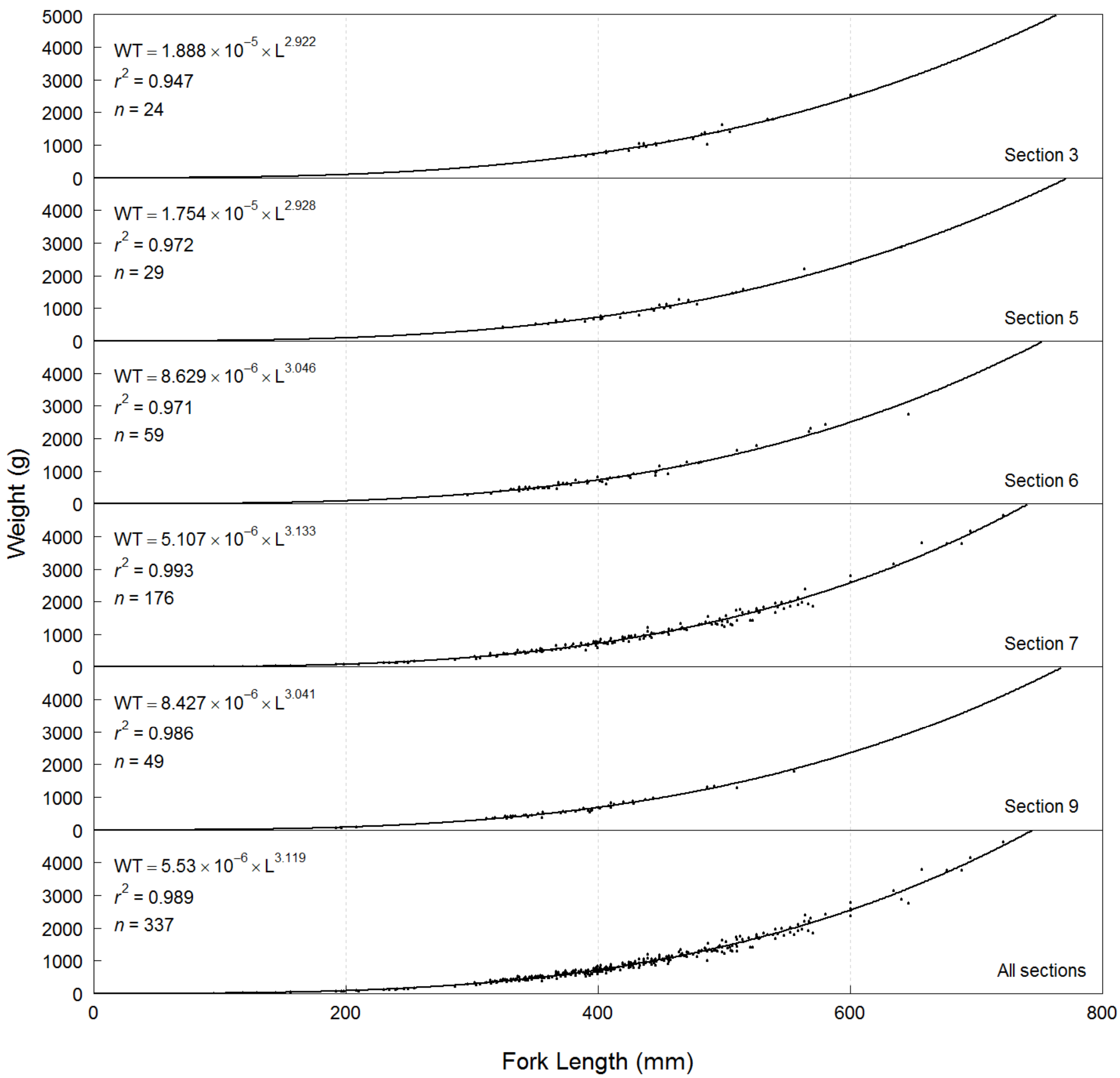

Figure 56: Length-weight regressions for Walleye captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

3.12.2 Abundance and Spatial Distribution

In Sections 1, 3, and 5, which were consistently sampled between 2002 and 2018, the number of Walleye captured ranged from 0 to 61 individuals each year. In 2018, 53 Walleye were captured in these three sections combined. All of these 53 fish were recorded in Section 3 (n = 24) and Section 5 (n = 29; Table 8). Only four individuals have been recorded upstream of the Halfway River confluence since the program began in 2001. In Sections 6, 7, and 9, which were only sampled as part of this program from 2015 onward, the number of

Walleye captured each year was 103 in 2015, 197 in 2016, 311 in 2017, and 288 in 2018 (Appendix E, Table E2). Catch data collected to date indicate a preference for the downstream portions of the study area for this species and catch rates suggest increasing use of the area since 2015.

Of the 361 Walleye captured in 2018, 352 of these fish were implanted with PIT tags, and of those, 20 were recaptured in subsequent sessions. Two fish were recaptured in a different section than they were initially tagged and released. One individual was initially captured in Section 5 and recaptured in Section 6 and one individual was initially captured in Section 5 and recaptured in Section 7. In Sections 7 and 9, sufficient fish were recaptured in 2018 to calculate Walleye abundance estimates (Table 22).

Table 22: Population abundance estimates generated using the Bayes sequential model for Walleye captured by boat electroshocking in sampled sections of the Peace River, 2018.

Section	Bayes Mean	Maximum Likelihood	95% Highest Probability Density		Standard Deviation	Coefficient of Variation (%)
			Low	High		
7	574	270	98	1,454	393	68.4
9	1,952	1,568	868	3,376	677	34.7
Total[a]	2,526	2,112	1,478	2,552	783	31.0

[a] Calculated from the joint distribution of Section 7 plus Section 9.

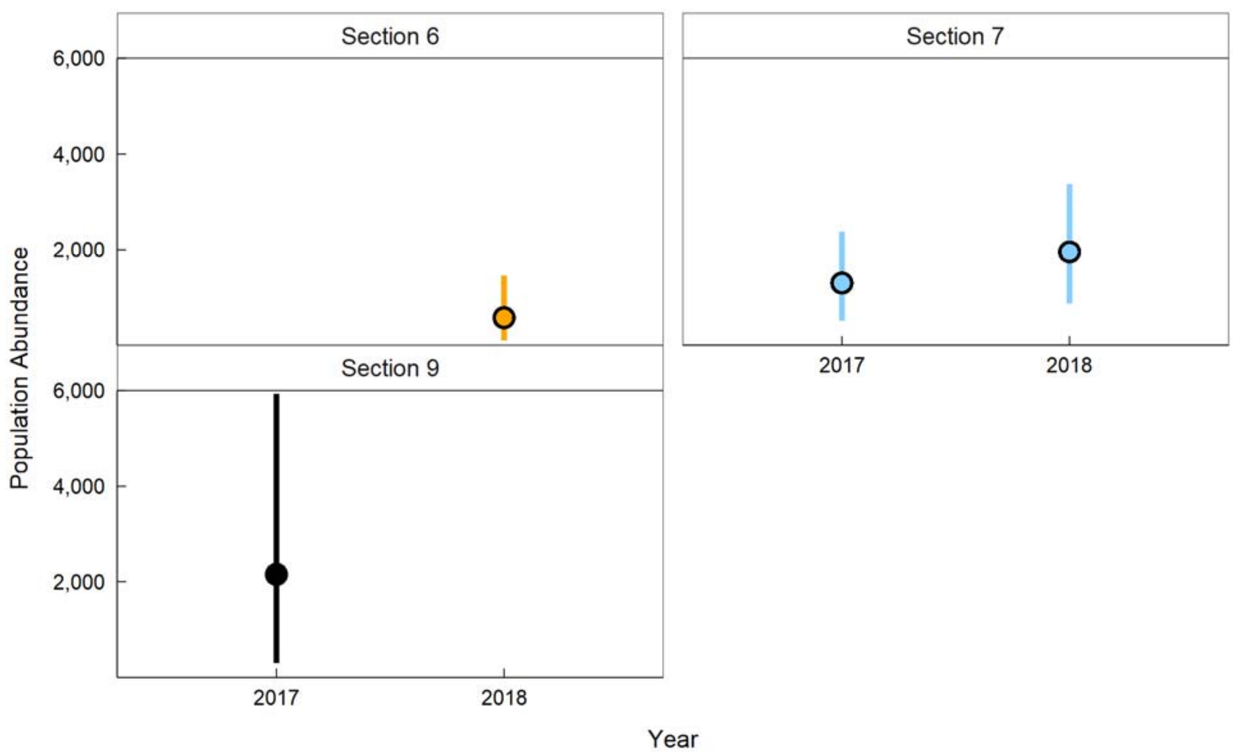

Figure 57: Population abundance estimates (with 95% credibility intervals) generated using the Bayes sequential model for Walleye captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2017–2018.

3.13 White Sucker

3.13.1 Biological Characteristics

During the 2018 survey, 145 White Sucker were initially captured (i.e., excluding within-year recaptures; Table 8). Of these 145 fish, 122 were measured for length and weight. Fork lengths ranged between 215 and 471 mm, and weights ranged between 125 and 1609 g.

The majority of White Sucker encountered were between 300 and 500 mm FL. No White Sucker smaller than 200 mm FL were captured in 2018. Length-frequency histograms suggest similar length distributions among sections (Figure 58), except that White Sucker between 200 and 300 mm FL were only captured in Section 6, 7, and 9 and not in Sections 1,3, and 5. Use of downstream sections by young White Suckers was also identified in 2016 and 2017.

The length-weight relationship in 2018 was similar to previous years; however, the differences were not statistically compared in 2017. Analyses conducted in 2017 (Golder and Gazey 2018) indicated little significant difference in the length-weight relationship among years or sections. Small sample sizes hinder interpretation of length-weight relationships for White Sucker (Figure 59). The mean body condition (*K*) of White Sucker varied little among sections or years with typical values of 1.3 and a range of 1.1 to 1.6 (Figure 60).

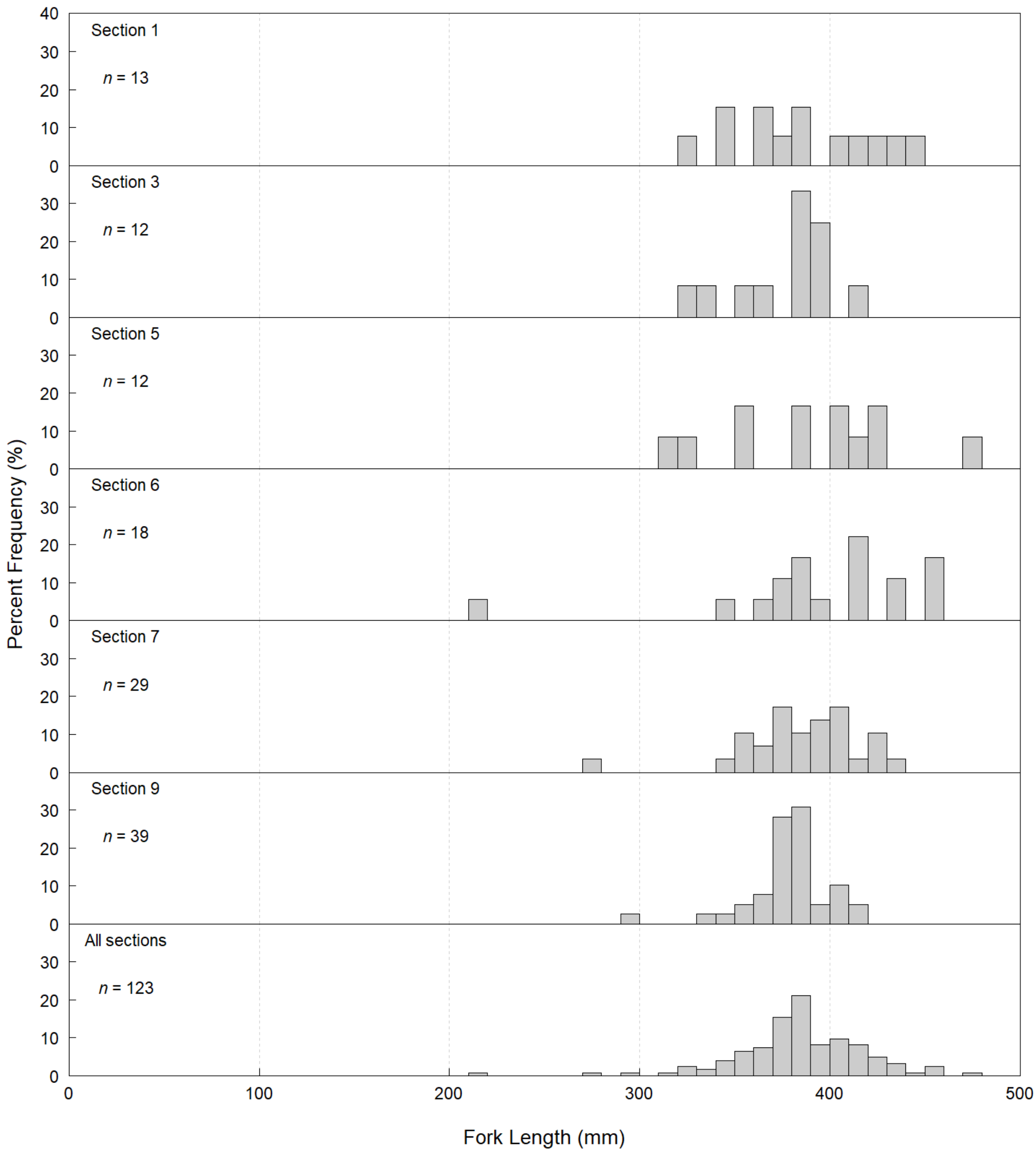

Figure 58: Length-frequency distributions for White Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

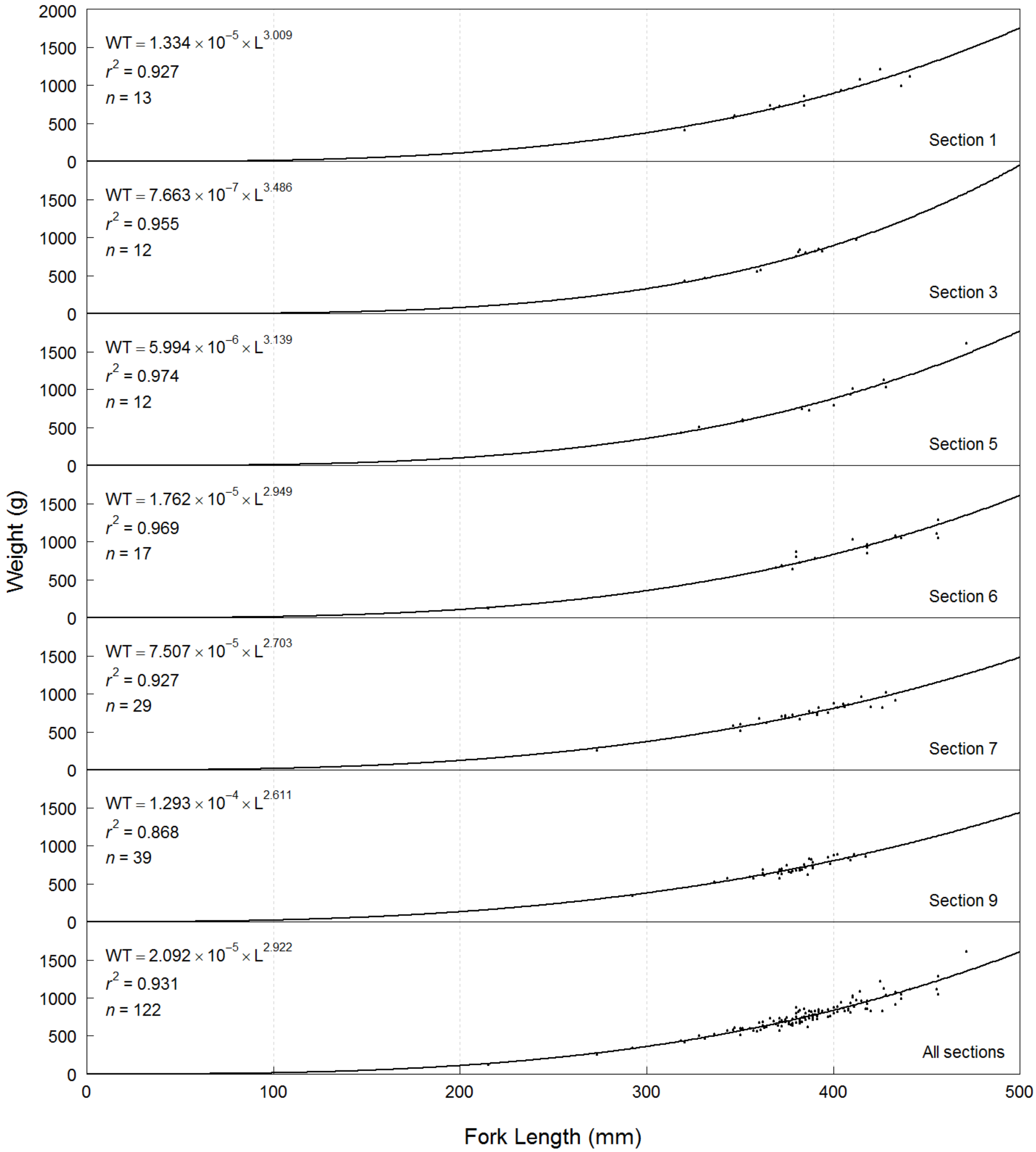

Figure 59: Length-weight regressions for White Sucker captured by boat electroshocking in sampled sections of the Peace River, 27 August to 10 October 2018.

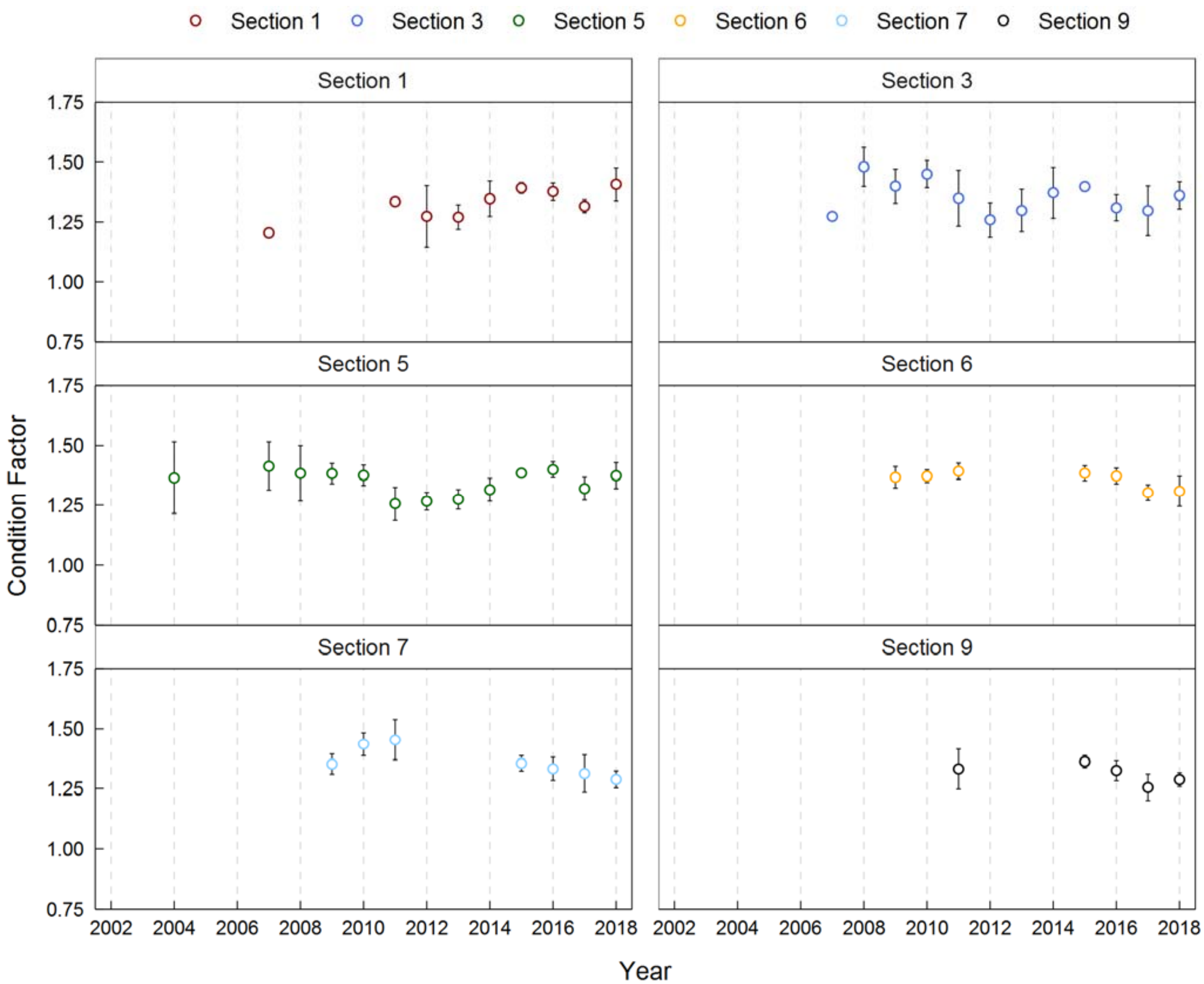

Figure 60: Mean Fulton's body condition index (*K*) with 95% confidence intervals (CIs) for White Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.

3.13.2 Abundance and Spatial Distribution

In 2018, White Sucker were recorded in all sections; however, they were more common in the upstream sections (Sections 1, 3, and 5; range: 13 to 14 individuals) than the downstream sections (Sections 6, 7, and 9; range: 30 to 41 individuals). Of the 145 White Sucker encountered during the 2018 survey, 126 were implanted with PIT tags; four were subsequently recaptured. Movement between sections was not observed. There were insufficient data to produce absolute abundance estimates for this species; however, catch rate data suggest stable abundance between 2015 and 2018.

3.14 Goldeye and Walleye Survey

A total of 14 different species and 171 individual fish were captured during the 2018 Goldeye and Walleye Survey Table 23). None of these fish were captured more than once during the Goldeye and Walleye Survey; however, one Largescale sucker, one Longnose Sucker, one Mountain Whitefish, and 3 Walleye that were captured during the Goldeye and Walleye Survey were also captured during the previous (i.e., 2017) Indexing Survey.

Two Walleye captured during the Goldeye and Walleye Survey were captured during the subsequent (i.e., 2018) Indexing Survey (Attachement A). Longnose Sucker were the most commonly captured species, accounting for 34% of the catch (*n* = 58). The remaining species encountered, in declining order of abundance, were as follows: Largescale Sucker (18%; *n* = 31), Mountain Whitefish (13%; *n* = 23), Walleye (13%; *n* = 22), Redside Shiner (5%; *n* = 8), Northern Pikeminnow (3%; *n* = 5), Lake Chub (3%; *n* = 5), Flathead Chub (3%; *n* = 5), Northern Pike (3%; *n* = 5), White Sucker (2%; *n* = 4), and Goldeye (1%; *n* = 2). Single individuals of Longnose Sucker, Arctic Grayling, and Burbot were also encountered. Species classified as Group 3 by Golder et al. (2012) (i.e., species sensitive to fish passage) were not recorded during the survey.

Table 23: Average fork length, weight, and body condition of fish captured by boat electroshocking during the Goldeye and Walleye survey, 15 June to 17 July 2018.

Species	Group[a]	Fork Length (mm)			Weight (g)			Body Condition (K)		
		Average ± SD	Range	n[b]	Average ± SD	Range	n[b]	Average ± SD	Range	n[b]
Burbot	1	515	-	1	729	-	1	0.53	-	1
Northern Pike	1	517 ± 185	237 – 748	5	1313 ± 1247	85 – 3402	5	0.70 ± 0.09	0.59 – 0.81	5
Walleye	1	415 ± 111	275 – 662	22	864 ± 803	231 – 3391	21	1.06 ± 0.14	0.81 – 1.31	21
Arctic Grayling	2	255	-	1	185	-	1	1.12	-	1
Mountain Whitefish	2	276 ± 106	101 – 449	23	288 ± 220	12 – 754	22	1.02 ± 0.14	0.83 – 1.42	22
Flathead Chub	4	104 ± 28	58 – 133	5	18 ± 8	13 – 28	3	1.09 ± 0.09	1.03 – 1.19	3
Goldeye	4	380 ± 7	375 – 385	2	632 ± 13	623 – 642	2	1.15 ± 0.09	1.09 – 1.22	2
Lake Chub	4	65 ± 21	42 – 97	5	6 ± 1	5 – 6	2	0.92 ± 0.37	0.66 – 1.19	2
Largescale Sucker	4	429 ± 88	189 – 575	31	1089 ± 584	75 – 2530	26	1.23 ± 0.09	1.07 – 1.41	26
Longnose Dace	4	57	-	1	-	-	0	-	-	0
Longnose Sucker	4	343 ± 81	146 – 444	58	538 ± 277	32 – 992	54	1.15 ± 0.1	0.97 – 1.43	54
Northern Pikeminnow	4	271 ± 121	145 – 430	5	312 ± 318	33 – 801	5	1.13 ± 0.13	1.01 – 1.34	5
Redside Shiner	4	84 ± 11	63 – 97	8	8 ± 3	3 – 12	7	1.27 ± 0.11	1.13 – 1.47	7
White Sucker	4	370 ± 23	340 – 395	4	682 ± 151	556 – 880	4	1.33 ± 0.16	1.1 – 1.43	4

[a] As assigned by Golder et al. (2012).

[b] Number of individuals sampled.

Lower capture numbers hindered detailed analysis of life history measurements recorded during the 2018 Goldeye and Walleye Survey (Table 23). Length measurements taken during the Goldeye and Walleye Survey were similar to measurements recorded during the Indexing Survey for most species, suggesting use of the area by similar life stages during both study periods. With the exception of Largescale Sucker and White Sucker, body condition (*K*) was lower for all species during the Goldeye and Walleye Survey when compared to values recorded during the 2018 Indexing Survey (all size classes combined).

3.15 Catchability

When catchability is near constant across study years or sections, indices of abundance, such as catch rates, are more comparable to one another. As such, for years or sections where poor mark-recapture data prevented the generation of population abundance estimates, catch rate data can be used as an estimate of relative abundance. Greater differences in catchability across sections or years would suggests that catch was influenced by some external factor (e.g., physical conditions at the time of sampling, gear saturation, size selectivity). For these reasons, catchability by year and section was assessed for Mountain Whitefish. Mountain Whitefish are the most common fish species captured during the Indexing Survey and were the only species with sufficient numbers of recaptures to compute catchability coefficients.

For Mountain Whitefish, catchability coefficients were computed based on the Bayesian sequential estimates. The catchability coefficients were calculated using effort as measured in the kilometres of shoreline sampled (top panel) and using effort as measured in the number hours of electroshocking (bottom panel) for all sections sampled from 2015 to 2017 (Figure 61). Confidence limits overlapped for all sections and years.

The 2018 catchability coefficients for Sections 1, 3, and 5 were of similar scale to those estimated in 2010, and 2014 to 2017 (Figure 62). The coefficients were consistent among sections within 2018, as were many other years (e.g., 2008 through 2012). Coefficients were not consistent across all years but were similar between 2014 and 2018.

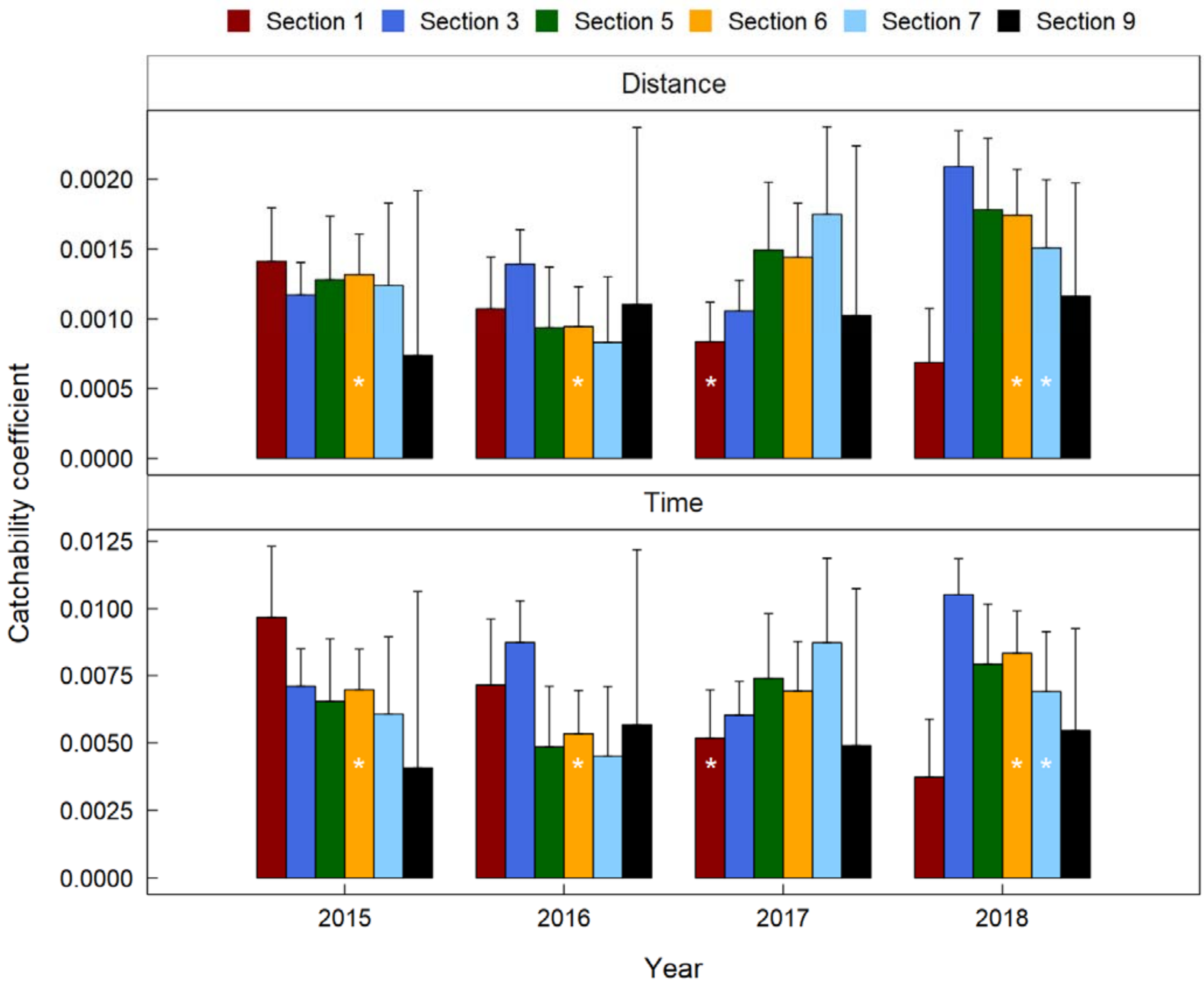

Figure 61: Catchability estimates by section for Mountain Whitefish captured by boat electroshocking based on sampling effort measured in distance (top panel) and time (bottom panel) in the Peace River, 2015–2018. Vertical bars represent 95% confidence intervals; stars indicate suspect population abundance estimates.

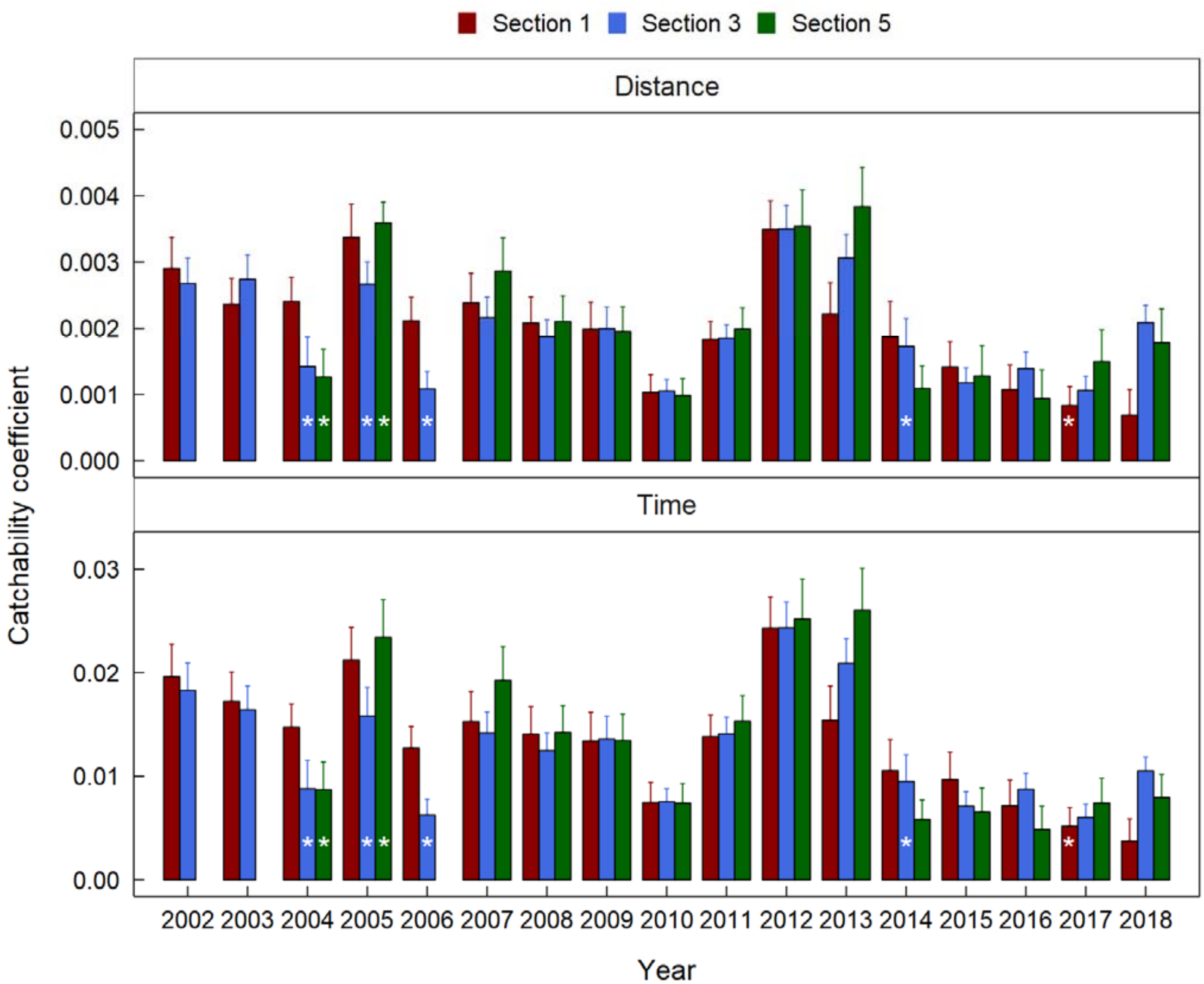

Figure 62: Catchability estimates by year and section (Sections 1, 3, and 5) for Mountain Whitefish captured by boat electroshocking based on sampling effort measured in time (top panel) or distance (bottom panel) in the Peace River, 2002–2018. Vertical bars represent 95% confidence intervals; stars indicate suspect population abundance estimates.

3.16 Diversity Profiles

In the diversity profiles, the effective number of species is used to indicate the diversity of fish taxa while varying the value of *q*, which represents the relative contribution of less common species to the diversity metric. The steep decline in the effective number of species with increasing values of *q* reflects the community composition in the study area, with a few species dominating the catch and low numbers of less common species (Figure 63). This community composition results in species richness (*q* = 0) of 8 to 12 effective species, but less than four effective species at values of *q* equal or greater than one in all sections. Consistent with 2017 (Golder and Gazey 2018), diversity was generally greater in downstream sections (Sections 6, 7, and 9) than in sections further upstream (Sections 1, 3, and 5).

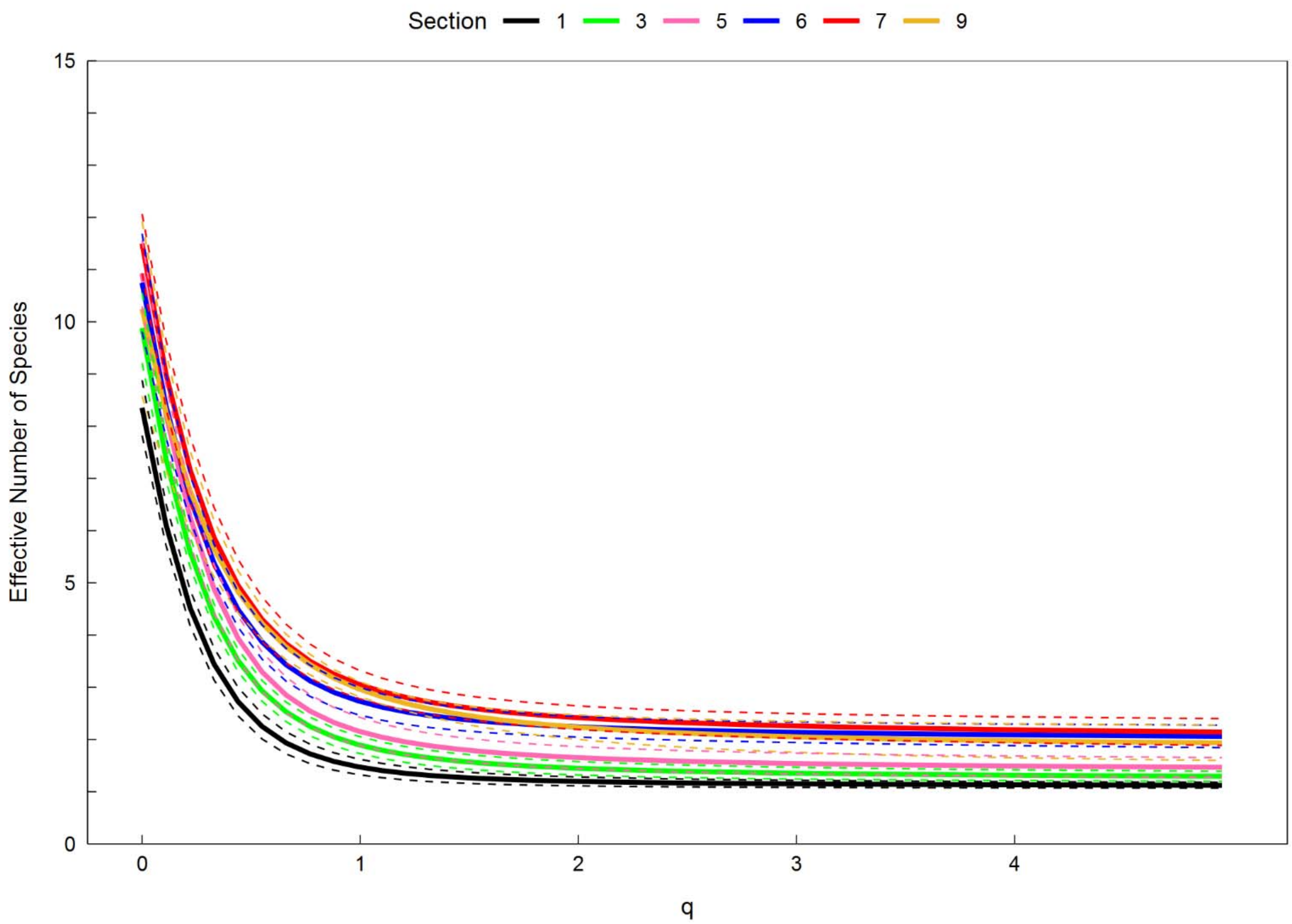

Figure 63: Diversity profiles showing effective number of species versus the parameter (*q*) representing the importance of less common to common species in the calculation. Values are means (solid lines) with 95% confidence intervals (dashed lines) from annual diversity profiles from 2002 to 2018 combined for each section in the Peace River study area (Sections 6, 7, and 9 only include data from 2015 to 2018). A value of q = 0 corresponds to species richness while a value of q = 1 corresponds to the Shannon index.

4.0 DISCUSSION

4.1 Management Hypotheses

Management hypotheses for this monitoring program relate to the predicted changes in the biomass and community composition of fish in the Peace River during the construction and operation of the Project. Data collected from 2002 to 2015 represent the baseline, pre-Project state of the fish community, while data collected from 2016 to 2018 represent initial stages of Project construction. Currently, management hypotheses are not scheduled to be statistically tested until after the river diversion phase of construction (i.e., after 2020). Instead, effort has focused on developing analyses and metrics that will eventually be used to test the management hypotheses.

4.2 Annual Sampling Consistency

Field methods employed during the Indexing Survey were standardized in 2002; these methods were carried over to the GMSMON-2 program in 2008 and to the current program in 2015. Over the 17-year study period (2002 to 2018), small changes were occasionally made to the methods based on results of preceding study years or to better address each program's management objectives. Examples of some of these changes include the sections of river sampled and the types of tags deployed (T-bar anchor tags initially, changing to full-duplex PIT tags in 2004, and to half-duplex PIT tags in 2016). For a long-term monitoring program, changes to methods, which also includes changes in handling procedures (such as additive effects associated with collecting tissue or stomach content samples), have the potential to confound results and hinder the identification of patterns and trends in the data through changes in behavior, health, or survival. Changes made between 2002 and 2013 are discussed in previous reports. In 2018, boat electroshocking methods adhered to methods developed by Mainstream and Gazey (2014) and subsequently modified in 2014 to reduce electroshocker related injuries to fish. These modifications included operating the electroshocking equipment at a lower frequency (30 Hz when compared to 60 Hz) and amperage (a range 2.0–4.2 A compared to 3.2–5.2 A). Studies from other river systems indicate that salmonids, particularly larger salmonids, are less likely to be injured (i.e., branding, internal hemorrhaging, or spinal injuries) at the lower operational settings (Snyder 2003; Golder 2004, 2005).

It is not known whether the difference in electroshocker settings used in 2014–2018 versus 2002–2013 resulted in differences in the rates of injury, survival, capture probability, and recapture of sampled fishes; however, the Mountain Whitefish synthesis model indicates differences in selectivity between the two epochs for this species. From 2014 to 2018, selectivity was more uniform across size classes when compared to 2002–2013 (Appendix H, Figure H11). Higher frequencies, which were used from 2002–2013, result in greater electrical power. Greater power makes it easier to catch small fish (Dolan and Miranda 2003). Lower frequencies, which were used from 2014–2018, have less electrical power, reducing the small fish catch and increasing the portion of large fish in the catch. The change in selectivity confounds comparisons between the two epochs but could prove beneficial to long-term study results, due to reduced injury or mortality associated with electroshocking. Increased selectivity for younger age-classes, particularly age-2 fish because they are young but still large enough to tag, would increase the precision of age-based metrics, including length-at-age, annual growth, recruitment, and inter-annual survival, and improve the precision of the synthesis model.

In 2018, a sixth session was scheduled but could not be conducted due to low water temperatures (i.e., water temperatures less than 5°C). The approximately 17% reduction in effort in 2018 relative to the 2002 to 2017 study years should be considered when interpreting total catch data.

4.3 Population Estimates

4.3.1 Evaluation of Assumptions

Mountain Whitefish are an indicator species for the study and are captured in sufficient numbers to allow for detailed population abundance modeling. Based on field observations, Mountain Whitefish are sensitive to external stresses, and that may result in the loss of tagged fish or reduced recapture rates, potentially confounding population abundance estimates and modeling efforts. Factors that affect population estimates can be evaluated through an assessment of assumptions required for the Bayes sequential and stratified population models, which are as follows:

1) The population size in the study area does not change (i.e., is closed) and is not subject to apparent mortality over the period of the experiment.

For Mountain Whitefish in Sections 6 and 7, the posterior distributions from 2018 indicated either unaccounted for immigration of fish to the section, or a trend to lower catchability of marked fish through time. It is unlikely that the catchability of one species would decline over the study period in some sections and remain constant in other sections when the same equipment and methods are used among sections. For that reason, the result is likely indicative of unaccounted for immigration. The high frequency of the violation in Section 6 (i.e., three of the last four years) may partially be due to the low percentage of side channel habitat sampled relative to main channel habitat. Side channels are common in Section 6 but few of the established sites are situated within side channels. It is possible that Mountain Whitefish move between main channel and side channel habitats and are therefore less likely to be recaptured in Section 6 due to the location of the sites. Reallocating some of the effort in Section 6 to side channel habitats may provide insight regarding the frequent assumption violations for this section. For all other sections and species, the available evidence does support a closed population.
Most recaptured Mountain Whitefish (92.8%) were recaptured in the section they were initially released into; only 7.2% of recaptured Mountain Whitefish were encountered in a different section. The population estimation model accounts for fish that move under the assumption that all movement is described by the history of recaptured marks. Growth over the study period, while significant, was small; therefore, the number of unmarked fish that entered the population through growth (i.e., fish that grew from less than 250 mm FL to more than 250 mm FL) during the study period (termed growth recruitment) should be negligible. No significant apparent mortality was estimated by the CJS analysis. Inspection of the posterior probability plot sequences generated by the Bayes model indicated that all species and sections (except Mountain Whitefish in Sections 6 and 7) were convergent with no marked trends to larger or smaller population sizes.

2) All fish in a stratum (day and section), whether marked or unmarked, have the same probability of being caught.

The available evidence implies that Section 3 marked and unmarked Mountain Whitefish underwent heterogeneous capture probabilities over the study period. For all other sections and species, the available evidence supports the assumption. The study area was stratified into six sections to account for any differences from marks applied, population size, or spatial catchability. Similarly, the day strata accounted for new marks applied through the study. While some T-bar anchor tags that had been implanted during previous study years were encountered in 2018 (two Mountain Whitefish and one Walleye), only PIT tags were used in the analyses. For Mountain Whitefish in Section 3, the time-varying catchability model had a better fit to the data than the constant catchability model. The constant catchability model fit the data better or nearly as well in all other sections.

3) Fish do not lose their marks over the period of the study.

Overall, tag retention was high, with only 3 out of 10,368 Mountain Whitefish (0.03%) showing evidence of a tag implantation wound (current year; *n* = 2) or scar (previous year; *n* = 1) without a tag being detected. This result is similar to results recorded during previous study years. The impact on 2018 population estimates from lost tags was assumed to be negligible.

4) All marked fish are reported on recapture.

Only fish brought on board were included in the number of fish examined for a tag; therefore, it is unlikely that a tagged fish would avoid detection.

4.3.2 Reliability of Estimates

The foremost issue for the reliability of estimates is the weight each session should receive for the estimation of population size. The sequential Bayes algorithm updates the posterior distribution of the previous session by the information from the current session. Gazey and Staley (1986) showed that the sequential mark-recapture experiment can be characterized as a sequential Bayes algorithm updated by the binomial kernel. Thus, the sequential Bayes model weighs each session by the information contained in the sample regardless of variation in catchability or population size. The sequential Bayes algorithm also incorporates time-varying capture probability because capture probability is implicitly linked to sampling intensity (i.e., sample size divided by population size; Williams et al. 2001). In addition, unmarked releases do not bias population estimates. From a practical perspective, when the model assumptions hold, the population estimates will be accurate. When the assumptions do not hold, the population estimate should provide good approximations.

The sequential Bayes model provides good population estimates for within-year sampling on the Peace River. The assumptions required to produce population estimates appear to hold for all species and sections with the exception of Mountain Whitefish in Section 6 and 7, which resulted in higher uncertainty in estimates for this section and species relative to others. This uncertainly is due to either the first or second assumptions not being supported by the data.

Low numbers of captured and recaptured Arctic Graying limited the effectiveness of the mark-recapture study for this species; however, estimates were generated for this species for Section 3. For Bull Trout, population estimates were available for Sections 3 and 5; however, precision was generally poor (overall CV = 32%).

One less session was conducted in 2018 relative to the 2002 to 2017 study years. Conducting five sessions instead of six sessions may have reduced the precision of population abundance estimates and widened credibility intervals.

4.4 Catchability

Catchability coefficients were calculated under the assumptions of a closed population with no apparent mortality, and that abundance indices are proportional to the population size (Figure 61 and Figure 62). If the above assumptions are true, coefficients should remain constant over study years and sections. Mainstream and Gazey (2006) provided three caveats for using boat electroshocking catch rates as an index of Mountain Whitefish abundance in the Peace River:

1) Sampling protocols (methods, equipment, and approach) must be consistent;
2) Water clarity must remain above 50 cm; and
3) The target population must remain closed during the sampling period.

The 2018 survey generally complied with the above caveats, and estimated catchability coefficients were consistent across sections within 2018 with the exception of Section 1 (see Figure 61). Historically, the coefficients have not been consistent across years, but were generally consistent, albeit lower, during the 2014-2018 period (Figure 62). Additional years of data are required to determine if the altered electroshocker settings employed from 2014 to 2018 allow for more consistent Mountain Whitefish catchability or to determine if Mountain Whitefish catchability was consistent from 2014 to 2018 for other, unknown reasons.

4.5 Arctic Grayling

Insufficient mark-recapture data for Arctic Grayling prevented the generation of population abundance estimates that could corroborate any trend. Over the 17-year monitoring period, the catch rate of Arctic Grayling has generally declined, with the lowest catch rate for Arctic Grayling being recorded in 2014. Arctic Grayling catch rates increased from 2014 to 2016, with catch rates in 2016 being approximately 60% higher than in 2014. Since 2016, Arctic Grayling catch rates have been stable and more similar to the level recorded in 2015. The credible interval surrounding the 2018 estimate was substantially wider when compared to those around the 2017 estimate. Reasons for the increase in uncertainty is largely due to the low number of samples in which Arctic Grayling were captured (6% of all samples) in 2018 when compared to 2017 (11% of all samples). In addition, one less session was conducted in 2018 relative to 2017, resulting in a smaller sample size. In 2016, almost 20% of the Arctic Grayling catch was recorded in Section 6, which was not consistent with any other study year in which Section 6 was surveyed (i.e., 2015 to 2018).

Use of the downstream portions of the study area by Arctic Grayling is not fully understood due to the limited amount of catch data available for Sections 6, 7 and 9 prior to 2015 (Mainstream 2010, 2011, 2013). Overall, catch data recorded after 2015 suggests that use of Sections 6, 7, and 9 is low. Of the 24 tagged Arctic Grayling that were recorded in Sections 6, 7, or 9 since 2015, only one was subsequently recaptured in Section 1, 3, or 5. This individual was initially tagged in Section 7 in 2015 and was recaptured in Section 3 in 2017. To date, two tagged Arctic Grayling that were recorded in the upper sections of the study area have subsequently been recaptured in the downstream sections. AMEC and LGL (2009) detected Arctic Grayling movements between the upstream and downstream sections during radio telemetry surveys conducted in 2008.

Age data collected since 2015 indicated that all age-classes of Arctic Grayling are present in the study area including age-0 and age-1 juveniles and adults up to age-4. Age-0 fish were not captured in 2017 and age-1 fish were not captured in 2018. These results indicate poor recruitment from the 2017 brood year.

Additional years of data from downstream sections could be used to assess the movement and distribution of Arctic Grayling within the study area in response to the construction and operation of the Project. It is anticipated that low recapture rates will result in uncertain absolute abundance estimates for this species during the construction and operation phases of the Project. Therefore, changes in abundance over time for this species should be assessed using indicators of relative abundance (e.g., catch-per-unit effort metrics). The anticipated reliance on relative abundance metrics highlights the importance of maintaining sample effort and methods across study years.

The trends observed in Arctic Grayling length-at-age data over the last six years suggests that statistical analyses of growth-related metrics may be possible after additional years of study; however, these analyses are likely to have low statistical power because of continued small sample sizes.

Since the commencement of the Peace River Large Fish Indexing Survey in 2015, biomass estimates for Arctic Grayling could be generated for Section 3 and only in 2016, 2017, and 2018. Continued low catch rates for this species in Sections 5 through 9 will reduce the precision of biomass estimates for this species in these sections and will likely prevent the generation of biomass estimates during most study years. As a result, the survey, in its current format, is unlikely to be able to test Hypothesis #3 for Arctic Grayling.

The bulk of the Arctic Grayling population spawns in Peace River tributaries, most notably the Moberly River (Mainstream 2012). After hatching, age-0 Arctic Grayling disperse downstream into the Peace River mainstem over the summer season. The success of these life stages of Arctic Grayling (i.e., spawning and age-0 dispersal) is paramount to sustaining the Peace River Arctic Grayling population. These early life history stages are also highly susceptible to environmental perturbation (McPhail 2007). Low abundance of a particular cohort, such as the 2011 and 2015 brood years (Appendix F, Figure F3), is likely related to poor environmental conditions during the spring and summer of the cohort's spawning year. In 2011 and 2015, discharges from the Moberly River were substantially greater than average during the spring (Water Office 2019), which may have negatively impacted pre-spawning migrations, spawning/incubation, or the downstream dispersal of age-0 Arctic Grayling. Based on age-frequency data collected in 2017 and 2018, the 2017 brood year is also underrepresented. Discharges from the Moberly River in the spring of 2017 were also substantially greater than average (Water Office 2019).

4.6 Bull Trout

The 2018 population abundance estimates and catch-per-unit-effort data did not suggest substantial or sustained changes in Bull Trout abundance when compared to historical data. Population abundance estimates for Bull Trout in 2018 were similar in Section 5 and lower in Section 3 when compared to 2017 estimates. In 2018, only two Bull Trout were recaptured in each of Section 1 and Section 6, and no Bull Trout were recaptured in Section 7, preventing the generation of abundance estimates in these sections. Bull Trout are infrequently recorded in Section 9.

Age-0 to age-2 Bull Trout were not recorded in 2018 and age-3 fish were infrequently recorded (n = 8). Young Bull Trout are known to rear in Peace River tributaries, most notably tributaries to the Halfway River. As such, younger Bull Trout were not present in the Peace River during the Indexing Survey. During the August to September study period, older, mature Bull Trout have migrated into tributaries to spawn and are also not present in the Peace River during the Indexing Survey. For these reasons, the Bull Trout population sampled during the Indexing Survey was largely composed of fish that were old enough to have migrated out of their natal streams but had not yet reached sexual maturity (i.e., subadults). However, a small portion of the sampled population may have included adult fish that had forgone spawning (i.e., skip spawners) and Bull Trout that had either not yet migrated into tributaries to spawn or had already returned to Peace River after spawning. Some of the adult Bull Trout captured in 2018 appeared to be in post-spawning condition (e.g., frayed fins, gaunt, superficial scratches).

Otoliths are the most accurate hard structure for ageing Bull Trout (Golder 2003; Mackay 1990; Zymonas and McMahon 2009). Zymonas and McMahon (2009) also state that the identification of annuli on Bull Trout fin rays is more difficult in the region of the fin ray that forms after the fish initially emigrates from its rearing tributary. Repeated annual migrations to and from spawning tributaries as the Bull Trout matures results in an absence of clearly defined annuli and inconsistency in the width and intensity of the annuli. Zymonas and McMahon (2009) further state that these inconsistencies are likely due to the environmental and physiological changes that the fish experiences while migrating and varied growing conditions while occupying downstream waterbodies. The growth check observed between the third and fourth annuli on Peace River Bull Trout fin rays (see Section 2.1.5) likely forms as the fish makes its initial migration downstream to the Peace River after the fish spends its first few growing seasons in rearing tributaries. However, additional growth checks may form with each subsequent spawning migration, further increasing the difficulty of assigning ages and decreasing the precision of assigned ages. This issue may be further complicated by some Bull Trout in the Peace River forgoing spawning during some years. Of the 19 adult Bull Trout detected on the Chowade River PIT array in 2018 (Ramos-Espinoza et al. 2019), 2 (11%) were also detected in 2016, but were not detected in 2017. Substantially more data are required to confirm the extent of skip spawning by Bull Trout in the Peace River. During future study years, growth-related analyses should be based on data collected from inter-year recaptured individuals. In particular, the dataset should be supplemented with data collected from fish that were initially captured as juveniles in their natal streams (Golder 2018) and subsequently captured in the Peace River mainstem. These fish can be assigned an age based solely on their fork length at the time of their initial capture. As of 2018, none of the 1127 immature Bull Trout that have been PIT tagged in the Halfway River watershed as part of the Site C Reservoir Tributaries Fish Population Indexing Survey (Golder 2018) have been subsequently captured in the Peace River mainstem; however, most of these individuals would not be expected to migrate to the Peace River until at least 2019 based on their age at initial capture.

There was little difference in growth among sections for Bull Trout, which could be due to the migratory nature of the Bull Trout population. It is possible that Peace River Bull Trout are not present in any single section of the study area long enough for the habitat quality of that section to influence their growth rate. Similar to most previous study years, the body condition of Bull Trout was higher in Section 1 than most other sections, a result that may be influenced by Bull Trout feeding on dead and injured fish entrained through PCD. Between 2017 and 2018, body condition of Bull Trout increased in all sections except Section 1; however, confidence intervals overlapped with 2017 estimates in all sections and were similar to historical values.

4.7 Mountain Whitefish

Mountain Whitefish abundance estimates were similar over recent study years, suggesting a generally stable population. Sections 1, 3, and 5 were consistently sampled from 2002 to 2018. For all study years, relative population abundance estimates for Mountain Whitefish (greater than 250 mm FL) were typically highest in Section 1 and decreased incrementally downstream, with lower abundance in Section 3 and the lowest abundance estimate in Section 5. In Section 1, abundance in most years between 2002 and 2018 was similar, with the exception of substantial increases in abundance in Section 1 in 2010, 2011, and 2016 to 2018. The 2018 abundance estimates for Mountain Whitefish in Section 1 was higher than all previous study years. Typical of most years, discharges in the Peace River in 2018 exhibited some variability during the study period, but was generally lower than most study years.

Previous studies found that the abundance of Mountain Whitefish in the study area appeared to be related to water levels, with higher densities generally observed when water levels were lower (e.g., Golder and Gazey 2017). Mainstream and Gazey (2011) postulated that at lower water levels, side channel habitats become isolated or unsuitable for use by Mountain Whitefish, thereby concentrating fish in remaining portions of the study area, where they are more susceptible to capture during the sampling program. This hypothesis was supported by data from 2010, 2011, 2016, and 2018 that recorded high Mountain Whitefish abundance estimates in years when, for a substantial portion of the study period, flows remained below the historical seasonal average (Appendix C, Figure C1). In years with lower population abundance estimates (i.e., 2012–2015), flows ranged from above average to below average and the relationship between flow and abundance estimates was less evident. Presently, it is difficult to conclude whether variation in population abundance estimates represent true Peace River fish abundances or are indicative of changes in Peace River water levels and the concentration of fish in sampled areas.

Overall, population abundance estimates for the constant catchability model (i.e., not allowed to vary across sessions within a year) generally exceeded the time-varying catchability model. In 2018, catchability did not vary by time in any section except Section 3 where catchability varied by time. Use of specific sections of the river in relation to aspects of Mountain Whitefish life history may influence catchability. The Halfway River is a known spawning area for Mountain Whitefish (RRCS 1978; Mainstream 2012) and may serve as a holding area for this species prior to the spawning season. AMEC and LGL (2008) noted substantial movements of Mountain Whitefish as early as August, which they associated with pre-spawning migration. Spawning for this species likely occurs in October when water temperature declines to approximately 7°C (Northcote and Ennis 1994 cited in Mainstream and Gazey 2014). Therefore, differences in the catchability of Mountain Whitefish between sample sessions in Section 3 could be due to pre-spawning movements and migration into the Halfway River or other spawning tributaries.

Across all sections, the average body condition of Mountain Whitefish was higher in 2018 (K = 1.037) compared to 2017 (K = 1.092), an increase of approximately 5.3%. Overall, body condition in 2018 was similar to historical averages, with 2017 values appearing below average. Results suggest a cyclical trend in average body condition, with lower values recorded from 2011 to 2013 and 2017 and higher values recorded in 2010, and from 2014 to 2015 in most sections. Schleppe et al. (2018) noted that high turbidity in the Peace River during the 2017 growing season reduced light penetration and decreased primary productivity. It is possible that a decrease in primary productivity in 2017 had a measurable effect on Mountain Whitefish body condition during the same year. Turbidity data were not readily available for other years in which low body condition were recorded (2011 to 2013).

Consistent among study years, the highest average body condition is typically recorded in the upstream sections and the lowest in the downstream-most sections of the study area. The underlying biological factors responsible for this decline in average body condition were not evident. Completion of future studies will allow further analysis to examine whether or not this trend persists and identification of possible causal factors.

The biomass of Mountain Whitefish generally declined in Sections 3 and 5 between the late 2000s and the current study year, while biomass in Section 1 generally increased over this same time period. Results indicate that biomass estimates are heavily influenced by abundance estimates and abundance estimates are further influenced by the relative strengths of individual age cohorts.

4.7.1 Mountain Whitefish Synthesis Model

The population estimates generated by the synthesis model were based on more information than used for the Bayes within year estimates. Therefore, synthesis population estimates should be more reliable if the model assumptions were consistent with the data.

The partial lack of fit for Mountain Whitefish across year recaptures in Section 5 is not understood and may undermine the reliability of predicted survival, recruitment, and population estimates. The consistency of Section 5 population estimates between the synthesis model and the within-year Bayes model (no across-year recaptures) argues that the impact was not large.

The altered electroshocker settings that were implemented in 2014 changed the selectivity of the gear. Additional years of data will be required to fully characterize the new selectivity (e.g., the functional form of the selectivity function may require alteration of the model). The monitoring program targets large fish, and when combined with high variation in growth, survival, and selectivity, large uncertainty in recruitment estimates should be anticipated.

4.8 Rainbow Trout

Population abundance estimates for Rainbow Trout exhibited large credibility intervals for all study years and sections due to the low number of captured and recaptured individuals, hindering the identification of any meaningful trends. The number of Rainbow Trout captured in 2018 was similar to previous study years, suggesting no substantial changes in population abundance. The annual variation in catch among years does not appear to correspond to environmental variables and most likely reflects underlying variability in Rainbow Trout catchability.

Consistent with previous studies, approximately 96% of the encountered Rainbow Trout were recorded in the upstream three sections of the study area. The higher abundance of Rainbow Trout in these sections was attributed to feeding and rearing habitat provided by tributaries to the Peace River in the upstream portion of the study area. Lynx Creek, which flows into the Peace River in Section 1, is one of three known spawning and rearing streams for Peace River Rainbow Trout (RRCS 1978; Mainstream 2012). It is possible that recent landslides in the Lynx Creek watershed[7] have left the system undesirable for Rainbow Trout. The extent that Rainbow Trout spawn in Lynx Creek relative to the other two streams (i.e., Maurice and Farrell creeks) is unknown. As such, the long-term effects, if any, that the landslide will have on the Peace River Rainbow Trout population is also unknown.

Similar to 2016, population abundance estimates were generated for Rainbow Trout for two of the six study sections in 2018, whereas in 2016, due to higher catch, estimates were generated for four of the six sections. Confidence intervals associated with the 2017 and 2018 estimates for Section 3 were tighter compared to the 2016 estimate. Overall, low and inconsistent catches in other sections limit the usefulness of estimates generated for these sections. Increases to the Rainbow Trout catch and recapture rates will be required in future study years to improve the certainty around estimates.

[7] http://hudsonshope.ca/residents/water-services/.

4.9 Walleye

Substantially more Walleye were recorded in 2017 (*n* = 389) and 2018 (*n* = 363) than during any previous study year (an average of 42 Walleye were recorded each year between 2002 and 2016). The number of Walleye encountered during the survey increased each year between 2014 and 2017 and remained high in 2018. Walleye are more commonly recorded in the downstream sections of the study area. As such, more Walleye have been recorded since 2015 (when Sections 6, 7, and 9 were added to the program). In 2017, a PUP was issued that allowed sites historically established in Beatton River Provincial Park (e.g., Mainstream 2010) to be sampled, including sites at the Beatton River's confluence with the Peace River. This confluence area is a known feeding area for Walleye (Mainstream 2012). Two sites located at the confluence area (i.e., 07BEA01 and 07BEA02) have accounted for 22% of the Walleye catch over the last two years. Mainstream (2012) also notes that the Kiskatinaw River is a likely recruitment source for Peace River Walleye. In 2018, one site at the Kiskatinaw River's confluence with the Peace River (Site 07KIS01) was surveyed six times (two times during the Goldeye and Walleye Survey and four times during the Indexing Survey). A total of 12 Walleye were captured during all of these surveys combined. This site was not surveyed prior to 2018.

Mark-recapture data collected in 2018 allowed the generation of population abundance estimates for Sections 7 and 9. Confidence intervals associated with both estimates were wide; however, if the current trend of increasing Walleye catch persists into future study years, additional population abundance estimates will allow inter-year comparisons and assessments of the influence that construction and operation of the Project has had on the Peace River Walleye population.

The precision of ages assigned to Walleye was a source of uncertainty in both 2015 and 2016. In 2017, improvements in ray sectioning methods and the implementation of alternative ageing techniques (Watkins and Spencer 2009) improved accuracy and agreement between individual technicians. As a result, these techniques were also implemented in 2018 and provided results similar to those recorded in 2017 (i.e., improved accuracy and agreement between technicians).

The Goldeye and Walleye Survey was implemented in 2018 in response to low Goldeye catch rates during the Indexing Survey. While Walleye were recorded during the Goldeye and Walleye Survey (*n* = 22), substantially more Walleye were recorded during the Indexing Survey (*n* = 362). During future study years, the Goldeye and Walleye Survey could be tailored as needed to maximize Goldeye catch rates, provided Walleye catches remain high during the Indexing Survey.

4.10 Sucker species

Although none of the sucker species are considered indicator species under this program's objectives, all adult large-bodied fishes are monitored as part of the program in order to test Management Hypothesis #4 regarding fish community structure. Sucker species may be useful for detecting changes in the fish community in the study area for several reasons. Suckers can contribute substantially to ecosystem function through nutrient cycling, affect the invertebrate communities through grazing, and serve as prey items (both as eggs and fish) for other fish species (Cooke et al. 2005). For these reasons, and their low trophic position as grazers, suckers can be an important sentinel species for monitoring changes in fish communities and ecosystems (Cooke et al. 2005). Suckers (all species combined) are common in the Peace River catch data and their large sample sizes and recapture rates will likely result in greater precision in estimates of fish population metrics and greater power to detect change as a result of the construction and operation of the Project when compared to some of the indicator fish species.

Population abundance estimates for Largescale Sucker and Longnose Sucker were consistent among years and sections with suitable data (2015 and 2018). Abundance estimates could not be generated for White Sucker in 2018 due to the low number of recaptured individuals (n = 4).

The distribution of suckers varied by species, life-stage, and section. During most study years, immature Largescale Sucker and Longnose Sucker are infrequently captured in Section 1 and are common in Section 9. White Sucker was the least common of the three species in all six sections, and nearly all captured White Sucker were adults.

Data suggest that the Goldeye and Walleye Survey may have been conducted after the Longnose Sucker spawning season but before the Largescale Sucker and White Sucker spawning seasons. Nelson and Paetz (1992) state that Largescale Sucker and White Sucker typically spawn at the same time and that Largescale Sucker typically spawn after Longnose Sucker. Largescale Sucker and White Sucker had higher body condition during the 2018 Goldeye and Walleye Survey compared to the 2018 Indexing Survey. Longnose Sucker had lower body condition during the Goldeye and Walleye Survey compared to the Indexing Survey. The higher body condition recorded for Largescale Sucker and White Sucker relative to Longnose Sucker during the Goldeye and Walleye Survey may be because Largescale Sucker and White Sucker had not yet spawned and maintained gametal products while Longnose Sucker were in post-spawn condition.

4.11 Other species

For two of the seven indicator species (Burbot and Goldeye) there were not enough mark-recapture data to calculate precise population abundance estimates.

A total of 14 Burbot were captured in 2018, higher than the number captured in 2017 (n = 6), but lower than the number captured in 2016 (n = 37). The high number of Burbot recorded in 2016, and to a lesser extent 2018, are anomalous. With the exception of these two study years, no more than 6 Burbot were ever recorded during a single year of the program (i.e., 2002 to 2018). Reasons for the higher catch in 2016 are not known, but reduced habitat quality in the Moberly River, resulting in Burbot moving into the Peace River, was identified as a likely factor (Golder and Gazey 2017). Given Burbot's propensity for deeper water during the daytime, boat electroshocking is not an ideal capture method for this species. Due to typically low catch numbers, it is unlikely that Burbot catches will allow for meaningful inter-annual comparisons of life history metrics or abundance levels during future years of the study.

Goldeye were not captured prior to 2015 and were captured each year between 2015 and 2017 in low numbers (range = 1 to 8); Goldeye were not captured in 2018 during the Indexing Survey. Goldeye are seasonal residents in the study area, migrating upstream into the study area in the spring to spawn and/or feed in select tributaries, most notably the Beatton River (Mainstream 2011). The Goldeye encountered during the Indexing Survey likely represent the last of this population migrating out of these tributaries and travelling back downstream.
The Indexing Survey in its current form will continue to encounter sporadic captures and small sample sizes and is unlikely to generate enough data to allow for meaningful inter-annual comparisons of life history metrics or abundance levels for this species in future study years. The purpose of the Goldeye and Walleye Survey was to

increase Goldeye catch by surveying suspected feeding areas for Goldeye in the late spring to early summer prior to the downstream migration. Only 2 Goldeye were recorded during the Goldeye and Walleye Survey, suggesting that the bulk of downstream migration occurs prior to mid-June.

Northern Pike is not an indicator species under the current program but is a frequent target of anglers. It was captured in low numbers during most previous study years. During the four years that sampling was conducted in the downstream sections, more Northern Pike were captured in 2017 (*n* = 37) and 2018 (*n* = 39) than in the 2015 (*n* = 13) and 2016 (*n* = 17). Reasons for the higher catch during the most recent two study years are not known. In 2018, Northern Pike were captured in all six sections but are generally recorded in very low numbers in Sections 1 and 3.

In 2018, five Spottail Shiner were encountered in Sections 5 (*n* = 2) and 6 (*n* = 3). Spottail Shiner is a species of conservation concern and is on the Provincial red list[8]. Spottail Shiner are not native in the Peace River, and those present originated from a population introduced into Charlie Lake, which flows into the Beatton River (McPhail 2007).

4.12 Species Diversity

Consistent with 2017 (Golder and Gazey 2018), species richness (diversity) was generally greater in the downstream portion of the study area (Sections 6, 7, and 9) than in upstream portion (Sections 1, 3, and 5). The downstream sections of the study represent the transition zone between cold/clear and cool/turbid habitats detailed by Mainstream (2012). As such, these sections likely include fish species that prefer both habitat types.

Based on the current results, diversity profiles will potentially be an effective method for testing H_4 and should identify changes in species richness in response to the construction and operation of the Project.

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[8] http://www.speciesatriskbc.ca/node/9189.

5.0 CONCLUSIONS

Sampling conducted since 2002 provides a long-term, baseline dataset that can be used to estimate the abundance, spatial distribution, body condition, and growth rates of large-bodied fish populations in the Peace River prior to the construction, and during construction and operation of the Project. During future study years, data from this program will be used to test management hypotheses that relate to predicted changes in biomass and fish community composition in the Peace River during and after the construction and operation of the Project.

The confidence bounds from most 2018 population estimates overlapped estimates from previous study years and were, in many cases, not statistically different. For Mountain Whitefish, 2018 catch rates were the highest recorded since 2013. Between 2017 and 2018, catch rates increased 42% in Sections 1, 3, and 5 combined and increased 74% in Sections 6, 7, and 9 combined. Discharges from PCD during the 2018 study period were near historical lows, further supporting the hypothesis that Mountain Whitefish concentrate in sampled areas during low water levels. Mountain Whitefish body condition appears to follow cyclical trends and increased by 5.3% between 2017 and 2018 after declining each year between 2014 and 2017.

Overall, high catches of Burbot, Longnose Sucker, Mountain Whitefish, Northern Pike, and Walleye were recorded in 2018, while Arctic Grayling catch was low. Catches of Bull Trout, Largescale Sucker, Rainbow Trout, and White Sucker were similar to recent historical study years.

For some indicator fish species, most notably Burbot and Goldeye, small sample sizes and limited mark-recapture data will likely limit the program's ability to generate absolute abundance estimates during all study years.
For these species, changes in abundance over time will be monitoring using measures of relative abundance and catch rate data. The Goldeye and Walleye Survey provided supplemental Goldeye data in 2018; however, several more years of data from these surveys would be required to adequately characterize the Goldeye population in the Peace River. Without higher Burbot and Goldeye catches, the program is likely to only detect large changes in population abundance for these species.

6.0 CLOSURE

We trust that the information contained in this report meets your present requirements. Please contact us if you have any questions or concerns regarding the above.

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APPENDIX A

Maps and UTM Locations

Table A1. Location and distance from WAC Bennett Dam of Peace River boat electroshocking sites sampled in 2018.

Section	Site Name	Bank[a]	Bank Habitat Type[b]	Physical Habitat[c]	Upper Site Limit				Lower Site Limit				Site Length (m)
					Zone[d]	Easting	Northing	River Km[e]	Zone[d]	Easting	Northing	River Km[e]	
1	0101	ILDB	A3	Absent	10	566453	6207858	25.4	10	566936	6208239	25.9	600
	0102	ILDB	A3	Absent	10	566936	6208240	25.9	10	567497	6208907	26.9	975
	0103	RDB	A1	Present	10	566302	6207742	25.3	10	567401	6208075	26.2	1200
	0104	IRDB	A3	Absent	10	566460	6207754	25.4	10	566934	6207880	25.8	500
	0105	RDB	A2	Present	10	567402	6208074	26.2	10	568000	6208913	27.3	1100
	0107	LDB	A1	Present	10	568372	6210050	28.4	10	568798	6210402	28.9	550
	0108	RDB	A3	Absent	10	568605	6209966	28.5	10	569259	6210477	29.3	850
	0109	RDB	A3	Absent	10	569260	6210478	29.3	10	569850	6211235	30.3	975
	0110	LDB	A1	Present	10	568798	6210403	28.9	10	569302	6211053	29.7	650
	0111	LDB	A1	Present	10	569302	6211053	29.7	10	569825	6211869	30.7	1000
	0112	LDB	A1	Present	10	569824	6211868	30.7	10	570686	6212472	31.8	1070
	0113	RDB	A2	Present	10	569994	6211528	30.6	10	570510	6212043	31.3	750
	0114	LDB	A2	Present	10	570686	6212474	31.8	10	571342	6213121	32.8	950
	0116	RDB	A3	Absent	10	570511	6212043	31.3	10	571265	6212633	32.3	985
	0119	LDB	A1	Present	10	567516	6209096	27.0	10	568019	6209628	27.8	750
3	0301	RDB	A2	Present	10	600824	6232860	71.3	10	602606	6233198	73.1	1800
	0302	IRDB	A2	Present	10	599753	6233307	70.2	10	601597	6233232	72.0	1900
	0303	IRDB	A2	Present	10	601597	6233232	72.0	10	602930	6233597	73.6	1450
	0304	ILDB	A2	Absent	10	602583	6233193	73.1	10	603787	6233290	74.5	1350
	0305	LDB	A2	Absent	10	603204	6233827	73.8	10	604640	6233426	75.4	1550
	0306	LDB	A3	Absent	10	604655	6233435	75.4	10	605586	6233750	76.5	1000
	0307	IRDB	A3	Absent	10	605976	6233888	77.0	10	606935	6234160	78.0	950
	0308	IRDB	A3	Absent	10	606935	6234158	78.0	10	607692	6235034	79.4	1350
	0309	ILDB	A3	Absent	10	605976	6233878	77.0	10	606666	6234387	77.8	950
	0310	ILDB	A3	Present	10	606662	6234395	77.8	10	607691	6235034	79.4	1200
	0311	LDB	A3	Present	10	605585	6233743	76.5	10	606512	6234441	77.7	1250
	0312	LDB	A2	Absent	10	607058	6234840	78.6	10	608047	6235753	80.2	1170
	0314	RDB	A2	Present	10	604468	6233079	75.1	10	605400	6233321	76.1	975
	0315	RDB	A3	Present	10	605400	6233320	76.1	10	606956	6233951	77.9	1700
	0316	RDB	A2	Present	10	606956	6233951	77.9	10	607974	6234928	79.3	1475
5	0502	RDB	A2	Present	10	630016	6229305	106.2	10	630954	6229298	107.1	950
	0505	LDB	A1	Present	10	630553	6229765	106.7	10	631540	6229590	107.7	1000
	0506	LDB	A2	Present	10	631539	6229590	107.7	10	632491	6229713	108.6	1000
	0507	RDB	A2	Present	10	632339	6229356	108.4	10	633099	6229489	109.1	780
	0508	LDB	A2	Present	10	637926	6227901	115.5	10	638432	6227150	116.4	925
	0509	IRDB	A3	Absent	10	632785	6229686	108.9	10	633704	6229905	109.8	975
	0510	RDB	A1	Present	10	634530	6229634	110.5	10	635555	6230048	111.6	1130
	0511	LDB	A2	Present	10	635651	6230419	111.8	10	636334	6230361	112.4	720
	0512	IRDB	A3	Absent	10	633855	6229835	110.0	10	634872	6230026	111.0	1280
	0513	RDB	A3	Absent	10	637113	6228814	114.2	10	637433	6228125	115.0	770
	0514	ILDB	A3	Absent	10	637427	6228123	115.0	10	637735	6227647	115.5	560
	0515	IRDB	A3	Absent	10	637376	6229072	114.1	10	637591	6228192	115.0	970
	0516	ILDB	n/a	n/a	10	633861	6229939	58.2	10	634404	6230473	57.7	800
	0517	ILDB	n/a	n/a	10	634513	6230626	57.7	10	635000	6230250	56.8	700
	05SC060	RDB	n/a	n/a	10	633456	6229118	58.7	10	633909	6229258	58.3	530

[a] RDB=Right bank as viewed facing downstream; LDB=Left bank as viewed facing downstream; IRDB=Right bank of island as viewed facing downstream; ILDB=Left bank of island as viewed facing downstream.

[b] Bank Habitat Type as assigned by R.L.&L. (2001). See Appendix C, Table C2 for a description of each bank habitat type.

[c] Absent=Nearshore habitat without physical cover; Present=Nearshore habitat with physical cover. Assigned by P&E and Gazey (2003).

[d] NAD 83.

[e] River kilometres measured downstream from WAC Bennett Dam (RiverKm 0.0).

Continued . . .

Table A1. Concluded.

Section	Site Name	Bank[a]	Bank Habitat Type[b]	Physical Habitat[c]	Upper Site Limit				Lower Site Limit				Site Length (m)
					Zone[d]	Easting	Northing	River Km[e]	Zone[d]	Easting	Northing	River Km[e]	
6	0601	LDB	n/a	n/a	10	643238	6224330	122.0	10	644400	6224099	123.0	1200
	0602	RDB	n/a	n/a	10	644567	6223590	123.3	10	645385	6223368	124.1	900
	0603	IRDB	n/a	n/a	10	646156	6223144	124.8	10	647208	6222813	125.9	1300
	0604	RDB	n/a	n/a	10	646546	6222599	125.4	10	647508	6222650	126.2	1000
	0605	IRDB	n/a	n/a	10	647888	6222979	126.5	10	648668	6223109	127.3	800
	0606	LDB	n/a	n/a	10	649302	6223371	127.1	10	650601	6222912	129.3	1400
	0607	IRDB	n/a	n/a	10	651250	6222649	130.0	10	652139	6222123	131.0	1000
	0608	RDB	n/a	n/a	10	647711	6222699	126.4	10	648681	6222855	127.3	1000
	0609	ILDB	n/a	n/a	10	649423	6223115	128.0	10	650300	6222732	129.0	1000
	0610	ILDB	n/a	n/a	10	650309	6222738	129.0	10	651089	6222427	129.9	850
	0611	ILDB	n/a	n/a	10	651070	6222442	129.9	10	651842	6221990	130.9	900
	0612	IRDB	n/a	n/a	10	652136	6222141	131.0	10	652937	6221822	132.0	850
	0613	RDB	n/a	n/a	10	653270	6221438	132.4	10	654182	6221491	133.2	900
	0614	IRDB	n/a	n/a	10	645301	6223722	123.5	10	646108	6223365	124.7	975
	06PIN01	RDB	n/a	n/a	10	641497	6223588	1.9[f]	10	642638	6224067	0.3[f]	1500
	06PIN02	RDB	n/a	n/a	10	642639	6224071	0.3[f]	10	643433	6224055	122.2	1000
	06SC036	IRDB	n/a	n/a	10	654048	6222162	133.3	10	654522	6222203	133.8	500
	06SC047	RDB	n/a	n/a	10	644017	6223518	122.8	10	644510	6223546	123.2	550
7	0701	LDB	n/a	n/a	10	662099	6220280	141.8	10	662869	6220173	142.5	785
	0702	IRDB	n/a	n/a	10	664322	6219824	144.0	10	665185	6220188	144.8	950
	0703	LDB	n/a	n/a	10	665724	6220631	145.5	10	666643	6220828	146.4	950
	0704	IRDB	n/a	n/a	10	667149	6220752	146.8	10	668100	6220738	147.7	1000
	0705	RDB	n/a	n/a	10	667571	6220294	147.2	10	668547	6220497	148.1	1000
	0706	RDB	n/a	n/a	10	668544	6220498	148.1	10	669537	6220614	149.0	1000
	0707	IRDB	n/a	n/a	10	669735	6220916	149.3	10	670551	6221286	150.1	980
	0708	LDB	n/a	n/a	10	663908	6220160	143.6	10	665071	6220480	144.8	1240
	0709	IRDB	n/a	n/a	10	665176	6220191	144.8	10	666096	6220512	145.7	1000
	0710	IRDB	n/a	n/a	10	668109	6220743	147.7	10	669272	6220889	148.8	1400
	0711	ILDB	n/a	n/a	10	669781	6220712	149.3	10	671111	6221081	150.6	1390
	0712	ILDB	n/a	n/a	10	671288	6221104	150.8	10	672241	6220774	151.9	1065
	0713	IRDB	n/a	n/a	10	672355	6221006	151.7	10	672991	6220293	152.7	980
	0714	IRDB	n/a	n/a	10	673481	6220112	153.2	10	674730	6219912	154.4	1275
	07BEA01	LDB	n/a	n/a	10	662969	6220383	0.4[g]	10	663146	6220001	0.0[g]	430
	07BEA02	LDB	n/a	n/a	10	663146	6220001	143.9	10	663728	6220100	143.5	600
	07KIS01	RDB	n/a	n/a	10	676794	6219192	1.0[h]	10	676743	6220010	157.7	1300
	07SC012	LDB	n/a	n/a	10	676579	6220730	156.4	10	676792	6220831	156.6	220
	07SC022	RDB	n/a	n/a	10	666832	6219962	146.3	10	667130	6220145	146.7	360
9	0901	LDB	n/a	n/a	11	357843	6239030	217.6	11	358391	6239968	218.7	1100
	0902	LDB	n/a	n/a	11	358391	6239968	218.6	11	359350	6240287	219.5	1000
	0903	ILDB	n/a	n/a	11	358363	6239289	218.1	11	359084	6240016	219.2	1100
	0904	ILDB	n/a	n/a	11	359520	6240016	219.4	11	360625	6240169	220.7	1100
	0905	LDB	n/a	n/a	11	361692	6240512	221.7	11	362771	6240709	222.9	1100
	0906	RDB	n/a	n/a	11	363235	6241089	223.5	11	363870	6241929	224.6	1000
	0907	ILDB	n/a	n/a	11	364583	6242344	225.2	11	365319	6243257	226.3	1200
	0908	ILDB	n/a	n/a	11	365837	6243458	226.6	11	366849	6243231	228.0	1100
	0909	ILDB	n/a	n/a	11	366849	6243231	228.0	11	367534	6242583	228.9	950
	0910	LDB	n/a	n/a	11	363258	6240685	223.3	11	364070	6241393	224.3	1100
	0911	IRDB	n/a	n/a	11	366799	6243728	227.6	11	367379	6243081	228.4	1000
	0912	LDB	n/a	n/a	11	368560	6241724	230.0	11	368549	6240689	231.0	1100
	0913	RDB	n/a	n/a	11	367347	6241966	229.5	11	367721	6241096	230.5	1000
	0914	IRDB	n/a	n/a	11	367734	6241649	230.0	11	368179	6240875	230.8	950
	09SC53	RDB	n/a	n/a	11	360795	6239970	220.8	11	361029	6240059	221.1	260
	09SC61	RDB	n/a	n/a	11	366861	6242408	228.6	11	367347	6241966	229.4	675

[a] RDB=Right bank as viewed facing downstream; LDB=Left bank as viewed facing downstream; IRDB=Right bank of island as viewed facing downstream; ILDB=Left bank of island as viewed facing downstream.

[b] Bank Habitat Type as assigned by R.L.&L. (2001). See Appendix C, Table C2 for a description of each bank habitat type.

[c] Absent=Nearshore habitat without physical cover; Present=Nearshore habitat with physical cover. Assigned by P&E and Gazey (2003).

[d] NAD 83.

[e] River kilometres measured downstream from WAC Bennett Dam (RiverKm 0.0).

[f] River kilometres measured upstream from the Pine River's confluence with the Peace River (RiverKm 0.0).

[g] River kilometres measured upstream from the Beatton River's confluence with the Peace River (RiverKm 0.0).

Table A2 Location and distance from WAC Bennett Dam of Peace River boat electroshocking sites sampled for Goldeye and Walleye in 2018.

Section	Site Name	Bank[a]	Upper Site Limit				Lower Site Limit				Site Length (m)
			Zone[b]	Easting	Northing	River Km[c]	Zone[b]	Easting	Northing	River Km[c]	
7	07ALC01	LDB	10	682614	6223992	163.5	10	683384	6224198	164.3	796
	07BEA01	LDB	10	662969	6220383	0.4[d]	10	663146	6220001	0.0[d]	430
	07BEA02	LDB	10	663146	6220001	143.9	10	663728	6220100	143.5	600
	07KIS01	RDB	10	676794	6219192	1.0[e]	10	676743	6220010	157.7	1300
	07MileEight01	RDB	10	655782	6222032	135.1	10	656456	6221827	135.8	700
	07MileSix01	RDB	10	655486	6222037	134.7	10	655782	6222032	135.1	300
8	08CLEA01	LDB	11	331479	6228739	187.4	11	332103	6228412	188.1	700
	08POC01	RDB	11	318808	6224656	173.6	11	319816	6224760	174.5	1035

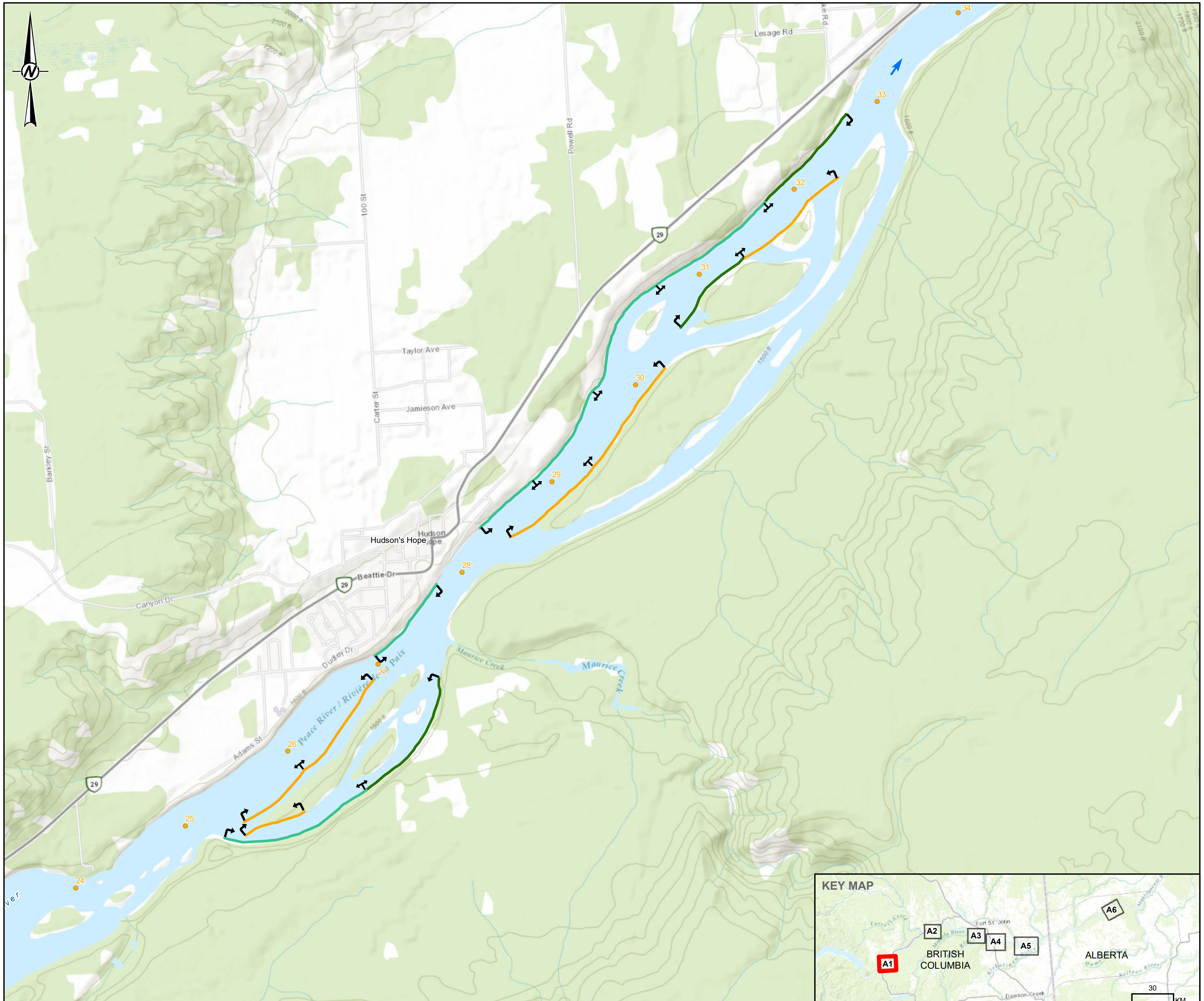
[a] RDB=Right bank as viewed facing downstream; LDB=Left bank as viewed facing downstream.

[b] NAD 83.

[c] River kilometres measured downstream from WAC Bennett Dam (RiverKm 0.0).

[d] River kilometres measured upstream from the Beatton River's confluence with the Peace River (RiverKm 0.0).

[e] River kilometres measured upstream from the Kiskatinaw River's confluence with the Peace River (RiverKm 0.0).



