



Site C Clean Energy Project

Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9)

Task 2b – Water Temperature

Construction Year 7 (2021)

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9 September 2022



REPORT

2021 Annual Report

Peace River and Site C Reservoir Water and Sediment Quality Monitoring Program (Mon-8/9) - Water Temperature Monitoring (Task 2b) - 2021

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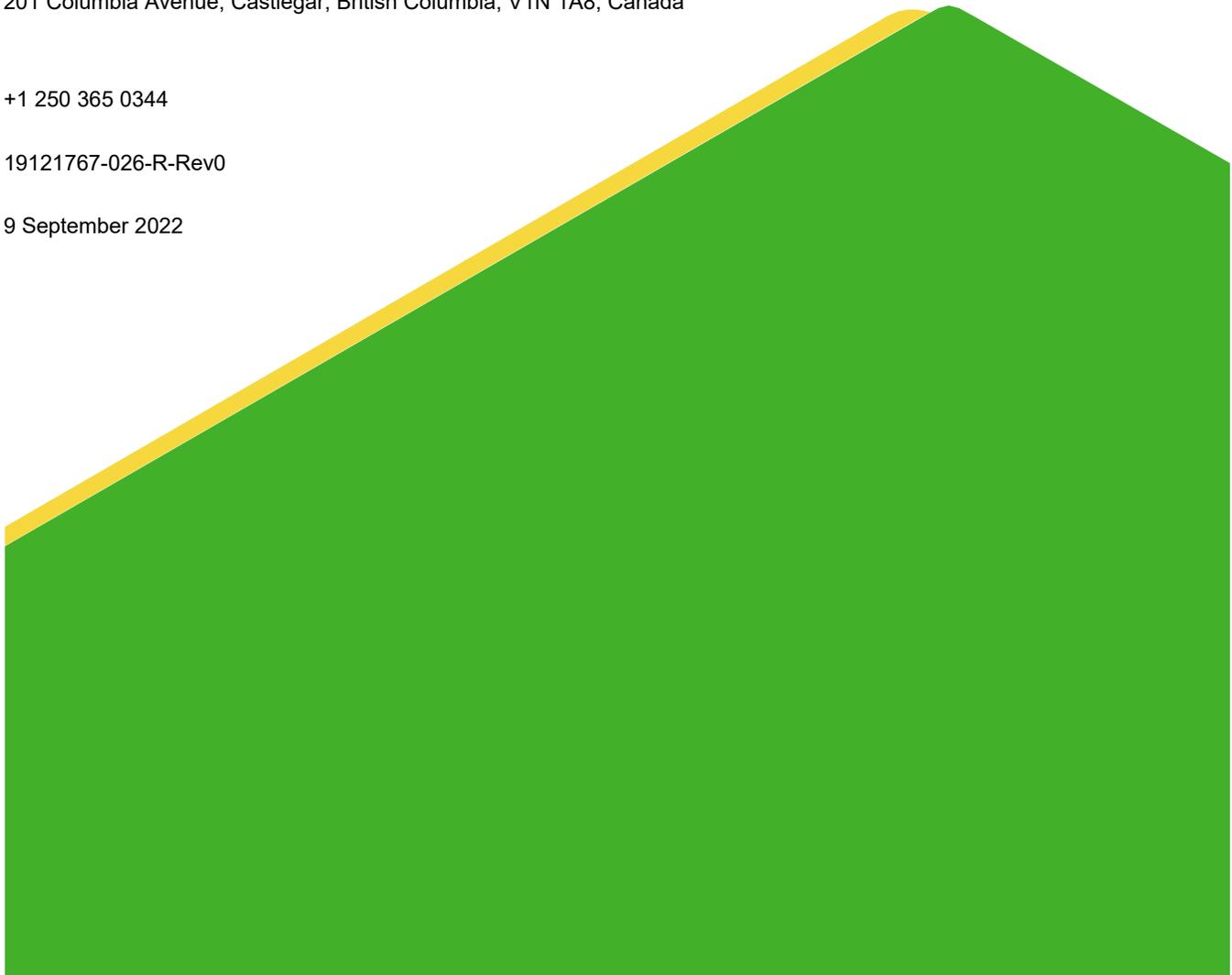
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Executive Summary

In accordance with Provincial Environmental Assessment Certificate (EAC) Schedule B Condition No. 7¹ and Federal Decision Statement (FDS) Condition Nos. 8.4.3² and 8.4.4³ for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP⁴). The Site C Reservoir Water and Sediment Quality Monitoring Program (Mon-8) and the Peace River Water and Sediment Quality Monitoring Program (Mon-9) represent two components of the FAHMFP and Site C Reservoir and Peace River Water Temperature Monitoring represents one task within Mon-8/9 (Task 2b). Task 2b is not intended to address specific management questions or hypotheses under the FAHMFP. Instead, temperature data collected under Task 2b provides information to diagnose causes of observed changes in other FAHMFP programs (i.e., Site C Reservoir Fish Community Monitoring Program [Mon-1a], Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program [Mon-1b], and Peace River Fish Community Monitoring Program [Mon-2]) designed to monitor key indicator species of the Peace River.

The Peace River Water Temperature Database was developed in 2020. The database houses water temperature data collected between 2008 and 2014 by Diversified Environmental Services as part of BC Hydro's Water License Requirement (WLR) Peace River Baseline Total Dissolved Gas (TDG) and Temperature Program (GMSWORKS-2) and data collected during the first seven years (2015 to 2021) of Mon-8/9.

In 2021, stations situated on the Peace River upstream of the Highway #29 bridge were maintained under BC Hydro's WUP and serviced by Diversified Environmental Services. Stations in the Peace River mainstem downstream of Highway #29 