LEGEND

RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM

FLOW DIRECTION

0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

UNASSIGNED HABITAT CLASSIFICATION

A1 WITH PHYSICAL COVER

A2 WITH PHYSICAL COVER

A3 WITHOUT PHYSICAL COVER

0 590 1,180

1:30,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT

BC HYDRO

PROJECT

PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE

SECTION 1 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

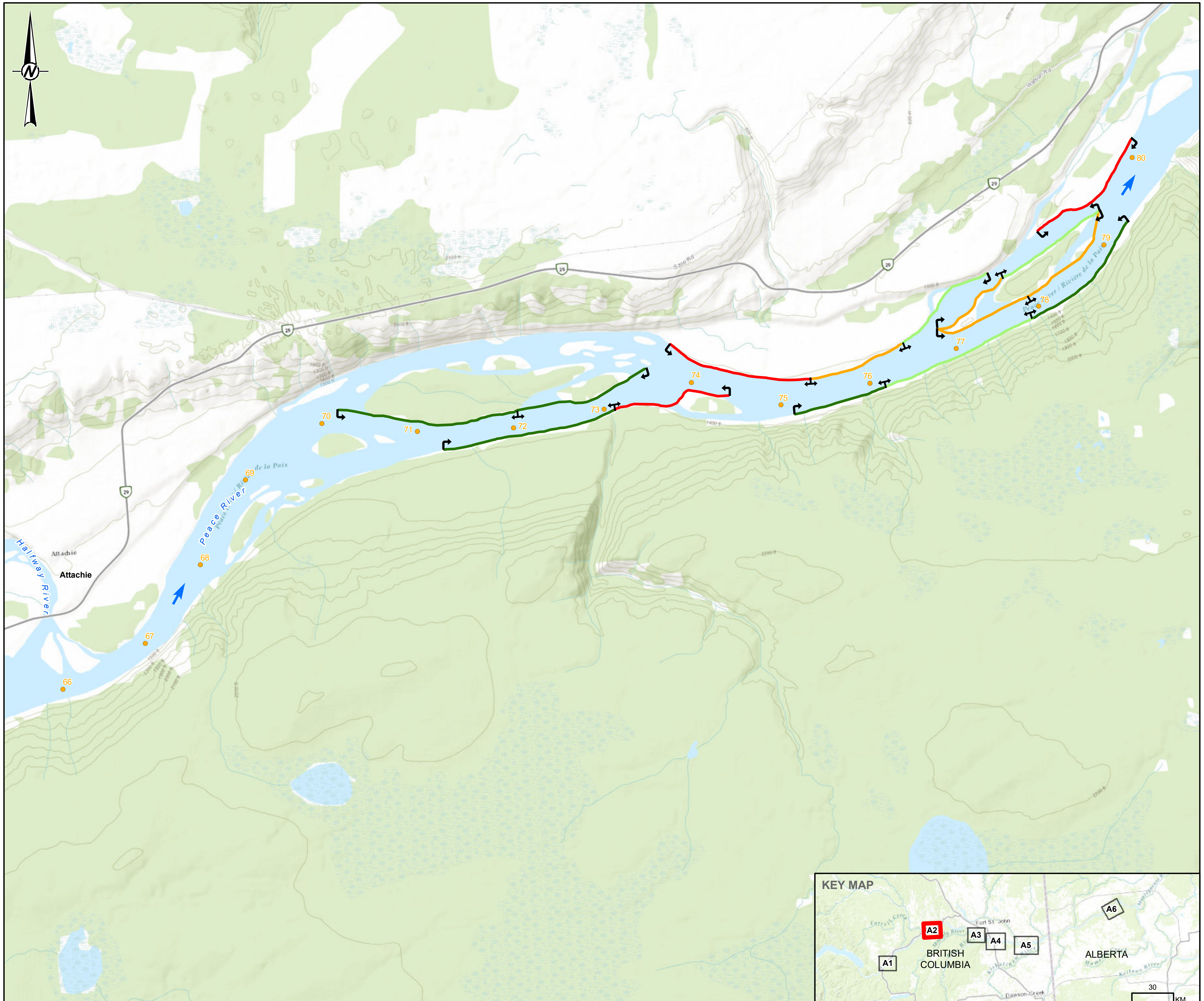
CONSULTANT

GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION
- A2 WITH PHYSICAL COVER
- A2 WITHOUT PHYSICAL COVER
- A3 WITH PHYSICAL COVER
- A3 WITHOUT PHYSICAL COVER

0 800 1,600

1:40,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 3 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
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25mm

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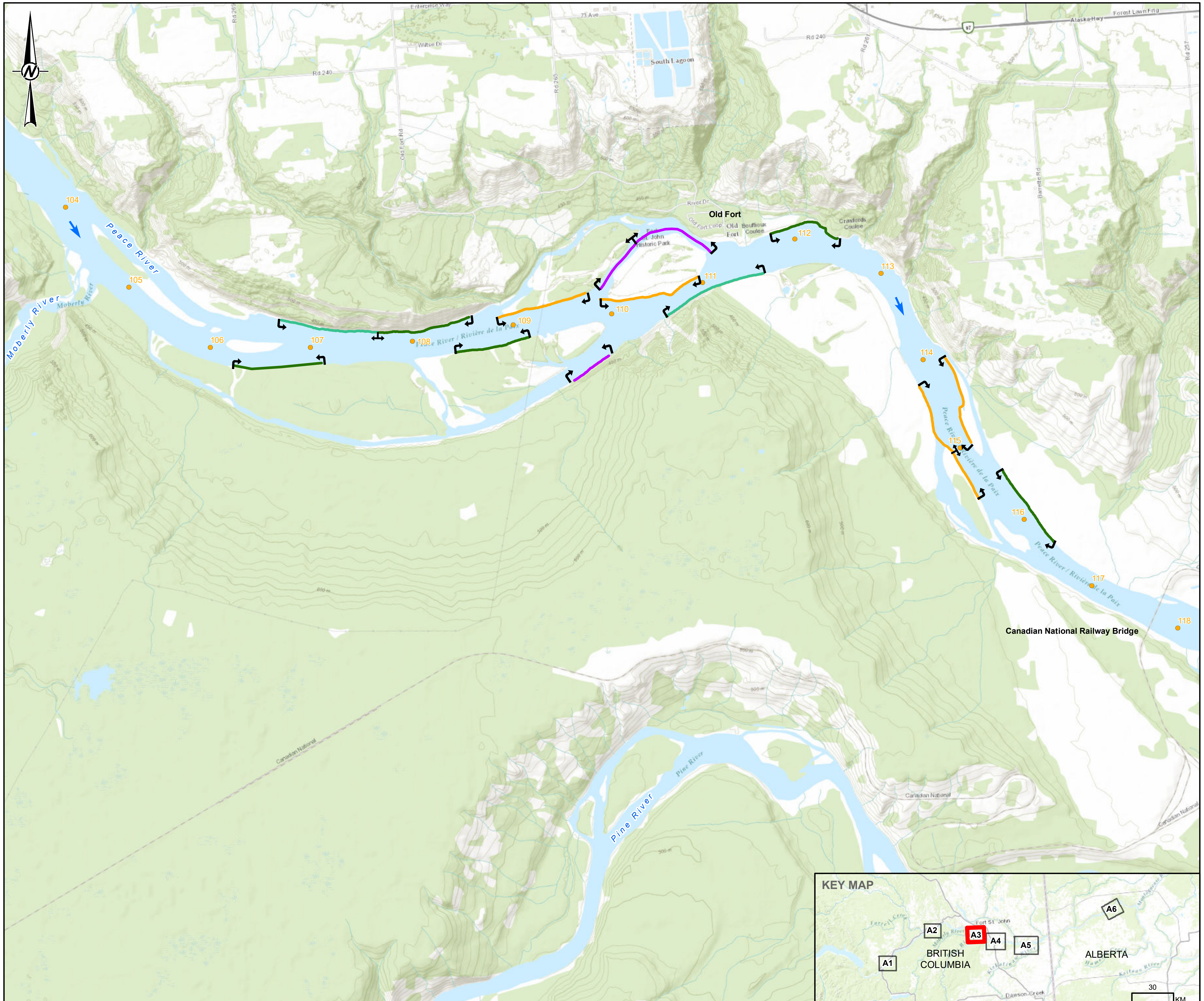

LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION
- A1 WITH PHYSICAL COVER
- A2 WITH PHYSICAL COVER
- A3 WITHOUT PHYSICAL COVER

0 800 1,600

1:40,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 5 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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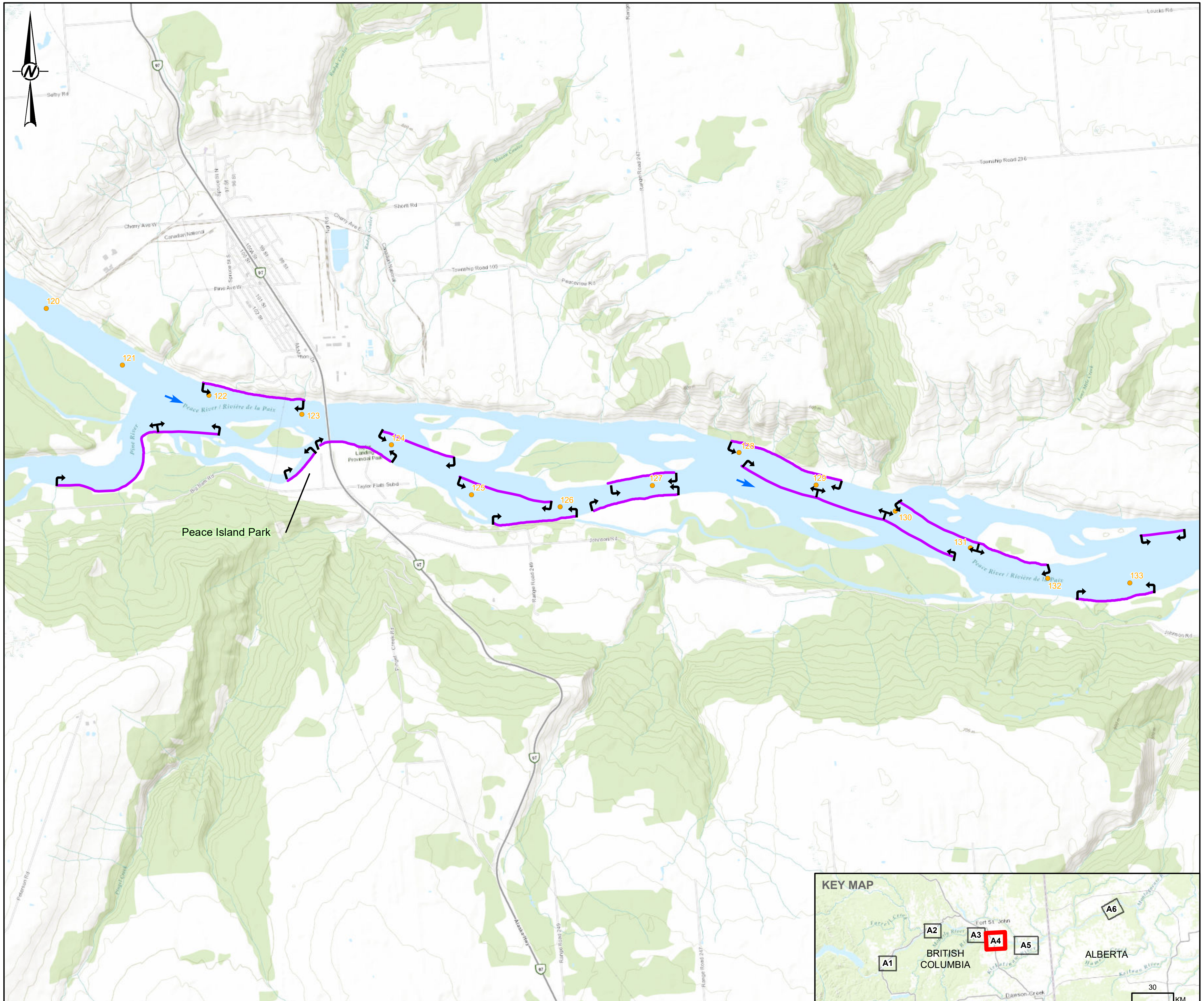

LEGEND

RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM

FLOW DIRECTION

0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

UNASSIGNED HABITAT CLASSIFICATION

0 890 1,780

1:45,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT

BC HYDRO

PROJECT

PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE

SECTION 6 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

CONSULTANT

GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
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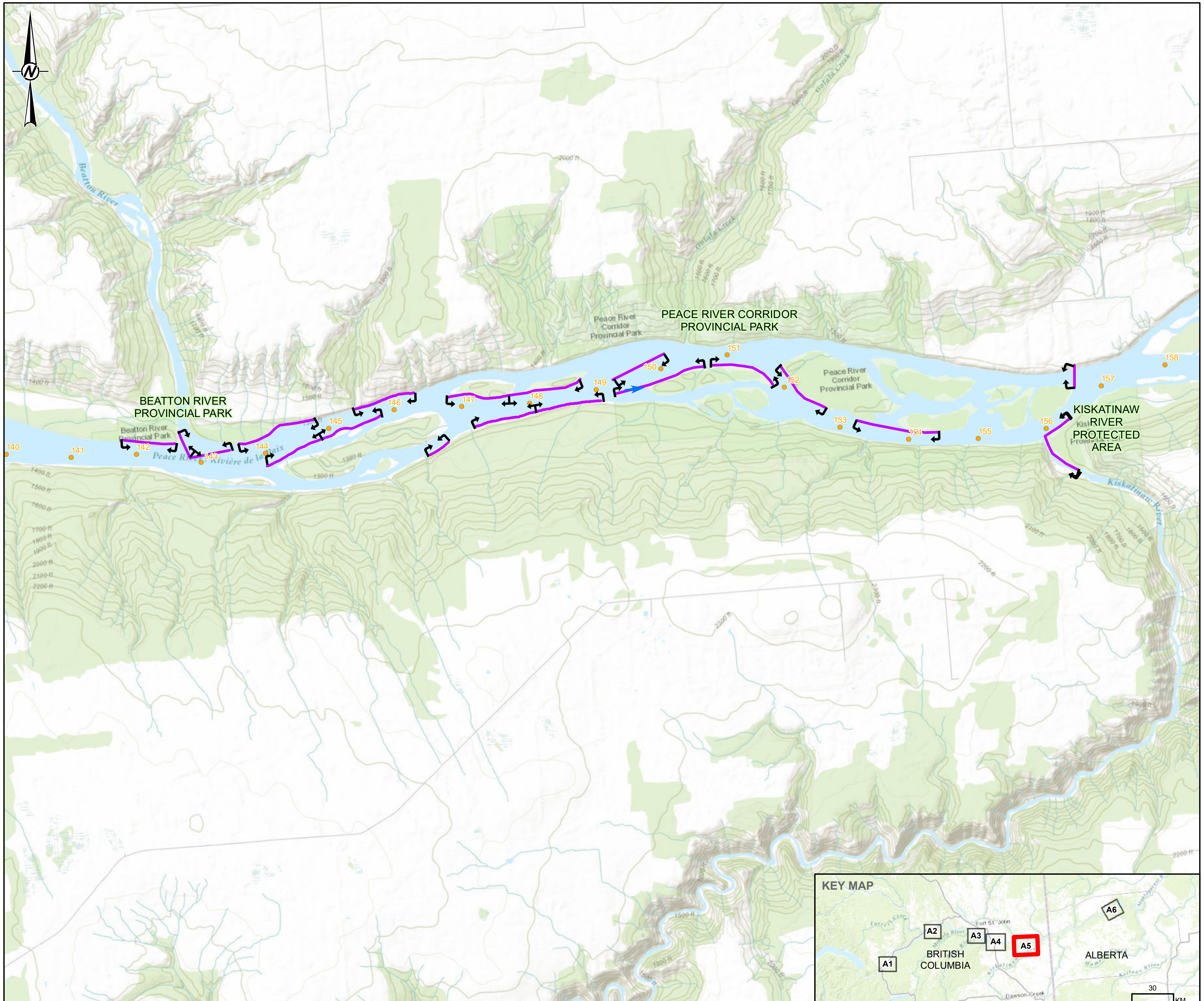


LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION

0 1,100 2,200

1:60,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

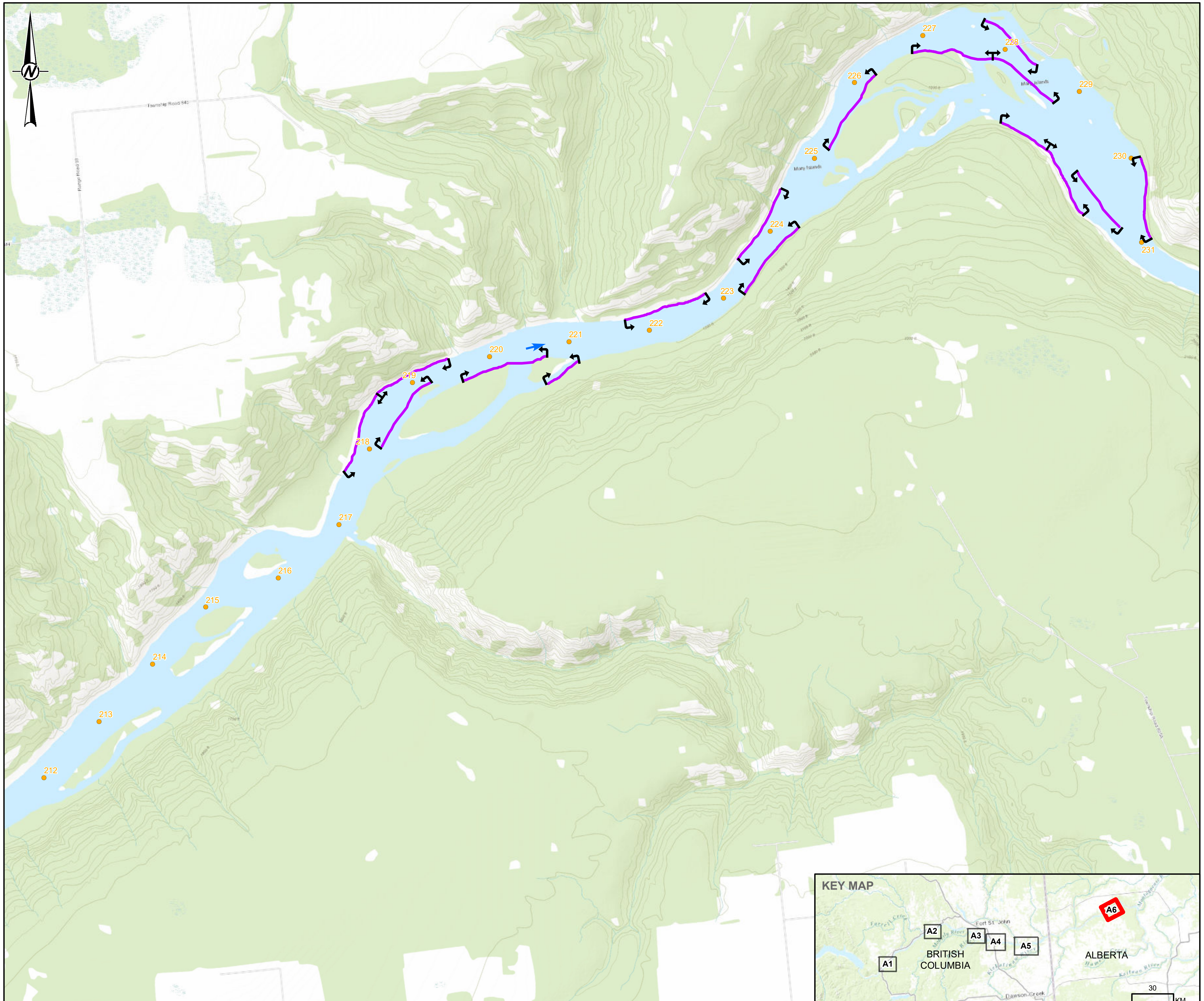
PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 7 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A5



LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION

0 990 1,980

1:50,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 9 - PEACE RIVER LARGE FISH INDEXING SURVEY (TASK 2A)

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	DF
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A6

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25mm

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LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION
- PROVINCIAL PARK AND PROTECTED AREA

0 990 1,980
1:50,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

KEY MAP
BRITISH COLUMBIA
ALBERTA
A7
A8
A9
30
KM

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 7 – PEACE RIVER LARGE FISH INDEXING SUIRVEY (TASK 2A) – GOLDEYE AND WALLEYE SAMPLING SITES

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	KL
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
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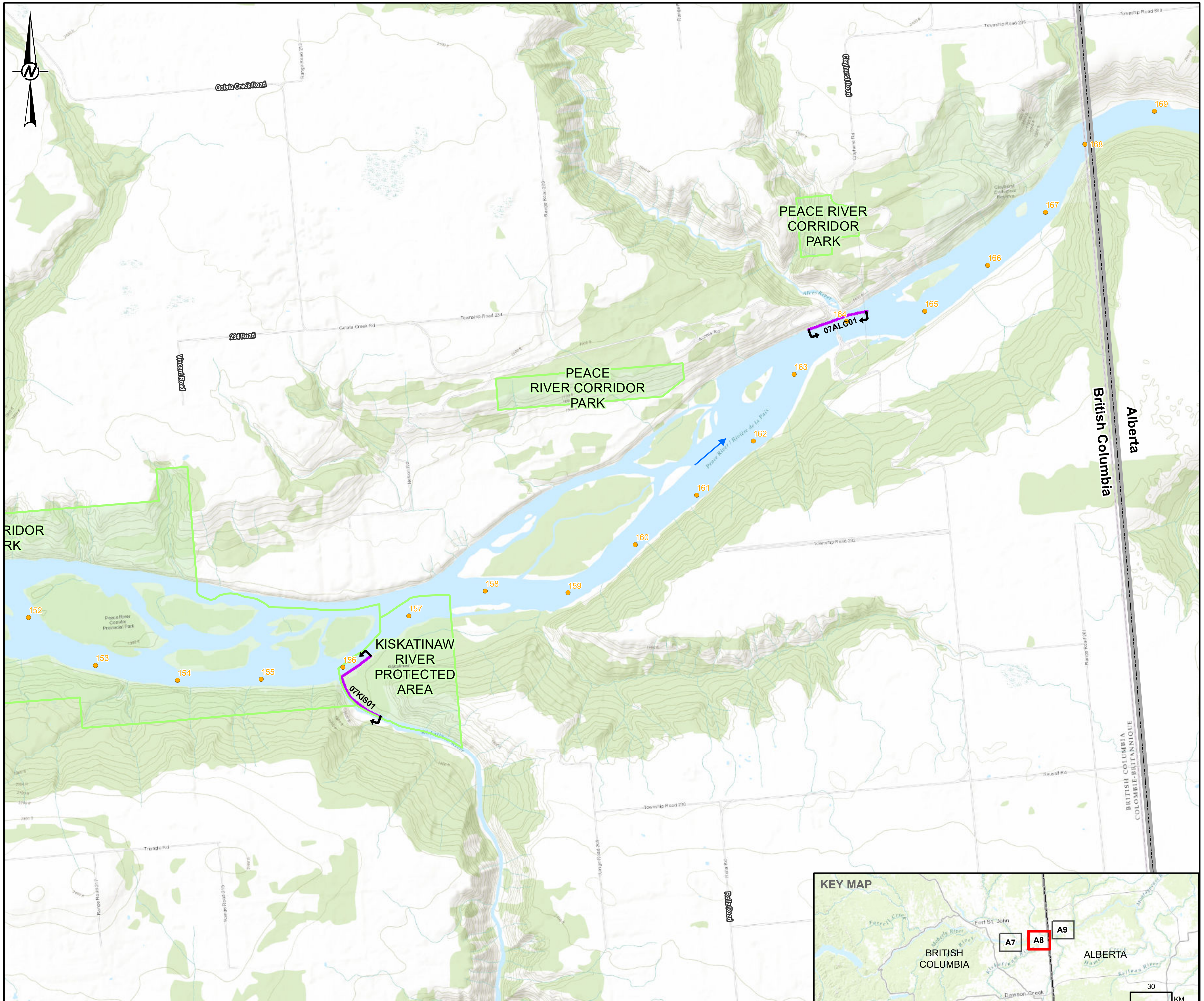

LEGEND

- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM
- FLOW DIRECTION
- 0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

- UNASSIGNED HABITAT CLASSIFICATION
- PROVINCIAL PARK AND PROTECTED AREA

0 990 1,980

1:50,000 METRES

REFERENCES

1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 7 – PEACE RIVER LARGE FISH INDEXING SUIRVEY (TASK 2A) – GOLDEYE AND WALLEYE SAMPLING SITES

CONSULTANT

GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	KL
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A8

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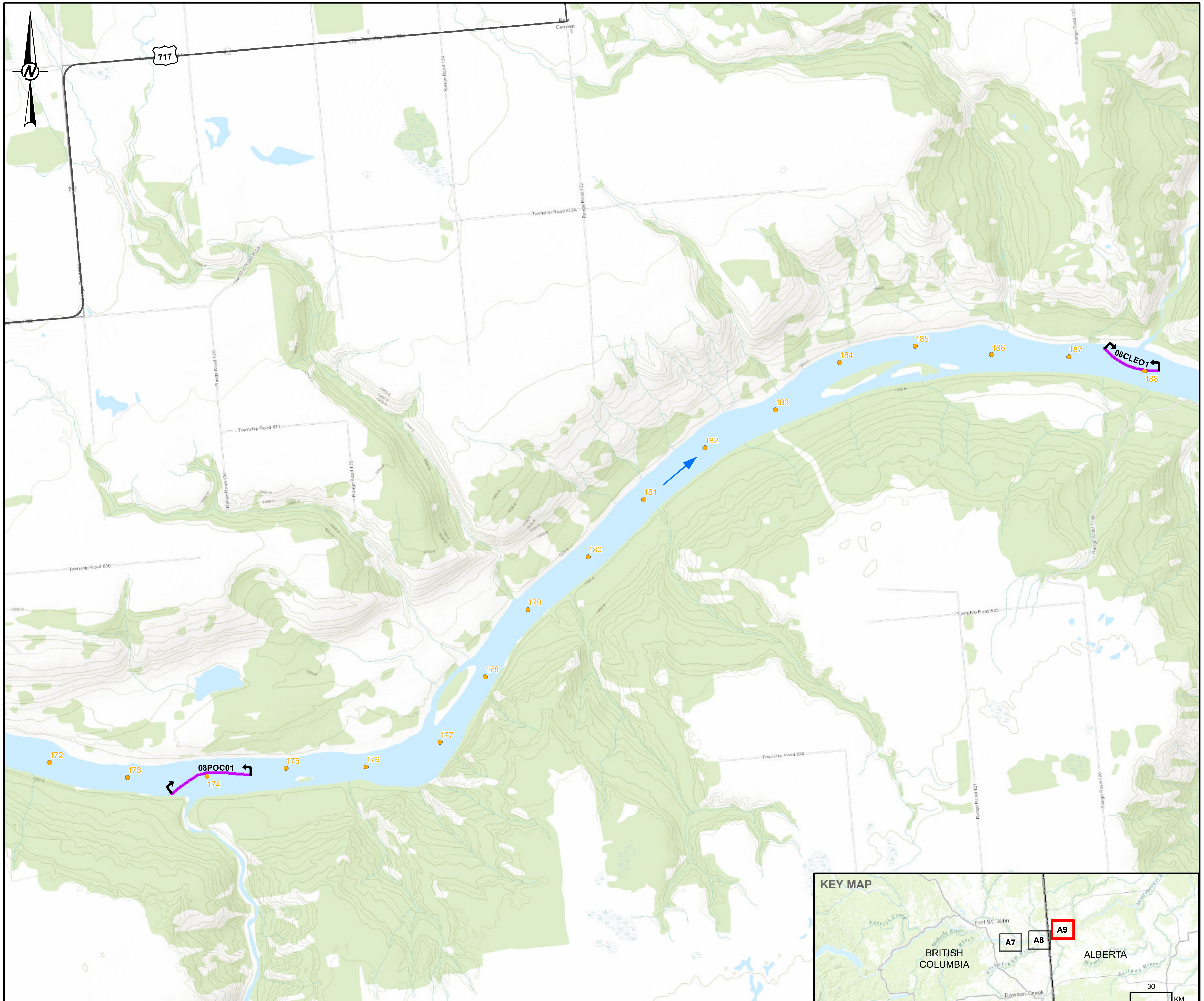


LEGEND

RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM W.A.C. BENNETT DAM

FLOW DIRECTION

0110 BOAT ELECTROSHOCKING SITE

SITE HABITAT CLASSIFICATION

UNASSIGNED HABITAT CLASSIFICATION

0 990 1,980

1:50,000 METRES

REFERENCES
1. TRANSPORTATION, HYDROLOGY AND TOPOGRPHY LAYERS CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. RAILROAD OBTAINED FROM IHS ENERGY.
3. RIVER KILOMETER MARKERS OBTAINED FROM BC HYDRO.
4. DAM SECTION AND ISLANDS OBTAINED FROM FROM GEOBASE®.
5. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: NAD 1983 BC ENVIRONMENT ALBERS

CLIENT
BC HYDRO

PROJECT
PEACE RIVER FISH COMMUNITY MONITORING PROGRAM (MON-2)

TITLE
SECTION 8 – PEACE RIVER LARGE FISH INDEXING SUIRVEY (TASK 2A) – GOLDEYE AND WALLEYE SAMPLING SITES

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-31
DESIGNED	KL
PREPARED	CD
REVIEWED	SR
APPROVED	DF

PROJECT NO.	PHASE	REV.	FIGURE
1670320	1000	0	A9

APPENDIX B

Historical Datasets

Table B1 Summary of historical datasets by sample section as delineated in Mainstream (2012). The summary is limited to studies that used similar capture techniques (i.e., boat electroshocking) during similar times of the year (i.e., August to October) when compared to the current program.

Year	Study Period	Effort (# of Days)	Section									
			1a	1	2	3	4	5	6	7	8	9
2002	21-Aug to 1-Oct	43		P&E and Gazey 2003	P&E and Gazey 2003	P&E and Gazey 2003	P&E and Gazey 2003					
2003	22-Aug to 2-Oct	48		Mainstream and Gazey 2004	Mainstream and Gazey 2004	Mainstream and Gazey 2004	Mainstream and Gazey 2004					
2004	24-Aug to 6-Oct	36		Mainstream and Gazey 2005		Mainstream and Gazey 2005		Mainstream and Gazey 2005				
2005	17-Aug to 26-Sep	33		Mainstream and Gazey 2006		Mainstream and Gazey 2006		Mainstream and Gazey 2006				
2006	16-Aug to 21-Sep	36		Mainstream and Gazey 2007	Mainstream and Gazey 2007	Mainstream and Gazey 2007						
2007	22-Aug to 24-Sep	30		Mainstream and Gazey 2008		Mainstream and Gazey 2008		Mainstream and Gazey 2008				
2008	20-Aug to 20-Sep	32		Mainstream and Gazey 2009		Mainstream and Gazey 2009		Mainstream and Gazey 2009				
2009	18-Aug to 27-Sep	37	Mainstream 2010a	Mainstream and Gazey 2010; Mainstream 2010a	Mainstream 2010a	Mainstream and Gazey 2010; Mainstream 2010a		Mainstream and Gazey 2010; Mainstream 2010a	Mainstream 2010a	Mainstream 2010a		
2010	24-Aug to 19-Oct	40	Mainstream 2011a	Mainstream and Gazey 2011; Mainstream 2011a	Mainstream 2011a	Mainstream and Gazey 2011; Mainstream 2011a		Mainstream and Gazey 2011; Mainstream 2011a	Mainstream 2011a	Mainstream 2011a	Mainstream 2011a	
2011	24-Aug to 19-Oct	37	Mainstream 2013a	Mainstream and Gazey 2012; Mainstream 2013a	Mainstream 2013a	Mainstream and Gazey 2012; Mainstream 2013a		Mainstream and Gazey 2012; Mainstream 2013a	Mainstream 2013a	Mainstream 2013a	Mainstream 2013a	Mainstream 2013a
2012	23-Aug to 21-Sep	30		Mainstream and Gazey 2013		Mainstream and Gazey 2013		Mainstream and Gazey 2013				
2013	24-Aug to 26-Sep	30		Mainstream and Gazey 2014		Mainstream and Gazey 2014		Mainstream and Gazey 2014				
2014	25-Aug to 4-Oct	35		Golder and Gazey 2015		Golder and Gazey 2015		Golder and Gazey 2015				
2015	25-Aug to 7-Oct	39		Golder and Gazey 2016		Golder and Gazey 2016		Golder and Gazey 2016	Golder and Gazey 2016	Golder and Gazey 2016		Golder and Gazey 2016
2016	23-Aug to 1-Oct	39		Golder and Gazey 2017		Golder and Gazey 2017		Golder and Gazey 2017	Golder and Gazey 2017	Golder and Gazey 2017		Golder and Gazey 2017
2017	21-Aug to 4-Oct	39		Golder and Gazey 2018		Golder and Gazey 2018		Golder and Gazey 2018	Golder and Gazey 2018	Golder and Gazey 2018		Golder and Gazey 2018
2018	27-Aug to 10-Oct	41		Current Study Year		Current Study Year		Current Study Year	Current Study Year	Current Study Year		Current Study Year

APPENDIX C

Discharge and Temperature

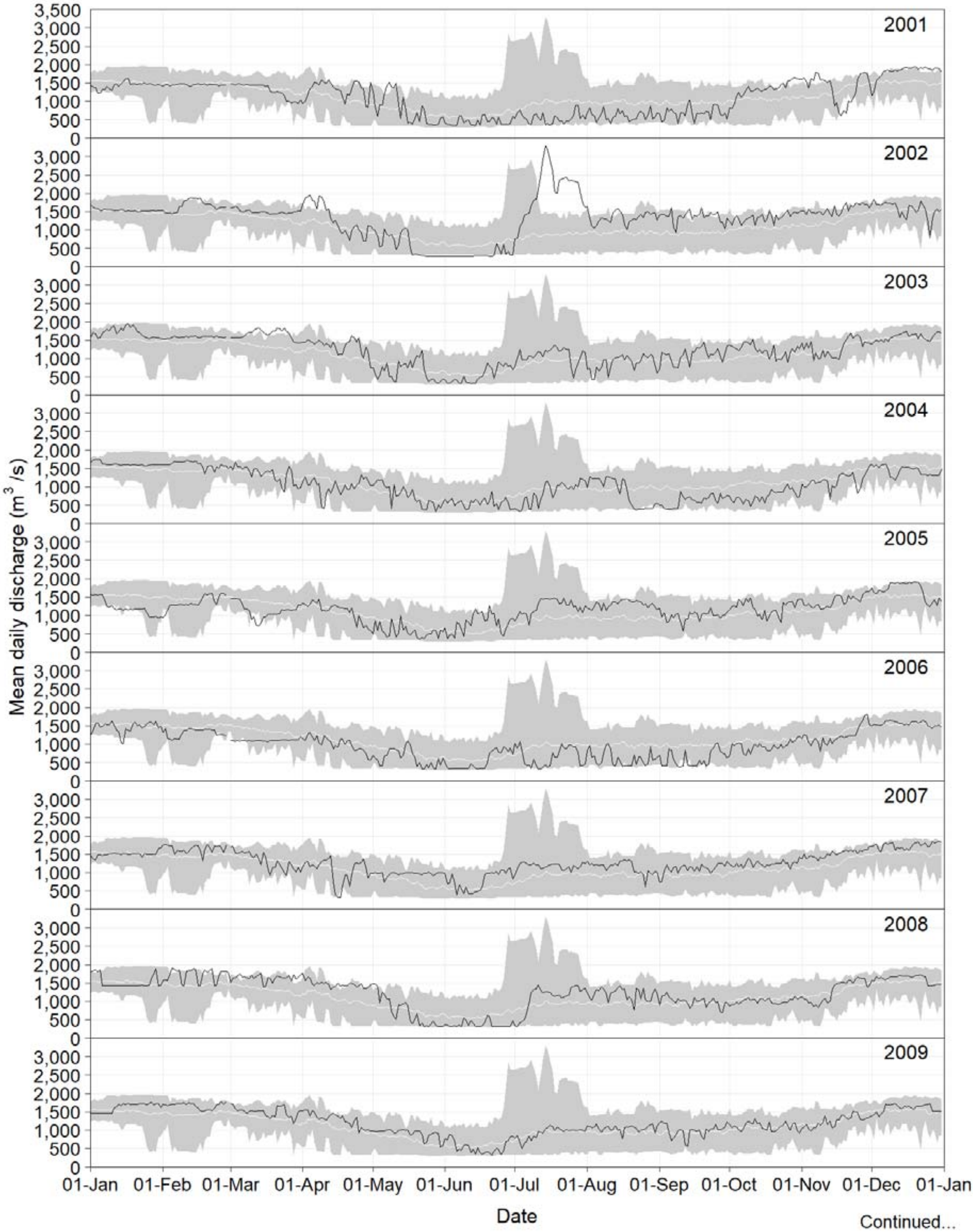
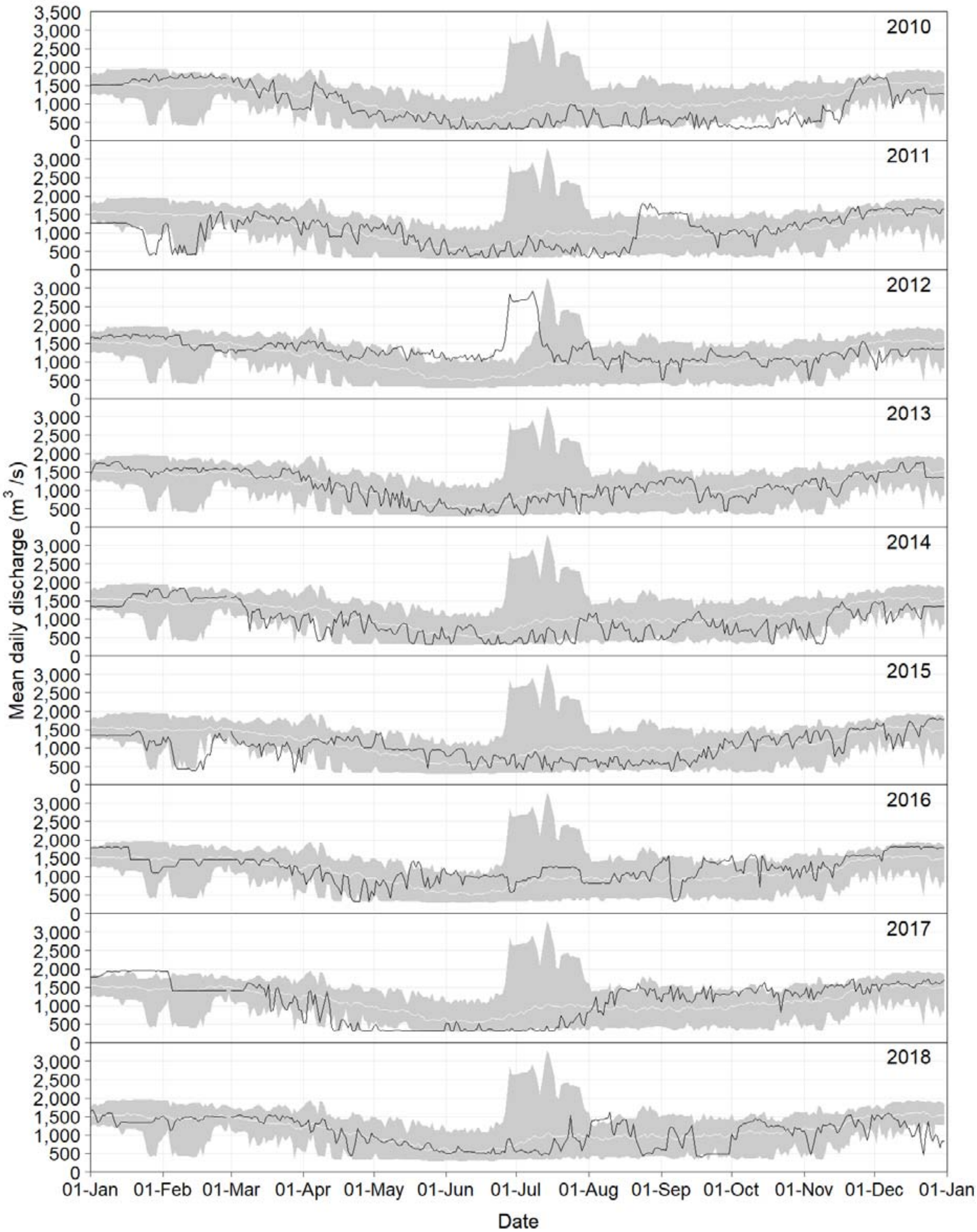


Figure C1: ***Mean daily discharge (m³/s) for the Peace River at Peace Canyon Dam (PCD; black line), 2001 to 2018. The shaded area represents minimum and maximum mean daily discharge recorded at PCD during other study years between 2001 and 2017. The white line represents average mean daily discharge over the same time period.***



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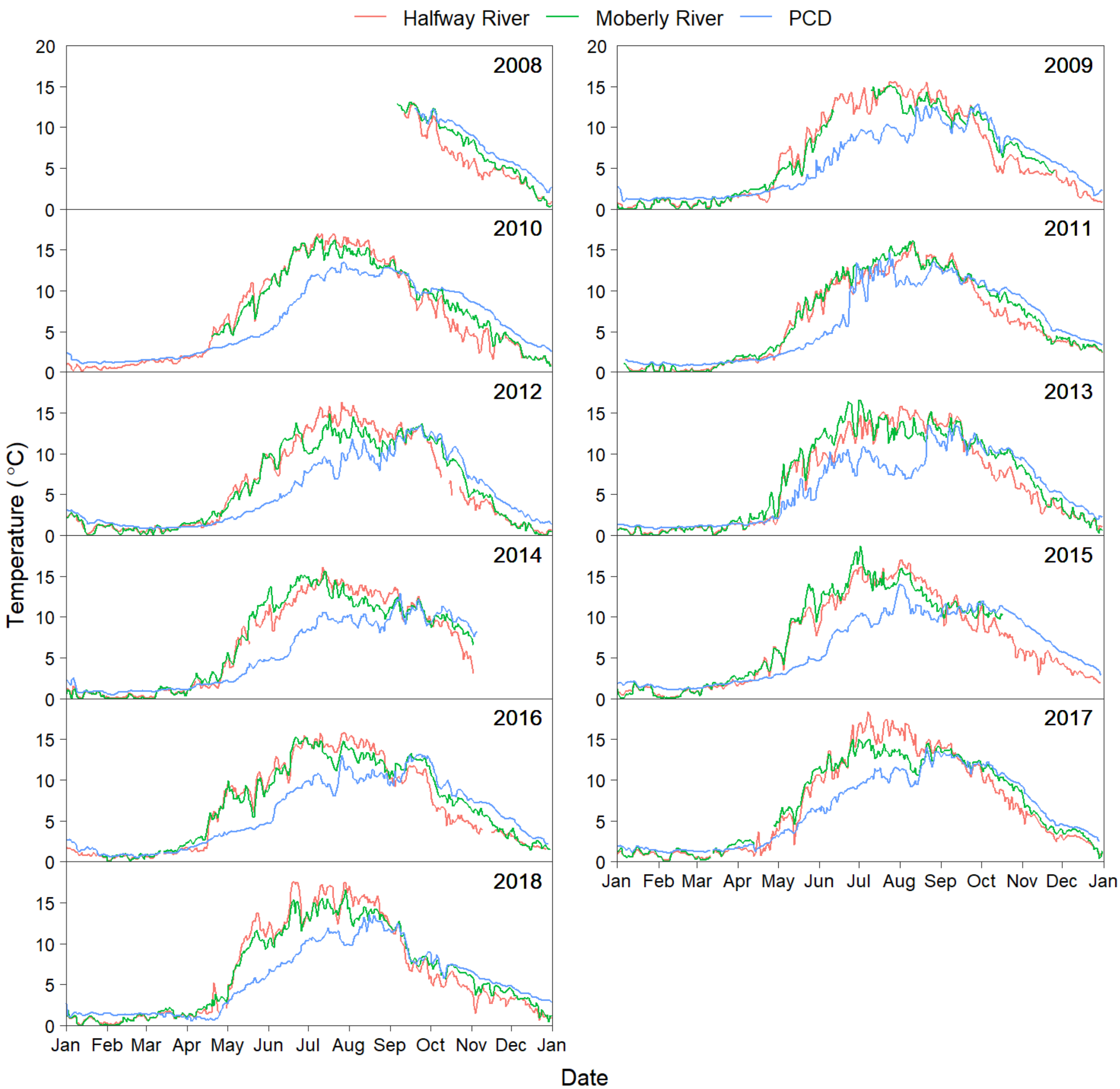
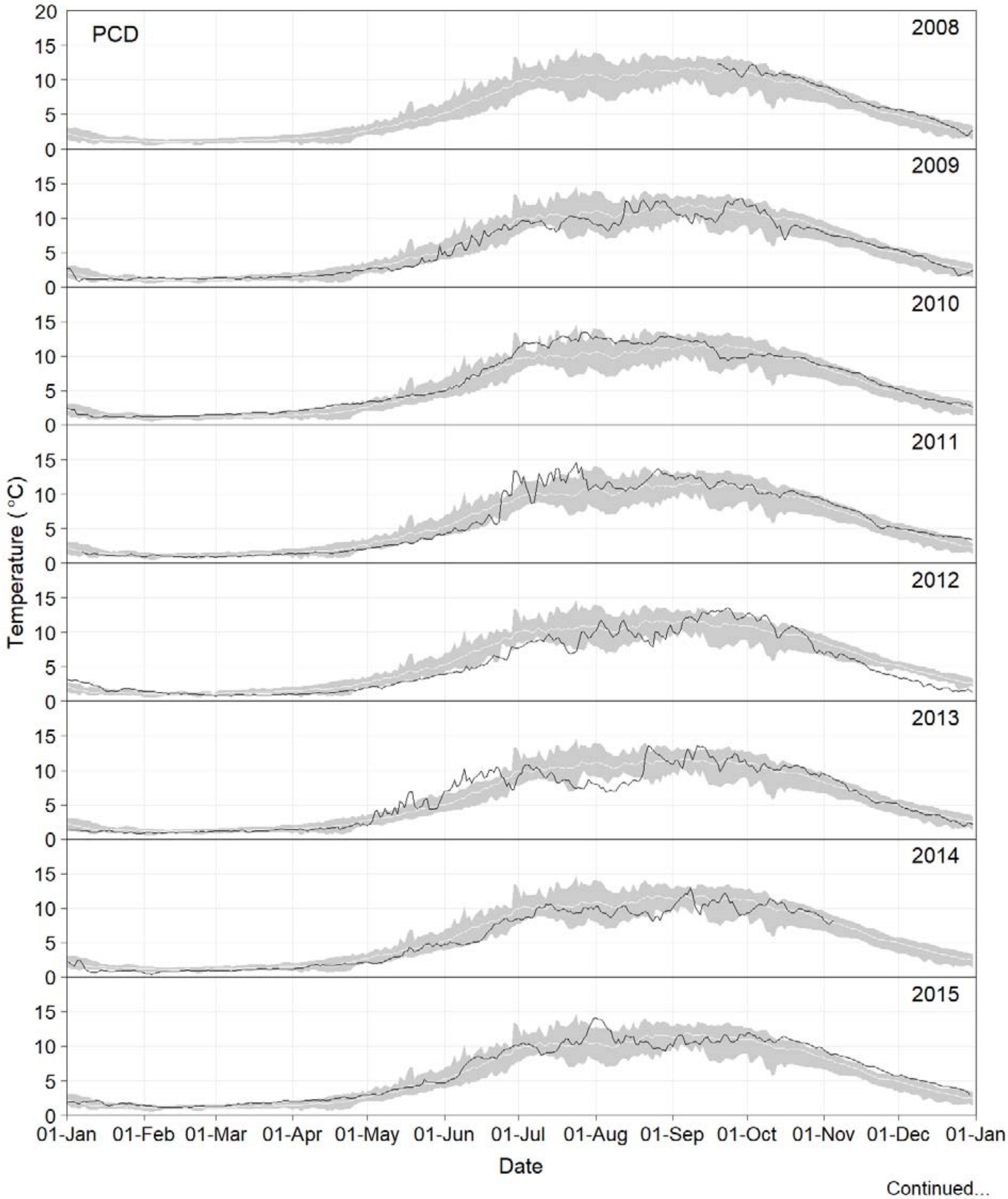
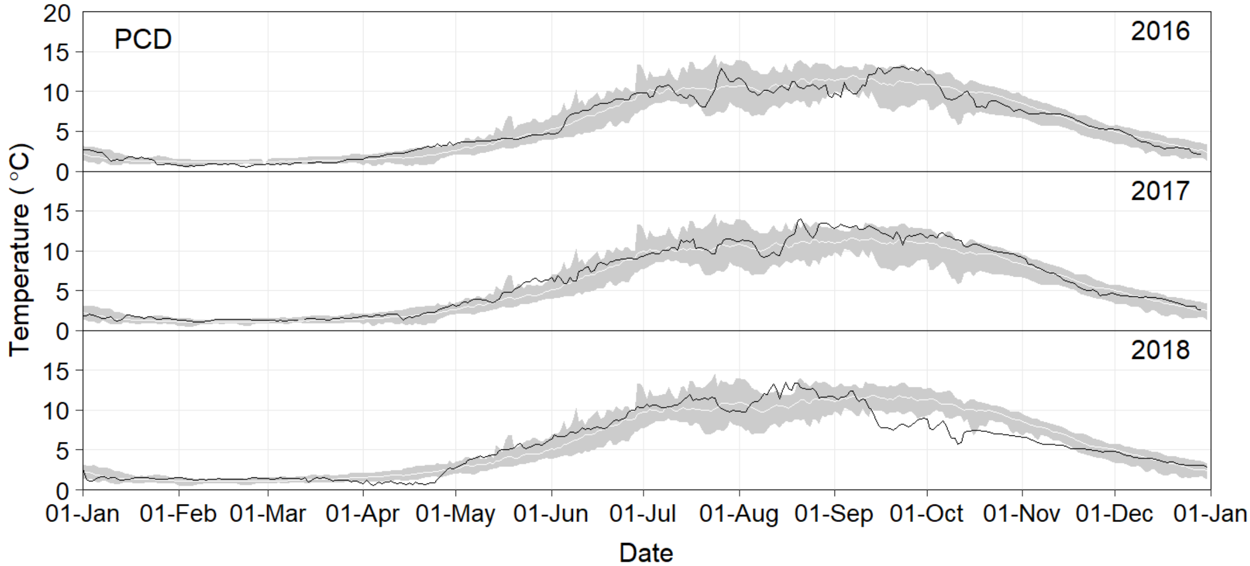


Figure C2: ***Mean daily water temperatures (°C) for the Peace River downstream of Peace Canyon Dam (PCD; blue line), downstream of the Halfway River confluence (red line) and downstream of the Moberly River confluence (green line), 2008 to 2018. Data were collected under from the Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9).***



Continued...

Figure C3: ***Mean daily water temperature (°C) for the Peace River at Peace Canyon Dam (PCD; black line), 2008 to 2018. The shaded area represents minimum and maximum water temperatures recorded at PCD during other study years between 2008 and 2017. The white line represents average mean daily water temperatures over the same time period. Data were collected under from the Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9).***



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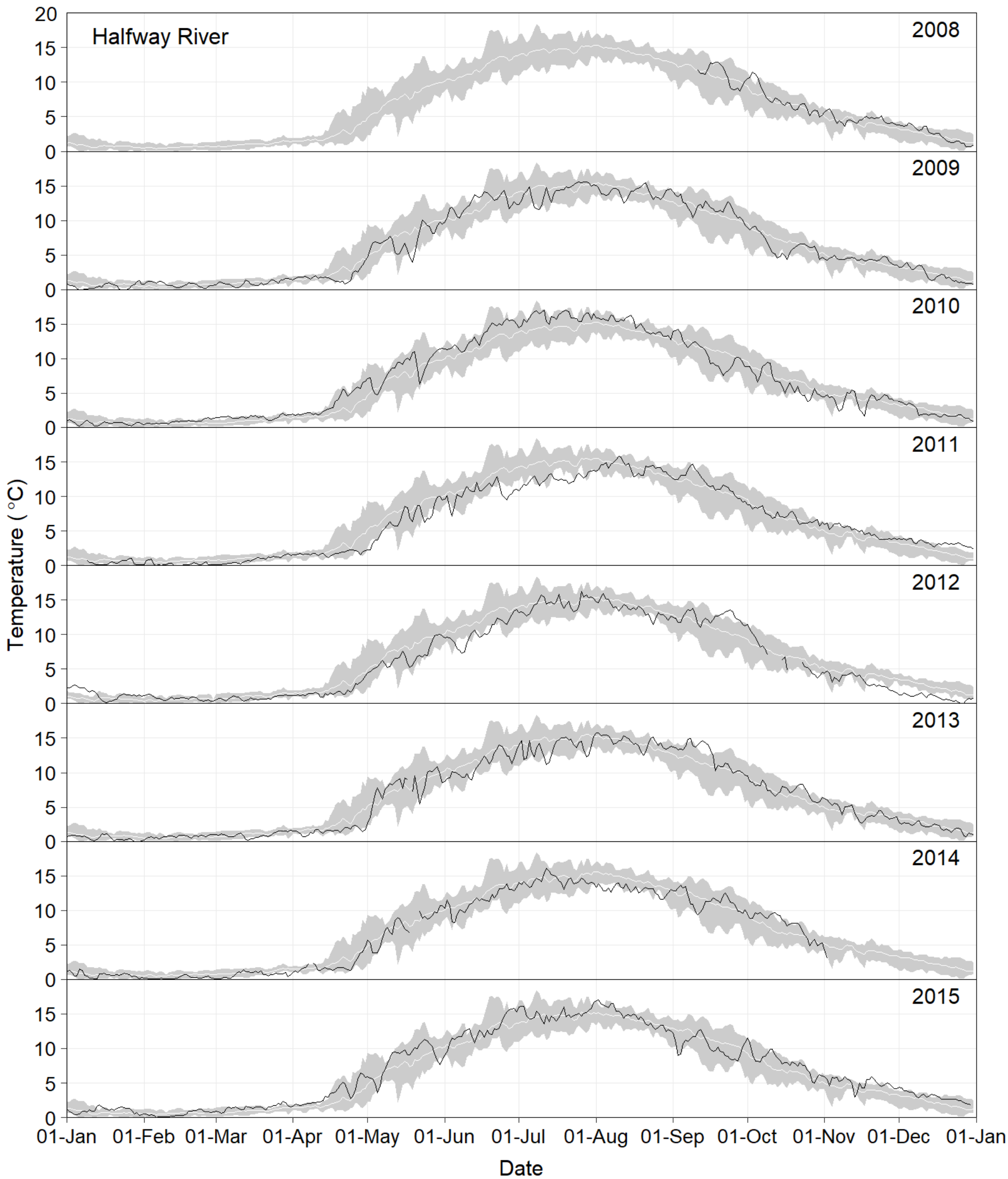


Continued…

Figure C4: ***Mean daily water temperature (°C) for the Peace River downstream of the Halfway River confluence (black line), 2008 to 2018. The shaded area represents minimum and maximum water temperatures recorded at the site during other study years between 2008 and 2017. The white line represents average mean daily water temperatures over the same time period. Data were collected under from the Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9).***

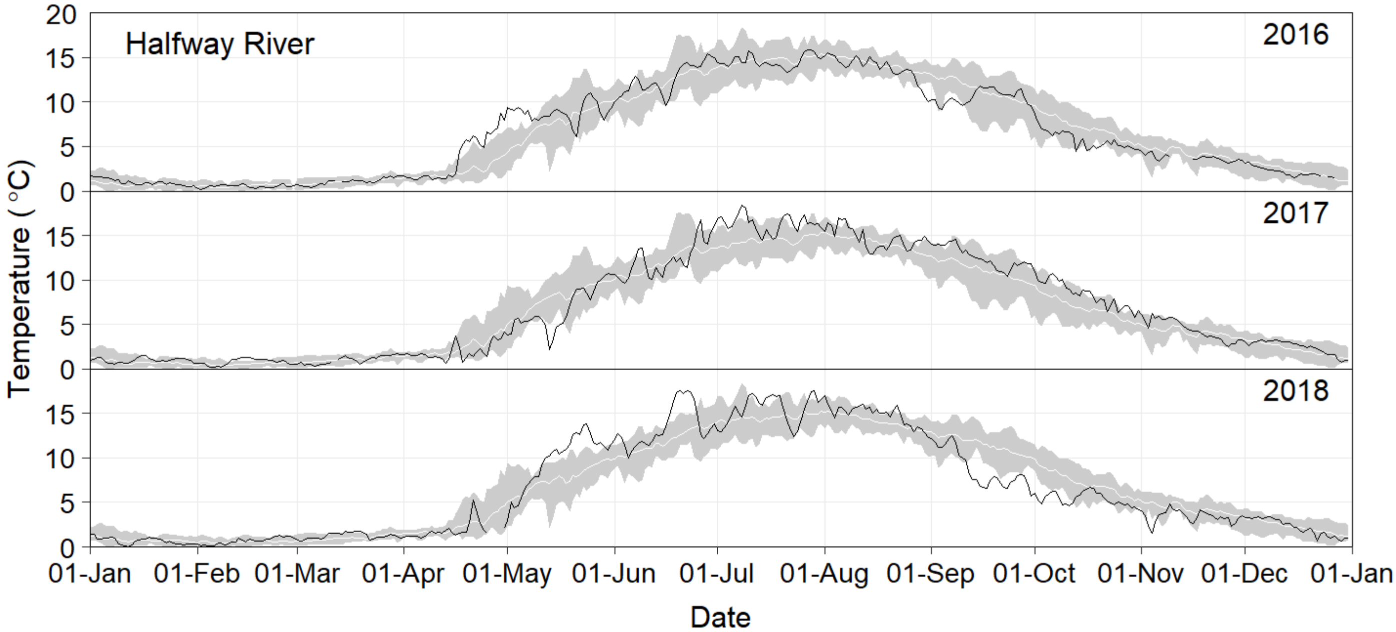
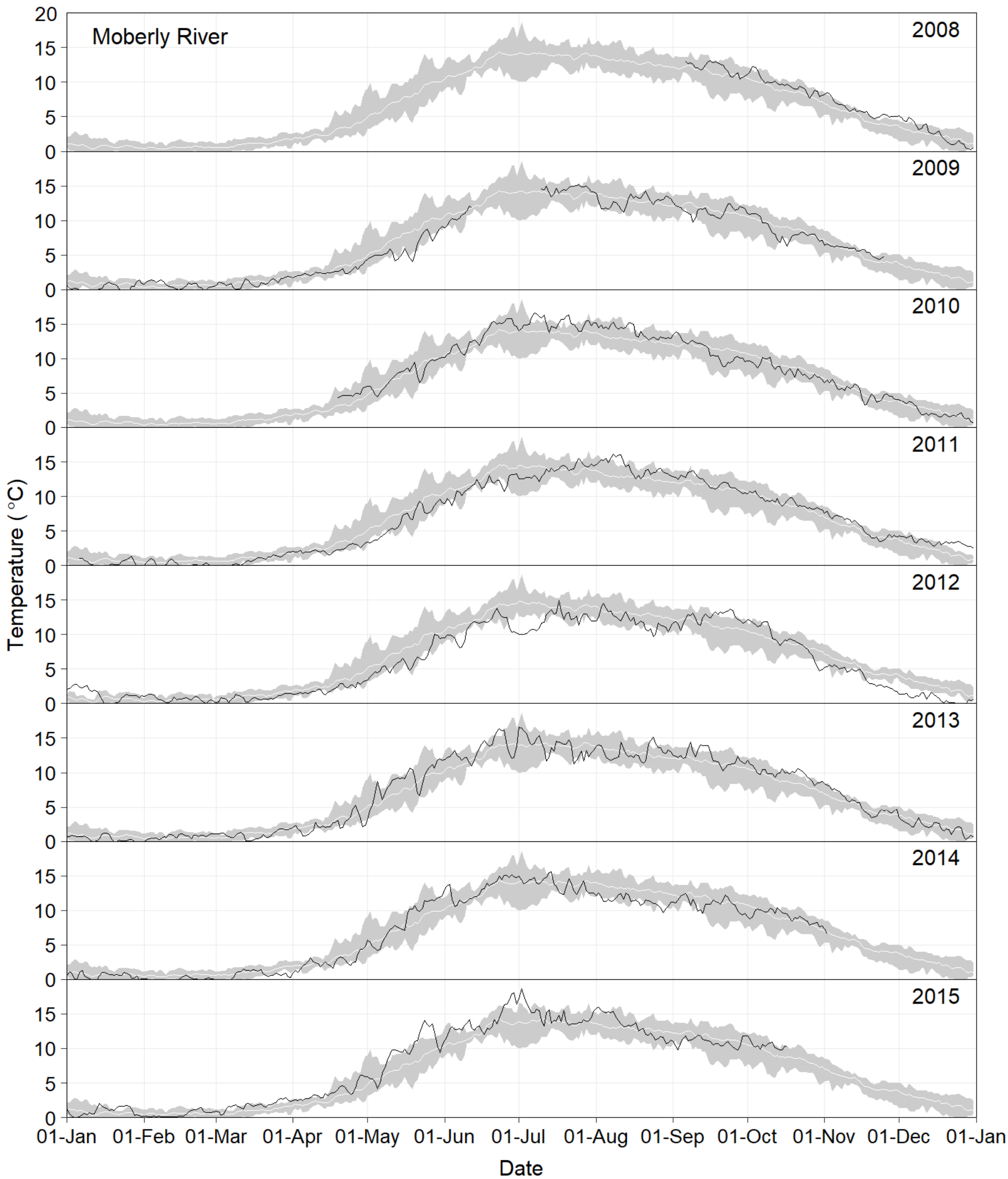


Figure C4: Concluded



Continued...

Figure C5: ***Mean daily water temperature (°C) for the Peace River downstream of the Moberly River confluence (black line), 2008 to 2018. The shaded area represents minimum and maximum water temperatures recorded at the site during other study years between 2008 and 2017. The white line represents average mean daily water temperatures over the same time period. Data were collected under from the Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9).***

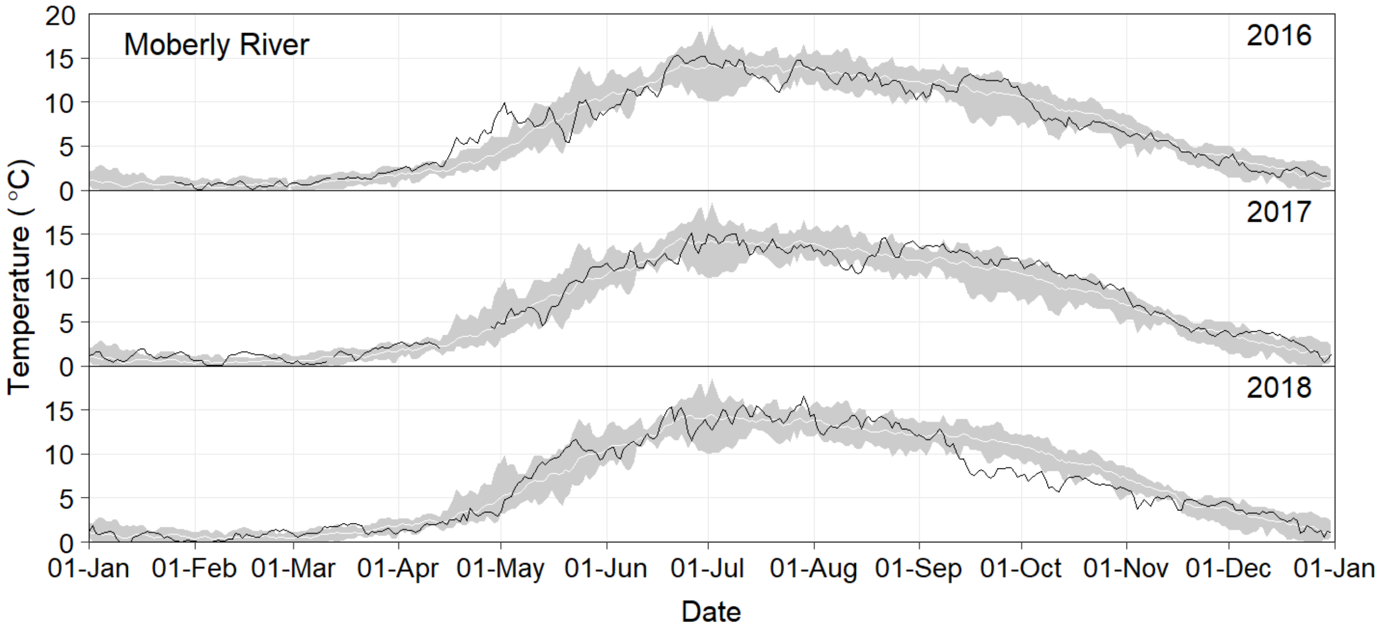


Figure C5: Concluded

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APPENDIX D

Habitat Data

Table D1 Lengths of boat electroshocking sites by habitat type in the Peace River, 2018. Bank habitat data were not available for Sections 6, 7, or 9.

Section	Site[a]	Length (m) of Site							Total Length (m)
		Physical Cover Present[b]				Physical Cover Absent[b]			
		A1[c]	A2[c]	A3[c]	Total	A2[c]	A3[c]	Total	
1	0101				0		600	600	**600**
	0102				0		975	975	**975**
	0103	1200			1200			0	**1200**
	0104				0		500	500	**500**
	0105		1100		1100			0	**1100**
	0107	550			550			0	**550**
	0108				0		850	850	**850**
	0109				0		975	975	**975**
	0110	650			650			0	**650**
	0111	1000			1000			0	**1000**
	0112	1070			1070			0	**1070**
	0113		750		750			0	**750**
	0114		950		950			0	**950**
	0116				0		985	985	**985**
	0119	750			750			0	**750**
Section 1 Total		**5220**	**2800**	**0**	**8020**	**0**	**4885**	**4885**	**12905**
3	0301		1800		1800			0	**1800**
	0302		1900		1900			0	**1900**
	0303		1450		1450			0	**1450**
	0304				0	1350		1350	**1350**
	0305				0	1550		1550	**1550**
	0306				0		1000	1000	**1000**
	0307				0		950	950	**950**
	0308				0		1350	1350	**1350**
	0309				0		950	950	**950**
	0310			1200	1200			0	**1200**
	0311			1250	1250			0	**1250**
	0312				0	1170		1170	**1170**
	0314		975		975			0	**975**
	0315			1700	1700			0	**1700**
	0316		1475		1475			0	**1475**
Section 3 Total		**0**	**7600**	**4150**	**11750**	**4070**	**4250**	**8320**	**20070**
5	0502		950		950			0	**950**
	0505	1000			1000			0	**1000**
	0506		1000		1000			0	**1000**
	0507		780		780			0	**780**
	0508		925		925			0	**925**
	0509				0		975	975	**975**
	0510	1130			1130			0	**1130**
	0511		720		720			0	**720**
	0512				0		1280	1280	**1280**
	0513				0		770	770	**770**
	0514				0		560	560	**560**
	0515				0		970	970	**970**
	0516				0	800		800	**800**
	0517				0	700		700	**700**
	05SC060	530			530			0	**530**
Section 5 Total		**2660**	**4375**	**0**	**7035**	**1500**	**4555**	**6055**	**13090**
Grand Total		**7880**	**14775**	**4150**	**26805**	**5570**	**13690**	**19260**	**46065**

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Nearshore habitat with physical cover as assigned by P&E and Gazey (2003).

[c] Nearshore habitat with no physical cover as assigned by P&E and Gazey (2003).

[d] Bank Habitat Type as assigned by R.L.&L. (2001). See Appendix D, Table D2 for a description of each bank habitat type.

Table D2 Descriptions of categories used in the Bank Habitat Types Classification System as summarized from R.L.&L. (2001).

Category	Code	Description
Armoured/Stable	A1	Banks generally stable and at repose with cobble/small boulder/gravel substrates predominating; uniform shoreline configuration with few/minor bank irregularities; velocities adjacent to bank generally low-moderate, instream cover limited to substrate roughness (i.e., cobble/small boulder interstices).
	A2	Banks generally stable and at repose with cobble/small boulder and large boulder substrates predominating; irregular shoreline configuration generally consisting of a series of armoured cobble/boulder outcrops that produce Backwater habitats; velocities adjacent to bank generally moderate with low velocities provided in BW habitats: instream cover provided by BW areas and substrate roughness; overhead cover provided by depth and woody debris; occasionally associated with C2, E4, and E5 banks.
	A3	Similar to A2 in terms of bank configuration and composition although generally with higher composition of large boulders/bedrock fractures; very irregular shoreline produced by large boulders and bed rock outcrops; velocities adjacent to bank generally moderate to high; instream cover provided by numerous small BW areas, eddy pools behind submerged boulders, and substrate interstices; overhead cover provided by depth; exhibits greater depths offshore than found in A1 or A2 banks; often associated with C1 banks.
	A4	Gently sloping banks with predominantly small and large boulders (boulder garden) often embedded in finer materials; shallow depths offshore, generally exhibits moderate to high velocities; instream cover provided by “pocket eddies” behind boulders; overhead cover provided by surface turbulence.
	A5	Bedrock banks, generally steep in profile resulting in deep water immediately offshore; often with large bedrock fractures in channel that provide instream cover; usually associated with moderate to high current velocities; overhead cover provided by depth.
	A6	Man-made banks usually armoured with large boulder or concrete rip-rap; depths offshore generally deep and usually found in areas with moderate to high velocities; instream cover provided by rip-rap interstices; overhead cover provided by depth and turbulence.
Depositional	D1	Low relief, gently sloping bank type with shallow water depths offshore; substrate consists predominantly of fines (i.e., sand/silt); low current velocities offshore; instream cover generally absent or, if present, consisting of shallow depressions produced by dune formation (i.e., in sand substrates) or embedded cobble/boulders and vegetative debris; this bank type was generally associated with bar formations or large backwater areas.
	D2	Low relief, gently sloping bank type with shallow water depths offshore; substrate consists of coarse materials (i.e., gravels/cobbles); low-moderate current velocities offshore; areas with higher velocities usually producing riffle areas; overhead cover provided by surface turbulence in riffle areas; instream cover provided by substrate roughness; often associated with bar formations and shoal habitat.
	D3	Similar to D2 but with coarser substrates (i.e., large cobble/small boulder) more dominant; boulders often embedded in cobble/gravel matrix; generally found in areas with higher average flow velocities than D1 or D2 banks; instream cover abundantly available in form of substrate roughness; overhead cover provided by surface turbulence; often associated with fast riffle transitional bank type that exhibits characteristics of both Armoured and Depositional bank types.
SPECIAL HABITAT FEATURES		
BACKWATER POOLS	-	These areas represent discrete areas along the channel margin where backwater irregularities produce localized areas of counter-current flows or areas with reduced flow velocities relative to the mainstem; can be quite variable in size and are often an integral component of Armoured and erosional bank types. The availability and suitability of Backwater pools are determined by flow level. To warrant separate identification as a discrete unit, must be a minimum of 10 m in length; widths highly variable depending on bank irregularity that produces the pool. Three classes are identified:
	BW-P1	Highest quality pool habitat type for adult and subadult cohorts for feeding/holding functions. Maximum depth exceeding 2.5 m, average depth 2.0 m or greater; high availability of instream cover types (e.g., submerged boulders, bedrock fractures, depth, woody debris); usually with Moderate to High countercurrent flows that provide overhead cover in the form of surface turbulence.
	BW-P2	Moderate quality pool type for adult and subadult cohorts for feeding/holding; also provides moderate quality habitat for smaller juveniles for rearing. Maximum depths between 2.0 to 2.5 m, average depths generally in order of 1.5 m. Moderate availability of instream cover types; usually with Low to Moderate countercurrent flow velocities that provide limited overhead cover.

Continued.

Table D2 Concluded.

	BW-P3	Low quality pool type for adult/subadult classes; moderate-high quality habitat for y-o-y and small juveniles for rearing. Maximum depth <1.0 m. Low availability of instream cover types; usually with Low-Nil current velocities.
EDDY POOL	EDDY	Represent large (<30 m in diameter) areas of counter current flows with depths generally >5 m; produced by major bank irregularities and are available at all flow stages although current velocities within eddy are dependent on flow levels. High quality areas for adult and subadult life stages. High availability of instream cover.
SNYE	SN	A side channel area that is separated from the mainstem at the upstream end but retains a connection at the lower end. SN habitats generally present only at lower flow stages since area is a flowing side channel at higher flows: characterized by low-nil velocity, variable depths (generally <3 m) and predominantly depositional substrates (i.e., sand/silt/gravel); often supports growths of aquatic vegetation; very important areas for rearing and feeding.

Velocity Classifications:

Low: <0.5 m/s
Moderate: 0.5 to 1.0 m/s
High: >1.0 m/s

Table D3 Summary of habitat variables recorded at boat electroshocking sites in the Peace River, 27 August to 10 October 2018.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
1	119	1	15	10.7	190	Partly cloudy	High	Low	220	30	1				19	50	
1	119	2	6	9.8	200	Overcast	Medium	Med	250	50		5			25	20	
1	119	3	10	7.4	220	Clear	Low	Med	270	5					15	80	
1	119	4	12	7.8	190	Partly cloudy	Medium	Med	300	65					10	25	
1	119	5	3	7.7	210	Overcast	Medium	Med	380	45		5			10	40	
1	116	1	18	11.0	170	Overcast	High	Med	150	30					70		
1	116	2	8	10.0	200	Overcast	High	Med	250	70					20	10	
1	116	3	10	7.4	220	Clear	High	Med	270	25		25			50		
1	116	4	4	6.8	210	Partly cloudy	High	Med	180	60					35	5	
1	116	5	3	7.8	210	Mostly cloudy	Medium	Med	110	60					40		
1	114	1	18	10.9	170	Overcast	High	Med	240	70	1				29		
1	114	2	15	10.1	200	Overcast	Medium	Med	230	55	5	10			20	10	
1	114	3	5	6.2	210	Overcast	Medium	Med	270	30		30				40	
1	114	4	3	6.6	210	Partly cloudy	High	Med	230	60						40	
1	114	5	3	8.2	210	Mostly cloudy	Medium	Med	180	70					20	10	
1	113	1		10.9	170	Overcast	High	High	230	30					70		
1	113	2	8	10.0	200	Overcast	Medium	Med	250	50					45	5	
1	113	3	12	7.4	220	Clear	High	Med	270	10		50				40	
1	113	4	6	6.7	210	Partly cloudy	Medium	Med	220	40		30			15	15	
1	113	5	2	7.9	210	Mostly cloudy	Medium	Med	160	55					40	5	
1	112	1	17	11.2	190	Mostly cloudy	Medium	Med	160	45	1				45	9	
1	112	2	12	10.1	190	Overcast	Medium	Med	230	60		15			10	15	
1	112	3	5	6.3	210	Overcast	Medium	Med	270	50		10				40	
1	112	4	3	6.5	210	Partly cloudy	High	Med	210	85					10	5	
1	112	5	3	7.8	210	Mostly cloudy	Medium	Med	170	55					40	5	
1	111	1	17	11.6	190	Mostly cloudy	High	Low	180	45					50	5	
1	111	2	12	10.2	190	Overcast	Medium	Med	230	60		10			5	25	
1	111	3	5	6.2	210	Overcast	High	Low	210	90						10	
1	111	4	1	6.2	210	Partly cloudy	High	Low	220	60					10	30	
1	111	5	3	7.8	210	Mostly cloudy	Medium	Low	180	50					50		
1	110	1	15	10.9	190	Mostly cloudy	Medium	Med	240	45					45	10	
1	110	2	6	9.6	200	Overcast	High	Low	250	30					20	50	
1	110	3	3	6.5	220	Clear	High	Med	270	35					25	40	
1	110	4	14	7.7	190	Partly cloudy	High	Med	280	49	1				20	30	
1	110	5	3	7.8	210	Overcast	Medium	Med	300	58	2				20	20	
1	109	1	16	11.1	190	Mostly cloudy	Medium	Med	180	50	1				49		
1	109	2	6	9.9	200	Overcast	High	Low	250	55					40	5	
1	109	3	10	7.1	220	Clear	High	Med	270	40					40	20	
1	109	4	14	7.8	190	Partly cloudy	Medium	Med	140	70					30		
1	109	5	2	7.8	210	Mostly cloudy	Medium	Med	150	60					40		
1	108	1	16	11.1	190	Partly cloudy	Medium	Med	120	49	1				50		
1	108	2	6	9.9	200	Overcast	High	Low	250	60					30	10	
1	108	3	10	7.1	220	Clear	Low	Med	n/a	40					40	20	
1	108	4	14	7.6	190	Partly cloudy	Medium	Med	130	50					50		
1	108	5	3	7.9	210	Overcast	Medium	Med	130	60					40		
1	107	1	15	10.9	190	Mostly cloudy	High	Med	280	32	2				33	33	
1	107	2	6	9.9	200	Overcast	High	Low	250	40					20	40	

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.

[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.

[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%) Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
1	107	3	3	6.5	220	Fog	High	Med	270	20					5	75	
1	107	4	14	7.7	190	Partly cloudy	High	Med	250	70						30	
1	107	5	3	7.8	210	Overcast	Medium	Med	330	59	1				10	30	
1	105	1	18	10.9	170	Overcast	Medium	High	180	43	2	10			40	5	
1	105	2	1	10.5	190	Overcast	Medium	High	300	10		60			10	20	
1	105	5	0	6.7	190	Partly cloudy	Medium	High	160	20	5	40			30	5	
1	104	1	18	10.9	170	Overcast	High	Med	190	39		2		4	50	5	
1	104	2	10	10.5	190	Overcast	Medium	Med	300	45		10			45		
1	104	5	0	6.7	190	Partly cloudy	High	Med	180	55					40	5	
1	103	1	18	10.9	170	Overcast	Medium	High	210	55	2	3			30	10	
1	103	2	13	10.4	190	Overcast	Medium	Med	300	15		10			15	60	
1	103	5	0	6.7	190	Partly cloudy	Medium	High	220	20	10	20			20	30	
1	102	1	12	10.4	190	Clear	Medium	High	130	50					46	4	
1	102	2	8	10.1	200	Overcast	Low	High	250	60		20			20		
1	102	3	6	6.9	220	Clear	Low	High	270	33		34			33		
1	102	4	15	7.9	190	Partly cloudy	Low	High	500	45		45				10	
1	102	5	3	7.9	210	Overcast	Low	High	150	50		20			30		
1	101	1	12	10.3	190	Clear	Medium	High	110	30					70		
1	101	2	8	10.1	200	Overcast	Medium	High	250	70					30		
1	101	3	5	6.6	220	Clear	Medium	High	270	33		34			33		
1	101	4	10	7.3	190	Partly cloudy	Low	High	140	50		50					
1	101	5	3	7.8	210	Overcast	Low	High	150	60		20			20		
3	316	1	18	11.2	250	Mostly cloudy	High	Med	230	50	2				38	10	
3	316	2	5	8.8	200	Clear	High	Med	150	30	5	5			35	25	
3	316	3	0	6.0	230	Clear	Medium	Med	150	15	5	30			20	30	
3	316	4	3	6.9	210	Partly cloudy	Medium	High	240	60		10			25	5	
3	316	5	-1	7.0	210	Overcast	Medium	Med	100	10		5			5	80	
3	315	1	10	10.6	250	Overcast	High	Low	230	30					20	50	
3	315	2	10	8.8	220	Overcast	Medium	Med	150	40					30	30	
3	315	3	-1	6.0	230	Mostly cloudy	Medium	Med	150	45	5				10	40	
3	315	4	4	6.9	210	Overcast	Medium	Low	220	68	2				20	10	
3	315	5	-1	7.0	210	Overcast	Medium	Med	270	10					10	80	
3	314	1	11	10.7	250	Overcast	Medium	Med	230	50					30	20	
3	314	2	4	8.6	220	Overcast	Medium	Med	150	60					20	20	
3	314	3	7	6.4	240	Partly cloudy	High	Med	120	27	1	5			27	40	
3	314	4	3	6.9	210	Overcast	Medium	Med	220	70		5			15	10	
3	314	5	3	7.9	220	Partly cloudy	Medium	Med	160	70					25	5	
3	312	1	15	10.7	330	Overcast	Medium	Med	130	20		10			20	50	
3	312	2	3	7.6	200	Partly cloudy	High	Low	100	35					20	45	
3	312	3	4	7.5	230	Mostly cloudy	Medium	Med	150	20		10			30	40	
3	312	4	5	7.4	210	Partly cloudy	Medium	Med	300	50		5			35	10	
3	312	5	0	7.2	210	Overcast	Medium	Med	n/a	40					20	40	
3	311	1	15	10.8	330	Fog	Medium	Med	130	40		5			40	15	
3	311	2	0	7.4	290	Mostly cloudy	High	Med	110	40					50	10	
3	311	3	10	6.9	240	Partly cloudy	Medium	Med	120	55		5				40	
3	311	4	8	7.4	240	Overcast	High	Med	200	85						15	
3	311	5	-3	7.0	210	Partly cloudy	Medium	Med	200	40		5			40	15	
3	310	1	15	10.7	330	Overcast	Medium	Low	130	39		10		1	40	10	

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.

[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.

[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
3	310	2	2	8.1	200	Partly cloudy	Medium	Med	150	40		5			30	25	
3	310	3	8	6.8	230	Mostly cloudy	Medium	Med	150	75		5			15	5	
3	310	4	8	7.3	240	Overcast	Medium	Med	200	74	1	15			10		
3	310	5	0	7.2	210	Overcast	Medium	Med	n/a	40					30	30	
3	309	1	15	10.7	330	Overcast	Medium	Low	130	35		20			35	10	
3	309	2	1	8.2	200	Partly cloudy	High	Low	150	50					40	10	
3	309	3	3	6.9	230	Mostly cloudy	High	Med	150	28	2	10			50	10	
3	309	4	8	7.3	240	Overcast	High	Med	200	69	1	10			10	10	
3	309	5	0	7.2	210	Overcast	Medium	Med	250	50					30	20	
3	308	1	16	11.2	250	Partly cloudy	High	Med	230	45					50	5	
3	308	2	10	8.5	220	Overcast	Medium	Med	150	60		5			20	15	
3	308	3	5	6.3	230	Partly cloudy	Medium	Med	150	30					30	40	
3	308	4	10	7.8	210	Clear	Medium	Med	200	55					40	5	
3	308	5	0	7.3	210	Overcast	Medium	Med	200	50					40	10	
3	307	1	14	10.8	250	Overcast	High	Low	150	60	5				20	15	
3	307	2	8	8.4	220	Overcast	Medium	Med	150	60					40		
3	307	3	2	6.2	230		Medium	Med	150	45		5			40	10	
3	307	4	6	7.5	210	Partly cloudy	High	Low	150	60					40		
3	307	5	0	7.3	210	Overcast	High	Med	220	40	5			10	30	15	
3	306	1	13	10.6	250	Overcast	High	Low	230	40	1				49	10	
3	306	2	4	9.6	210	Overcast	High	Low	40	50					50		
3	306	3	10	6.3	240	Partly cloudy	High	Med	120	50					50		
3	306	4	12	7.2	240	Overcast	Medium	Med	230	50					50		
3	306	5	3	7.2	330	Clear	High	Low	100	40					60		
3	305	1	19	11.3	230	Overcast	Medium	Med	250	30		10			30	30	
3	305	2	5	9.2	210	Overcast	High	Low	40	50					50		
3	305	3	6	5.8	240	Overcast	High	Med	120	85					15		
3	305	4	14	7.1	240	Mostly cloudy	Medium	Med	240	60					40		
3	305	5	4	6.7	330	Mostly cloudy		Low	100	50					50		
3	304	1	17	11.2	230	Mostly cloudy	Medium	Med	350	40	5	10			40	5	
3	304	2	5	10.2	190	Overcast	Medium	Med	150	45					50	5	
3	304	3	5	5.8	240	Overcast	High	Med	120	10		5			80	5	
3	304	4	8	7.0	190	Mostly cloudy	Medium	Med	200	50		10			30	10	
3	304	5	3	7.9	210	Mostly cloudy	Medium	Med	n/a	20					80		
3	303	1		10.9	230	Partly cloudy	Medium	High	300	40		10			40	10	
3	303	2	12	9.4	220	Overcast	Medium	Med	130	50		5			45		
3	303	3	4	5.8	240	Overcast	Medium	Med	120	65		10			15	10	
3	303	4	12	6.9	240	Mostly cloudy	Medium	Med	230	50					50		
3	303	5	2	7.4	270	Mostly cloudy		Med	170	70					25	5	
3	302	1	10	10.9	190	Mostly cloudy	Medium	Med	200	49	1				50		
3	302	2	7	9.2	220	Overcast	Medium	Med	70	45		10			45		
3	302	3	10	6.6	210	Partly cloudy	Medium	Med	215	33		33				34	
3	302	4	9	6.7	190	Mostly cloudy	Medium	Med	200	65		5			20	10	
3	302	5	2	6.8	270	Overcast		Med	170	50					50		
3	301	1	17	11.2	230	Mostly cloudy	Medium	Med	200	40	5	5			40	10	
3	301	2	7	10.2	190	Overcast	High	Med	150	60					30	10	
3	301	3	6	6.7	210		Medium	Med	215	50		5			5	40	
3	301	4	8	7.0	190	Mostly cloudy	Medium	Med	200	29	1	5			25	40	

[a] See Appendix A, Figures A1 to A3 for sample site locations.
[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.
[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.
[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

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Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
3	0301	5	3	7.5		Overcast	High	High	200	90					5	5	
5	05SC060	1	10	10.5	200	Partly cloudy	High	Low	170	15	5		15		40	25	
5	05SC060	2	5	9.2	230	Clear	High	Low	150		1		50		39	10	
5	05SC060	5	1	3.4	290	Overcast		Low	170				90			10	
5	0517	1	15	10.9	200	Clear	High	Low	170	25	5				20	50	
5	0517	2	3	9.3	220	Partly cloudy	High	Med	125	50		5			40	5	
5	0517	3	3			Clear	Low	Low	120	10					80	10	
5	0517	4	10	9.9	490	Clear	High	Low	100						100		
5	0517	5	1	4.8	290	Overcast	High	Med	140	30					70		
5	0516	1	14	10.7	200	Clear	High	Med	170	30					20	50	
5	0516	2	3	9.3	220	Partly cloudy	High	Med	125	60					30	10	
5	0516	5	1	4.9	190	Overcast	Medium	High	140	80						20	
5	0515	1	12	11.3	200	Partly cloudy	Medium	Med	210	43					42	15	
5	0515	2	2	9.3	210	Clear	High	Med	140	50				10	30	10	
5	0515	3	3	7.5	200	Mostly cloudy	High	Low	140	60					30	10	
5	0515	4	1	8.1	240	Overcast	High	Low	160	50					50		
5	0515	5	1	4.9	290	Overcast		Med	140	60					30	10	
5	0514	1	18	11.2	200	Partly cloudy	High	Low	170	40					35	25	
5	0514	2	4	9.9	200	Clear	High	Low	170	19	1			10	70		
5	0514	3	2	7.6	200	Overcast	High	Low	140	60					40		
5	0514	4	1	8.3	230	Overcast	High	Low	100	40					60		
5	0514	5	1	5.4	200	Overcast	High	Med	115	39	1			20	40		
5	0513	1	18	11.2	200	Partly cloudy	High	Med	170	30					40	30	
5	0513	2	4	9.9	200	Clear	High	Low	170	20				10	70		
5	0513	3	3	7.7	200	Overcast	High	Med	140	60					40		
5	0513	4	1	8.2	230	Overcast	High	Low	110	20					80		
5	0513	5	1	5.3	220	Overcast	High	Med	115	20				20	60		
5	0512	1	8	10.4	200	Partly cloudy	High	Med	170	10					20	70	
5	0512	2	-4	9.1	230	Fog	High	Med	135	20		5		10	60	5	
5	0512	3	3	6.6	200	Partly cloudy	Low	Med	n/a	30					30	40	
5	0512	4	10	8.9		Clear	High	Med	225	23	1				75	1	
5	0512	5	2	5.2	220	Overcast	High	High	175	40		10		5	40	5	
5	0511	1	18	11.0	200	Partly cloudy	High	High	170	15	5				20	60	
5	0511	2	1	9.2	210	Clear	High	Med	140	40	2	3		10	40	5	
5	0511	3	3	7.3	200	Partly cloudy	Low	Med	140	20		10			70		
5	0511	4	1	8.1	240	Overcast	High	Med	160	70					26	4	
5	0511	5	1	4.9	290	Overcast	Medium	Med	140	50		10			30	10	
5	0510	1	12	10.5	200	Clear	High	High	170	20	5	5		5	15	50	
5	0510	2	-3	9.0	220	Clear	High	Med	130	30	1			10	39	20	
5	0510	3	3			Clear	Low	Low	n/a	50					50		
5	0510	4	10	8.9		Clear		Med	n/a	35					60	5	
5	0510	5	2	5.3	200	Overcast	High	High	115	40	5			10	40	5	
5	0509	1	12	11.6		Mostly cloudy	High	Med	n/a	75					10	15	
5	0509	2	2	9.2	190	Mostly cloudy		Med	120	39	1				55	5	
5	0509	3	2	7.9	250	Mostly cloudy	Medium	Med	160	50					40	10	
5	0509	4	10	8.6	240	Partly cloudy	High	Med	200	20					70	10	
5	0509	5	1	5.0	220	Overcast	High	High	175	39	1		5	25	30		
5	0508	1	9	12.4	210	Mostly cloudy	High	Low	100	50					50		

[a] See Appendix A, Figures A1 to A3 for sample site locations.
[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.
[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.
[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%) Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
5	0508	2	4	9.6	230	Clear	High	Med	145	20				20	60		
5	0508	3	6	8.0	230	Partly cloudy	High	Med	160	78	2				10	10	
5	0508	4	5	8.5		Partly cloudy	High	Low	n/a	50					45	5	
5	0508	5	1	5.3	130	Overcast	High	Med	130	25	1			20	50	4	
5	0507	1	10	11.5		Overcast	High	Med	n/a	90					10		
5	0507	2	2	9.1	220	Overcast	High	Med	110	65					30	5	
5	0507	3	4	8.2	240	Partly cloudy	Medium	Med	110	60					40		
5	0507	4	8	8.7	210	Clear	High	Med	180	35					60	5	
5	0507	5	1	5.0	200	Overcast	High	High	180	45	2			5	45	3	
5	0506	1	10	11.4	200	Overcast	High	Med	200	50						50	
5	0506	2	1	8.9	190	Overcast	High	Med	120	40	1	3			1	55	
5	0506	3	0	8.0	250	Overcast	High	Med	160	90					5	5	
5	0506	4	5	8.1	240	Overcast	High	Med	200	85					10	5	
5	0506	5	1	5.0	220	Overcast	High	High	175	20	10	20			5	45	
5	0505	1	10	11.4	200	Overcast	Medium	High	220	50						50	
5	0505	2	1	8.9	190	Overcast	High	High	120	49		10			1	40	
5	0505	3	0	7.9	250	Overcast	High	High	155	75		5			10	10	
5	0505	4	3	8.1	240	Mostly cloudy	Medium	High	200	40		10				50	
5	0505	5	1	5.0	220	Overcast	High	High	175	20		40				40	
5	0502	1	10	12.5	190	Overcast	Medium	Med	240	30					30	40	
5	0502	2	-3	8.9	240	Overcast		High	110	59	1				15	25	
5	0502	3	0	7.8	240	Overcast	High	Med	150	60					35	5	
5	0502	4	3	8.0	220	Partly cloudy	Medium	High	160	45		2			50	3	
5	0502	5	-1	5.0	200	Overcast	High	High	180	29	1	30			10	30	
6	06SC047	1	9	13.3	440	Overcast	Medium	Low	140	10	5				80	5	
6	06SC047	2	5	11.1	380	Overcast		Med	10		1				7	2	
6	06SC047	3	-4	6.0	380	Fog	High	Low	15		5			5	55	5	
6	06SC047	4	10	8.7	580	Overcast	High	Low	110		1				99		
6	06SC047	5	-5	4.4	410	Overcast		Med	45		10				30	10	
6	06SC036	1	9	13.1	520	Mostly cloudy	Medium	Low	75		5				95		
6	06SC036	2	8	11.1	230	Overcast	High	Low	25		3				2	5	
6	06SC036	5	1	7.1	210	Mostly cloudy	High	Low	150		2				95	3	
6	06PIN02	1	17	15.3	370	Overcast	High	Med	120	55	25				10	10	
6	06PIN02	2	12	12.3	340	Mostly cloudy	High	Low	150	10	10				5	75	
6	06PIN02	3	4	6.4	380	Clear	High	Med	20	5	20				5	5	
6	06PIN02	4	8	6.7	340	Clear	High	Low	50	30	10				50	5	
6	06PIN02	5	-5	4.1	410	Overcast	High	Med	70	10	10				20	30	
6	06PIN01	1	15	14.8	370	Overcast	High	Med	120	60	10				25	5	
6	06PIN01	2	16	12.9	340	Mostly cloudy	High	Low	150	20	10				20	50	
6	06PIN01	3	-4	6.4	380	Fog	High	Med	20		30				30	10	
6	06PIN01	4	2	6.8	360	Clear	High	Low	50	20	20				30	10	
6	06PIN01	5	-6	4.0	340	Overcast	High	Med	60	15	10				5	45	
6	0614	1	17	13.6	220	Overcast	High	Med	135	49	1				50		
6	0614	2	5	11.3	210	Overcast	High	Low	45	20					50		
6	0614	3	5	8.5	220	Overcast	Medium	Low	120	39	1				45	5	
6	0614	4	10	9.0	190	Clear	High	Low	160	45					50	5	
6	0614	5	0	7.4	230	Overcast	Medium	Med	85	25					25		
6	0613	1	10	12.7	220	Mostly cloudy	High	Low	160	50					50		

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.

[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.

[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

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Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (μS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
6	613	2	8	11.1	280	Overcast	High	Med	10	15					35		
6	613	3	4	2.3	260		High	Low	45	30					50		
6	613	4	7	8.0	280	Overcast	High	Low	110	80					15	5	
6	613	5	1	6.0	240	Clear		Low	120								
6	612	1	9	12.8	220	Overcast	High	Med	160	50	1				30	19	
6	612	2	8	11.0	240	Overcast		Med	35	20					30	5	
6	612	3	0	6.5	240	Fog	High	Med	100	25					70	5	
6	612	4	7	8.3		Overcast	High	Med	145	70					25	5	
6	612	5	0	6.9	230	Overcast	High	Med	135	80					10	10	
6	611	1	12	14.1	260	Overcast	Medium	Low	110	50					50		
6	611	2	8	10.8	290	Overcast	High	Low	10	20					40		
6	611	3	5	7.1	290	Overcast	High	Low	65	50					50		
6	611	4	10	8.6	280	Overcast	Medium	Low	80	50					50		
6	611	5	-4	6.4	230	Overcast	High	Low	120	60					25	5	
6	610	1	9	12.5	230	Overcast		Med	160	15	5				75	5	
6	610	2	8	10.9	260	Overcast	High	Low	10	10					70		
6	610	3	5	7.7	290	Overcast	High	Low	65	35					35	5	
6	610	4	10	8.8	280	Overcast	High	Low	80	42	1				55	2	
6	610	5	-4	6.4	230	Overcast	High	Low	120	35	2				60	3	
6	609	1	12	14.1	260	Mostly cloudy	Medium	Low	100	50	1				48	1	
6	609	2	8	11.4	296	Overcast	High	Med	10	20					20		
6	609	3	4	7.0	290	Overcast	High	Low	65	50					40	5	
6	609	4	5	8.4	280	Overcast	Medium	Low	80	50					45	5	
6	609	5	0	6.4	300	Overcast	Medium	Med	85	25					45		
6	608	1	15	13.6	260	Mostly cloudy	High	Med	110	50					50		
6	608	2	5	10.3	290	Overcast	High	Low	10	30					30		
6	608	3	2	6.6	270	Overcast		Low	40	40					40		
6	608	4	4	7.8	280	Clear	High	Low	80	50					50		
6	608	5	0	6.5	280	Overcast	Medium	Med	80	39					30	1	
6	607	1	10	12.8	230	Overcast	High	Low	160	50					50		
6	607	2	8	10.8	240	Overcast	High	Low	35	20					60		
6	607	3	0	6.9	240	Fog	High	Low	100	20					80		
6	607	4	10	9.0	280	Overcast	Medium	Low	160	50					50		
6	607	5	0	6.9	230	Mostly cloudy		Low	135	39	1				60		
6	606	1	13	13.1	220	Overcast	Low	Low	110	50		1			49		
6	606	2	8	10.5	250	Overcast	High	Low	35	40					20		
6	606	3	4	7.0	250	Overcast	High	Low	150	30					70		
6	606	4	5	8.5	280	Partly cloudy	High	Med	n/a	39	1				60		
6	606	5	0	7.4	240	Overcast	Medium	Med	80	39	1				10	25	
6	605	1	15	13.1	210	Mostly cloudy	High	Med	n/a	45					50	5	
6	605	2	5	10.5	260	Overcast	High	Low	35	30					45	5	
6	605	3	2	7.2	260	Overcast	High	Low	100	30					60		
6	605	4	2	7.9	240	Clear	High	Med	165	60					39	1	
6	605	5	0	7.3	230	Overcast	Medium	Med	100	35					5	10	
6	604	1	15	13.4	260	Partly cloudy	High	Med	110	20	2				5		
6	604	2	8	10.9	300	Overcast	High	Low	15	30	10				25	5	
6	604	3	2	6.5	270	Overcast	High	Low	40	50	20				20	5	
6	604	4	1	7.2	250	Fog	High	Med	80	40	5				45	10	

[a] See Appendix A, Figures A1 to A3 for sample site locations.
[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.
[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.
[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
6	0604	5	0	6.4	280	Overcast	Medium	High	80	5	20				30	15	
6	0603	1	15	12.8	220	Overcast	High	Low	110	50					50		
6	0603	2	5	11.1	210	Overcast	High	Low	45	30					30		
6	0603	3	5	8.8	220	Overcast	High	Low	130	30					65	5	
6	0603	4	14	9.1	190	Clear	High	Low	160	10					85	5	
6	0603	5	0	7.5	230	Overcast	Medium	Med	80	30					10	10	
6	0602	1	17	14.3	290	Overcast	High	Med	140	75	5	10				10	
6	0602	2	5	11.4	310	Overcast	High	Med	15	50	5	5			5	10	
6	0602	3	5	7.4	300	Overcast	Medium	High	30	5	15	5			5	40	
6	0602	4	10	8.1	190	Clear		Med	50	5	10				35	50	
6	0602	5	-4	5.7	310	Overcast	High	High	80	25	20	5			30	10	
6	0601	1	19	13.1	220	Overcast	High	Med	320	70					20	10	
6	0601	2	14	11.8	190	Mostly cloudy	High	Med	n/a	30					30	40	
6	0601	3	4	8.7	220	Mostly cloudy	Medium	Med	130	57	1	1		1	10	30	
6	0601	4	10	8.5	190	Clear	High	Med	160	60					30	10	
6	0601	5	-5	6.6	230	Overcast	High	High	90	10	5				5	80	
7	07SC022	1	15	11.1	230	Partly cloudy	High	Med	150	20					20	60	
7	07SC022	2	5	10.8	280	Overcast	Medium	Low	20		1					50	
7	07SC022	3	9	8.6	240	Clear	High	Low	90	5	5				5	70	
7	07SC022	4	5	8.5	260	Overcast	High	Low	120	2	3				15	80	
7	07SC022	5	1	5.7	220	Clear	Medium	Low	130	5	2				3	90	
7	07SC012	1	15	11.1	240	Partly cloudy	High	Low	150	5	5				70	20	
7	07SC012	2	0	9.8	240	Overcast	High	Low	50	5	2				5	68	
7	07SC012	3	6	8.3	250	Partly cloudy	Medium	Low	70		2					40	
7	07SC012	4	2	7.7	280	Overcast	Medium	Low	85	5	5				5	85	
7	07SC012	5	2	6.1	220	Clear	High	Low	125	25					5	70	
7	07KIS01	2	2	9.6	610	Overcast	High	Med	15	40	15				30	15	
7	07KIS01	3	6	7.4	250	Partly cloudy	High	Low	40	25					50		
7	07KIS01	4	5	7.2	490	Overcast	Medium	Med	15	30					10	10	
7	07KIS01	5	-3	4.3	460	Overcast	Medium	Med	30		1				4	85	
7	07BEA02	1	11	11.0	300	Overcast	Medium	Med	100	15					15	70	
7	07BEA02	2	7	11.0	320	Overcast	High	Med	n/a						10	10	
7	07BEA02	3	3	6.7	320	Overcast	High	Low	45	20						10	
7	07BEA02	4	9	8.6	240	Overcast	High	Low	90	50	1				39	10	
7	07BEA02	5	-4	4.7	270	Clear	High	Low	60	30					25	5	
7	07BEA01	1	10	10.9	440	Overcast	High	Low	40						100		
7	07BEA01	2	6	11.8	440	Overcast	High	Low	10	5					65		
7	07BEA01	3	1	5.9	320	Overcast	High	Low	45	30					30		
7	07BEA01	4	2	7.6	340	Overcast	High	Low	45	10					40		
7	07BEA01	5	-4	2.2	330	Clear		Low	30	10					20	5	
7	0714	1	17	10.9	230	Clear	Medium	Med	130	25					25	50	
7	0714	2	2	10.1	250	Overcast	High	Low	60	45					45	1	
7	0714	3	6	8.0	260	Partly cloudy		Med	90	40					30		
7	0714	4	2	7.8	260	Overcast	Medium	Low	110	50					50		
7	0714	5	-3	4.9	200	Overcast	Low	Low	140	30					60	10	
7	0713	1	16	10.8	230	Clear	Medium	Med	120	30		10			30	30	
7	0713	2	1	10.1	230	Mostly cloudy	High	Med	60	30					40	1	
7	0713	3	5	7.2	260	Partly cloudy		High	90	95					5		

[a] See Appendix A, Figures A1 to A3 for sample site locations.
[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.
[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.
[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
7	713	4	3	7.9	260	Overcast	High	Med	110	45					50	5	
7	713	5	-3	4.9	200	Overcast	High	Med	140	60					35	5	
7	712	1	16	10.9	230	Clear	Medium	Med	110	25					75		
7	712	2	0	10.0	250	Mostly cloudy	High	Low	30	40	1				35	1	
7	712	3	10	8.7	240	Clear	High	Low	80	29	1				70		
7	712	4	2	7.8	270	Overcast	Medium	Low	110	49	1				50		
7	712	5	2	5.9	230	Clear	Medium	Low	135	50					50		
7	711	1	16	10.7	230	Clear	Medium	Med	120	30		20			30	20	
7	711	2	-3	9.9	250	Overcast	High	Med	30	30					20	5	
7	711	3	10	8.6	240	Clear	High	Low	80	30					70		
7	711	4	2	7.9	270	Mostly cloudy	High	Med	110	40					60		
7	711	5	2	6.2	230	Clear	Medium	Med	135	39	1				55	5	
7	710	1	15	10.4	220	Clear	High	Low	140	10					75	15	
7	710	2	-3	10.0	270	Overcast	High	Low	60		2				75	3	
7	710	3	8	8.7	270	Clear	High	Low	50	9	1				70	10	
7	710	4	1	7.7	260	Overcast	Medium	Low	170	80					10	10	
7	710	5	2	6.0	210	Clear	Medium	Med	140	10	1				75	14	
7	709	1	10	11.0	230	Mostly cloudy	High	Low	150	25					75		
7	709	2	5	11.0		Overcast	Medium	Low	n/a	30					40		
7	709	3	0	7.5	270	Overcast		Low	50	30					70		
7	709	4	8	8.5	250	Overcast	High	Low	110	50						50	
7	709	5	0	5.5	230	Clear		Low	140	28	1				70	1	
7	708	1	10	10.8	220	Overcast	Medium	Med	130	25		10			25	40	
7	708	2	7	11.1	240	Overcast	High	High	20	4	1					40	
7	708	3	9	7.8	250	Clear		High	70	30		5			30	5	
7	708	4	9	8.6	240	Overcast		High	100	40					20	20	
7	708	5	-2	5.4	240	Clear	High	High	110	54	1				5	30	
7	707	1	15	10.6	220	Clear	Medium	Med	140	10					70	20	
7	707	2	0	9.8	250	Mostly cloudy	High	Med	60	40					40	5	
7	707	3	9	8.7	250	Clear	High	Low	80	45					50	5	
7	707	4	1	7.1	260	Mostly cloudy	Medium	Med	170	50					40	10	
7	707	5	2	6.1	210	Clear		Med	140	30					40	30	
7	706	1	15	10.4	230	Clear	Medium	Med	120	25					25	50	
7	706	2	5	10.8	290	Overcast	Medium	Low	20	5	5				10	10	
7	706	3	4	7.8	280	Clear	High	Low	60	65	3				30	2	
7	706	4	5	8.5	240	Partly cloudy	High	Low	150	40	5				50	5	
7	706	5	1	5.6	220	Clear		Med	130	60	10				15	15	
7	705	1	16	10.4	230	Clear	Medium	Med	120	19		5		1	15	60	
7	705	2	5	10.8	290	Overcast	High	Med	20	10	1	1			20	10	
7	705	3	4	8.0	280	Clear	High	Med	60	60	5				30	5	
7	705	4	5	8.5		Partly cloudy	High	Low	150	75	5				10	10	
7	705	5	1	5.6	220	Clear		High	130	30	5	10			15	40	
7	704	1	5	9.6	230	Partly cloudy	Medium	Med	140	35					35	30	
7	704	2	5	11.0	250	Overcast	Medium	Low	25	20					50		
7	704	3	0	7.8	270	Fog	High	Low	160	30					70		
7	704	4	5	8.4	240	Overcast	High	Med	100	30					70		
7	704	5	1	6.0	210	Clear	High	Med	140	30	1				60	9	
7	703	1	13	11.2	230	Mostly cloudy	Medium	Med	150	30					30	40	

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.

[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.

[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Continued.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
7	0703	2	5	11.0	250	Overcast	Medium	Low	25	10					10	10	
7	0703	3	9	8.2	250	Clear	High	Low	60	10					70	1	
7	0703	4	5	8.6		Overcast	High	Low	120	35					50	5	
7	0703	5	1	5.0	210	Clear	High	Low	140	75					10	5	
7	0702	1	12	11.0	230	Overcast	Medium	Med	130	35		10			35	20	
7	0702	2	5	11.1	250	Overcast	High	Med	20	15					70		
7	0702	3	0	7.6	270	Fog	High	Med	50	50					50		
7	0702	4	9	8.4	250	Overcast	High	Med	110	50					50		
7	0702	5	1	5.5	230	Clear	High	Med	140	48					50	2	
7	0701	1	8	10.4	220	Overcast	Medium	Med	150	40	10				40	10	
7	0701	2	8	10.8	260	Overcast	High	Low	30		1				49		
7	0701	3	5	7.5	250	Clear	High	Low	90	4	1				95		
7	0701	4	8	8.2	230	Overcast	High	Low	140	30	1				65	4	
7	0701	5	1	6.9	210	Overcast		Low	150	9	1				90		
9	09SC061	1	15	11.4	220	Partly cloudy	High	Low	130	20					20	60	
9	09SC061	2	8	7.0	270	Mostly cloudy	High	Low	80	40					40	20	
9	09SC061	5	-1	5.6	230	Overcast	Low	Low	130	5	2		3		10	80	
9	09SC053	5	-1	4.2	250	Overcast	Low	Low	120						100		
9	0914	1	12	11.3	250	Mostly cloudy	High	Low	170	50					40	10	
9	0914	2	9	6.7	270	Mostly cloudy	Medium	Med	80	20		10			60	10	
9	0914	3	10	6.3	250	Clear	Medium	Med	80	34	1	10			35	20	
9	0914	4	3	7.0	260	Overcast	Medium	Med	140	60		5			30	5	
9	0914	5	-1	5.7	230	Overcast	Low	Med	n/a						95	5	
9	0913	1	17	11.6	230	Mostly cloudy	Medium	Med	130	30	5				5	60	
9	0913	2	8	6.7	270	Mostly cloudy	Medium	Low	80	40					40	20	
9	0913	3	10	6.4	250	Clear	Medium	Med	80	50					10	40	
9	0913	4	3	6.8	260	Overcast	Medium	Med	140	54	1	5			30	10	
9	0913	5	-1	5.5	230	Overcast	Low	Med	130	30	1				29	40	
9	0912	1	17	12.0	220	Partly cloudy	Medium	Low	120	10					20	70	
9	0912	2	10	7.2	270	Mostly cloudy	High	Low	80	30					30	40	
9	0912	3	10	7.1	250	Clear	Medium	Med	80	30					30	40	
9	0912	4	3	6.9	260	Overcast	Medium	Med	140	40					30	30	
9	0912	5	-1	5.6	230	Overcast	Low	Low	130	15					60	25	
9	0911	1	15	11.3	220	Mostly cloudy	High	Low	170	30					20	50	
9	0911	2	6	6.3	270	Overcast	Medium	Med	80	35					50	15	
9	0911	3	10	6.2	250	Clear	High	Low	80	35					60	5	
9	0911	4	4	6.9	260	Overcast	High	Med	140	60					30	10	
9	0911	5	-1	5.6	230	Overcast		Med	120	20					20	60	
9	0910	1	12	11.3	250	Overcast	High	Low	100	30					20	50	
9	0910	2	3	6.6	270	Overcast	Medium	Med	80	15					60	25	
9	0910	3	9	6.6	250	Clear	Medium	Med	80	10					90		
9	0910	4	-1	6.7	210	Mostly cloudy	Medium	Low	140	60					20	20	
9	0910	5	-1	5.6	230	Overcast	Low	Low	120						100		
9	0909	1	14	10.7	220	Mostly cloudy	High	Med	170	30					30	40	
9	0909	2	6	6.4	270	Overcast	Medium	Med	80	70					25	5	
9	0909	3	8	5.9	250	Partly cloudy	High	Low	80	30					60	10	
9	0909	4	4	6.7	260	Overcast	High	Med	140	50	2				43	5	
9	0909	5	0	5.7	230	Overcast	Medium	Low	130	10					90		

[a] See Appendix A, Figures A1 to A3 for sample site locations.
[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.
[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.
[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

Continued...

Table D3 Concluded.

Section	Site[a]	Session	Air Temperature (°C)	Water Temperature (°C)	Conductivity (µS /cm)	Cloud Cover[b]	Water Clarity[d]	Instream Velocity[c]	Secchi Bar Depth (m)	Cover Types (%)							
										Substrate Interstices	Woody Debris	Turbulence	Aquatic Vegetation	Terrestrial Vegetation	Shallow Water	Deep Water	Other Cover
9	908	1	14	11.3	220	Mostly cloudy	High	Low	170	60					30	10	
9	908	2	6	6.4	270	Overcast	Medium	Med	80	30					70		
9	908	3	8	5.8	250	Mostly cloudy	High	Low	80	25					75		
9	908	4	4	7.8	260	Overcast	High	Med	140	50					50		
9	908	5	-1	5.6	230	Overcast	Low	Low	100						100		
9	907	1	12	11.3	250	Overcast	High	Low	170	40					40	20	
9	907	2	3	6.7	270	Overcast	Medium	Med	80	30	5				60	5	
9	907	3	7	7.3	290	Clear	Low	Low	80	10					90		
9	907	4	3	6.7	260	Mostly cloudy	Medium	Med	140	55					40	5	
9	907	5	-1	5.6	240	Overcast	Low	Low	n/a								
9	906	1	12	11.3	250	Overcast	High	Low	170	40					30	30	
9	906	2	3	6.4	270	Overcast	Medium	Med	80	30					60	10	
9	906	3	12	7.6	290	Clear	High	Low	80	50					50		
9	906	4	6	7.8	240	Partly cloudy	High	Low	150	50					50		
9	906	5	-1	5.6	230	Overcast	Low	Low	120	20	5				5	70	
9	905	1	12	11.4	250	Overcast	High	Med	170	15		10			15	60	
9	905	2	3	6.2	270	Overcast	Medium	Med	80	40		5			30	25	
9	905	3	5	7.3	290	Clear	Low	Low	80	10					80	10	
9	905	4	8	7.9	240	Partly cloudy	Medium	Med	150	50					30	20	
9	905	5	-1	5.5	240	Overcast	Low	Med	120	20	1	4			35	40	
9	904	1	10	11.2	250	Overcast	High	Low	170	30	1				39	30	
9	904	2	3	6.7	270	Overcast	Medium	Med	80	40					40	20	
9	904	3	4	7.3		Clear	Low	Low	80	10					90		
9	904	4	6	7.8	240	Partly cloudy	Medium	Med	150	64	1				20	15	
9	904	5	-1	5.7	230	Overcast	Low	Low	270	20					75	5	
9	903	1	7	11.2	250	Mostly cloudy	High	Med	170	40	1	4			35	20	
9	903	2	4	6.6	270	Overcast	Medium	Med	80	40					40	20	
9	903	3	3	6.7	290	Clear	Low	Low	80	20					80		
9	903	4	6	8.0	240	Partly cloudy	Medium	Med	150	30					40	30	
9	903	5	-1	5.7	230	Overcast	Medium	Low	110	50					50		
9	902	1	3	10.8	250	Fog	High	Med	170	20	1	5			14	60	
9	902	2	5	6.5	270	Overcast	Medium	Med	80	15	5				20	60	
9	902	3	0	6.7	290	Clear	Low	Low	80	30					30	40	
9	902	4	10	7.3	240	Partly cloudy	Medium	Med	150	30					30	40	
9	902	5	-1	5.7	240	Overcast	Low	Med	140	14	1	5				80	
9	901	1	2	11.0	250	Fog	High	Med	170	30					35	35	
9	901	2	5	6.5	270	Overcast	Medium	Med	80	70					5	25	
9	901	3	0	6.7	290	Clear	Low	Low	80	80					20		
9	901	4	3	7.3	240	Mostly cloudy	Medium	Med	150	74	1				20	5	
9	901	5	-1	5.7	240	Overcast		Low	180	40					50	10	

[a] See Appendix A, Figures A1 to A3 for sample site locations.

[b] Clear = <10%; Partly Cloudy = 10-50%; Mostly Cloudy = 50-90%; Overcast = >90%.

[c] High = >1.0 m/s; Medium = 0.5-1.0 m/s; Low = <0.5 m/s.

[d] High = >3.0 m; Medium = 1.0-3.0 m; Low = <1.0 m.

APPENDIX E

Catch and Effort Data

Table E1 Number of fish caught during boat electroshocking surveys and their frequency of occurrence in Sections 1, 3, and 5 of Peace River, 2002 to 2018.

	2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018	
Species	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]
Sportfish		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0
Arctic Grayling	13	<1	54	1	271	2	280	2	93	1	344	3	202	2	116	1	59	1	135	1	43	<1	27	<1	10	<1	48	1	85	1	80	1	49	1
Bull Trout	105	2	91	2	122	1	175	2	76	1	156	1	170	1	144	1	97	1	206	1	186	2	180	2	143	2	169	2	205	3	180	3	167	2
Burbot					5	<1	2	<1	5	<1	4	<1			2	<1	2	<1	1	<1	3	<1	1	<1	1	<1			3	<1	2	<1	4	<1
Kokanee	24	<1	5	<1	18	<1	43	<1	16	<1	154	1	49	<1	28	<1	25	<1	73	1	99	1	27	<1	20	<1	20	<1	21	<1	51	1	11	<1
Lake Trout					1	<1	1	<1			2	<1			3	<1	1	<1	2	<1	4	<1	5	<1	2	<1	3	<1	1	<1	1	<1		
Lake Whitefish	2	<1	2	<1	13	<1			1	<1	4	<1	1	<1	3	<1			7	<1	3	<1					1	<1	3	<1			1	<1
Mountain Whitefish	5496	97	5686	96	10 418	95	10 658	95	6365	96	10 436	93	11 565	95	10 005	95	10 633	97	13 175	95	10 825	95	8429	96	7274	96	6730	95	7110	93	5987	92	7835	95
Northern Pike					1	<1	4	<1	1	<1	7	<1	8	<1	8	<1	4	<1	11	<1	7	<1	5	<1	4	<1			4	<1	11	<1	18	<1
Rainbow Trout	50	1	63	1	107	1	94	1	39	1	102	1	169	1	165	2	131	1	171	1	139	1	67	1	106	1	105	1	176	2	115	2	140	2
Walleye	3	<1			6	<1	5	<1			17	<1	58	<1	17	<1	3	<1	49	<1	48	<1	43	<1	19	<1	12	<1	34	<1	61	1	53	1
Yellow Perch											1	<1															8	<1	2	<1	2	<1	2	<1
Sportfish subtotal	5693	91	5901	93	10 962	92	11 262	91	6596	96	11 227	93	12 222	92	10 491	93	10 955	96	13 830	95	11 357	91	8784	89	7579	87	7096	70	7644	74	6490	70	8280	80
Non-sportfish		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0
Flathead Chub																			1	<1											1	<1	3	<1
Lake Chub																									4	<1	1	<1	2	<1	3	<1	5	<1
Northern Pikeminnow	20	4	25	5	57	6	34	3	6	2	24	3	28	2	16	2	13	3	21	3	41	4	37	4	39	4	102	3	122	4	78	3	48	2
Peamouth	3	1																			1	<1	1	<1							4	<1		
Redside Shiner	2	<1																							1	<1	15	1	71	3	49	2	44	2
Sculpin spp.[d]	2	<1																							78	7	44	1	53	2	42	2	58	3
Spottail Shiner																											5	<1	4	<1	2	<1	2	<1
Sucker spp.[d]	533	95	435	95	879	94	1088	97	238	98	835	97	1103	98	787	98	500	97	733	97	1118	96	1011	96	963	89	2821	94	2480	91	2589	93	1836	91
Troutperch																																	12	1
Non-sportfish subtotal	560	9	460	7	936	8	1122	9	244	4	859	7	1131	8	803	7	513	4	755	5	1160	9	1049	11	1085	13	2988	30	2732	26	2768	30	2008	20
All species	6253		6361		11 898		12 384		6840		12 086		13 353		11 294		11 468		14 585		12 517		9833		8666		10 087		10 383		9266		10 288	

[a] Includes fish captured and identified to species; does not include fish recaptured within the year.
[b] Percent composition of sportfish or non-sportfish catch.
[c] Species combined for table or not identified to species.

Table E2 Number of fish caught during boat electroshocking surveys and their frequency of occurrence in Sections 6, 7, and 9 of Peace River, 2015 to 2018.

	2015		2016		2017		2018	
Species	n^a	%[b]	n^a	%[b]	n^a	%[b]	n^a	%[b]
Sportfish		*0*		*0*		*0*		*0*
Arctic Grayling	7	*<1*	26	*1*	7	*<1*	6	*<1*
Bull Trout	88	*3*	90	*3*	57	*2*	47	*1*
Burbot	2	*<1*	34	*1*	4	*<1*	9	*<1*
Goldeye	1	*<1*	8	*<1*	3	*<1*		
Kokanee	1	*<1*	2	*<1*	5	*<1*		
Lake Trout	1	*<1*					1	*<1*
Lake Whitefish							2	*<1*
Mountain Whitefish	3250	*93*	2768	*88*	2198	*84*	3480	*90*
Northern Pike	12	*<1*	12	*<1*	26	*1*	16	*<1*
Rainbow Trout	24	*1*	10	*<1*	7	*<1*	6	*<1*
Walleye	102	*3*	197	*6*	308	*12*	286	*7*
Yellow Perch	3	*<1*			2	*<1*		
Sportfish subtotal	3491	*44*	3147	*48*	2617	*40*	3853	*58*
Non-sportfish		*0*		*0*		*0*		*0*
Finescale Dace	1	*<1*						
Flathead Chub	3	*<1*	18	*1*	34	*1*	8	*<1*
Lake Chub	40	*1*	26	*1*	62	*2*	18	*1*
Northern Pikeminnow	151	*3*	88	*3*	117	*3*	75	*3*
Peamouth					1	*<1*		
Redside Shiner	137	*3*	95	*3*	133	*3*	10	*<1*
Sculpin spp.[d]	6	*<1*	55	*2*	9	*<1*	6	*<1*
Spottail Shiner	10	*<1*	9	*<1*	8	*<1*	3	*<1*
Sucker spp.[d]	4072	*92*	3036	*91*	3455	*89*	2631	*95*
Troutperch	5	*<1*	9	*<1*	26	*1*	21	*1*
Non-sportfish subtotal	4425	*56*	3336	*51*	3845	*59*	2772	*42*
All species	7925		6492		6498		6630	

[a] Includes fish captured and identified to species; does not include fish recaptured within the year.
[b] Percent composition of sportfish or non-sportfish catch.
[c] Species combined for table or not identified to species.

Table E3 Summary of boat electroshocking sportfish catch (includes fish captured and observed and identified to species) and catch-per-unit-effort (CPUE = no. fish/km/hour) in the Peace River, 27 August to 10 October 2018.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																									
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 1	1	00101	27-Aug-18	292	0.60			1	20.55											171	3513.7									172	3534.25
		00102	27-Aug-18	421	0.98									1	8.77					256	2245.2									257	2253.97
		00103	28-Aug-18	684	1.20			4	17.54											87	381.58									91	399.12
		00104	28-Aug-18	414	0.50															23	400									23	400
		00105	28-Aug-18	473	1.10															79	546.61									79	546.61
		00107	27-Aug-18	535	0.55															17	207.99			1	12.23					18	220.22
		00108	27-Aug-18	713	0.85															17	100.98									17	100.98
		00109	27-Aug-18	655	0.98															71	400.23									71	400.23
		00110	27-Aug-18	599	0.65															27	249.65	1	9.25							28	258.89
		00111	27-Aug-18	579	0.55									1	11.3					4	45.22									5	56.52
		00112	27-Aug-18	781	1.07			1	4.31											90	387.71			2	8.62					93	400.64
		00113	28-Aug-18	344	0.75															14	195.35									14	195.35
		00114	28-Aug-18	578	0.95															50	327.81			3	19.67					53	347.48
		00116	28-Aug-18	542	0.98															22	148.35									22	148.35
		00119	27-Aug-18	640	0.75			1	7.5					2	15					72	540			3	22.5					78	585
	Session Summary			**550**	**12.50**	**0**	**0**	**7**	**3.67**	**0**	**0**	**0**	**0**	**4**	**2.09**	**0**	**0**	**0**	**0**	**1000**	**523.64**	**1**	**0.52**	**9**	**4.71**	**0**	**0**	**0**	**0**	**1021**	**534.63**
Section 1	2	00101	09-Sep-18	291	0.60															176	3628.87									176	3628.87
		00102	09-Sep-18	352	0.98			1	10.49											162	1699.3									163	1709.79
		00103	10-Sep-18	259	1.20			5	57.92											157	1818.53			2	23.17					164	1899.61
		00104	10-Sep-18	388	0.50															109	2022.68			1	18.56					110	2041.24
		00105	10-Sep-18	533	1.10			2	12.28											86	528.06			3	18.42					91	558.76
		00107	09-Sep-18	586	0.55			2	22.34											16	178.72									18	201.05
		00108	09-Sep-18	782	0.85															48	259.97									48	259.97
		00109	09-Sep-18	691	0.98	1	5.34	2	10.69											110	587.78									113	603.81
		00110	09-Sep-18	535	0.65															24	248.45									24	248.45
		00111	08-Sep-18	77	1.00	1	46.75													144	6732.47			12	561.04					157	7340.26
		00112	08-Sep-18	719	1.07	1	4.68	2	9.36					1	4.68					165	772.1			5	23.4					174	814.21
		00113	09-Sep-18	347	0.75			1	13.83											74	1023.63			1	13.83					76	1051.3
		00114	08-Sep-18	683	0.95			1	5.55											126	699.08			31	172					158	876.63
		00116	09-Sep-18	546	0.98															114	763.09									114	763.09
		00119	09-Sep-18	631	0.75			2	15.21											68	517.27			2	15.21					72	547.7
	Session Summary			**495**	**12.90**	**3**	**1.69**	**18**	**10.15**	**0**	**0**	**0**	**0**	**1**	**0.56**	**0**	**0**	**0**	**0**	**1579**	**890.2**	**0**	**0**	**57**	**32.14**	**0**	**0**	**0**	**0**	**1658**	**934.74**
Section 1	3	00101	19-Sep-18	283	0.60															103	2183.75									103	2183.75
		00102	19-Sep-18	325	0.98															110	1249.7									110	1249.7
		00108	19-Sep-18	693	0.85															4	24.45			2	12.22					6	36.67
		00109	19-Sep-18	638	0.98			1	5.79											63	364.6			1	5.79					65	376.18
		00110	19-Sep-18	557	0.65															19	188.92									19	188.92
		00111	20-Sep-18	467	0.50			1	15.42																					1	15.42
		00112	20-Sep-18	662	1.07									1	5.08					116	589.55			1	5.08					118	599.71
		00113	19-Sep-18	393	0.75			3	36.64											102	1245.8									105	1282.44
		00114	20-Sep-18	494	0.95															96	736.42									96	736.42
		00116	19-Sep-18	578	0.98			1	6.32											100	632.32									101	638.65
		00119	19-Sep-18	597	0.75			1	8.04											73	586.93			4	32.16					78	627.14
	Session Summary			**517**	**9.10**	**0**	**0**	**7**	**5.36**	**0**	**0**	**0**	**0**	**1**	**0.77**	**0**	**0**	**0**	**0**	**786**	**601.44**	**0**	**0**	**8**	**6.12**	**0**	**0**	**0**	**0**	**802**	**613.68**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h) Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 1	4	00101	24-Sep-18	290	0.60															99	2048.28									99	2048.28
		00102	24-Sep-18	394	0.98															121	1133.93									121	1133.93
		00107	24-Sep-18	574	0.55			1	11.4											14	159.65			3	34.21					18	205.26
		00108	24-Sep-18	706	0.85			3	18											4	24			1	6					8	47.99
		00109	24-Sep-18	671	0.98			3	16.51											105	577.78									108	594.29
		00110	24-Sep-18	604	0.65									1	9.17					38	348.45			2	18.34					41	375.96
		00112	25-Sep-18	808	1.07															110	458.04			2	8.33					112	466.36
		00113	25-Sep-18	382	0.75			1	12.57											120	1507.85									121	1520.42
		00114	25-Sep-18	553	0.95			2	13.71					1	6.85					49	335.78			3	20.56					55	376.89
		00116	25-Sep-18	520	0.98			1	7.03											18	126.51									19	133.54
		00119	24-Sep-18	694	0.75			5	34.58					1	6.92					62	428.82			2	13.83					70	484.15
	Session Summary			**563**	**9.10**	**0**	**0**	**16**	**11.24**	**0**	**0**	**0**	**0**	**3**	**2.11**	**0**	**0**	**0**	**0**	**740**	**519.98**	**0**	**0**	**13**	**9.13**	**0**	**0**	**0**	**0**	**772**	**542.46**
Section 1	5	00101	30-Sep-18	321	0.60			1	18.69											118	2205.61									119	2224.3
		00102	30-Sep-18	373	0.98															96	950.3									96	950.3
		00103	02-Oct-18	624	1.20			4	19.23											72	346.15									76	365.38
		00104	02-Oct-18	291	0.50			2	49.48											29	717.53									31	767.01
		00105	02-Oct-18	465	1.10			1	7.04											16	112.61			2	14.08					19	133.72
		00107	30-Sep-18	555	0.55															6	70.76			1	11.79					7	82.56
		00108	30-Sep-18	891	0.85															13	61.79									13	61.79
		00109	30-Sep-18	805	0.98			5	22.93											90	412.8			1	4.59					96	440.32
		00110	30-Sep-18	688	0.65															17	136.85			3	24.15					20	161
		00111	30-Sep-18	511	0.49																			2	28.76					2	28.76
		00112	30-Sep-18	916	1.07															86	315.88			6	22.04					92	337.92
		00113	30-Sep-18	493	0.75			1	9.74											88	856.8									89	866.53
		00114	30-Sep-18	698	0.95			2	10.86											150	814.36			1	5.43					153	830.64
		00116	30-Sep-18	863	0.98															34	143.99									34	143.99
		00119	30-Sep-18	646	0.75			1	7.43											40	297.21			1	7.43					42	312.07
	Session Summary			**609**	**12.40**	**0**	**0**	**17**	**8.1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**855**	**407.6**	**0**	**0**	**17**	**8.1**	**0**	**0**	**0**	**0**	**889**	**423.8**
Section Total All Samples				**36693**	**55.91**	**3**	**0**	**65**	**0**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**4960**	**0**	**1**	**0**	**104**	**0**	**0**	**0**	**0**	**0**	**5142**	**0**
Section Average All Samples				**548**	**0.83**	**0**	**0.35**	**1**	**7.64**	**0**	**0**	**0**	**0**	**0**	**1.06**	**0**	**0**	**0**	**0**	**74**	**582.74**	**0**	**0.12**	**2**	**12.22**	**0**	**0**	**0**	**0**	**77**	**604.12**
Section Standard Error of Mean						**0.03**	**0.7**	**0.16**	**1.45**	**0**	**0**	**0**	**0**	**0.05**	**0.36**	**0**	**0**	**0**	**0**	**6.59**	**130.47**	**0.01**	**0.14**	**0.5**	**8.67**	**0**	**0**	**0**	**0**	**6.72**	**136.69**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																									
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 3	1	00301	29-Aug-18	1398	1.80			1	1.43											61	87.27			8	11.44	1	1.43			71	101.57
		00302	28-Aug-18	1044	1.88			3	5.52											66	121.38									69	126.9
		00303	29-Aug-18	1236	1.45															76	152.66	1	2.01			2	4.02			79	158.69
		00304	29-Aug-18	966	1.35			3	8.28											65	179.43									68	187.72
		00305	29-Aug-18	1111	1.55															201	420.2									201	420.2
		00306	30-Aug-18	801	1.00			1	4.49											57	256.18					3	13.48			61	274.16
		00307	30-Aug-18	798	0.95															57	270.68									57	270.68
		00308	30-Aug-18	806	1.35															95	314.31									95	314.31
		00309	31-Aug-18	1043	0.95			1	3.63					1	3.63					131	475.95									133	483.22
		00310	31-Aug-18	1181	1.20			1	2.54											104	264.18	1	2.54							106	269.26
		00311	31-Aug-18	1000	1.25															85	244.8					2	5.76			87	250.56
		00312	31-Aug-18	1249	1.17			2	4.93											245	603.56	1	2.46	2	4.93	1	2.46			251	618.34
		00314	30-Aug-18	909	0.98			1	4.06					2	8.12					13	52.81			1	4.06					17	69.05
		00315	30-Aug-18	1358	1.70															42	65.49			1	1.56	2	3.12			45	70.17
		00316	30-Aug-18	1032	1.48			2	4.73											28	66.22			10	23.65					40	94.6
	Session Summary			**1062**	**20.00**	**0**	**0**	**15**	**2.54**	**0**	**0**	**0**	**0**	**3**	**0.51**	**0**	**0**	**0**	**0**	**1326**	**224.75**	**3**	**0.51**	**22**	**3.73**	**11**	**1.86**	**0**	**0**	**1380**	**233.9**
Section 3	2	00301	11-Sep-18	1302	1.80	2	3.07													68	104.45			7	10.75	2	3.07			79	121.35
		00302	10-Sep-18	1410	1.90			2	2.69											204	274.13			2	2.69	1	1.34			209	280.85
		00303	10-Sep-18	1051	1.45															166	392.14					5	11.81			171	403.95
		00304	11-Sep-18	786	1.35															71	240.88			1	3.39	4	13.57			76	257.85
		00305	11-Sep-18	994	1.55			1	2.34					1	2.34			1	2.34	118	275.72			1	2.34					122	285.07
		00306	11-Sep-18	720	1.00															64	320									64	320
		00307	12-Sep-18	734	0.95															140	722.79									140	722.79
		00308	12-Sep-18	772	1.35															206	711.57									206	711.57
		00309	13-Sep-18	648	0.95			1	5.85											42	245.61									43	251.46
		00310	13-Sep-18	838	1.20			2	7.16											78	279.24			2	7.16					82	293.56
		00311	13-Sep-18	833	1.25			2	6.91					1	3.46					86	297.33									89	307.71
		00312	13-Sep-18	818	1.17			2	7.52											110	413.77			1	3.76					113	425.05
		00314	12-Sep-18	1090	0.98	2	6.77	1	3.39											56	189.7			6	20.32					65	220.18
		00315	12-Sep-18	1432	1.70	2	2.96	1	1.48											165	244			3	4.44	1	1.48			172	254.35
		00316	13-Sep-18	1000	1.48	11	26.85	1	2.44					1	2.44					152	370.98			7	17.08					172	419.8
	Session Summary			**962**	**20.10**	**17**	**3.17**	**13**	**2.42**	**0**	**0**	**0**	**0**	**3**	**0.56**	**0**	**0**	**1**	**0.19**	**1726**	**321.35**	**0**	**0**	**30**	**5.59**	**13**	**2.42**	**0**	**0**	**1803**	**335.68**
Section 3	3	00301	20-Sep-18	1381	1.80	6	8.69	2	2.9											106	153.51			8	11.59	1	1.45			123	178.13
		00302	20-Sep-18	883	1.80															141	319.37									141	319.37
		00303	21-Sep-18	740	1.45															89	298.6									89	298.6
		00304	21-Sep-18	779	1.35															66	225.93									66	225.93
		00305	21-Sep-18	1064	1.55			1	2.18											320	698.52									321	700.7
		00306	21-Sep-18	701	1.00															156	801.14					1	5.14			157	806.28
		00307	22-Sep-18	694	0.95			1	5.46											135	737.15									136	742.61
		00308	22-Sep-18	627	1.35			1	4.25											180	765.55									181	769.8
		00309	22-Sep-18	646	0.95			1	5.87											116	680.46									117	686.33
		00310	22-Sep-18	810	1.20															113	418.52			1	3.7	1	3.7			115	425.93
		00311	21-Sep-18	803	1.25			1	3.59											73	261.82									74	265.4
		00312	22-Sep-18	1028	1.17			5	14.97											235	703.38									240	718.35
		00314	21-Sep-18	738	0.98	1	5	1	5											60	300.19			2	10.01					64	320.2
		00315	22-Sep-18	1257	1.70	2	3.37	1	1.68											134	225.75			1	1.68					138	232.49
		00316	22-Sep-18	1140	1.48	3	6.42	1	2.14											145	310.44			4	8.56					153	327.56
	Session Summary			**886**	**20.00**	**12**	**2.44**	**15**	**3.05**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2069**	**420.34**	**0**	**0**	**16**	**3.25**	**3**	**0.61**	**0**	**0**	**2115**	**429.68**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h) Arctic Grayling No.	Arctic Grayling CPUE	Bull Trout No.	Bull Trout CPUE	Burbot No.	Burbot CPUE	Goldeye No.	Goldeye CPUE	Kokanee No.	Kokanee CPUE	Lake Trout No.	Lake Trout CPUE	Lake Whitefish No.	Lake Whitefish CPUE	Mountain Whitefish No.	Mountain Whitefish CPUE	Northern Pike No.	Northern Pike CPUE	Rainbow Trout No.	Rainbow Trout CPUE	Walleye No.	Walleye CPUE	Yellow Perch No.	Yellow Perch CPUE	All Species No.	All Species CPUE
Section 3	4	00301	25-Sep-18	1076	1.80	1	1.86													74	137.55			3	5.58	2	3.72			80	148.7
		00302	25-Sep-18	1019	1.90															168	312.38									168	312.38
		00303	26-Sep-18	1068	1.45			1	2.32											223	518.4									224	520.73
		00304	25-Sep-18	658	1.35	2	8.11	2	8.11											40	162.11									44	178.32
		00305	26-Sep-18	1181	1.55			3	5.9											353	694.22					1	1.97			357	702.08
		00306	26-Sep-18	924	1.00															155	603.9									155	603.9
		00307	27-Sep-18	735	0.95			2	10.31											93	479.48									95	489.8
		00308	27-Sep-18	760	1.35			3	10.53											110	385.96									113	396.49
		00309	26-Sep-18	813	0.95			6	27.97											106	494.08									112	522.04
		00310	26-Sep-18	939	1.20			2	6.39											111	354.63					1	3.19			114	364.22
		00311	26-Sep-18	1023	1.25			1	2.82											152	427.92					1	2.82			154	433.55
		00312	27-Sep-18	1014	1.17			2	6.07											218	661.51									220	667.58
		00314	27-Sep-18	679	0.98			4	21.75											30	163.14			1	5.44	1	5.44			36	195.76
		00315	27-Sep-18	1295	1.70															77	125.91									77	125.91
		00316	27-Sep-18	1010	1.48	2	4.83	1	2.42											109	263.4			1	2.42					113	273.07
	Session Summary			**946**	**20.10**	**5**	**0.95**	**27**	**5.11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2019**	**382.25**	**0**	**0**	**5**	**0.95**	**6**	**1.14**	**0**	**0**	**2062**	**390.39**
Section 3	5	00301	30-Sep-18	1208	1.80			1	1.66											63	104.3			1	1.66					65	107.62
		00302	30-Sep-18	1031	1.90			1	1.84											138	253.61									139	255.45
		00303	30-Sep-18	1021	1.45			3	7.3											105	255.33									108	262.62
		00304	30-Sep-18	633	1.15			1	4.95											76	375.85									77	380.8
		00305	30-Sep-18	1011	1.55			3	6.89											148	340									151	346.89
		00306	30-Sep-18	876	1.00			2	8.22											59	242.47									61	250.68
		00307	01-Oct-18	716	0.95			3	15.88											133	703.91									136	719.79
		00308	01-Oct-18	861	1.35															179	554.39									179	554.39
		00309	01-Oct-18	625	0.95			3	18.19											72	436.55									75	454.74
		00310	01-Oct-18	818	1.20	1	3.67													130	476.77					1	3.67			132	484.11
		00311	02-Oct-18	918	1.25			1	3.14											94	294.9					1	3.14			96	301.18
		00312	01-Oct-18	713	1.17			2	8.63											121	522.17									123	530.8
		00314	30-Sep-18	926	0.98	1	3.99													26	103.67			1	3.99					28	111.65
		00315	01-Oct-18	1335	1.70	1	1.59	1	1.59					1	1.59					151	239.52			2	3.17	1	1.59			157	249.04
		00316	01-Oct-18	1009	1.48	6	14.51	2	4.84											194	469.27			4	9.68					206	498.3
	Session Summary			**913**	**19.90**	**9**	**1.78**	**23**	**4.56**	**0**	**0**	**0**	**0**	**1**	**0.2**	**0**	**0**	**0**	**0**	**1689**	**334.66**	**0**	**0**	**8**	**1.59**	**3**	**0.59**	**0**	**0**	**1733**	**343.38**
Section Total All Samples				**71546**	**100.03**	**43**	**0**	**93**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**1**	**0**	**8829**	**0**	**3**	**0**	**81**	**0**	**36**	**0**	**0**	**0**	**9093**	**0**
Section Average All Samples				**954**	**1.33**	**1**	**1.62**	**1**	**3.51**	**0**	**0**	**0**	**0**	**0**	**0.26**	**0**	**0**	**0**	**0.04**	**118**	**333.09**	**0**	**0.11**	**1**	**3.06**	**0**	**1.36**	**0**	**0**	**121**	**343.05**
Section Standard Error of Mean						**0.19**	**0.45**	**0.14**	**0.6**	**0**	**0**	**0**	**0**	**0.04**	**0.13**	**0**	**0**	**0.01**	**0.03**	**7.49**	**22.75**	**0.02**	**0.05**	**0.25**	**0.56**	**0.11**	**0.33**	**0**	**0**	**7.48**	**22.58**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																							
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 5	1	00502	07-Sep-18	509	0.95															50	372.25									50	372.25
		00505	07-Sep-18	1450	1.00					1	2.48									11	27.31			2	4.97	2	4.97			16	39.72
		00506	07-Sep-18	1521	1.00			1	2.37											12	28.4	2	4.73			2	4.73			17	40.24
		00507	07-Sep-18	555	0.76					5	42.67									66	563.3	1	8.53			1	8.53			73	623.04
		00508	30-Aug-18	888	0.92															11	48.21					2	8.77			13	56.98
		00509	07-Sep-18	669	0.94															17	96.8									17	96.8
		00510	05-Sep-18	657	1.10	2	9.92													62	307.44					1	4.96			65	322.32
		00511	05-Sep-18	682	0.72			1	7.33											19	139.3					1	7.33			21	153.96
		00512	05-Sep-18	539	1.28			1	5.22											21	109.58					4	20.87			26	135.67
		00513	05-Sep-18	483	0.77			1	9.68											26	251.67	2	19.36			2	19.36			31	300.07
		00514	05-Sep-18	371	0.56			1	17.33											25	433.19									26	450.52
		00515	06-Sep-18	684	0.97			1	5.43											25	135.65					1	5.43			27	146.5
		00516	05-Sep-18	359	0.80			1	12.53											20	250.7					1	12.53			22	275.77
		00517	05-Sep-18	725	0.70															11	78.03	1	7.09			5	35.47			17	120.59
		005SC060	05-Sep-18	742	0.53																							2	18.31	2	18.31
	Session Summary			**722**	**13.00**	**2**	**0.77**	**7**	**2.68**	**6**	**2.3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**376**	**144.21**	**6**	**2.3**	**2**	**0.77**	**22**	**8.44**	**2**	**0.77**	**423**	**162.24**
Section 5	2	00502	13-Sep-18	517	0.95	2	14.66	1	7.33											57	417.79									60	439.78
		00505	13-Sep-18	1143	1.00			1	3.15	1	3.15									6	18.9			3	9.45	1	3.15			12	37.8
		00506	13-Sep-18	955	1.00			3	11.31	1	3.77									36	135.71			1	3.77	1	3.77			42	158.32
		00507	13-Sep-18	588	0.78															68	533.75	1	7.85							69	541.6
		00508	14-Sep-18	754	0.92															78	402.61									78	402.61
		00509	13-Sep-18	775	0.98			1	4.76											40	190.57					1	4.76			42	200.1
		00510	14-Sep-18	806	1.13	2	7.91	1	3.95											94	371.55	3	11.86							100	395.27
		00511	14-Sep-18	587	0.72															40	340.72	1	8.52	1	8.52					42	357.75
		00512	14-Sep-18	801	1.28			1	3.51											81	284.41					2	7.02			84	294.94
		00513	14-Sep-18	513	0.77			1	9.11											24	218.73	1	9.11							26	236.96
		00514	14-Sep-18	467	0.56															27	371.67	1	13.77							28	385.44
		00515	14-Sep-18	670	0.97			1	5.54											70	387.75					1	5.54			72	398.83
		00516	13-Sep-18	583	0.80			1	7.72											35	270.15									36	277.87
		00517	13-Sep-18	573	0.70			1	8.98											22	197.46									23	206.43
	Session Summary			**695**	**12.60**	**4**	**1.64**	**12**	**4.93**	**2**	**0.82**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**678**	**278.73**	**7**	**2.88**	**5**	**2.06**	**6**	**2.47**	**0**	**0**	**714**	**293.53**
Section 5	3	00502	20-Sep-18	598	0.80															61	459.03									61	459.03
		00505	20-Sep-18	1110	1.00			3	9.73											9	29.19			3	9.73	2	6.49			17	55.14
		00506	20-Sep-18	1103	1.00			2	6.53											47	153.4					2	6.53			51	166.46
		00507	20-Sep-18	542	0.78			1	8.52											119	1013.34									120	1021.86
		00508	21-Sep-18	794	0.92	2	9.8													85	416.64									87	426.44
		00509	20-Sep-18	816	0.98															41	185.52									41	185.52
		00510	22-Sep-18	722	1.13			1	4.41											130	573.63									131	578.04
		00511	22-Sep-18	586	0.72	1	8.53													71	605.8					1	8.53			73	622.87
		00512	22-Sep-18	1409	1.28			2	3.99											153	305.4					1	2			156	311.39
		00513	22-Sep-18	707	0.77															78	515.81									78	515.81
		00514	22-Sep-18	625	0.56			1	10.29											59	606.86	1	10.29							61	627.43
		00515	22-Sep-18	909	0.97	1	4.08	1	4.08											155	632.85									157	641.01
		00517	22-Sep-18	535	0.12															1	56.07									1	56.07
	Session Summary			**804**	**11.00**	**4**	**1.63**	**11**	**4.48**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1009**	**410.72**	**1**	**0.41**	**3**	**1.22**	**6**	**2.44**	**0**	**0**	**1034**	**420.9**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																									
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 5	4	00502	27-Sep-18	366	0.45			2	43.72											59	1289.62									61	1333.33
		00505	27-Sep-18	1058	1.00			1	3.4	1	3.4									16	54.44			1	3.4					19	64.65
		00506	27-Sep-18	981	1.00															25	91.74	2	7.34	1	3.67	1	3.67			29	106.42
		00507	27-Sep-18	434	0.77															104	1120.35									104	1120.35
		00508	28-Sep-18	808	0.92															48	231.2									48	231.2
		00509	27-Sep-18	732	0.98															79	398.49	1	5.04							80	403.53
		00510	27-Sep-18	852	1.10															40	153.65					1	3.84			41	157.49
		00511	28-Sep-18	556	0.72															24	215.83									24	215.83
		00512	27-Sep-18	1015	1.28															63	174.57									63	174.57
		00513	28-Sep-18	637	0.77			2	14.68											28	205.51									30	220.19
		00514	28-Sep-18	493	0.56			2	26.08											26	339.03									28	365.11
		00515	28-Sep-18	721	0.97															84	432.39									84	432.39
	Session Summary			**721**	**10.50**	**0**	***0***	**7**	***3.33***	**1**	***0.48***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**596**	***283.42***	**3**	***1.43***	**2**	***0.95***	**2**	***0.95***	**0**	***0***	**611**	***290.55***
Section 5	5	00502	10-Oct-18	376	0.95			2	20.16											25	251.96									27	272.12
		00505	10-Oct-18	1190	1.00			1	3.03					1	3.03					11	33.28			2	6.05					15	45.38
		00506	10-Oct-18	664	1.00			1	5.42											9	48.8									10	54.22
		00507	10-Oct-18	507	0.78	1	9.1													85	773.78									86	782.89
		00508	10-Oct-18	598	0.92															55	357.95									55	357.95
		00509	10-Oct-18	552	0.98															33	220.74									33	220.74
		00510	10-Oct-18	639	1.13									1	4.99					50	249.28			1	4.99					52	259.25
		00511	09-Oct-18	475	0.72															32	336.84									32	336.84
		00512	10-Oct-18	625	1.28															51	229.5									51	229.5
		00513	10-Oct-18	563	0.77															77	639.43									77	639.43
		00514	10-Oct-18	381	0.56									1	16.87					73	1231.72									74	1248.59
		00515	09-Oct-18	525	0.97															52	367.6									52	367.6
		00516	09-Oct-18	351	0.80															3	38.46									3	38.46
		00517	09-Oct-18	486	0.70															1	10.58									1	10.58
		005SC060	09-Oct-18	598	0.53																	6	68.15							6	68.15
	Session Summary			**569**	**13.10**	**1**	***0.48***	**4**	***1.93***	**0**	***0***	**0**	***0***	**3**	***1.45***	**0**	***0***	**0**	***0***	**557**	***269.01***	**6**	***2.9***	**3**	***1.45***	**0**	***0***	**0**	***0***	**574**	***277.22***
Section Total All Samples				**48205**	**60.22**	**11**	***0***	**41**	***0***	**9**	***0***	**0**	***0***	**3**	***0***	**0**	***0***	**0**	***0***	**3216**	***0***	**23**	***0***	**15**	***0***	**36**	***0***	**2**	***0***	**3356**	***0***
Section Average All Samples				**699**	**0.87**	**0**	***0.94***	**1**	***3.51***	**0**	***0.77***	**0**	***0***	**0**	***0.26***	**0**	***0***	**0**	***0***	**47**	***275.07***	**0**	***1.97***	**0**	***1.28***	**1**	***3.08***	**0**	***0.17***	**49**	***287.04***
Section Standard Error of Mean						**0.06**	***0.35***	**0.09**	***0.87***	**0.08**	***0.62***	**0**	***0***	**0.02**	***0.26***	**0**	***0***	**0**	***0***	**4.26**	***33.85***	**0.11**	***1.07***	**0.08**	***0.27***	**0.12**	***0.71***	**0.03**	***0.27***	**4.22**	***33.92***

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 6	1	00601	28-Aug-18	991	1.15															13	41.07									13	41.07
		00602	28-Aug-18	621	0.90			3	19.32	1	6.44									4	25.76			1	6.44	2	12.88			11	70.85
		00603	29-Aug-18	843	1.30															19	62.41	1	3.28							20	65.7
		00604	29-Aug-18	817	1.00															24	105.75					3	13.22			27	118.97
		00605	29-Aug-18	524	0.80	1	8.59													57	489.5									58	498.09
		00606	29-Aug-18	995	1.40			1	2.58											70	180.9									71	183.49
		00607	30-Aug-18	795	1.00	1	4.53													26	117.74	1	4.53			2	9.06			30	135.85
		00608	29-Aug-18	673	1.00															53	283.51					1	5.35			54	288.86
		00609	29-Aug-18	743	1.00															22	106.59					2	9.69			24	116.29
		00610	30-Aug-18	746	0.85															10	56.77					5	28.39			15	85.16
		00611	29-Aug-18	744	0.90															18	96.77					2	10.75			20	107.53
		00612	30-Aug-18	525	0.85															110	887.39									110	887.39
		00613	30-Aug-18	806	0.90															21	104.22					4	19.85			25	124.07
		00614	28-Aug-18	846	0.98															19	82.92					3	13.09			22	96.02
		006PIN01	28-Aug-18	1352	1.50					1	1.78	1	1.78							8	14.2					2	3.55			12	21.3
		006PIN02	28-Aug-18	681	1.00															5	26.43					9	47.58			14	74.01
		006SC047	30-Aug-18	640	0.35																	1	16.07	1	16.07					2	32.14
	Session Summary			**785**	**16.90**	**2**	**0.54**	**4**	**1.09**	**2**	**0.54**	**1**	**0.27**	**0**	**0**	**0**	**0**	**0**	**0**	**479**	**129.98**	**3**	**0.81**	**2**	**0.54**	**35**	**9.5**	**0**	**0**	**528**	**143.28**
Section 6	2	00601	07-Sep-18	824	1.20															15	54.61									15	54.61
		00602	09-Sep-18	609	0.90					1	6.57									4	26.27									5	32.84
		00603	09-Sep-18	864	1.30	2	6.41													68	217.95									70	224.36
		00604	09-Sep-18	780	1.00					1	4.62									21	96.92					1	4.62			23	106.15
		00605	10-Sep-18	500	0.80															82	738									82	738
		00606	10-Sep-18	1049	1.40															48	117.66			1	2.45	4	9.81			53	129.92
		00607	10-Sep-18	844	1.00															68	290.05	1	4.27							69	294.31
		00608	10-Sep-18	595	1.00	1	6.05													40	242.02									41	248.07
		00609	09-Sep-18	776	1.00															32	148.45									32	148.45
		00610	10-Sep-18	764	0.85					2	11.09									24	133.05									26	144.13
		00611	10-Sep-18	770	0.90															28	145.45	1	5.19							29	150.65
		00612	10-Sep-18	571	0.85			1	7.42	1	7.42									54	400.54									56	415.37
		00613	09-Sep-18	847	0.90					1	4.72									24	113.34									25	118.06
		00614	09-Sep-18	629	0.98			1	5.87											25	146.75									26	152.62
		006PIN01	06-Sep-18	1272	1.50															19	35.85									19	35.85
		006PIN02	06-Sep-18	812	1.00															12	53.2					9	39.9			21	93.1
		006SC036	09-Sep-18	448	0.30															1	26.79									1	26.79
		006SC047	09-Sep-18	437	0.43																	1	19.16							1	19.16
	Session Summary			**744**	**17.30**	**3**	**0.84**	**2**	**0.56**	**6**	**1.68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**565**	**158.03**	**3**	**0.84**	**1**	**0.28**	**14**	**3.92**	**0**	**0**	**594**	**166.14**
Section 6	3	00601	15-Sep-18	973	1.20			1	3.08											57	175.75									58	178.83
		00602	15-Sep-18	619	0.90			3	19.39											6	38.77					2	12.92			11	71.08
		00603	15-Sep-18	1027	1.30															68	183.36					1	2.7			69	186.05
		00604	17-Sep-18	748	1.00															35	168.45					1	4.81			36	173.26
		00605	17-Sep-18	557	0.80			1	8.08											168	1357.27									169	1365.35
		00606	17-Sep-18	1045	1.40			1	2.46											178	438					1	2.46			180	442.93
		00607	18-Sep-18	793	1.00															36	163.43									36	163.43
		00608	17-Sep-18	550	1.00															140	916.36									140	916.36
		00609	17-Sep-18	709	1.00															37	187.87									37	187.87
		00610	17-Sep-18	718	0.85															37	218.25									37	218.25
		00611	17-Sep-18	742	0.90															16	86.25									16	86.25
		00612	18-Sep-18	562	0.85															123	926.94					1	7.54			124	934.48
		00613	18-Sep-18	779	0.90															24	123.23					1	5.13			25	128.37
		00614	15-Sep-18	847	0.98															54	235.4					6	26.16			60	261.56
		006PIN01	15-Sep-18	1487	1.50															5	8.07	1	1.61							6	9.68
		006PIN02	15-Sep-18	511	1.00															34	239.53									34	239.53
	Session Summary			**792**	**16.60**	**0**	**0**	**6**	**1.64**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1018**	**278.75**	**1**	**0.27**	**0**	**0**	**13**	**3.56**	**0**	**0**	**1038**	**284.23**

Number Caught (CPUE = no. fish/km/h)

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																							
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 6	4	00601	24-Sep-18	842	1.15															58	215.64									58	215.64
		00602	24-Sep-18	559	0.90			2	14.31											15	107.33									17	121.65
		00603	24-Sep-18	978	1.30															141	399.24	1	2.83			1	2.83			143	404.91
		00604	25-Sep-18	697	1.00			1	5.16											69	356.38					1	5.16			71	366.71
		00605	25-Sep-18	481	0.80			1	9.36											144	1347.19									145	1356.55
		00606	25-Sep-18	993	1.40			3	7.77											131	339.23					1	2.59			135	349.59
		00607	25-Sep-18	772	1.00															136	634.2									136	634.2
		00608	25-Sep-18	563	1.00					1	6.39									117	748.13									118	754.53
		00609	25-Sep-18	586	1.00															54	331.74									54	331.74
		00610	25-Sep-18	730	0.85															47	272.68					1	5.8			48	278.49
		00611	25-Sep-18	666	0.90															51	306.31									51	306.31
		00612	26-Sep-18	526	0.85															118	950.12					2	16.1			120	966.23
		00613	26-Sep-18	735	0.90			1	5.44											82	446.26					1	5.44			84	457.14
		00614	24-Sep-18	802	0.98			2	9.21											101	464.99					15	69.06			118	543.26
		006PIN01	24-Sep-18	1007	1.50															128	305.06									128	305.06
		006PIN02	24-Sep-18	614	1.00			1	5.86											154	902.93									155	908.79
	Session Summary			**722**	**16.50**	**0**	***0***	**11**	***3.32***	**1**	***0.3***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**1546**	***467.19***	**1**	***0.3***	**0**	***0***	**22**	***6.65***	**0**	***0***	**1581**	***477.76***
Section 6	5	00601	01-Oct-18	686	1.20			1	4.37											44	192.42			1	4.37					46	201.17
		00602	01-Oct-18	514	0.90			1	7.78											26	202.33									27	210.12
		00603	01-Oct-18	742	1.30	2	7.46	1	3.73											68	253.78									71	264.98
		00604	01-Oct-18	648	1.00			1	5.56											48	266.67									49	272.22
		00605	01-Oct-18	487	0.80															54	498.97									54	498.97
		00606	01-Oct-18	930	1.40															119	329.03									119	329.03
		00607	03-Oct-18	864	1.00			1	4.17											41	170.83									42	175
		00608	01-Oct-18	580	1.00															70	434.48									70	434.48
		00609	01-Oct-18	795	1.00															78	353.21									78	353.21
		00610	03-Oct-18	620	0.85													1	6.83	61	416.7					1	6.83			63	430.36
		00611	03-Oct-18	593	0.90															10	67.45									10	67.45
		00612	03-Oct-18	592	0.85															67	479.33	1	7.15							68	486.49
		00613	03-Oct-18	703	0.90															44	250.36	1	5.69							45	256.05
		00614	01-Oct-18	714	0.98			1	5.17											50	258.56	1	5.17							52	268.91
		006PIN01	01-Oct-18	1341	1.49			1	1.8											79	142.34									80	144.14
		006PIN02	01-Oct-18	568	1.00			1	6.34											39	247.18									40	253.52
		006SC036	03-Oct-18	476	0.31			1	24.4									1	24.4	5	121.98									7	170.78
		006SC047	01-Oct-18	465	0.39															9	178.66									9	178.66
	Session Summary			**684**	**17.30**	**2**	***0.61***	**9**	***2.74***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**2**	***0.61***	**912**	***277.46***	**3**	***0.91***	**1**	***0.3***	**1**	***0.3***	**0**	***0***	**930**	***282.93***
Section Total All Samples				**63269**	**84.55**	**7**	***0***	**32**	***0***	**9**	***0***	**1**	***0***	**0**	***0***	**0**	***0***	**2**	***0***	**4520**	***0***	**11**	***0***	**4**	***0***	**85**	***0***	**0**	***0***	**4671**	***0***
Section Average All Samples				**744**	**0.99**	**0**	***0.4***	**0**	***1.83***	**0**	***0.52***	**0**	***0.06***	**0**	***0***	**0**	***0***	**0**	***0.11***	**53**	***258.69***	**0**	***0.63***	**0**	***0.23***	**1**	***4.86***	**0**	***0***	**55**	***267.33***
Section Standard Error of Mean						**0.04**	***0.17***	**0.08**	***0.51***	**0.04**	***0.21***	**0.01**	***0.02***	**0**	***0***	**0**	***0***	**0.02**	***0.3***	**4.79**	***30.82***	**0.04**	***0.33***	**0.02**	***0.21***	**0.25**	***1.2***	**0**	***0***	**4.77**	***30.66***

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Arctic Grayling No.	Arctic Grayling CPUE	Bull Trout No.	Bull Trout CPUE	Burbot No.	Burbot CPUE	Goldeye No.	Goldeye CPUE	Kokanee No.	Kokanee CPUE	Lake Trout No.	Lake Trout CPUE
Section 7	1	00701	03-Sep-18	782	0.78												
		00702	03-Sep-18	670	0.95												
		00703	03-Sep-18	995	0.95												
		00704	04-Sep-18	521	1.00												
		00705	04-Sep-18	535	1.00												
		00706	04-Sep-18	852	1.00												
		00707	04-Sep-18	678	0.98												
		00708	03-Sep-18	711	1.24												
		00709	03-Sep-18	970	1.00												
		00710	04-Sep-18	931	1.40												
		00711	04-Sep-18	718	1.39												
		00712	04-Sep-18	726	1.06			1	4.66								
		00713	04-Sep-18	500	0.98	1	7.35										
		00714	04-Sep-18	680	1.27			1	4.15								
		007BEA01	03-Sep-18	1185	0.32												
		007BEA02	03-Sep-18	523	0.60												
		007SC012	03-Sep-18	999	0.22												
		007SC022	03-Sep-18	450	0.36												
	Session Summary			**746**	**16.50**	**1**	**0.29**	**2**	**0.58**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Section 7	2	00701	10-Sep-18	735	0.78												
		00702	11-Sep-18	557	0.95												
		00703	11-Sep-18	711	0.95												
		00704	11-Sep-18	645	1.00												
		00705	11-Sep-18	770	1.00												
		00706	11-Sep-18	1013	1.00												
		00707	12-Sep-18	749	0.98												
		00708	11-Sep-18	762	1.24												
		00709	11-Sep-18	665	1.00												
		00710	12-Sep-18	995	1.40												
		00711	12-Sep-18	943	1.39												
		00712	12-Sep-18	896	1.06												
		00713	12-Sep-18	557	0.98												
		00714	12-Sep-18	924	1.27												
		007BEA01	10-Sep-18	470	0.38												
		007BEA02	11-Sep-18	291	0.60												
		007KIS01	12-Sep-18	446	0.84					2	19.22						
		007SC012	12-Sep-18	384	0.22												
		007SC022	11-Sep-18	505	0.36												
	Session Summary			**685**	**17.40**	**0**	**0**	**0**	**0**	**2**	**0.6**	**0**	**0**	**0**	**0**	**0**	**0**
Section 7	3	00701	18-Sep-18	820	0.78												
		00702	19-Sep-18	762	0.95												
		00703	18-Sep-18	882	0.95												
		00704	19-Sep-18	769	1.00												
		00705	19-Sep-18	85	1.00												
		00706	19-Sep-18	1193	1.00												
		00707	19-Sep-18	706	0.98												
		00708	18-Sep-18	770	1.24												
		00709	19-Sep-18	930	1.00												
		00710	19-Sep-18	1037	1.35												
		00711	19-Sep-18	904	1.19			1	3.35								
		00712	19-Sep-18	817	1.06												
		00713	21-Sep-18	655	0.98												
		00714	21-Sep-18	987	1.27												
		007BEA01	21-Sep-18	799	0.43												
		007BEA02	21-Sep-18	622	0.60												
		007KIS01	21-Sep-18	686	0.51												
	Session Summary			**790**	**16.30**	**0**	**0**	**1**	**0.28**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Number Caught (CPUE = no. fish/km/h) — continued

Section	Session	Site	Lake Whitefish No.	Lake Whitefish CPUE	Mountain Whitefish No.	Mountain Whitefish CPUE	Northern Pike No.	Northern Pike CPUE	Rainbow Trout No.	Rainbow Trout CPUE	Walleye No.	Walleye CPUE	Yellow Perch No.	Yellow Perch CPUE	All Species No.	All Species CPUE
Section 7	1	00701			6	35.19									6	35.19
		00702			42	237.55									42	237.55
		00703			26	99.02					6	22.85			32	121.87
		00704			23	158.93									23	158.93
		00705			22	148.04			1	6.73					23	154.77
		00706			4	16.9									4	16.9
		00707			16	86.69					3	16.25			19	102.94
		00708			28	114.33					3	12.25			31	126.58
		00709			20	74.23					7	25.98			27	100.21
		00710			11	30.38					2	5.52			13	35.91
		00711			63	227.25					1	3.61			64	230.86
		00712			27	125.71					2	9.31			30	139.68
		00713			78	573.06					1	7.35			80	587.76
		00714			64	265.74									65	269.9
		007BEA01			2	18.99	5	47.47			53	503.16			60	569.62
		007BEA02									4	45.89			4	45.89
		007SC012									6	98.28			6	98.28
		007SC022			1	22.22									1	22.22
	Session Summary		**0**	**0**	**433**	**126.64**	**5**	**1.46**	**1**	**0.29**	**88**	**25.74**	**0**	**0**	**530**	**155.01**
Section 7	2	00701			2	12.48					1	6.24			3	18.72
		00702			25	170.08									25	170.08
		00703			6	31.98									6	31.98
		00704			61	340.47									61	340.47
		00705			22	102.86					1	4.68			23	107.53
		00706			7	24.88					1	3.55			8	28.43
		00707			27	132.42									27	132.42
		00708			27	102.87									27	102.87
		00709			32	173.23	1	5.41			2	10.83			35	189.47
		00710			30	77.53					2	5.17			32	82.7
		00711			53	145.56	1	2.75							54	148.31
		00712			26	98.09					1	3.77			27	101.86
		00713			46	303.37									46	303.37
		00714			37	113.06									37	113.06
		007BEA01									8	161.25			8	161.25
		007BEA02									1	20.62			1	20.62
		007KIS01			2	19.22					1	9.61			5	48.05
		007SC012							1	42.61					1	42.61
		007SC022									1	19.8			1	19.8
	Session Summary		**0**	**0**	**403**	**121.72**	**2**	**0.6**	**1**	**0.3**	**19**	**5.74**	**0**	**0**	**427**	**128.97**
Section 7	3	00701			4	22.37					8	44.74			12	67.11
		00702			17	84.54									17	84.54
		00703			11	47.26									11	47.26
		00704			44	205.98					1	4.68			45	210.66
		00705			15	635.29									15	635.29
		00706			11	33.19					1	3.02			12	36.21
		00707			24	124.88					1	5.2			25	130.08
		00708			41	154.59									41	154.59
		00709			18	69.68					2	7.74			20	77.42
		00710			1	2.57					3	7.71			4	10.29
		00711			40	133.86					2	6.69			43	143.9
		00712			35	144.81					3	12.41			38	157.22
		00713			95	532.79			1	5.61					96	538.4
		00714			57	163.06									57	163.06
		007BEA01									16	167.65			16	167.65
		007BEA02			3	28.94	1	9.65			3	28.94			7	67.52
		007KIS01									5	51.45			5	51.45
	Session Summary		**0**	**0**	**416**	**116.3**	**1**	**0.28**	**1**	**0.28**	**45**	**12.58**	**0**	**0**	**464**	**129.72**

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																									
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 7	4	00701	26-Sep-18	846	0.78																	2	10.84			4	21.68			6	32.52
		00702	26-Sep-18	685	0.95															36	199.15									36	199.15
		00703	26-Sep-18	853	0.95											1	4.44			23	102.18					2	8.89			26	115.51
		00704	28-Sep-18	732	1.00			1	4.92											64	314.75									65	319.67
		00705	28-Sep-18	794	1.00			1	4.53											21	95.21									22	99.75
		00706	28-Sep-18	1130	0.90															5	17.7									5	17.7
		00707	29-Sep-18	699	0.98			1	5.26											14	73.57					1	5.26			16	84.09
		00708	26-Sep-18	782	1.24															36	133.65					9	33.41			45	167.07
		00709	26-Sep-18	857	1.00															37	155.43			1	4.2					38	159.63
		00710	29-Sep-18	1275	1.20			1	2.35											6	14.12									7	16.47
		00711	29-Sep-18	986	1.39			2	5.25											64	168.11					1	2.63			67	175.99
		00712	29-Sep-18	998	1.06															37	125.32					1	3.39			38	128.71
		00713	29-Sep-18	495	0.98															69	512.06									69	512.06
		00714	29-Sep-18	1050	1.27															39	104.87									39	104.87
		007BEA01	29-Sep-18	235	0.23															3	199.81					12	799.26			15	999.07
		007BEA02	26-Sep-18	494	0.60																					20	242.91			20	242.91
		007KIS01	29-Sep-18	371	0.74															1	13.11					1	13.11			2	26.23
		007SC012	29-Sep-18	491	0.22															3	99.98					1	33.33			4	133.31
		007SC022	26-Sep-18	492	0.36																	1	20.33							1	20.33
	Session Summary			751	16.90	0	0	6	1.7	0	0	0	0	0	0	1	0.28	0	0	458	129.91	3	0.85	1	0.28	52	14.75	0	0	521	147.78
Section 7	5	00701	03-Oct-18	807	0.78															1	5.68					40	227.31			41	232.99
		00702	04-Oct-18	490	0.95															46	355.75									46	355.75
		00703	04-Oct-18	764	0.95			1	4.96											16	79.36					1	4.96			18	89.28
		00704	04-Oct-18	620	1.00			1	5.81											44	255.48					1	5.81			46	267.1
		00705	04-Oct-18	609	1.00			1	5.91											24	141.87									25	147.78
		00706	04-Oct-18	851	1.00															6	25.38									6	25.38
		00707	04-Oct-18	604	0.98															14	85.15									14	85.15
		00708	04-Oct-18	703	1.24			1	4.13											30	123.89					1	4.13			32	132.15
		00709	04-Oct-18	598	1.00					1	6.02									16	96.32									17	102.34
		00710	04-Oct-18	868	1.40			1	2.96											21	62.21					2	5.92			24	71.1
		00711	04-Oct-18	771	1.39															48	161.24	1	3.36							49	164.6
		00712	04-Oct-18	706	1.06			3	14.36											7	33.52									10	47.88
		00713	09-Oct-18	489	0.98															5	37.56									5	37.56
		00714	09-Oct-18	881	1.27															7	22.43									7	22.43
		007BEA01	04-Oct-18	310	0.43															2	54.01					3	81.02			5	135.03
		007BEA02	04-Oct-18	568	0.60															2	21.13					3	31.69			5	52.82
		007KIS01	09-Oct-18	526	0.84															42	342.21									42	342.21
	Session Summary			657	16.90	0	0	8	2.59	1	0.32	0	0	0	0	0	0	0	0	331	107.32	1	0.32	0	0	51	16.54	0	0	392	127.1
Section Total All Samples				65298	83.98	1	0	17	0	3	0	0	0	0	0	1	0	0	0	2041	0	12	0	4	0	255	0	0	0	2334	0
Section Average All Samples				726	0.93	0	0.06	0	1	0	0.18	0	0	0	0	0	0.06	0	0	23	120.51	0	0.71	0	0.24	3	15.06	0	0	26	137.81
Section Standard Error of Mean						0.01	0.08	0.05	0.23	0.02	0.22	0	0	0	0	0.01	0.05	0	0	2.27	13.79	0.06	0.59	0.02	0.48	0.79	11.16	0	0	2.21	16.89

Table E3 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h): Arctic Grayling No.	Arctic Grayling CPUE	Bull Trout No.	Bull Trout CPUE	Burbot No.	Burbot CPUE	Goldeye No.	Goldeye CPUE	Kokanee No.	Kokanee CPUE	Lake Trout No.	Lake Trout CPUE	Lake Whitefish No.	Lake Whitefish CPUE	Mountain Whitefish No.	Mountain Whitefish CPUE	Northern Pike No.	Northern Pike CPUE	Rainbow Trout No.	Rainbow Trout CPUE	Walleye No.	Walleye CPUE	Yellow Perch No.	Yellow Perch CPUE	All Species No.	All Species CPUE
Section 9	1	00901	02-Sep-18	703	1.10															32	148.97									32	148.97
		00902	02-Sep-18	967	1.00															8	29.78					3	11.17			11	40.95
		00903	02-Sep-18	793	1.00															6	27.24									6	27.24
		00904	02-Sep-18	872	1.10															38	142.62	1	3.75			1	3.75			40	150.13
		00905	02-Sep-18	1015	1.10															21	67.71					4	12.9			25	80.61
		00906	02-Sep-18	835	1.00															6	25.87									6	25.87
		00907	02-Sep-18	1069	1.20					1	2.81									9	25.26									10	28.06
		00908	01-Sep-18	685	1.10															7	33.44									7	33.44
		00909	01-Sep-18	681	0.95															1	5.56					1	5.56			2	11.13
		00910	02-Sep-18	1127	1.10															3	8.71					2	5.81			5	14.52
		00911	01-Sep-18	655	1.00															7	38.47									7	38.47
		00912	01-Sep-18	752	0.65															3	22.09					2	14.73			5	36.82
		00913	01-Sep-18	589	0.90															10	67.91									10	67.91
		00914	02-Sep-18	601	0.95																					1	6.31			1	6.31
		009SC061	01-Sep-18	614	0.68															1	8.69									1	8.69
	Session Summary			**797**	**14.80**	**0**	**0**	**0**	**0**	**1**	**0.31**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**152**	**46.39**	**1**	**0.31**	**0**	**0**	**14**	**4.27**	**0**	**0**	**168**	**51.27**
Section 9	2	00901	17-Sep-18	570	1.10															10	57.42									10	57.42
		00902	17-Sep-18	965	1.00															3	11.19									3	11.19
		00903	17-Sep-18	845	1.10															4	15.49									4	15.49
		00904	17-Sep-18	660	1.10															23	114.05									23	114.05
		00905	17-Sep-18	959	1.10															8	27.3									8	27.3
		00906	17-Sep-18	1003	1.00																					2	7.18			2	7.18
		00907	17-Sep-18	891	1.20			1	3.37	1	3.37									15	50.51					2	6.73			19	63.97
		00908	18-Sep-18	751	1.10															17	74.08									17	74.08
		00909	18-Sep-18	763	0.95															19	94.36									19	94.36
		00910	17-Sep-18	1151	1.10															1	2.84					3	8.53			4	11.37
		00911	18-Sep-18	720	1.00															12	60					1	5			13	65
		00912	18-Sep-18	614	1.10															7	37.31					2	10.66			9	47.97
		00913	18-Sep-18	569	0.90															13	91.39					1	7.03			14	98.42
		00914	18-Sep-18	537	0.95															7	49.4									7	49.4
		009SC061	18-Sep-18	699	0.68																					3	22.89			3	22.89
	Session Summary			**780**	**15.40**	**0**	**0**	**1**	**0.3**	**1**	**0.3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**139**	**41.66**	**0**	**0**	**0**	**0**	**14**	**4.2**	**0**	**0**	**155**	**46.45**
Section 9	3	00901	23-Sep-18	771	1.10															25	106.12									25	106.12
		00902	23-Sep-18	855	1.00															6	25.26					1	4.21			7	29.47
		00903	23-Sep-18	1057	1.10			1	3.1											8	24.77					1	3.1			10	30.96
		00904	23-Sep-18	856	1.10															22	84.11									22	84.11
		00905	23-Sep-18	1115	1.10															5	14.68									5	14.68
		00906	23-Sep-18	996	1.00															12	43.37					1	3.61			13	46.99
		00907	23-Sep-18	1064	1.20															15	42.29									15	42.29
		00908	23-Sep-18	695	1.10															4	18.84									4	18.84
		00909	23-Sep-18	699	0.95															10	54.21					1	5.42			11	59.63
		00910	23-Sep-18	894	1.10															1	3.66									1	3.66
		00911	23-Sep-18	570	1.00															19	120					1	6.32			20	126.32
		00912	23-Sep-18	576	0.55															2	22.73	1	11.36			1	11.36			4	45.45
		00913	23-Sep-18	519	0.90															7	53.95									7	53.95
		00914	23-Sep-18	591	0.95															6	38.47									6	38.47
	Session Summary			**804**	**14.20**	**0**	**0**	**1**	**0.32**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**142**	**44.78**	**1**	**0.32**	**0**	**0**	**6**	**1.89**	**0**	**0**	**150**	**47.3**

Table E3 Concluded.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																									
						Arctic Grayling		Bull Trout		Burbot		Goldeye		Kokanee		Lake Trout		Lake Whitefish		Mountain Whitefish		Northern Pike		Rainbow Trout		Walleye		Yellow Perch		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
Section 9	4	00901	28-Sep-18	790	1.10															30	124.28					1	4.14			31	128.42
		00902	28-Sep-18	1170	1.00															5	15.38					5	15.38			10	30.77
		00903	28-Sep-18	1094	1.10															8	23.93					4	11.97			12	35.9
		00904	28-Sep-18	951	1.10			1	3.44											21	72.27									22	75.71
		00905	28-Sep-18	1168	1.10															11	30.82					2	5.6			13	36.43
		00906	28-Sep-18	973	1.00															6	22.2					1	3.7			7	25.9
		00907	29-Sep-18	974	1.20			1	3.08											3	9.24									4	12.32
		00908	29-Sep-18	785	1.10			1	4.17											3	12.51									4	16.68
		00909	29-Sep-18	786	0.95															3	14.46					1	4.82			4	19.28
		00910	29-Sep-18	1146	1.10															2	5.71					1	2.86			3	8.57
		00911	29-Sep-18	647	1.00															6	33.38					2	11.13			8	44.51
		00912	29-Sep-18	383	0.46																					4	81.73			4	81.73
		00913	29-Sep-18	614	0.90															11	71.66					2	13.03			13	84.69
	Session Summary			**883**	**13.10**	**0**	*0*	**3**	*0.93*	**0**	*0*	**0**	*0*	**0**	*0*	**0**	*0*	**0**	*0*	**109**	*33.92*	**0**	*0*	**0**	*0*	**23**	*7.16*	**0**	*0*	**135**	*42.01*
Section 9	5	00901	08-Oct-18	728	1.10															2	8.99									2	8.99
		00902	08-Oct-18	644	1.00													1	5.59	1	5.59									2	11.18
		00903	08-Oct-18	690	1.10			1	4.74											2	9.49									3	14.23
		00904	08-Oct-18	682	1.10															3	14.4									3	14.4
		00905	08-Oct-18	735	1.10															2	8.91									2	8.91
		00906	08-Oct-18	825	1.00															1	4.36					1	4.36			2	8.73
		00907	08-Oct-18	682	1.20															2	8.8									2	8.8
		00909	08-Oct-18	653	0.95															1	5.8									1	5.8
		00910	08-Oct-18	706	1.10															1	4.64									1	4.64
		00911	08-Oct-18	503	1.00															2	14.31									2	14.31
		00912	08-Oct-18	667	1.10															4	19.63									4	19.63
		00914	08-Oct-18	529	0.95																					1	7.16			1	7.16
		009SC053	08-Oct-18	309	0.26																	1	44.81							1	44.81
	Session Summary			**643**	**13.00**	**0**	*0*	**1**	*0.43*	**0**	*0*	**0**	*0*	**0**	*0*	**0**	*0*	**1**	*0.43*	**21**	*9.04*	**1**	*0.43*	**0**	*0*	**2**	*0.86*	**0**	*0*	**26**	*11.2*
Section Total All Samples				**54747**	**70.42**	**0**	*0*	**6**	*0*	**2**	*0*	**0**	*0*	**0**	*0*	**0**	*0*	**1**	*0*	**563**	*0*	**3**	*0*	**0**	*0*	**59**	*0*	**0**	*0*	**634**	*0*
Section Average All Samples				**782**	**1.01**	**0**	*0*	**0**	*0.39*	**0**	*0.13*	**0**	*0*	**0**	*0*	**0**	*0*	**0**	*0.07*	**8**	*36.81*	**0**	*0.2*	**0**	*0*	**1**	*3.86*	**0**	*0*	**9**	*41.45*
Section Standard Error of Mean						**0**	*0*	**0.03**	*0.12*	**0.02**	*0.06*	**0**	*0*	**0**	*0*	**0**	*0*	**0.01**	*0.08*	**1**	*4.4*	**0.02**	*0.66*	**0**	*0*	**0.14**	*1.26*	**0**	*0*	**1.01**	*4.37*
All Sections Total All Samples				**339758**	**455.11**	*25230*	*0.59*	*65*	*0*	*254*	*0.01*	*23*	*0*	*1*	*0*	*19*	*0*	*1*	*0*	*4*	*0*	*24129*	*0.56*	*53*	*0*	*208*	*0*	*471*	*0.01*	*2*	*0*
All Sections Average All Samples						*55*	*267.86*	*0*	*0.69*	*1*	*2.7*	*0*	*0.24*	*0*	*0.01*	*0*	*0.2*	*0*	*0.01*	*0*	*0.04*	*53*	*256.17*	*0*	*0.56*	*0*	*2.21*	*1*	*5*	*0*	*0.02*
All Sections Standard Error of Mean						*2.59*	*24.57*	*0.04*	*0.14*	*0.05*	*0.31*	*0.01*	*0.11*	*0*	*0*	*0.01*	*0.07*	*0*	*0.01*	*0*	*0.06*	*2.57*	*23.72*	*0.02*	*0.24*	*0.09*	*1.3*	*0.17*	*2.28*	*0*	*0.04*

Table E4 Summary of boat electroshocking non-sportfish catch (includes fish captured and observed and identified to species) and catch-per-unit-effort (CPUE = no. fish/km/hour) in the Peace River, 27 August to 10 October 2018.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 1	1	00103	28-Aug-18	684	1.20															11	48.25			11	48.25
		00104	28-Aug-18	414	0.50											1	17.39			1	17.39			2	34.78
		00105	28-Aug-18	473	1.10															2	13.84			2	13.84
		00107	27-Aug-18	535	0.55											18	220.22			2	24.47			20	244.69
		00108	27-Aug-18	713	0.85											8	47.52							8	47.52
		00109	27-Aug-18	655	0.98											5	28.19			3	16.91			8	45.1
		00110	27-Aug-18	599	0.65											65	601			1	9.25			66	610.25
		00111	27-Aug-18	579	0.55											13	146.96			1	11.3			14	158.27
		00112	27-Aug-18	781	1.07											16	68.93							16	68.93
		00113	28-Aug-18	344	0.75											1	13.95							1	13.95
		00114	28-Aug-18	578	0.95															4	26.22			4	26.22
		00119	27-Aug-18	640	0.75											12	90							12	90
	Session Summary			**583**	**9.90**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**139**	**86.7**	**0**	**0**	**25**	**15.59**	**0**	**0**	**164**	**102.29**
Section 1	2	00101	09-Sep-18	291	0.60															6	123.71			6	123.71
		00103	10-Sep-18	259	1.20											4	46.33			23	266.41			27	312.74
		00104	10-Sep-18	388	0.50															50	927.84			50	927.84
		00105	10-Sep-18	533	1.10											2	12.28			10	61.4			12	73.68
		00107	09-Sep-18	586	0.55											8	89.36			1	11.17			9	100.53
		00108	09-Sep-18	782	0.85															13	70.41			13	70.41
		00109	09-Sep-18	691	0.98											10	53.43			48	256.48			58	309.92
		00110	09-Sep-18	535	0.65															2	20.7			2	20.7
		00111	08-Sep-18	77	1.00											7	327.27			21	981.82			28	1309.09
		00112	08-Sep-18	719	1.07											1	4.68			37	173.14			38	177.82
		00113	09-Sep-18	347	0.75															12	165.99			12	165.99
		00114	08-Sep-18	683	0.95									3	16.64					26	144.26			29	160.9
		00116	09-Sep-18	546	0.98															29	194.12			29	194.12
		00119	09-Sep-18	631	0.75															3	22.82			3	22.82
	Session Summary			**505**	**11.90**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1.8**	**32**	**19.17**	**0**	**0**	**281**	**168.33**	**0**	**0**	**316**	**189.3**
Section 1	3	00107	19-Sep-18	452	0.55											44	637.17							44	637.17
		00108	19-Sep-18	693	0.85															1	6.11			1	6.11
		00109	19-Sep-18	638	0.98											1	5.79							1	5.79
		00110	19-Sep-18	557	0.65											4	39.77			2	19.89			6	59.66
		00112	20-Sep-18	662	1.07											3	15.25							3	15.25
		00113	19-Sep-18	393	0.75															1	12.21			1	12.21
		00114	20-Sep-18	494	0.95											4	30.68							4	30.68
		00116	19-Sep-18	578	0.98											8	50.59							8	50.59
		00119	19-Sep-18	597	0.75															1	8.04			1	8.04
	Session Summary			**563**	**7.50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**64**	**54.56**	**0**	**0**	**5**	**4.26**	**0**	**0**	**69**	**58.83**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h) Flathead Chub No.	CPUE	Lake Chub No.	CPUE	Longnose Dace No.	CPUE	Northern Pikeminnow No.	CPUE	Redside Shiner No.	CPUE	Sculpin spp. No.	CPUE	Spottail Shiner No.	CPUE	Sucker spp. No.	CPUE	Troutperch No.	CPUE	All Species No.	CPUE
Section 1	4	00101	24-Sep-18	290	0.60											4	82.76			1	20.69			5	103.45
		00102	24-Sep-18	394	0.98											6	56.23							6	56.23
		00107	24-Sep-18	574	0.55											37	421.92			2	22.81			39	444.73
		00108	24-Sep-18	706	0.85											4	24							4	24
		00109	24-Sep-18	671	0.98											28	154.08							28	154.08
		00110	24-Sep-18	604	0.65											37	339.28			2	18.34			39	357.62
		00111	25-Sep-18	577	0.50											9	112.31							9	112.31
		00112	25-Sep-18	808	1.07											16	66.62			4	16.66			20	83.28
		00114	25-Sep-18	553	0.95											13	89.08			2	13.71			15	102.79
		00116	25-Sep-18	520	0.98											6	42.17							6	42.17
		00119	24-Sep-18	694	0.75											18	124.5							18	124.5
	Session Summary			**581**	**8.90**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**178**	**123.92**	**0**	**0**	**11**	**7.66**	**0**	**0**	**189**	**131.58**
Section 1	5	00102	30-Sep-18	373	0.98											1	9.9							1	9.9
		00104	02-Oct-18	291	0.50															2	49.48			2	49.48
		00107	30-Sep-18	555	0.55											91	1073.22			2	23.59			93	1096.81
		00108	30-Sep-18	891	0.85											6	28.52							6	28.52
		00109	30-Sep-18	805	0.98											21	96.32							21	96.32
		00110	30-Sep-18	688	0.65											23	185.15			3	24.15			26	209.3
		00111	30-Sep-18	511	0.49											21	301.93							21	301.93
		00112	30-Sep-18	916	1.07											68	249.77			1	3.67			69	253.44
		00113	30-Sep-18	493	0.75											7	68.15							7	68.15
		00114	30-Sep-18	698	0.95											74	401.75			1	5.43			75	407.18
		00116	30-Sep-18	863	0.98											57	241.4							57	241.4
		00119	30-Sep-18	646	0.75											55	408.67			1	7.43			56	416.1
	Session Summary			**644**	**9.50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**424**	**249.49**	**0**	**0**	**10**	**5.88**	**0**	**0**	**434**	**255.38**
Section Total All Samples				**33248**	**47.70**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**837**	**0**	**0**	**0**	**332**	**0**	**0**	**0**	**1172**	**0**
Section Average All Samples				**573**	**0.82**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.4**	**14**	**110.23**	**0**	**0**	**6**	**43.72**	**0**	**0**	**20**	**154.35**
Section Standard Error of Mean						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.05**	**0.29**	**2.81**	**25.88**	**0**	**0**	**1.5**	**23.71**	**0**	**0**	**2.86**	**34.65**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Flathead Chub No.	Flathead Chub CPUE	Lake Chub No.	Lake Chub CPUE	Longnose Dace No.	Longnose Dace CPUE	Northern Pikeminnow No.	Northern Pikeminnow CPUE	Redside Shiner No.	Redside Shiner CPUE	Sculpin spp. No.	Sculpin spp. CPUE	Spottail Shiner No.	Spottail Shiner CPUE	Sucker spp. No.	Sucker spp. CPUE	Troutperch No.	Troutperch CPUE	All Species No.	All Species CPUE
						Number Caught (CPUE = no. fish/km/h)																			
Section 3	1	00301	29-Aug-18	1398	1.80											6	8.58			9	12.88			15	21.46
		00302	28-Aug-18	1044	1.88															120	220.69			120	220.69
		00303	29-Aug-18	1236	1.45															173	347.51			173	347.51
		00304	29-Aug-18	966	1.35											5	13.8			5	13.8			10	27.61
		00305	29-Aug-18	1111	1.55							17	35.54	19	39.72	2	4.18			225	470.37			263	549.81
		00306	30-Aug-18	801	1.00							9	40.45							82	368.54			91	408.99
		00307	30-Aug-18	798	0.95											2	9.5			72	341.91			74	351.4
		00308	30-Aug-18	806	1.35											1	3.31			67	221.67			68	224.98
		00309	31-Aug-18	1043	0.95									38	138.06	3	10.9			17	61.77			58	210.73
		00310	31-Aug-18	1181	1.20	1	2.54					1	2.54	7	17.78	5	12.7			47	119.39			61	154.95
		00311	31-Aug-18	1000	1.25			3	8.64			1	2.88	8	23.04					74	213.12			86	247.68
		00312	31-Aug-18	1249	1.17			1	2.46			2	4.93	14	34.49					155	381.84			172	423.72
		00314	30-Aug-18	909	0.98									24	97.49	3	12.19			9	36.56			36	146.23
		00315	30-Aug-18	1358	1.70											11	17.15			22	34.31			33	51.46
		00316	30-Aug-18	1032	1.48											3	7.09			14	33.11			17	40.2
	Session Summary			**1062**	**20.00**	**1**	**0.17**	**4**	**0.68**	**0**	**0**	**30**	**5.08**	**110**	**18.64**	**41**	**6.95**	**0**	**0**	**1091**	**184.92**	**0**	**0**	**1277**	**216.44**
Section 3	2	00301	11-Sep-18	1302	1.80							1	1.54	1	1.54					11	16.9			13	19.97
		00302	10-Sep-18	1410	1.90							2	2.69	11	14.78	18	24.19			89	119.6			120	161.25
		00303	10-Sep-18	1051	1.45							3	7.09							81	191.34			84	198.43
		00304	11-Sep-18	786	1.35															7	23.75			7	23.75
		00305	11-Sep-18	994	1.55	1	2.34					1	2.34	5	11.68	2	4.67			73	170.57			82	191.6
		00306	11-Sep-18	720	1.00															40	200			40	200
		00307	12-Sep-18	734	0.95															27	139.39			27	139.39
		00308	12-Sep-18	772	1.35															61	210.71			61	210.71
		00309	13-Sep-18	648	0.95															4	23.39			4	23.39
		00310	13-Sep-18	838	1.20															10	35.8			10	35.8
		00311	13-Sep-18	833	1.25															17	58.78			17	58.78
		00312	13-Sep-18	818	1.17															45	169.27			45	169.27
		00314	12-Sep-18	1090	0.98											4	13.55			23	77.91			27	91.46
		00315	12-Sep-18	1432	1.70			1	1.48			1	1.48			1	1.48			68	100.56			71	105
		00316	13-Sep-18	1000	1.48															16	39.05			16	39.05
	Session Summary			**962**	**20.10**	**1**	**0.19**	**1**	**0.19**	**0**	**0**	**8**	**1.49**	**17**	**3.17**	**25**	**4.65**	**0**	**0**	**572**	**106.49**	**0**	**0**	**624**	**116.18**
Section 3	3	00301	20-Sep-18	1381	1.80															9	13.03			9	13.03
		00302	20-Sep-18	883	1.80															23	52.1			23	52.1
		00303	21-Sep-18	740	1.45															21	70.46			21	70.46
		00304	21-Sep-18	779	1.35															13	44.5			13	44.5
		00305	21-Sep-18	1064	1.55									1	2.18	6	13.1			52	113.51			59	128.79
		00306	21-Sep-18	701	1.00															49	251.64			49	251.64
		00307	22-Sep-18	694	0.95															7	38.22			7	38.22
		00308	22-Sep-18	627	1.35															17	72.3			17	72.3
		00309	22-Sep-18	646	0.95															37	217.04			37	217.04
		00310	22-Sep-18	810	1.20									2	7.41					20	74.07			22	81.48
		00311	21-Sep-18	803	1.25															28	100.42			28	100.42
		00312	22-Sep-18	1028	1.17															46	137.68			46	137.68
		00314	21-Sep-18	738	0.98															21	105.07			21	105.07
		00315	22-Sep-18	1257	1.70											4	6.74			12	20.22			16	26.95
		00316	22-Sep-18	1140	1.48											3	6.42			2	4.28			5	10.7
	Session Summary			**886**	**20.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0.61**	**13**	**2.64**	**0**	**0**	**357**	**72.53**	**0**	**0**	**373**	**75.78**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 3	4	00301	25-Sep-18	1076	1.80											10	*18.59*			9	*16.73*			19	*35.32*
		00302	25-Sep-18	1019	1.90															49	*91.11*			49	*91.11*
		00303	26-Sep-18	1068	1.45							1	*2.32*							101	*234.79*			102	*237.12*
		00305	26-Sep-18	1181	1.55											1	*1.97*			54	*106.2*			55	*108.16*
		00306	26-Sep-18	924	1.00							2	*7.79*							73	*284.42*			75	*292.21*
		00307	27-Sep-18	735	0.95															22	*113.43*			22	*113.43*
		00308	27-Sep-18	760	1.35															23	*80.7*			23	*80.7*
		00309	26-Sep-18	813	0.95															13	*60.59*			13	*60.59*
		00310	26-Sep-18	939	1.20											1	*3.19*			13	*41.53*			14	*44.73*
		00311	26-Sep-18	1023	1.25	1	*2.82*													46	*129.5*			47	*132.32*
		00312	27-Sep-18	1014	1.17											3	*9.1*			46	*139.58*			49	*148.69*
		00314	27-Sep-18	679	0.98											5	*27.19*			8	*43.5*			13	*70.69*
		00315	27-Sep-18	1295	1.70											44	*71.95*			4	*6.54*			48	*78.49*
		00316	27-Sep-18	1010	1.48											5	*12.08*							5	*12.08*
	Session Summary			**967**	**18.70**	**1**	***0.2***	**0**	***0***	**0**	***0***	**3**	***0.6***	**0**	***0***	**69**	***13.74***	**0**	***0***	**461**	***91.78***	**0**	***0***	**534**	***106.31***
Section 3	5	00301	30-Sep-18	1208	1.80											4	*6.62*			9	*14.9*			13	*21.52*
		00302	30-Sep-18	1031	1.90															16	*29.4*			16	*29.4*
		00303	30-Sep-18	1021	1.45															28	*68.09*			28	*68.09*
		00304	30-Sep-18	633	1.15															2	*9.89*			2	*9.89*
		00305	30-Sep-18	1011	1.55															18	*41.35*			18	*41.35*
		00306	30-Sep-18	876	1.00															2	*8.22*			2	*8.22*
		00307	01-Oct-18	716	0.95															13	*68.8*			13	*68.8*
		00308	01-Oct-18	861	1.35															5	*15.49*			5	*15.49*
		00309	01-Oct-18	625	0.95															16	*97.01*			16	*97.01*
		00310	01-Oct-18	818	1.20															12	*44.01*			12	*44.01*
		00311	02-Oct-18	918	1.25											5	*15.69*			5	*15.69*			10	*31.37*
		00312	01-Oct-18	713	1.17															13	*56.1*			13	*56.1*
		00314	30-Sep-18	926	0.98															3	*11.96*			3	*11.96*
		00315	01-Oct-18	1335	1.70															15	*23.79*			15	*23.79*
		00316	01-Oct-18	1009	1.48															25	*60.47*			25	*60.47*
	Session Summary			**913**	**19.90**	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**9**	***1.78***	**0**	***0***	**182**	***36.06***	**0**	***0***	**191**	***37.85***
Section Total All Samples				**70888**	**98.67**	**3**	***0***	**5**	***0***	**0**	***0***	**41**	***0***	**130**	***0***	**157**	***0***	**0**	***0***	**2663**	***0***	**0**	***0***	**2999**	***0***
Section Average All Samples				**958**	**1.33**	**0**	***0.11***	**0**	***0.19***	**0**	***0***	**1**	***1.56***	**2**	***4.95***	**2**	***5.98***	**0**	***0***	**36**	***101.41***	**0**	***0***	**41**	***114.21***
Section Standard Error of Mean						**0.02**	***0.06***	**0.04**	***0.12***	**0**	***0***	**0.26**	***0.73***	**0.7**	***2.38***	**0.67**	***1.18***	**0**	***0***	**4.79**	***12.02***	**0**	***0***	**5.21**	***12.82***

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Flathead Chub No.	Flathead Chub CPUE	Lake Chub No.	Lake Chub CPUE	Longnose Dace No.	Longnose Dace CPUE	Northern Pikeminnow No.	Northern Pikeminnow CPUE	Redside Shiner No.	Redside Shiner CPUE	Sculpin spp. No.	Sculpin spp. CPUE	Spottail Shiner No.	Spottail Shiner CPUE	Sucker spp. No.	Sucker spp. CPUE	Troutperch No.	Troutperch CPUE	All Species No.	All Species CPUE
						Number Caught (CPUE = no. fish/km/h)																			
Section 5	1	00502	07-Sep-18	509	0.95															24	***178.68***			24	***178.68***
		00505	07-Sep-18	1450	1.00											1	***2.48***			18	***44.69***			19	***47.17***
		00506	07-Sep-18	1521	1.00															15	***35.5***			15	***35.5***
		00507	07-Sep-18	555	0.76											19	***162.16***			24	***204.84***	1	***8.53***	44	***375.53***
		00508	30-Aug-18	888	0.92									2	***8.77***					28	***122.72***			30	***131.48***
		00509	07-Sep-18	669	0.94															18	***102.5***			18	***102.5***
		00510	05-Sep-18	657	1.10									1	***4.96***					16	***79.34***			17	***84.3***
		00511	05-Sep-18	682	0.72							1	***7.33***	1	***7.33***					8	***58.65***			10	***73.31***
		00512	05-Sep-18	539	1.28															24	***125.23***			24	***125.23***
		00513	05-Sep-18	483	0.77															3	***29.04***			3	***29.04***
		00514	05-Sep-18	371	0.56															9	***155.95***			9	***155.95***
		00515	06-Sep-18	684	0.97															104	***564.3***			104	***564.3***
		00516	05-Sep-18	359	0.80							1	***12.53***					1	***12.53***	18	***225.63***			20	***250.7***
		00517	05-Sep-18	725	0.70							1	***7.09***	1	***7.09***					12	***85.12***			14	***99.31***
		005SC060	05-Sep-18	742	0.53															3	***27.46***			3	***27.46***
	Session Summary			**722**	**13.00**	**0**	***0***	**0**	***0***	**0**	***0***	**3**	***1.15***	**5**	***1.92***	**20**	***7.67***	**1**	***0.38***	**324**	***124.27***	**1**	***0.38***	**354**	***135.78***
Section 5	2	00502	13-Sep-18	517	0.95															13	***95.29***			13	***95.29***
		00505	13-Sep-18	1143	1.00															4	***12.6***			4	***12.6***
		00506	13-Sep-18	955	1.00							1	***3.77***			3	***11.31***			6	***22.62***			10	***37.7***
		00507	13-Sep-18	588	0.78															10	***78.49***	2	***15.7***	12	***94.19***
		00508	14-Sep-18	754	0.92									1	***5.16***					25	***129.04***			26	***134.2***
		00509	13-Sep-18	775	0.98									1	***4.76***	3	***14.29***			18	***85.76***	1	***4.76***	23	***109.58***
		00510	14-Sep-18	806	1.13															25	***98.82***	1	***3.95***	26	***102.77***
		00511	14-Sep-18	587	0.72															7	***59.63***			7	***59.63***
		00512	14-Sep-18	801	1.28															19	***66.71***			19	***66.71***
		00513	14-Sep-18	513	0.77															10	***91.14***			10	***91.14***
		00514	14-Sep-18	467	0.56									2	***27.53***	2	***27.53***			16	***220.25***	3	***41.3***	23	***316.61***
		00515	14-Sep-18	670	0.97															56	***310.2***			56	***310.2***
		00516	13-Sep-18	583	0.80															21	***162.09***	1	***7.72***	22	***169.81***
		00517	13-Sep-18	573	0.70									1	***8.98***					15	***134.63***			16	***143.61***
		005SC060	13-Sep-18	679	0.53									6	***60.02***					1	***10***			7	***70.03***
	Session Summary			**694**	**13.10**	**0**	***0***	**0**	***0***	**0**	***0***	**1**	***0.4***	**11**	***4.36***	**8**	***3.17***	**0**	***0***	**246**	***97.41***	**8**	***3.17***	**274**	***108.5***
Section 5	3	00502	20-Sep-18	598	0.80													1	***7.53***	25	***188.13***	1	***7.53***	27	***203.18***
		00505	20-Sep-18	1110	1.00							1	***3.24***							2	***6.49***			3	***9.73***
		00506	20-Sep-18	1103	1.00							1	***3.26***							20	***65.28***			21	***68.54***
		00507	20-Sep-18	542	0.78											2	***17.03***			12	***102.19***			14	***119.22***
		00508	21-Sep-18	794	0.92															41	***200.97***			41	***200.97***
		00509	20-Sep-18	816	0.98															24	***108.6***			24	***108.6***
		00510	22-Sep-18	722	1.13	1	***4.41***									1	***4.41***			27	***119.14***			29	***127.96***
		00511	22-Sep-18	586	0.72															11	***93.86***			11	***93.86***
		00512	22-Sep-18	1409	1.28							1	***2***							38	***75.85***			39	***77.85***
		00513	22-Sep-18	707	0.77															22	***145.48***			22	***145.48***
		00514	22-Sep-18	625	0.56															45	***462.86***			45	***462.86***
		00515	22-Sep-18	909	0.97															19	***77.57***			19	***77.57***
	Session Summary			**827**	**10.90**	**1**	***0.4***	**0**	***0***	**0**	***0***	**3**	***1.2***	**0**	***0***	**3**	***1.2***	**1**	***0.4***	**286**	***114.22***	**1**	***0.4***	**295**	***117.81***

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 5	4	00502	27-Sep-18	366	0.45															5	***109.29***			5	***109.29***
		00505	27-Sep-18	1058	1.00											6	***20.42***					1	***3.4***	7	***23.82***
		00506	27-Sep-18	981	1.00											3	***11.01***			7	***25.69***			10	***36.7***
		00507	27-Sep-18	434	0.77											12	***129.27***			12	***129.27***			24	***258.54***
		00508	28-Sep-18	808	0.92							1	***4.82***							24	***115.6***			25	***120.42***
		00509	27-Sep-18	732	0.98															8	***40.35***			8	***40.35***
		00510	27-Sep-18	852	1.10											30	***115.24***			12	***46.09***	2	***7.68***	44	***169.01***
		00511	28-Sep-18	556	0.72															18	***161.87***			18	***161.87***
		00512	27-Sep-18	1015	1.28															19	***52.65***			19	***52.65***
		00513	28-Sep-18	637	0.77															12	***88.08***			12	***88.08***
		00514	28-Sep-18	493	0.56															17	***221.67***			17	***221.67***
		00515	28-Sep-18	721	0.97															57	***293.41***			57	***293.41***
	Session Summary			**721**	**10.50**	**0**	***0***	**0**	***0***	**0**	***0***	**1**	***0.48***	**0**	***0***	**51**	***24.25***	**0**	***0***	**191**	***90.83***	**3**	***1.43***	**246**	***116.98***
Section 5	5	00507	10-Oct-18	507	0.78															2	***18.21***			2	***18.21***
		00508	10-Oct-18	598	0.92			8	***52.07***															8	***52.07***
		00509	10-Oct-18	552	0.98															3	***20.07***			3	***20.07***
		00511	09-Oct-18	475	0.72															2	***21.05***			2	***21.05***
		00512	10-Oct-18	625	1.28															2	***9***			2	***9***
		00514	10-Oct-18	381	0.56															1	***16.87***			1	***16.87***
		00515	09-Oct-18	525	0.97															43	***303.98***			43	***303.98***
		00517	09-Oct-18	486	0.70															1	***10.58***			1	***10.58***
		005SC060	09-Oct-18	598	0.53															2	***22.72***			2	***22.72***
	Session Summary			**527**	**7.40**	**0**	***0***	**8**	***7.38***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**0**	***0***	**56**	***51.69***	**0**	***0***	**64**	***59.08***
Section Total All Samples				**44566**	**54.98**	**1**	***0***	**8**	***0***	**0**	***0***	**8**	***0***	**16**	***0***	**82**	***0***	**2**	***0***	**1103**	***0***	**13**	***0***	**1233**	***0***
Section Average All Samples				**707**	**0.87**	**0**	***0.09***	**0**	***0.74***	**0**	***0***	**0**	***0.74***	**0**	***1.48***	**1**	***7.6***	**0**	***0.19***	**18**	***102.16***	**0**	***1.2***	**20**	***114.2***
Section Standard Error of Mean						**0.02**	***0.07***	**0.13**	***0.83***	**0**	***0***	**0.04**	***0.27***	**0.11**	***1.06***	**0.59**	***3.72***	**0.02**	***0.23***	**2.15**	***13.39***	**0.07**	***0.73***	**2.18**	***14.14***

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																	
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 6	1	00601	28-Aug-18	991	1.15															15	47.38	1	3.16	16	50.54
		00602	28-Aug-18	621	0.90							1	6.44	3	19.32					5	32.21			9	57.97
		00603	29-Aug-18	843	1.30									4	13.14					106	348.21			110	361.35
		00604	29-Aug-18	817	1.00							7	30.84	2	8.81					49	215.91			58	255.57
		00605	29-Aug-18	524	0.80															49	420.8			49	420.8
		00606	29-Aug-18	995	1.40															130	335.97			130	335.97
		00607	30-Aug-18	795	1.00															231	1046.04			231	1046.04
		00608	29-Aug-18	673	1.00									1	5.35					26	139.08			27	144.43
		00609	29-Aug-18	743	1.00							1	4.85							9	43.61			10	48.45
		00610	30-Aug-18	746	0.85							1	5.68							17	96.51			18	102.19
		00611	29-Aug-18	744	0.90									1	5.38					4	21.51			5	26.88
		00612	30-Aug-18	525	0.85															53	427.56			53	427.56
		00613	30-Aug-18	806	0.90			3	14.89			1	4.96	3	14.89					13	64.52	1	4.96	21	104.22
		00614	28-Aug-18	846	0.98															60	261.87			60	261.87
		006PIN01	28-Aug-18	1352	1.50					1	1.78	3	5.33							14	24.85			18	31.95
		006PIN02	28-Aug-18	681	1.00															14	74.01			14	74.01
		006SC036	30-Aug-18	374	0.35															1	27.5			1	27.5
		006SC047	30-Aug-18	640	0.35									1	16.07					2	32.14			3	48.21
	Session Summary			**762**	**17.20**	**0**	**0**	**3**	**0.82**	**1**	**0.27**	**14**	**3.85**	**15**	**4.12**	**0**	**0**	**0**	**0**	**798**	**219.19**	**2**	**0.55**	**833**	**228.8**
Section 6	2	00601	07-Sep-18	824	1.20															10	36.41			10	36.41
		00603	09-Sep-18	864	1.30															36	115.38			36	115.38
		00604	09-Sep-18	780	1.00							1	4.62			4	18.46			7	32.31			12	55.38
		00605	10-Sep-18	500	0.80					1	9					3	27			6	54			10	90
		00606	10-Sep-18	1049	1.40															46	112.76			46	112.76
		00607	10-Sep-18	844	1.00			1	4.27							3	12.8			80	341.23			84	358.29
		00608	10-Sep-18	595	1.00											4	24.2			18	108.91			22	133.11
		00609	09-Sep-18	776	1.00											2	9.28			17	78.87			19	88.14
		00610	10-Sep-18	764	0.85											4	22.17			25	138.59			29	160.76
		00611	10-Sep-18	770	0.90															27	140.26			27	140.26
		00612	10-Sep-18	571	0.85									2	14.83	1	7.42			44	326.36			47	348.61
		00613	09-Sep-18	847	0.90							1	4.72							6	28.34			7	33.06
		00614	09-Sep-18	629	0.98															42	246.55			42	246.55
		006PIN01	06-Sep-18	1272	1.50					1	1.89	1	1.89							26	49.06			28	52.83
		006PIN02	06-Sep-18	812	1.00							3	13.3	1	4.43	4	17.73			18	79.8			26	115.27
		006SC036	09-Sep-18	448	0.30							1	26.79	1	26.79			2	53.57	11	294.64			15	401.79
		006SC047	09-Sep-18	437	0.43															2	38.32			2	38.32
	Session Summary			**752**	**16.40**	**0**	**0**	**1**	**0.29**	**2**	**0.58**	**7**	**2.04**	**4**	**1.17**	**25**	**7.3**	**2**	**0.58**	**421**	**122.89**	**0**	**0**	**462**	**134.86**
Section 6	3	00601	15-Sep-18	973	1.20											1	3.08			9	27.75			10	30.83
		00602	15-Sep-18	619	0.90	1	6.46													1	6.46			2	12.92
		00603	15-Sep-18	1027	1.30															43	115.95			43	115.95
		00604	17-Sep-18	748	1.00							2	9.63			1	4.81			8	38.5			11	52.94
		00605	17-Sep-18	557	0.80											1	8.08			71	573.61			72	581.69
		00606	17-Sep-18	1045	1.40															55	135.34			55	135.34
		00607	18-Sep-18	793	1.00															108	490.29			108	490.29
		00608	17-Sep-18	550	1.00											2	13.09			4	26.18			6	39.27
		00609	17-Sep-18	709	1.00			1	5.08											17	86.32	1	5.08	19	96.47
		00610	17-Sep-18	718	0.85							1	5.9									1	5.9	2	11.8
		00611	17-Sep-18	742	0.90															3	16.17			3	16.17
		00612	18-Sep-18	562	0.85															18	135.65			18	135.65
		00613	18-Sep-18	779	0.90													1	5.13	12	61.62			13	66.75
		00614	15-Sep-18	847	0.98															57	248.48			57	248.48
		006PIN01	15-Sep-18	1487	1.50															6	9.68			6	9.68
		006PIN02	15-Sep-18	511	1.00															1	7.05			1	7.05
	Session Summary			**792**	**16.60**	**1**	**0.27**	**1**	**0.27**	**0**	**0**	**3**	**0.82**	**0**	**0**	**5**	**1.37**	**1**	**0.27**	**413**	**113.09**	**2**	**0.55**	**426**	**116.65**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 6	4	00601	24-Sep-18	842	1.15															35	130.12			35	130.12
		00602	24-Sep-18	559	0.90															2	14.31			2	14.31
		00603	24-Sep-18	978	1.30											1	2.83			58	164.23			59	167.06
		00604	25-Sep-18	697	1.00															7	36.15			7	36.15
		00605	25-Sep-18	481	0.80							2	18.71							58	542.62			60	561.33
		00606	25-Sep-18	993	1.40															124	321.1			124	321.1
		00607	25-Sep-18	772	1.00															124	578.24			124	578.24
		00608	25-Sep-18	563	1.00															17	108.7			17	108.7
		00609	25-Sep-18	586	1.00															13	79.86			13	79.86
		00610	25-Sep-18	730	0.85															17	98.63			17	98.63
		00611	25-Sep-18	666	0.90															16	96.1			16	96.1
		00612	26-Sep-18	526	0.85															64	515.32			64	515.32
		00613	26-Sep-18	735	0.90															14	76.19	1	5.44	15	81.63
		00614	24-Sep-18	802	0.98							1	4.6							74	340.69			75	345.29
		006PIN01	24-Sep-18	1007	1.50															8	19.07			8	19.07
		006PIN02	24-Sep-18	614	1.00															2	11.73	1	5.86	3	17.59
		006SC047	26-Sep-18	383	0.30															2	62.66	2	62.66	4	125.33
	Session Summary			**702**	**16.80**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0.92**	**0**	**0**	**1**	**0.31**	**0**	**0**	**635**	**193.83**	**4**	**1.22**	**643**	**196.28**
Section 6	5	00601	01-Oct-18	686	1.20															32	139.94			32	139.94
		00603	01-Oct-18	742	1.30															85	317.23	2	7.46	87	324.69
		00604	01-Oct-18	648	1.00															9	50			9	50
		00605	01-Oct-18	487	0.80															57	526.69			57	526.69
		00606	01-Oct-18	930	1.40							2	5.53							68	188.02	1	2.76	71	196.31
		00607	03-Oct-18	864	1.00							1	4.17							168	700			169	704.17
		00608	01-Oct-18	580	1.00					1	6.21									7	43.45			8	49.66
		00609	01-Oct-18	795	1.00															20	90.57			20	90.57
		00610	03-Oct-18	620	0.85															5	34.16			5	34.16
		00611	03-Oct-18	593	0.90															3	20.24			3	20.24
		00612	03-Oct-18	592	0.85															39	279.01			39	279.01
		00613	03-Oct-18	703	0.90			1	5.69			1	5.69			2	11.38			14	79.66	2	11.38	20	113.8
		00614	01-Oct-18	714	0.98															45	232.71	1	5.17	46	237.88
		006PIN01	01-Oct-18	1341	1.49															1	1.8	1	1.8	2	3.6
		006PIN02	01-Oct-18	568	1.00															1	6.34			1	6.34
		006SC036	03-Oct-18	476	0.31															31	756.3			31	756.3
	Session Summary			**709**	**16.00**	**0**	**0**	**1**	**0.32**	**1**	**0.32**	**4**	**1.27**	**0**	**0**	**2**	**0.63**	**0**	**0**	**585**	**185.65**	**7**	**2.22**	**600**	**190.41**
Section Total All Samples				**62438**	**83.00**	**1**	**0**	**6**	**0**	**4**	**0**	**31**	**0**	**19**	**0**	**33**	**0**	**3**	**0**	**2852**	**0**	**15**	**0**	**2964**	**0**
Section Average All Samples				**743**	**0.99**	**0**	**0.06**	**0**	**0.35**	**0**	**0.23**	**0**	**1.81**	**0**	**1.11**	**0**	**1.93**	**0**	**0.18**	**34**	**166.48**	**0**	**0.88**	**35**	**173.02**
Section Standard Error of Mean						**0.01**	**0.08**	**0.04**	**0.2**	**0.02**	**0.13**	**0.11**	**0.57**	**0.08**	**0.52**	**0.11**	**0.63**	**0.03**	**0.64**	**4.47**	**21.95**	**0.05**	**0.77**	**4.46**	**21.94**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Flathead Chub No.	Flathead Chub CPUE	Lake Chub No.	Lake Chub CPUE	Longnose Dace No.	Longnose Dace CPUE	Northern Pikeminnow No.	Northern Pikeminnow CPUE	Redside Shiner No.	Redside Shiner CPUE	Sculpin spp. No.	Sculpin spp. CPUE	Spottail Shiner No.	Spottail Shiner CPUE	Sucker spp. No.	Sucker spp. CPUE	Troutperch No.	Troutperch CPUE	All Species No.	All Species CPUE
Section 7	1	00701	03-Sep-18	782	0.78															17	99.7			17	99.7
		00702	03-Sep-18	670	0.95															3	16.97			3	16.97
		00703	03-Sep-18	995	0.95							4	15.23	1	3.81					72	274.21			77	293.26
		00704	04-Sep-18	521	1.00							1	6.91							209	1444.15			210	1451.06
		00705	04-Sep-18	535	1.00							2	13.46							26	174.95			28	188.41
		00706	04-Sep-18	852	1.00							1	4.23							6	25.35			7	29.58
		00707	04-Sep-18	678	0.98															24	130.03			24	130.03
		00708	03-Sep-18	711	1.24							1	4.08	3	12.25					102	416.5			106	432.83
		00709	03-Sep-18	970	1.00															25	92.78			25	92.78
		00710	04-Sep-18	931	1.40															23	63.53			23	63.53
		00711	04-Sep-18	718	1.39							1	3.61							70	252.5			71	256.11
		00712	04-Sep-18	726	1.06															25	116.4			25	116.4
		00713	04-Sep-18	500	0.98															40	293.88			40	293.88
		00714	04-Sep-18	680	1.27															39	161.94			39	161.94
		007BEA01	03-Sep-18	1185	0.32									3	28.48					15	142.41	2	18.99	20	189.87
		007BEA02	03-Sep-18	523	0.60									12	137.67					30	344.17			42	481.84
		007SC012	03-Sep-18	999	0.22							1	16.38	40	655.2					23	376.74			64	1048.32
		007SC022	03-Sep-18	450	0.36							1	22.22	54	1200					2	44.44			57	1266.67
	Session Summary			**746**	**16.50**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**3.51**	**113**	**33.05**	**0**	**0**	**0**	**0**	**751**	**219.64**	**2**	**0.58**	**878**	**256.79**
Section 7	2	00701	10-Sep-18	735	0.78											1	6.24			14	87.35			15	93.59
		00702	11-Sep-18	557	0.95							1	6.8			3	20.41			13	88.44			17	115.66
		00703	11-Sep-18	711	0.95	1	5.33					1	5.33							45	239.84			47	250.5
		00704	11-Sep-18	645	1.00							1	5.58							26	145.12	1	5.58	28	156.28
		00705	11-Sep-18	770	1.00															5	23.38			5	23.38
		00706	11-Sep-18	1013	1.00															12	42.65			12	42.65
		00707	12-Sep-18	749	0.98															19	93.19			19	93.19
		00708	11-Sep-18	762	1.24	1	3.81													15	57.15			16	60.96
		00709	11-Sep-18	665	1.00							2	10.83			2	10.83			26	140.75			30	162.41
		00710	12-Sep-18	995	1.40									1	2.58					45	116.3			46	118.88
		00711	12-Sep-18	943	1.39			6	16.48			2	5.49	1	2.75					16	43.94			25	68.66
		00712	12-Sep-18	896	1.06			4	15.09											32	120.72			36	135.81
		00713	12-Sep-18	557	0.98															12	79.14			12	79.14
		00714	12-Sep-18	924	1.27															32	97.78			32	97.78
		007BEA01	10-Sep-18	470	0.38															3	60.47			3	60.47
		007BEA02	11-Sep-18	291	0.60							1	20.62							4	82.47			5	103.09
		007KIS01	12-Sep-18	446	0.84							1	9.61							4	38.44			5	48.05
		007SC012	12-Sep-18	384	0.22															1	42.61			1	42.61
		007SC022	11-Sep-18	505	0.36															1	19.8			1	19.8
	Session Summary			**685**	**17.40**	**2**	**0.6**	**10**	**3.02**	**0**	**0**	**9**	**2.72**	**2**	**0.6**	**6**	**1.81**	**0**	**0**	**325**	**98.16**	**1**	**0.3**	**355**	**107.22**
Section 7	3	00701	18-Sep-18	820	0.78															22	123.04			22	123.04
		00702	19-Sep-18	762	0.95															4	19.89			4	19.89
		00703	18-Sep-18	882	0.95							1	4.3							20	85.93			21	90.23
		00704	19-Sep-18	769	1.00							1	4.68							66	308.97			67	313.65
		00705	19-Sep-18	85	1.00															3	127.06			3	127.06
		00706	19-Sep-18	1193	1.00							1	3.02							9	27.16			10	30.18
		00707	19-Sep-18	706	0.98															37	192.52			37	192.52
		00708	18-Sep-18	770	1.24							1	3.77							26	98.03			27	101.8
		00709	19-Sep-18	930	1.00															13	50.32			13	50.32
		00710	19-Sep-18	1037	1.35															23	59.14			23	59.14
		00711	19-Sep-18	904	1.19															26	87.01			26	87.01
		00712	19-Sep-18	817	1.06															10	41.37			10	41.37
		00713	21-Sep-18	655	0.98															44	246.77			44	246.77
		00714	21-Sep-18	987	1.27															60	171.64			60	171.64
		007BEA01	21-Sep-18	799	0.43															3	31.43			3	31.43
		007BEA02	21-Sep-18	622	0.60	1	9.65													4	38.59			5	48.23
		007KIS01	21-Sep-18	686	0.51	1	10.29					1	10.29							8	82.32	1	10.29	11	113.19
		007SC012	21-Sep-18	575	0.22									1	28.46					4	113.83			5	142.29
		007SC022	18-Sep-18	467	0.36													1	21.41					1	21.41
	Session Summary			**761**	**16.90**	**2**	**0.56**	**0**	**0**	**0**	**0**	**5**	**1.4**	**1**	**0.28**	**0**	**0**	**1**	**0.28**	**382**	**106.93**	**1**	**0.28**	**392**	**109.73**

Number Caught (CPUE = no. fish/km/h)

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 7	4	00701	26-Sep-18	846	0.78															5	27.1			5	27.1
		00702	26-Sep-18	685	0.95							2	11.06							10	55.32			12	66.38
		00703	26-Sep-18	853	0.95							4	17.77							57	253.22			61	270.99
		00704	28-Sep-18	732	1.00															143	703.28			143	703.28
		00705	28-Sep-18	794	1.00															9	40.81			9	40.81
		00706	28-Sep-18	1130	0.90											3	10.62			1	3.54			4	14.16
		00707	29-Sep-18	699	0.98											2	10.51			11	57.81	1	5.26	14	73.57
		00708	26-Sep-18	782	1.24							1	3.71							21	77.96			22	81.68
		00709	26-Sep-18	857	1.00															13	54.61			13	54.61
		00710	29-Sep-18	1275	1.20															2	4.71			2	4.71
		00711	29-Sep-18	986	1.39															37	97.19			37	97.19
		00712	29-Sep-18	998	1.06															12	40.64			12	40.64
		00713	29-Sep-18	495	0.98															69	512.06			69	512.06
		00714	29-Sep-18	1050	1.27															41	110.25			41	110.25
		007BEA01	29-Sep-18	235	0.23																	5	333.02	5	333.02
		007BEA02	26-Sep-18	494	0.60							1	12.15							12	145.75	1	12.15	14	170.04
		007KIS01	29-Sep-18	371	0.74							1	13.11							1	13.11			2	26.23
		007SC012	29-Sep-18	491	0.22															1	33.33			1	33.33
		007SC022	26-Sep-18	492	0.36									14	284.55					1	20.33			15	304.88
	Session Summary			**751**	**16.90**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**2.55**	**14**	**3.97**	**5**	**1.42**	**0**	**0**	**446**	**126.51**	**7**	**1.99**	**481**	**136.43**
Section 7	5	00701	03-Oct-18	807	0.78															23	130.7	1	5.68	24	136.39
		00702	04-Oct-18	490	0.95															4	30.93			4	30.93
		00703	04-Oct-18	764	0.95							2	9.92							43	213.28			45	223.2
		00704	04-Oct-18	620	1.00															113	656.13			113	656.13
		00705	04-Oct-18	609	1.00															4	23.65			4	23.65
		00706	04-Oct-18	851	1.00			1	4.23											2	8.46			3	12.69
		00707	04-Oct-18	604	0.98															13	79.06			13	79.06
		00708	04-Oct-18	703	1.24															14	57.82			14	57.82
		00709	04-Oct-18	598	1.00															11	66.22			11	66.22
		00710	04-Oct-18	868	1.40															11	32.59			11	32.59
		00711	04-Oct-18	771	1.39															12	40.31			12	40.31
		00712	04-Oct-18	706	1.06															4	19.15			4	19.15
		00714	09-Oct-18	881	1.27															26	83.33			26	83.33
		007BEA01	04-Oct-18	310	0.43															2	54.01			2	54.01
		007BEA02	04-Oct-18	568	0.60															4	42.25			4	42.25
		007KIS01	09-Oct-18	526	0.84															4	32.59			4	32.59
		007SC022	04-Oct-18	349	0.36									25	716.33									25	716.33
	Session Summary			**649**	**16.30**	**0**	**0**	**1**	**0.34**	**0**	**0**	**2**	**0.68**	**25**	**8.51**	**0**	**0**	**0**	**0**	**290**	**98.69**	**1**	**0.34**	**319**	**108.56**
Section Total All Samples				**66200**	**83.94**	**4**	**0**	**11**	**0**	**0**	**0**	**37**	**0**	**155**	**0**	**11**	**0**	**1**	**0**	**2194**	**0**	**12**	**0**	**2425**	**0**
Section Average All Samples				**720**	**0.91**	**0**	**0.24**	**0**	**0.66**	**0**	**0**	**0**	**2.2**	**2**	**9.23**	**0**	**0.66**	**0**	**0.06**	**24**	**130.68**	**0**	**0.71**	**26**	**144.44**
Section Standard Error of Mean						**0.02**	**0.17**	**0.08**	**0.25**	**0**	**0**	**0.08**	**0.54**	**0.79**	**16.87**	**0.06**	**0.3**	**0.01**	**0.23**	**3.33**	**19.76**	**0.06**	**3.62**	**3.37**	**25.99**

Table E4 Continued.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h)																			
						Flathead Chub		Lake Chub		Longnose Dace		Northern Pikeminnow		Redside Shiner		Sculpin spp.		Spottail Shiner		Sucker spp.		Troutperch		All Species	
						No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE	No.	CPUE
Section 9	1	00901	02-Sep-18	703	1.10															5	23.28			5	23.28
		00902	02-Sep-18	967	1.00							5	18.61							14	52.12			19	70.73
		00903	02-Sep-18	793	1.00															3	13.62			3	13.62
		00904	02-Sep-18	872	1.10	1	3.75	1	3.75											2	7.51			4	15.01
		00905	02-Sep-18	1015	1.10			1	3.22											14	45.14			15	48.37
		00906	02-Sep-18	835	1.00	2	8.62													3	12.93			5	21.56
		00907	02-Sep-18	1069	1.20							1	2.81							16	44.9			17	47.71
		00908	01-Sep-18	685	1.10															1	4.78			1	4.78
		00909	01-Sep-18	681	0.95															4	22.26			4	22.26
		00910	02-Sep-18	1127	1.10									9	26.14					16	46.46			25	72.6
		00911	01-Sep-18	655	1.00							1	5.5							21	115.42			22	120.92
		00912	01-Sep-18	752	0.65	1	7.36							4	29.46					15	110.47			20	147.3
		00913	01-Sep-18	589	0.90							1	6.79							5	33.96			6	40.75
		00914	02-Sep-18	601	0.95															9	56.75			9	56.75
		009SC061	01-Sep-18	614	0.68	2	17.37	2	17.37											5	43.43			9	78.18
	Session Summary			**797**	**14.80**	**6**	**1.83**	**4**	**1.22**	**0**	**0**	**8**	**2.44**	**13**	**3.97**	**0**	**0**	**0**	**0**	**133**	**40.59**	**0**	**0**	**164**	**50.05**
Section 9	2	00902	17-Sep-18	965	1.00															1	3.73			1	3.73
		00903	17-Sep-18	845	1.10															4	15.49			4	15.49
		00904	17-Sep-18	660	1.10															1	4.96			1	4.96
		00905	17-Sep-18	959	1.10							2	6.83							13	44.36			15	51.19
		00906	17-Sep-18	1003	1.00															7	25.12			7	25.12
		00907	17-Sep-18	891	1.20															15	50.51			15	50.51
		00908	18-Sep-18	751	1.10							1	4.36							5	21.79			6	26.15
		00909	18-Sep-18	763	0.95															3	14.9			3	14.9
		00910	17-Sep-18	1151	1.10															22	62.55			22	62.55
		00911	18-Sep-18	720	1.00											2	10			2	10			4	20
		00912	18-Sep-18	614	1.10															19	101.27			19	101.27
		00914	18-Sep-18	537	0.95															1	7.06			1	7.06
		009SC061	18-Sep-18	699	0.68			1	7.63											11	83.93	1	7.63	13	99.19
	Session Summary			**812**	**13.40**	**0**	**0**	**1**	**0.33**	**0**	**0**	**3**	**0.99**	**0**	**0**	**2**	**0.66**	**0**	**0**	**104**	**34.41**	**1**	**0.33**	**111**	**36.73**
Section 9	3	00901	23-Sep-18	771	1.10															5	21.22			5	21.22
		00902	23-Sep-18	855	1.00															5	21.05			5	21.05
		00903	23-Sep-18	1057	1.10					6	18.58					1	3.1			21	65.02			28	86.69
		00904	23-Sep-18	856	1.10															3	11.47			3	11.47
		00906	23-Sep-18	996	1.00															19	68.67			19	68.67
		00907	23-Sep-18	1064	1.20															34	95.86			34	95.86
		00908	23-Sep-18	695	1.10															8	37.67			8	37.67
		00909	23-Sep-18	699	0.95															6	32.53			6	32.53
		00910	23-Sep-18	894	1.10															14	51.25			14	51.25
		00911	23-Sep-18	570	1.00															7	44.21			7	44.21
		00912	23-Sep-18	576	0.55															8	90.91			8	90.91
		00913	23-Sep-18	519	0.90															5	38.54			5	38.54
		00914	23-Sep-18	591	0.95															2	12.82			2	12.82
	Session Summary			**780**	**13.10**	**0**	**0**	**0**	**0**	**6**	**2.11**	**0**	**0**	**0**	**0**	**1**	**0.35**	**0**	**0**	**137**	**48.27**	**0**	**0**	**144**	**50.73**

Table E4 Concluded.

Section	Session	Site	Date	Time Sampled (s)	Length Sampled (km)	Number Caught (CPUE = no. fish/km/h) Flathead Chub No.	Flathead Chub CPUE	Lake Chub No.	Lake Chub CPUE	Longnose Dace No.	Longnose Dace CPUE	Northern Pikeminnow No.	Northern Pikeminnow CPUE	Redside Shiner No.	Redside Shiner CPUE	Sculpin spp. No.	Sculpin spp. CPUE	Spottail Shiner No.	Spottail Shiner CPUE	Sucker spp. No.	Sucker spp. CPUE	Troutperch No.	Troutperch CPUE	All Species No.	All Species CPUE
Section 9	4	00901	28-Sep-18	790	1.10											1	***4.14***			6	***24.86***			7	***29***
		00902	28-Sep-18	1170	1.00															15	***46.15***			15	***46.15***
		00903	28-Sep-18	1094	1.10											4	***11.97***			37	***110.69***			41	***122.65***
		00904	28-Sep-18	951	1.10	1	***3.44***													4	***13.77***			5	***17.21***
		00905	28-Sep-18	1168	1.10							1	***2.8***			1	***2.8***			24	***67.25***			26	***72.85***
		00906	28-Sep-18	973	1.00															6	***22.2***			6	***22.2***
		00907	29-Sep-18	974	1.20															5	***15.4***			5	***15.4***
		00908	29-Sep-18	785	1.10															2	***8.34***			2	***8.34***
		00910	29-Sep-18	1146	1.10															6	***17.13***			6	***17.13***
		00911	29-Sep-18	647	1.00															21	***116.85***			21	***116.85***
		00912	29-Sep-18	383	0.46															16	***326.94***			16	***326.94***
		00913	29-Sep-18	614	0.90															3	***19.54***			3	***19.54***
		00914	29-Sep-18	500	0.95															2	***15.16***			2	***15.16***
	Session Summary			**861**	**13.10**	**1**	***0.32***	**0**	***0***	**0**	***0***	**1**	***0.32***	**0**	***0***	**6**	***1.92***	**0**	***0***	**147**	***46.92***	**0**	***0***	**155**	***49.47***
Section 9	5	00901	08-Oct-18	728	1.10															7	***31.47***			7	***31.47***
		00902	08-Oct-18	644	1.00															5	***27.95***			5	***27.95***
		00903	08-Oct-18	690	1.10															5	***23.72***			5	***23.72***
		00905	08-Oct-18	735	1.10															13	***57.88***			13	***57.88***
		00906	08-Oct-18	825	1.00															6	***26.18***			6	***26.18***
		00907	08-Oct-18	682	1.20															4	***17.6***			4	***17.6***
		00908	08-Oct-18	478	1.10															2	***13.69***			2	***13.69***
		00910	08-Oct-18	706	1.10															4	***18.54***			4	***18.54***
		00911	08-Oct-18	503	1.00															4	***28.63***			4	***28.63***
		00912	08-Oct-18	667	1.10															1	***4.91***			1	***4.91***
		00913	08-Oct-18	529	0.90							1	***7.56***											1	***7.56***
		009SC053	08-Oct-18	309	0.26															11	***492.91***			11	***492.91***
	Session Summary			**625**	**12.00**	**0**	***0***	**0**	***0***	**0**	***0***	**1**	***0.48***	**0**	***0***	**0**	***0***	**0**	***0***	**62**	***29.76***	**0**	***0***	**63**	***30.24***
Section Total All Samples				**51350**	**66.32**	**7**	***0***	**5**	***0***	**6**	***0***	**13**	***0***	**13**	***0***	**9**	***0***	**0**	***0***	**583**	***0***	**1**	***0***	**637**	***0***
Section Average All Samples				**778**	**1.00**	**0**	***0.49***	**0**	***0.35***	**0**	***0.42***	**0**	***0.91***	**0**	***0.91***	**0**	***0.63***	**0**	***0***	**9**	***40.68***	**0**	***0.07***	**10**	***44.44***
Section Standard Error of Mean						**0.05**	***0.32***	**0.04**	***0.29***	**0.09**	***0.28***	**0.09**	***0.35***	**0.15**	***0.59***	**0.07**	***0.25***	**0**	***0***	**0.97**	***8.93***	**0.02**	***0.12***	**1.06**	***9.04***
All Sections Total All Samples				**328690**	**434.62**	***11430***	***0.29***	***16***	***0***	***35***	***0***	***10***	***0***	***130***	***0***	***336***	***0.01***	***1129***	***0.03***	***6***	***0***	***9727***	***0.25***	***41***	***0***
All Sections Average All Samples						***26***	***125.87***	***0***	***0.18***	***0***	***0.39***	***0***	***0.11***	***0***	***1.43***	***1***	***3.7***	***3***	***12.43***	***0***	***0.07***	***22***	***107.12***	***0***	***0.45***
All Sections Standard Error of Mean						***1.58***	***9.14***	***0.01***	***0.06***	***0.03***	***0.14***	***0.01***	***0.05***	***0.05***	***0.21***	***0.21***	***3.62***	***0.46***	***3.97***	***0.01***	***0.14***	***1.52***	***7.61***	***0.02***	***0.78***

Table E5 Summary of the number (N) of fish captured and recaptured in sampled sections of the Peace River, 27 August to 10 October 2018.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Arctic Grayling	Section 1	1	0	0	-	0
		2	3	1	0	1
		3	0	0	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 1 subtotal		3	1	0	1
	Section 3	1	0	0	-	0
		2	14	12	0	2
		3	13	9	2	2
		4	4	4	0	0
		5	7	7	0	0
	Section 3 subtotal		38	32	2	4
	Section 5	1	1	1	-	0
		2	4	3	0	1
		3	4	3	0	1
		4	0	0	0	0
		5	1	1	0	0
	Section 5 subtotal		10	8	0	2
	Section 6	1	1	1	-	0
		2	2	1	0	1
		3	0	0	0	0
		4	0	0	0	0
		5	2	2	0	0
	Section 6 subtotal		5	4	0	1
	Section 7	1	1	1	-	0
		2	0	0	0	0
		3	0	0	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 7 subtotal		1	1	0	0
	Section 9	1	0	0	-	0
		2	0	0	0	0
		3	0	0	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 9 subtotal		0	0	0	0
Arctic Grayling Total			57	46	2	8

Continued...

Table E5 Continued.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Bull Trout	Section 1	1	4	3	-	1
		2	18	14	1	3
		3	6	6	0	0
		4	13	12	0	1
		5	17	15	1	1
	Section 1 subtotal		58	50	2	6
	Section 3	1	12	10	-	2
		2	12	7	2	3
		3	14	11	1	2
		4	25	19	5	1
		5	23	18	3	2
	Section 3 subtotal		86	65	11	10
	Section 5	1	6	5	-	1
		2	13	11	1	1
		3	9	6	0	3
		4	10	5	3	2
		5	3	1	1	1
	Section 5 subtotal		41	28	5	8
	Section 6	1	2	2	-	0
		2	4	2	2	0
		3	6	6	0	0
		4	9	7	0	2
		5	8	7	0	1
	Section 6 subtotal		29	24	2	3
	Section 7	1	2	2	-	0
		2	0	0	0	0
		3	1	1	0	0
		4	6	6	0	0
		5	5	5	0	0
	Section 7 subtotal		14	14	0	0
	Section 9	1	0	0	-	0
		2	1	1	0	0
		3	1	1	0	0
		4	4	2	1	1
		5	1	1	0	0
	Section 9 subtotal		7	5	1	1
Bull Trout Total			235	186	21	28

Continued...

Table E5 Continued.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Largescale Sucker	Section 1	1	1	1	-	0
		2	27	26	0	1
		3	0	0	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 1 subtotal		28	27	0	1
	Section 3	1	78	76	-	2
		2	68	61	4	3
		3	43	40	1	2
		4	43	41	1	1
		5	23	17	2	4
	Section 3 subtotal		255	235	8	12
	Section 5	1	28	26	-	2
		2	34	32	1	1
		3	33	30	1	2
		4	15	14	0	1
		5	1	1	0	0
	Section 5 subtotal		111	103	2	6
	Section 6	1	58	51	-	7
		2	70	64	2	4
		3	37	31	2	4
		4	29	23	2	4
		5	43	35	3	5
	Section 6 subtotal		237	204	9	24
	Section 7	1	76	73	-	3
		2	27	18	5	4
		3	43	39	4	0
		4	37	30	5	2
		5	11	8	1	2
	Section 7 subtotal		194	168	15	11
	Section 9	1	13	12	-	1
		2	16	16	0	0
		3	24	24	0	0
		4	20	16	3	1
		5	1	1	0	0
	Section 9 subtotal		74	69	3	2
Largescale Sucker Total			899	806	37	56

Continued...

Table E5 Continued.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Longnose Sucker	Section 1	1	9	9	-	0
		2	69	64	0	5
		3	3	3	0	0
		4	4	4	0	0
		5	8	8	0	0
	Section 1 subtotal		93	88	0	5
	Section 3	1	469	420	-	38
		2	249	211	12	26
		3	106	90	4	12
		4	163	137	13	13
		5	47	42	0	5
	Section 3 subtotal		1034	900	40	94
	Section 5	1	139	122	-	15
		2	70	63	0	7
		3	77	68	1	8
		4	37	34	1	2
		5	6	4	0	2
	Section 5 subtotal		329	291	4	34
	Section 6	1	279	256	-	21
		2	163	140	7	16
		3	158	138	6	14
		4	189	173	7	9
		5	136	113	10	13
	Section 6 subtotal		925	820	32	73
	Section 7	1	370	343	-	26
		2	149	137	2	10
		3	155	136	9	10
		4	121	110	7	4
		5	82	79	1	2
	Section 7 subtotal		877	805	20	52
	Section 9	1	85	66	-	9
		2	52	48	0	4
		3	65	57	1	7
		4	79	71	0	8
		5	21	18	0	3
	Section 9 subtotal		302	260	1	31
Longnose Sucker Total			3560	3164	97	289

Continued...

Table E5 Continued.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Mountain Whitefish	Section 1	1	360	317	-	43
		2	691	578	6	104
		3	329	280	10	38
		4	347	302	8	37
		5	384	323	11	50
	Section 1 subtotal		2111	1800	35	272
	Section 3	1	504	401	-	91
		2	818	589	51	178
		3	1131	844	104	182
		4	1074	795	136	143
		5	1076	797	146	133
	Section 3 subtotal		4603	3426	449	727
	Section 5	1	202	164	-	35
		2	383	293	28	62
		3	585	457	56	72
		4	296	233	35	27
		5	281	233	20	28
	Section 5 subtotal		1747	1380	142	224
	Section 6	1	199	151	-	43
		2	270	210	9	47
		3	564	432	50	82
		4	721	567	67	87
		5	570	454	58	58
	Section 6 subtotal		2324	1814	188	317
	Section 7	1	201	167	-	32
		2	167	137	14	16
		3	253	198	27	28
		4	229	190	22	17
		5	194	169	12	13
	Section 7 subtotal		1044	861	77	106
	Section 9	1	108	94	-	9
		2	92	82	0	10
		3	97	83	7	7
		4	91	66	16	9
		5	15	13	2	0
	Section 9 subtotal		403	338	25	35
Mountain Whitefish Total			12232	9619	916	1681

Continued...

Table E5 Continued.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
Rainbow Trout	Section 1	1	6	6	-	0
		2	27	24	0	3
		3	7	7	0	0
		4	11	11	0	0
		5	12	12	0	0
	Section 1 subtotal		63	60	0	3
	Section 3	1	12	10	-	2
		2	30	22	1	7
		3	18	12	4	2
		4	6	5	1	0
		5	8	5	2	1
	Section 3 subtotal		74	54	8	12
	Section 5	1	1	1	-	0
		2	5	4	0	1
		3	4	2	2	0
		4	3	1	1	1
		5	2	1	1	0
	Section 5 subtotal		15	9	4	2
	Section 6	1	1	1	-	0
		2	1	1	0	0
		3	0	0	0	0
		4	0	0	0	0
		5	1	0	1	0
	Section 6 subtotal		3	2	1	0
	Section 7	1	1	1	-	0
		2	1	1	0	0
		3	1	1	0	0
		4	1	1	0	0
		5	0	0	0	0
	Section 7 subtotal		4	4	0	0
	Section 9	1	0	0	-	0
		2	0	0	0	0
		3	0	0	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 9 subtotal		0	0	0	0
Rainbow Trout Total			159	129	13	17

Continued...

Table E5 Concluded.

Species Name	Section	Session	N Captured	N Marked	N Recaptured (within year)	N Recaptured (between years)
White Sucker	Section 1	1	4	4	-	0
		2	8	8	0	0
		3	1	1	0	0
		4	0	0	0	0
		5	0	0	0	0
	Section 1 subtotal		13	13	0	0
	Section 3	1	6	6	-	0
		2	5	5	0	0
		3	0	0	0	0
		4	1	1	0	0
		5	2	2	0	0
	Section 3 subtotal		14	14	0	0
	Section 5	1	6	6	-	0
		2	1	1	0	0
		3	2	2	0	0
		4	3	3	0	0
		5	1	1	0	0
	Section 5 subtotal		13	13	0	0
	Section 6	1	6	6	-	0
		2	5	4	0	1
		3	1	1	0	0
		4	4	4	0	0
		5	14	12	0	2
	Section 6 subtotal		30	27	0	3
	Section 7	1	12	12	-	0
		2	6	6	0	0
		3	7	6	1	0
		4	5	5	0	0
		5	5	5	0	0
	Section 7 subtotal		35	34	1	0
	Section 9	1	8	7	-	1
		2	19	17	1	1
		3	7	6	1	0
		4	8	7	1	0
		5	2	2	0	0
	Section 9 subtotal		44	39	3	2
White Sucker Total			149	140	4	5

APPENDIX F

Life History Information

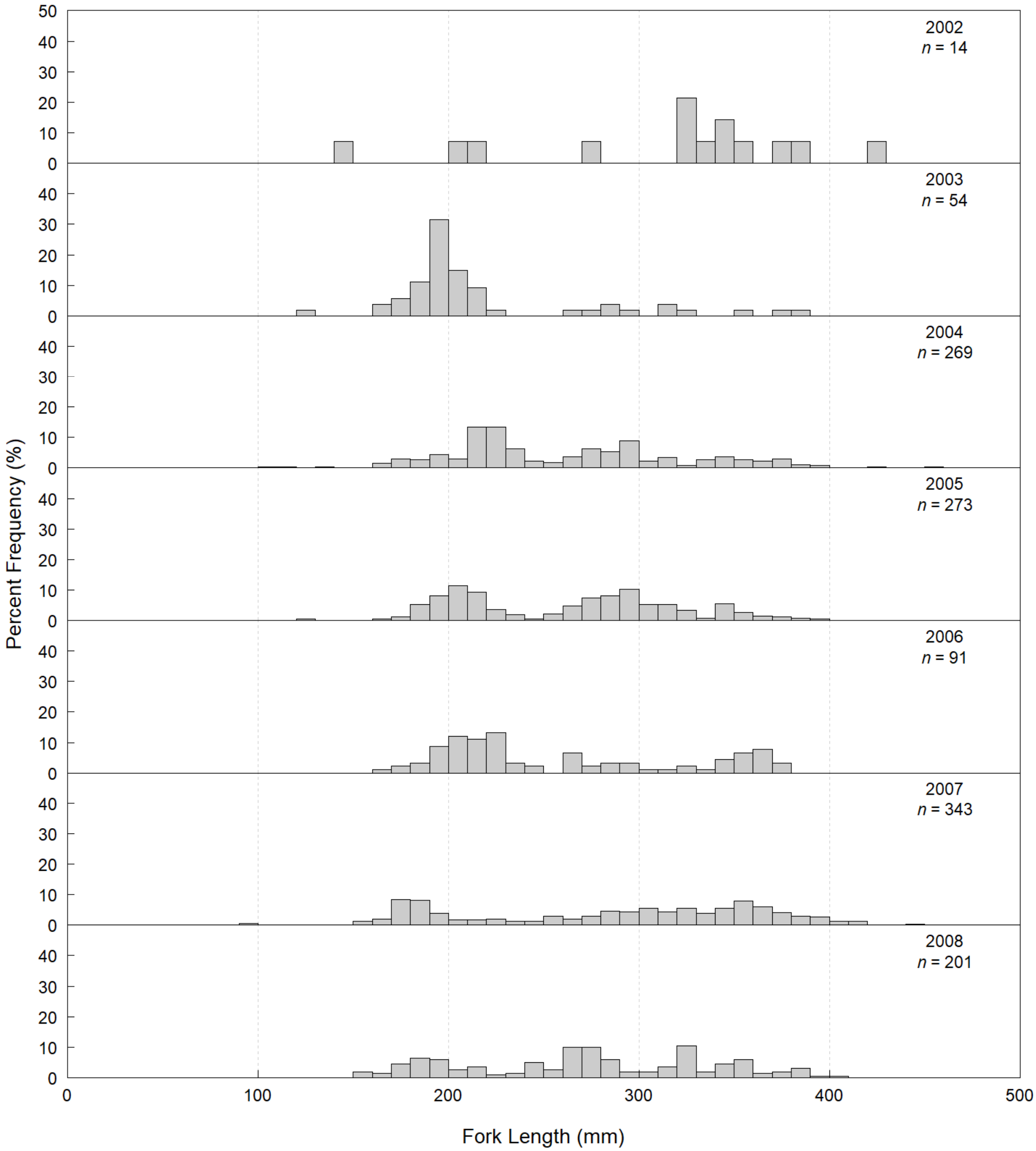
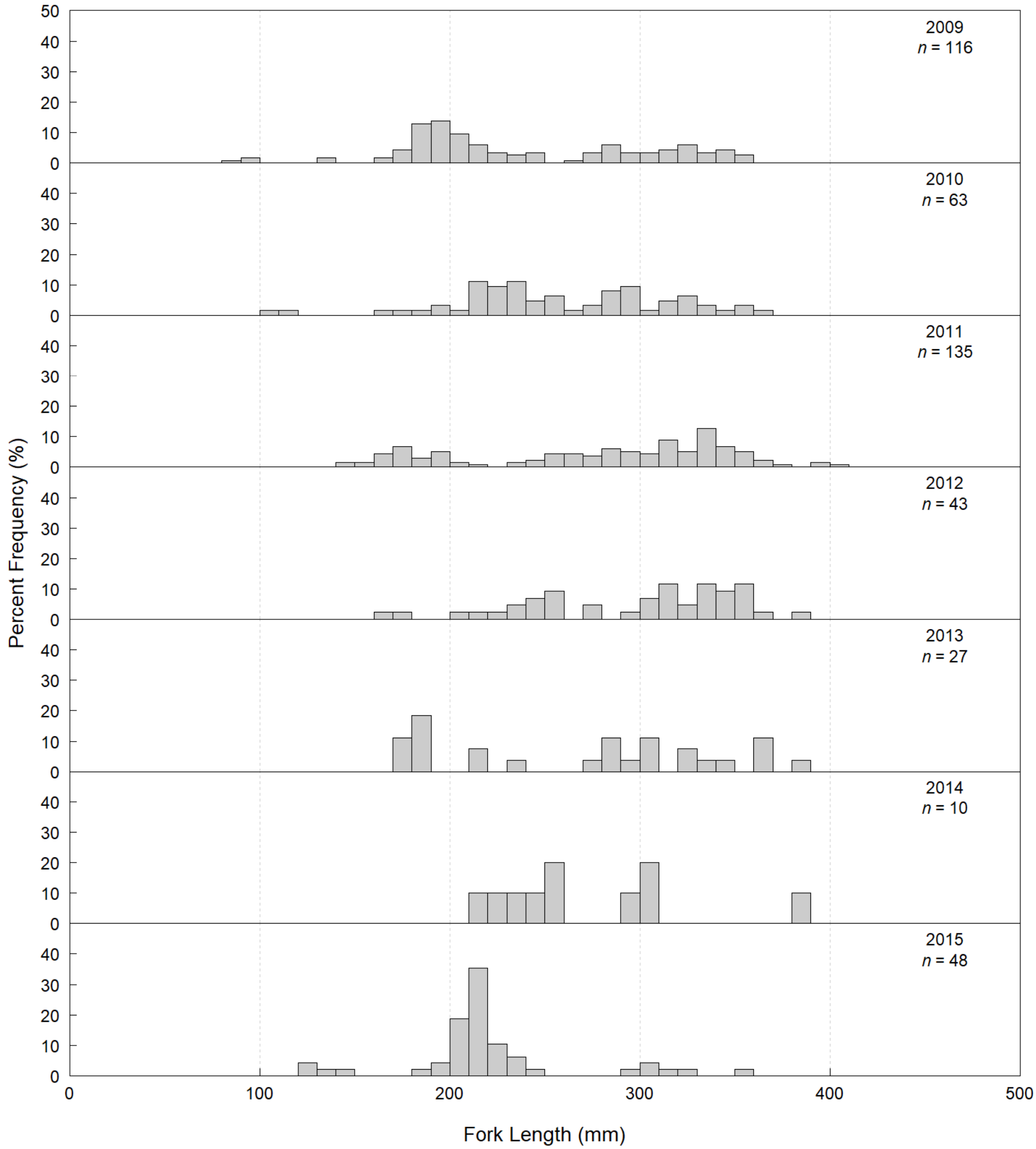


Figure F1: Length-frequency distributions by year for Arctic Grayling captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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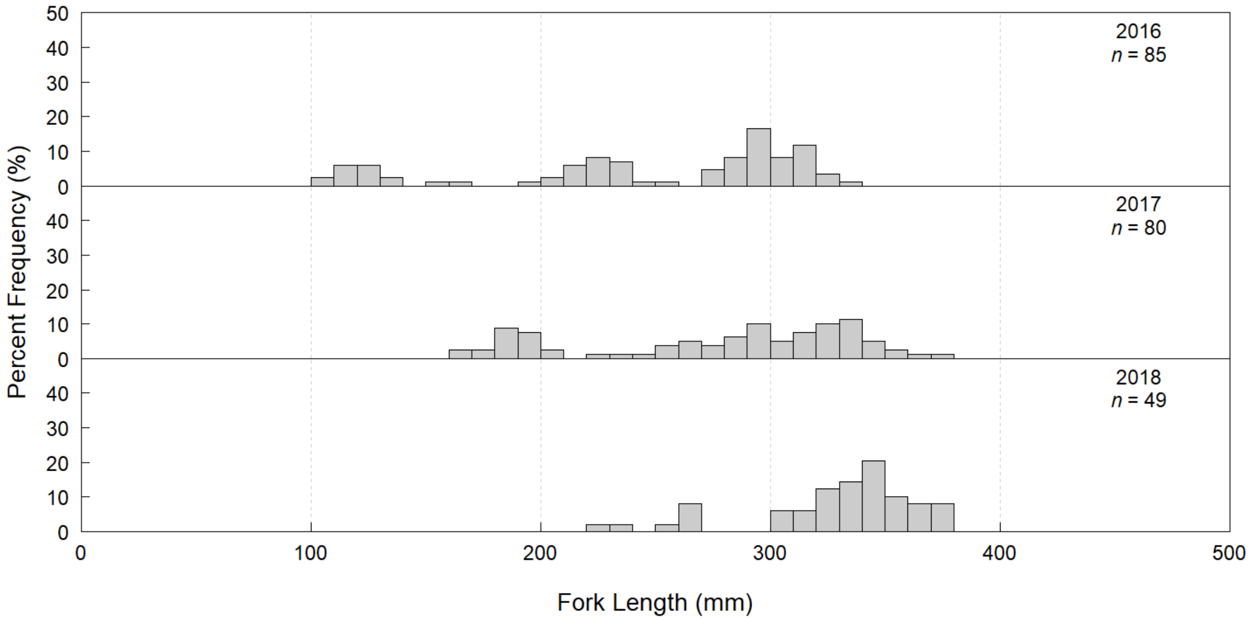

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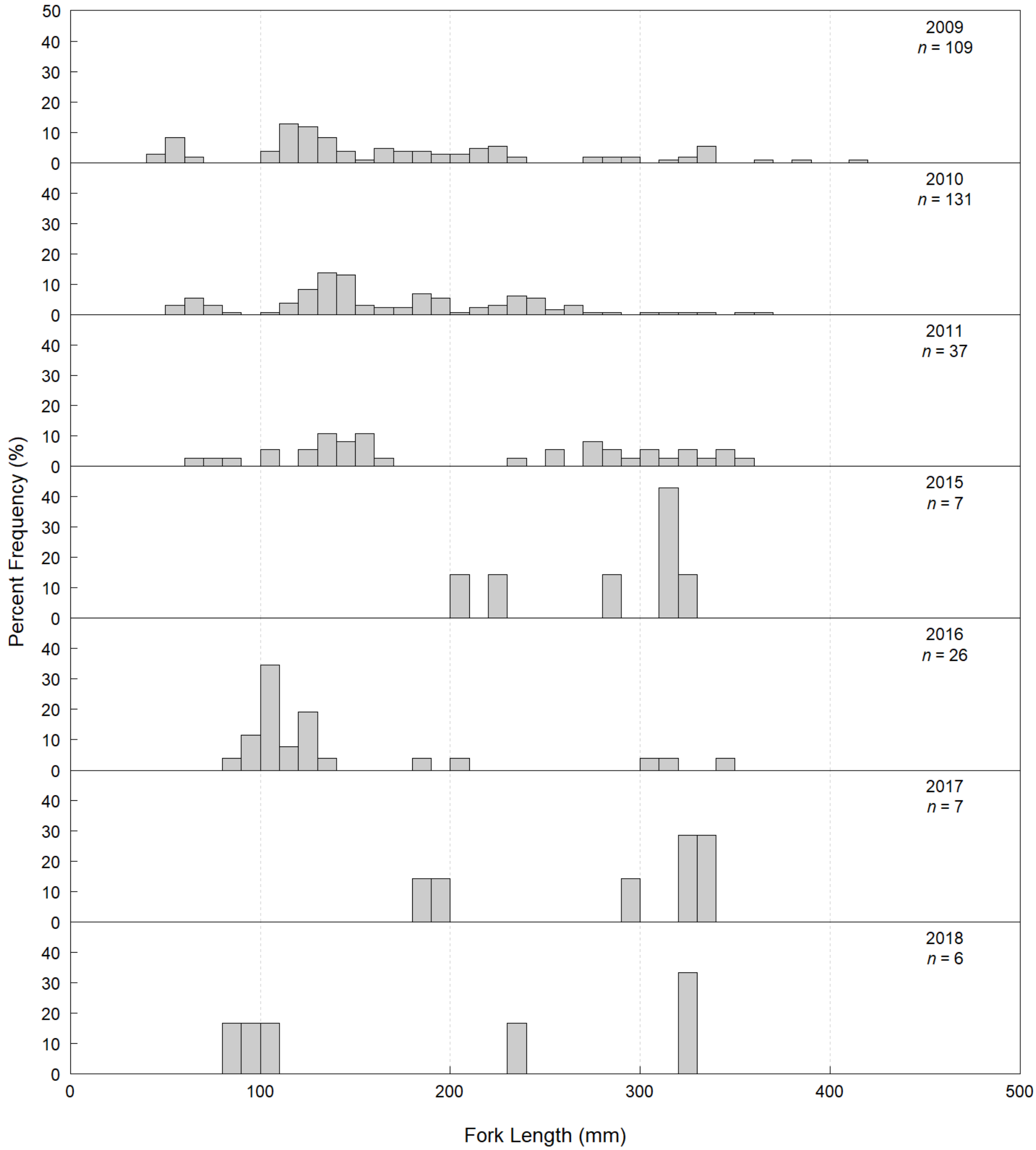

Figure F2: Length-frequency distributions by year for Arctic Grayling captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2009 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

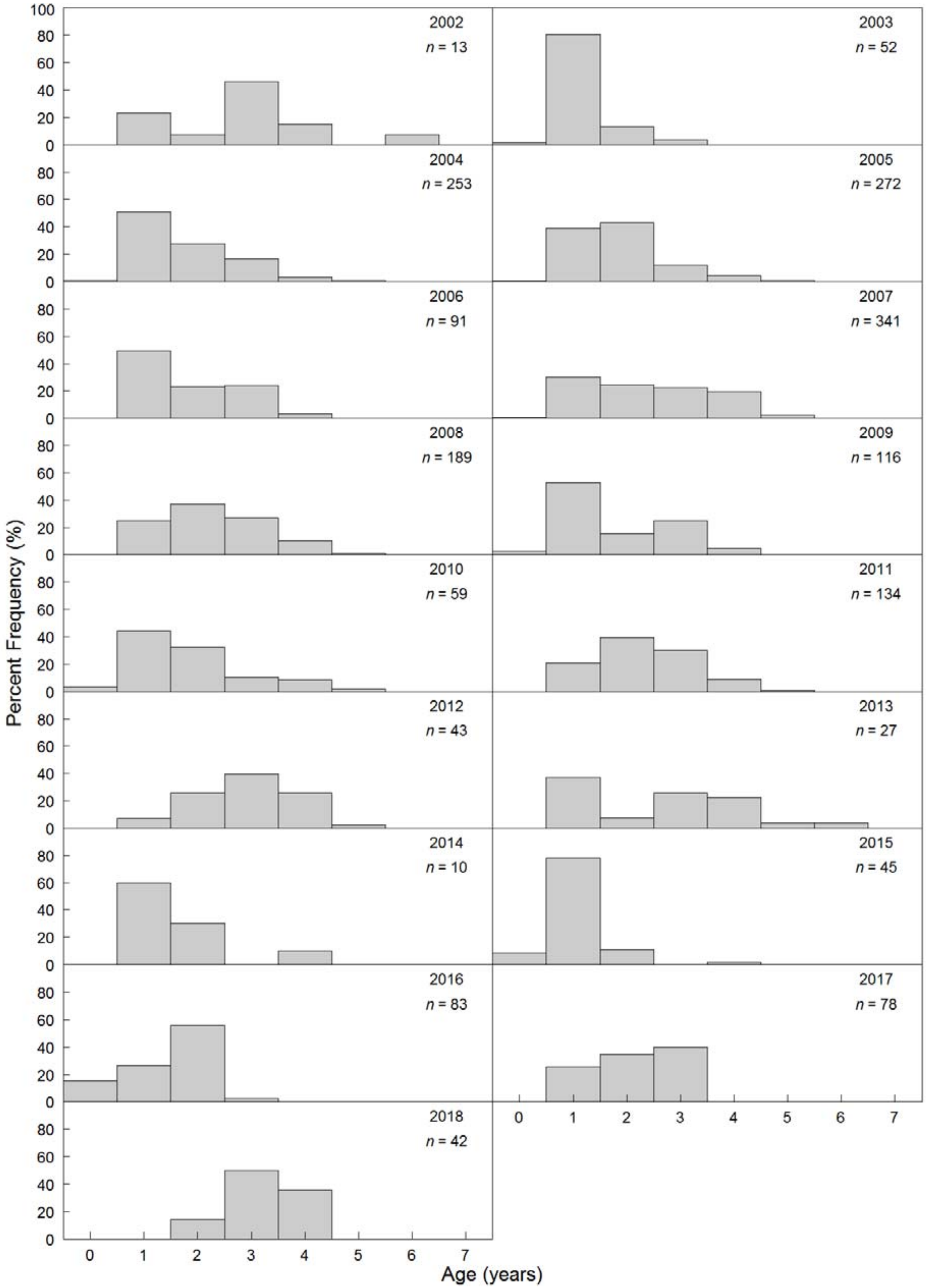

Figure F3: **Age-frequency distributions by year for Arctic Grayling captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.**

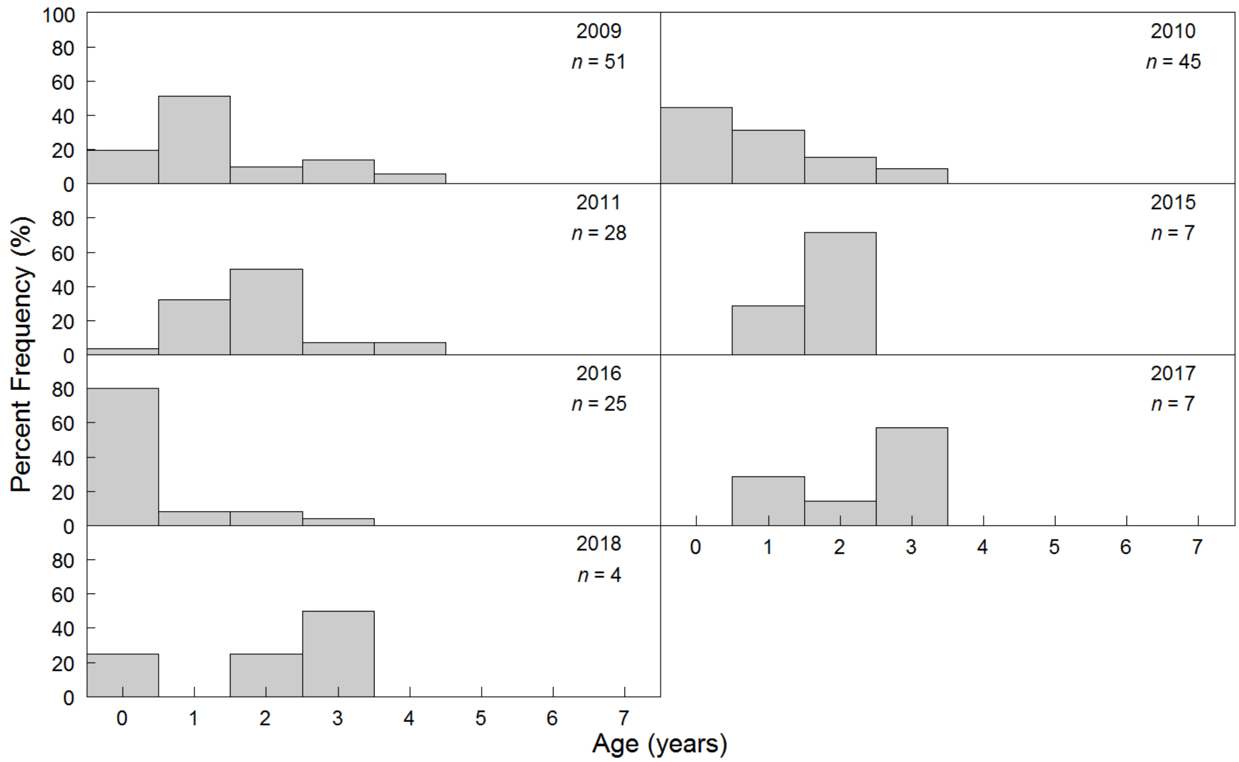

Figure F4: Age-frequency distributions by year for Arctic Grayling captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2009 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

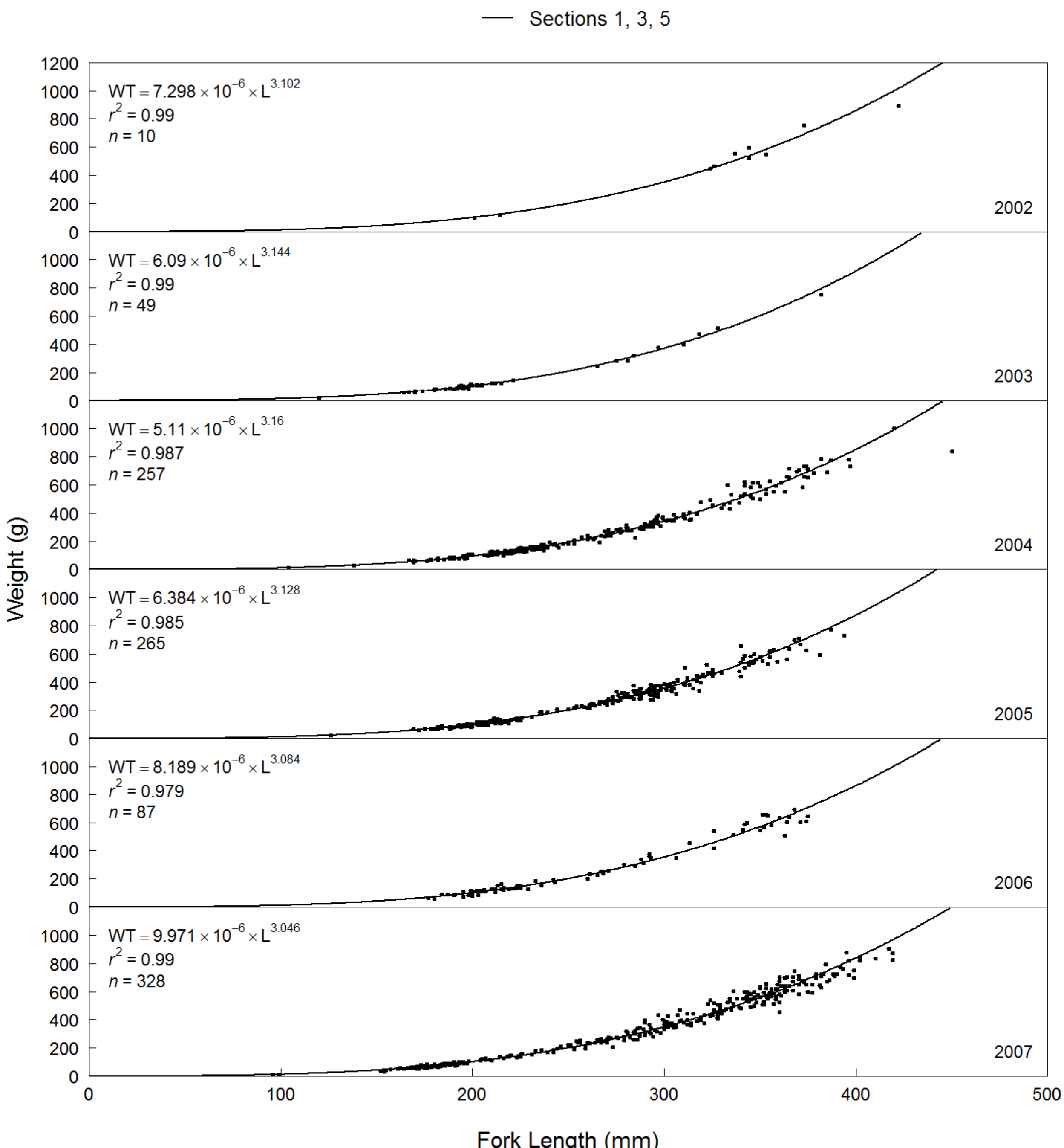

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Figure F5: Length-weight regressions for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

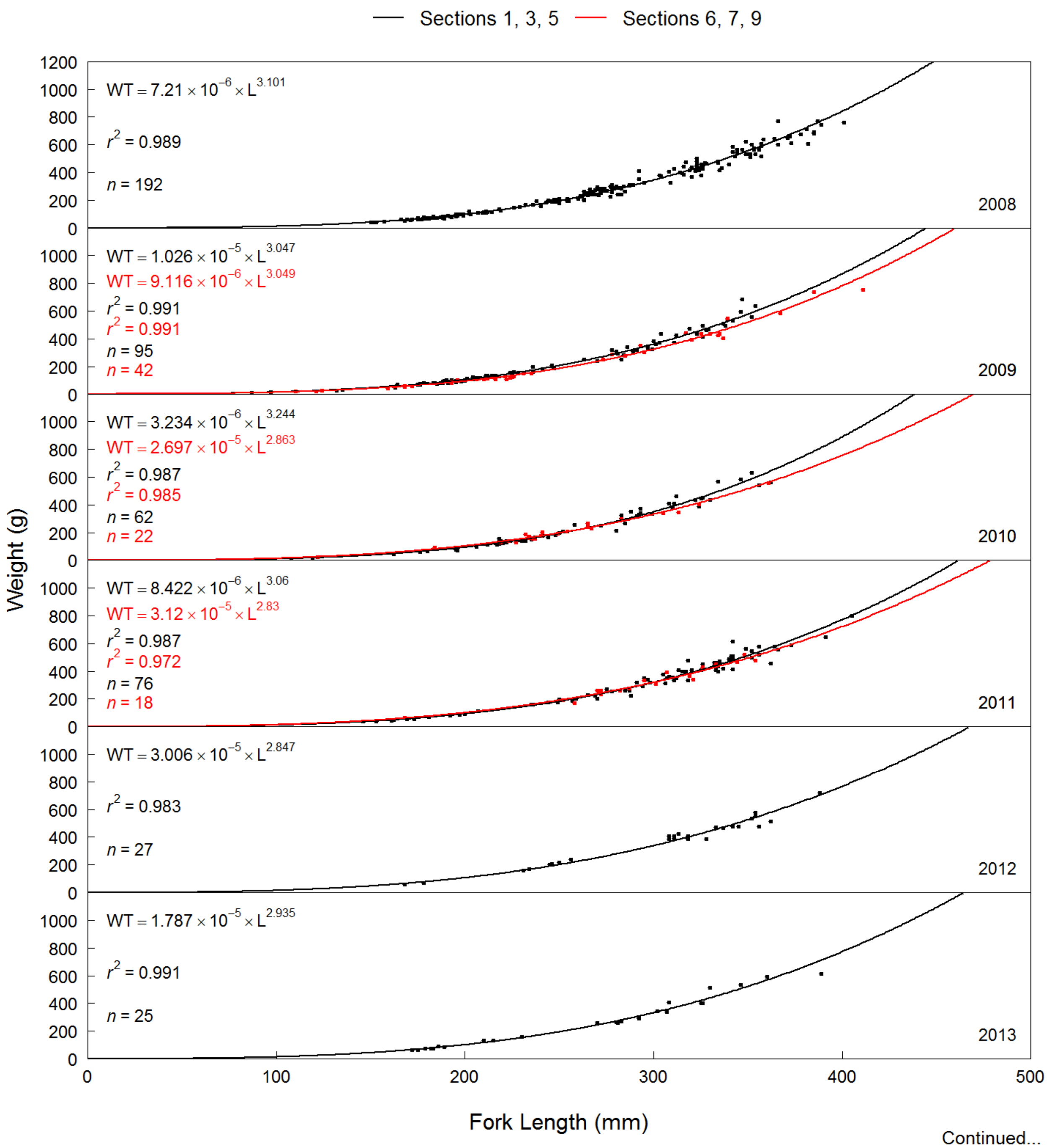

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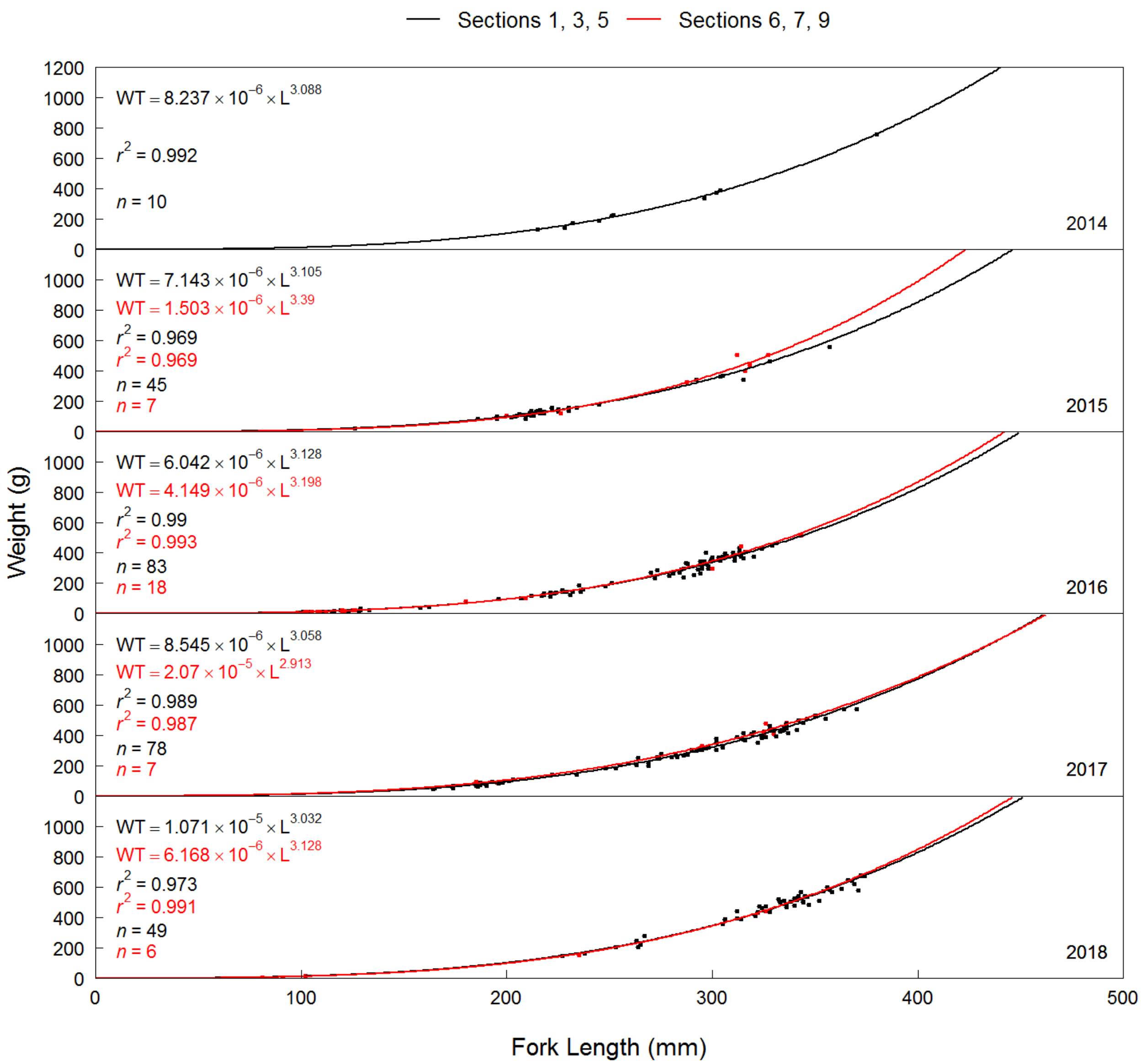
Figure F5: Continued.



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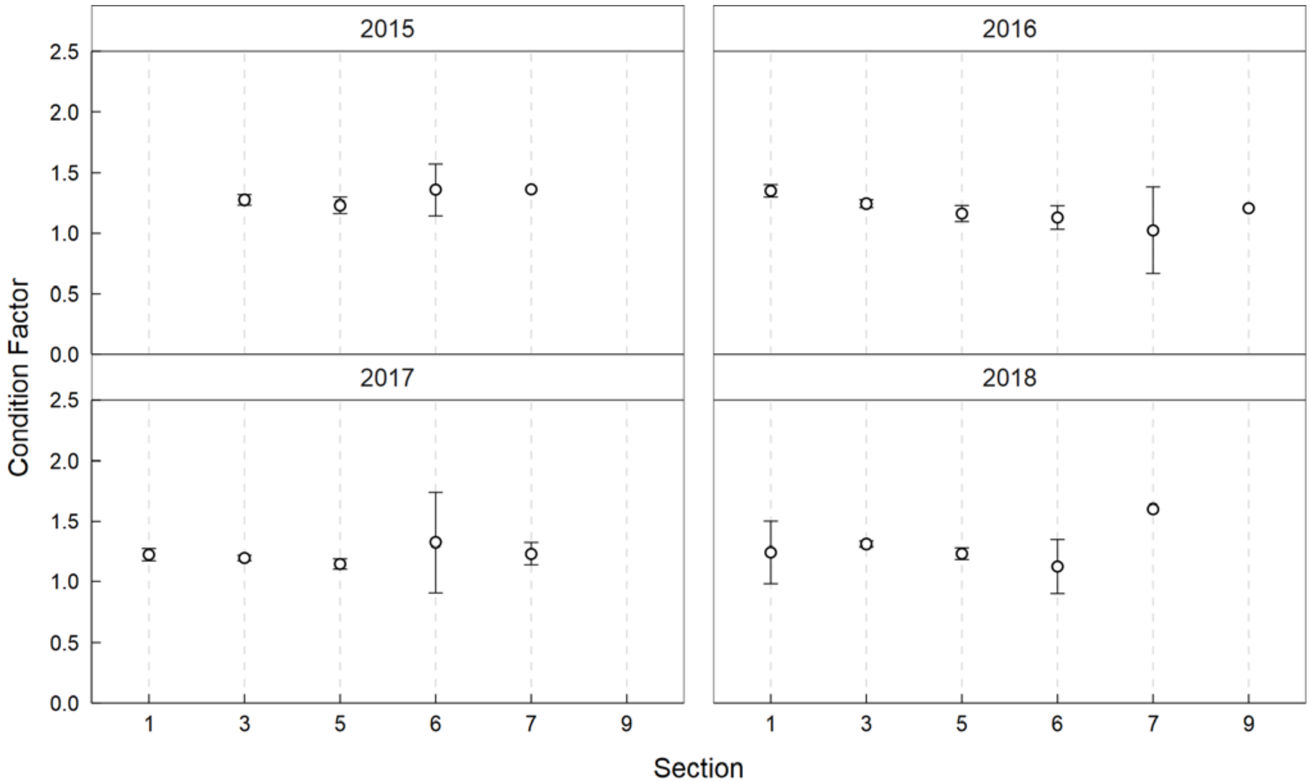


Figure F6: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Arctic Grayling captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

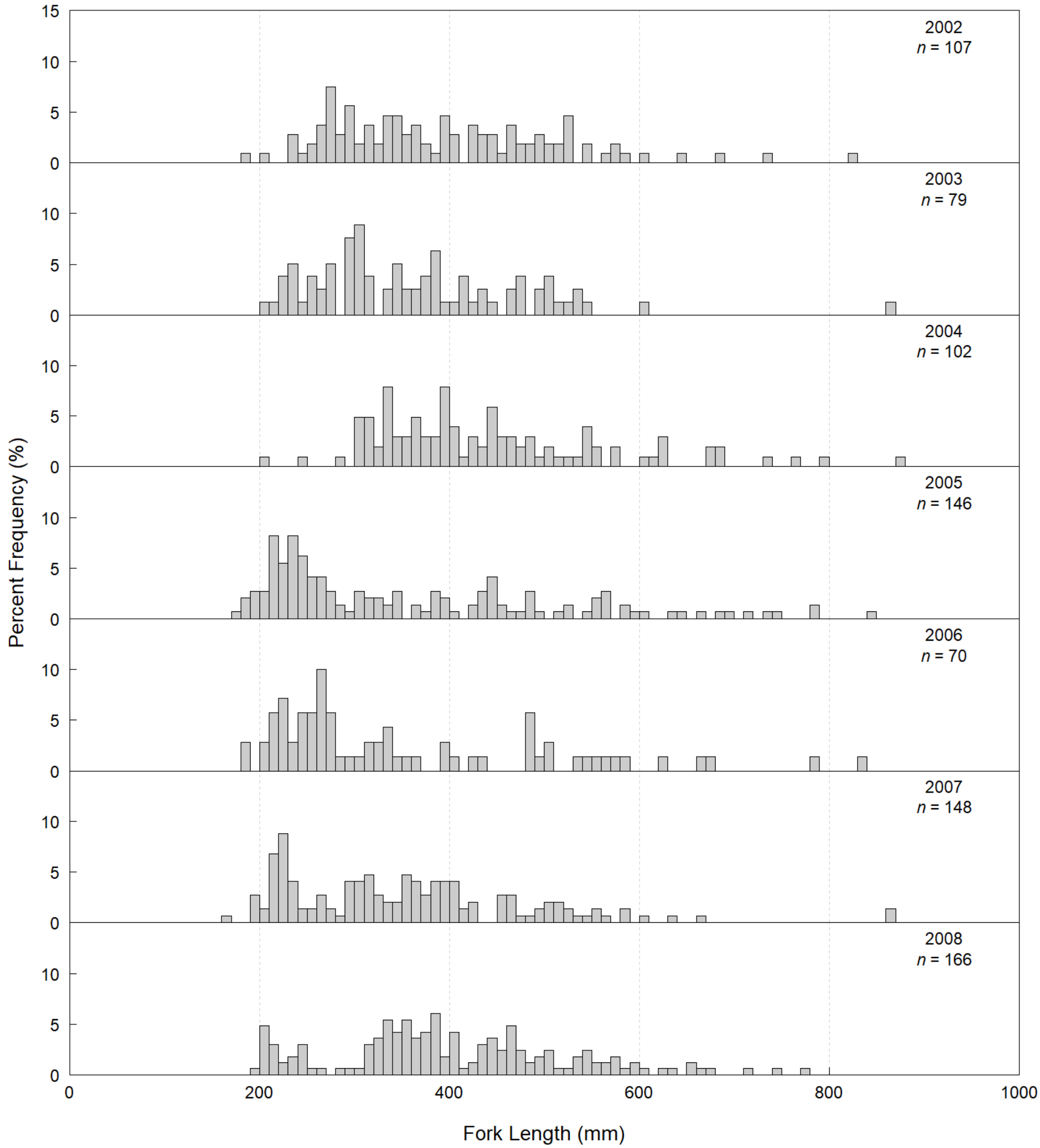
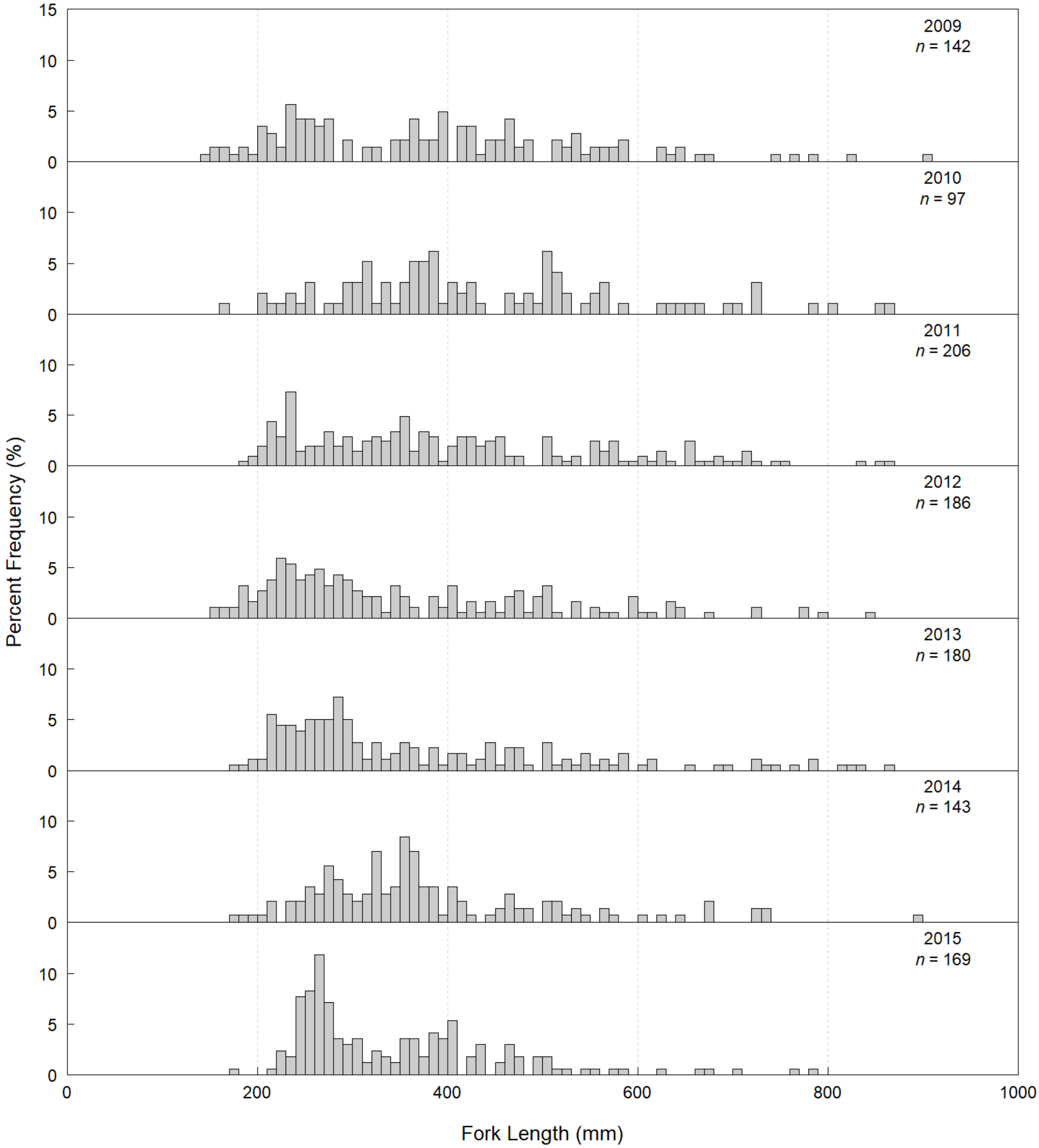


Figure F7: Length-frequency distributions by year for Bull Trout captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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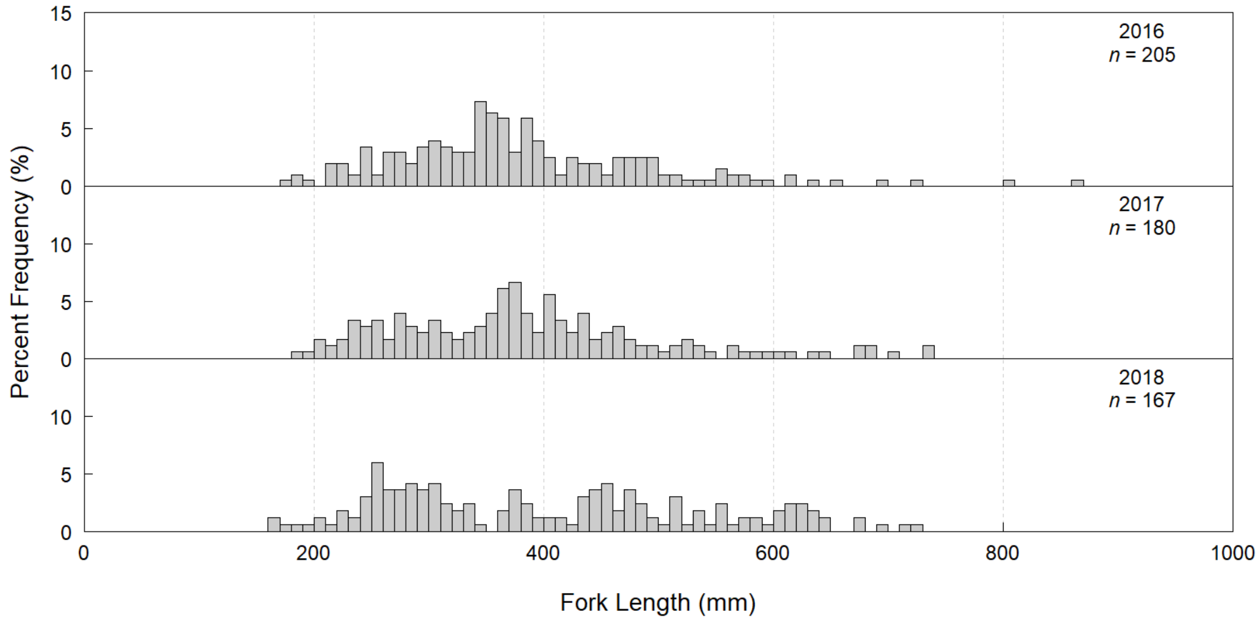

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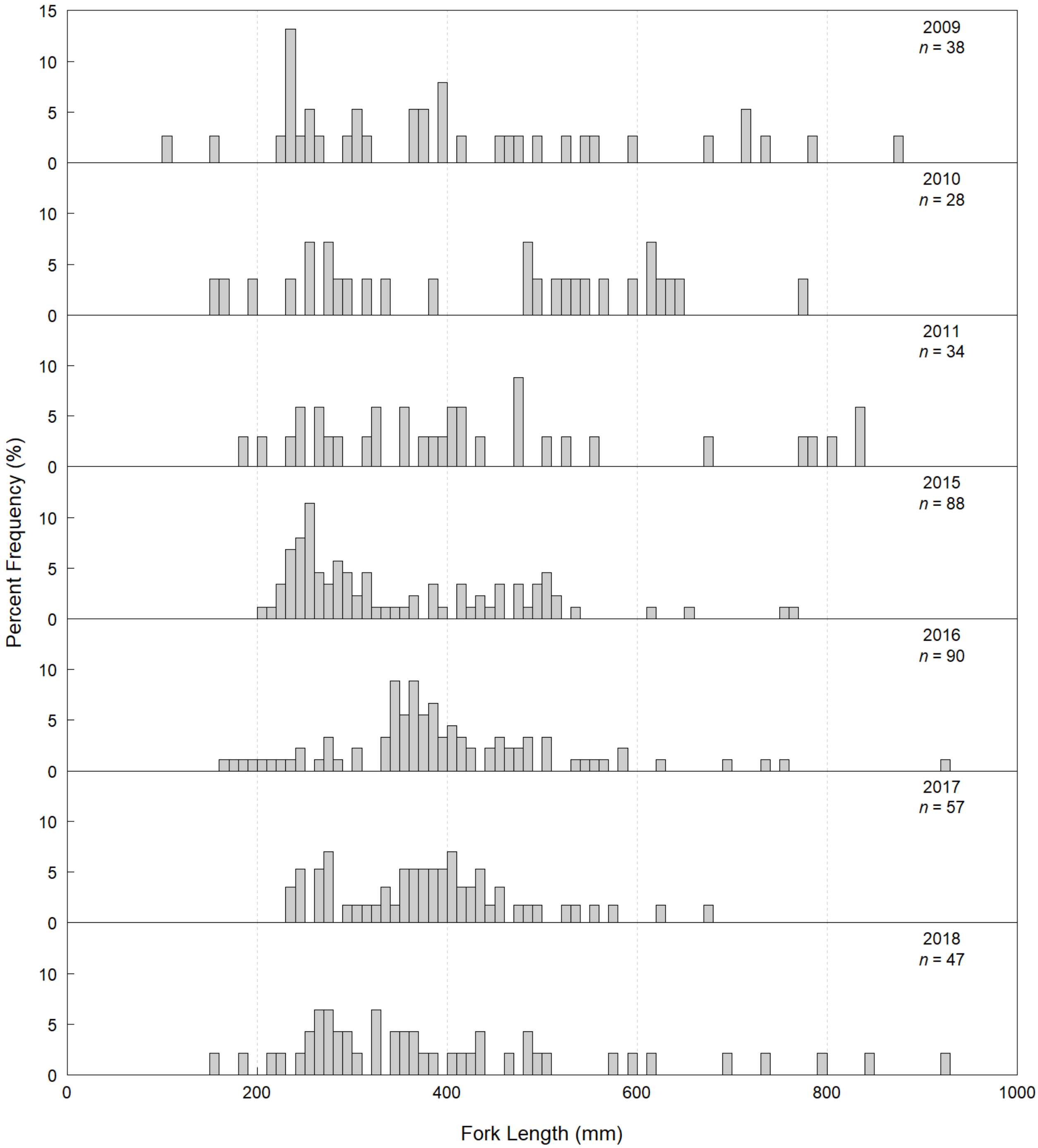

Figure F8: Length-frequency distributions by year for Bull Trout captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

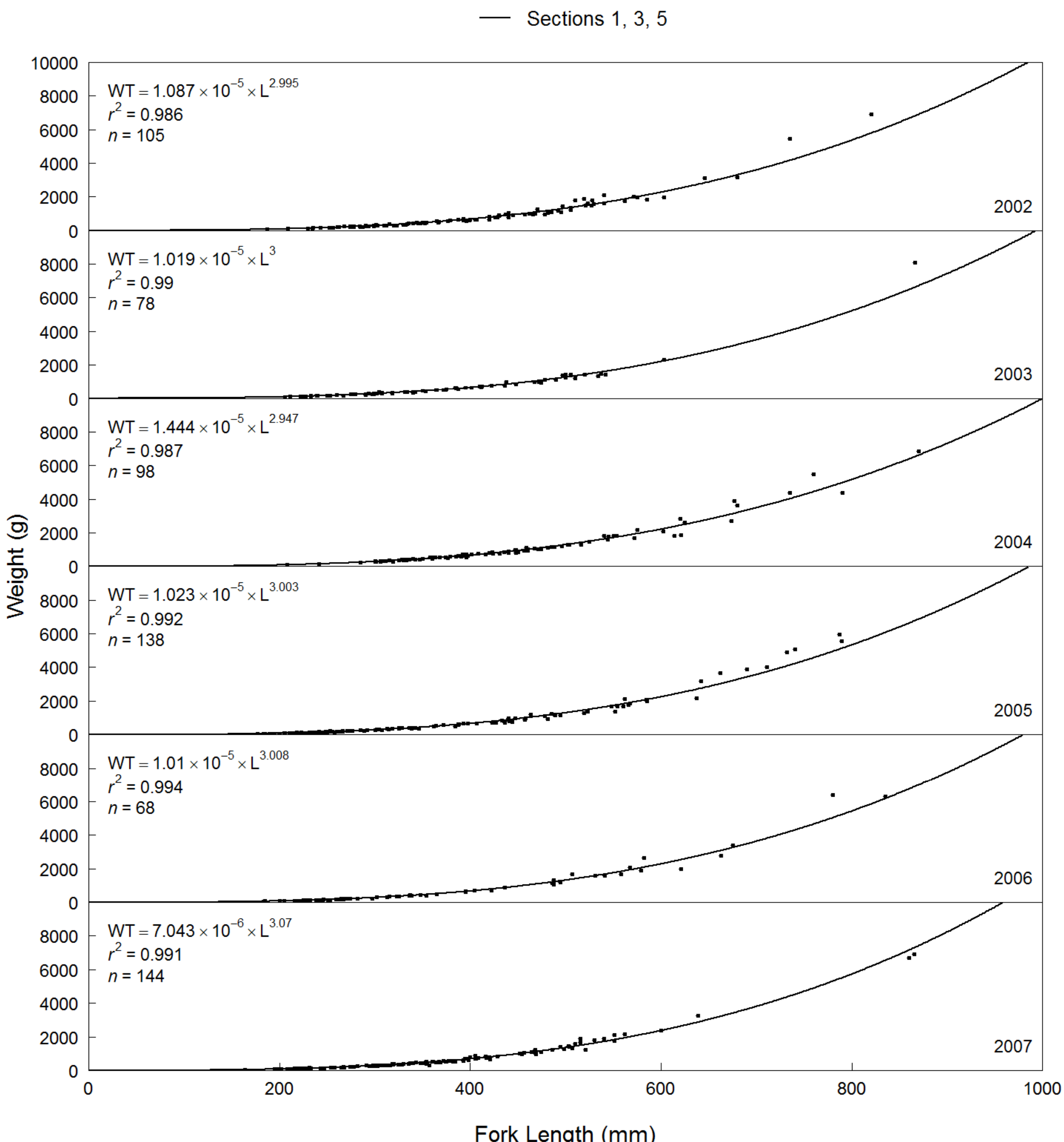

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Figure F9: Length-weight regressions for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

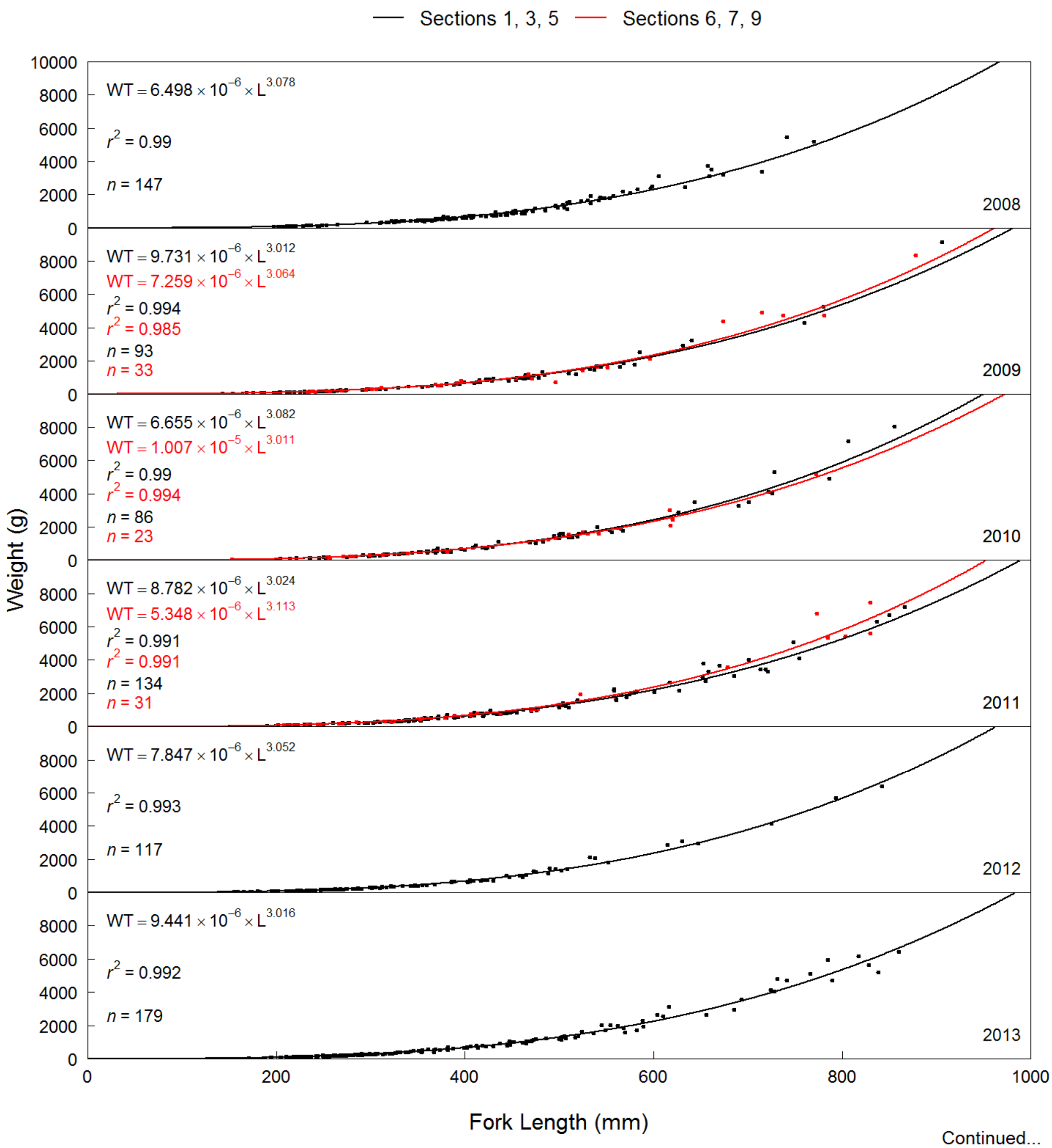

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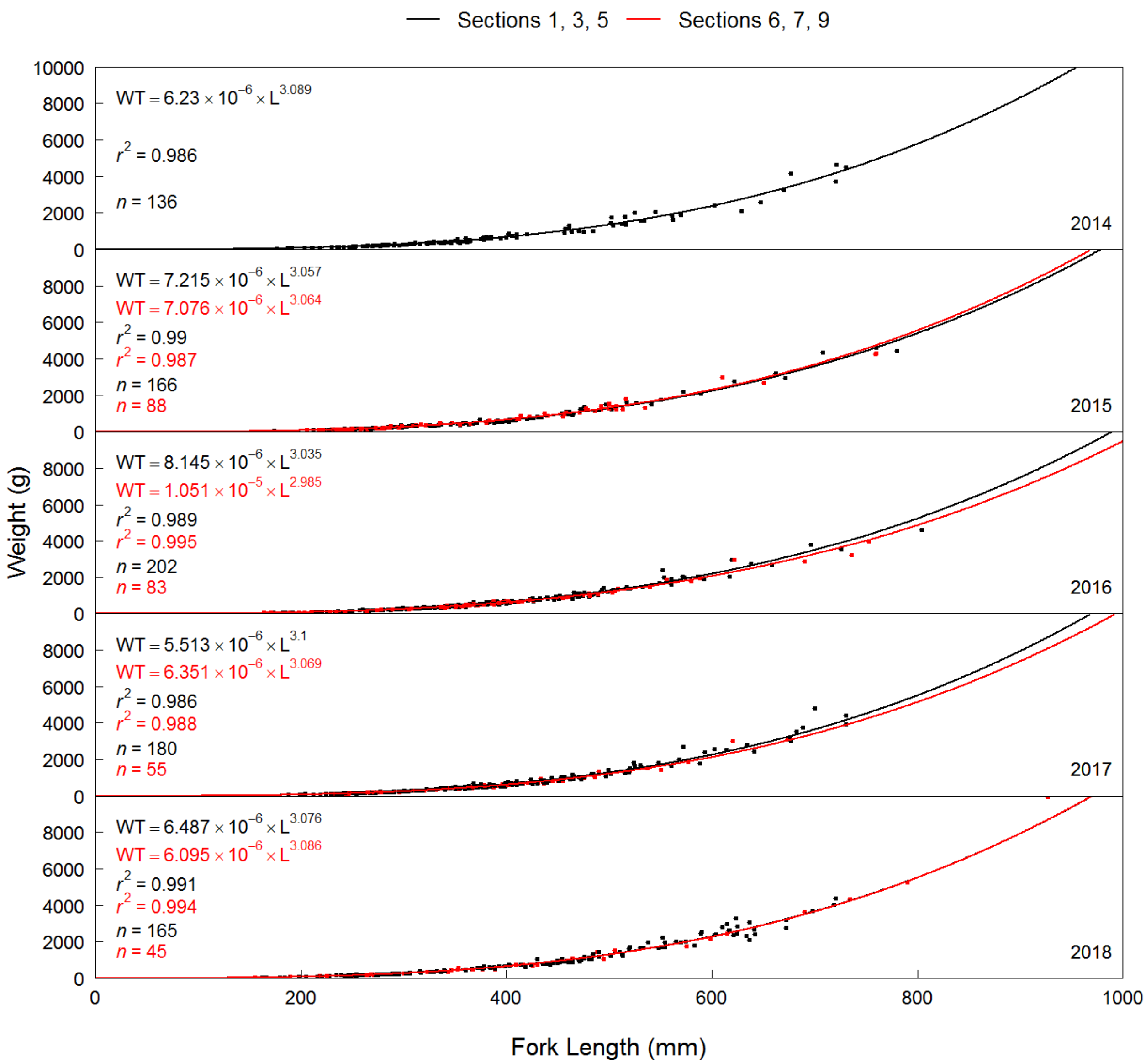
Figure F9: Continued.



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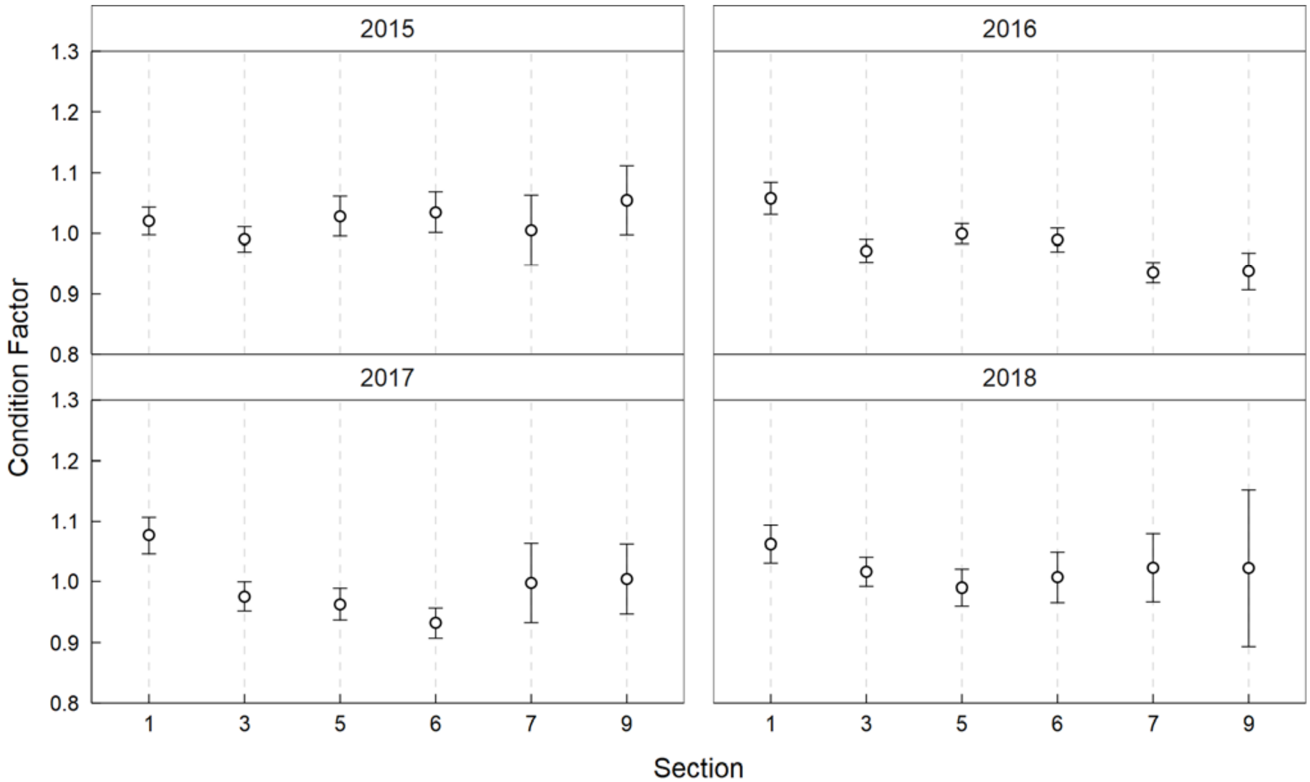


Figure F10: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Bull Trout captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

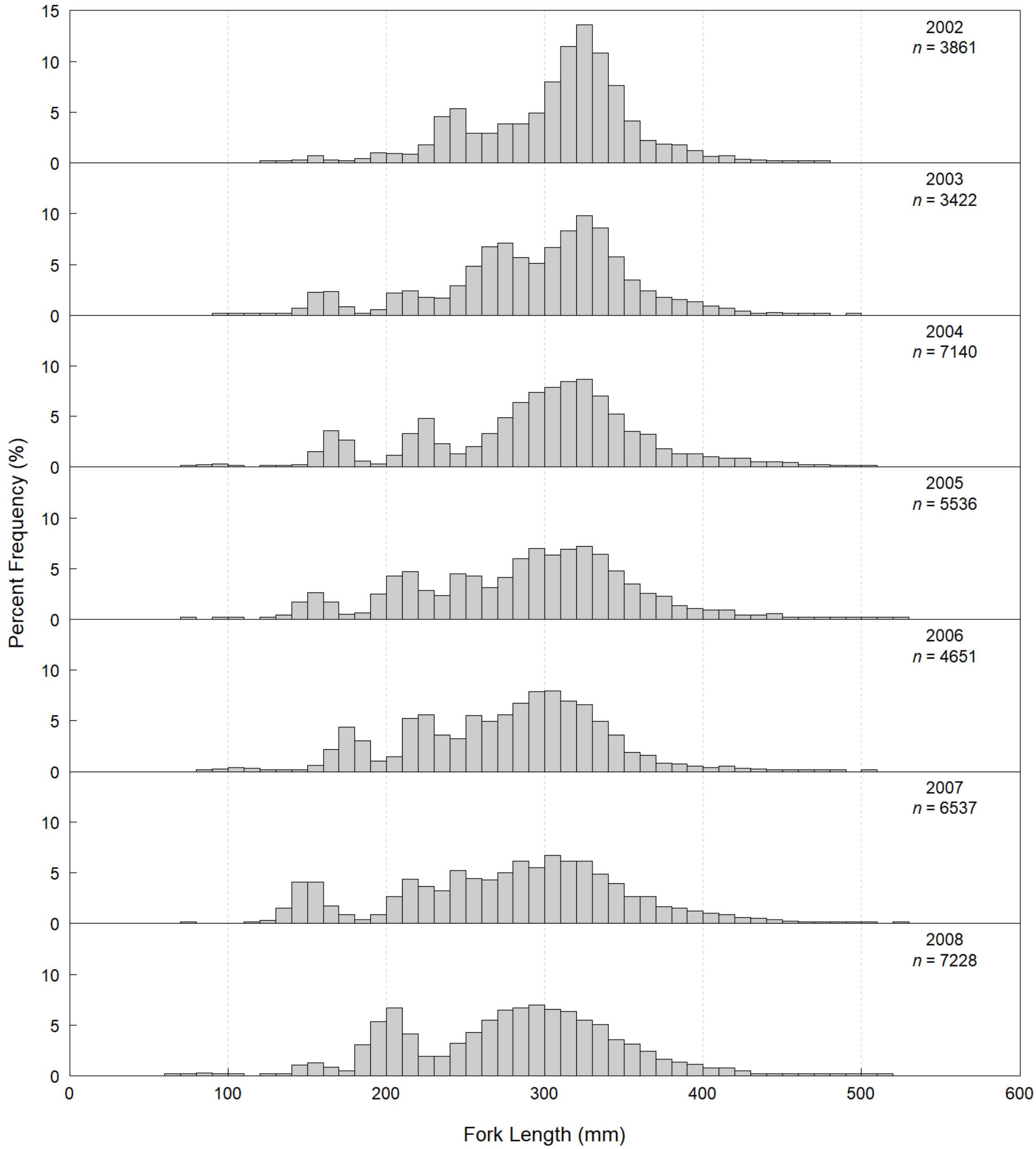
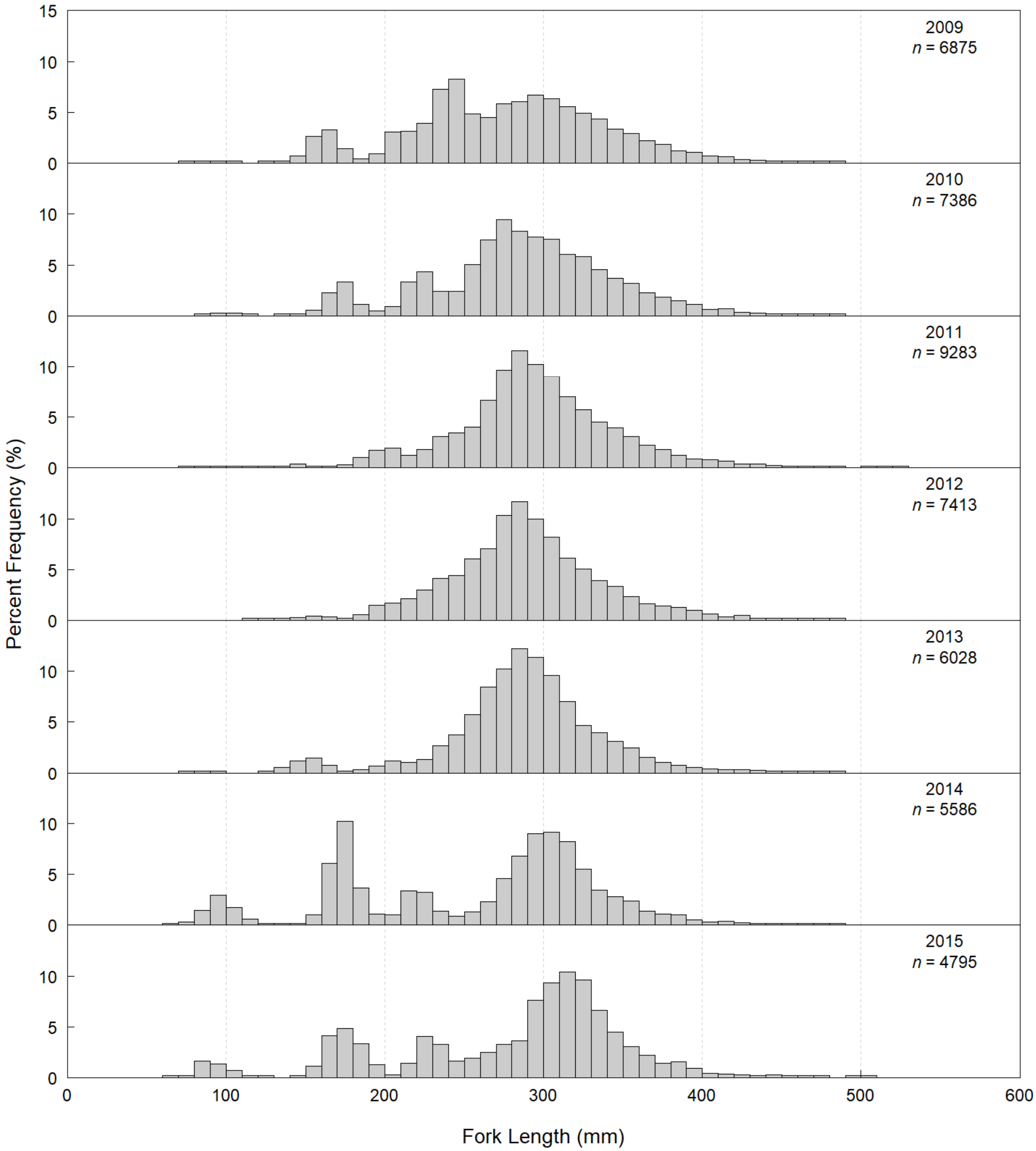


Figure F11: Length-frequency distributions by year for Mountain Whitefish captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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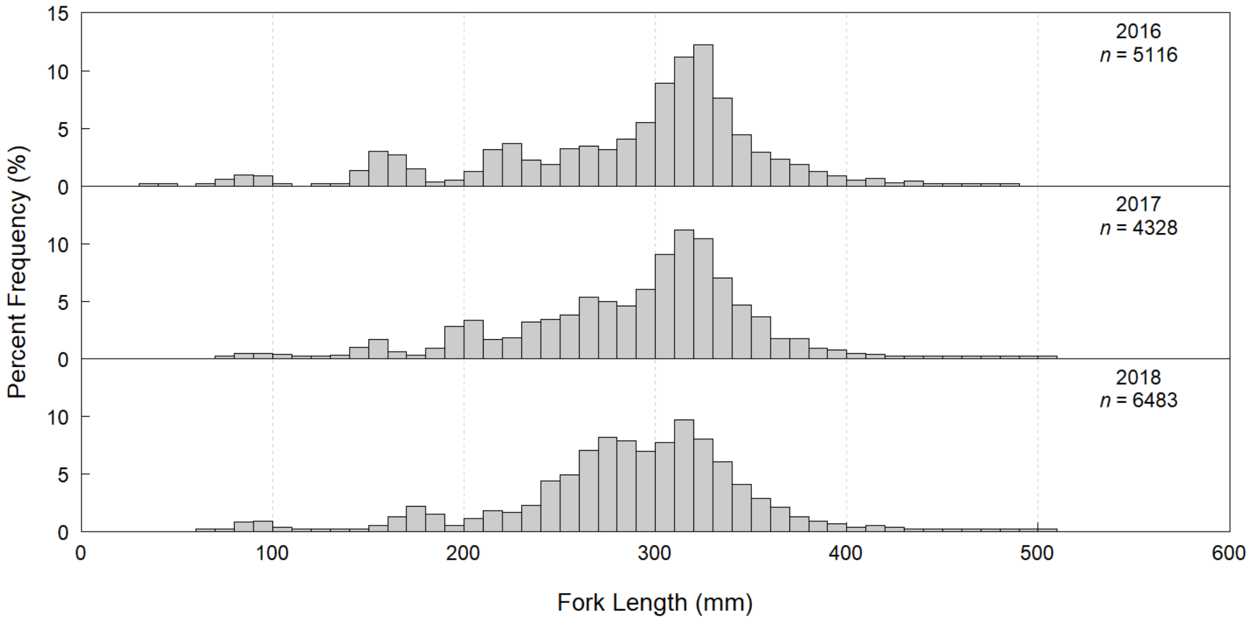

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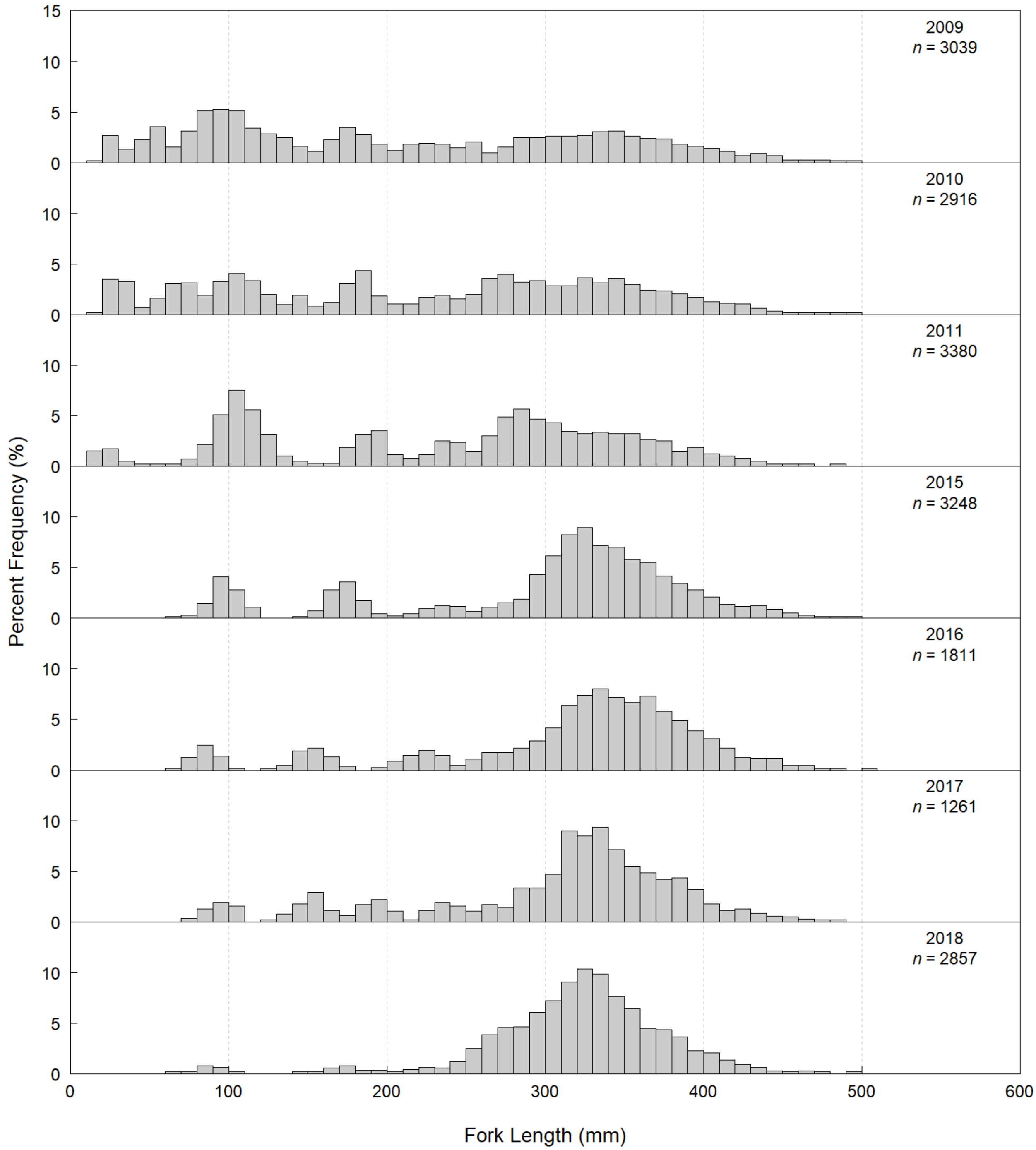

Figure F12: Length-frequency distributions by year for Mountain Whitefish captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2009 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

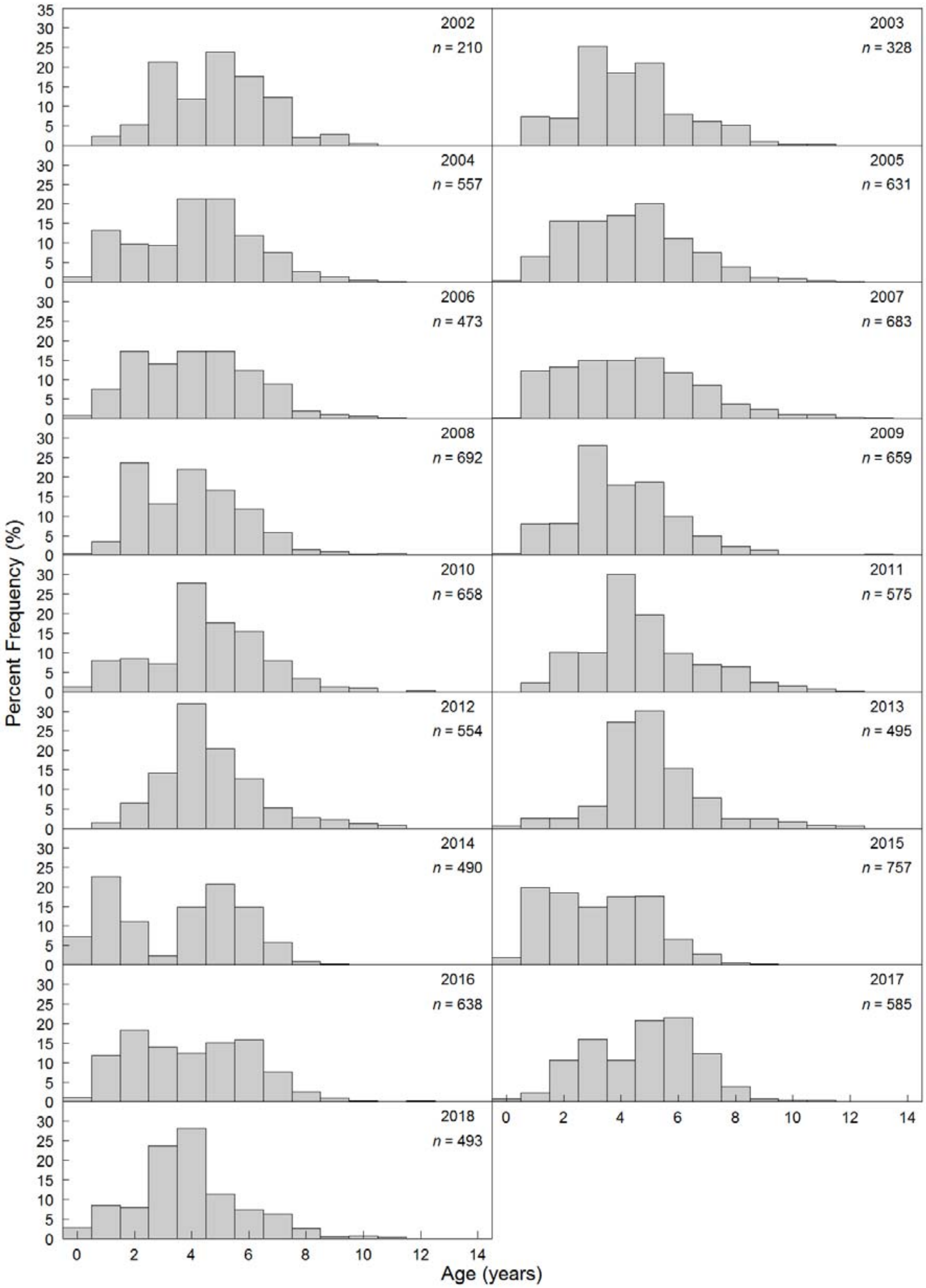

Figure F13: Age-frequency distributions by year for Mountain Whitefish captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 20118. Figure F8. Age-frequency distributions by year for Bull Trout captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.

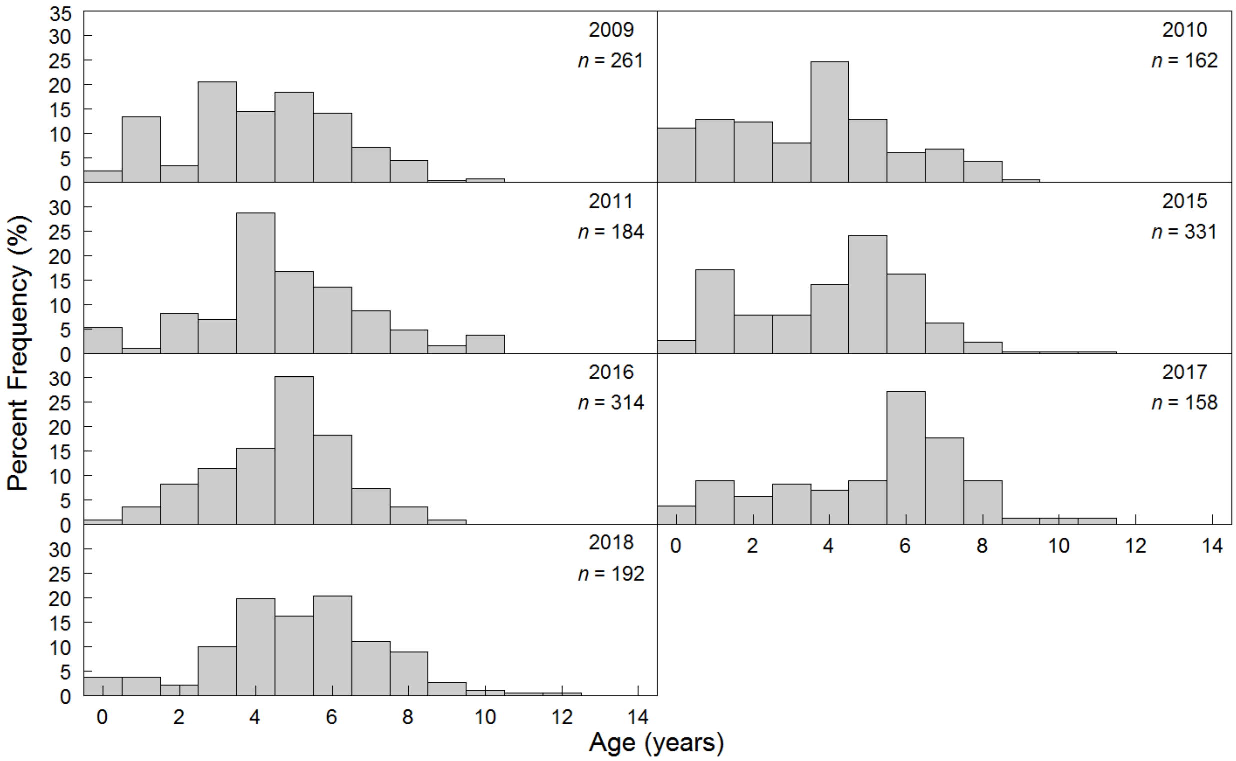

Figure F14: Age-frequency distributions by year for Mountain Whitefish captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

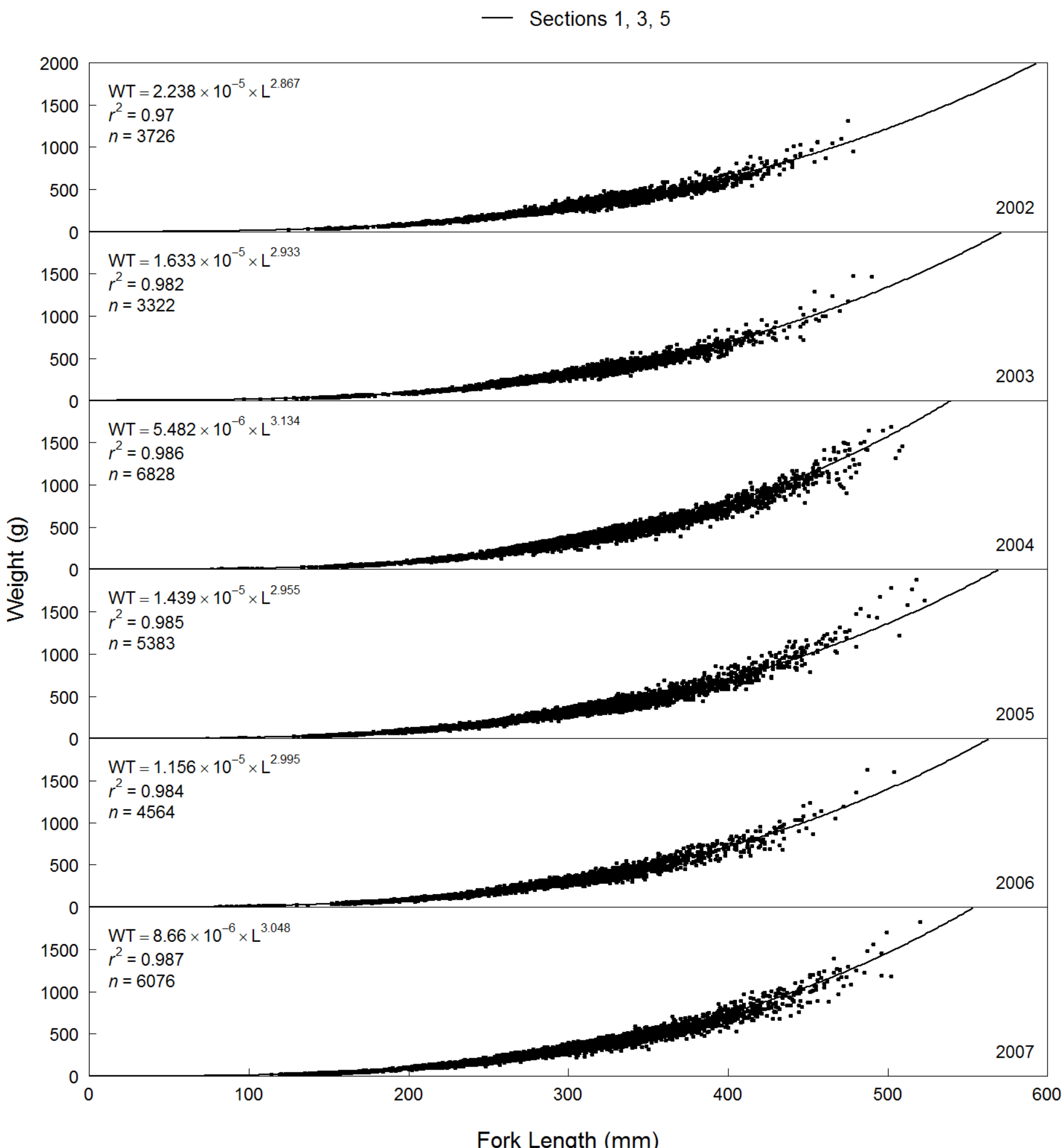

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Figure F15: Length-weight regressions for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

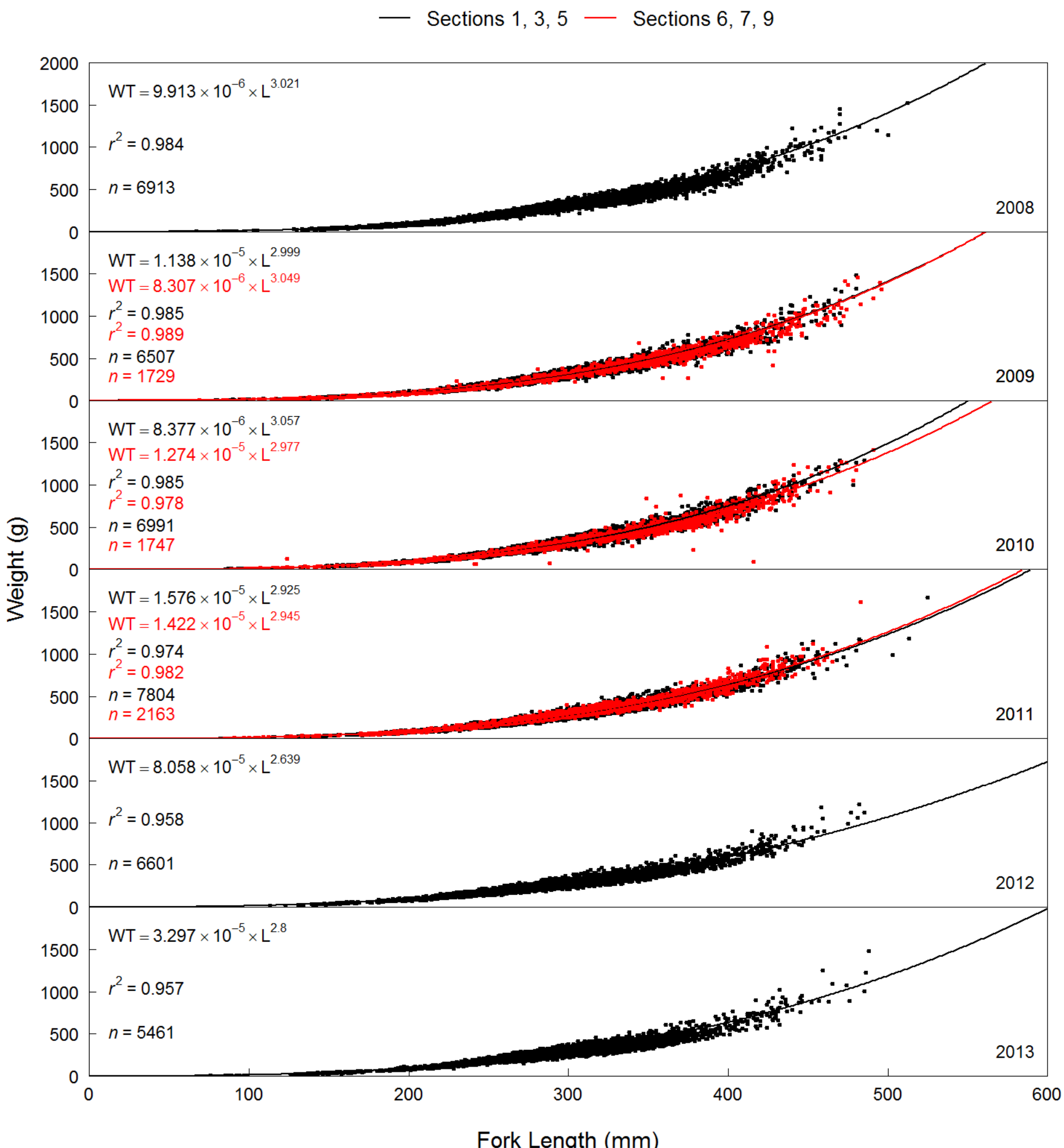

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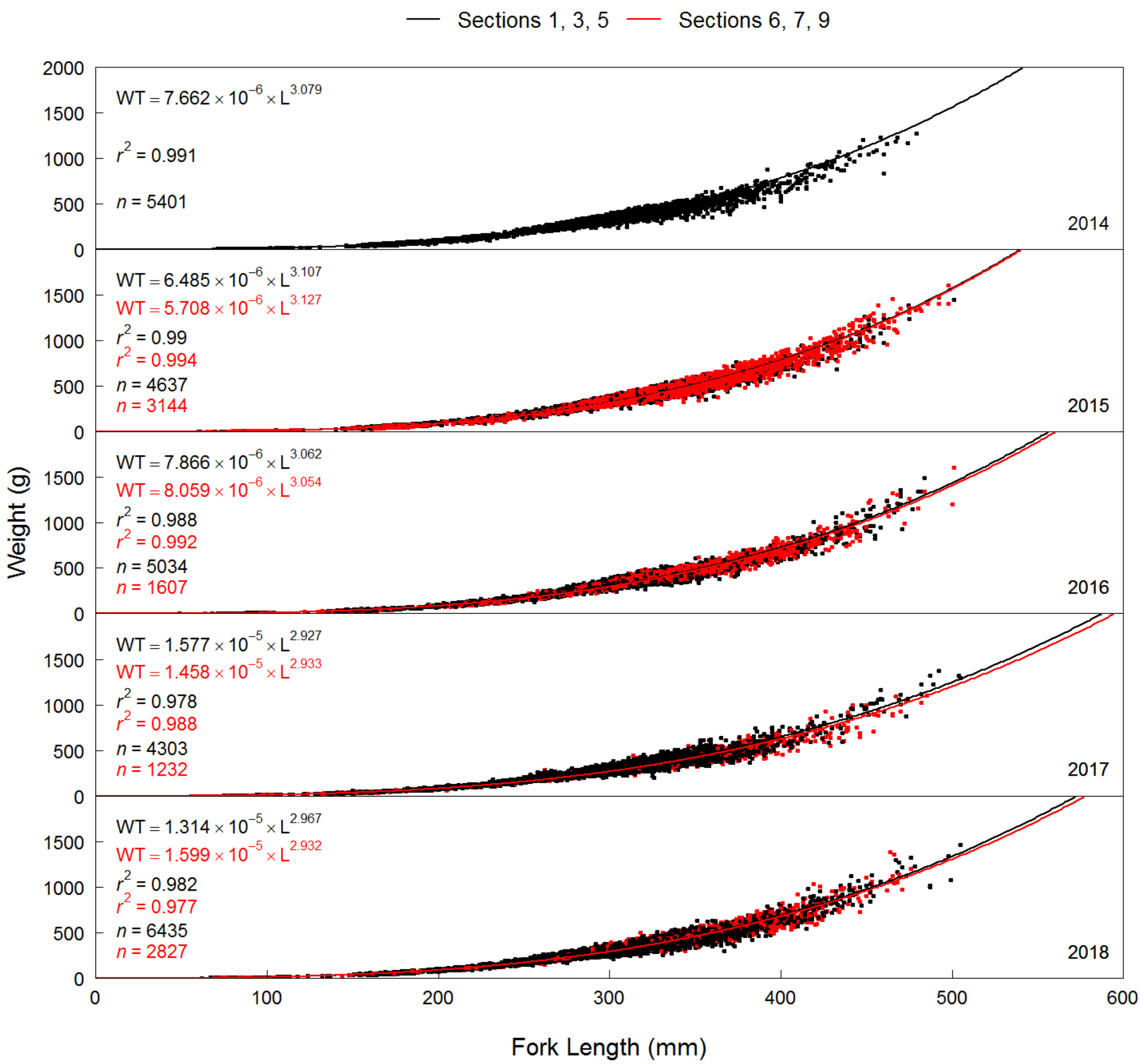
Figure F15: Continued.



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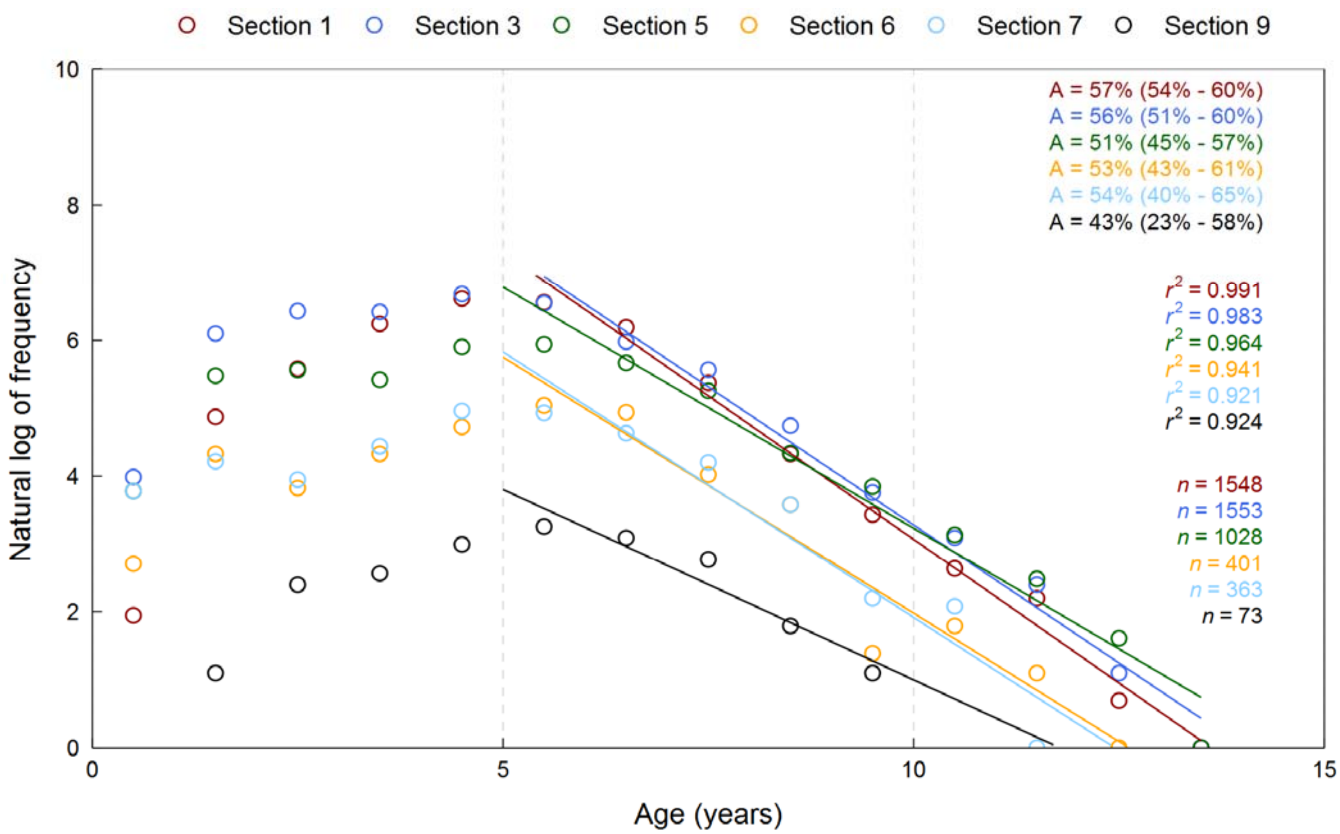


Figure F16: Catch curve and annual mortality estimates (A; mean and 95% confidence intervals) for Mountain Whitefish, calculated for each sample section using data from 2002 to 2018 combined. Sample size, and r^2 of the catch curve regression, are provided for each section.

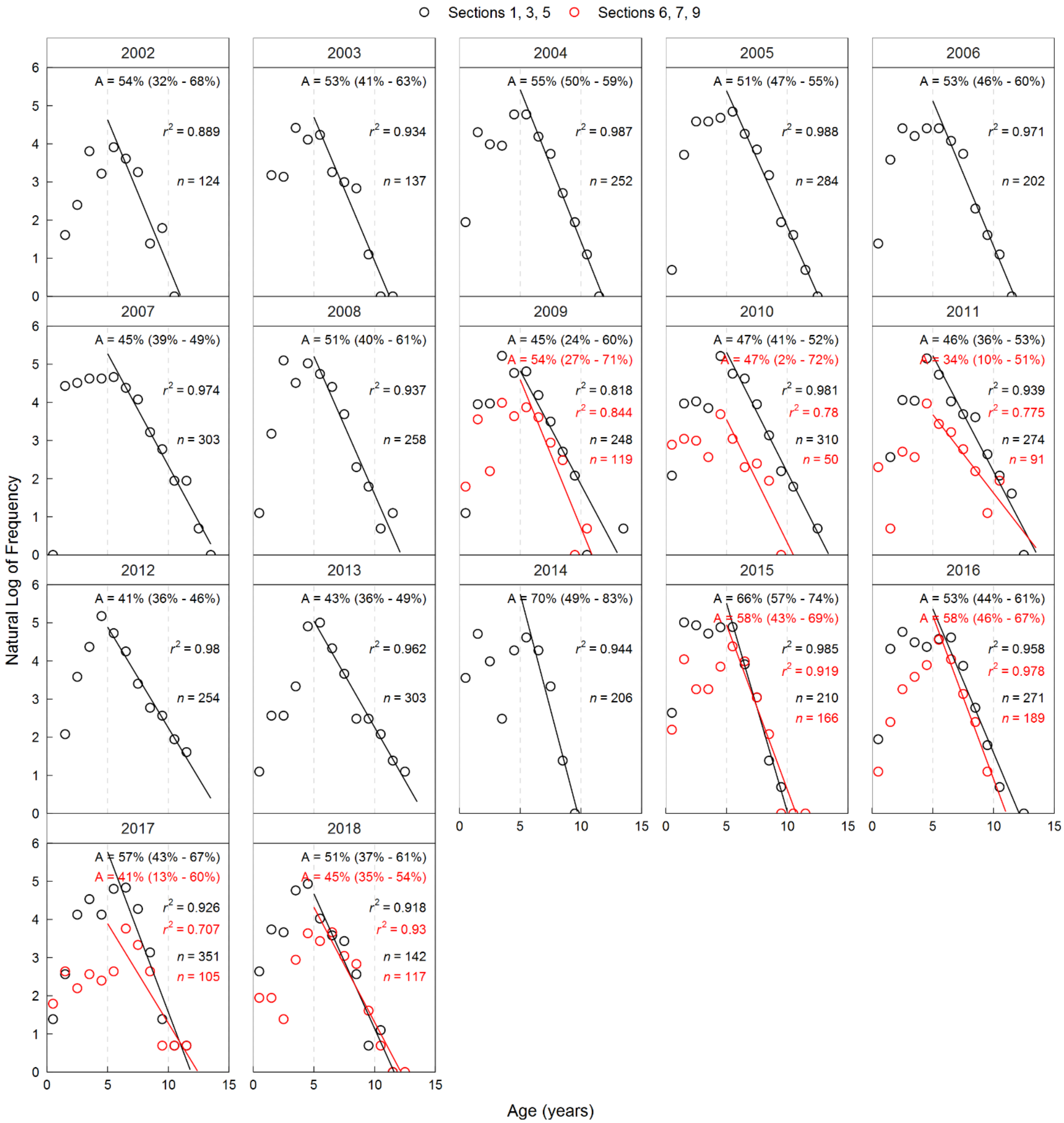


Figure F17: Catch curve and annual mortality estimates (A; mean and 95% confidence intervals) for Mountain Whitefish, calculated for each sample year. Sample size and r² of the catch curve regression are provided for each sample year.

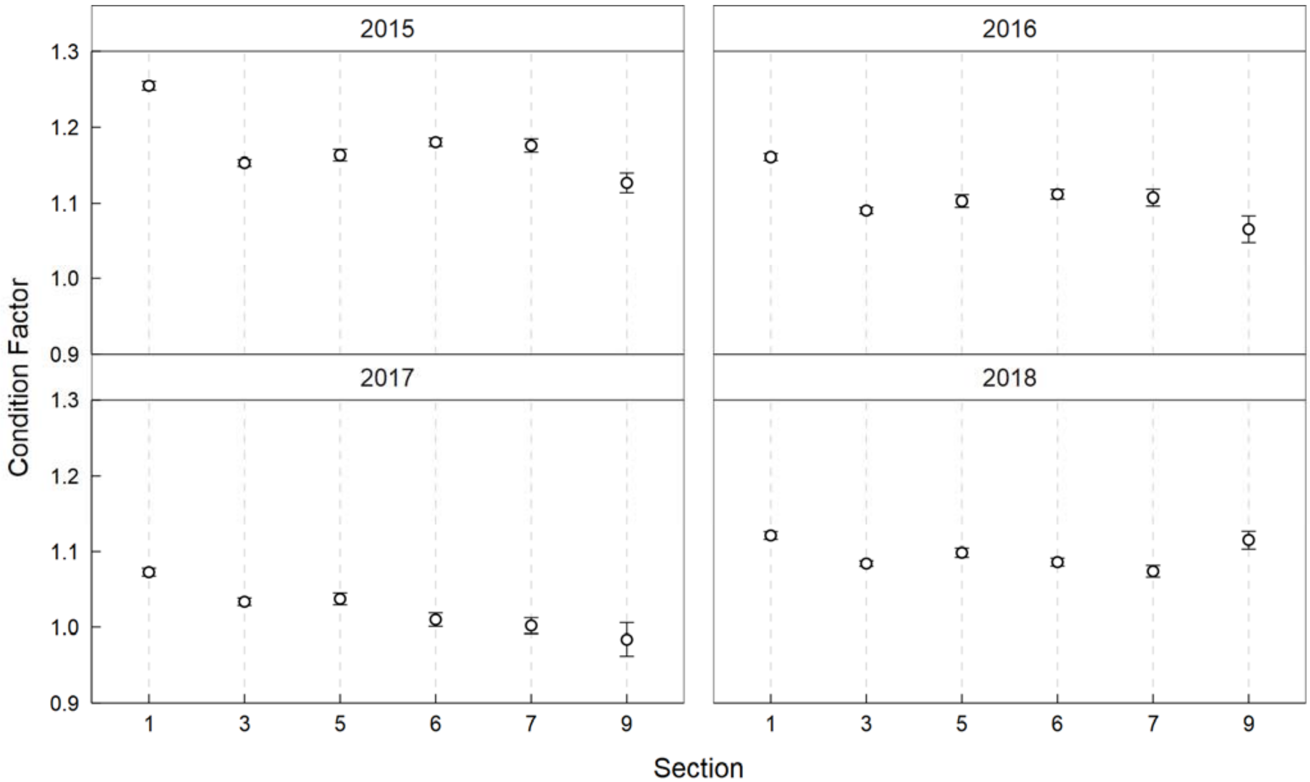


Figure F18: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Mountain Whitefish captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

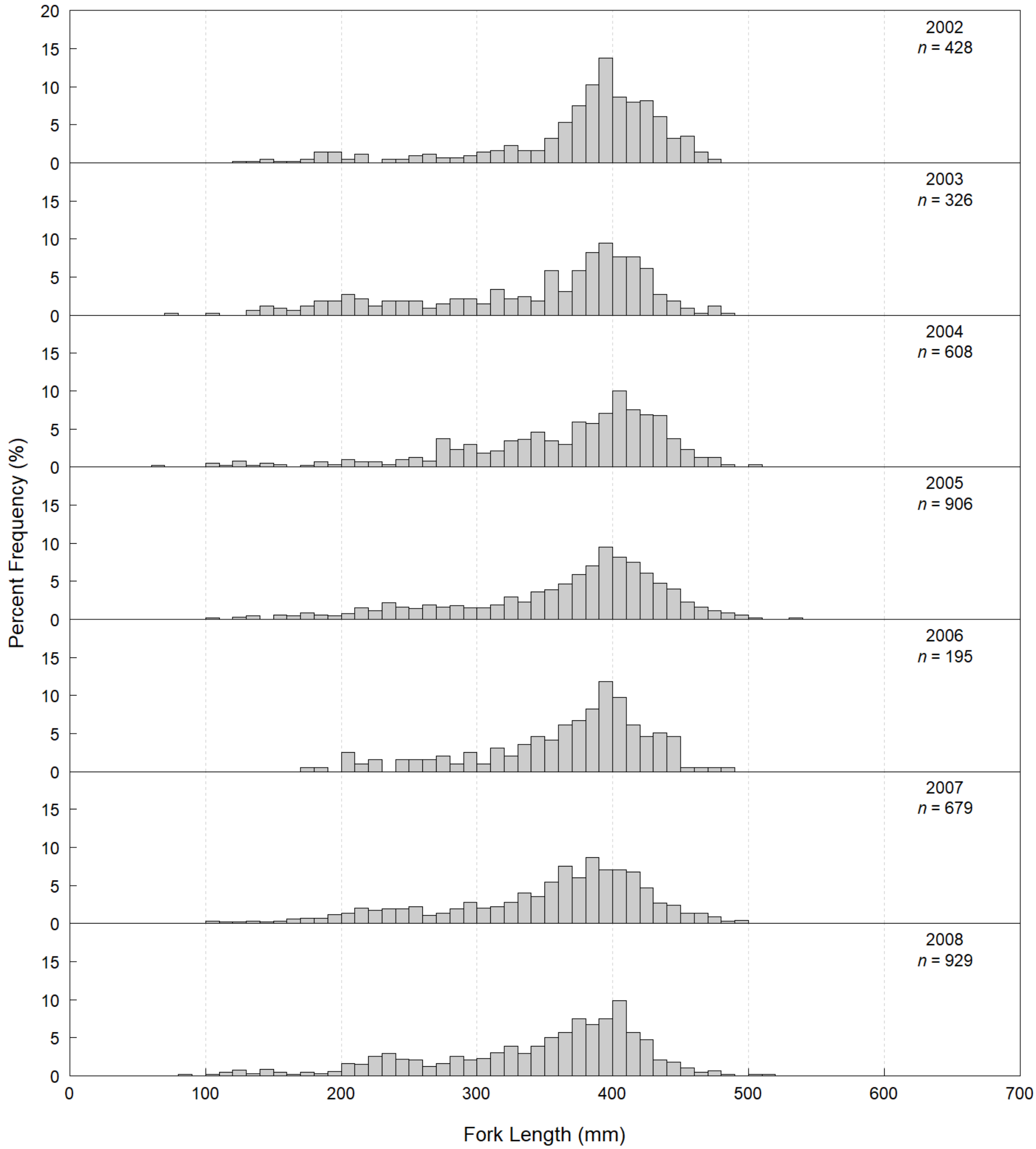


Figure F19: Length-frequency distributions by year for Longnose Sucker captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.

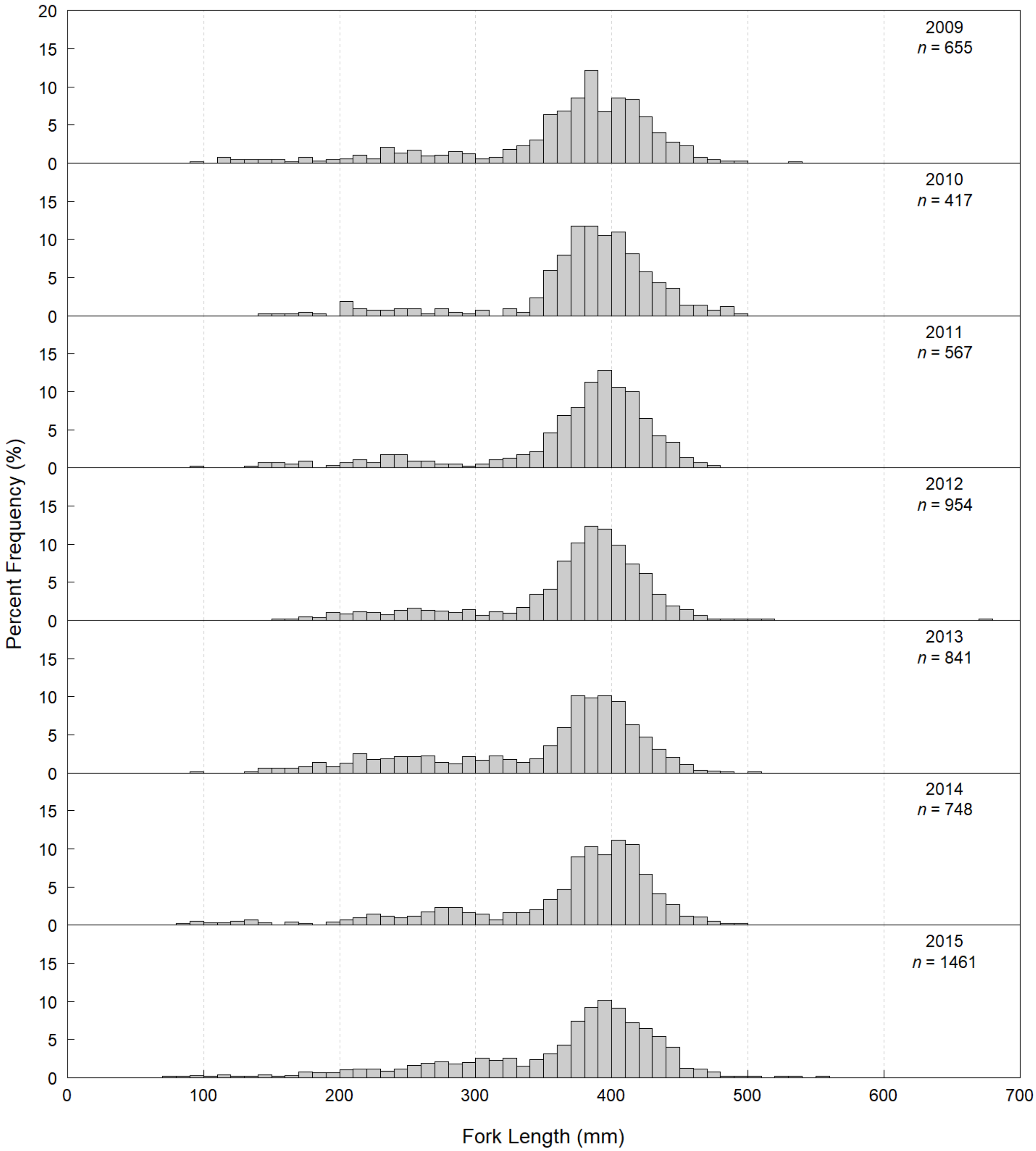
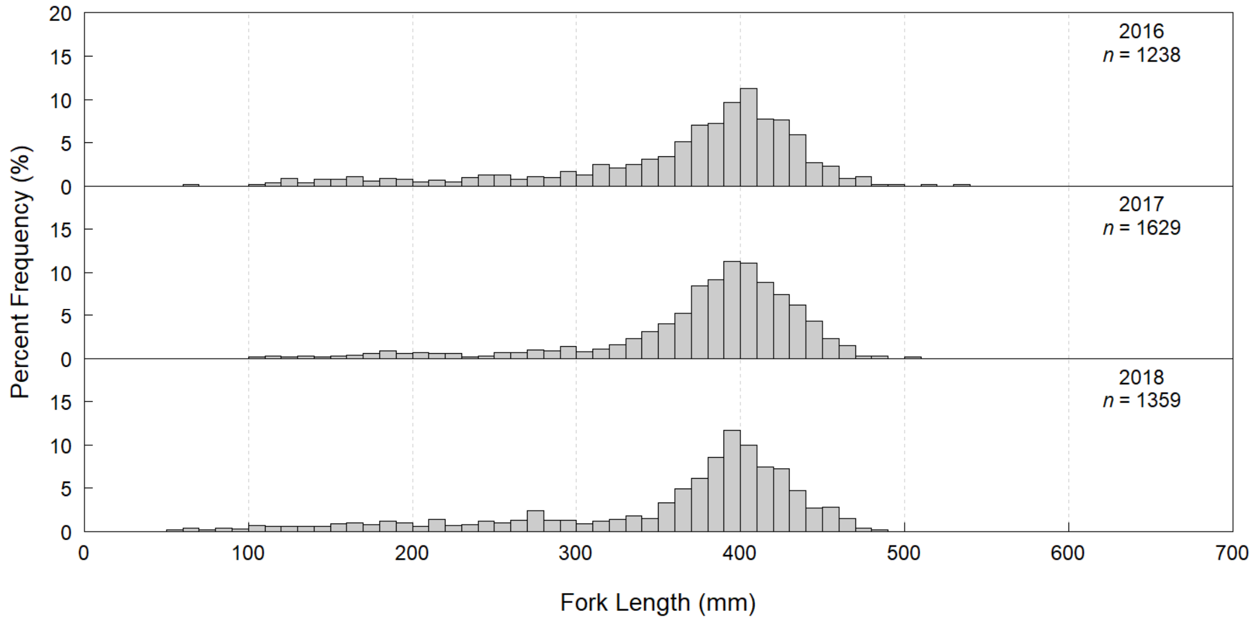


Figure F19: Continued.



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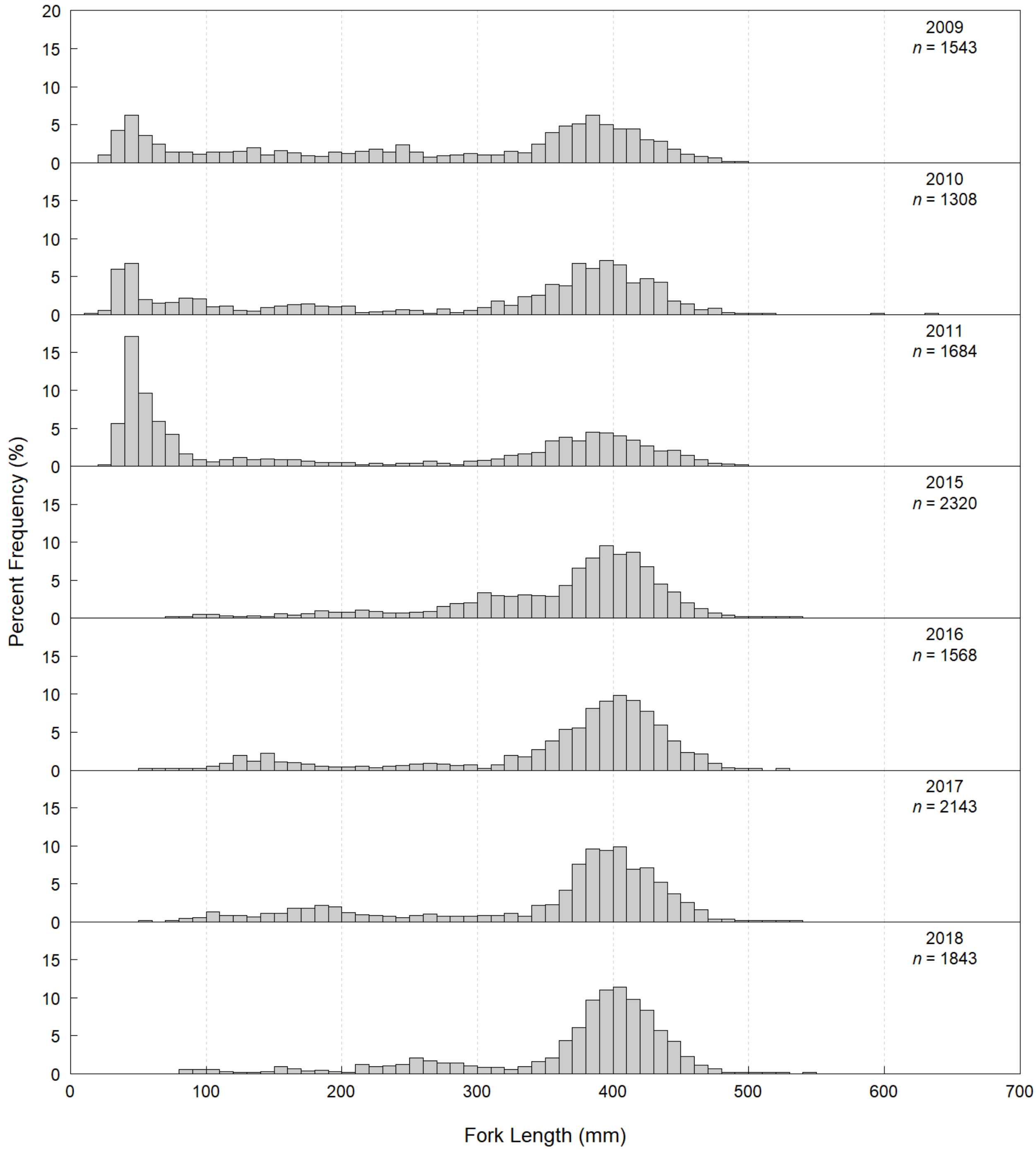

Figure F20: Length-frequency distributions by year for Longnose Sucker captured by boat electroshocking in sections 6, 7, and 9 of Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

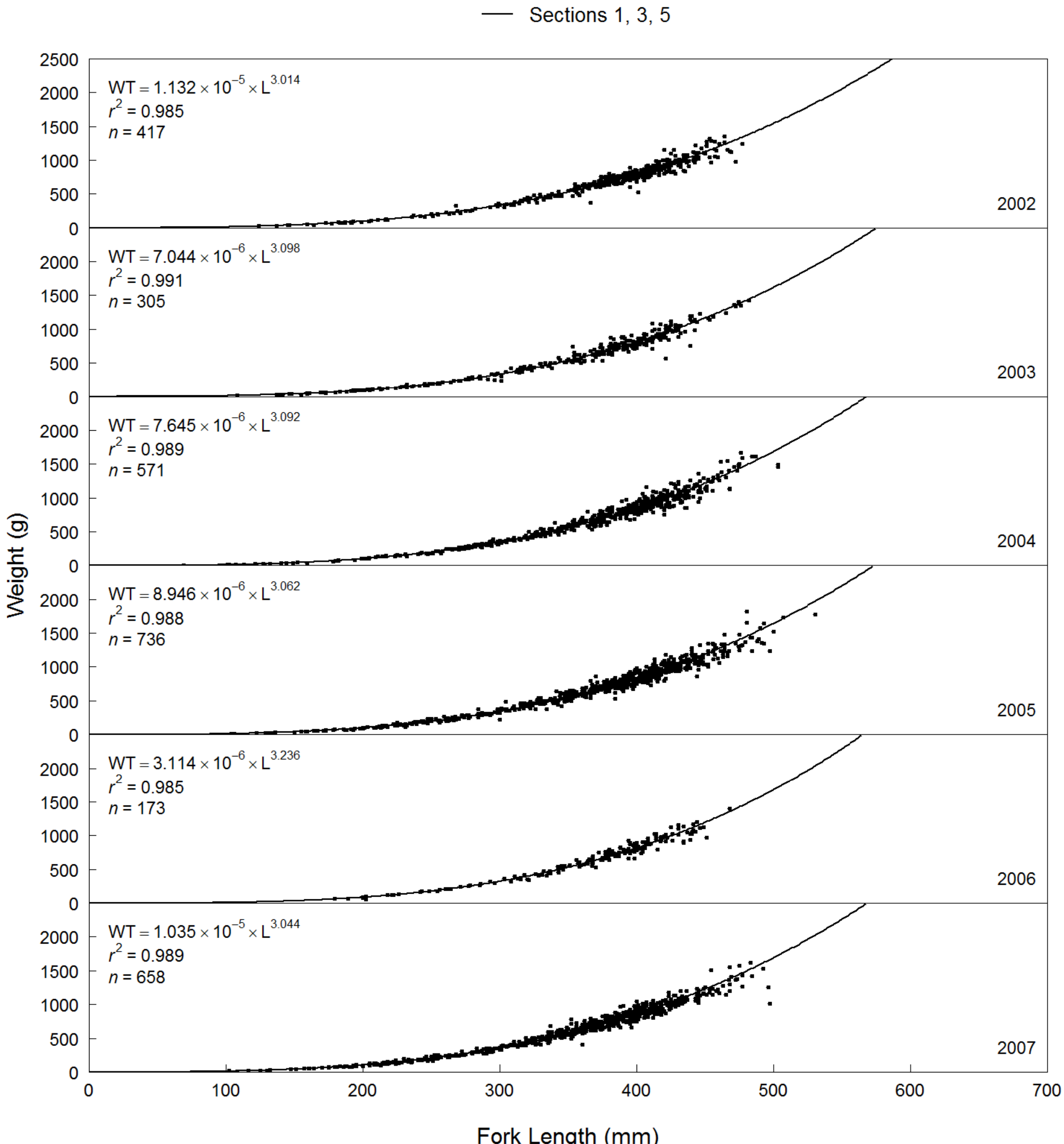

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Figure F21: Length-weight regressions for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

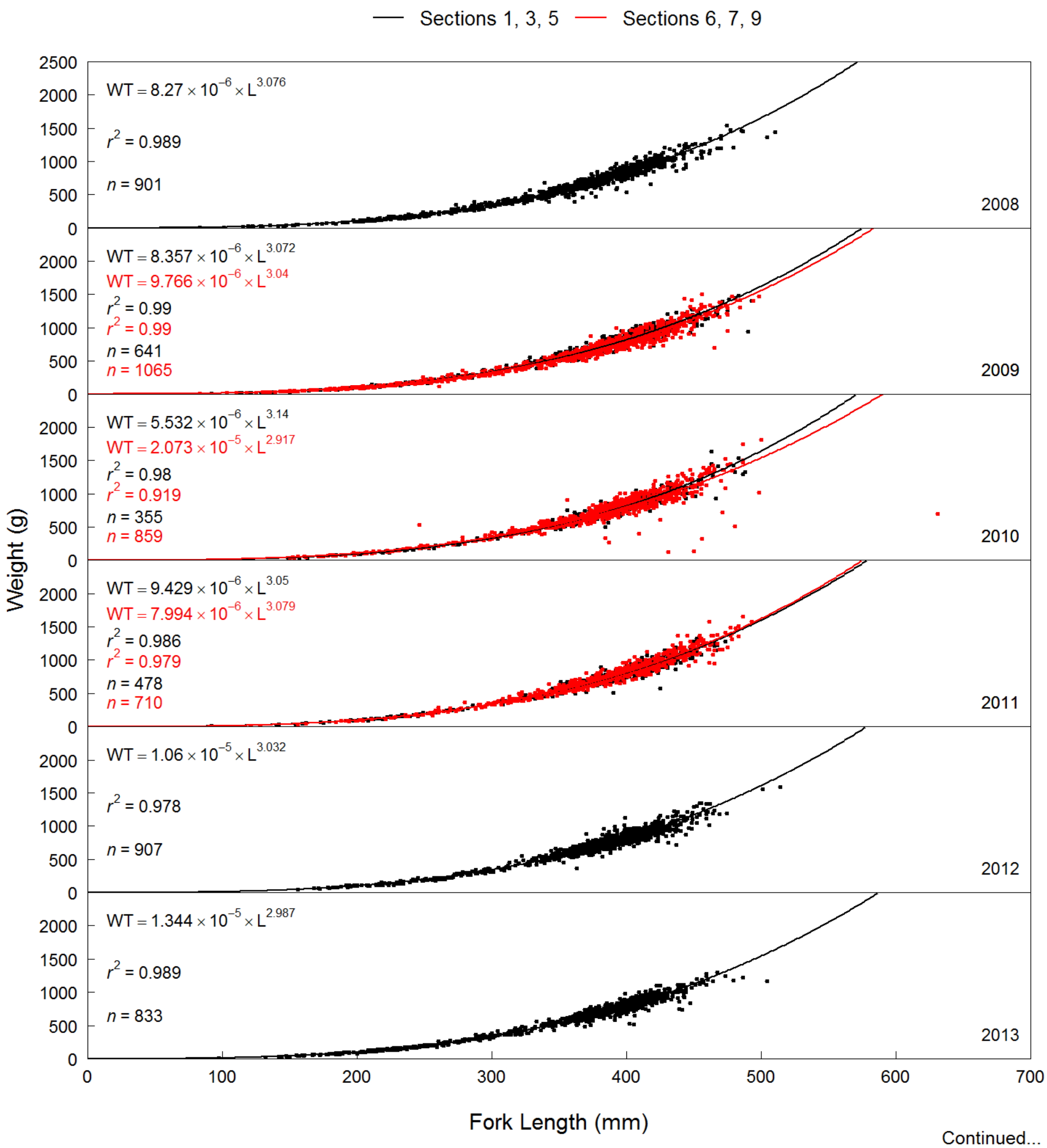

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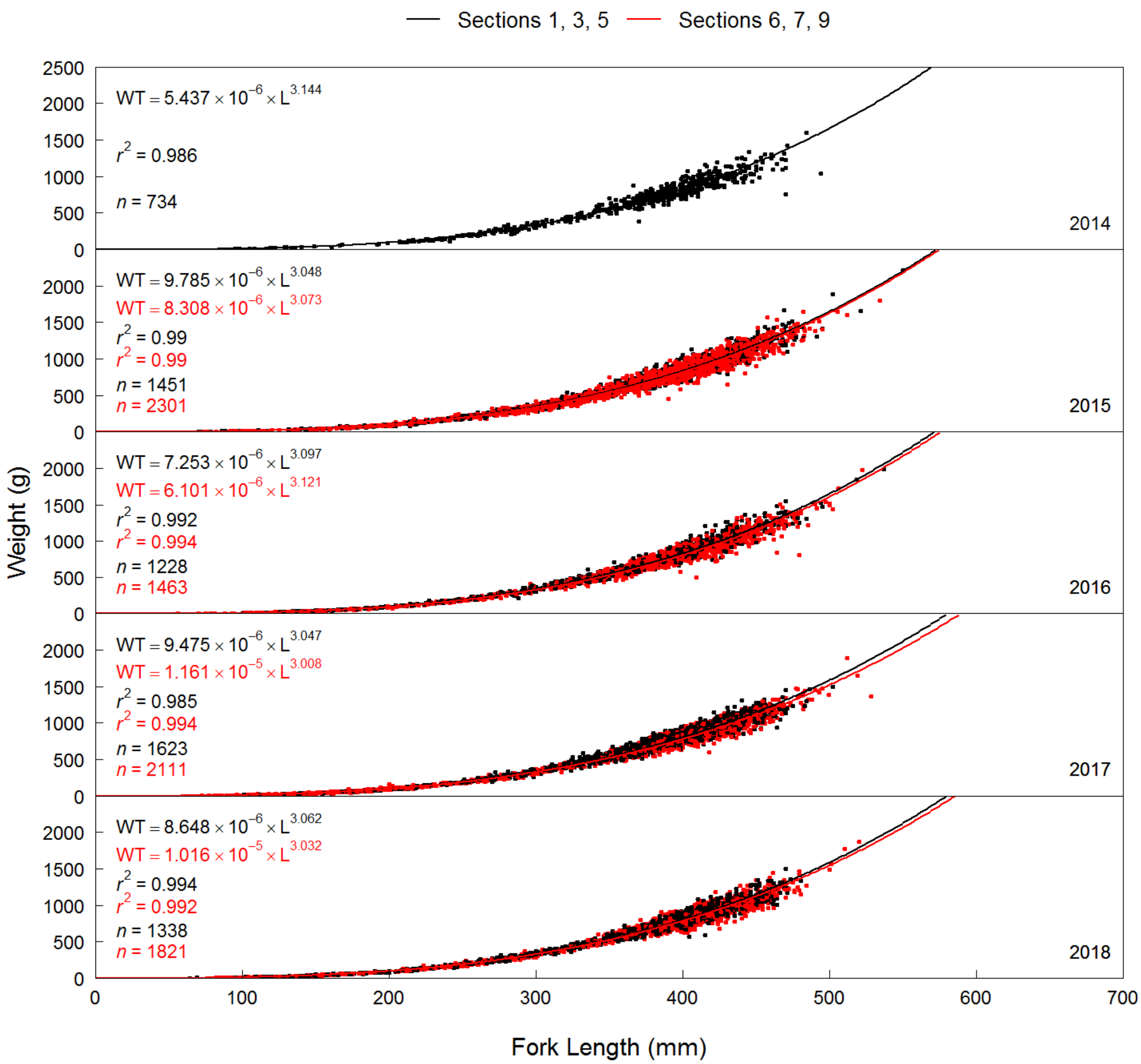
Figure F21: Continued.



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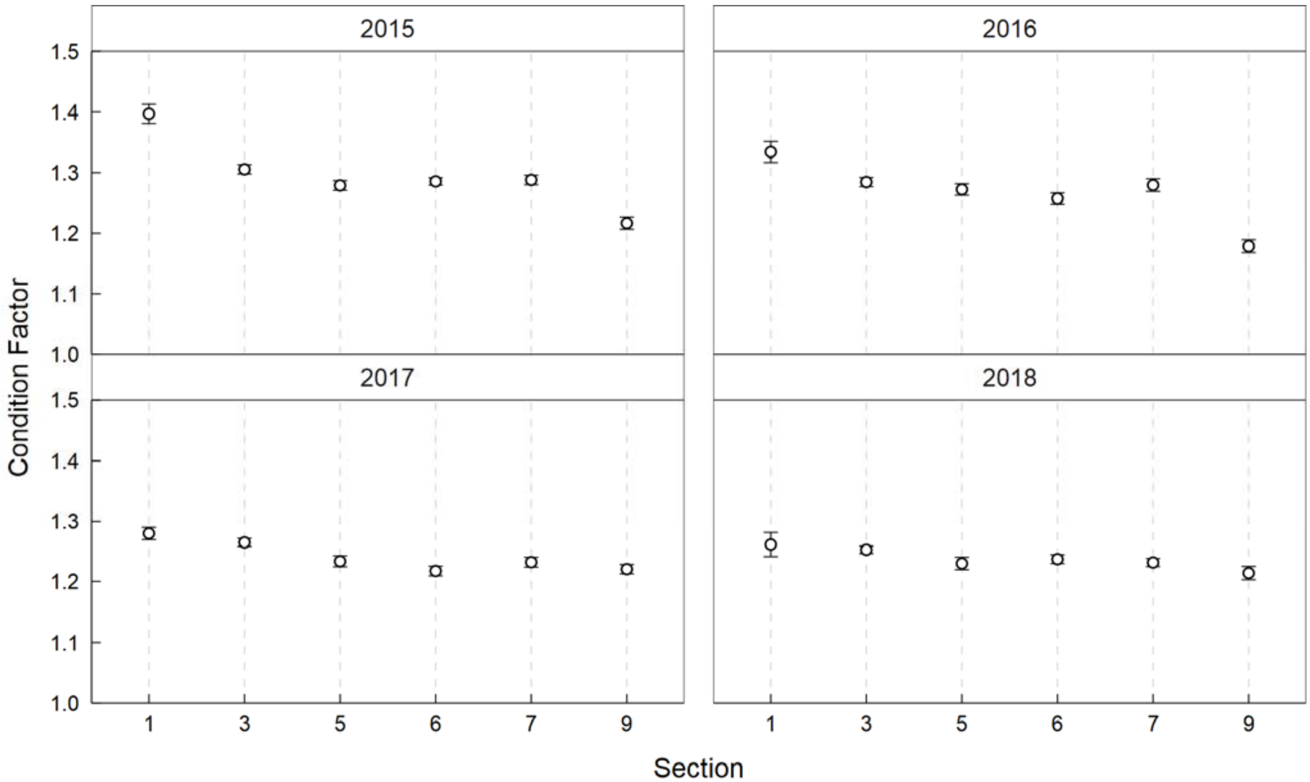


Figure F22: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Longnose Sucker captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

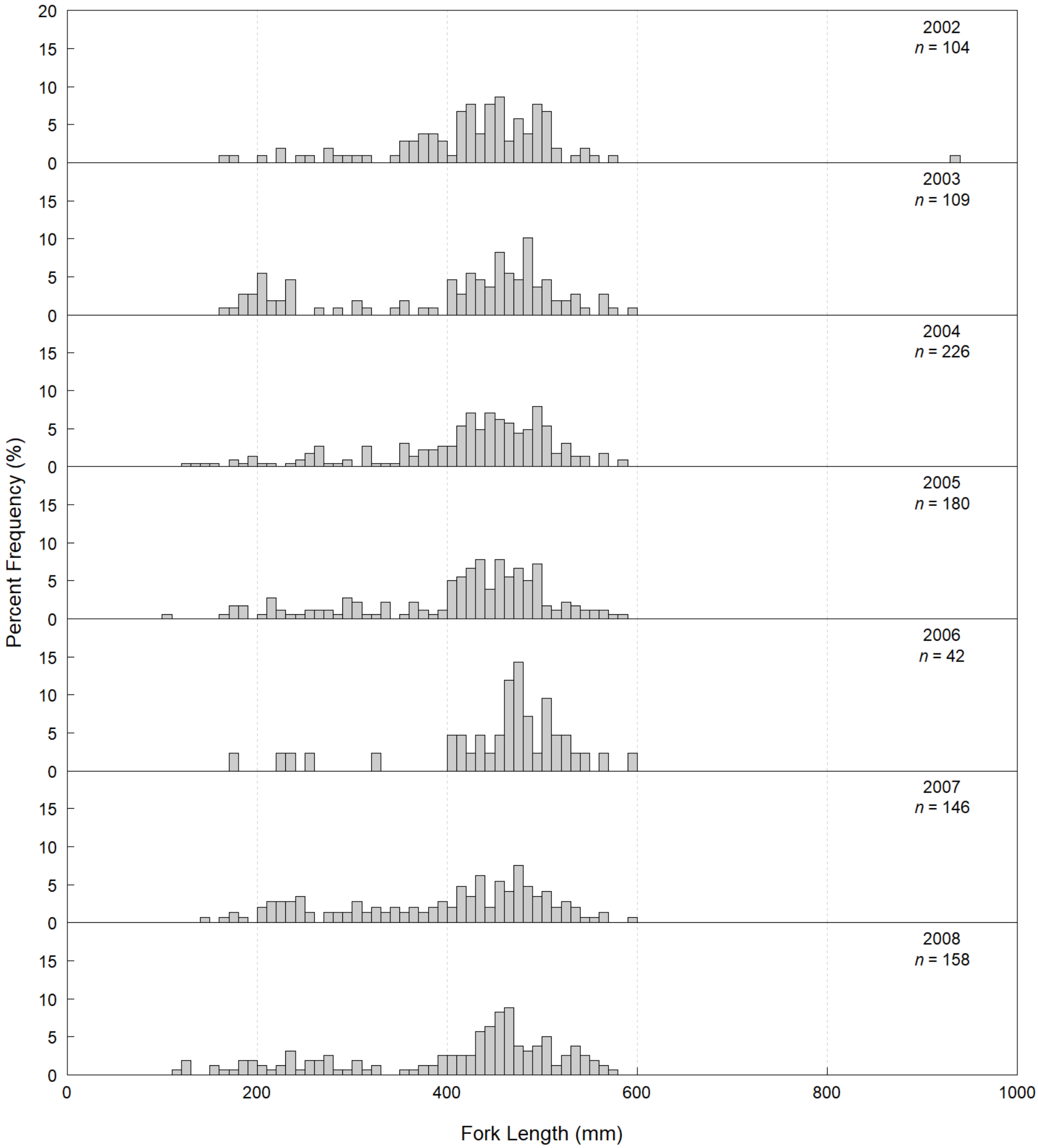
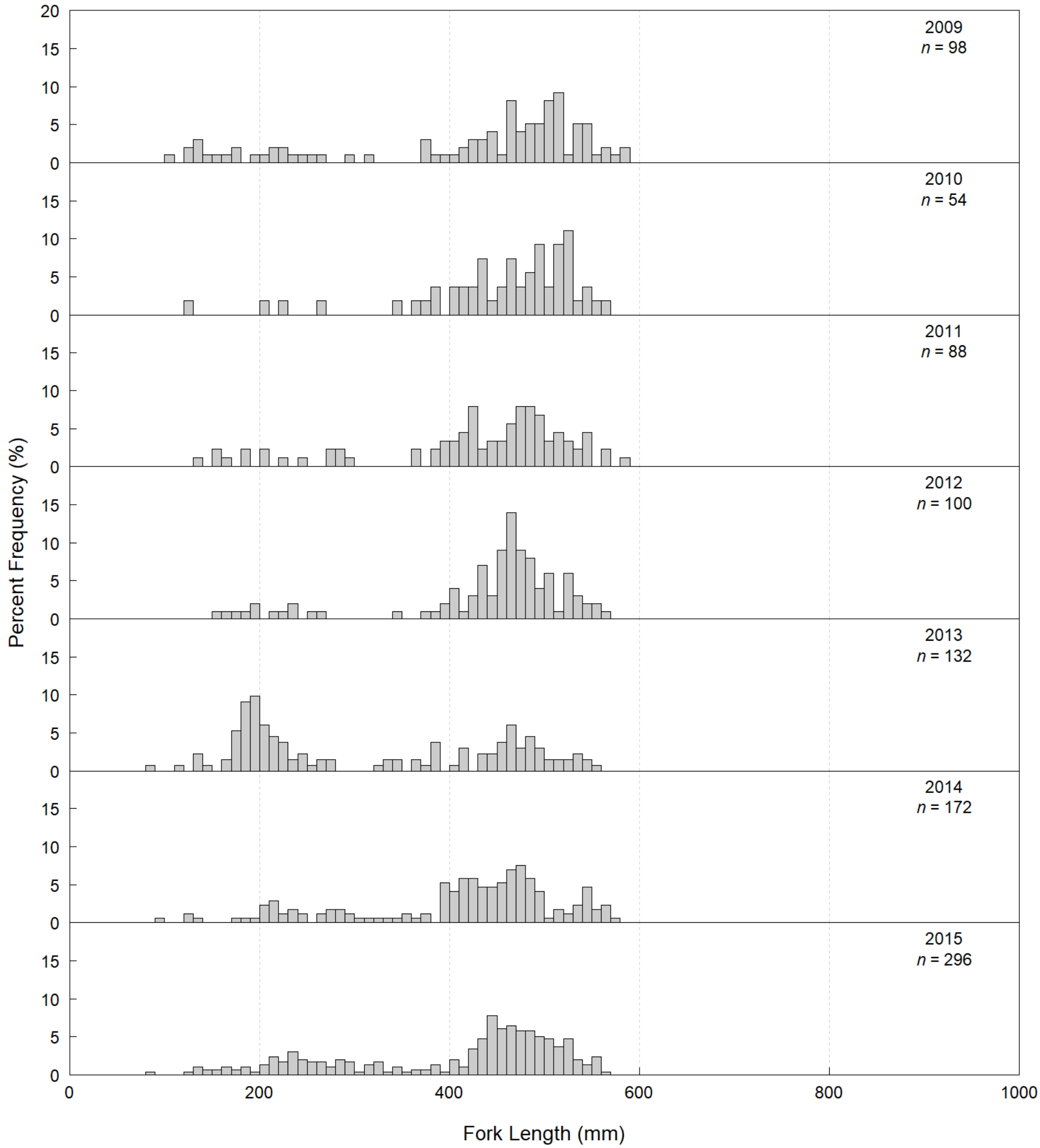


Figure F23: Length-frequency distributions by year for Largescale Sucker captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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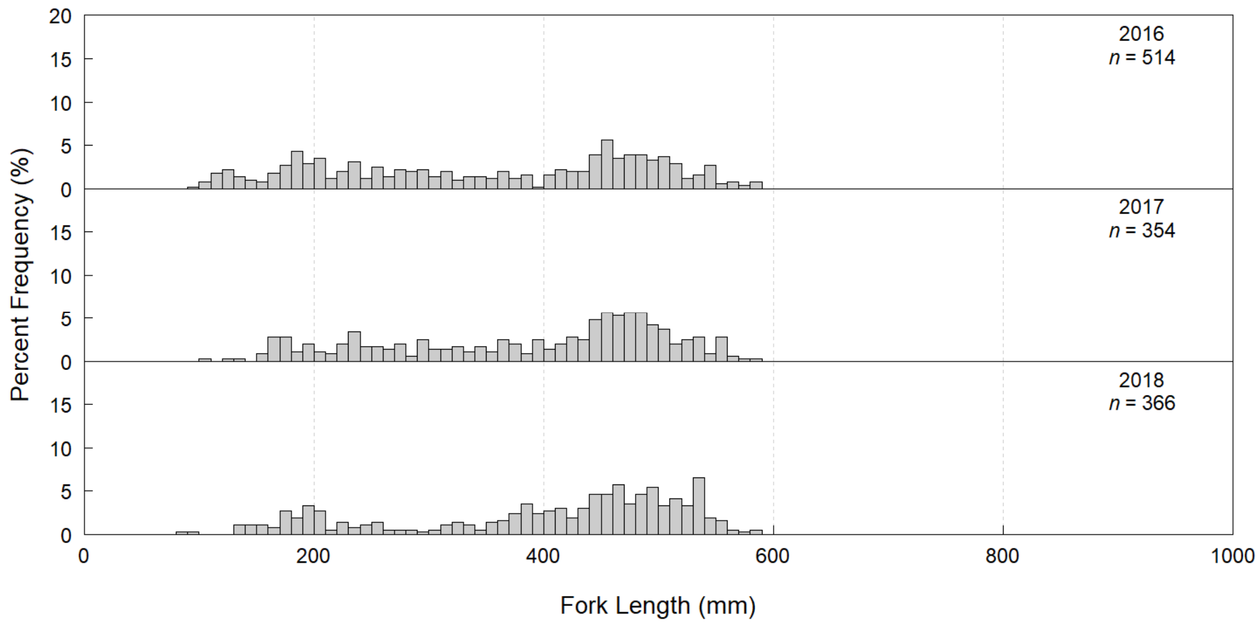

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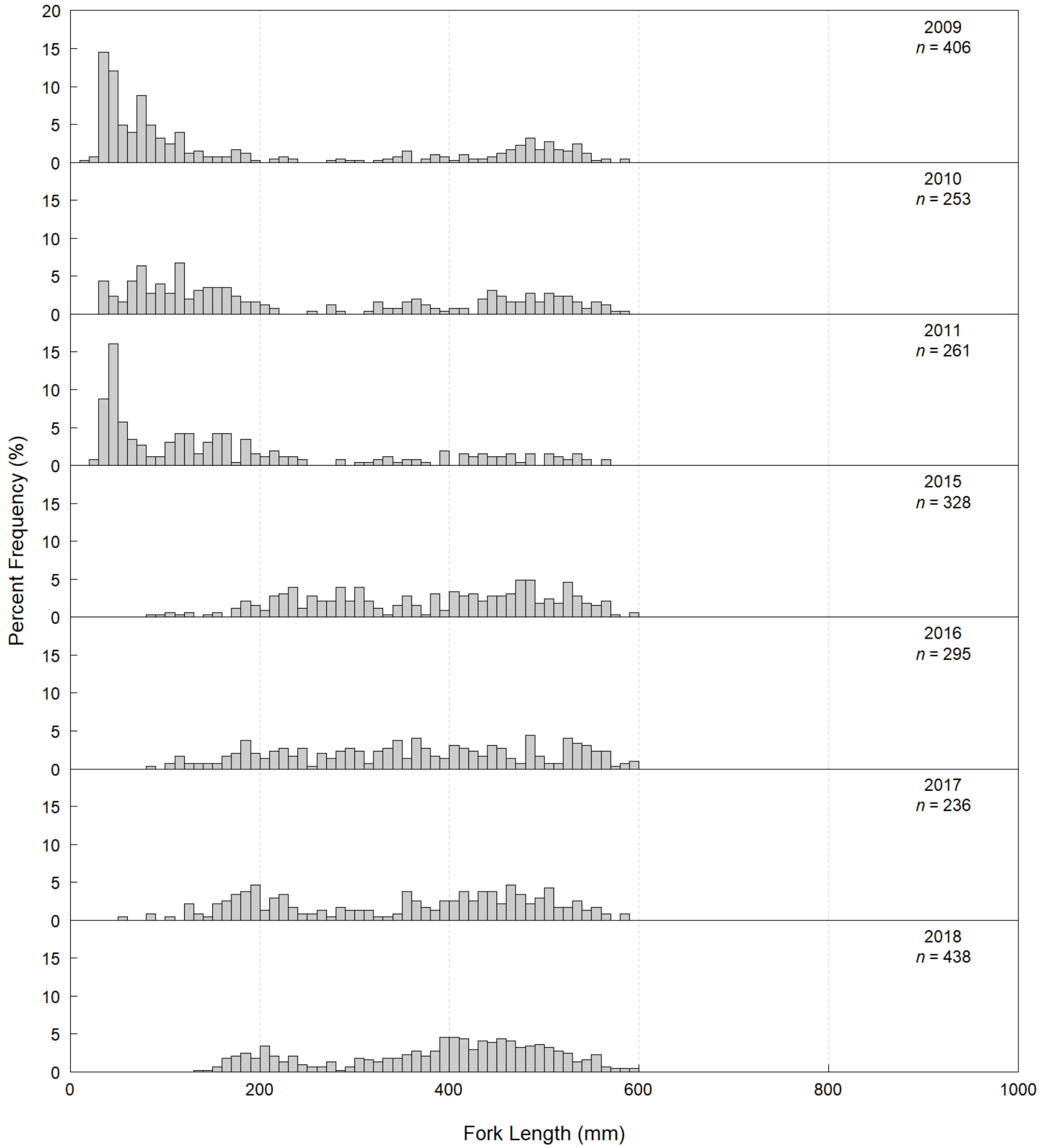

Figure F24: Length-frequency distributions by year for Largescale Sucker captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2009 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

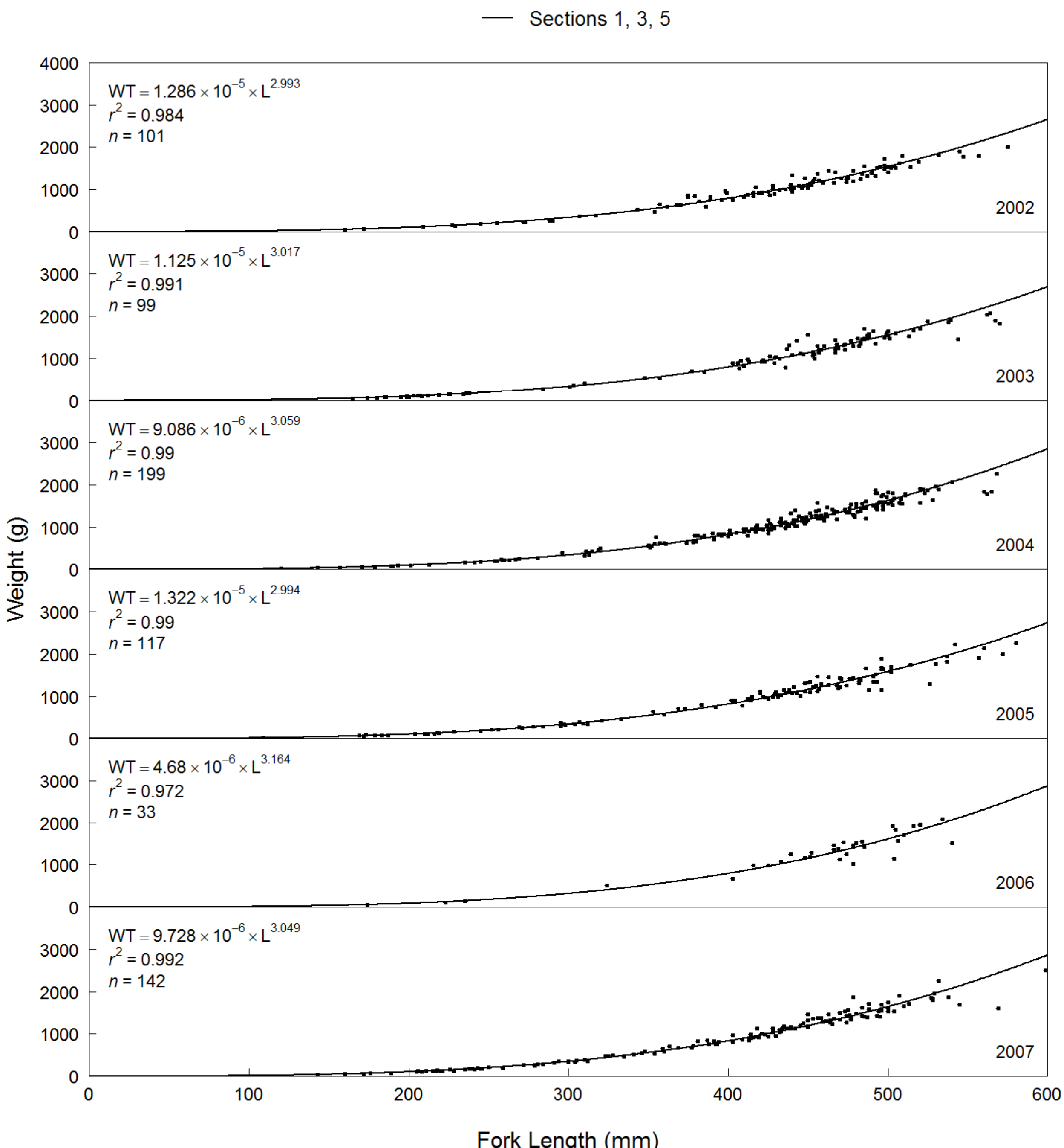

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Figure F25: Length-weight regressions for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

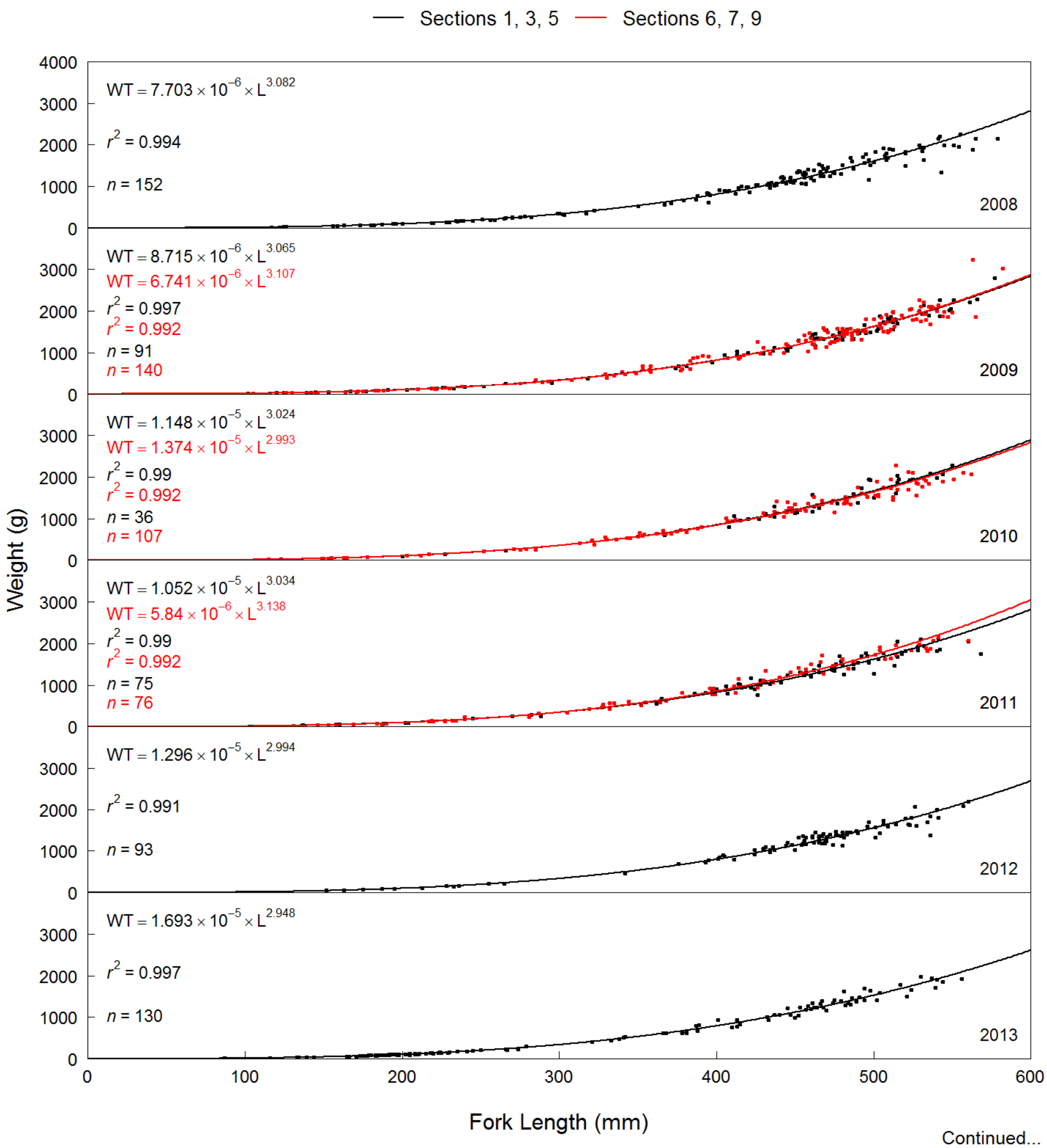

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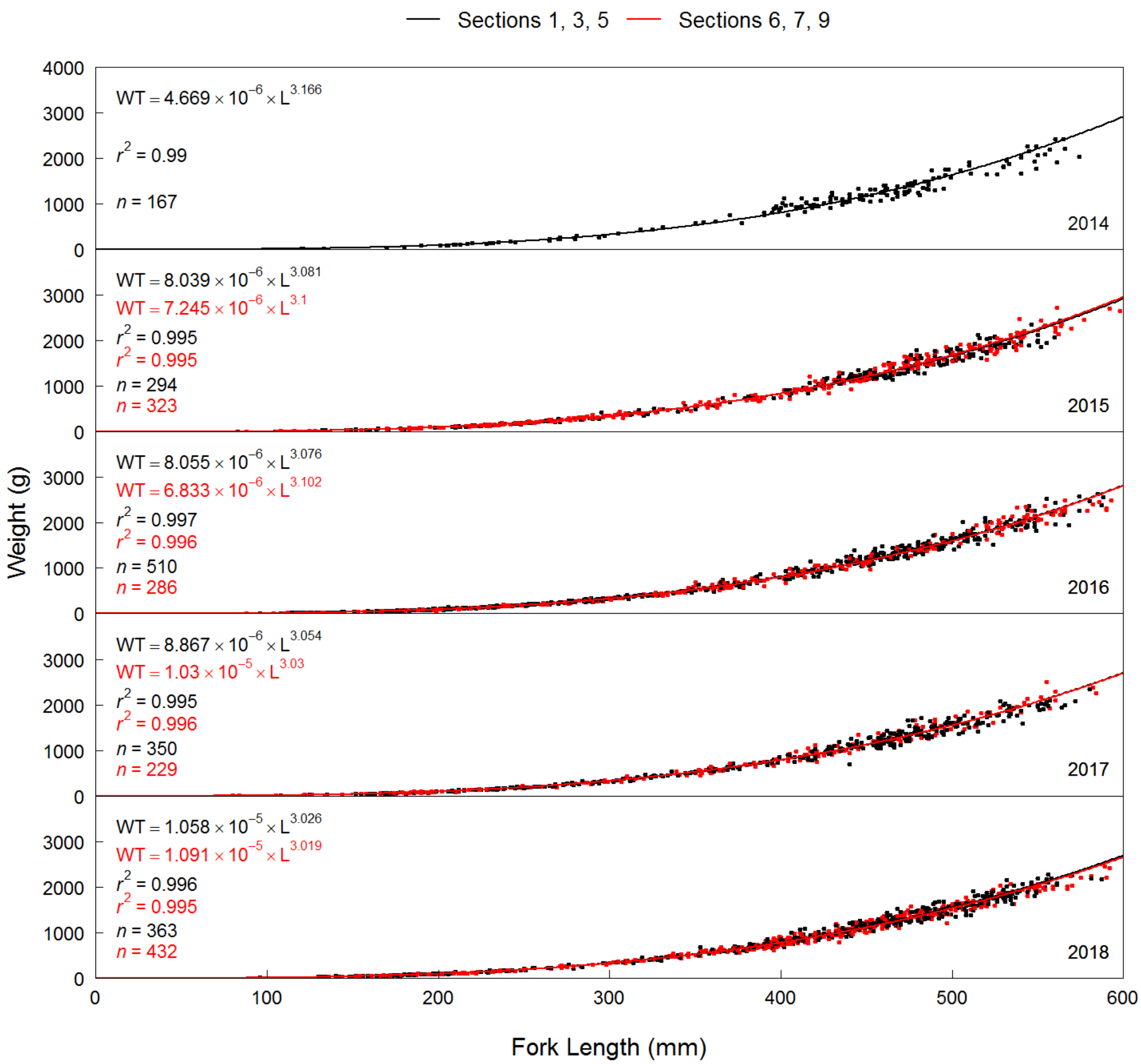
Figure F25: Continued.



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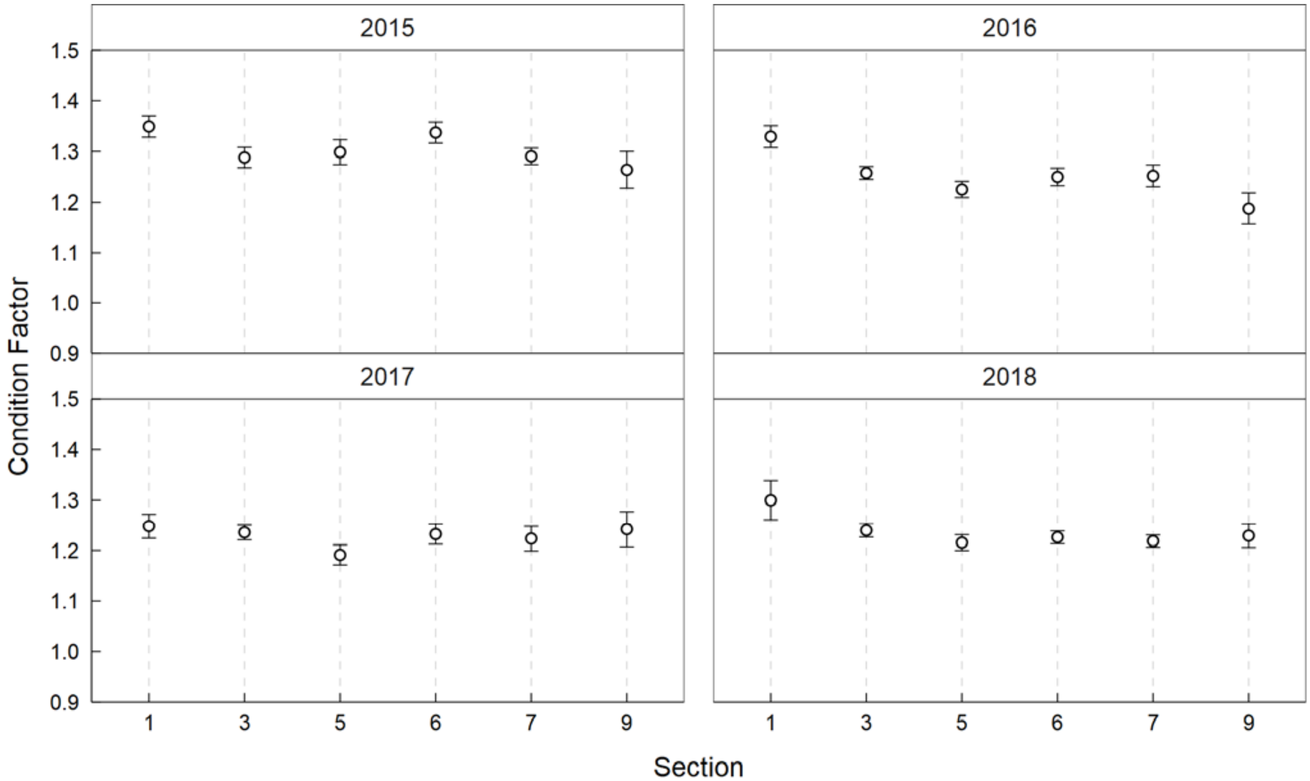


Figure F26: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Largescale Sucker captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

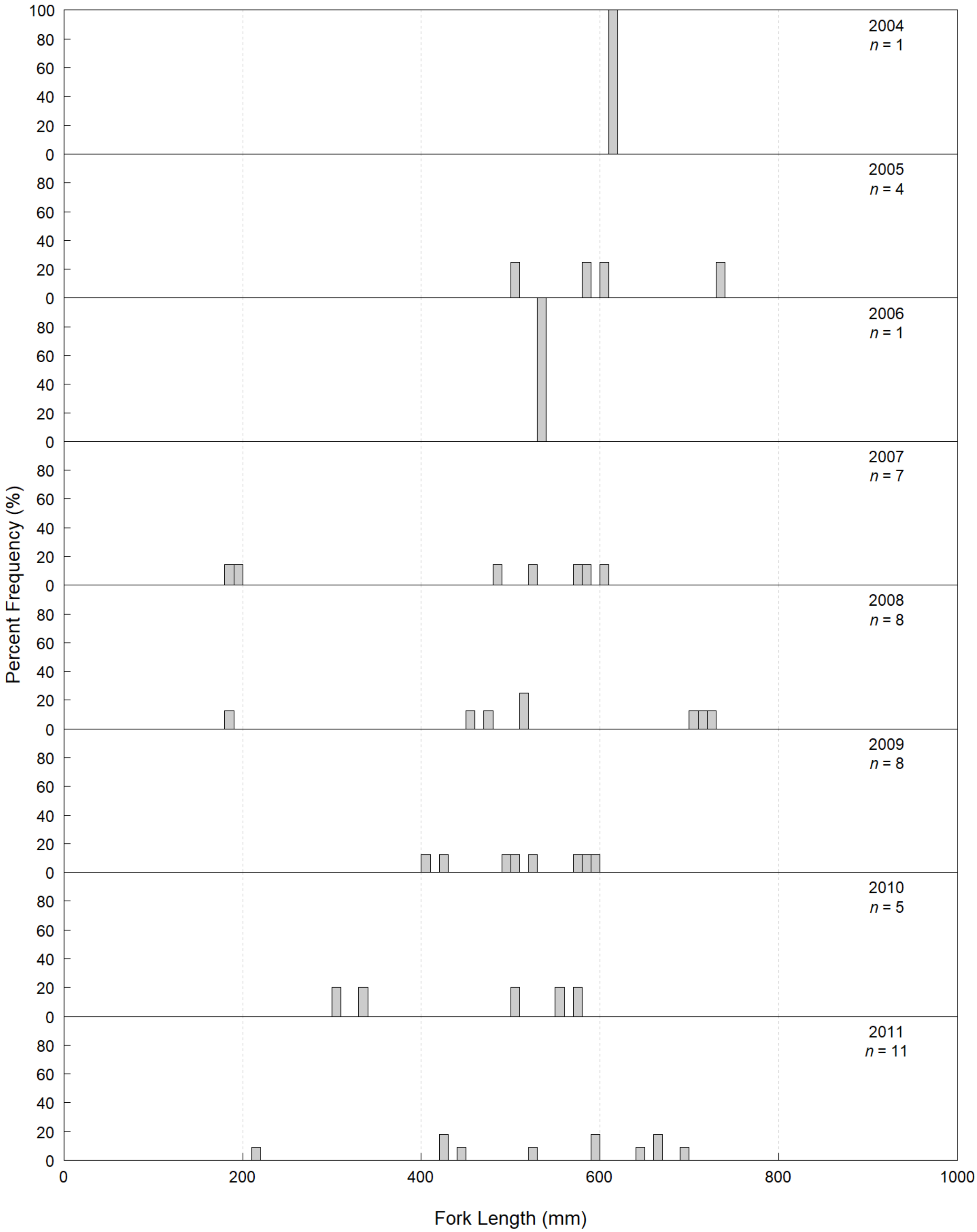
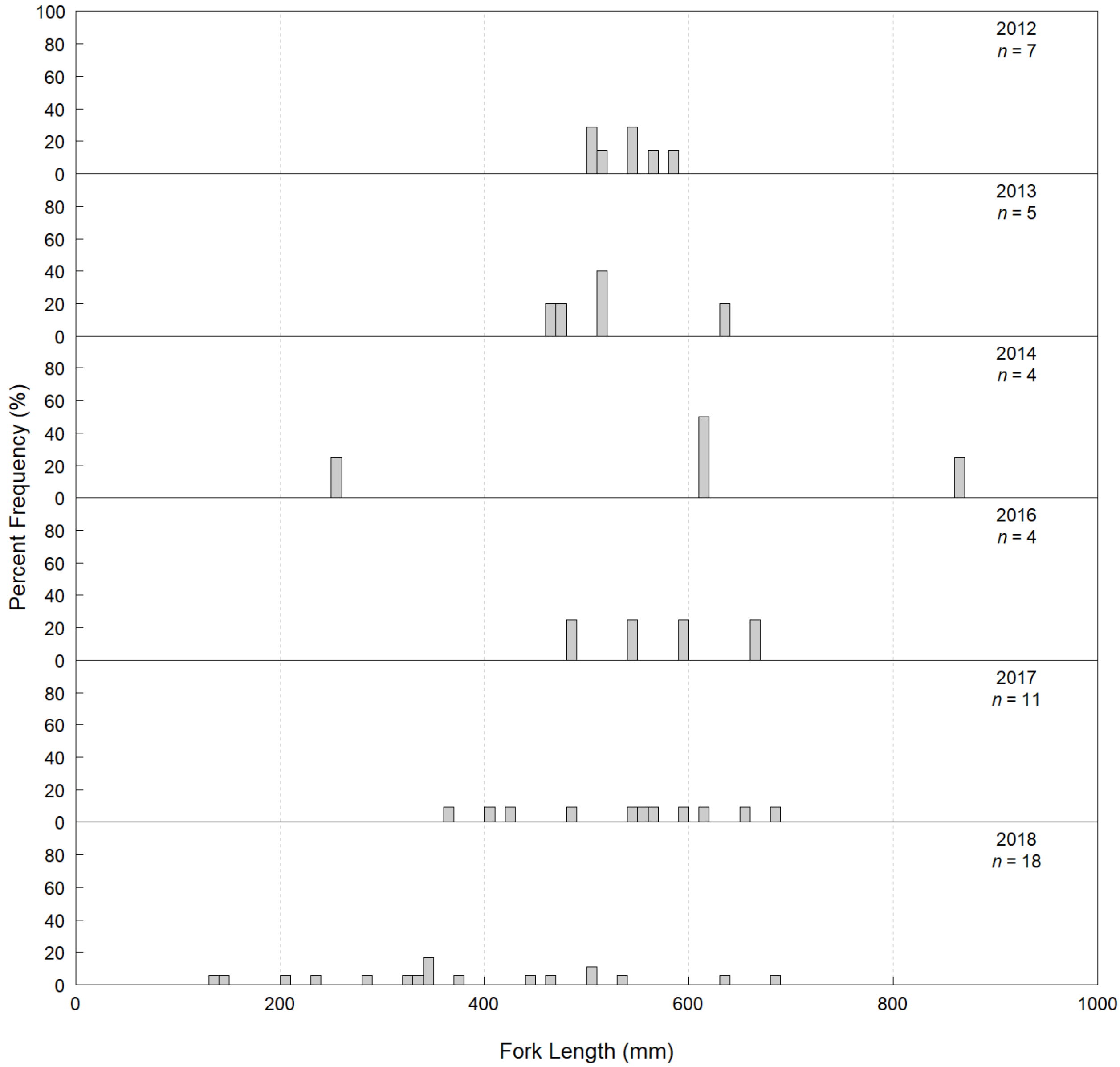


Figure F27: Length-frequency distributions by year for Northern Pike captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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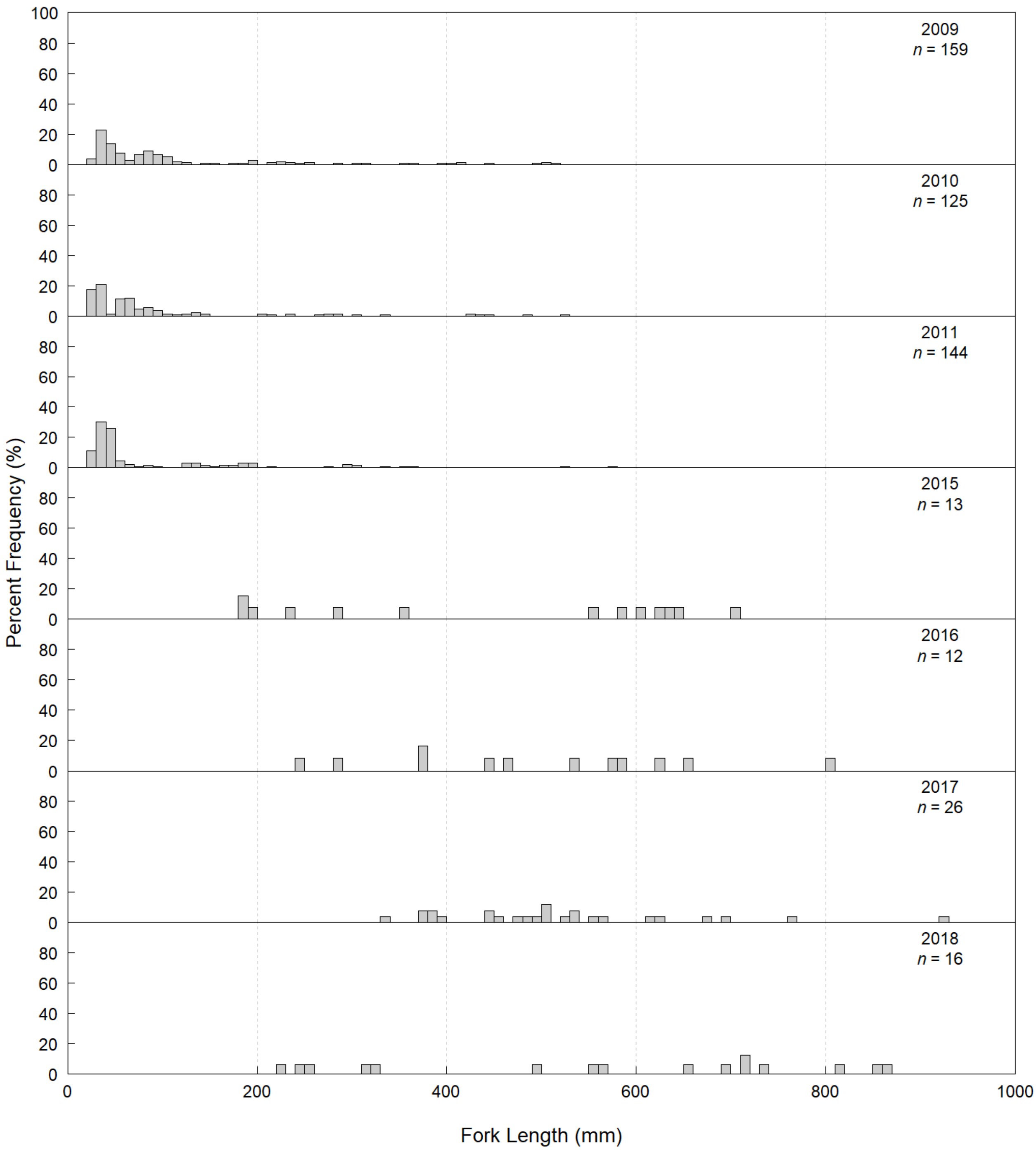

Figure F28: Length-frequency distributions by year for Northern Pike captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2009 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

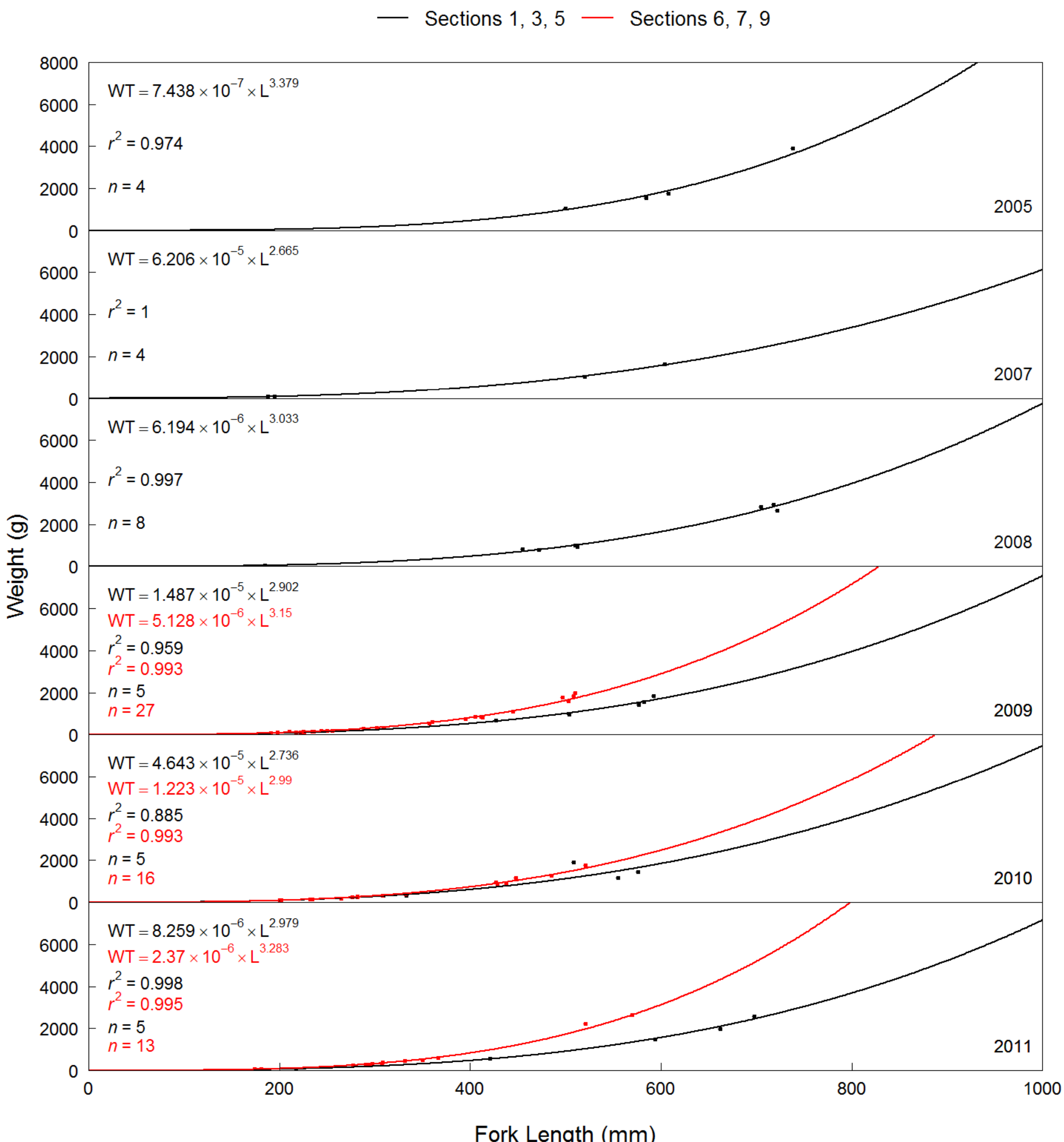

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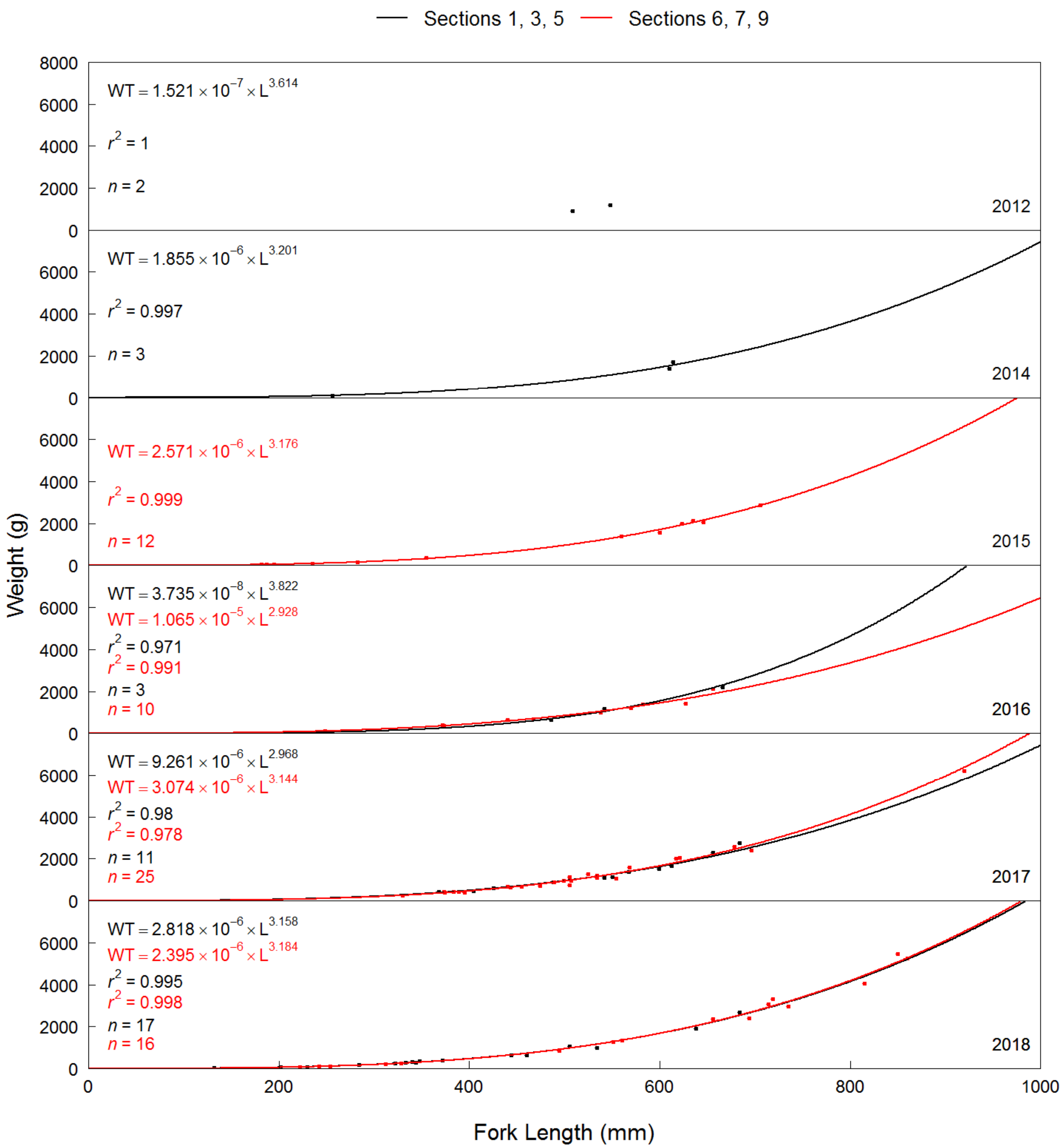
Figure F29: Length-weight regressions for Northern Pike captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).



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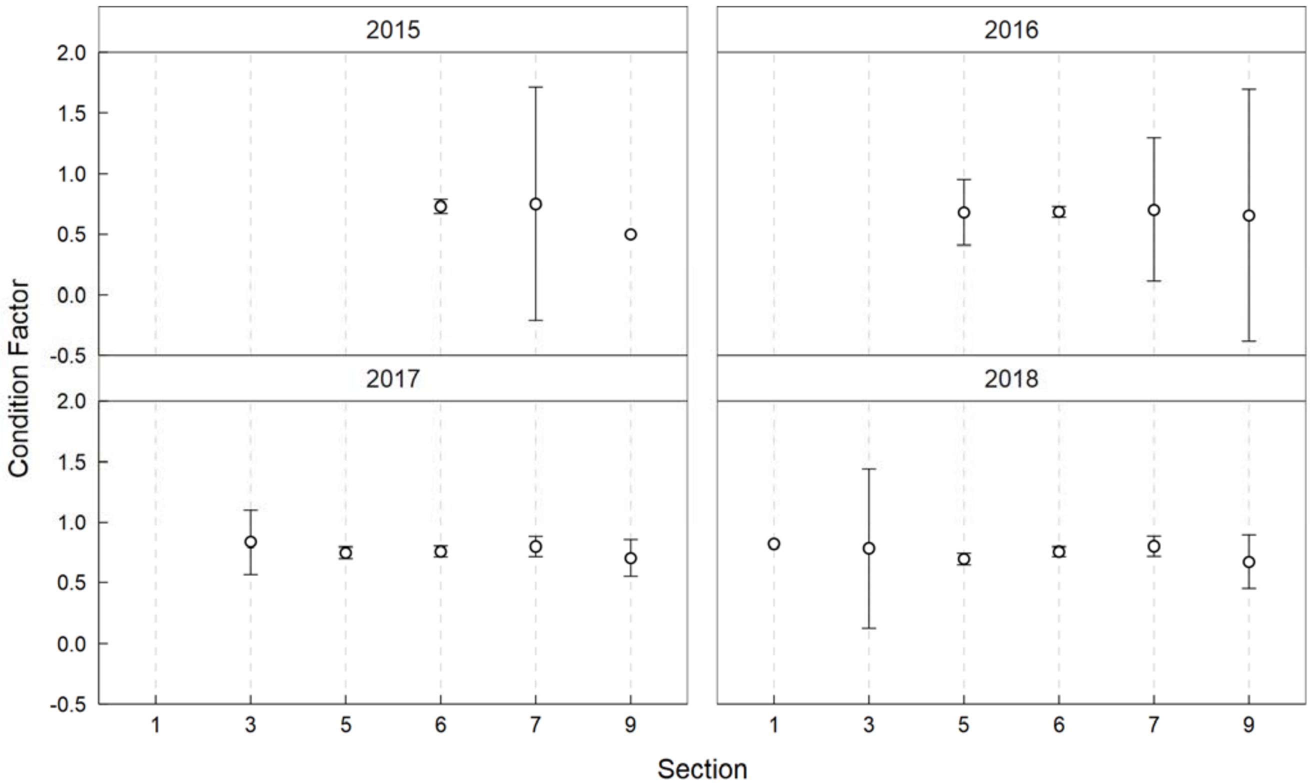


Figure F30: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Northern Pike captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

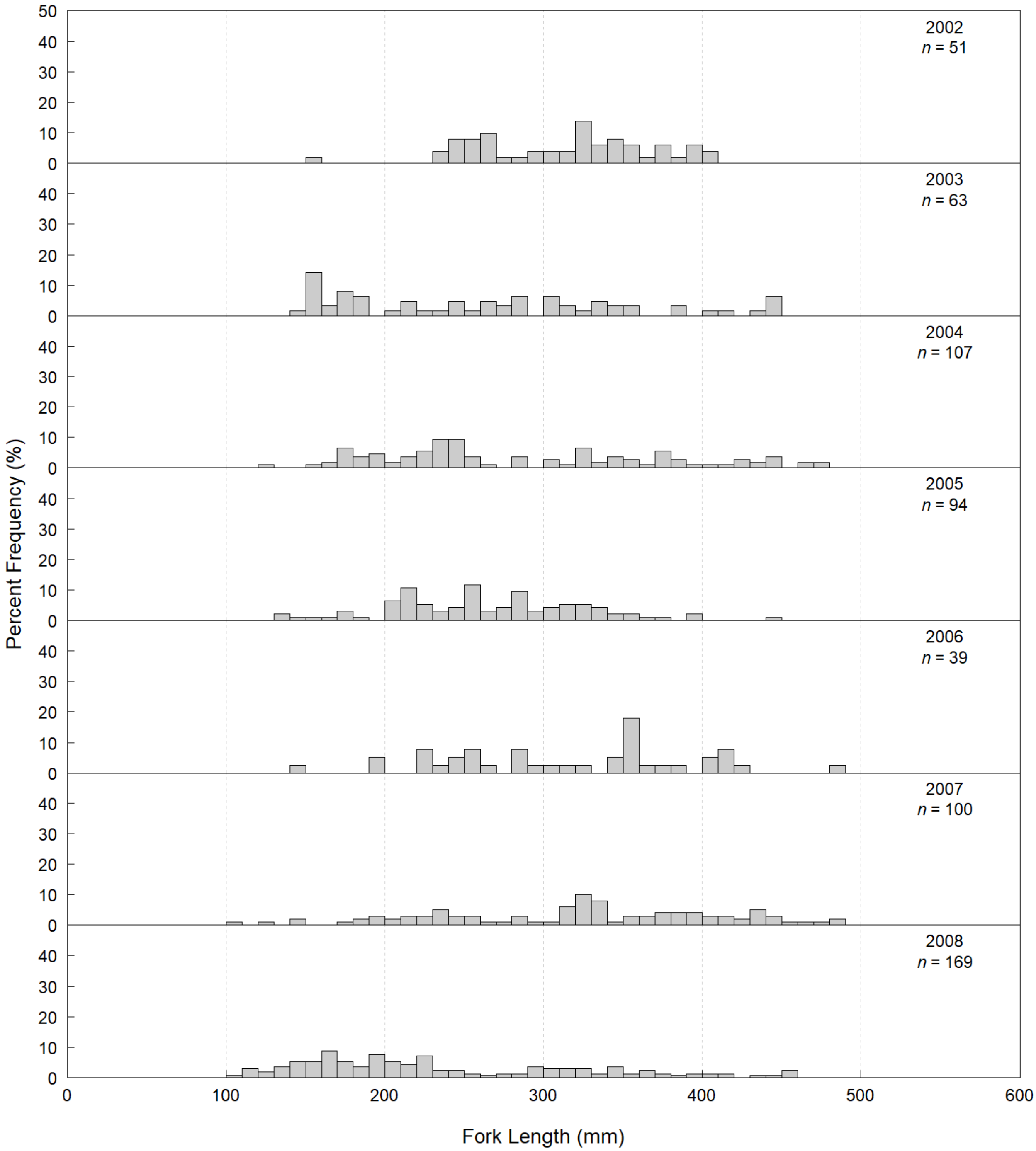
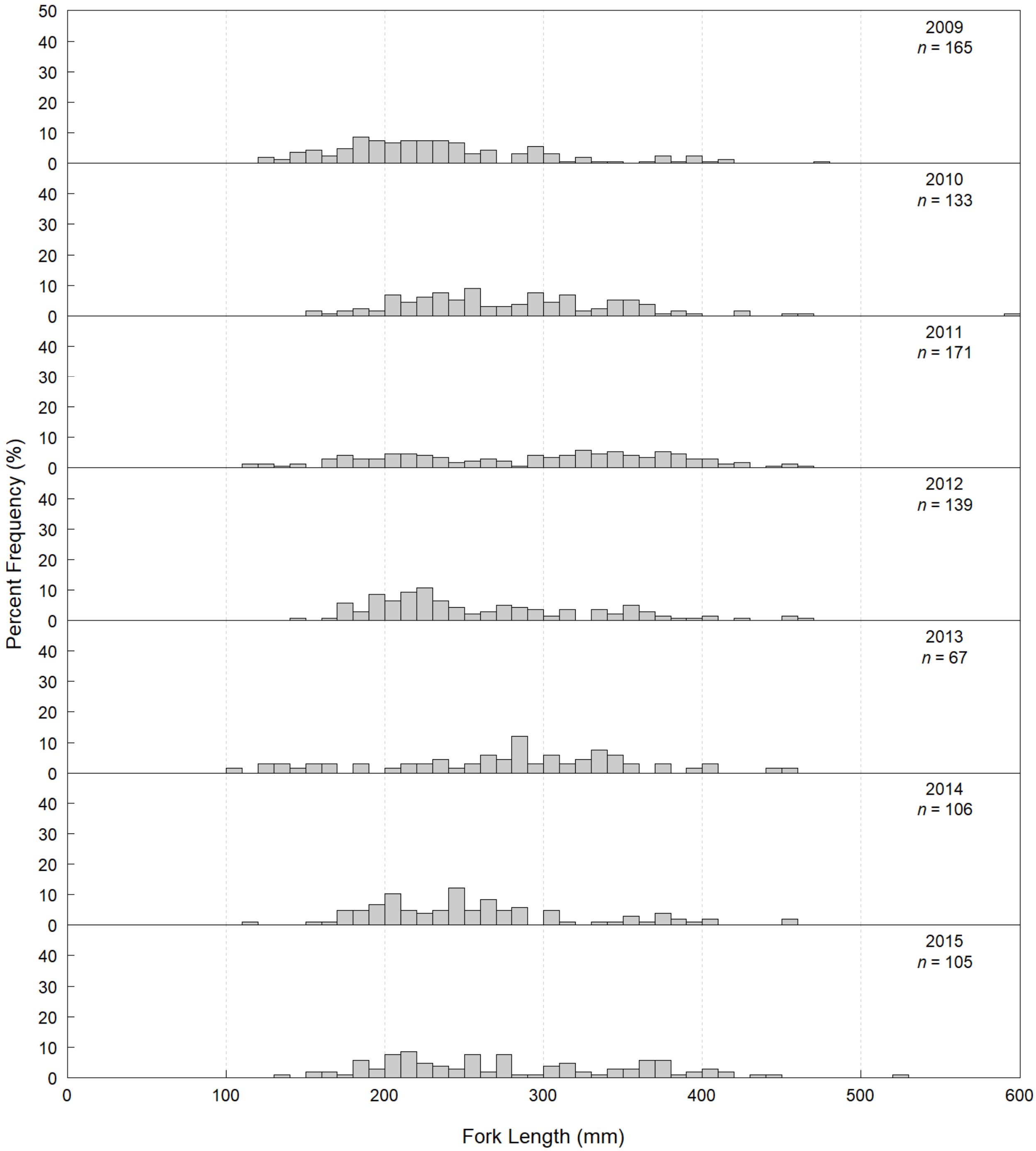


Figure F31: Length-frequency distributions by year for Rainbow Trout captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.



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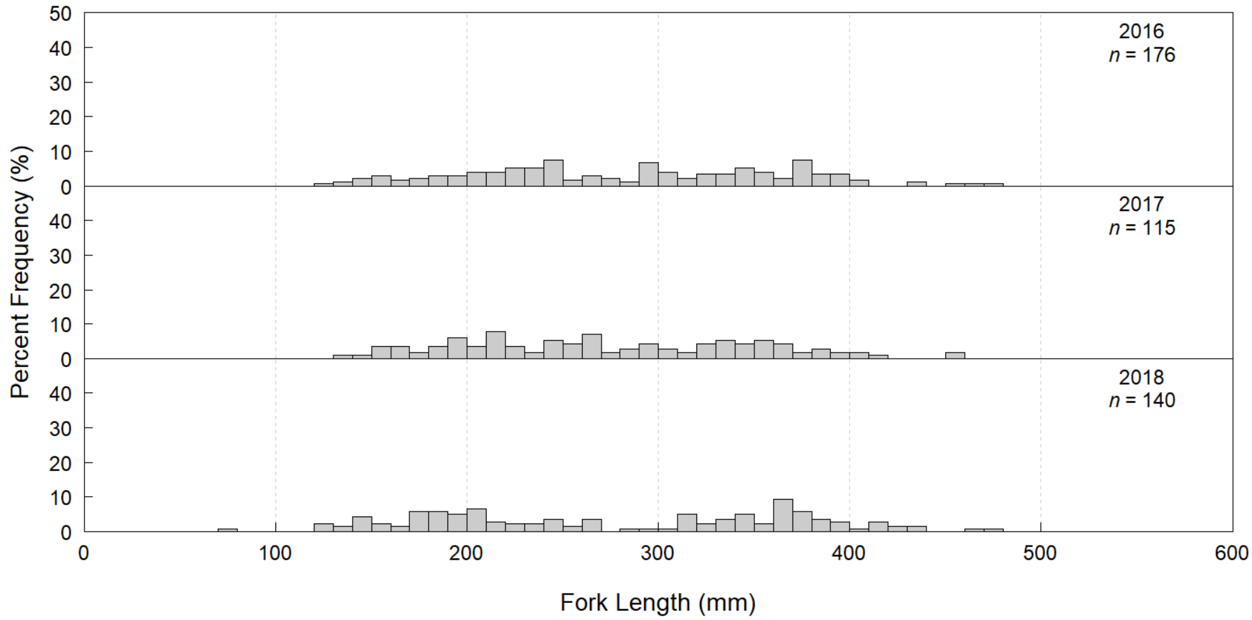


Figure F31: Concluded.

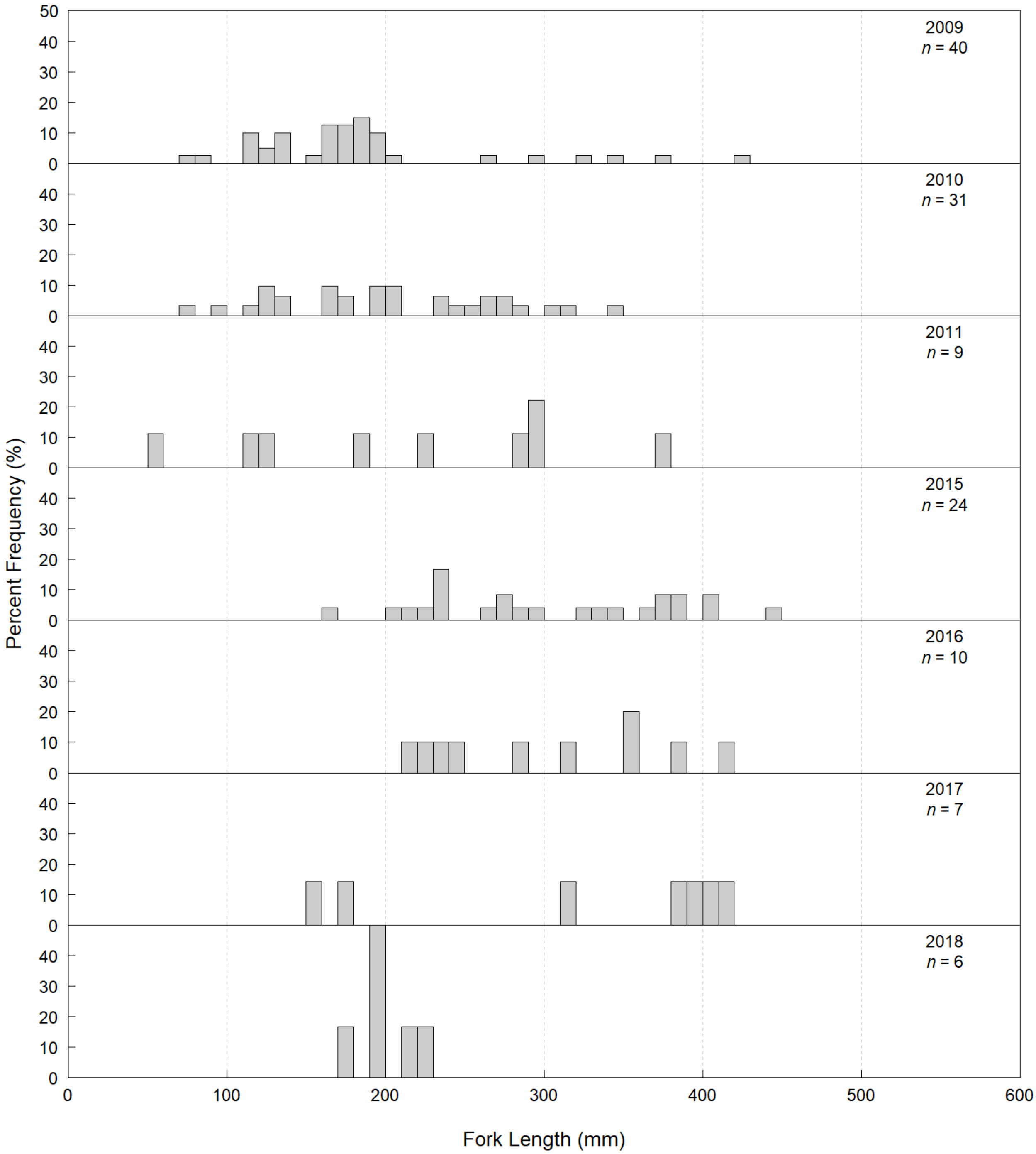
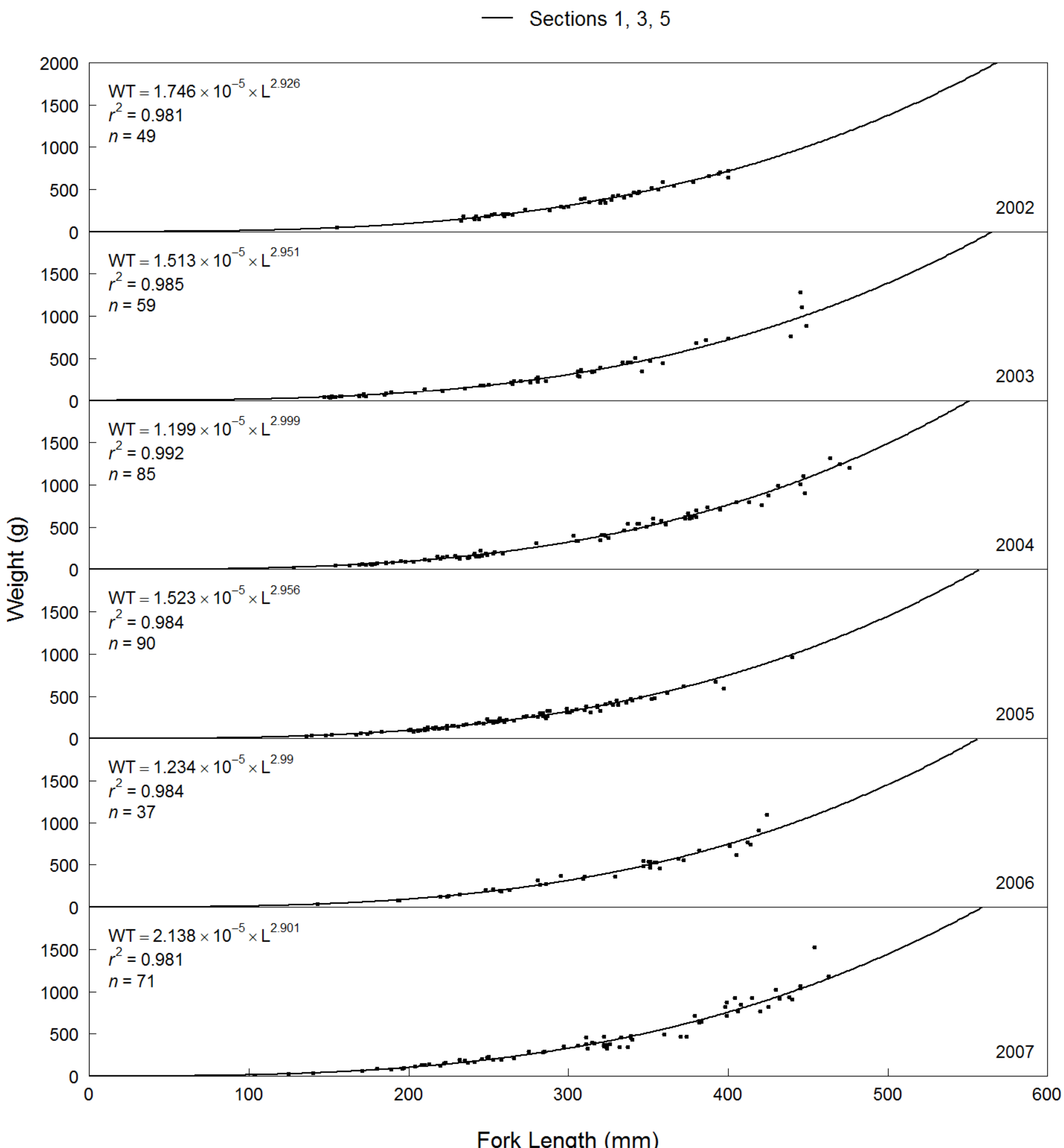


Figure F32: Length-frequency distributions by year for Rainbow Trout captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).



Continued...

Figure F33: Length-weight regressions for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

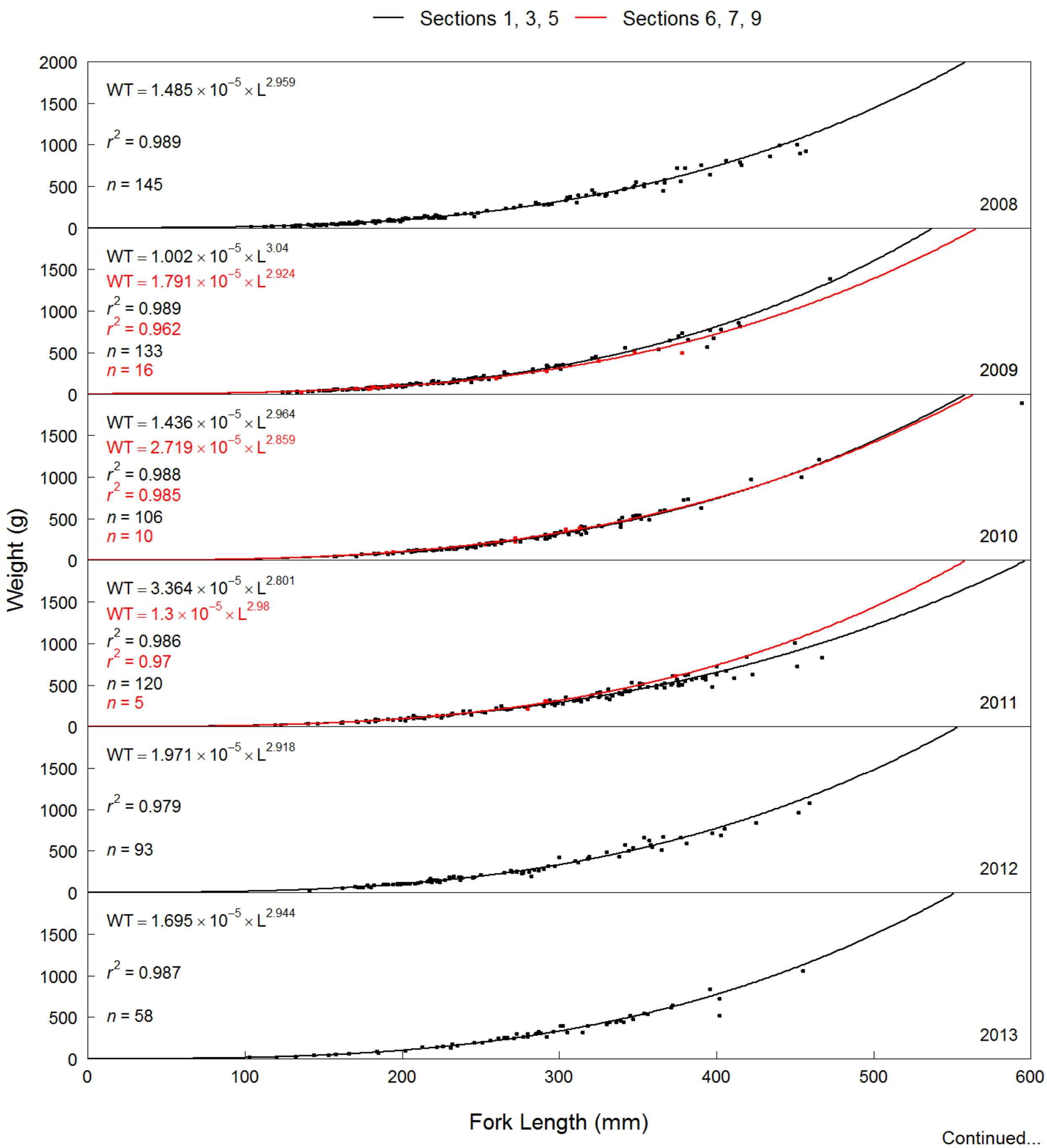


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Figure F33: Continued.

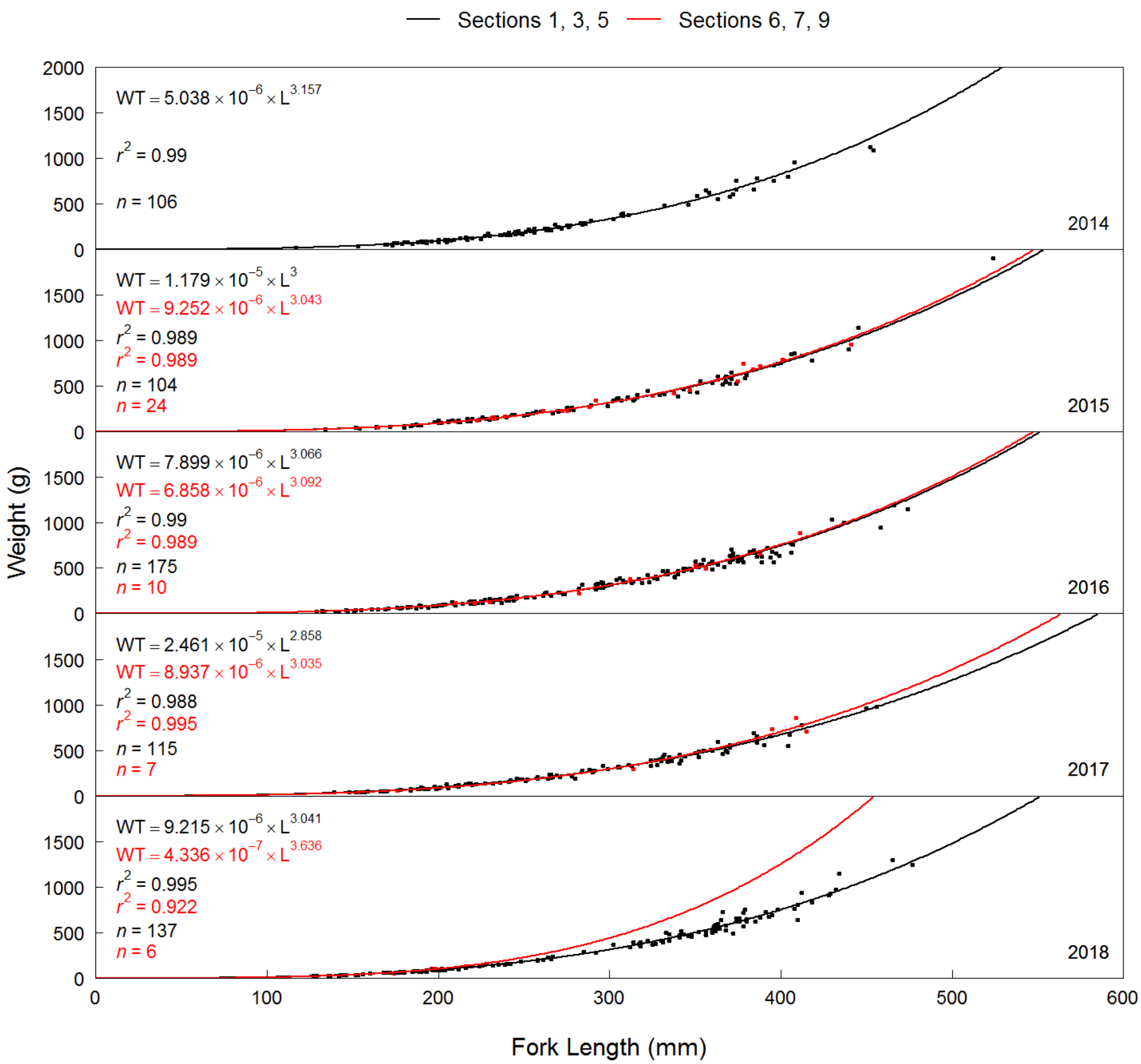


Figure F33: Concluded.

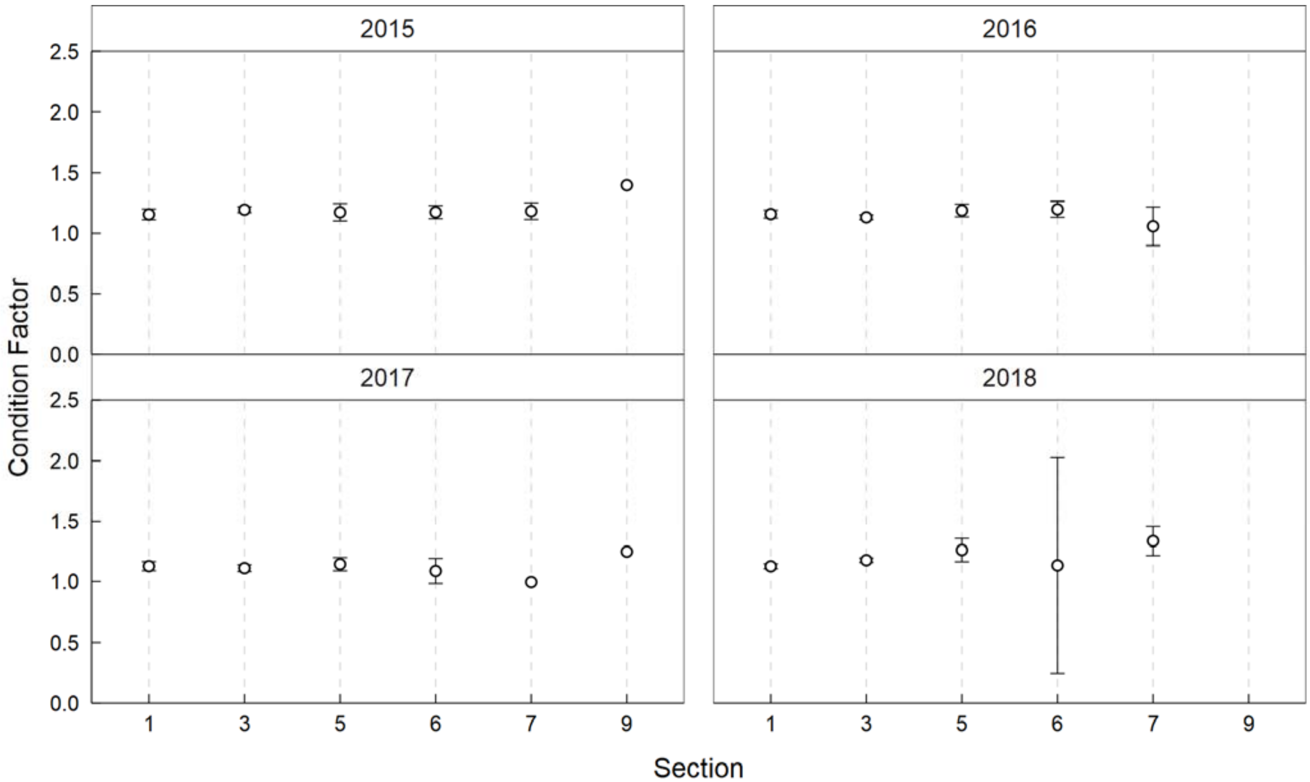


Figure F34: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Rainbow Trout captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

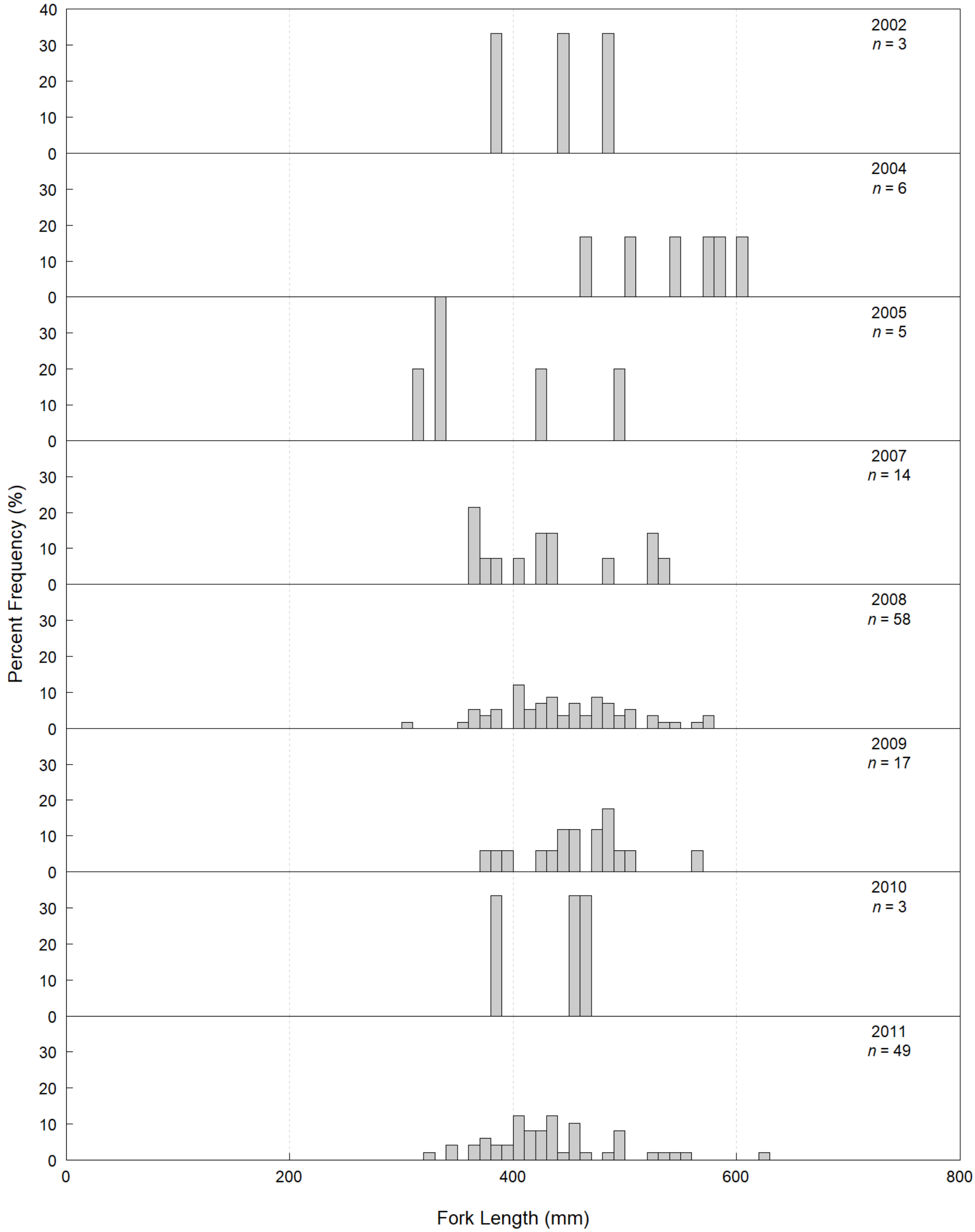


Figure F35: Length-frequency distributions by year for Walleye captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.

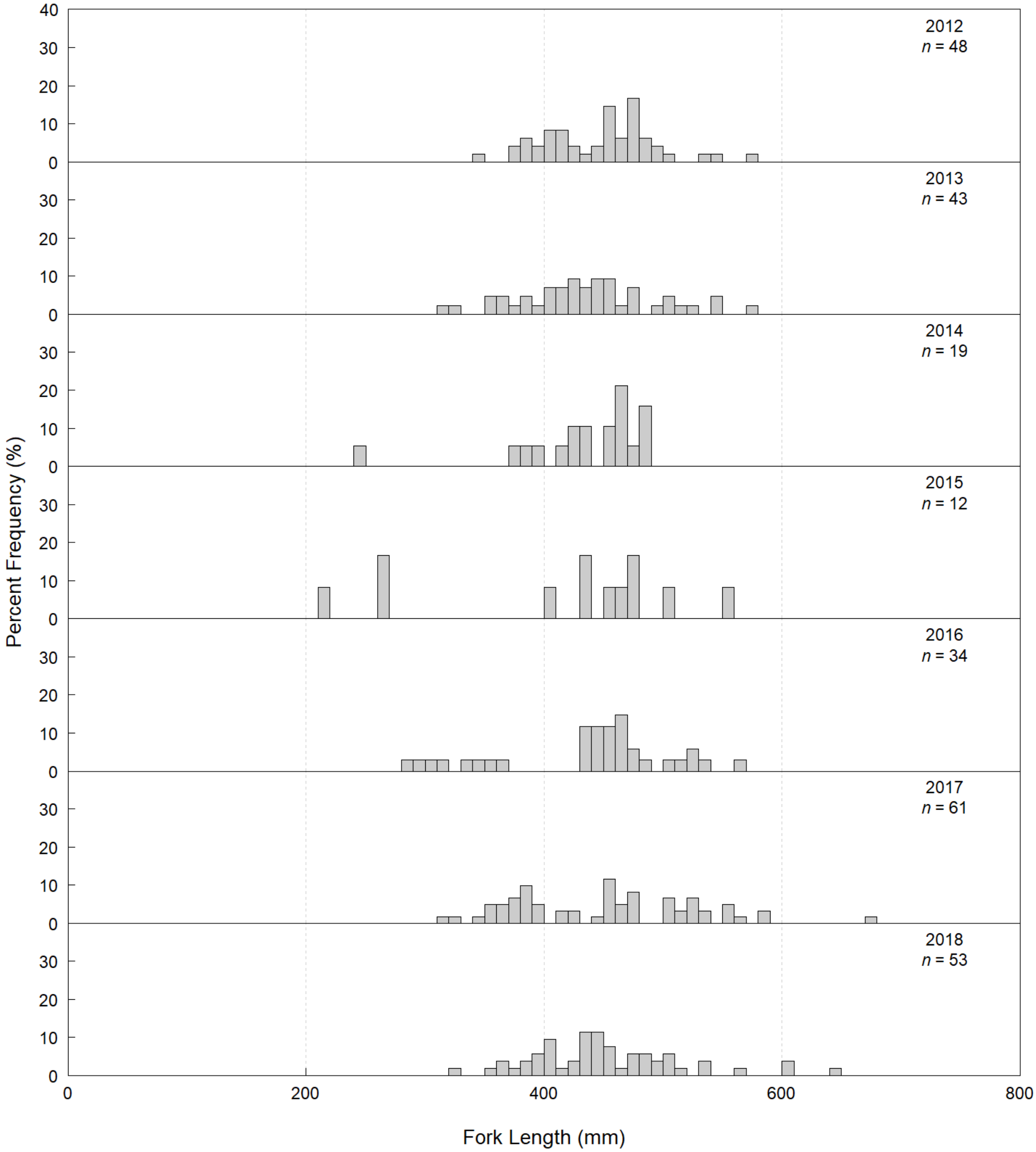


Figure F35: Concluded.

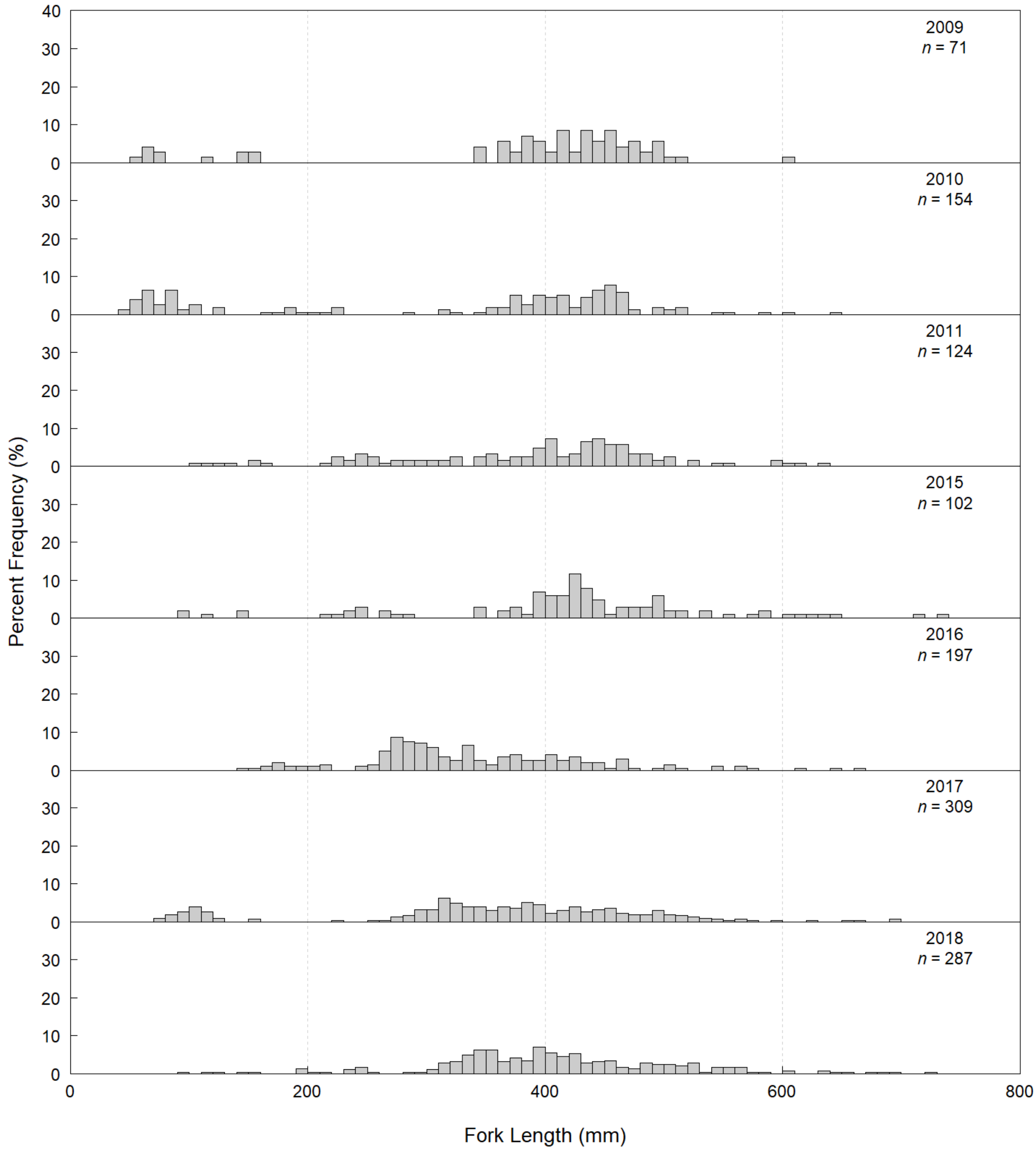


Figure F36: Length-frequency distributions by year for Walleye captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

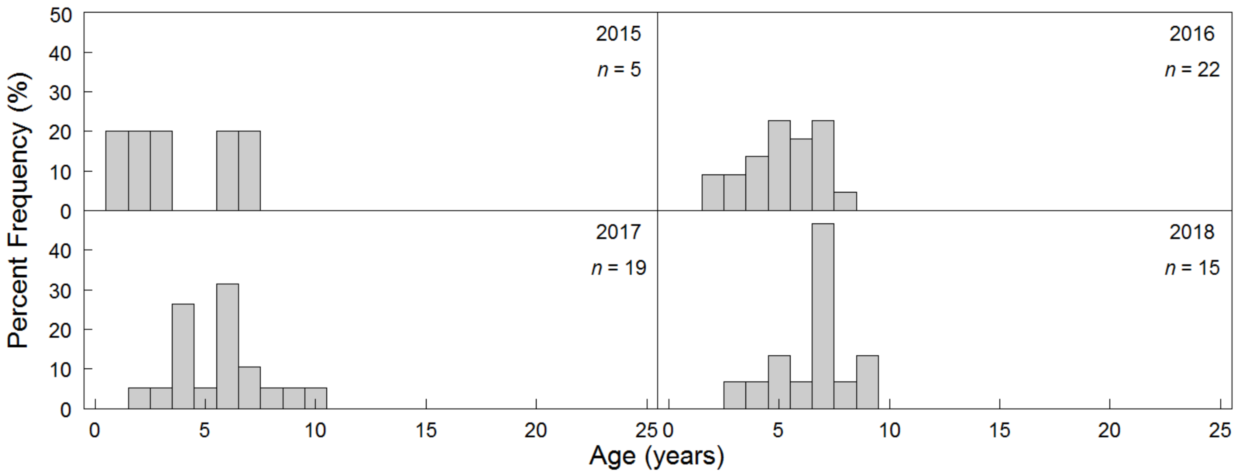


Figure F37: Age-frequency distributions by year for Walleye captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.

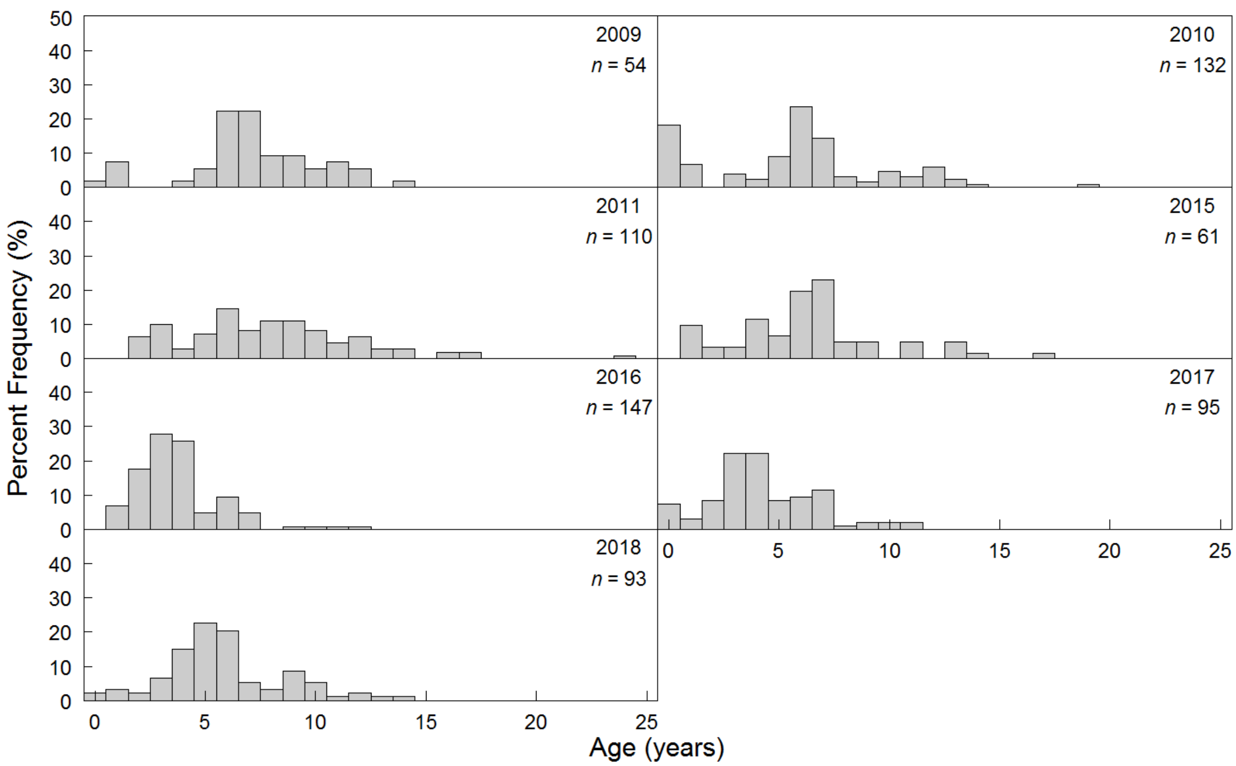
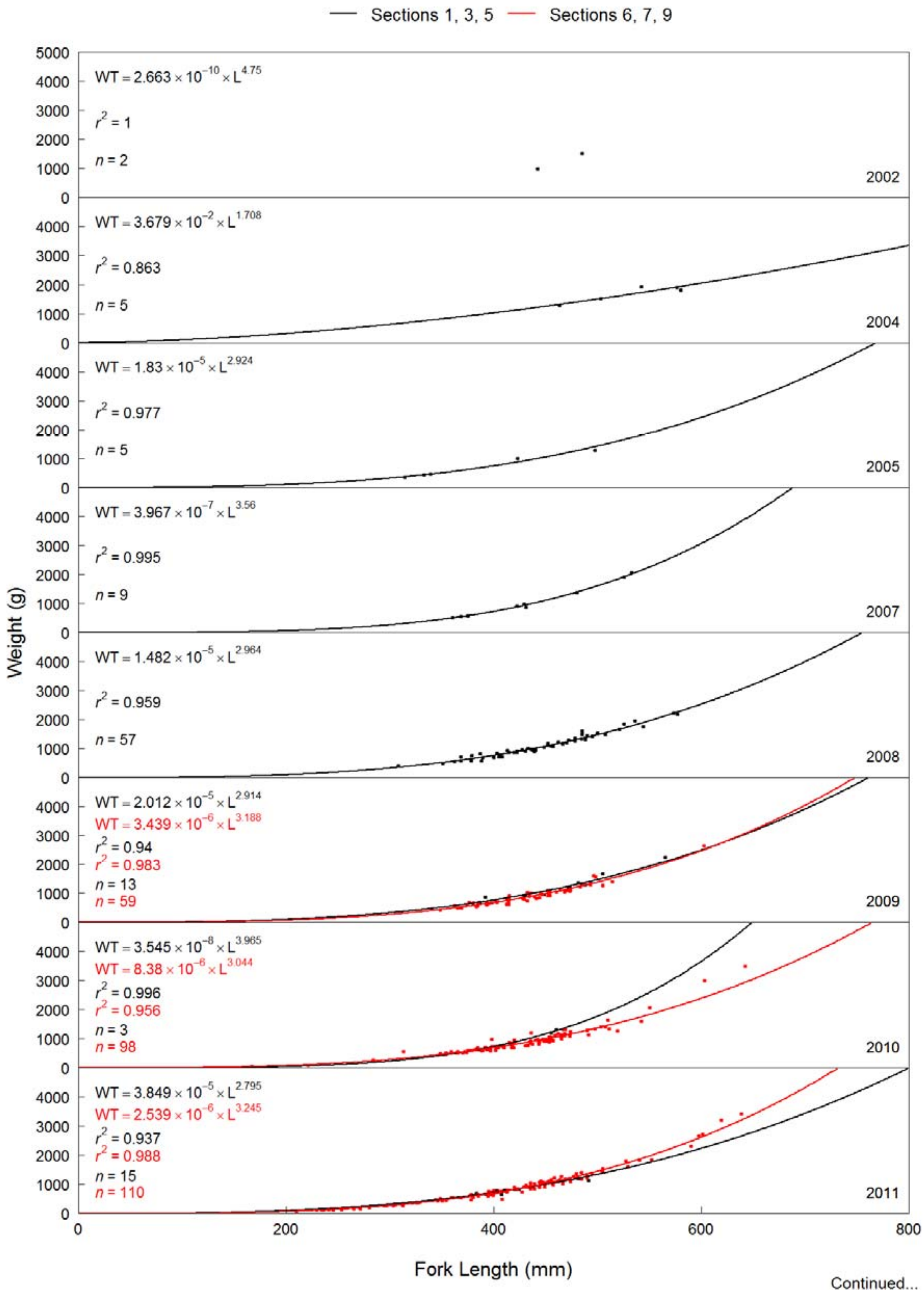


Figure F38: Age-frequency distributions by year for Walleye captured by boat electroshocking in Sections 6, 7, and 9 of the Peace River, 2002 to 2018. Data from 2009 to 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).



Continued...

Figure F39: Length-weight regressions for Walleye captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

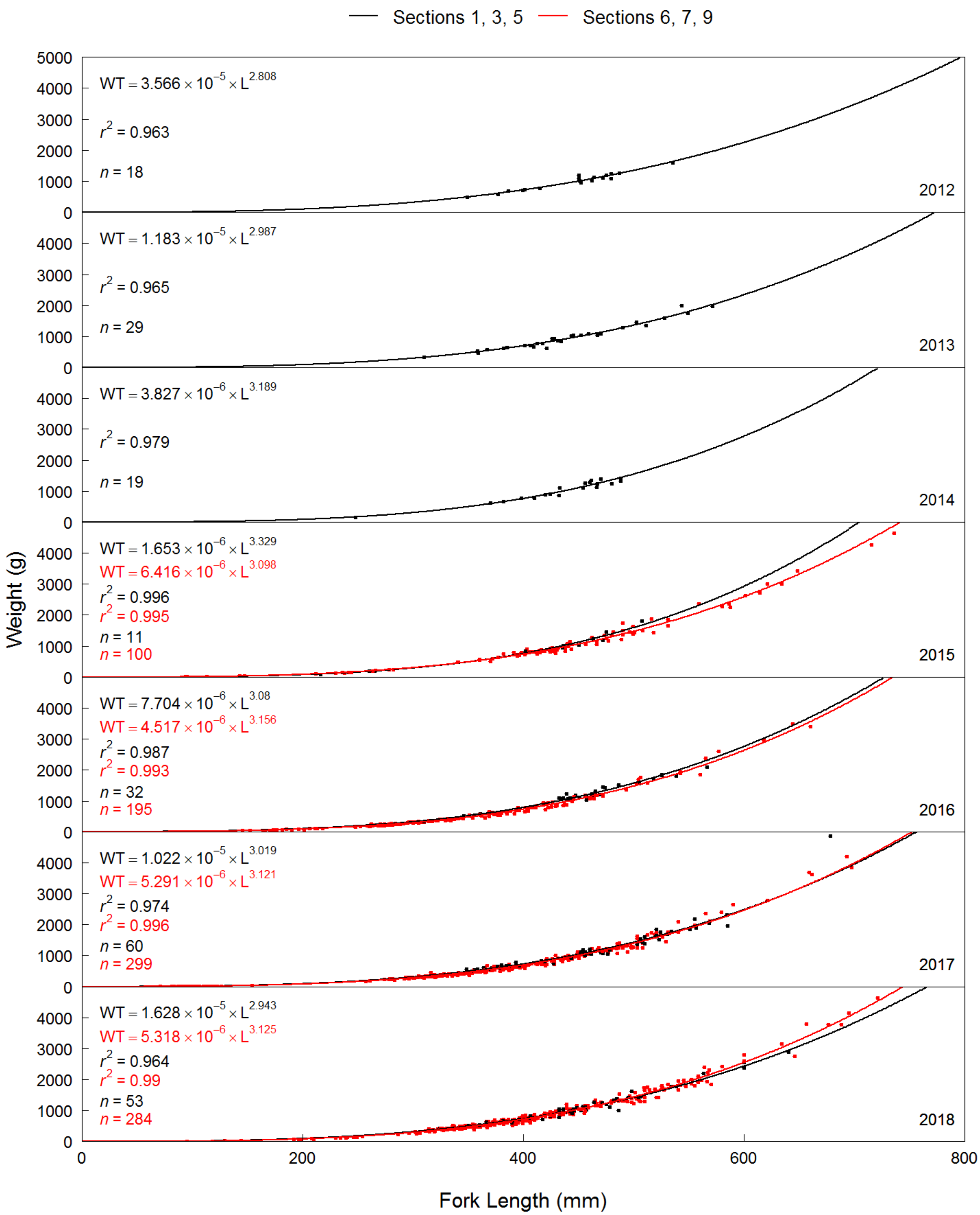


Figure F39: Concluded.

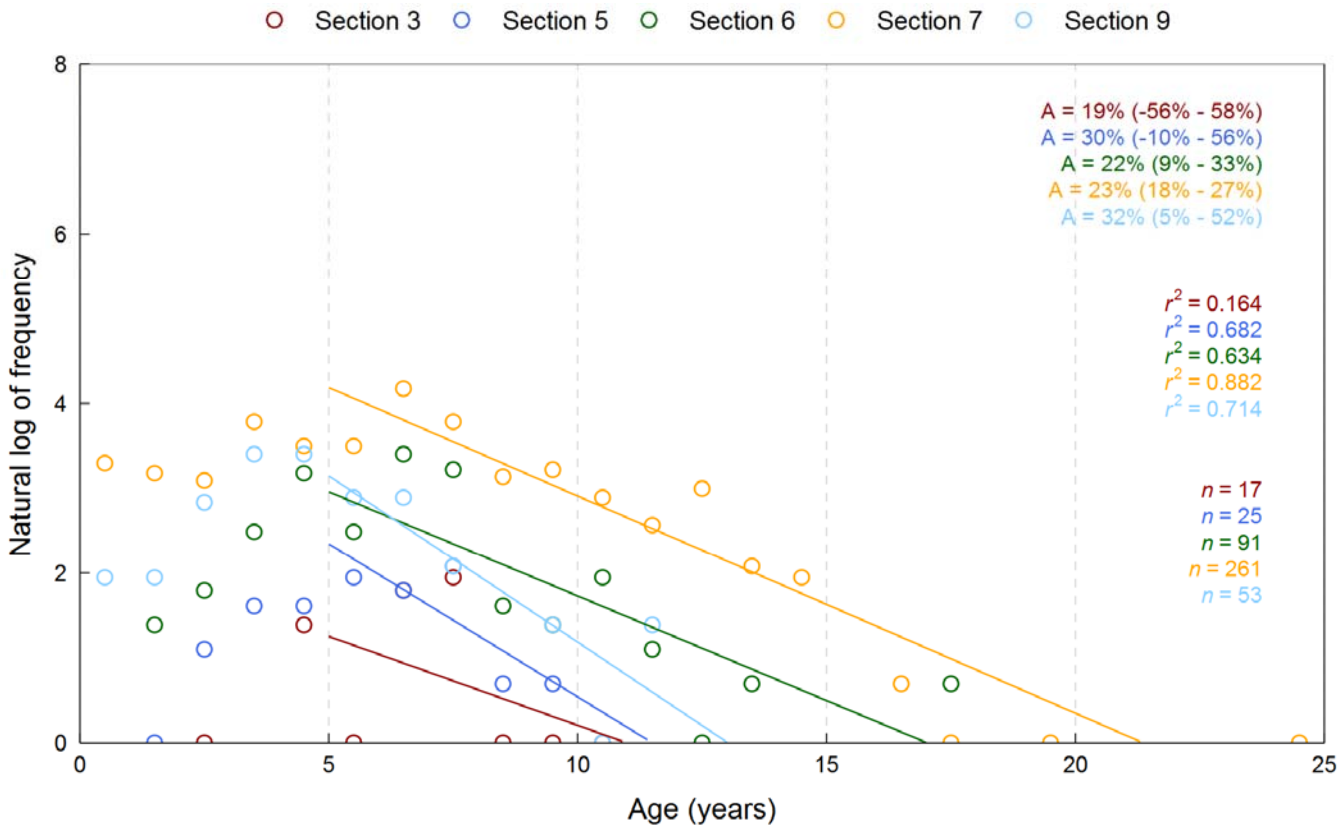


Figure F40: Catch curve and annual mortality estimates (A; mean and 95% confidence intervals) for Walleye, calculated for each sample section using data from 2002 to 2018 combined. Sample size, and r^2 of the catch curve regression are provided for each section.

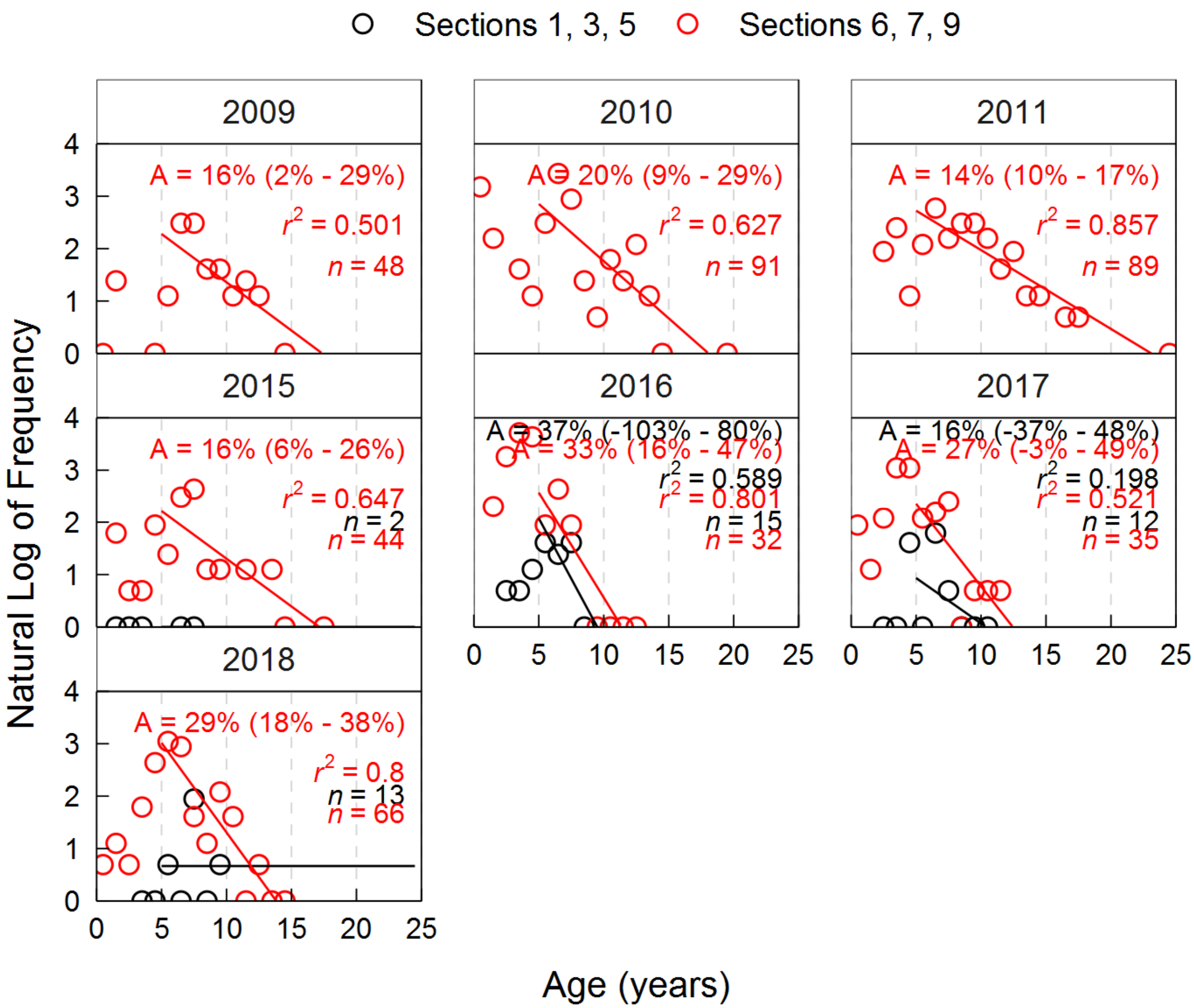


Figure F41: Catch curve and annual mortality estimates (A; mean and 95% confidence intervals) for Walleye, calculated for each sample year. Sample size and r² of the catch curve regression are provided for each sample year. Data from Sections 6, 7, and 9 in 2009, 2010, and 2011 courtesy of BC Hydro's Site C Peace River Fish Inventory (Mainstream 2010, 2011, 2013a).

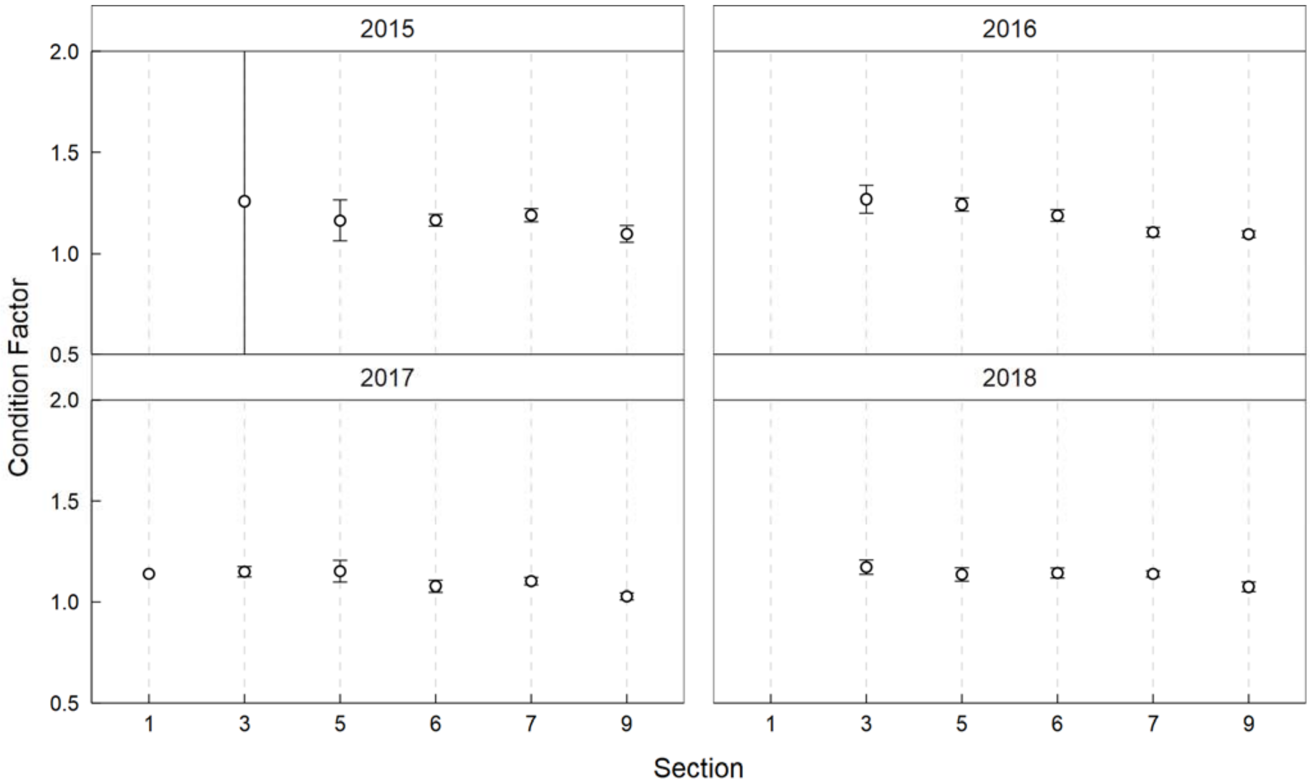


Figure F42: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for Walleye captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

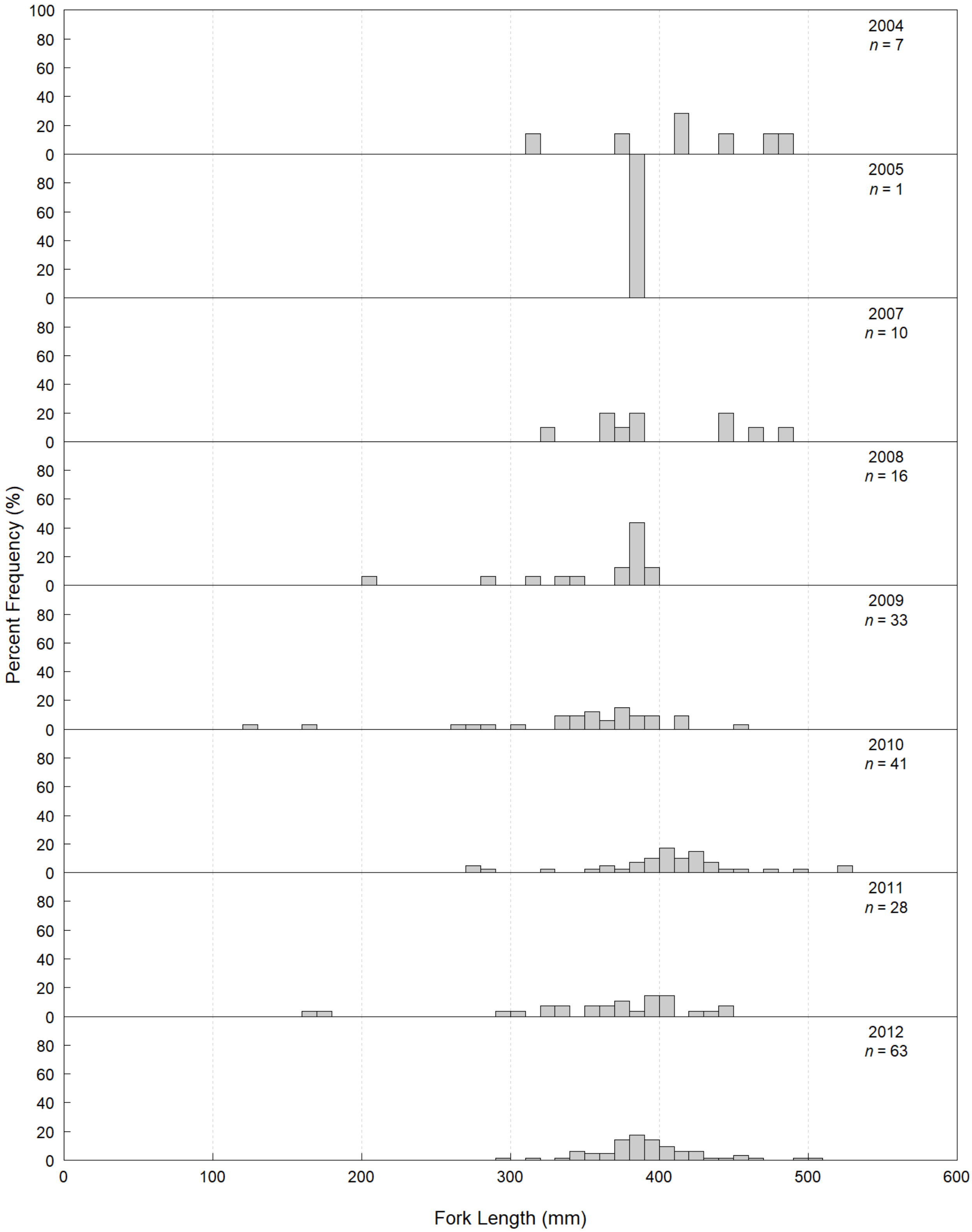


Figure F43: Length-frequency distributions by year for White Sucker captured by boat electroshocking in Sections 1, 3, and 5 of the Peace River, 2002 to 2018.

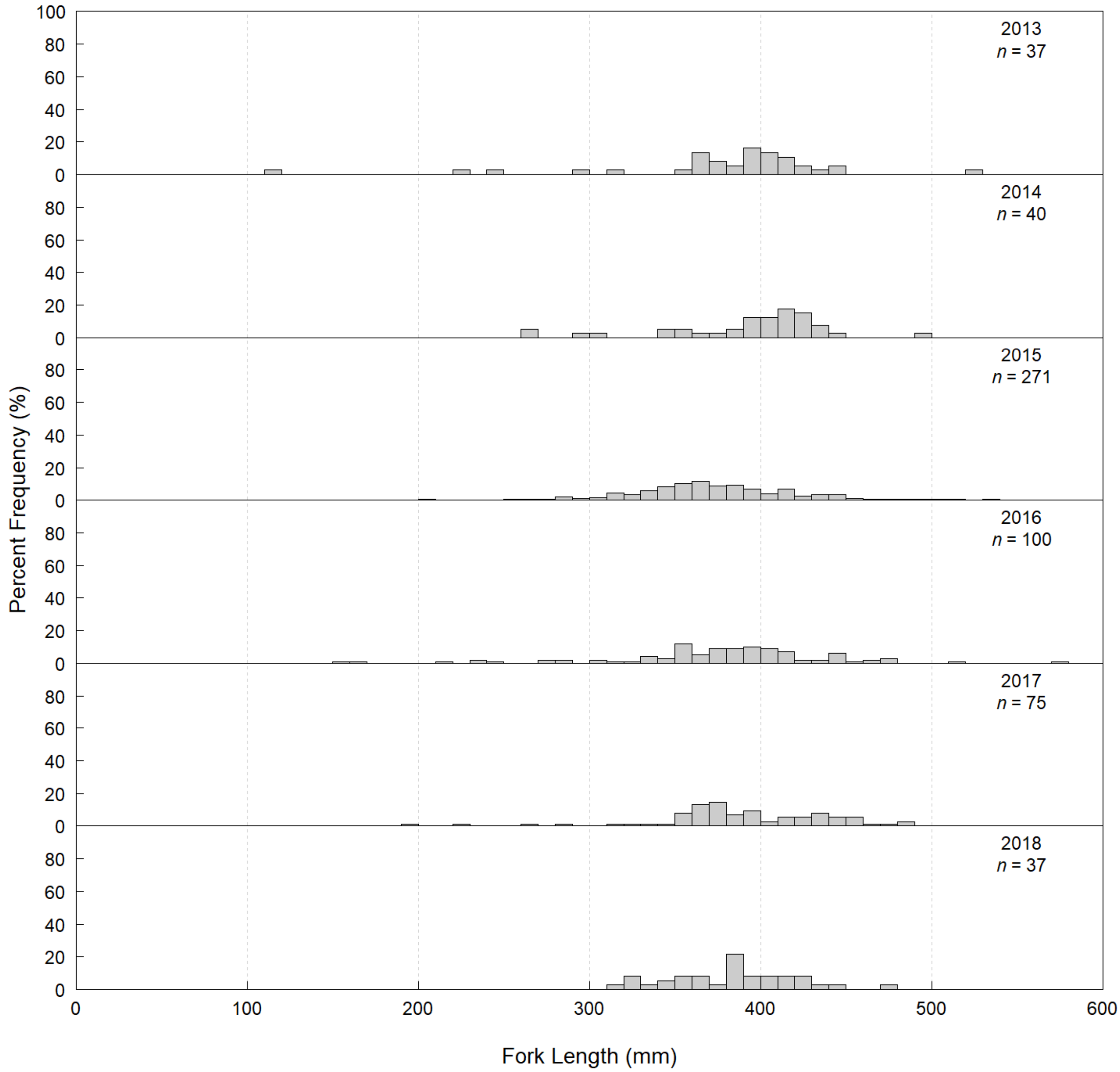


Figure F43: Concluded.

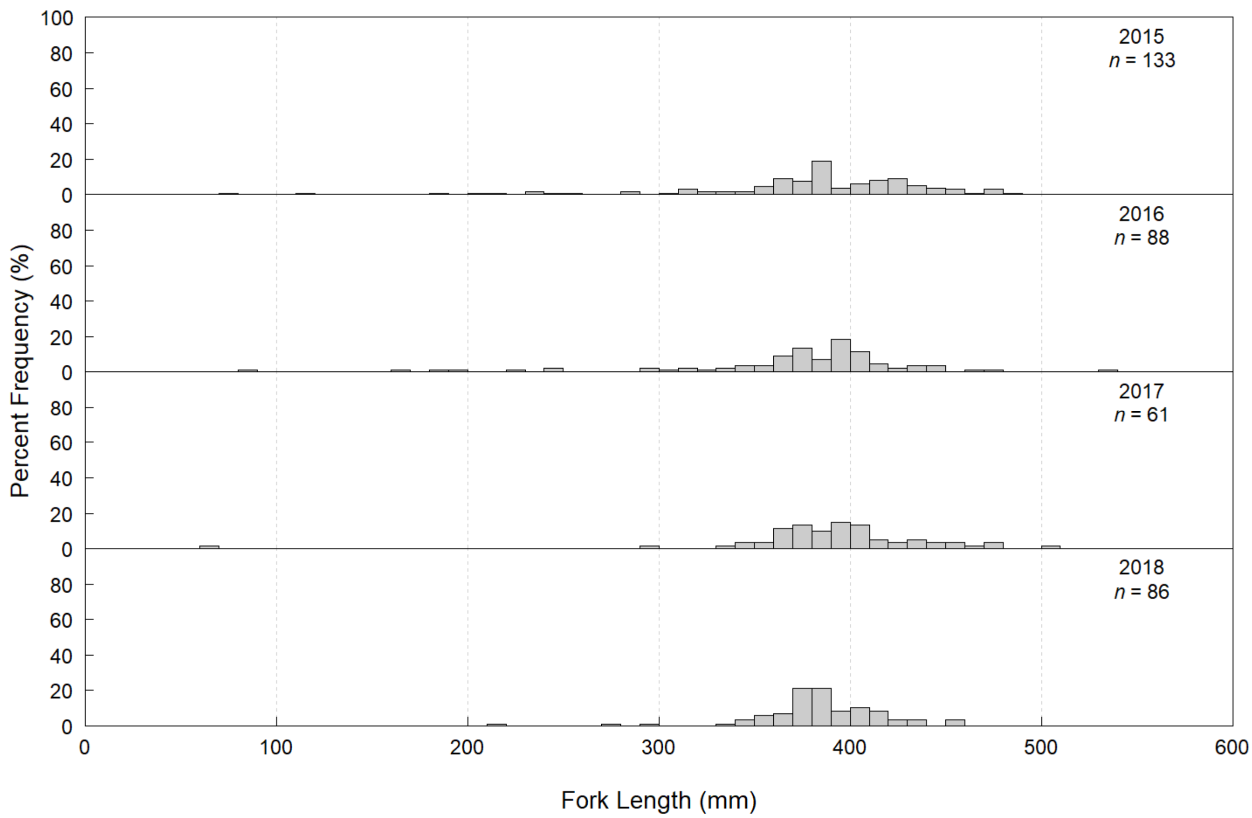


Figure F44: Length-frequency distributions by year for White Sucker captured by boat electroshocking in Sections 6, 7, and 9 of Peace River, 2018.

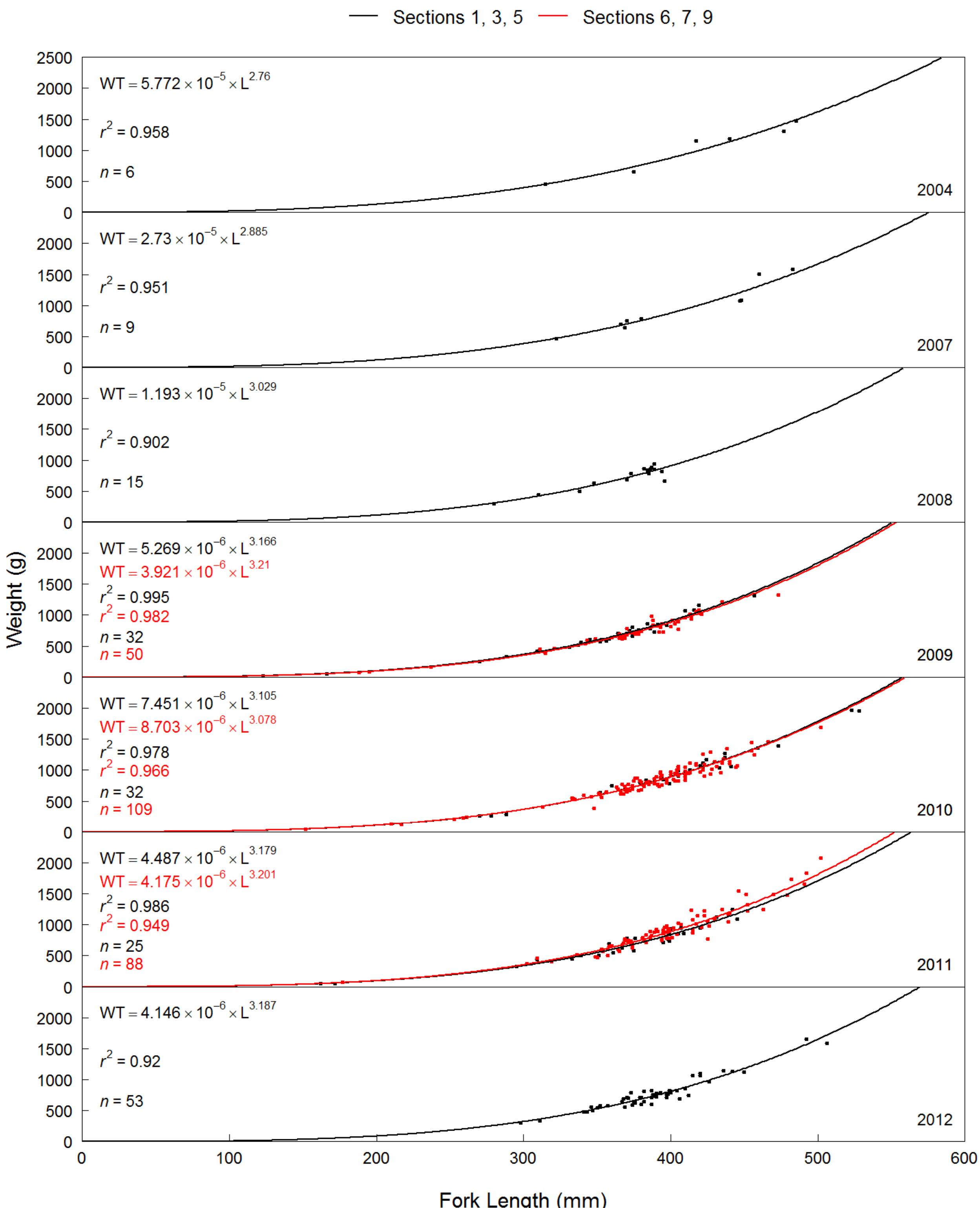


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Figure F45: Length-weight regressions for White Sucker captured by boat electroshocking in sampled sections of the Peace River, 2002 to 2018.

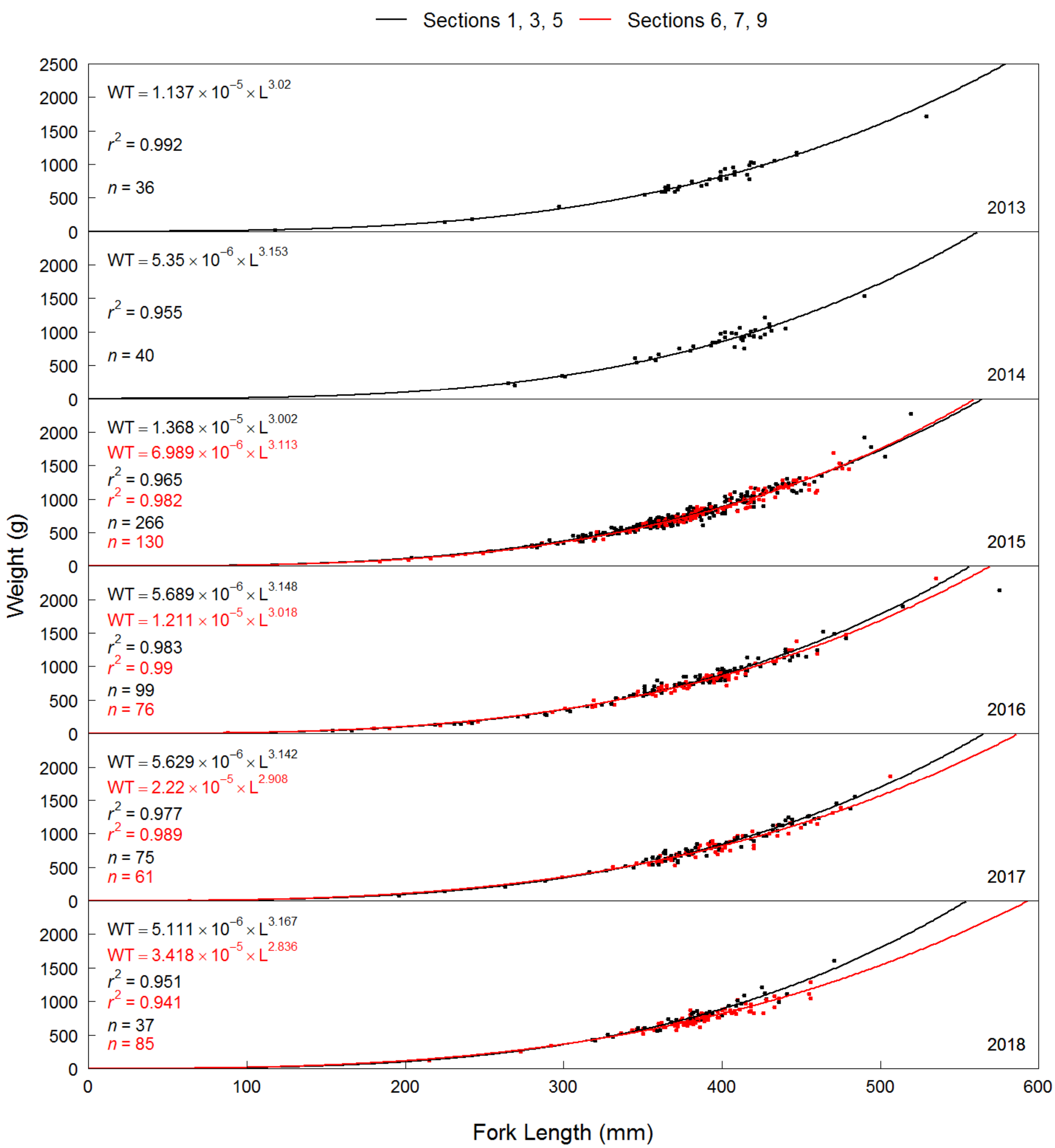

Figure F45: Concluded.

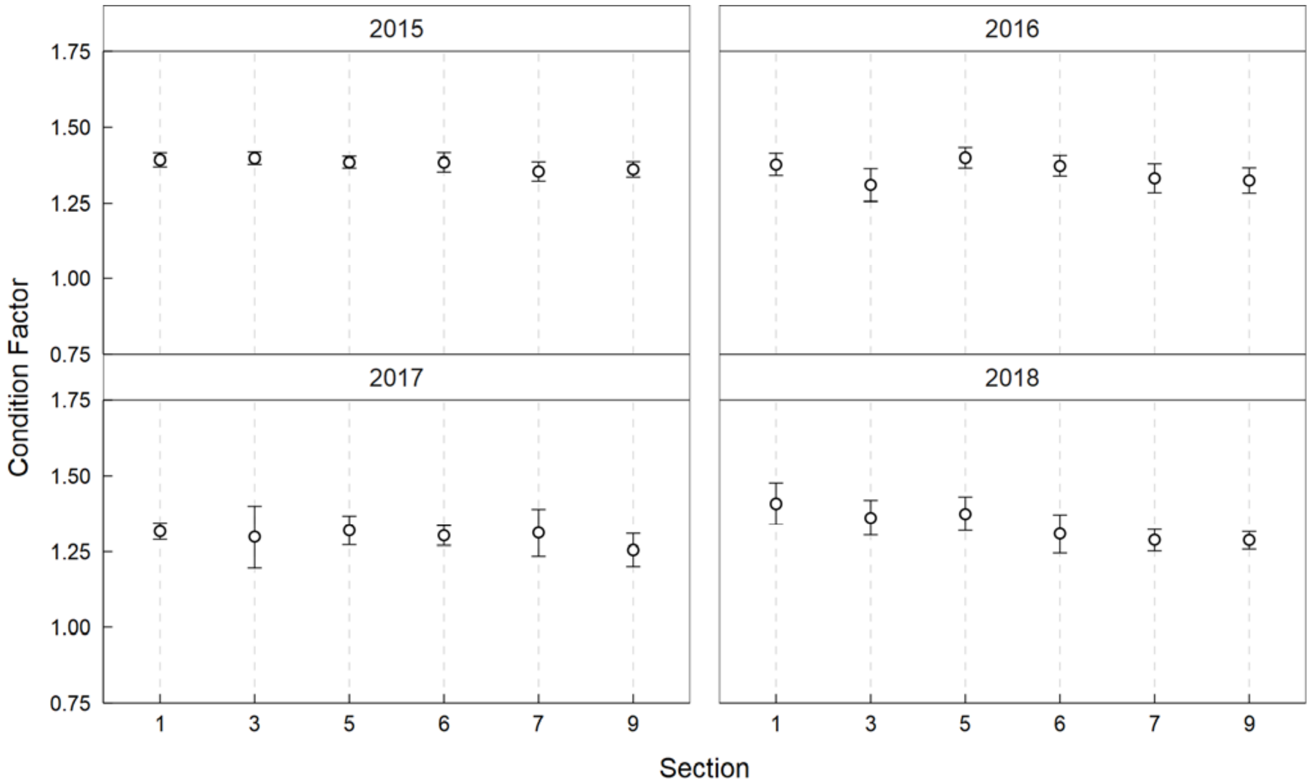

Figure F46: Mean Fulton's body condition index (K) with 95% confidence intervals (CIs) for White Sucker captured by boat electroshocking in sampled sections of the Peace River, 2015 to 2018. Data from 2002 to 2014 are not presented because not all sections were sampled during these study years.

APPENDIX G

Population Analysis Output

Introduction

In 2018, Bayes sequential modelling as part of the Peace River Large Fish Indexing Survey was conducted by Bill Gazey of W.J. Gazey Research. Appendix G was written by W.J. Gazey Research and provides additional information on the model and its corresponding output.

Mountain Whitefish

Characteristics that Impact Population Estimates

For the 2018 study, PIT tags were applied to lengths ≥ 200 mm; however, in past studies tag application was restricted to lengths ≥ 250 mm. In order to obtain population estimates consistent with past studies and to minimize bias from size selectivity to electrofishing, only fish marked and sampled of length ≥ 250mm were used to obtain population estimates. Histograms of Mountain Whitefish lengths at release and recapture are plotted in Figures G.1 and G.2, respectively. Inspection of the figures reveals that smaller fish (200-250 mm) were not recaptured with the same frequency. Comparison of the sample cumulative proportion of length at release and recapture illustrates (see Figure G.3) that the distributions were similar for lengths greater than 250 mm. The complete overlap of the cumulative release and recapture offset by 14 mm proportions illustrate that the difference was attributable to the capture of small fish. A consistent, but statistically nonsignificant, under representation of recaptured smaller Mountain Whitefish (250-275 mm) has been noted in all previous studies. A comparison of lengths at release and recapture accumulated into 25 mm bins (not shown) for the 2018 study was not significantly different (test for independence, $P > 0.05$).

Time at large of recaptured Mountain Whitefish regressed on the growth increment (length at release minus length at recapture) is plotted in Figure G.4. The growth trend of 0.017 mm per day was statistically significant ($P < 0.05$); however, the mean growth was only 0.16 mm per fish (mean time-at-large was 9.65 days) and 0.58 mm over the study period (maximum time-at-large was 35 days). The boarder histogram of the growth increment provides an indication of measurement error (residual standard deviation of 3.0 mm for each measurement), which was slightly larger than the historical mean of 2.8 mm.

The movement of recaptured Mountain Whitefish between sections during 2018 is listed in Table G.1 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). These proportions are plotted in Figure G.5. Figure G.6 provides a bar plot of the distance traveled within each section for marked fish released in 2018. Positive values indicate fish were recaptured upstream of the release site and vice-versa. Note that most fish were recaptured in the same site-of-release. Consistent with movement patterns in previous studies, Mountain Whitefish had remarkable fidelity to a site.

Empirical Model Selection

The number of captures by encounter history (five sessions) and section used for the CJS analysis are listed in Table G.2. Capture probabilities were evaluated by session (time varying) and pooled over sessions 1 to 4 and 4 to 5 within each section. Survival was evaluated by session (time varying) and as constant within each section. Constant survival provided the best fit to the data based on Akaike information criteria (AIC) in all river sections (see Table G.3). Capture probability by session provided the best fit in Section 9. Pooled capture probability provided the best fit in all other sections. Survival estimates were not significantly different than 1.0 in all sections for the best fitting models (not shown, $P > 0.8$). Based on these results, we applied no apparent mortality for Mountain Whitefish within 2018.

A direct test of catchability is provided with population estimates using ADMB with Equations (1 to 8) in Table G.4 (input data corrected for movement listed in Table G.1 which was also used for the Bayesian model). The Bayesian population model assumed constant catchability for samples taken during the year. Neither time varying nor constant catchability models provided markedly better fits to the data in sections 5 through 9. In section 1 the constant catchability model fit better. However, in Section 3 the time varying model provided a substantially better fit to the data. Population estimates for the time varying model generally exceeded the constant model. The logarithmic population deviation estimates for the time varying catchability model (Equation 2) are plotted by section and date in Figure G.7. The deviations were highly variable but section 7 displayed an upward trend over time.

Bayes Sequential Model for a Closed Population

The mark-recapture data were extracted by section from the database using PIT tags applied during 2018 and PIT tags that were observed during 2018 that were originally applied in 2004 through 2017 and a minimum length of 250 mm. Table G.5 lists Mountain Whitefish examined for marks and recaptures by date and section. The estimated releases, adjusted for movement between sections (Equation 4) by section and date, are given in Table G.6. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no instantaneous mortality rate or undetected mark rate are listed in Table G.7. The subsequent population estimates using the Bayesian closed model are given in Table G.8. The sequential posterior probability plots by section are provided in Figures G.8 through G.13. The final posterior distributions for the six sections are drawn in Figure G.14.

The sequence of posterior probability plots were used as an indicator of closure or change in the population size over the study period (Gazey and Staley 1986). Trends in the posterior plots can also be caused by trends in catchability (changes in population size and catchability are confounded). Inspection of the posterior probability plot sequences appear stable (no marked trend or sequence to larger or smaller population sizes) and were consistent with a convergence to a modal population size except for sections 6 and 7. Section 7 displayed a trend in catchability (Figure 7) and/or immigration of unmarked fish consistent the trend illustrated in Figure G.12.

Arctic Grayling

The mark-recapture data were extracted by section from the database using all available marks (smallest length 200 mm). No recaptured fish were observed to move between sections. Table G.9 lists Arctic Grayling examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.10. Only Section 3 had sufficient captures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.11. The sequential posterior probability plots for the population estimates are provided in Figure G.15 and the population estimates in Table G.12. Given the sparse data, minimal population estimates were also calculated (see Figure G.16). There was a 0.95 probability of at least 160 fish in Section 3.

Bull Trout

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. One fish released in Section 5 was recaptured in Section 6; otherwise, there were no movements between sections (see Table G.13). Table G.14 lists Bull Trout examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.15. Only sections 3 and 5 had sufficient recaptures to generate population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.16. The population estimates using the Bayesian model are given in Table G.17 and the associated sequential posterior probability plots are provided in Figures G.17 and G.18. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.19.

Walleye

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The recaptures, adjusted for movement between sections (Equation 4) by section and date, are given in Table G.18. Table G.19 lists Walleye examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.20. Only sections 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.21. The population estimates using the Bayesian model are given in Table G.22 and the associated sequential posterior probability plots are provided in Figures G.20 and G.21. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.22.

Largescale Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The movement of recaptured Largescale Sucker between sections is listed in Table G.23 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). Table G.24 lists Largescale Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.25. Only sections 3, 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.26. The population estimates using the Bayesian model are given in Table G.27 and the associated sequential posterior probability plots are provided in Figures G.23 through G.25. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.26.

Longnose Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The movement of recaptured Longnose Sucker between sections is listed in Table G.28 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). Table G.29 lists Longnose Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.30. Only sections 3, 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.31. The population estimates using the Bayesian model are given in Table G.32 and the associated sequential posterior probability plots are provided in Figures G.27 through G.29. The posterior probability plots do not display trends over time. The final posterior distributions are drawn in Figure G.30.

White Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. No movement between river sections of recaptured White Sucker was observed. Table G.33 lists Longnose Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.34. Only Section 9 had sufficient recaptures to enable population estimates. The compilation of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.35. The population estimates using the Bayesian model are given in Table G.36 and the associated sequential posterior probability plots are provided in Figures G.31. The posterior probability plots do not display trends over time.

Rainbow Trout

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. There was no movement between sections. Table G.37 lists Rainbow Trout examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.38. Only sections 3 and 5 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.39. The population estimates using the Bayesian model are given in Table G.40 and the associated sequential posterior probability plots are provided in Figures G.32 and G.33. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.34.

Table G.1: Mountain Whitefish recaptures and migration proportions adjusted (inverse weight) for fish examined by section during 2018.

Release Section	Recapture Section						
	One	Three	Five	Six	Seven	Nine	Total
One	28	6	1	2	0	0	37
Three	0	307	6	2	1	0	316
Five	0	0	74	7	0	0	81
Six	0	0	0	127	1	0	128
Seven	0	0	0	13	57	0	70
Nine	0	0	0	1	0	24	25
Sample:	1692	3558	1437	2180	933	359	10159
Recap. %	1.65	8.80	5.64	6.97	6.32	6.69	6.47
Proportions:							
One	0.834	0.085	0.035	0.046	0	0	1.000
Three	0.000	0.933	0.045	0.010	0.012	0.000	1.000
Five	0.000	0.000	0.941	0.059	0.000	0.000	1.000
Six	0.000	0.000	0.000	0.982	0.018	0.000	1.000
Seven	0.000	0.000	0.000	0.089	0.911	0.000	1.000
Nine	0.000	0.000	0.000	0.007	0.000	0.993	1.000

Table G.2: Mountain Whitefish captures by encounter history and section used for the Cormack-Jolly-Seber analysis. A '1' indicates a capture and '0' no capture in the session. Negative values indicate mortality at capture.

Section						
History	One	Three	Five	Six	Seven	Nine
00011	4	56	5	21	10	1
00101	1	34	9	10	0	0
00110	3	51	11	21	19	8
00111	0	2	0	1	0	0
01001	8	22	3	8	1	1
01010	4	32	10	8	5	5
01011	0	2	1	2	0	0
01100	7	28	15	12	7	5
01101	0	3	0	0	0	0
01110	0	5	0	2	0	0
10001	2	12	1	5	3	0
10010	1	9	4	6	4	3
10011	0	1	0	0	0	0
10100	4	20	8	7	10	2
10110	0	0	1	2	0	0
10111	0	0	0	1	0	0
10101	0	3	0	0	0	0
11000	4	14	5	3	7	0
11001	0	2	0	0	0	0
11010	0	2	0	0	1	0
11100	0	3	2	5	0	0
01010	-1	0	0	0	0	0

Table G.3: Evaluation of various Mountain Whitefish survival Cormack-Jolly-Seber models using MARK based on delta Akaike information criteria (ΔAIC)

Model	ΔAIC	AIC Weights	Model Like.	Num. Par
River Section One:				
{S(.)p(2 levels)}	0.0	0.790	1.000	3
{S(.)p(t)}	3.8	0.121	0.153	5
{S(t)p(2 levels)}	4.6	0.079	0.100	5
{S(t)p(t)}	8.8	0.010	0.013	7
River Section Three:				
{S(.)p(2 levels)}	0.0	0.605	1.000	3
{S(.)p(t)}	1.5	0.280	0.463	5
{S(t)p(2 levels)}	4.1	0.079	0.130	5
{S(t)p(t)}	5.7	0.036	0.059	7
River Section Five:				
{S(.)p(2 levels)}	0.0	0.632	1.000	3
{S(.)p(t)}	1.3	0.332	0.526	5
{S(t)p(t)}	5.7	0.036	0.057	7
{S(t)p(2 levels)}	102.2	0.000	0.000	5
River Section Six:				
{S(.)p(2 levels)}	0.0	0.488	1.000	3
{S(.)p(t)}	0.4	0.404	0.829	5
{S(t)p(2 levels)}	4.2	0.060	0.123	5
{S(t)p(t)}	4.7	0.048	0.097	7
River Section Seven:				
{S(.)p(2 levels)}	0.0	0.619	1.000	3
{S(.)p(t)}	1.8	0.256	0.414	5
{S(t)p(2 levels)}	4.3	0.072	0.116	5
{S(t)p(t)}	4.9	0.053	0.085	7
River Section Nine:				
{S(.)p(t)}	0.0	0.864	1.000	5
{S(.)p(2 levels)}	5.0	0.071	0.082	3
{S(t)p(t)}	5.4	0.059	0.068	7
{S(t)p(2 levels)}	9.9	0.006	0.007	5

Models:
S(.)p(2 levels) - constant survival, capture probabilities pooled for sessions 1 to 4 and session 5.
S(.)p(t) - constant survival, capture probabilities by session.
S(t)p(2 levels) - survival by session, capture probabilities pooled for sessions 1 to 4 and session 5.
S(t)p(t) - survival by session, capture probalilities by session.

Table G.4: Mountain Whitefish population estimates using AD Model Builder assuming constant population size (M0t) and time varying catchability (Mtt)

Model	N	SD	Function	Param.	AIC	ΔAIC	Weight	Model Like.
Section One:								
M_{0t}	30,107	5,929	113.4	1	228.8	0.00	0.966	1.000
M_{tt}	29,347	6,525	112.7	5	235.5	6.72	0.034	0.035
Section Three:								
M_{tt}	17,110	1,095	965.7	12	1955.4	0.00	0.999	1.000
M_{0t}	14,892	786	983.8	1	1969.6	14.21	0.001	0.001
Section Five:								
M_{0t}	10,119	1,073	294.1	1	590.1	0.00	0.771	1.000
M_{tt}	10,325	1,605	288.3	8	592.5	2.43	0.229	0.296
Section Six:								
M_{tt}	11,975	1,542	522.9	10	1,065.8	0.00	0.877	1.000
M_{0t}	13,058	1,006	533.9	1	1,069.7	3.92	0.123	0.141
Section Seven:								
M_{tt}	7,170	2,378	204.6	10	429.2	0.00	0.698	1.000
M_{0t}	5,747	712	214.4	1	430.9	1.68	0.302	0.432
Section Nine:								
M_{0t}	1,588	300	68.7	1	139.5	0.00	0.884	1.000
M_{tt}	1,734	431	67.8	4	143.5	4.06	0.116	0.132

Table G.5: Sample size and recaptures of Mountain Whitefish by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-27	124	0	0	0	0	0	0	0	0	0	0	0	124	0
2018-08-28	73	0	23	0	0	0	22	0	0	0	0	0	118	0
2018-08-29	0	0	94	0	0	0	105	0	0	0	0	0	199	0
2018-08-30	0	0	115	0	4	0	50	0	0	0	0	0	169	0
2018-08-31	0	0	114	0	0	0	0	0	0	0	0	0	114	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	19	0	19	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	80	0	80	0
2018-09-03	0	0	0	0	0	0	0	0	50	0	0	0	50	0
2018-09-04	0	0	0	0	0	0	0	0	116	0	0	0	116	0
2018-09-05	0	0	0	0	85	0	0	0	0	0	0	0	85	0
2018-09-06	0	0	0	0	10	0	14	0	0	0	0	0	24	0
2018-09-07	0	0	0	0	57	0	9	0	0	0	0	0	66	0
2018-09-08	131	0	0	0	0	0	0	0	0	0	0	0	131	0
2018-09-09	372	1	0	0	0	0	84	2	0	0	0	0	456	3
2018-09-10	73	1	64	0	0	0	136	6	0	0	0	0	273	7
2018-09-11	0	0	157	5	0	0	0	0	68	6	0	0	225	11
2018-09-12	0	0	172	6	0	0	0	0	75	3	0	0	247	9
2018-09-13	0	0	192	8	118	0	0	0	0	0	0	0	310	8
2018-09-14	0	0	0	0	197	8	0	0	0	0	0	0	197	8
2018-09-15	0	0	0	0	0	0	127	3	0	0	0	0	127	3
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	302	19	0	0	44	0	346	19
2018-09-18	0	0	0	0	0	0	86	8	21	1	40	0	147	9
2018-09-19	196	5	0	0	0	0	0	0	124	12	0	0	320	17

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-20	80	3	105	5	125	11	0	0	0	0	0	0	310	19
2018-09-21	0	0	391	18	41	2	0	0	79	5	0	0	511	25
2018-09-22	0	0	418	37	336	17	0	0	0	0	0	0	754	54
2018-09-23	0	0	0	0	0	0	0	0	0	0	85	7	85	7
2018-09-24	164	4	0	0	0	0	253	14	0	0	0	0	417	18
2018-09-25	128	3	119	3	0	0	344	29	0	0	0	0	591	35
2018-09-26	0	0	451	54	0	0	102	14	66	5	0	0	619	73
2018-09-27	0	0	267	40	165	19	0	0	0	0	0	0	432	59
2018-09-28	0	0	0	0	90	6	0	0	31	2	52	11	173	19
2018-09-29	0	0	0	0	0	0	0	0	121	14	26	4	147	18
2018-09-30	294	10	274	31	0	0	0	0	0	0	0	0	568	41
2018-10-01	0	0	535	86	0	0	405	42	0	0	0	0	940	128
2018-10-02	57	1	67	20	0	0	0	0	0	0	0	0	124	21
2018-10-03	0	0	0	0	0	0	141	15	1	0	0	0	142	15
2018-10-04	0	0	0	0	0	0	0	0	150	10	0	0	150	10
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	13	2	13	2
2018-10-09	0	0	0	0	31	3	0	0	31	1	0	0	62	4
2018-10-10	0	0	0	0	178	15	0	0	0	0	0	0	178	15
Total	1,692	28	3,558	313	1,437	81	2,180	152	933	59	359	24	10,159	657

Table G.6: Estimated Mountain Whitefish mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-27	102.6	10.5	4.3	5.7	0.0	0.0	123
2018-08-28	60.0	27.6	3.6	23.2	0.6	0.0	115
2018-08-29	0.0	87.7	4.2	102.1	3.0	0.0	197
2018-08-30	0.0	107.3	8.0	48.5	2.2	0.0	166
2018-08-31	0.0	106.4	5.1	1.1	1.3	0.0	114
2018-09-01	0.0	0.0	0.0	0.1	0.0	18.9	19
2018-09-02	0.0	0.0	0.0	0.5	0.0	71.5	72
2018-09-03	0.0	0.0	0.0	4.4	45.6	0.0	50
2018-09-04	0.0	0.0	0.0	10.2	104.8	0.0	115
2018-09-05	0.0	0.0	80.0	5.0	0.0	0.0	85
2018-09-06	0.0	0.0	9.4	14.3	0.3	0.0	24
2018-09-07	0.0	0.0	53.7	12.2	0.2	0.0	66
2018-09-08	109.2	11.1	4.6	6.1	0.0	0.0	131
2018-09-09	309.3	31.5	13.0	97.7	1.5	0.0	453
2018-09-10	60.0	65.8	5.4	131.6	3.1	0.0	266
2018-09-11	0.0	140.9	6.8	7.0	58.2	0.0	213
2018-09-12	0.0	154.9	7.5	8.0	66.6	0.0	237
2018-09-13	0.0	171.7	119.4	8.8	2.1	0.0	302
2018-09-14	0.0	0.0	176.0	11.0	0.0	0.0	187
2018-09-15	0.0	0.0	0.0	120.8	2.2	0.0	123
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	277.2	5.1	43.7	326
2018-09-18	0.0	0.0	0.0	76.7	19.6	39.7	136
2018-09-19	157.6	16.1	6.6	18.7	102.0	0.0	301
2018-09-20	64.2	98.9	114.5	11.2	1.1	0.0	290
2018-09-21	0.0	348.1	53.6	12.6	71.7	0.0	486
2018-09-22	0.0	352.8	316.4	22.4	4.4	0.0	696
2018-09-23	0.0	0.0	0.0	0.5	0.0	75.5	76
2018-09-24	131.7	13.4	5.5	242.0	4.3	0.0	397
2018-09-25	104.2	118.9	9.6	313.3	7.0	0.0	553
2018-09-26	0.0	370.5	17.9	94.7	60.8	0.0	544
2018-09-27	0.0	210.9	146.7	10.8	2.6	0.0	371
2018-09-28	0.0	0.0	79.1	7.7	25.5	40.7	153
2018-09-29	0.0	0.0	0.0	9.7	97.5	21.9	129
2018-09-30	30.0	41.3	3.1	2.1	0.5	0.0	77
2018-10-01	0.0	70.9	3.4	46.9	1.7	0.0	123

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-02	12.5	16.2	1.2	0.9	0.2	0.0	31
2018-10-03	0.0	0.0	0.0	14.7	0.3	0.0	15
2018-10-04	0.0	0.0	0.0	1.4	14.6	0.0	16
2018-10-05	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-07	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-08	0.0	0.0	0.0	0.0	0.0	1.0	1
2018-10-09	0.0	0.0	4.7	0.5	1.8	0.0	7
2018-10-10	0.0	0.0	20.7	1.3	0.0	0.0	22
Total	1,141	2,574	1,284	1,783	712	313	7,808

Table G.7: Mountain Whitefish sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
Section One:				**Section Six:**			
2018-09-08	131	163		2018-08-30	50	6	
2018-09-09	372	163	1	2018-09-06	14	186	
2018-09-10	73	163	1	2018-09-07	9	196	
2018-09-19	196	641	5	2018-09-09	84	215	2
2018-09-20	80	641	3	2018-09-10	136	227	6
2018-09-24	164	863	4	2018-09-15	127	478	3
2018-09-25	128	863	3	2018-09-17	302	497	19
2018-09-30	294	1099	10	2018-09-18	86	618	8
2018-10-02	57	1099	1	2018-09-24	253	1015	14
				2018-09-25	344	1037	29
Section Three:				2018-09-26	102	1037	14
2018-08-30	115	10		2018-10-01	405	1706	42
2018-08-31	114	38		2018-10-03	141	1718	15
2018-09-10	64	339					
2018-09-11	157	351	5	**Section Seven:**			
2018-09-12	172	382	6	2018-09-03	50	7	
2018-09-13	192	448	8	2018-09-04	116	7	
2018-09-20	105	916	5	2018-09-11	68	158	6
2018-09-21	391	916	18	2018-09-12	75	159	3
2018-09-22	418	932	37	2018-09-18	21	292	1
2018-09-25	119	1732	3	2018-09-19	124	292	12
2018-09-26	451	1732	54	2018-09-21	79	316	5

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
2018-09-27	267	1745	40	2018-09-26	66	496	5
2018-09-30	274	2445	31	2018-09-28	31	507	2
2018-10-01	535	2445	86	2018-09-29	121	568	14
2018-10-02	67	2445	20	2018-10-03	1	694	
				2018-10-04	150	696	10
Section Five:				2018-10-09	31	711	1
2018-08-30	4	4					
2018-09-05	85	25		**Section Nine:**			
2018-09-06	10	25		2018-09-17	44	90	
2018-09-07	57	25		2018-09-18	40	90	
2018-09-13	118	191		2018-09-23	85	174	7
2018-09-14	197	198	8	2018-09-28	52	249	11
2018-09-20	125	501	11	2018-09-29	26	249	4
2018-09-21	41	501	2	2018-10-08	13	312	2
2018-09-22	336	508	17				
2018-09-27	165	998	19				
2018-09-28	90	1007	6				
2018-10-09	31	1259	3				
2018-10-10	178	1259	15				

Table G.8: Mountain Whitefish population estimates by river section

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
One	34,868	32,450	22,760	48,640	6,795	19.5
Three	15,058	14,970	13,510	16,650	800	5.3
Five	10,674	10,420	8,500	12,990	1,157	10.8
Six	13,252	13,090	11,290	15,320	1,032	7.8
Seven	5,968	5,770	4,560	7,500	760	12.7
Nine	2,042	1,880	1,300	2,900	423	20.7
Total	81,862		68,007	95,717	7,069	8.6

Table G.9: Sample size and recaptures of Arctic Grayling by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-30	0	0	0	0	0	0	1	0	0	0	0	0	1	0
2018-08-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-05	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2018-09-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-08	2	0	0	0	0	0	0	0	0	0	0	0	2	0
2018-09-09	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-09-10	0	0	0	0	0	0	1	0	0	0	0	0	1	0
2018-09-11	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-09-12	0	0	4	0	0	0	0	0	0	0	0	0	4	0
2018-09-13	0	0	9	0	2	0	0	0	0	0	0	0	11	0
2018-09-14	0	0	0	0	2	0	0	0	0	0	0	0	2	0
2018-09-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-20	0	0	6	0	0	0	0	0	0	0	0	0	6	0
2018-09-21	0	0	1	0	2	0	0	0	0	0	0	0	3	0
2018-09-22	0	0	6	2	2	0	0	0	0	0	0	0	8	2

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-25	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-09-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-27	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-09-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-30	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-10-01	0	0	6	0	0	0	1	0	0	0	0	0	7	0
2018-10-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-10	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	3	0	38	2	10	0	3	0	0	0	0	0	54	2

Table G.10: Estimated Arctic Grayling mark releases by river section and date

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-30	0.0	0.0	0.0	1.0	0.0	0.0	1
2018-08-31	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-01	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-02	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-03	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-04	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-05	0.0	0.0	1.0	0.0	0.0	0.0	1
2018-09-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-07	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-08	2.0	0.0	0.0	0.0	0.0	0.0	2
2018-09-09	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-10	0.0	0.0	0.0	1.0	0.0	0.0	1
2018-09-11	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-09-12	0.0	4.0	0.0	0.0	0.0	0.0	4
2018-09-13	0.0	9.0	2.0	0.0	0.0	0.0	11
2018-09-14	0.0	0.0	2.0	0.0	0.0	0.0	2
2018-09-15	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-18	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-19	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-20	0.0	6.0	0.0	0.0	0.0	0.0	6
2018-09-21	0.0	1.0	2.0	0.0	0.0	0.0	3
2018-09-22	0.0	4.0	2.0	0.0	0.0	0.0	6
2018-09-23	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-24	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-25	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-26	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-27	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-28	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-29	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-30	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-10-01	0.0	6.0	0.0	1.0	0.0	0.0	7
2018-10-02	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-03	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-04	0.0	0.0	0.0	0.0	0.0	0.0	0

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-05	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-07	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-08	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-09	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-10	0.0	0.0	1.0	0.0	0.0	0.0	1
Total	2	25	9	2	0	0	38

Table G.11: Arctic Grayling sample, cumulative marks available for recapture and recaptures for river section 3

Date	Sample	Marks	Recap.
Section Three:			
2018-09-20	6	14	
2018-09-21	1	14	
2018-09-22	6	14	2
2018-09-25	2	25	
2018-09-27	2	25	
2018-09-30	1	29	
2018-10-01	6	29	

Table G.12: Arctic Grayling population estimates for river section 3

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Three	998	250	70	3,300	987	98.9

Table G.13: Bull Trout recaptures and migration proportions adjusted (inverse weight) for fish examined by section during 2018

Release Section	Recapture Section						
	One	Three	Five	Six	Seven	Nine	Total
One	1	0	0	0	0	0	1
Three	0	9	0	0	0	0	9
Five	0	0	5	1	0	0	6
Six	0	0	0	0	0	0	0
Seven	0	0	0	0	0	0	0
Nine	0	0	0	0	0	0	0
Sample:	55	71	38	27	12	4	207
Recap. %	1.82	12.68	13.16	3.70	0.00	0.00	7.73
Proportions:							
One	1.000	0.000	0.000	0.000	0.000	0.000	1.000
Three	0.000	1.000	0.000	0.000	0.000	0.000	1.000
Five	0.000	0.000	0.780	0.220	0.000	0.000	1.000
Six	0.000	0.000	0.000	1.000	0.000	0.000	1.000
Seven	0.000	0.000	0.000	0.000	1.000	0.000	1.000
Nine	0.000	0.000	0.000	0.000	0.000	1.000	1.000

Table G.14: Sample size and recaptures of Bull Trout by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-27	3	0	0	0	0	0	0	0	0	0	0	0	3	0
2018-08-28	1	0	1	0	0	0	1	0	0	0	0	0	3	0
2018-08-29	0	0	3	0	0	0	1	0	0	0	0	0	4	0
2018-08-30	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-08-31	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-04	0	0	0	0	0	0	0	0	2	0	0	0	2	0
2018-09-05	0	0	0	0	5	0	0	0	0	0	0	0	5	0
2018-09-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-07	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2018-09-08	3	0	0	0	0	0	0	0	0	0	0	0	3	0
2018-09-09	6	0	0	0	0	0	2	1	0	0	0	0	8	1
2018-09-10	8	1	2	0	0	0	1	0	0	0	0	0	11	1
2018-09-11	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-09-12	0	0	2	1	0	0	0	0	0	0	0	0	2	1
2018-09-13	0	0	6	1	9	1	0	0	0	0	0	0	15	2
2018-09-14	0	0	0	0	4	0	0	0	0	0	0	0	4	0
2018-09-15	0	0	0	0	0	0	3	0	0	0	0	0	3	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	2	0	0	0	1	0	3	0
2018-09-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-19	5	0	0	0	0	0	0	0	0	0	0	0	5	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-20	0	0	1	0	4	0	0	0	0	0	0	0	5	0
2018-09-21	0	0	3	0	0	0	0	0	0	0	0	0	3	0
2018-09-22	0	0	9	1	3	0	0	0	0	0	0	0	12	1
2018-09-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-24	11	0	0	0	0	0	3	0	0	0	0	0	14	0
2018-09-25	2	0	0	0	0	0	5	0	0	0	0	0	7	0
2018-09-26	0	0	10	2	0	0	1	0	0	0	0	0	11	2
2018-09-27	0	0	9	2	4	2	0	0	0	0	0	0	13	4
2018-09-28	0	0	0	0	5	1	0	0	2	0	0	0	7	1
2018-09-29	0	0	0	0	0	0	0	0	3	0	2	0	5	0
2018-09-30	10	0	11	0	0	0	0	0	0	0	0	0	21	0
2018-10-01	0	0	8	2	0	0	6	0	0	0	0	0	14	2
2018-10-02	6	0	1	0	0	0	0	0	0	0	0	0	7	0
2018-10-03	0	0	0	0	0	0	2	0	0	0	0	0	2	0
2018-10-04	0	0	0	0	0	0	0	0	5	0	0	0	5	0
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2018-10-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-10	0	0	0	0	3	1	0	0	0	0	0	0	3	1
Total	55	1	71	9	38	5	27	1	12	0	4	0	207	16

Table G.15: Estimated Bull Trout mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-27	3.0	0.0	0.0	0.0	0.0	0.0	3
2018-08-28	1.0	1.0	0.0	1.0	0.0	0.0	3
2018-08-29	0.0	3.0	0.0	1.0	0.0	0.0	4
2018-08-30	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-08-31	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-01	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-02	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-03	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-04	0.0	0.0	0.0	0.0	2.0	0.0	2
2018-09-05	0.0	0.0	3.9	1.1	0.0	0.0	5
2018-09-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-07	0.0	0.0	0.8	0.2	0.0	0.0	1
2018-09-08	3.0	0.0	0.0	0.0	0.0	0.0	3
2018-09-09	6.0	0.0	0.0	1.0	0.0	0.0	7
2018-09-10	7.0	2.0	0.0	1.0	0.0	0.0	10
2018-09-11	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-09-12	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-09-13	0.0	5.0	6.2	1.8	0.0	0.0	13
2018-09-14	0.0	0.0	3.1	0.9	0.0	0.0	4
2018-09-15	0.0	0.0	0.0	3.0	0.0	0.0	3
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	2.0	0.0	1.0	3
2018-09-18	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-19	5.0	0.0	0.0	0.0	0.0	0.0	5
2018-09-20	0.0	1.0	3.1	0.9	0.0	0.0	5
2018-09-21	0.0	3.0	0.0	0.0	0.0	0.0	3
2018-09-22	0.0	8.0	2.3	0.7	0.0	0.0	11
2018-09-23	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-24	11.0	0.0	0.0	3.0	0.0	0.0	14
2018-09-25	2.0	0.0	0.0	5.0	0.0	0.0	7
2018-09-26	0.0	8.0	0.0	1.0	0.0	0.0	9
2018-09-27	0.0	6.0	1.6	0.4	0.0	0.0	8
2018-09-28	0.0	0.0	3.1	0.9	2.0	0.0	6
2018-09-29	0.0	0.0	0.0	0.0	3.0	2.0	5
2018-09-30	10.0	9.0	0.0	0.0	0.0	0.0	19
2018-10-01	0.0	6.0	0.0	6.0	0.0	0.0	12

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-02	6.0	1.0	0.0	0.0	0.0	0.0	7
2018-10-03	0.0	0.0	0.0	2.0	0.0	0.0	2
2018-10-04	0.0	0.0	0.0	0.0	4.0	0.0	4
Total	54	59	24	33	11	3	184

Table G.16: Bull Trout sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
Section Three:				**Section Five:**			
2018-08-31	2	1		2018-09-13	9	5	1
2018-09-10	2	8		2018-09-14	4	5	
2018-09-11	1	8		2018-09-20	4	14	
2018-09-12	2	8	1	2018-09-22	3	14	
2018-09-13	6	10	1	2018-09-27	4	20	2
2018-09-20	1	17		2018-09-29	5	20	1
2018-09-21	3	17		2018-10-10	3	24	1
2018-09-22	9	17	1				
2018-09-26	10	29	2				
2018-09-27	9	29	2				
2018-09-30	11	43					
2018-10-01	8	43	2				
2018-10-02	1	43					

Table G.17: Bull Trout population estimates by river section

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Three	253	201	113	440	95	37.4
Five	128	80	38	275	79	61.9
Total	381		139	623	123	32.4

Table G.18: Walleye recaptures and migration proportions adjusted (inverse weight) for fish examined by section during 2018

Release Section	Recapture Section						
	One	Three	Five	Six	Seven	Nine	Total
One	0	0	0	0	0	0	0
Three	0	0	0	0	0	0	0
Five	0	0	0	0	1	0	1
Six	0	0	1	3	0	0	4
Seven	0	0	0	0	8	0	8
Nine	0	0	0	0	0	1	1
Sample:	0	24	30	62	172	47	335
Recap. %		0.00	3.33	4.84	5.23	2.13	4.18
Proportions:							
One	1.000	0.000	0.000	0.000	0.000	0.000	1.000
Three	0.000	1.000	0.000	0.000	0.000	0.000	1.000
Five	0.000	0.000	0.000	0.000	1.000	0.000	1.000
Six	0.000	0.000	0.408	0.592	0.000	0.000	1.000
Seven	0.000	0.000	0.000	0.000	1.000	0.000	1.000
Nine	0.000	0.000	0.000	0.000	0.000	1.000	1.000

Table G.19: Sample size and recaptures of Walleye by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-28	0	0	0	0	0	0	12	0	0	0	0	0	12	0
2018-08-29	0	0	2	0	0	0	5	0	0	0	0	0	7	0
2018-08-30	0	0	3	0	1	0	7	0	0	0	0	0	11	0
2018-08-31	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	2	0	2	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	4	0	4	0
2018-09-03	0	0	0	0	0	0	0	0	54	0	0	0	54	0
2018-09-04	0	0	0	0	0	0	0	0	4	0	0	0	4	0
2018-09-05	0	0	0	0	12	0	0	0	0	0	0	0	12	0
2018-09-06	0	0	0	0	0	0	7	2	0	0	0	0	7	2
2018-09-07	0	0	0	0	5	0	0	0	0	0	0	0	5	0
2018-09-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-10	0	0	2	0	0	0	4	0	3	1	0	0	9	1
2018-09-11	0	0	4	0	0	0	0	0	3	1	0	0	7	1
2018-09-12	0	0	1	0	0	0	0	0	2	0	0	0	3	0
2018-09-13	0	0	0	0	2	0	0	0	0	0	0	0	2	0
2018-09-14	0	0	0	0	3	0	0	0	0	0	0	0	3	0
2018-09-15	0	0	0	0	0	0	7	0	0	0	0	0	7	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	2	0	0	0	7	0	9	0
2018-09-18	0	0	0	0	0	0	2	0	5	1	7	0	14	1
2018-09-19	0	0	0	0	0	0	0	0	13	0	0	0	13	0
2018-09-20	0	0	1	0	3	0	0	0	0	0	0	0	4	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-21	0	0	1	0	0	0	0	0	17	0	0	0	18	0
2018-09-22	0	0	1	0	2	0	0	0	0	0	0	0	3	0
2018-09-23	0	0	0	0	0	0	0	0	0	0	6	0	6	0
2018-09-24	0	0	0	0	0	0	8	0	0	0	0	0	8	0
2018-09-25	0	0	2	0	0	0	4	1	0	0	0	0	6	1
2018-09-26	0	0	3	0	0	0	3	0	21	1	0	0	27	1
2018-09-27	0	0	1	0	1	0	0	0	0	0	0	0	2	0
2018-09-28	0	0	0	0	1	1	0	0	1	1	11	0	13	2
2018-09-29	0	0	0	0	0	0	0	0	18	3	9	1	27	4
2018-09-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-01	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-10-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-03	0	0	0	0	0	0	1	0	23	1	0	0	24	1
2018-10-04	0	0	0	0	0	0	0	0	8	0	0	0	8	0
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Total	0	0	24	0	30	1	62	3	172	9	47	1	335	14

Table G.20: Estimated Walleye mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-28	0.0	0.0	4.9	7.1	0.0	0.0	12
2018-08-29	0.0	2.0	2.0	3.0	0.0	0.0	7
2018-08-30	0.0	2.0	2.9	4.1	1.0	0.0	10
2018-08-31	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-01	0.0	0.0	0.0	0.0	0.0	2.0	2
2018-09-02	0.0	0.0	0.0	0.0	0.0	4.0	4
2018-09-03	0.0	0.0	0.0	0.0	54.0	0.0	54
2018-09-04	0.0	0.0	0.0	0.0	4.0	0.0	4
2018-09-05	0.0	0.0	0.0	0.0	12.0	0.0	12
2018-09-06	0.0	0.0	1.6	2.4	0.0	0.0	4
2018-09-07	0.0	0.0	0.0	0.0	5.0	0.0	5
2018-09-08	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-09	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-10	0.0	2.0	1.6	2.4	2.0	0.0	8
2018-09-11	0.0	4.0	0.0	0.0	2.0	0.0	6
2018-09-12	0.0	1.0	0.0	0.0	2.0	0.0	3
2018-09-13	0.0	0.0	0.0	0.0	2.0	0.0	2
2018-09-14	0.0	0.0	0.0	0.0	3.0	0.0	3
2018-09-15	0.0	0.0	2.9	4.1	0.0	0.0	7
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.8	1.2	0.0	7.0	9
2018-09-18	0.0	0.0	0.8	1.2	4.0	7.0	13
2018-09-19	0.0	0.0	0.0	0.0	11.0	0.0	11
2018-09-20	0.0	1.0	0.0	0.0	3.0	0.0	4
2018-09-21	0.0	1.0	0.0	0.0	17.0	0.0	18
2018-09-22	0.0	1.0	0.0	0.0	2.0	0.0	3
2018-09-23	0.0	0.0	0.0	0.0	0.0	6.0	6
2018-09-24	0.0	0.0	3.3	4.7	0.0	0.0	8
2018-09-25	0.0	2.0	1.2	1.8	0.0	0.0	5
2018-09-26	0.0	3.0	1.2	1.8	19.0	0.0	25
2018-09-27	0.0	1.0	0.0	0.0	1.0	0.0	2
2018-09-28	0.0	0.0	0.0	0.0	0.0	11.0	11
2018-09-29	0.0	0.0	0.0	0.0	15.0	8.0	23
2018-09-30	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-01	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-10-02	0.0	0.0	0.0	0.0	0.0	0.0	0

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-03	0.0	0.0	0.4	0.6	22.0	0.0	23
2018-10-04	0.0	0.0	0.0	0.0	8.0	0.0	8
2018-10-05	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-07	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-08	0.0	0.0	0.0	0.0	0.0	1.0	1
Total	0.0	23.0	23.7	34.3	189.0	46.0	316

Table G.21: Walleye sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
Six Six:				**Section Seven:**			
2018-09-06	7	14	2	2018-09-03	54	1	
2018-09-10	4	17		2018-09-04	4	1	
2018-09-15	7	19		2018-09-10	3	76	1
2018-09-17	2	19		2018-09-11	3	76	1
2018-09-18	2	23		2018-09-12	2	76	
2018-09-24	8	25		2018-09-18	5	87	1
2018-09-25	4	25	1	2018-09-19	13	87	
2018-09-26	3	25		2018-09-21	17	91	
2018-10-03	1	34		2018-09-26	21	124	1
				2018-09-28	1	124	1
				2018-09-29	18	143	3
				2018-10-03	23	159	1
				2018-10-04	8	159	

Table G.22: Walleye population estimates by river section

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Six	574	270	98	1,454	393	68.4
Seven	1,952	1,568	868	3,376	677	34.7
Total[1]	2,526	2,112	1,478	2,552	783	31.0

[1] Calculated from the joint distribution of section 6 plus section 7.

Table G.23: Largescale Sucker recaptures and migration proportions adjusted (inverse weight) for fish examined by river section during 2018

Release Section	Recapture Section						
	One	Three	Five	Six	Seven	Nine	Total
One	0	0	0	0	0	0	0
Three	0	5	0	0	0	0	5
Five	0	1	0	0	0	0	1
Six	0	0	0	6	0	0	6
Seven	0	0	0	0	14	0	14
Nine	0	0	0	0	0	2	2
Sample:	27	190	103	217	156	41	734
Recap. %	0.00	3.16	0.00	2.76	8.97	4.88	3.81
Proportions:							
One	1.000	0.000	0.000	0.000	0.000	0.000	1.000
Three	0.000	1.000	0.000	0.000	0.000	0.000	1.000
Five	0.000	1.000	0.000	0.000	0.000	0.000	1.000
Six	0.000	0.000	0.000	1.000	0.000	0.000	1.000
Seven	0.000	0.000	0.000	0.000	1.000	0.000	1.000
Nine	0.000	0.000	0.000	0.000	0.000	1.000	1.000

Table G.24: Sample size and recaptures of Largescale Sucker by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-28	1	0	4	0	0	0	19	0	0	0	0	0	24	0
2018-08-29	0	0	9	0	0	0	15	0	0	0	0	0	24	0
2018-08-30	0	0	14	0	3	0	19	0	0	0	0	0	36	0
2018-08-31	0	0	15	0	0	0	0	0	0	0	0	0	15	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	2	0	2	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2018-09-03	0	0	0	0	0	0	0	0	37	0	0	0	37	0
2018-09-04	0	0	0	0	0	0	0	0	27	0	0	0	27	0
2018-09-05	0	0	0	0	6	0	0	0	0	0	0	0	6	0
2018-09-06	0	0	0	0	5	0	23	0	0	0	0	0	28	0
2018-09-07	0	0	0	0	11	0	0	0	0	0	0	0	11	0
2018-09-08	6	0	0	0	0	0	0	0	0	0	0	0	6	0
2018-09-09	16	0	0	0	0	0	11	0	0	0	0	0	27	0
2018-09-10	4	0	17	0	0	0	30	1	5	1	0	0	56	2
2018-09-11	0	0	8	0	0	0	0	0	12	3	0	0	20	3
2018-09-12	0	0	12	1	0	0	0	0	7	0	0	0	19	1
2018-09-13	0	0	11	1	15	0	0	0	0	0	0	0	26	1
2018-09-14	0	0	0	0	17	0	0	0	0	0	0	0	17	0
2018-09-15	0	0	0	0	0	0	12	0	0	0	0	0	12	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	6	0	0	0	7	0	13	0
2018-09-18	0	0	0	0	0	0	15	1	5	1	5	0	25	2
2018-09-19	0	0	0	0	0	0	0	0	14	2	0	0	14	2
2018-09-20	0	0	5	0	6	0	0	0	0	0	0	0	11	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-21	0	0	16	1	8	0	0	0	7	1	0	0	31	2
2018-09-22	0	0	15	0	18	0	0	0	0	0	0	0	33	0
2018-09-23	0	0	0	0	0	0	0	0	0	0	13	0	13	0
2018-09-24	0	0	0	0	0	0	10	1	0	0	0	0	10	1
2018-09-25	0	0	2	0	0	0	14	0	0	0	0	0	16	0
2018-09-26	0	0	27	1	0	0	2	0	24	4	0	0	53	5
2018-09-27	0	0	12	0	3	0	0	0	0	0	0	0	15	0
2018-09-28	0	0	0	0	10	0	0	0	3	0	9	1	22	1
2018-09-29	0	0	0	0	0	0	0	0	4	1	4	1	8	2
2018-09-30	0	0	6	0	0	0	0	0	0	0	0	0	6	0
2018-10-01	0	0	16	2	0	0	27	1	0	0	0	0	43	3
2018-10-02	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-10-03	0	0	0	0	0	0	14	2	1	0	0	0	15	2
2018-10-04	0	0	0	0	0	0	0	0	10	1	0	0	10	1
Total	27	0	190	6	102	0	217	6	156	14	41	2	733	28

Table G.25: Estimated Largescale Sucker mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-28	1.0	3.0	0.0	19.0	0.0	0.0	23
2018-08-29	0.0	9.0	0.0	14.0	0.0	0.0	23
2018-08-30	0.0	17.0	0.0	19.0	0.0	0.0	36
2018-08-31	0.0	15.0	0.0	0.0	0.0	0.0	15
2018-09-01	0.0	0.0	0.0	0.0	0.0	2.0	2
2018-09-02	0.0	0.0	0.0	0.0	0.0	1.0	1
2018-09-03	0.0	0.0	0.0	0.0	37.0	0.0	37
2018-09-04	0.0	0.0	0.0	0.0	27.0	0.0	27
2018-09-05	0.0	6.0	0.0	0.0	0.0	0.0	6
2018-09-06	0.0	5.0	0.0	23.0	0.0	0.0	28
2018-09-07	0.0	11.0	0.0	0.0	0.0	0.0	11
2018-09-08	6.0	0.0	0.0	0.0	0.0	0.0	6
2018-09-09	16.0	0.0	0.0	11.0	0.0	0.0	27
2018-09-10	3.0	17.0	0.0	29.0	4.0	0.0	53
2018-09-11	0.0	8.0	0.0	0.0	9.0	0.0	17
2018-09-12	0.0	11.0	0.0	0.0	7.0	0.0	18
2018-09-13	0.0	25.0	0.0	0.0	0.0	0.0	25
2018-09-14	0.0	17.0	0.0	0.0	0.0	0.0	17
2018-09-15	0.0	0.0	0.0	12.0	0.0	0.0	12
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	6.0	0.0	7.0	13
2018-09-18	0.0	0.0	0.0	14.0	4.0	5.0	23
2018-09-19	0.0	0.0	0.0	0.0	12.0	0.0	12
2018-09-20	0.0	11.0	0.0	0.0	0.0	0.0	11
2018-09-21	0.0	23.0	0.0	0.0	6.0	0.0	29
2018-09-22	0.0	32.0	0.0	0.0	0.0	0.0	32
2018-09-23	0.0	0.0	0.0	0.0	0.0	13.0	13
2018-09-24	0.0	0.0	0.0	8.0	0.0	0.0	8
2018-09-25	0.0	2.0	0.0	14.0	0.0	0.0	16
2018-09-26	0.0	26.0	0.0	1.0	18.0	0.0	45
2018-09-27	0.0	15.0	0.0	0.0	0.0	0.0	15
2018-09-28	0.0	10.0	0.0	0.0	3.0	8.0	21
2018-09-29	0.0	0.0	0.0	0.0	3.0	3.0	6
2018-09-30	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-10-01	0.0	2.0	0.0	3.0	0.0	0.0	5
2018-10-02	0.0	1.0	0.0	0.0	0.0	0.0	1

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-03	0.0	0.0	0.0	3.0	0.0	0.0	3
2018-10-04	0.0	0.0	0.0	0.0	2.0	0.0	2
Total	26	267	0	176	132	39	640

Table 26: Largescale Sucker sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
Section Three:				**Section Seven:**			
2018-08-31	15	3		2018-09-10	5	64	1
2018-09-10	17	66		2018-09-11	12	64	3
2018-09-11	8	66		2018-09-12	7	64	
2018-09-12	12	66	1	2018-09-18	5	84	1
2018-09-13	11	83	1	2018-09-19	14	84	2
2018-09-20	5	144		2018-09-21	7	88	1
2018-09-21	16	144	1	2018-09-26	24	106	4
2018-09-22	15	144		2018-09-28	3	106	
2018-09-25	2	210		2018-09-29	4	124	1
2018-09-26	27	210	1	2018-10-03	1	130	
2018-09-27	12	210		2018-10-04	10	130	1
2018-09-30	6	253					
2018-10-01	16	263	2				
2018-10-02	1	263					
Section Six:							
2018-09-06	23	52					
2018-09-09	11	75					
2018-09-10	30	75	1				
2018-09-15	12	115					
2018-09-17	6	115					
2018-09-18	15	127	1				
2018-09-24	10	147	1				
2018-09-25	14	147					
2018-09-26	2	147					
2018-10-01	27	170	1				
2018-10-03	14	170	2				

Table G.27: Largescale Sucker population estimates by river section

			95% HPD		Standard Deviation	CV (%)
Section	Bayes Mean	MLE	Low	High		
Three	5,738	3,875	1,750	11,750	3,076	53.6
Six	4,695	3,150	1,425	9,625	2,577	54.9
Seven	713	625	375	1,125	198	27.8
Total	11,146		3,271	19,021	4,018	36.0

Table G.28: Longnose Sucker recaptures and migration proportions adjusted (inverse weight) for fish examined by river section during 2018

Release Section	Recapture Section						
	One	Three	Five	Six	Seven	Nine	Total
One	0	0	0	0	0	0	0
Three	0	17	1	2	0	0	20
Five	0	0	1	5	0	0	6
Six	0	0	0	22	4	0	26
Seven	0	0	0	0	14	0	14
Nine	0	0	0	0	0	1	1
Sample:	76	857	304	876	773	262	3,148
Recap. %	0.00	1.98	0.66	3.31	2.33	0.38	2.13
Proportions:							
One	1.000	0.000	0.000	0.000	0.000	0.000	1.000
Three	0.000	0.781	0.129	0.090	0.000	0.000	1.000
Five	0.000	0.000	0.366	0.634	0.000	0.000	1.000
Six	0.000	0.000	0.000	0.829	0.171	0.000	1.000
Seven	0.000	0.000	0.000	0.000	1.000	0.000	1.000
Nine	0.000	0.000	0.000	0.000	0.000	1.000	1.000

Table G.29: Sample size and recaptures of Longnose Sucker by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-28	7	0	56	0	0	0	34	0	0	0	0	0	97	0
2018-08-29	0	0	124	0	0	0	141	0	0	0	0	0	265	0
2018-08-30	0	0	101	0	9	0	78	0	0	0	0	0	188	0
2018-08-31	0	0	64	1	0	0	0	0	0	0	0	0	64	1
2018-09-01	0	0	0	0	0	0	0	0	0	0	28	0	28	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	36	0	36	0
2018-09-03	0	0	0	0	0	0	0	0	72	0	0	0	72	0
2018-09-04	0	0	0	0	0	0	0	0	227	0	0	0	227	0
2018-09-05	0	0	0	0	46	0	0	0	0	0	0	0	46	0
2018-09-06	0	0	0	0	39	0	6	1	0	0	0	0	45	1
2018-09-07	0	0	0	0	31	0	5	0	0	0	0	0	36	0
2018-09-08	17	0	0	0	0	0	0	0	0	0	0	0	17	0
2018-09-09	34	0	0	0	0	0	43	3	0	0	0	0	77	3
2018-09-10	9	0	57	2	0	0	97	3	2	0	0	0	165	5
2018-09-11	0	0	66	2	0	0	0	0	59	1	0	0	125	3
2018-09-12	0	0	58	1	0	0	0	0	74	1	0	0	132	2
2018-09-13	0	0	37	0	17	0	0	0	0	0	0	0	54	0
2018-09-14	0	0	0	0	45	0	0	0	0	0	0	0	45	0
2018-09-15	0	0	0	0	0	0	35	2	0	0	0	0	35	2
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	46	0	0	0	36	0	82	0
2018-09-18	0	0	0	0	0	0	72	3	29	2	13	0	114	5
2018-09-19	3	0	0	0	0	0	0	0	70	5	0	0	73	5
2018-09-20	0	0	9	0	26	0	0	0	0	0	0	0	35	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-21	0	0	58	4	5	0	0	0	43	2	0	0	106	6
2018-09-22	0	0	31	0	44	1	0	0	0	0	0	0	75	1
2018-09-23	0	0	0	0	0	0	0	0	0	0	54	1	54	1
2018-09-24	1	0	0	0	0	0	57	3	0	0	0	0	58	3
2018-09-25	2	0	31	1	0	0	108	4	0	0	0	0	141	5
2018-09-26	0	0	92	5	0	0	19	0	34	3	0	0	145	8
2018-09-27	0	0	26	1	11	0	0	0	0	0	0	0	37	1
2018-09-28	0	0	0	0	25	1	0	0	35	2	45	0	105	3
2018-09-29	0	0	0	0	0	0	0	0	46	1	30	0	76	1
2018-09-30	1	0	10	0	0	0	0	0	0	0	0	0	11	0
2018-10-01	0	0	34	0	0	0	77	5	0	0	0	0	111	5
2018-10-02	2	0	3	0	0	0	0	0	0	0	0	0	5	0
2018-10-03	0	0	0	0	0	0	58	5	10	0	0	0	68	5
2018-10-04	0	0	0	0	0	0	0	0	63	1	0	0	63	1
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	20	0	20	0
2018-10-09	0	0	0	0	5	0	0	0	9	0	0	0	14	0
2018-10-10	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Total	76	0	857	17	304	2	876	29	773	18	262	1	3,148	67

Table G.30: Estimated Longnose Sucker mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-28	7.0	43.7	7.2	33.2	5.8	0.0	97
2018-08-29	0.0	96.0	15.9	123.8	23.2	0.0	259
2018-08-30	0.0	78.8	16.4	78.6	13.2	0.0	187
2018-08-31	0.0	49.2	8.2	5.7	0.0	0.0	63
2018-09-01	0.0	0.0	0.0	0.0	0.0	28.0	28
2018-09-02	0.0	0.0	0.0	0.0	0.0	36.0	36
2018-09-03	0.0	0.0	0.0	0.0	72.0	0.0	72
2018-09-04	0.0	0.0	0.0	0.0	227.0	0.0	227
2018-09-05	0.0	0.0	16.8	29.2	0.0	0.0	46
2018-09-06	0.0	0.0	14.3	28.9	0.9	0.0	44
2018-09-07	0.0	0.0	11.0	23.2	0.9	0.0	35
2018-09-08	17.0	0.0	0.0	0.0	0.0	0.0	17
2018-09-09	34.0	0.0	0.0	33.2	6.8	0.0	74
2018-09-10	9.0	42.9	7.1	81.2	17.7	0.0	158
2018-09-11	0.0	49.2	8.2	5.7	56.0	0.0	119
2018-09-12	0.0	44.5	7.4	5.1	71.0	0.0	128
2018-09-13	0.0	28.1	10.9	14.0	0.0	0.0	53
2018-09-14	0.0	0.0	16.5	28.5	0.0	0.0	45
2018-09-15	0.0	0.0	0.0	27.4	5.6	0.0	33
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	38.1	7.9	36.0	82
2018-09-18	0.0	0.0	0.0	56.4	38.6	13.0	108
2018-09-19	3.0	0.0	0.0	0.0	61.0	0.0	64
2018-09-20	0.0	6.2	10.5	17.2	0.0	0.0	34
2018-09-21	0.0	42.2	8.5	7.4	41.0	0.0	99
2018-09-22	0.0	24.2	19.7	30.1	0.0	0.0	74
2018-09-23	0.0	0.0	0.0	0.0	0.0	53.0	53
2018-09-24	1.0	0.0	0.0	44.8	9.2	0.0	55
2018-09-25	2.0	23.4	3.9	88.9	17.8	0.0	136
2018-09-26	0.0	66.4	11.0	23.4	31.2	0.0	132
2018-09-27	0.0	19.5	7.3	9.2	0.0	0.0	36
2018-09-28	0.0	0.0	8.8	15.2	33.0	45.0	102
2018-09-29	0.0	0.0	0.0	0.0	43.0	30.0	73
2018-09-30	0.0	0.8	0.1	0.1	0.0	0.0	1
2018-10-01	0.0	3.1	0.5	7.0	1.4	0.0	12
2018-10-02	0.0	0.8	0.1	0.1	0.0	0.0	1

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-03	0.0	0.0	0.0	5.0	2.0	0.0	7
2018-10-04	0.0	0.0	0.0	0.0	2.0	0.0	2
2018-10-05	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-07	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-08	0.0	0.0	0.0	0.0	0.0	3.0	3
2018-10-09	0.0	0.0	0.4	0.6	0.0	0.0	1
2018-10-10	0.0	0.0	0.4	0.6	0.0	0.0	1
Total	73.0	619.1	210.9	861.8	788.2	244.0	2,797

Table G.31: Longnose Sucker sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
SectionThree:				**Section Seven:**			
2018-08-31	64	44	1	2018-09-03	72	42	
2018-09-10	57	268	2	2018-09-04	227	42	
2018-09-11	66	268	2	2018-09-10	2	343	
2018-09-12	58	268	1	2018-09-11	59	343	1
2018-09-13	37	311		2018-09-12	74	350	1
2018-09-20	9	433		2018-09-18	29	500	2
2018-09-21	58	433	4	2018-09-19	70	500	5
2018-09-22	31	433		2018-09-21	43	547	2
2018-09-25	31	505	1	2018-09-26	34	649	3
2018-09-26	92	505	5	2018-09-28	35	676	2
2018-09-27	26	505	1	2018-09-29	46	707	1
2018-09-30	10	614		2018-10-03	10	783	
2018-10-01	34	614		2018-10-04	63	784	1
2018-10-02	3	614		2018-10-09	9	788	
Section Six:							
2018-09-06	6	241	1				
2018-09-07	5	241					
2018-09-09	43	299	3				
2018-09-10	97	323	3				
2018-09-15	35	448	2				
2018-09-17	46	490					
2018-09-18	72	518	3				
2018-09-24	57	637	3				
2018-09-25	108	667	4				
2018-09-26	19	667					
2018-10-01	77	848	5				
2018-10-03	58	849	5				

Table G.32: Longnose Sucker population estimates by river section

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Three	13,959	12,350	7,830	21,280	3,630	26.0
Six	13,264	12,370	8,760	18,360	2,537	19.1
Seven	17,091	15,290	9,880	25,650	4,174	24.4
Total	44,314		32,387	56,241	6,085	13.7

Table G.33: Sample size and recaptures of White Sucker by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-27	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-08-28	3	0	1	0	0	0	3	0	0	0	0	0	7	0
2018-08-29	0	0	1	0	0	0	3	0	0	0	0	0	4	0
2018-08-30	0	0	4	0	0	0	0	0	0	0	0	0	4	0
2018-08-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	5	0	5	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	3	0	3	0
2018-09-03	0	0	0	0	0	0	0	0	11	0	0	0	11	0
2018-09-04	0	0	0	0	0	0	0	0	1	0	0	0	1	0
2018-09-05	0	0	0	0	5	0	0	0	0	0	0	0	5	0
2018-09-06	0	0	0	0	0	0	1	0	0	0	0	0	1	0
2018-09-07	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2018-09-08	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-09-09	0	0	0	0	0	0	3	0	0	0	0	0	3	0
2018-09-10	7	0	1	0	0	0	1	0	1	0	0	0	10	0
2018-09-11	0	0	1	0	0	0	0	0	3	0	0	0	4	0
2018-09-12	0	0	3	0	0	0	0	0	2	0	0	0	5	0
2018-09-13	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2018-09-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	0	0	0	0	5	1	5	1
2018-09-18	0	0	0	0	0	0	1	0	0	0	14	0	15	0
2018-09-19	1	0	0	0	0	0	0	0	4	0	0	0	5	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-21	0	0	0	0	0	0	0	0	3	1	0	0	3	1
2018-09-22	0	0	0	0	2	0	0	0	0	0	0	0	2	0
2018-09-23	0	0	0	0	0	0	0	0	0	0	7	1	7	1
2018-09-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-25	0	0	0	0	0	0	1	0	0	0	0	0	1	0
2018-09-26	0	0	1	0	0	0	2	0	3	0	0	0	6	0
2018-09-27	0	0	0	0	3	0	0	0	0	0	0	0	3	0
2018-09-28	0	0	0	0	0	0	0	0	0	0	4	1	4	1
2018-09-29	0	0	0	0	0	0	0	0	2	0	4	0	6	0
2018-09-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-01	0	0	2	0	0	0	2	0	0	0	0	0	4	0
2018-10-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-03	0	0	0	0	0	0	12	0	0	0	0	0	12	0
2018-10-04	0	0	0	0	0	0	0	0	5	0	0	0	5	0
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	2	0	2	0
Total	13	0	14	0	12	0	29	0	35	1	44	3	147	4

Table G.34: Estimated White Sucker mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-27	1.0	0.0	0.0	0.0	0.0	0.0	1
2018-08-28	3.0	1.0	0.0	3.0	0.0	0.0	7
2018-08-29	0.0	1.0	0.0	3.0	0.0	0.0	4
2018-08-30	0.0	4.0	0.0	0.0	0.0	0.0	4
2018-08-31	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-01	0.0	0.0	0.0	0.0	0.0	5.0	5
2018-09-02	0.0	0.0	0.0	0.0	0.0	3.0	3
2018-09-03	0.0	0.0	0.0	0.0	11.0	0.0	11
2018-09-04	0.0	0.0	0.0	0.0	1.0	0.0	1
2018-09-05	0.0	0.0	5.0	0.0	0.0	0.0	5
2018-09-06	0.0	0.0	0.0	1.0	0.0	0.0	1
2018-09-07	0.0	0.0	1.0	0.0	0.0	0.0	1
2018-09-08	1.0	0.0	0.0	0.0	0.0	0.0	1
2018-09-09	0.0	0.0	0.0	3.0	0.0	0.0	3
2018-09-10	7.0	1.0	0.0	1.0	1.0	0.0	10
2018-09-11	0.0	1.0	0.0	0.0	3.0	0.0	4
2018-09-12	0.0	3.0	0.0	0.0	1.0	0.0	4
2018-09-13	0.0	0.0	1.0	0.0	0.0	0.0	1
2018-09-14	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-15	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	0.0	0.0	4.0	4
2018-09-18	0.0	0.0	0.0	1.0	0.0	14.0	15
2018-09-19	1.0	0.0	0.0	0.0	4.0	0.0	5
2018-09-20	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-21	0.0	0.0	0.0	0.0	2.0	0.0	2
2018-09-22	0.0	0.0	2.0	0.0	0.0	0.0	2
2018-09-23	0.0	0.0	0.0	0.0	0.0	6.0	6
2018-09-24	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-25	0.0	0.0	0.0	1.0	0.0	0.0	1
2018-09-26	0.0	1.0	0.0	2.0	3.0	0.0	6
2018-09-27	0.0	0.0	3.0	0.0	0.0	0.0	3
2018-09-28	0.0	0.0	0.0	0.0	0.0	3.0	3
2018-09-29	0.0	0.0	0.0	0.0	2.0	4.0	6
2018-09-30	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-01	0.0	0.0	0.0	0.0	0.0	0.0	0

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-02	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-10-03	0.0	0.0	0.0	2.0	0.0	0.0	2
Total	13.0	12.0	12.0	17.0	28.0	39.0	121

Table G.35: White Sucker sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.
Section Nine:			
2018-09-17	5	8	1
2018-09-18	14	8	
2018-09-23	7	26	1
2018-09-28	4	32	1
2018-09-29	4	32	
2018-10-08	2	39	

Table G.36: White Sucker population estimates by river section

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Nine	521	226	80	1,424	409	78.6
Total	521		80	1,424	409	78.6

Table 37: Sample size and recaptures of Rainbow Trout by river section and date

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-08-27	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-08-28	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-08-29	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-08-30	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2018-08-31	0	0	2	0	0	0	0	0	0	0	0	0	2	0
2018-09-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-07	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2018-09-08	5	0	0	0	0	0	0	0	0	0	0	0	5	0
2018-09-09	2	0	0	0	0	0	0	0	0	0	0	0	2	0
2018-09-10	3	0	0	0	0	0	0	0	0	0	0	0	3	0
2018-09-11	0	0	4	0	0	0	0	0	0	0	0	0	4	0
2018-09-12	0	0	6	0	0	0	0	0	0	0	0	0	6	0
2018-09-13	0	0	7	0	4	0	0	0	0	0	0	0	11	0
2018-09-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-19	6	0	0	0	0	0	0	0	0	0	0	0	6	0

Date	One		Three		Five		Six		Seven		Nine		Total	
	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.	Sample	Recap.
2018-09-20	0	0	3	1	3	2	0	0	0	0	0	0	6	3
2018-09-21	0	0	4	2	0	0	0	0	0	0	0	0	4	2
2018-09-22	0	0	4	1	0	0	0	0	0	0	0	0	4	1
2018-09-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-24	7	0	0	0	0	0	0	0	0	0	0	0	7	0
2018-09-25	3	0	2	0	0	0	0	0	0	0	0	0	5	0
2018-09-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-27	0	0	2	1	3	1	0	0	0	0	0	0	5	2
2018-09-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-09-30	4	0	2	1	0	0	0	0	0	0	0	0	6	1
2018-10-01	0	0	3	1	0	0	0	0	0	0	0	0	3	1
2018-10-02	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2018-10-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018-10-10	0	0	0	0	2	1	0	0	0	0	0	0	2	1
Total	33	0	41	7	13	4	0	0	0	0	0	0	87	11

Table G.38: Estimated Rainbow Trout mark releases by river section and date adjusted for migration

Date	One	Three	Five	Six	Seven	Nine	Total
2018-08-27	1.0	0.0	0.0	0.0	0.0	0.0	1
2018-08-28	1.0	0.0	0.0	0.0	0.0	0.0	1
2018-08-29	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-08-30	0.0	1.0	0.0	0.0	0.0	0.0	1
2018-08-31	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-01	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-02	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-03	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-04	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-05	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-06	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-07	0.0	0.0	1.0	0.0	0.0	0.0	1
2018-09-08	5.0	0.0	0.0	0.0	0.0	0.0	5
2018-09-09	2.0	0.0	0.0	0.0	0.0	0.0	2
2018-09-10	3.0	0.0	0.0	0.0	0.0	0.0	3
2018-09-11	0.0	4.0	0.0	0.0	0.0	0.0	4
2018-09-12	0.0	6.0	0.0	0.0	0.0	0.0	6
2018-09-13	0.0	7.0	4.0	0.0	0.0	0.0	11
2018-09-14	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-15	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-16	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-17	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-18	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-19	6.0	0.0	0.0	0.0	0.0	0.0	6
2018-09-20	0.0	2.0	1.0	0.0	0.0	0.0	3
2018-09-21	0.0	2.0	0.0	0.0	0.0	0.0	2
2018-09-22	0.0	3.0	0.0	0.0	0.0	0.0	3
2018-09-23	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-24	7.0	0.0	0.0	0.0	0.0	0.0	7
2018-09-25	3.0	2.0	0.0	0.0	0.0	0.0	5
2018-09-26	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-27	0.0	1.0	2.0	0.0	0.0	0.0	3
2018-09-28	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-29	0.0	0.0	0.0	0.0	0.0	0.0	0
2018-09-30	4.0	1.0	0.0	0.0	0.0	0.0	5
2018-10-01	0.0	2.0	0.0	0.0	0.0	0.0	2

Date	One	Three	Five	Six	Seven	Nine	Total
2018-10-02	1.0	0.0	0.0	0.0	0.0	0.0	1
Total	33.0	34.0	8.0	0.0	0.0	0.0	75

Table 39: Rainbow Trout sample, cumulative marks available for recapture and recaptures by river section and date

Date	Sample	Marks	Recap.	Date	Sample	Marks	Recap.
Section Three:				**Section Five:**			
2018-09-11	4	4		2018-09-13	4	1	
2018-09-12	6	4		2018-09-20	3	5	2
2018-09-13	7	4		2018-09-27	3	6	1
2018-09-20	3	21	1	2018-10-10	2	8	1
2018-09-21	4	21	2				
2018-09-22	4	21	1				
2018-09-25	2	28					
2018-09-27	2	28	1				
2018-09-30	2	31	1				
2018-10-01	3	31	1				

Table 40: Population estimates by river section for Rainbow Trout

Section	Bayes Mean	MLE	95% HPD		Standard Deviation	CV (%)
			Low	High		
Three	106	79	45	195	45	42.0
Five	23	13	9	52	14	60.4
Total[1]	128	102	61	218	45	35.1

[1] Calculated from the joint distribution of section 3 plus section 5

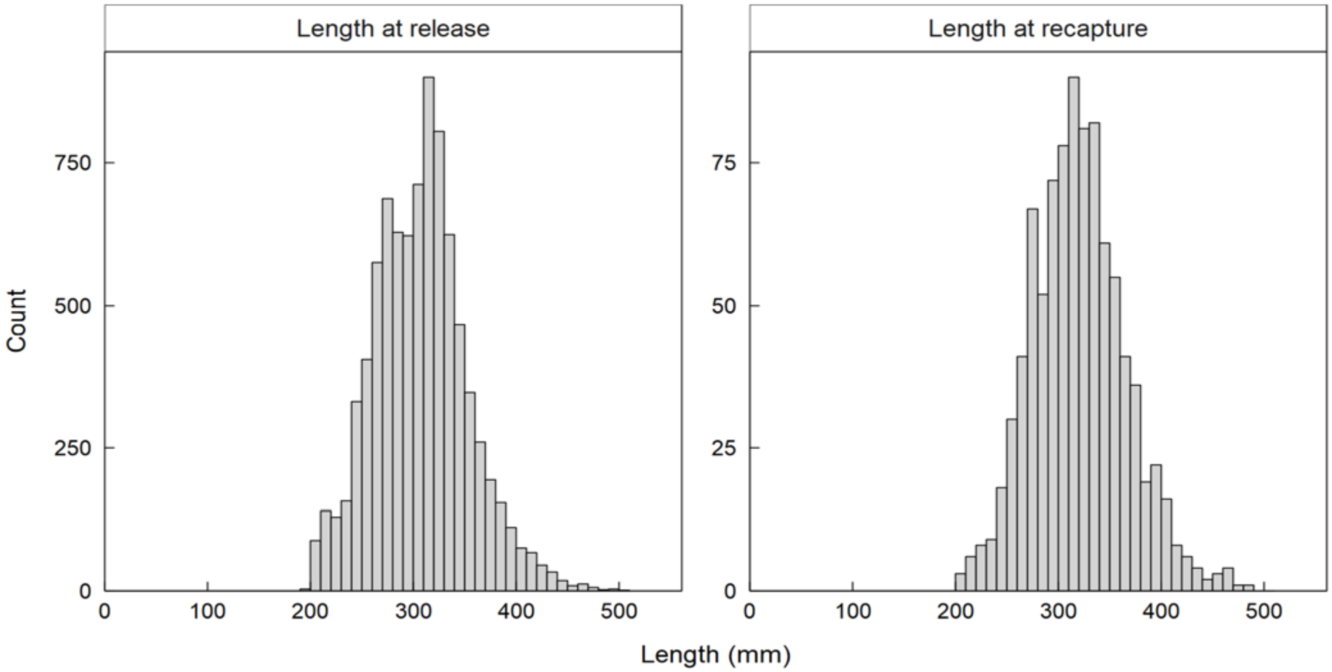

Figure G.1: Histogram of Mountain Whitefish lengths at release (left) and recapture (right)

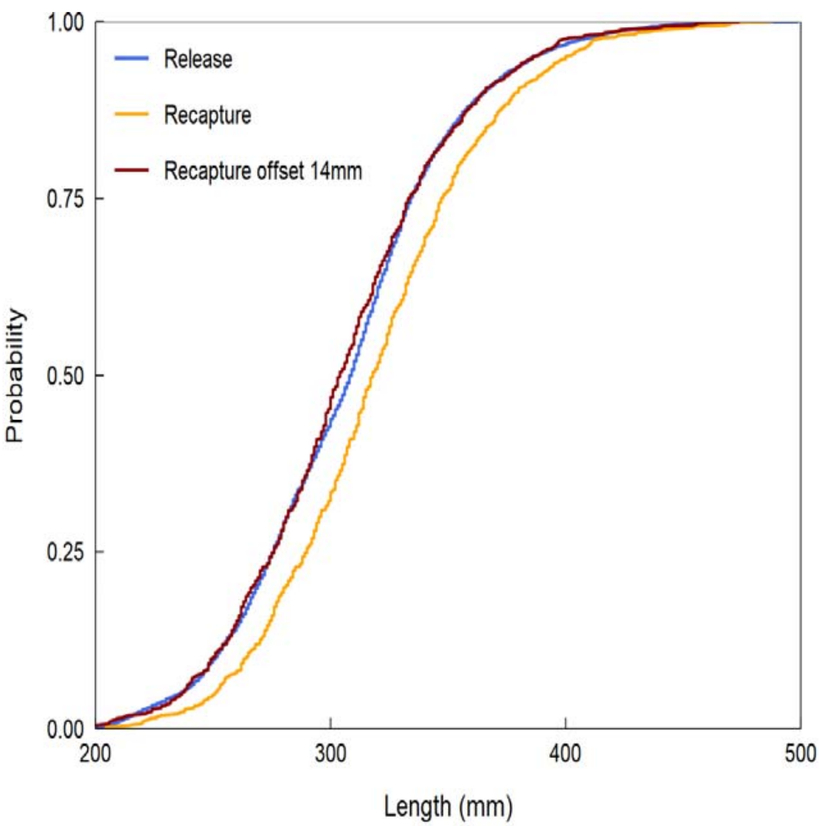

Figure G.2: Mountain Whitefish cumulative proportion of length at release and recapture

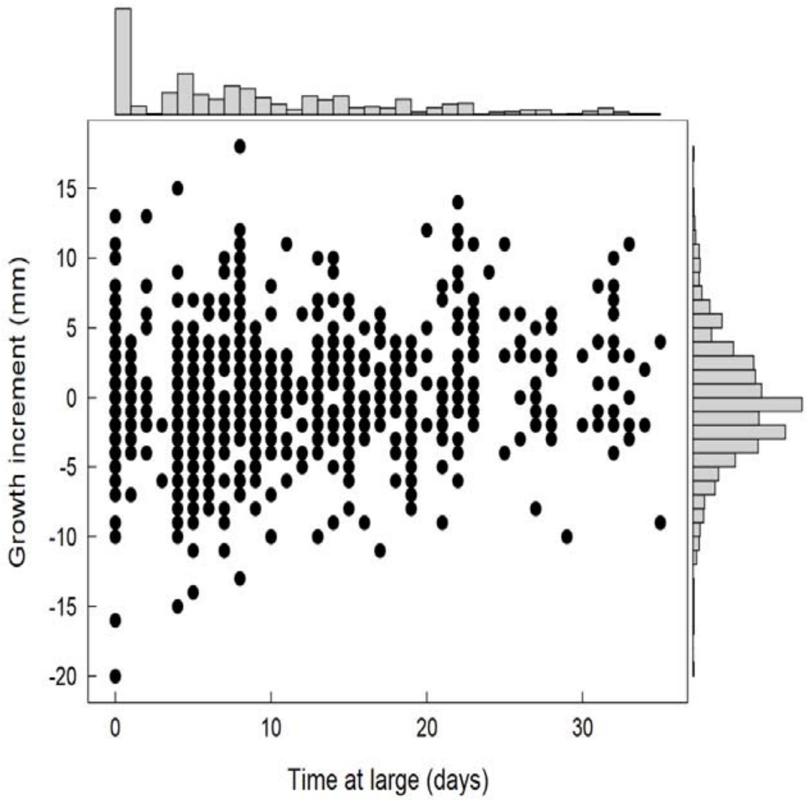

Figure G.3: Growth over the study period of Mountain Whitefish with border histograms of time at large and growth increment

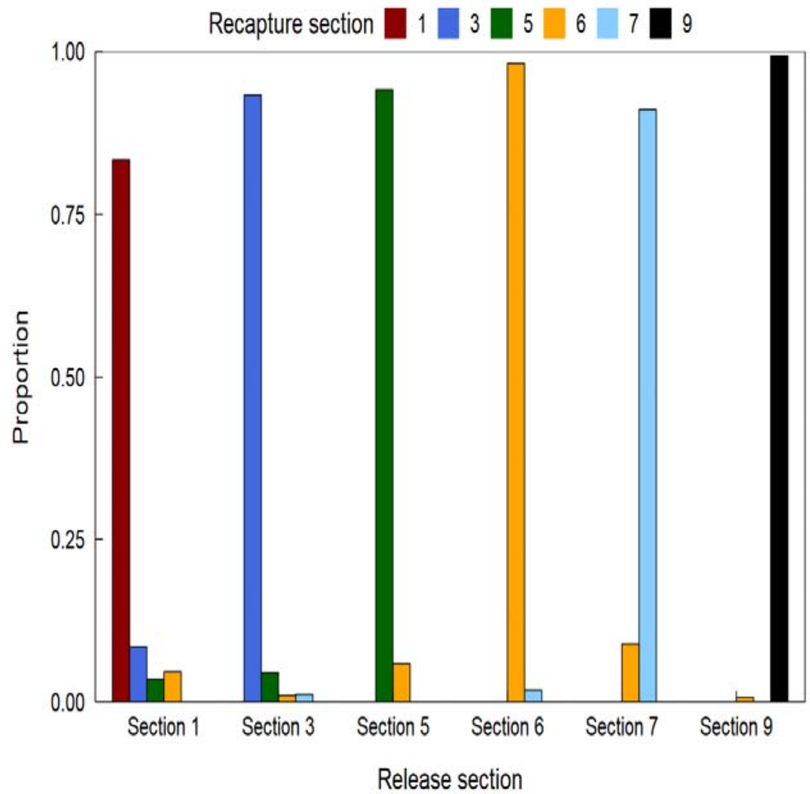

Figure G.4: Distribution of recaptured marks in 2018 standardized for sampling effort by section of Mountain Whitefish released in 2017

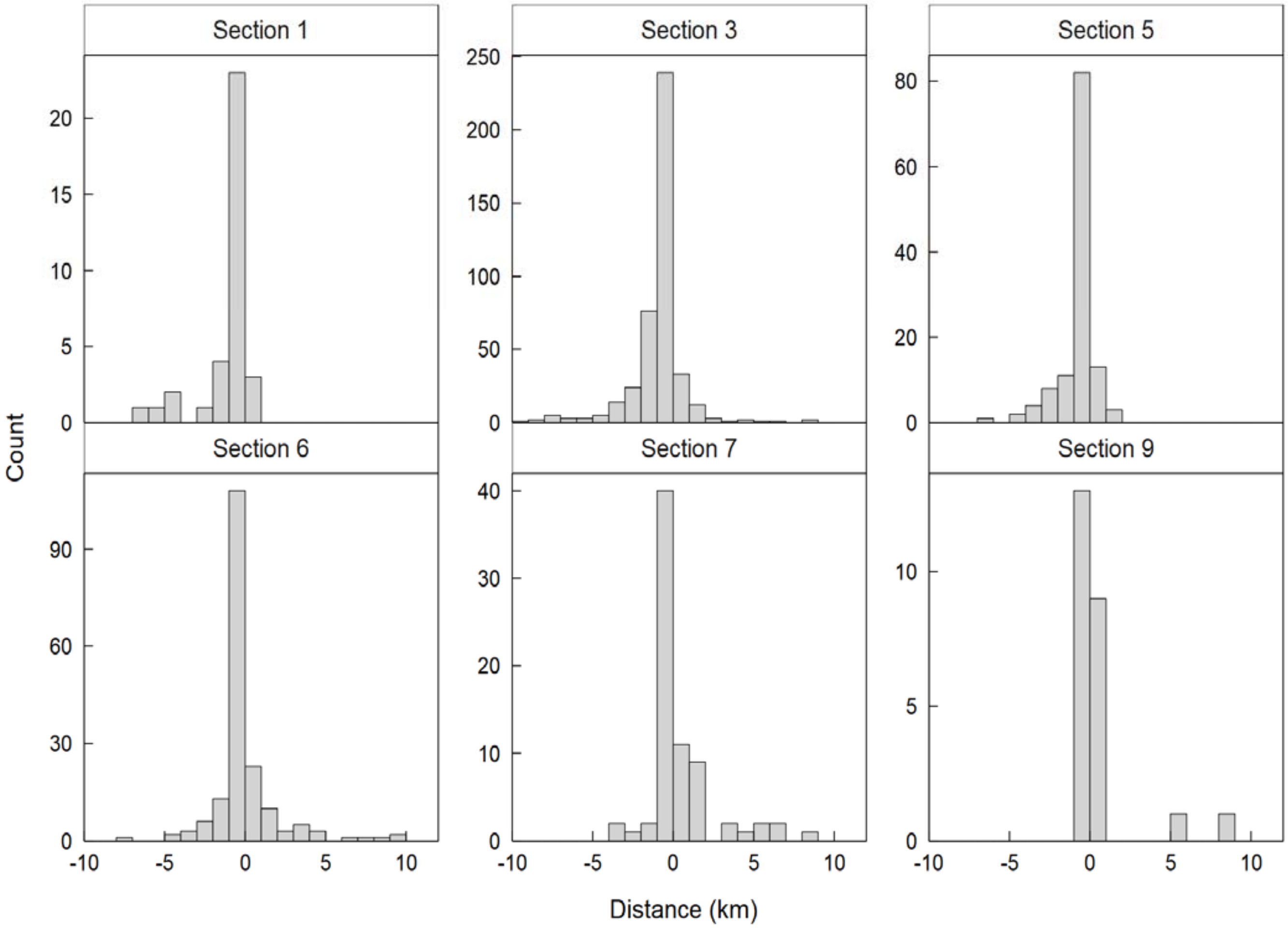

Figure G.5: Bar plot of the travel distance of recaptured Mountain Whitefish released in 2017 within each of the sections sampled (positive values indicate upstream movement and negative values downstream movement). Each section is independently scaled.

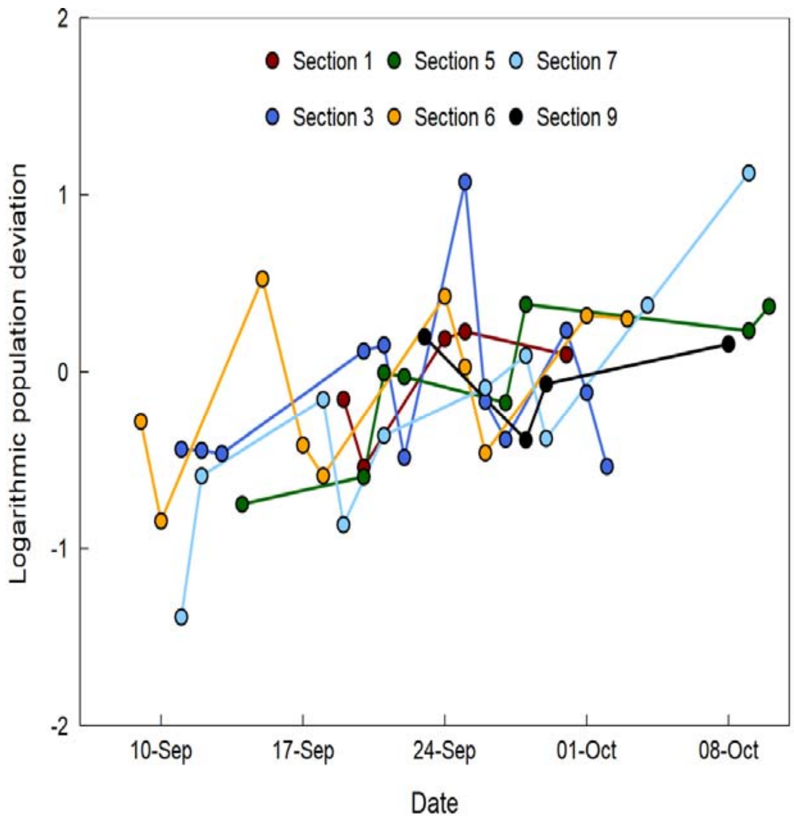

Figure G.6: Logarithmic population deviation from the mean by section and date for Mountain Whitefish

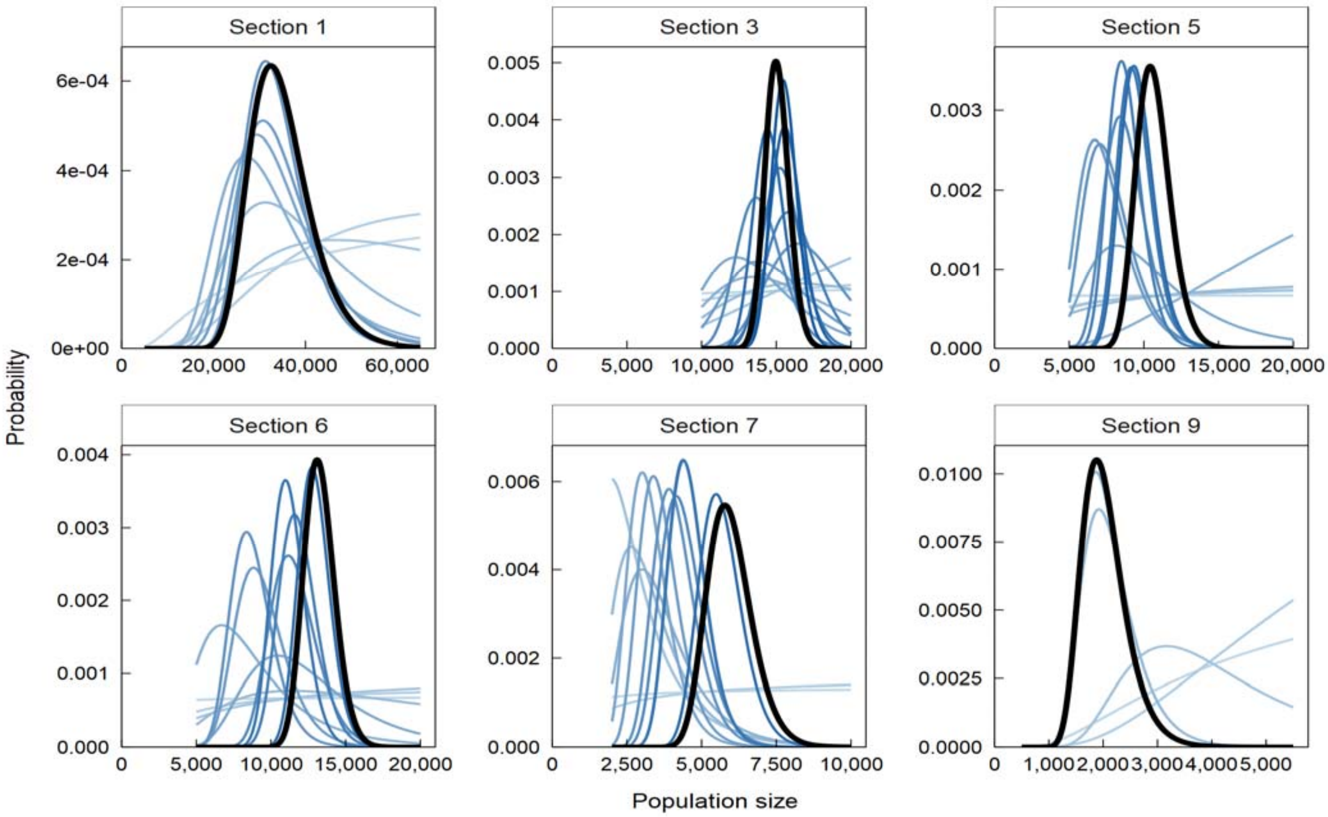

Figure G.7: Sequential posterior probability plots of population size by section for Mountain Whitefish in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line

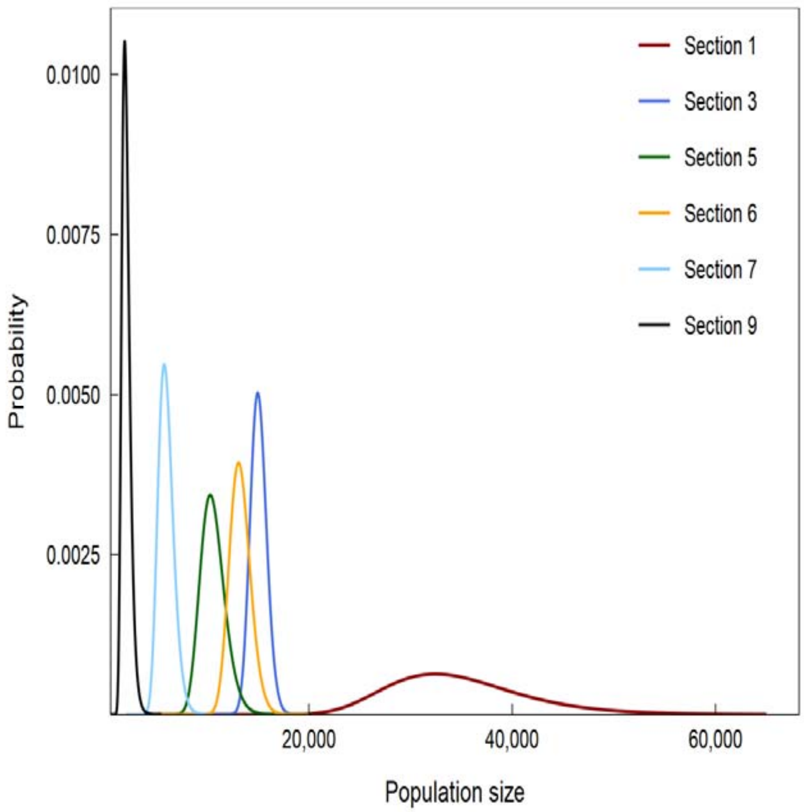

Figure G.8: Final posterior distributions by section for Mountain Whitefish in 2018

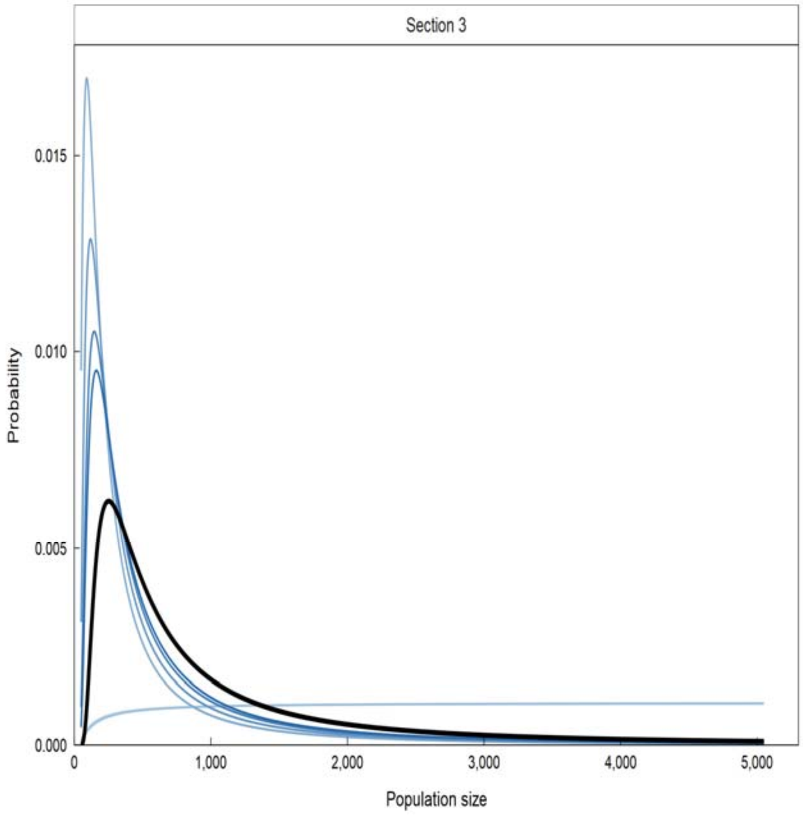

Figure G.9: Sequential posterior probability plots of population size by section for Arctic Grayling in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

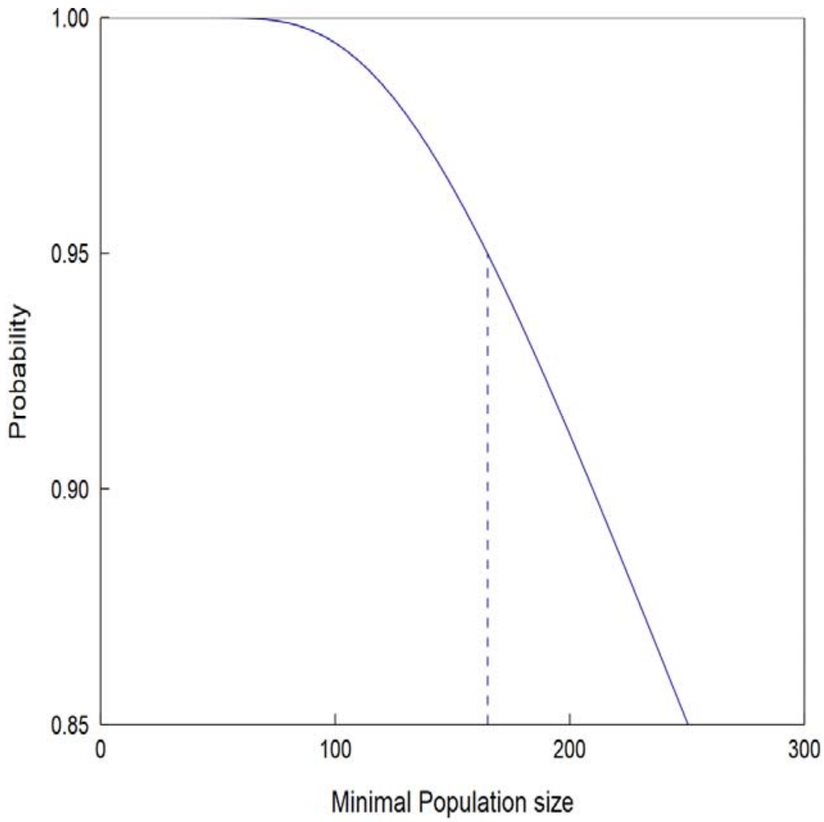

Figure G.10: Minimal population estimates for Section 3 Arctic Grayling in 2018. The dashed vertical line indicates the 0.95 probability that the population size was at least XXX in Section 3.

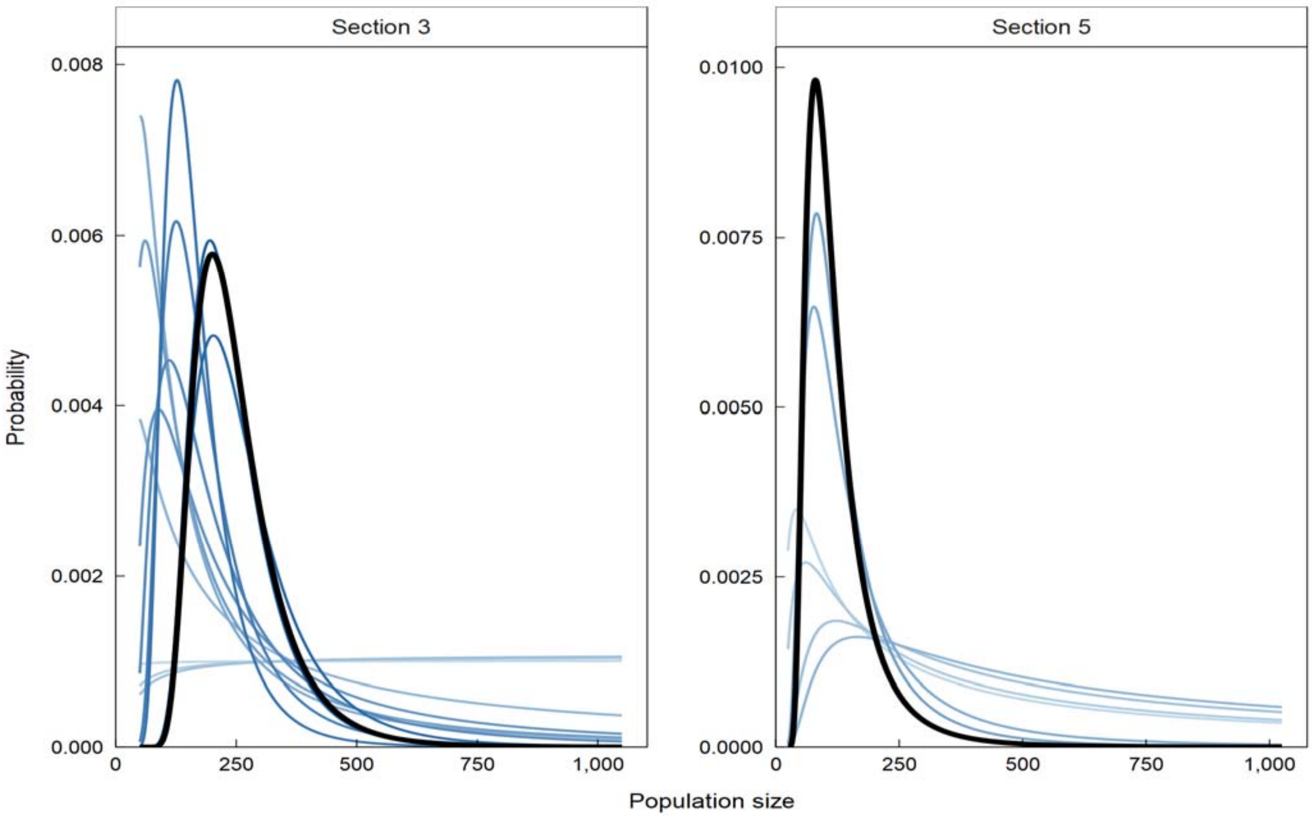

Figure G.11: Sequential posterior probability plots of population size by section for Bull Trout in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

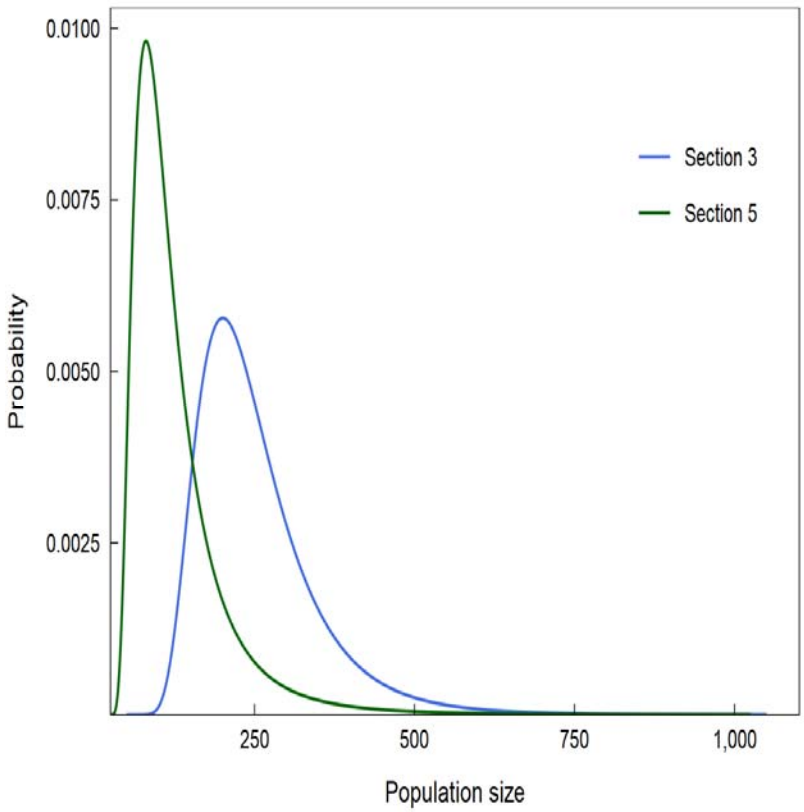

Figure G.12: Final posterior distributions by section for Bull Trout in 2018

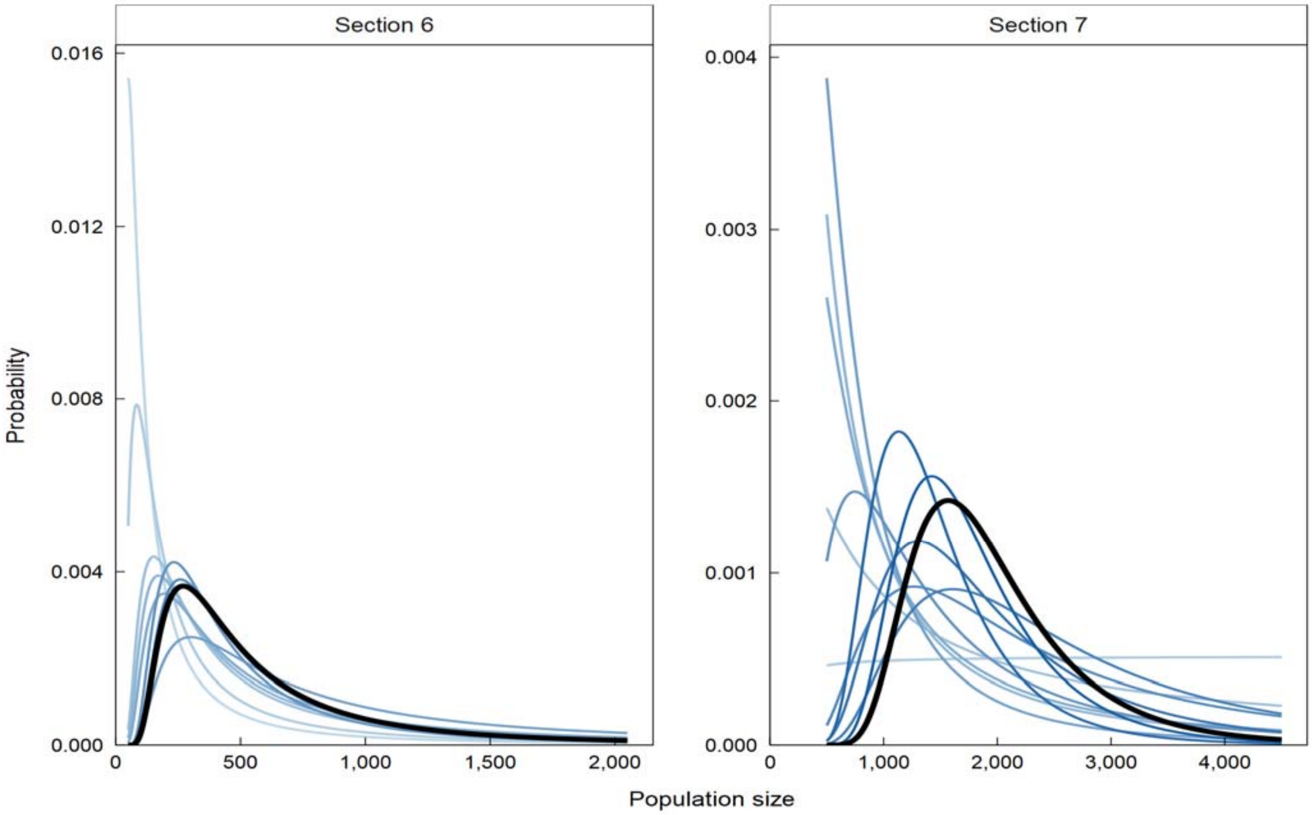

Figure G.13: Sequential posterior probability plots of population size by section for Walleye in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

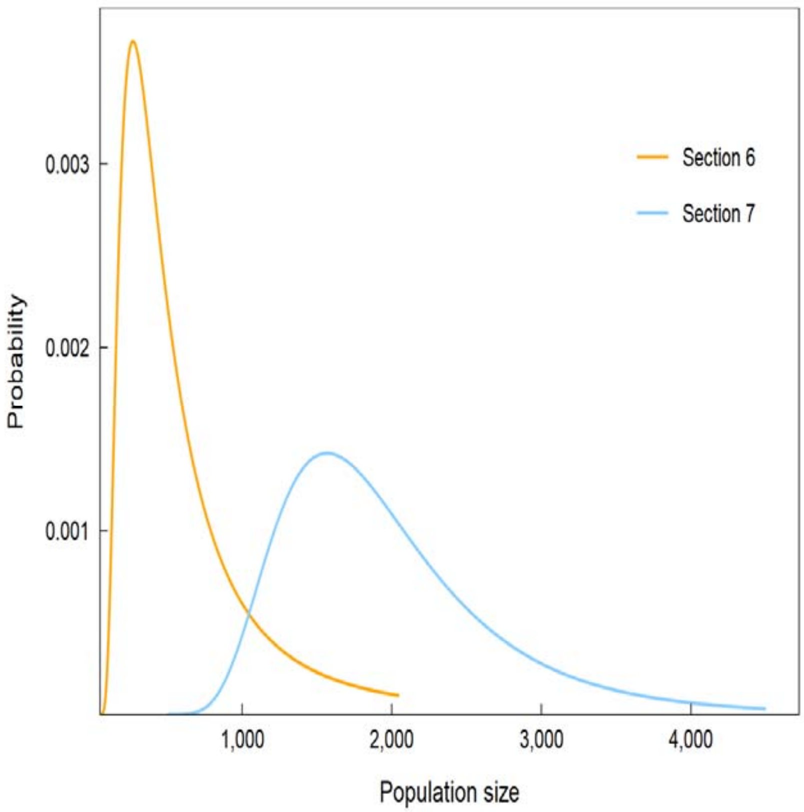

Figure G.14: Final posterior distributions by section for Walleye in 2018

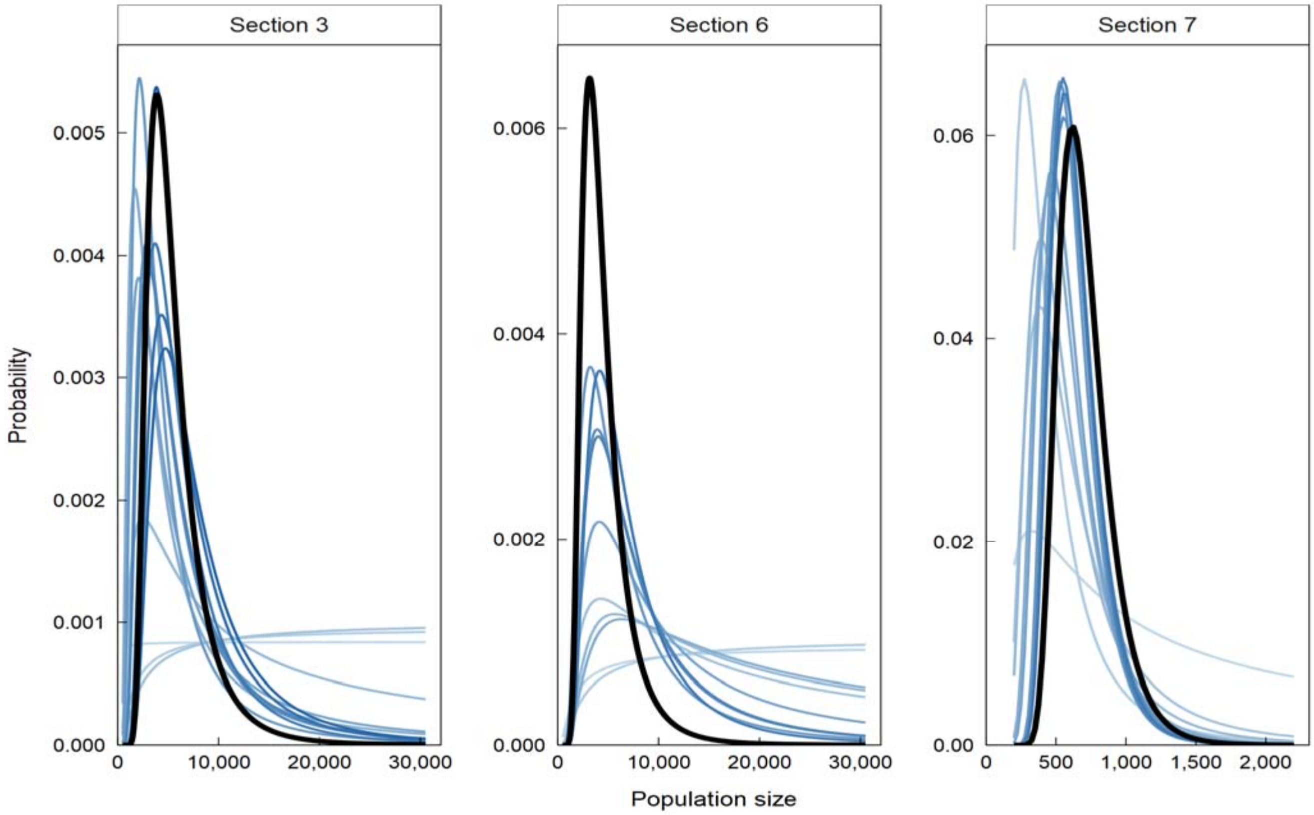

Figure G.15: Sequential posterior probability plots of population size by section for Largescale Sucker in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

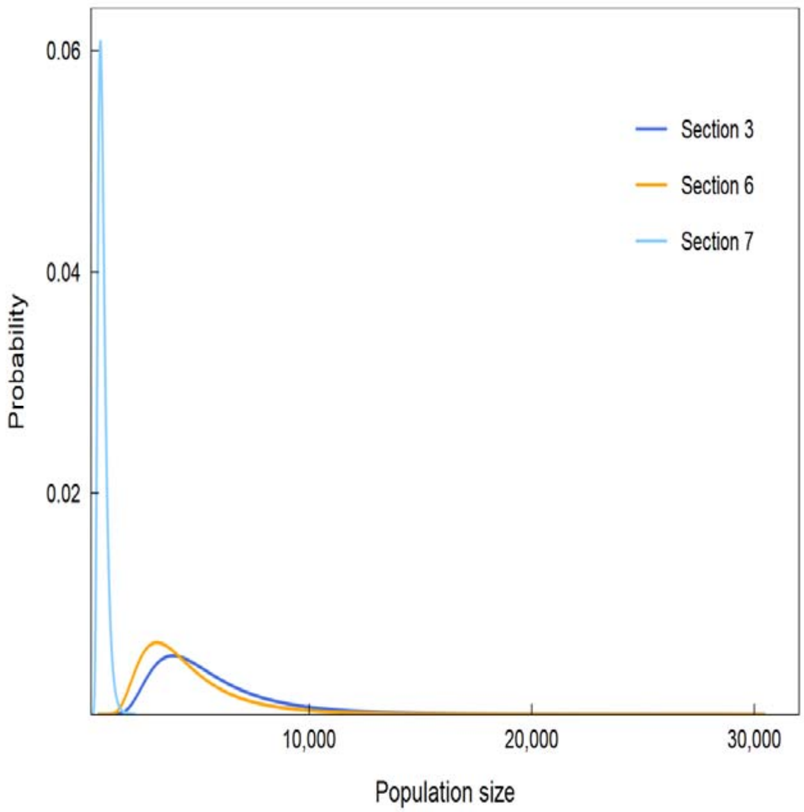

Figure G.16: Final posterior distributions by section for Largescale Sucker in 2018

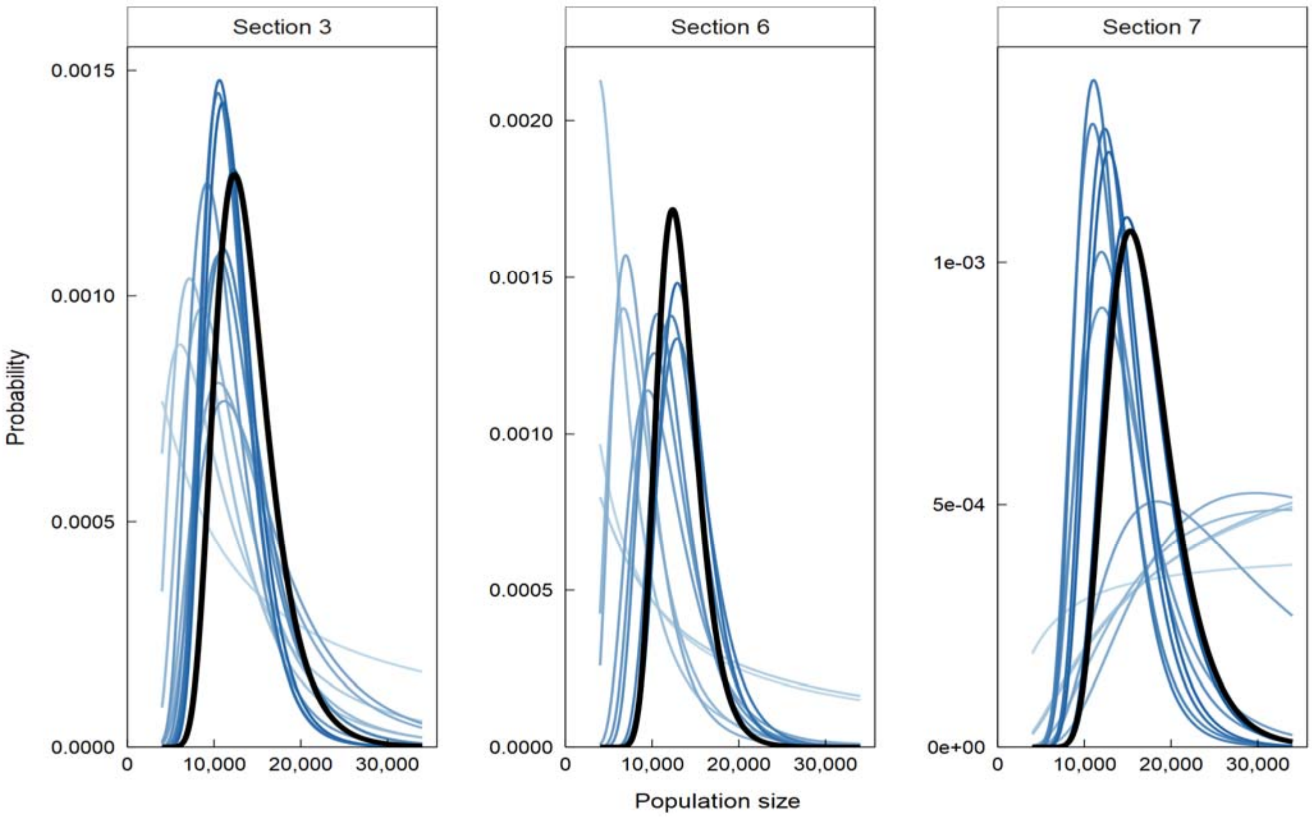

Figure G.17: Sequential posterior probability plots of population size by section for Longnose Sucker in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

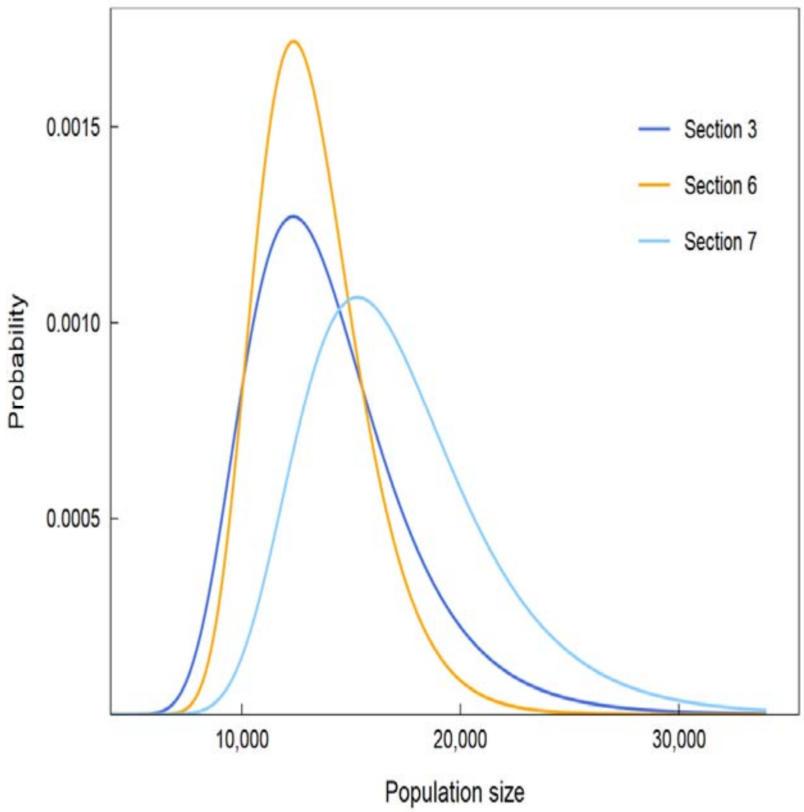

Figure G.18: Final posterior distributions by section for Longnose Sucker in 2018

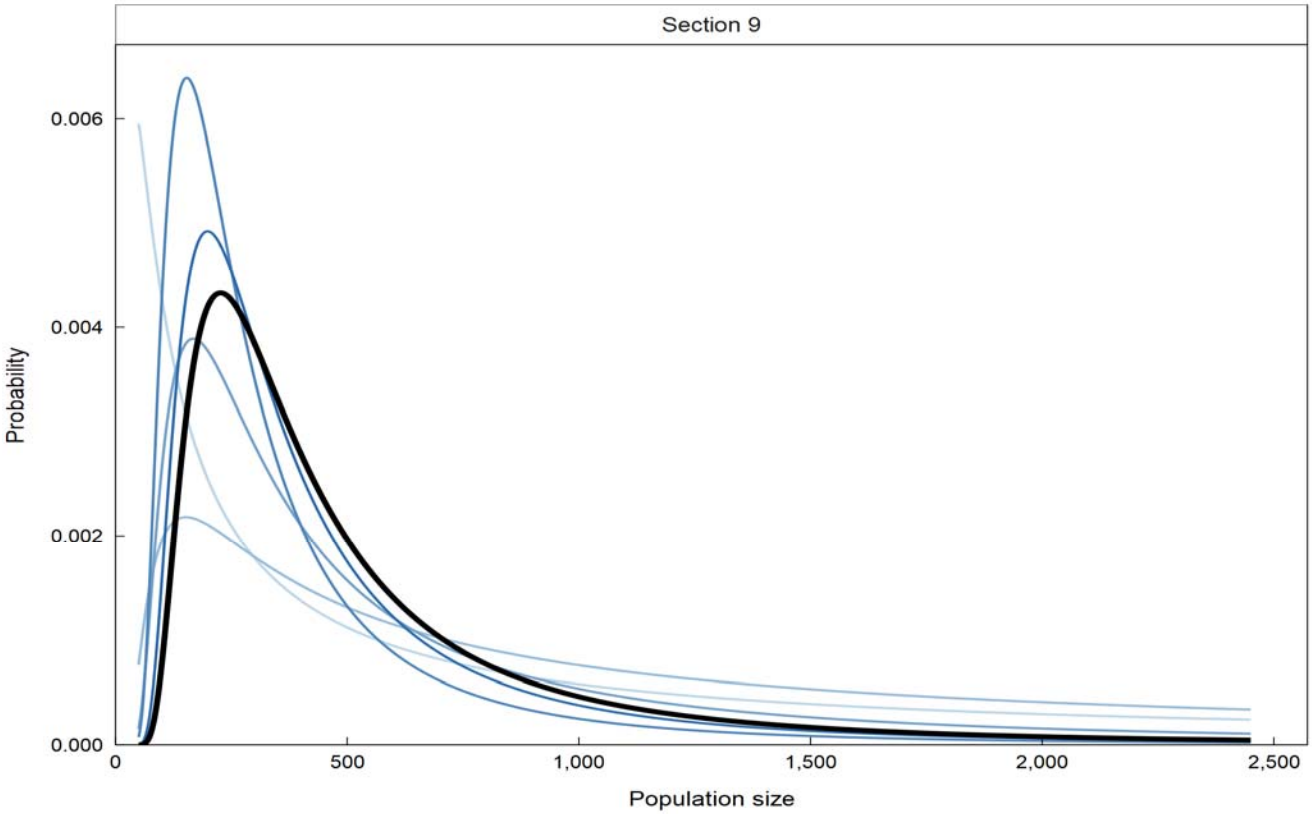

Figure G.19: Sequential posterior probability plots of population size by section for White Sucker in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

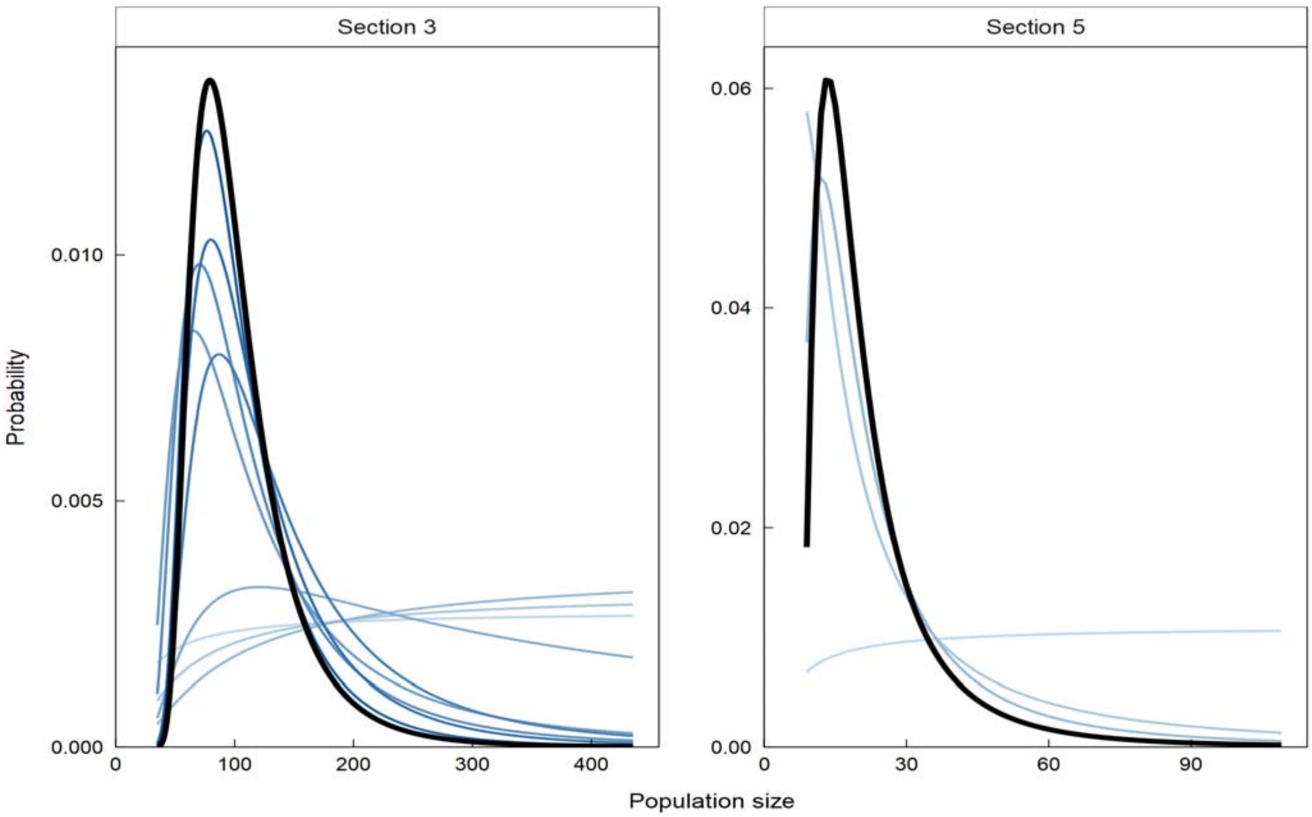

Figure G.20: Sequential posterior probability plots of population size by section for Rainbow trout in 2018. Each line is the posterior probability updated by a sample day. Final posterior distribution is indicated by a black line.

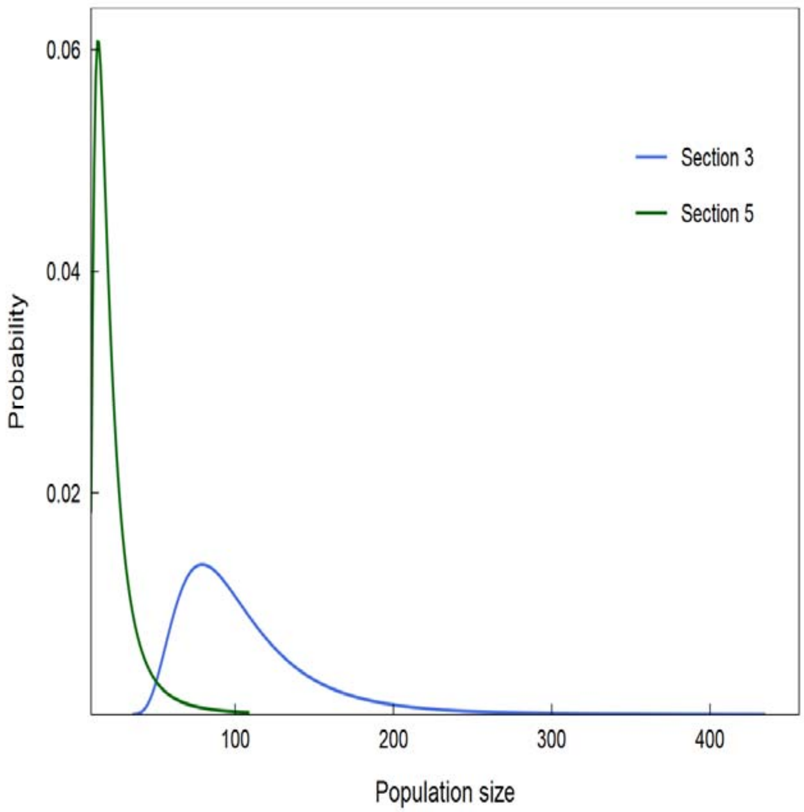

Figure G.21: Final posterior distributions by section for Rainbow Trout in 2018

APPENDIX H

Mountain Whitefish Synthesis Model

Introduction

In 2018, the Mountain Whitefish age structured stochastic model that was developed by Gazey and Korman (2016) was updated to include recent (i.e., 2018) data in addition to historical data from 2002 to 2016. The model synthesised length-at-age, incremental growth from release-recapture occurrences, length frequency, and mark-recapture data. The model was modified by Bill Gazey of W.J. Gazey Research. Appendix H was written by W.J. Gazey Research and provides additional information on the model and its corresponding output.

Mountain Whitefish

Characteristics that Impact Population Estimates

For the 2018 study, PIT tags were applied to lengths ≥ 200 mm; however, in past studies tag application was restricted to lengths ≥ 250 mm. In order to obtain population estimates consistent with past studies and to minimize bias from size selectivity to electrofishing, only fish marked and sampled of length ≥ 250 mm were used to obtain population estimates. Histograms of Mountain Whitefish lengths at release and recapture are plotted in Figures G.1 and G.2, respectively. Inspection of the figures reveals that smaller fish (200-250 mm) were not recaptured with the same frequency. Comparison of the sample cumulative proportion of length at release and recapture illustrates (see Figure G.3) that the distributions were similar for lengths greater than 250 mm. The complete overlap of the cumulative release and recapture offset by 14 mm proportions illustrate that the difference was attributable to the capture of small fish. A consistent, but statistically nonsignificant, under representation of recaptured smaller Mountain Whitefish (250-275 mm) has been noted in all previous studies. A comparison of lengths at release and recapture accumulated into 25 mm bins (not shown) for the 2018 study was not significantly different (test for independence, $P > 0.05$).

Time at large of recaptured Mountain Whitefish regressed on the growth increment (length at release minus length at recapture) is plotted in Figure G.4. The growth trend of 0.017 mm per day was statistically significant ($P < 0.05$); however, the mean growth was only 0.16 mm per fish (mean time-at-large was 9.65 days) and 0.58 mm over the study period (maximum time-at-large was 35 days). The boarder histogram of the growth increment provides an indication of measurement error (residual standard deviation of 3.0 mm for each measurement), which was slightly larger than the historical mean of 2.8 mm.

The movement of recaptured Mountain Whitefish between sections during 2018 is listed in Table G.1 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). These proportions are plotted in Figure G.5. Figure G.6 provides a bar plot of the distance traveled within each section for marked fish released in 2018. Positive values indicate fish were recaptured upstream of the release site and vice-versa. Note that most fish were recaptured in the same site-of-release. Consistent with movement patterns in previous studies, Mountain Whitefish had remarkable fidelity to a site.

Empirical Model Selection

The number of captures by encounter history (five sessions) and section used for the CJS analysis are listed in Table G.2. Capture probabilities were evaluated by session (time varying) and pooled over sessions 1 to 4 and 4 to 5 within each section. Survival was evaluated by session (time varying) and as constant within each section. Constant survival provided the best fit to the data based on Akaike information criteria (AIC) in all river sections (see Table G.3). Capture probability by session provided the best fit in Section 9. Pooled capture probability provided the best fit in all other sections. Survival estimates were not significantly different than 1.0 in all sections for the best fitting models (not shown, $P > 0.8$). Based on these results, we applied no apparent mortality for Mountain Whitefish within 2018.

A direct test of catchability is provided with population estimates using ADMB with Equations (1 to 8) in Table G.4 (input data corrected for movement listed in Table G.1 which was also used for the Bayesian model). The Bayesian population model assumed constant catchability for samples taken during the year. Neither time varying nor constant catchability models provided markedly better fits to the data in sections 5 through 9. In Section 1 the constant catchability model fit better. However, in Section 3 the time varying model provided a substantially better fit to the data. Population estimates for the time varying model generally exceeded the constant model. The logarithmic population deviation estimates for the time varying catchability model (Equation 2) are plotted by section and date in Figure G.7. The deviations were highly variable but Section 7 displayed an upward trend over time.

Bayes Sequential Model for a Closed Population

The mark-recapture data were extracted by section from the database using PIT tags applied during 2018 and PIT tags that were observed during 2018 that were originally applied in 2004 through 2017 and a minimum length of 250 mm. Table G.5 lists Mountain Whitefish examined for marks and recaptures by date and section. The estimated releases, adjusted for movement between sections (Equation 4) by section and date, are given in Table G.6. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no instantaneous mortality rate or undetected mark rate are listed in Table G.7. The subsequent population estimates using the Bayesian closed model are given in Table G.8. The sequential posterior probability plots by section are provided in Figures G.8 through G.13. The final posterior distributions for the six sections are drawn in Figure G.14.

The sequence of posterior probability plots were used as an indicator of closure or change in the population size over the study period (Gazey and Staley 1986). Trends in the posterior plots can also be caused by trends in catchability (changes in population size and catchability are confounded). Inspection of the posterior probability plot sequences appear stable (no marked trend or sequence to larger or smaller population sizes) and were consistent with a convergence to a modal population size except for sections 6 and 7. Section 7 displayed a trend in catchability (Figure 7) and/or immigration of unmarked fish consistent the trend illustrated in Figure G.12.

Arctic Grayling

The mark-recapture data were extracted by section from the database using all available marks (smallest length 200 mm). No recaptured fish were observed to move between sections. Table G.9 lists Arctic Grayling examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.10. Only Section 3 had sufficient captures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.11. The sequential posterior probability plots for the population estimates are provided in Figure G.15 and the population estimates in Table G.12. Given the sparse data, minimal population estimates were also calculated (see Figure G.16). There was a 0.95 probability of at least 160 fish in Section 3.

Bull Trout

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. One fish released in Section 5 was recaptured in Section 6; otherwise, there were no movements between sections (see Table G.13). Table G.14 lists Bull Trout examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.15. Only sections 3 and 5 had sufficient recaptures to generate population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.16. The population estimates using the Bayesian model are given in Table G.17 and the associated sequential posterior probability plots are provided in Figures G.17 and G.18. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.19.

Walleye

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The recaptures, adjusted for movement between sections (Equation 4) by section and date, are given in Table G.18. Table G.19 lists Walleye examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.20. Only sections 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.21. The population estimates using the Bayesian model are given in Table G.22 and the associated sequential posterior probability plots are provided in Figures G.20 and G.21. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.22.

Largescale Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The movement of recaptured Largescale Sucker between sections is listed in Table G.23 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). Table G.24 lists Largescale Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.25. Only Sections 3, 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.26. The population estimates using the Bayesian model are given in Table G.27 and the associated sequential posterior probability plots are provided in Figures G.23 through G.25. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.26.

Longnose Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. The movement of recaptured Longnose Sucker between sections is listed in Table G.28 along with the estimates of the migration proportions adjusted for the number of fish examined (Equation 4). Table G.29 lists Longnose Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.30. Only sections 3, 6 and 7 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.31. The population estimates using the Bayesian model are given in Table G.32 and the associated sequential posterior probability plots are provided in Figures G.27 through G.29. The posterior probability plots do not display trends over time. The final posterior distributions are drawn in Figure G.30.

White Sucker

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. No movement between river sections of recaptured White Sucker was observed. Table G.33 lists Longnose Sucker examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.34. Only Section 9 had sufficient recaptures to enable population estimates. The compilation of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.35. The population estimates using the Bayesian model are given in Table G.36 and the associated sequential posterior probability plots are provided in Figures G.31. The posterior probability plots do not display trends over time.

Rainbow Trout

The mark-recapture data were extracted by section from the database with a minimum length of 250 mm. There was no movement between sections. Table G.37 lists Rainbow Trout examined for marks and recaptures by date and section. The estimated releases by section and date are given in Table G.38. Only sections 3 and 5 had sufficient recaptures to enable population estimates. The compilations of marks available (Equation 6), fish examined (Equation 7), and recaptures (Equation 8) assuming no mortality and 0% undetected mark rate are listed in Table G.39. The population estimates using the Bayesian model are given in Table G.40 and the associated sequential posterior probability plots are provided in Figures G.32 and G.33. None of the posterior probability plots display trends over time. The final posterior distributions are drawn in Figure G.34.

Table H.1: Number of length-at-age samples by estimated age and river section. One outlier not included.

River Section	Estimated age															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	15		Total
1	6	105	259	457	20	17	13	8	3	5	1	2	1	1	1		899
3	44	438	610	578	53	41	20	14	5	7	4	4	1		1		1,820
5	42	237	249	211	13	10	8	1	3	3	1	3	2				783
Total	92	780	1,118	1,246	86	68	41	23	11	15	6	9	4	1	2		3,502

Table H.2: Number (sum of Floy and PIT tags) of incremental length samples by river section, release year, and recapture year. The model subsequently exlcluded 115 of these samples based on the outlier criteria (< -15 mm/yr and > 50 mm/yr).

Release	River	Recapture year																
Year	Section	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
2002	1	213	147	78	26	30	10	4	1	2								511
	3	279	119	109	25	23	18	8	4	4			1					590
2003	1		284	192	96	63	26	11	5	3	7	2	1					690
	3		248	217	50	46	28	14	11	5	4							623
2004	1			324	177	93	70	33	15	13	11	1	1	1				739
	3			358	84	112	63	16	15	23	8	3	1	1	1			685
	5			173		67	31	16	8	8	6	1						310
2005	1				178	153	77	28	19	29	10	7	1					502
	3				194	316	137	49	35	46	14	11	3	4				809
	5					192	71	43	16	21	9	5						357
2006	1					261	156	85	48	49	27	16	4	6	2		1	655
	3					221	110	51	37	36	12	6	1	3		1	2	480
2007	1						204	90	36	40	28	10	3	2	1			414
	3						331	160	76	99	34	19	8	6	4		1	738
	5						162	81	33	52	30	11	3	2			2	376
2008	1							200	85	87	56	23	6	2	4		3	466

Release	River	Recapture year																
	3							271	138	157	74	38	12	9	7	5	4	715
	5							184	55	79	43	21	4	4	4	2	3	399
2009	1								130	129	101	30	9	8	6	4	5	422
	3								203	192	90	40	8	7	7	2	5	554
	5								115	134	72	39	13	4	2	1	4	384
2010	1									153	107	37	22	17	9	7	10	362
	3									369	153	103	37	30	14	8	10	724
	5									148	66	32	21	16	5	6	4	298
2011	1										237	73	30	52	39	16	11	458
	3										397	221	62	66	47	25	22	840
	5										197	102	32	18	8	7	8	372
2012	1											203	98	58	45	21	17	442
	3											453	87	78	55	39	28	740
	5											229	49	27	9	17	8	339
2013	1												115	76	68	46	21	326
	3												197	190	113	76	69	645
	5												111	55	35	31	30	262
2014	1													128	72	33	26	259
	3													165	102	66	37	370
	5													74	32	29	30	165

Release	River	Recapture year																
2015	1														112	59	43	214
	3														238	140	111	489
	5														50	33	25	108
2016	1															91	56	147
	3															202	170	372
	5															58	27	85
2017	1																70	70
	3																227	227
	5																54	54
Total		492	798	1,451	830	1,577	1,494	1,344	1,085	1,878	1,793	1,736	940	1,109	1,091	1,025	1,144	19,787

Table H.3: Length frequency of marked (Floy and PIT) Mountain Whitefish

Size Bin (mm)	Capture year															
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
200-209								1		2							3
210-219																	
220-229								1					2	1	1		5
230-239		2											1		3	3	9
240-249			1		1					1				5	6	11	25
250-259		1	3		6	3	3	2	20	12	11	1		9	15	17	103
260-269	2	5	11	13	18	13	19	16	52	64	76	5	1	6	27	44	372

Size Bin (mm)	Capture year																
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
270-279	11	23	40	23	39	58	66	38	104	161	174	34	16	20	26	58	891
280-289	29	42	94	58	86	100	88	61	159	233	257	61	41	32	35	65	1,441
290-299	26	54	129	108	117	139	137	100	199	234	276	122	114	73	69	68	1,965
300-309	46	81	144	91	171	158	152	134	231	223	242	178	146	137	142	144	2,420
310-319	65	102	188	112	173	179	168	128	211	177	191	161	186	169	175	191	2,576
320-329	72	136	183	111	209	179	153	124	191	167	140	117	190	208	181	169	2,530
330-339	82	120	176	103	187	170	133	108	155	131	115	72	137	144	114	141	2,088
340-349	53	90	131	73	154	140	98	96	141	116	103	67	90	81	87	82	1,602
350-359	41	51	91	50	109	107	75	83	102	80	69	51	74	50	60	55	1,148
360-369	22	33	69	42	73	71	69	49	81	51	30	36	47	52	34	55	814
370-379	15	27	54	17	56	48	46	42	79	56	31	19	30	38	34	35	627
380-389	15	26	48	19	62	51	48	40	53	39	23	21	23	28	19	29	544
390-399	11	10	36	10	43	33	26	31	38	33	12	11	16	24	14	13	361
400-409	7	21	30	9	34	25	30	19	28	23	8	7	8	12	8	6	275
410-419	9	9	24	10	23	16	19	18	29	12	11	7	6	15	5	15	228
420-429	4	6	25	6	31	20	17	9	17	14	12	5	9	6	3	4	188
430-439	3	6	13	3	16	9	13	17	22	7	8	4	4	5	2	3	135
440-449	1	4	21	2	15	9	6	9	12	6	4	1	4	6	1	4	105
≥450		6	17	2	25	17	14	10	16	7	4	8	5	17	12	11	171
Total	514	855	1,528	862	1,648	1,545	1,380	1,136	1,940	1,849	1,797	988	1,150	1,138	1,073	1,223	####

Table H.4: Length frequency of unmarked Mountain Whitefish

Size Bin (mm)	Capture year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
30-39															2			2
40-49															1			1
50-59																		
60-69							1						1	4	3		3	12
70-79			1	1		2	2	2		1		1	19	11	28	8	11	87
80-89			17		4		19	8	5	1		4	80	80	50	18	54	340
90-99		2	23	6	11		7	8	17	1		5	164	64	47	18	59	432
100-109		1	6	3	18		5	3	19	2			97	35	7	15	23	234
110-119		1			14	3			10	3	2		34	6		2	7	82
120-129	1	2	3	1	2	22	1	1		15	1	7	4	1	2	3	2	68
130-139	3	7	5	22	2	101	17	11	1	19	5	35	2		11	13	3	257
140-149	10	24	17	93	1	267	76	51	6	33	19	73	6	6	68	41	1	792
150-159	27	77	110	146	29	266	91	180	41	6	31	90	56	55	152	71	36	1,464
160-169	10	80	256	96	102	113	63	224	163	18	24	44	341	198	140	26	81	1,979
170-179	5	28	188	28	203	57	38	101	234	28	9	10	570	232	75	14	141	1,961
180-189	16	3	43	34	143	27	220	31	84	94	44	18	205	159	18	40	98	1,277
190-199	40	18	21	140	48	55	387	65	36	164	112	43	62	60	24	121	32	1,428
200-209	36	75	84	238	67	175	484	212	61	179	126	73	56	15	64	143	74	2,162
210-219	32	82	236	261	243	286	300	217	230	115	156	65	189	67	163	70	118	2,830
220-229	70	61	345	159	259	239	140	269	304	168	220	80	179	193	188	76	106	3,056
230-239	175	57	167	130	168	209	137	498	172	286	306	160	77	156	114	134	145	3,091
240-249	206	99	95	247	151	338	230	568	172	321	327	226	48	77	91	141	275	3,612
250-259	113	166	146	234	257	285	306	332	356	352	435	337	71	91	156	149	301	4,087
260-269	112	231	237	170	228	261	385	293	514	567	457	434	122	119	169	206	410	4,915

Size Bin (mm)	Capture year																	
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
270-279	148	242	346	222	252	294	411	339	629	789	604	441	222	140	143	190	473	5,885
280-289	150	195	454	317	293	349	398	330	536	914	632	482	319	133	175	165	446	6,288
290-299	188	175	527	368	343	291	393	335	455	750	506	411	379	250	207	193	382	6,153
300-309	305	229	563	339	340	337	365	310	416	621	392	337	335	301	318	252	354	6,114
310-319	441	284	602	366	289	306	343	244	319	453	286	239	298	313	403	309	438	5,933
320-329	517	336	618	383	278	293	296	226	317	370	216	148	193	272	418	270	353	5,504
330-339	416	295	502	341	205	234	256	203	238	289	170	135	121	182	246	189	251	4,273
340-349	291	196	373	251	150	184	182	167	183	248	143	85	93	126	149	115	183	3,119
350-359	158	119	253	191	80	127	162	143	171	204	103	83	81	74	101	95	129	2,274
360-369	85	82	232	141	69	136	130	99	125	139	74	66	39	60	67	42	80	1,666
370-379	72	60	130	126	35	85	95	90	100	102	58	36	44	39	56	41	49	1,218
380-389	67	53	94	74	34	69	70	56	75	70	60	22	34	52	36	21	31	918
390-399	45	46	92	58	24	64	62	55	59	49	45	21	20	30	21	17	30	738
400-409	24	31	73	51	19	51	43	32	39	53	27	17	10	14	12	11	17	524
410-419	27	24	65	53	24	45	43	33	37	39	18	10	13	12	21	10	18	492
420-429	15	15	61	25	14	30	28	15	16	25	26	11	8	5	10	5	18	327
430-439	10	5	37	24	12	28	12	14	11	17	8	7	8	5	15	6	10	229
440-449	9	9	37	30	7	19	8	8	9	13	7	3	4	8	4	5	9	189
≥450	9	12	81	36	10	37	22	16	14	21	9	10	6	8	10	10	10	321
Total	3,833	3,422	7,140	5,405	4,428	5,685	6,228	5,789	6,174	7,539	5,658	4,269	4,610	3,653	3,985	3,255	5,261	86,334

Table H.5: Length frequency of unmarked Mountain Whitefish classified into length bins

Year	River Section	Length Bin	
		<250 mm	≥250 mm
2002	1	73	769
	3	97	722
2003	1	47	602
	3	358	743
2004	1	49	690
	3	245	830
	5	274	330
2005	1	182	966
	3	635	928
	5	352	658
2006	1	39	451
	3	276	309
2007	1	170	647
	3	412	825
	5	358	686
2008	1	257	791
	3	757	941
	5	344	702
2009	1	281	712
	3	389	634
	5	202	616
2010	1	92	756
	3	462	982
	5	245	784
2011	1	202	1,038
	3	307	1,175
	5	167	806
2012	1	299	1,355
	3	210	783
	5	139	531
2013	1	32	561
	3	104	867
	5	75	724
2014	1	13	434
	3	296	382

Year	River Section	Length Bin	
		<250 mm	≥250 mm
	5	169	382
2015	1	85	480
	3	255	633
	5	182	289
2016	1	116	480
	3	346	668
	5	159	215
2017	1	130	419
	3	155	493
	5	140	321
2018	1	33	289
	3	190	606
	5	69	164

Table H.6: Number of newly marked, marked in a previous year and unmarked Mountain Whitefish encountered by year and river section

Year	River Section	Newly Marked	Previously Marked	Unmarked	Dead Unmarked	Dead Marked
2002	1	1,646	0	2,619	5	0
	3	1,279	0	2,074	11	0
2003	1	1,523	214	2,243	15	5
	3	1,099	296	1,907	3	2
2004	1	2,284	435	3,565	94	12
	3	1,361	387	2,374	8	2
	5	1,008	20	1,434	0	0
2005	1	1,027	600	2,211	3	6
	3	1,423	719	2,479	2	9
	5	971	199	1,662	3	2
2006	1	1,780	473	2,335	5	43
	3	1,035	370	1,388	3	2
2007	1	1,020	611	1,755	14	5
	3	1,318	746	2,211	7	4
	5	989	281	1,717	6	0
2008	1	1,281	550	2,149	4	2
	3	1,465	710	2,447	7	0

Year	River Section	Newly Marked	Previously Marked	Unmarked	Dead Unmarked	Dead Marked
	5	1,111	283	1,848	2	1
2009	1	1,183	455	1,938	3	1
	3	1,071	576	1,728	2	3
	5	992	345	1,636	2	1
2010	1	1,315	343	2,112	7	2
	3	1,950	541	3,005	0	5
	5	1,207	244	2,024	1	2
2011	1	2,352	519	3,537	0	2
	3	2,088	958	3,319	0	0
	5	1,414	459	2,248	1	0
2012	1	1,795	608	3,196	7	2
	3	1,522	807	2,320	4	0
	5	875	430	1,429	10	1
2013	1	1,064	421	1,688	15	3
	3	1,216	913	2,098	3	1
	5	931	459	1,701	2	11
2014	1	823	298	1,307	9	3
	3	677	436	1,087	2	2
	5	821	253	1,224	1	1
2015	1	757	359	1,250	1	1
	3	908	579	1,549	0	0
	5	537	211	837	0	0
2016	1	1,301	371	1,789	1	0
	3	1,065	600	1,740	1	0
	5	352	158	572	0	0
2017	1	934	280	1,356	2	0
	3	907	581	1,426	5	1
	5	446	199	770	0	0
2018	1	1,101	268	1,396	1	0
	3	1,912	721	2,524	1	0
	5	962	220	1,131	1	0
Total		58,098	20,506	92,355	274	137

Table H.7: Recapture of Mountain Whitefish by river section, release year and year of recapture

Release Year	River Section	Recapture Year																	
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
2002	1	207	213	147	78	26	31	10	4	1	2								719
	3	261	280	120	109	25	23	18	8	4	4			1					853
2003	1		200	282	191	95	63	26	11	5	3	7	2	1					886
	3		275	251	218	50	47	28	14	11	5	4							903
2004	1			258	323	175	93	70	33	15	13	11	1	1	1				994
	3			159	357	84	113	62	16	15	23	8	3	1	1	1			843
	5			63	174		67	31	15	8	8	5	1						372
2005	1				255	178	153	76	28	19	29	10	7	1					756
	3				357	196	314	137	49	35	45	14	11	3	4				1,165
	5				227		192	71	45	16	21	10	5						587
2006	1					199	260	156	84	48	49	27	16	4	6	2		1	852
	3					92	224	110	51	37	36	12	6	1	3		1	2	575
2007	1						157	204	90	36	40	28	10	3	2	1			571
	3						281	332	160	75	99	34	19	8	6	4		1	1,019
	5						185	162	81	33	52	30	11	3	2			2	561
2008	1							161	200	85	87	56	23	6	2	4		3	627
	3							302	271	137	154	74	39	12	9	7	5	4	1,014
	5							168	184	54	79	43	21	4	4	4	2	3	566
2009	1								131	129	129	101	30	9	8	6	4	5	552
	3								215	203	192	90	40	8	7	7	2	5	769
	5								151	114	135	72	39	13	4	2	1	4	535
2010	1									84	153	107	37	22	17	9	7	10	446
	3									198	368	153	102	37	30	14	8	10	920
	5									85	147	66	32	21	15	5	6	4	381

Release Year	River Section	Recapture Year																
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
2011	1										244	235	74	30	52	39	16	11	701
	3										421	396	222	62	66	47	25	22	1,261
	5										206	197	102	32	18	8	7	8	578
2012	1											354	202	98	58	45	21	17	795
	3											534	452	87	77	55	40	28	1,273
	5											226	229	49	26	9	17	8	564
2013	1												126	114	76	68	46	21	451
	3												426	197	191	113	75	69	1,071
	5												230	111	55	35	31	30	492
2014	1													75	128	72	32	26	333
	3													82	167	100	66	36	451
	5													51	74	32	29	30	216
2015	1														75	106	58	40	279
	3														132	226	125	96	579
	5														46	48	30	20	144
2016	1															61	82	50	193
	3															148	198	150	496
	5															23	57	25	105
2017	1																49	55	104
	3																111	210	321
	5																46	47	93
2018	1																	26	26
	3																	293	293
	5																	66	66
Total		468	968	1,280	2,289	1,120	2,203	2,124	1,841	1,447	2,744	2,904	2,518	1,147	1,362	1,301	1,197	1,438	28,351

Table H.8: Parameter estimates and associated standard errors (SE)

Parameter	Year	River Section 1		River Section 3		River Section 5	
		Estimate	SE	Estimate	SE	Estimate	SE
Nuisance length-at-age							
Length age-10 (mm)		327.3	4.4	333.6	3.6	356.1	6.4
Growth coefficient		0.371	0.018	0.314	0.011	0.267	0.014
Individual length SD (mm)		26.4	0.8	30.2	0.7	33.6	1.2
Growth							
Length age-0 (mm)		100.3	2.7	103.8	1.2	94.4	1.2
Growth coefficient		0.197	0.005	0.145	0.004	0.155	0.006
Individual length SD (mm)		27.0	0.6	44.8	1.1	42.2	1.4
Length age-10 (mm)	2003	294.1	2.2	296.4	2.7		
	2004	312.2	1.6	346.5	2.5		
	2005	283.0	1.7	301.9	2.3	313.7	3.2
	2006	294.7	1.8	339.0	2.4		
	2007	291.5	1.8	310.4	2.1	344.3	3.2
	2008	307.3	1.8	300.9	2.0	323.6	3.2
	2009	292.8	1.8	298.9	2.5	325.5	2.9
	2010	308.8	1.9	310.8	2.4	321.8	2.8
	2011	288.2	1.5	281.8	1.8	292.4	2.4
	2012	279.0	1.5	268.7	1.8	277.0	2.6
	2013	287.9	1.8	270.6	1.9	281.5	2.5
	2014	332.9	2.1	328.9	2.6	328.4	3.1
	2015	329.3	2.3	321.6	2.5	319.9	3.8
	2016	309.2	2.2	297.8	2.3	300.1	4.5
	2017	295.9	2.1	281.9	2.2	291.4	3.6
	2018	306.8	2.6	301.8	2.3	298.0	3.9
Selectivity							
Mid length bin (10 mm increments)	2002-13	28.9	0.30	31.4	.50	34.9	.68
	2014-18	31.2	0.80	66.5	59.88	475.8	
Slope	2002-13	1.8	0.05	2.9	0.08	3.7	.016
	2014-18	2.4	0.18	13.1	4.58	14.5	2.28
Asymptotic Survival (logit)	2002-04	-1.162	0.046	-1.298	0.033		
	2005-07	-0.906	0.058	-1.319	0.052	10.917	0.048
	2008-10	-1.342	0.089	-1.216	0.054	-1.965	0.138
	2011-13	0.025	0.072	-0.474	0.052	-0.504	0.105
	2014-15	-28.549		-42.093		-2.235	0.574
	2016-17	-2.877	1.496	-1.603	0.278	-1.066	0.386

Parameter	Year	River Section 1		River Section 3		River Section 5	
		Estimate	SE	Estimate	SE	Estimate	SE
Recruitment (log_e)	2002	11.62	0.15	11.12	0.13		
	2003	11.63	0.48	13.81	0.14		
	2004	13.25	0.32	10.41	0.70	12.90	0.20
	2005	13.75	0.25	12.50	0.62	14.17	0.28
	2006	12.34	0.57	13.89	0.20	13.34	0.34
	2007	12.17	0.56	10.08	0.62	10.64	0.67
	2008	12.73	0.35	9.99	0.58	10.32	0.50
	2009	11.49	0.55	9.84	0.57	9.96	0.55
	2010	11.43	0.56	10.23	0.64	10.44	0.57
	2011	11.85	0.64	12.79	0.27	10.62	0.68
	2012	13.91	0.34	11.18	0.53	12.32	0.35
	2013	12.81	0.39	9.38	0.49	10.14	0.58
	2014	11.08	0.46	8.78	0.35	9.80	0.47
	2015	11.09	0.53	8.31	0.41	9.70	0.45
	2016	12.16	0.55	8.44	0.45	9.48	0.48
	2017	12.09	0.69	8.19	0.47	8.76	0.50
	2018	12.20	0.74	9.50	0.43	9.23	0.52
Miscellaneous							
Capture probability coefficient		0.0406	0.0097	0.0370	0.0106	0.0796	0.0168
Negative binomial dispersion coefficient		1.75	0.10	2.58	0.14	2.83	0.19

Table H.9: Population estimates and the associated standard errors (SE)

Year	River Section 1		River Section 3		River Section 5	
	Estimate	SE	Estimate	SE	Estimate	SE
2002	18,667	647	8,498	316		
2003	16,814	815	8,064	340		
2004	23,244	807	15,257	552	8,485	586
2005	14,187	512	9,354	291	9,746	701
2006	16,628	558	15,740	588		
2007	14,994	573	13,797	488	15,690	1,039
2008	19,804	905	15,380	570	11,890	719
2009	18,758	775	17,975	723	17,083	908
2010	38,577	1,899	27,002	999	22,737	1,143
2011	28,741	1,244	18,602	629	17,461	946
2012	18,785	677	13,305	411	11,732	602
2013	18,420	969	11,873	432	10,815	675
2014	19,180	1,157	16,354	734	18,374	1,437
2015	22,347	1,262	18,506	742	17,377	1,349
2016	21,772	1,013	18,203	682	15,040	1,858
2017	22,891	2,015	15,230	769	11,791	1,172
2018	41,158	6,862	17,708	1,459	10,754	1,527

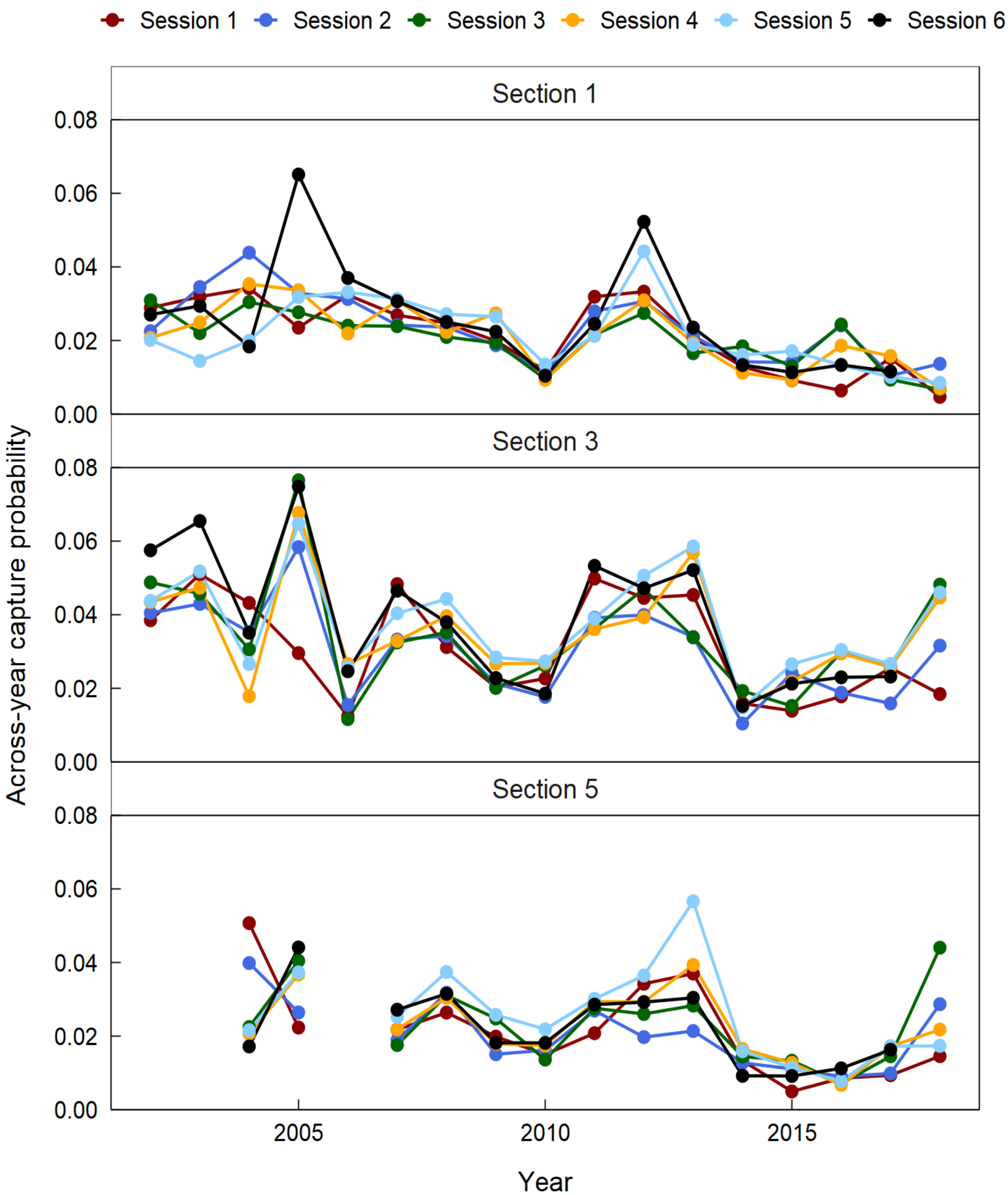

Figure H.1: Capture probability estimates by section, year and session

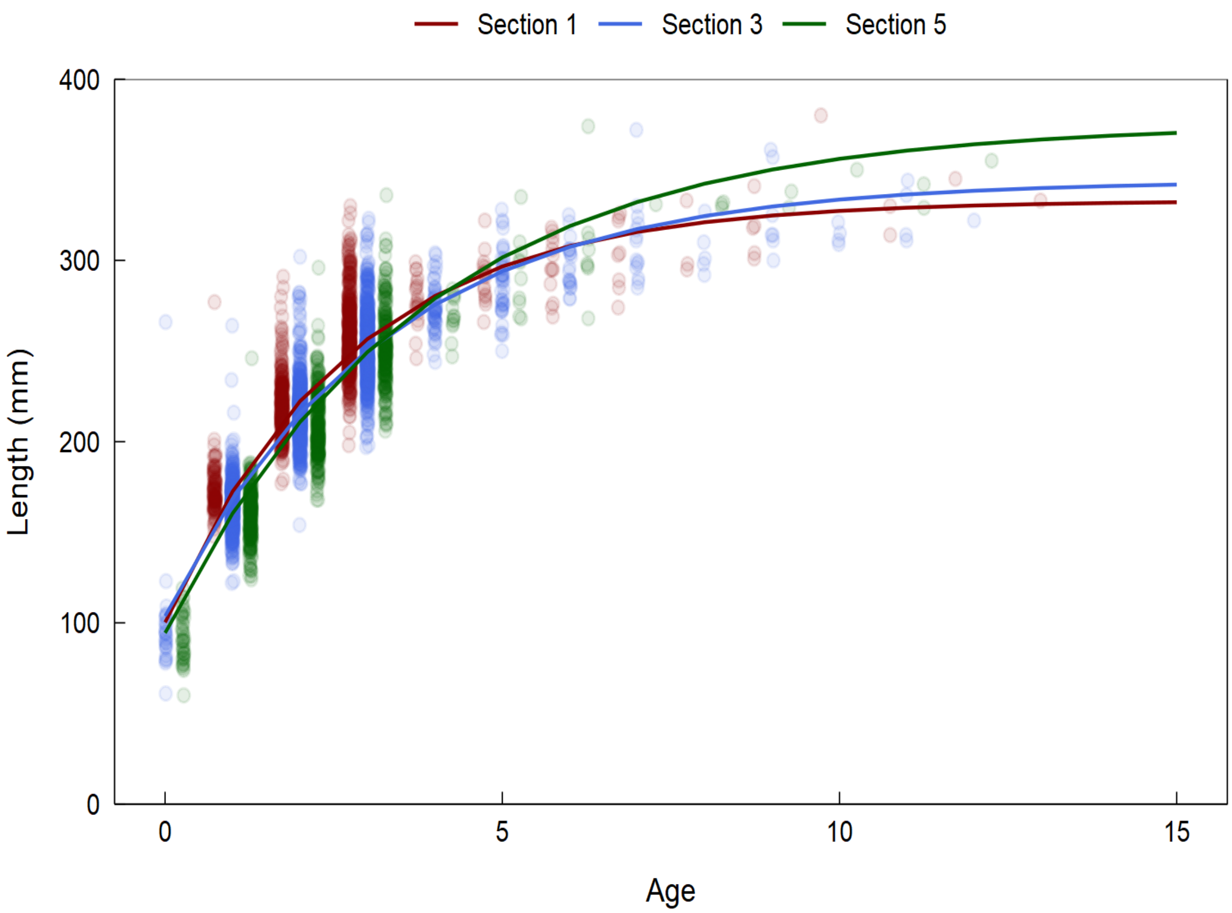

Figure H.2: Observed (points) and predicted (lines) length-at-age by section

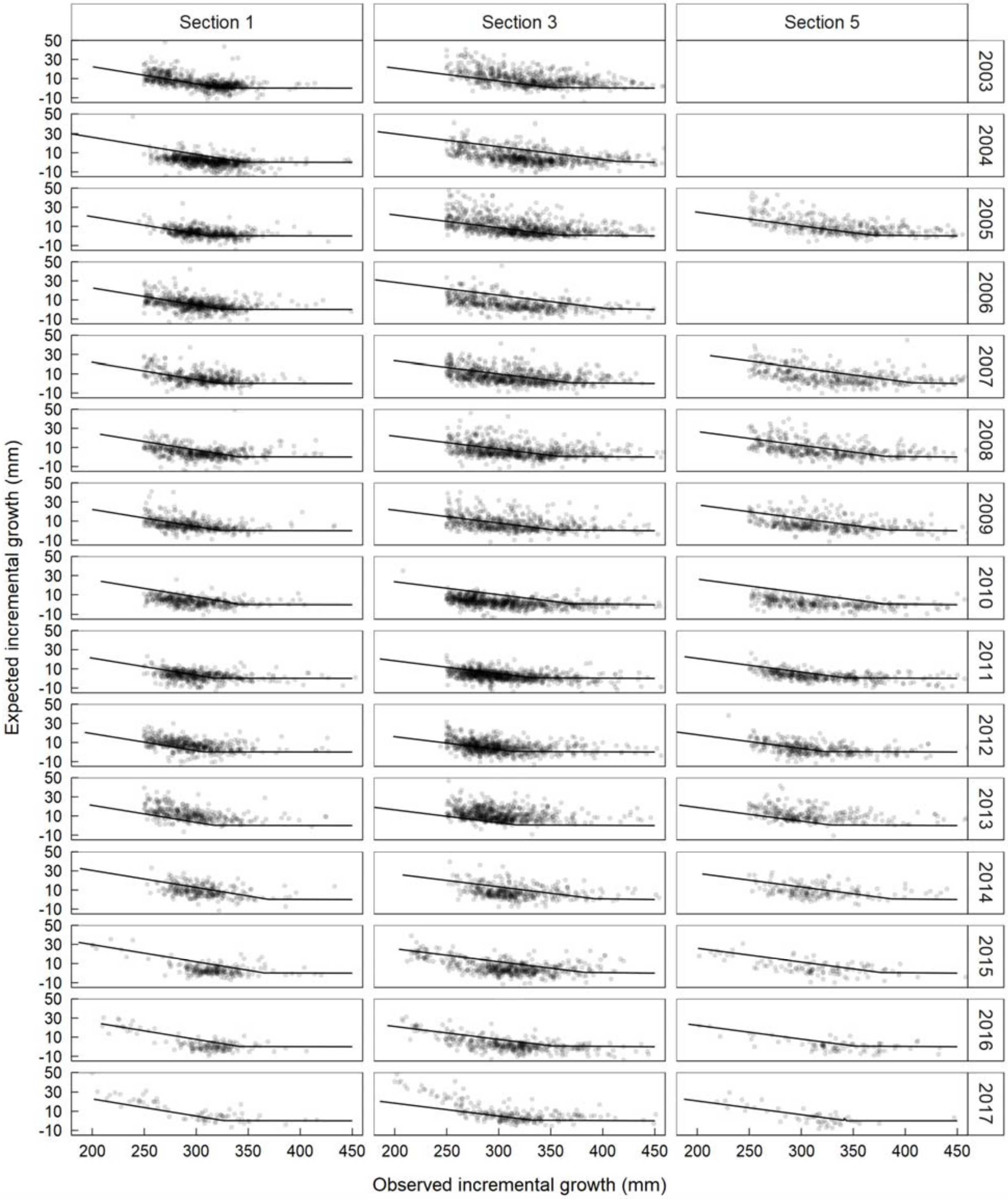

Figure H.3: Observed (points) and predicted (line) incremental growth of marked Mountain Whitefish as a function of size at release for Section 1 and year of recapture. Note that the predicted increment is based on all observations, which include recaptures from adjacent years.

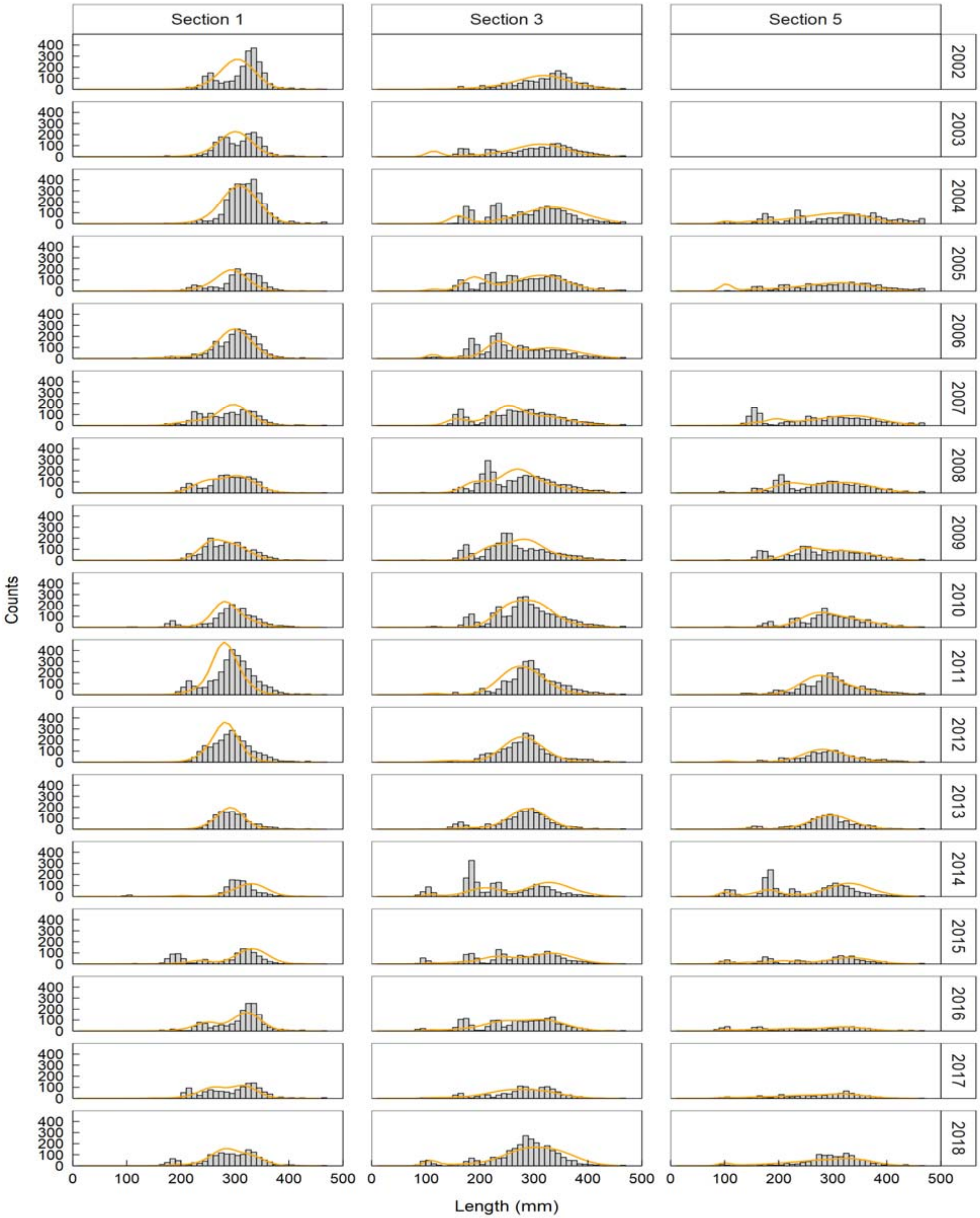

Figure H.4: Length frequency of observed (histogram) and predicted (lines) by year for unmarked Mountain Whitefish by section

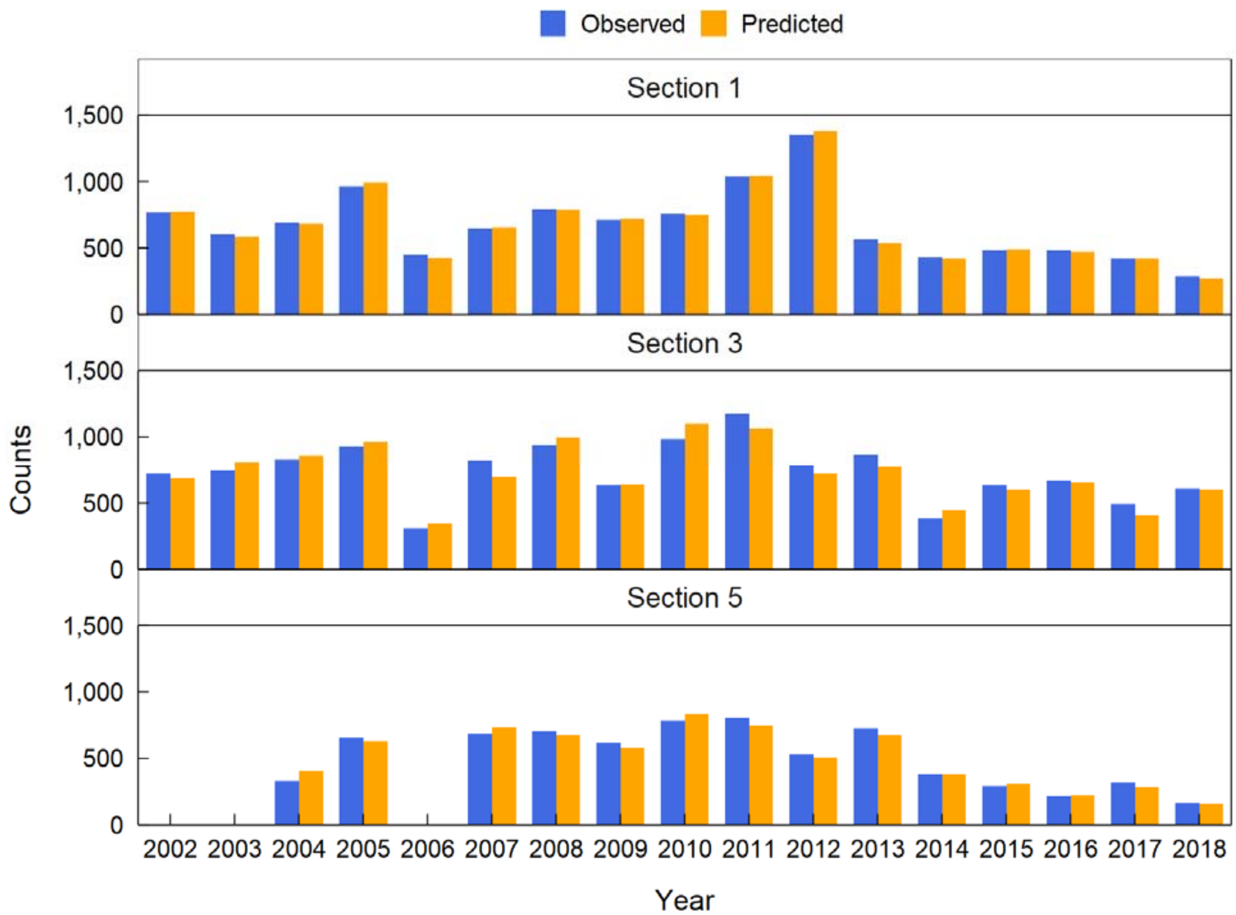

Figure H.5: Observed and predicted number of unmarked and unmeasured Mountain Whitefish by section

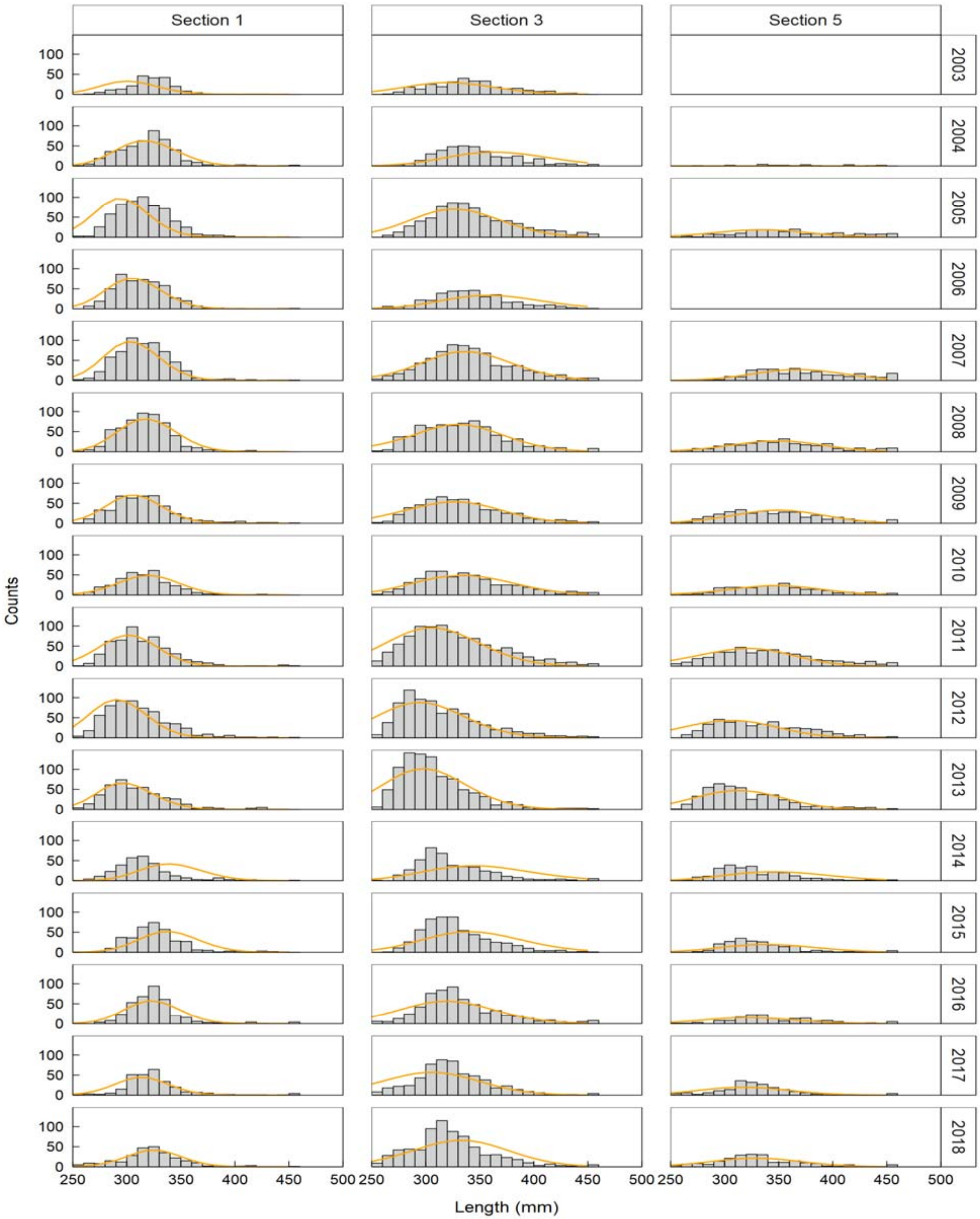

Figure H.6: Length frequency of observed (histogram) and predicted (lines) by year for marked Mountain Whitefish in Section 1

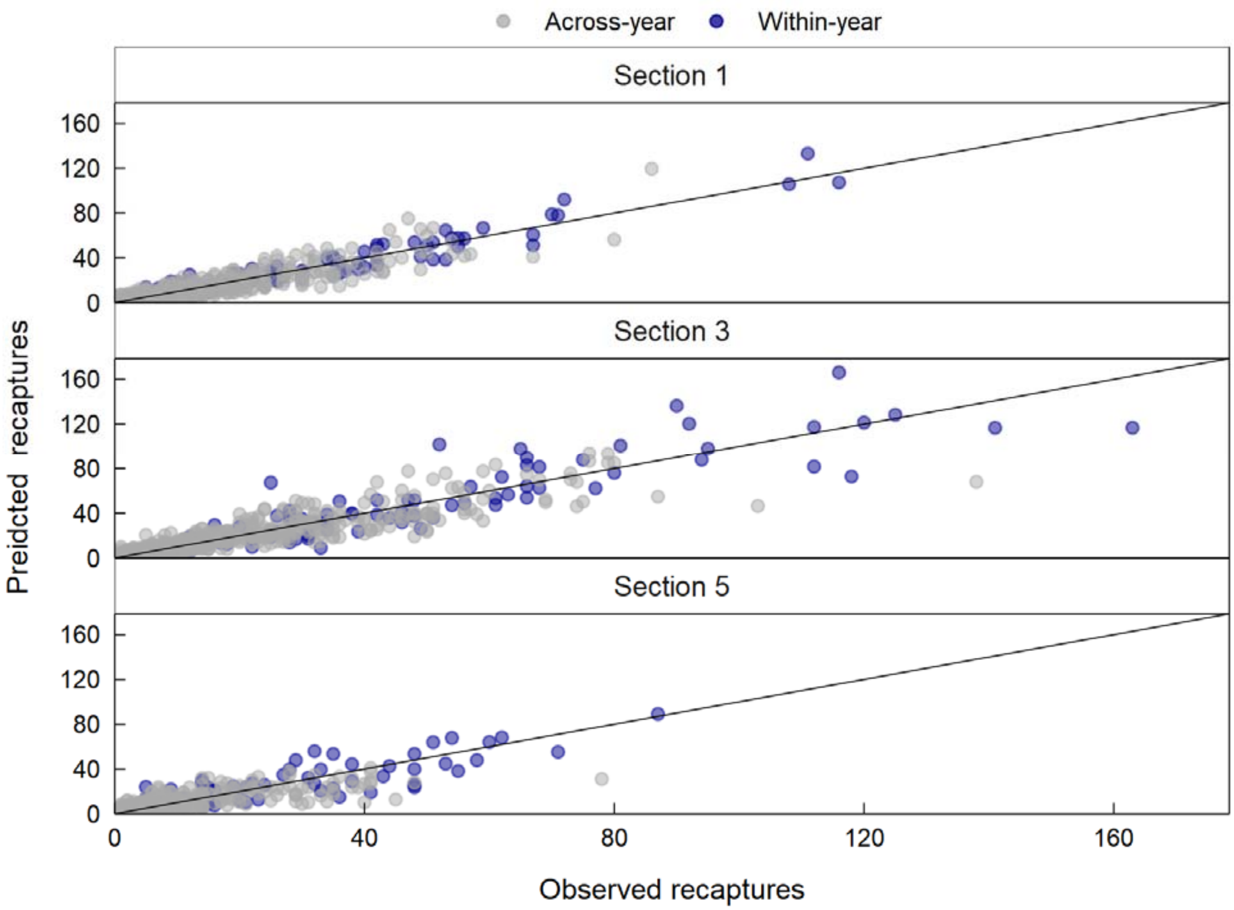

Figure H.7: Observed versus predicted recaptures by section. The line is the 1:1 association or line of equality. The solid points are within year and the grey points across year recaptures.

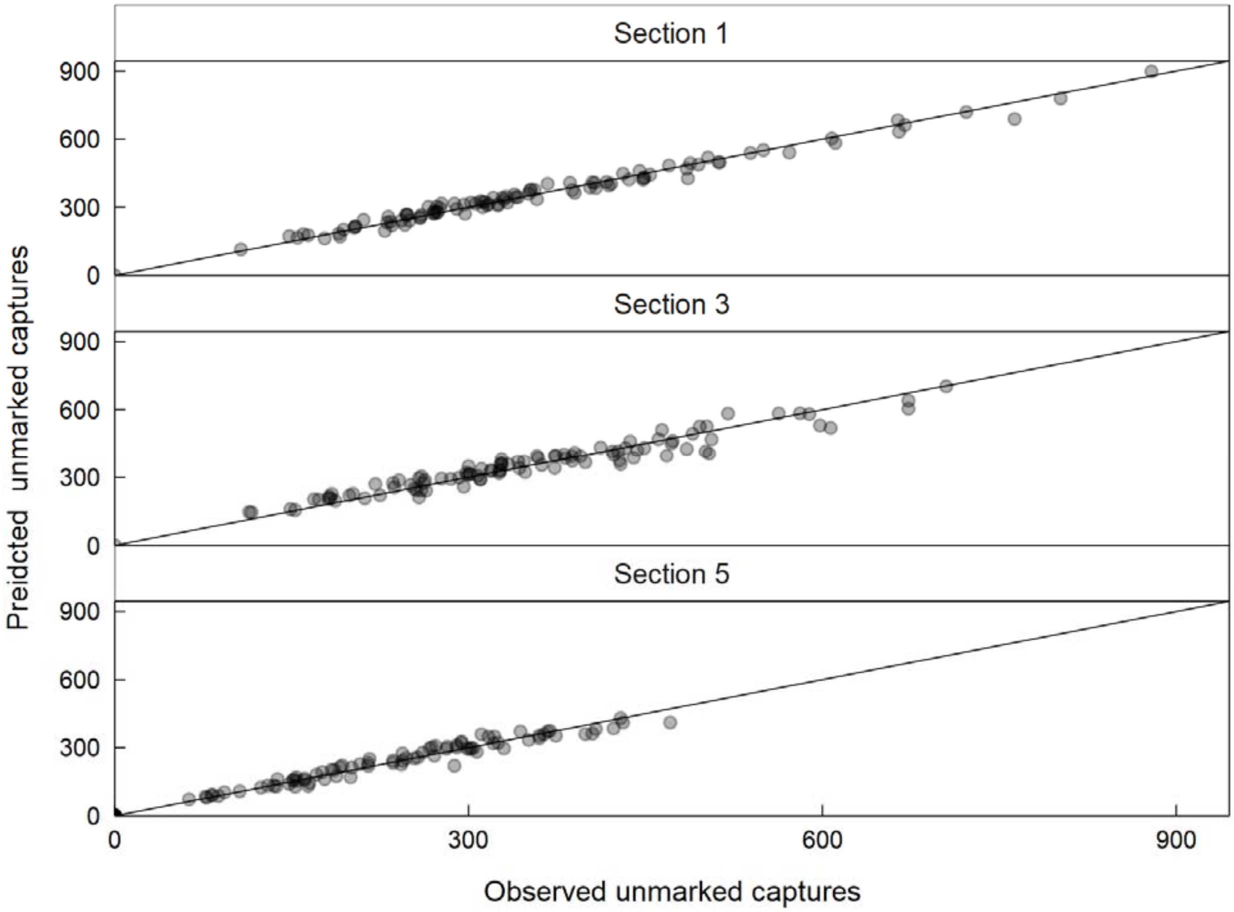

Figure H.8: Observed versus predicted unmarked captures by section. The line is the 1:1 association or line of equality.

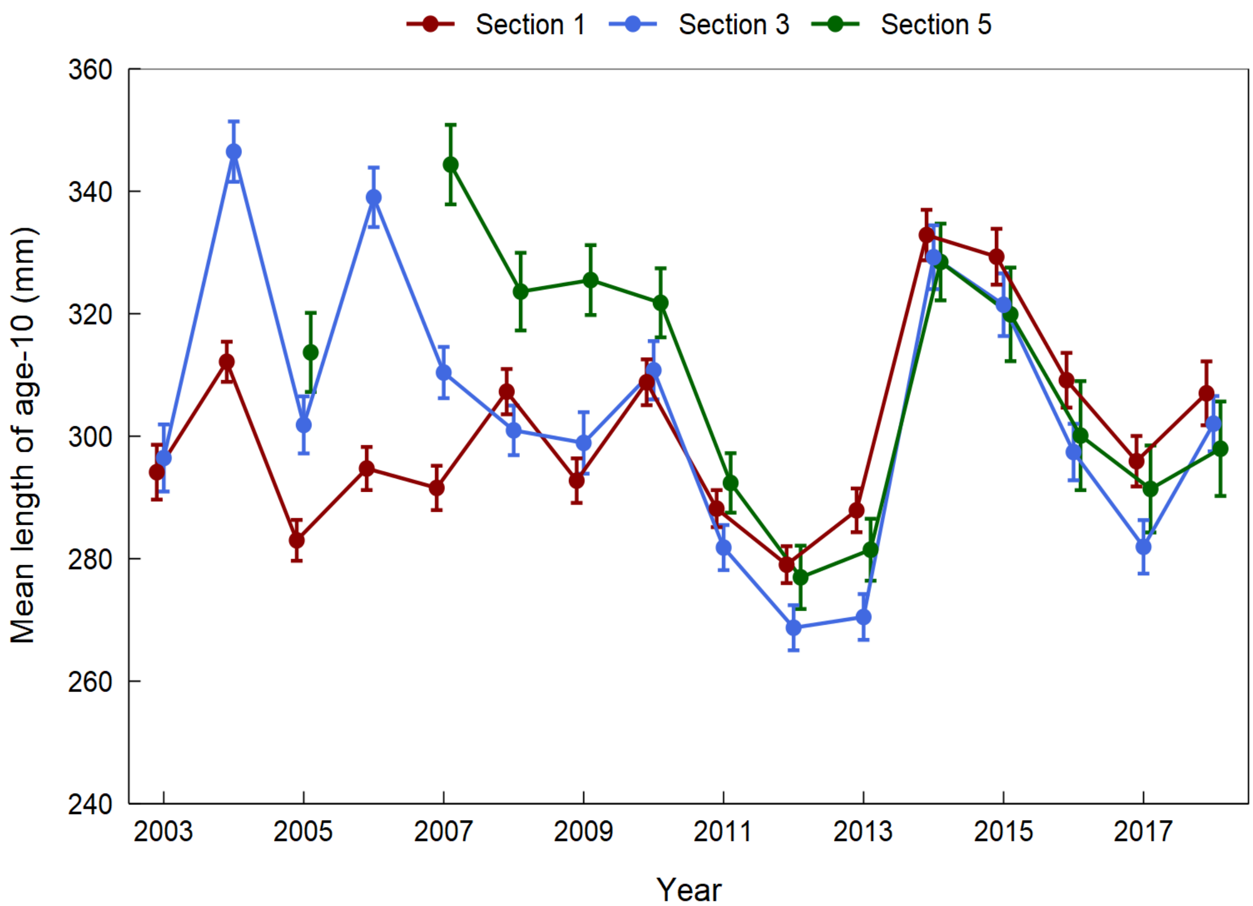

Figure H.9: Predicted mean length of age-10 Mountain Whitefish by section and year. The error bars represent ± 2 standard errors.

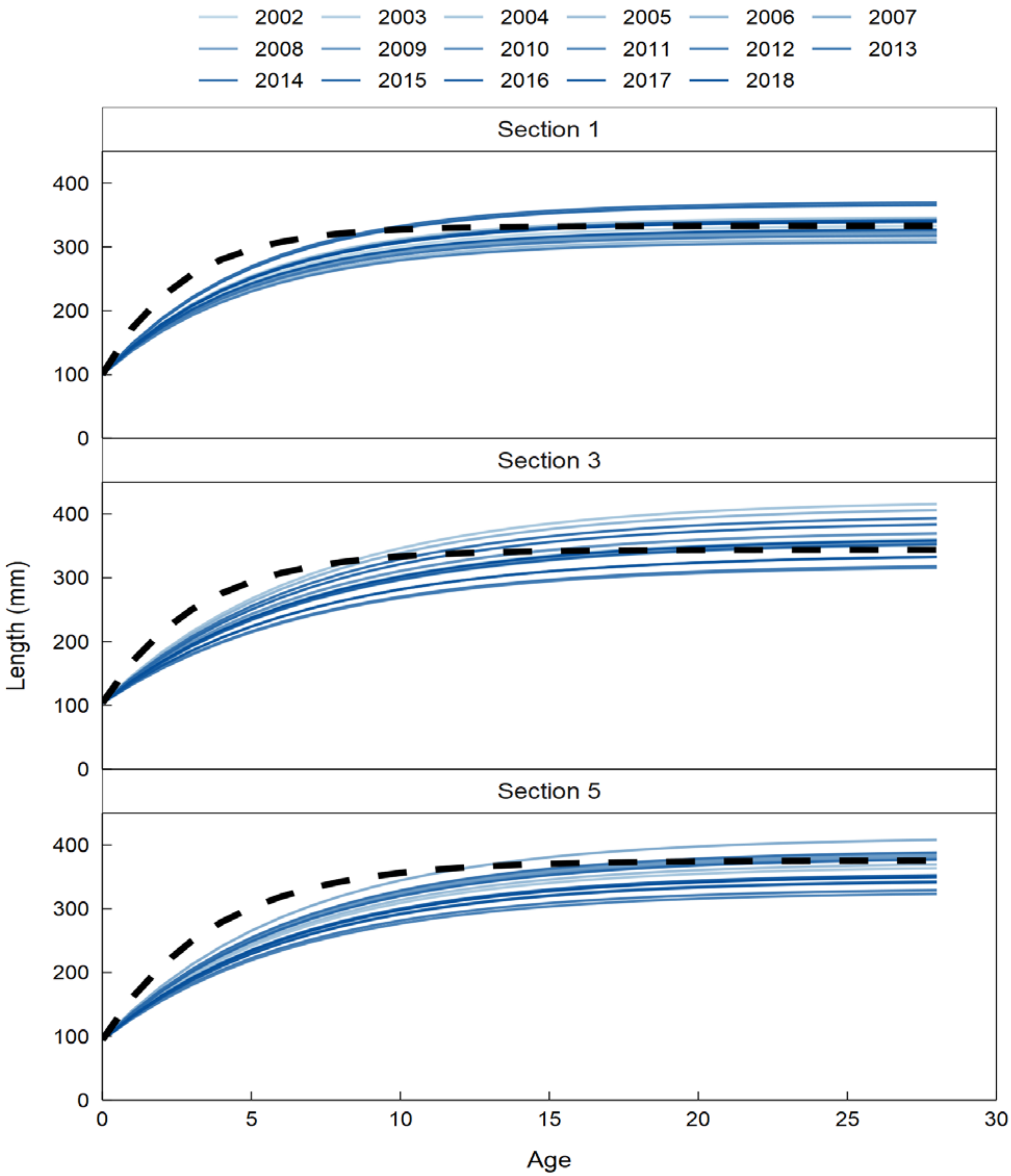

Figure H.10: Predicted length-at-age by year and section. The predicted length from age data is indicated by a dashed line.

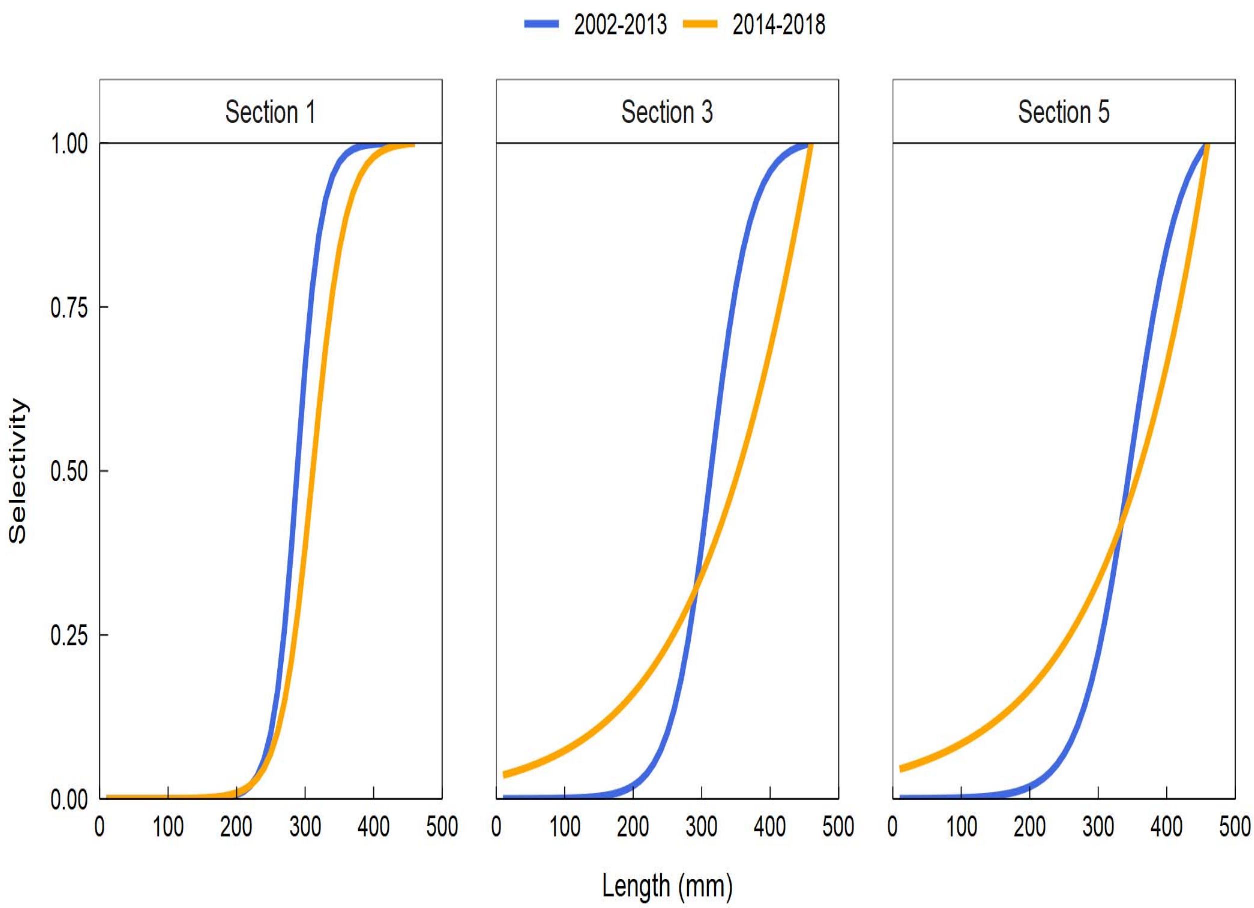

Figure H.11: Predicted size selectivity by epoch and section

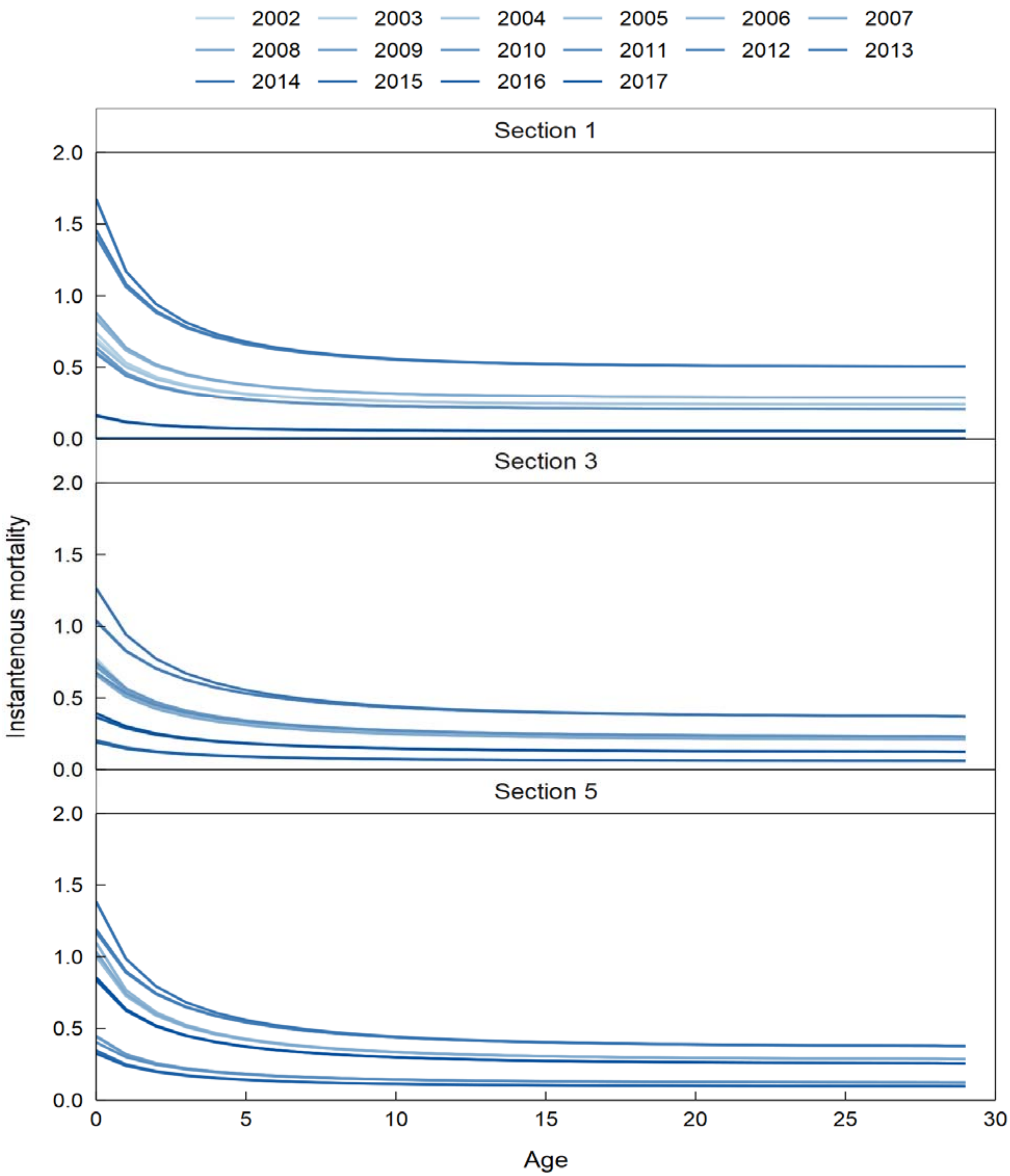

Figure H.12: Predicted instantaneous mortality by age and section

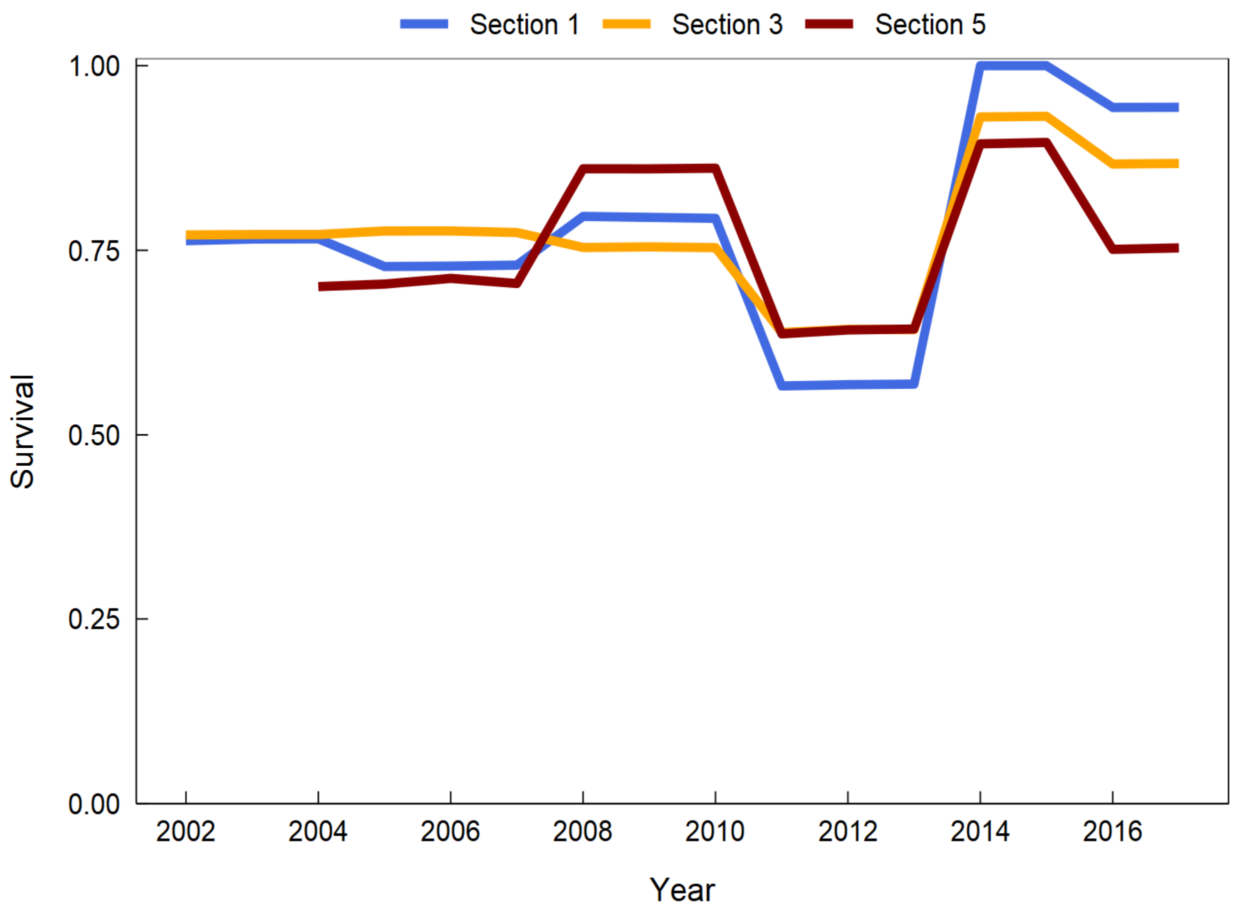

Figure H.13: Predicted mean survival of marked Mountain Whitefish by year, weighted by the number at age, and section

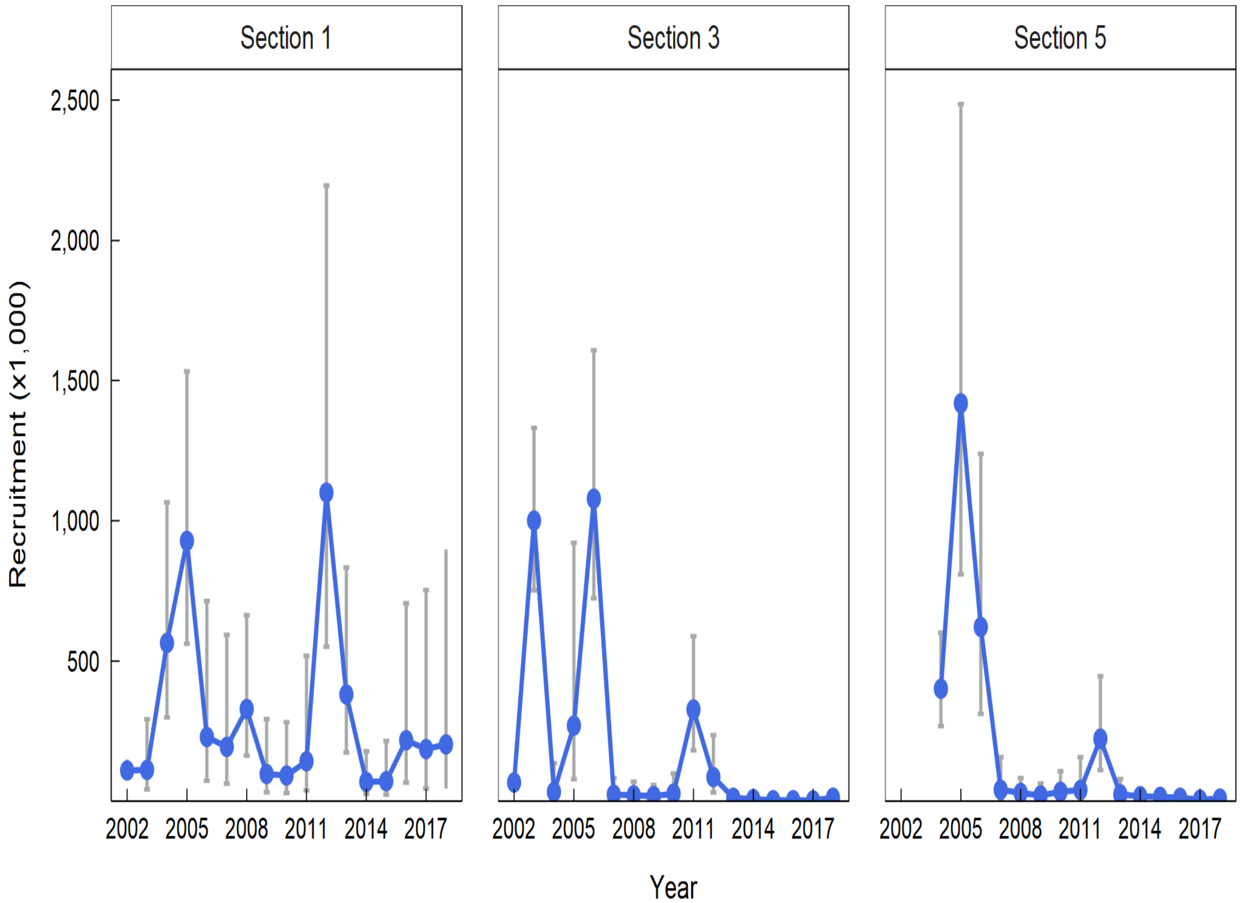

Figure H.14: Predicted recruitment by section and year. Error bars represent ± 2 standard errors. The error bars were truncated to 2.0 million.

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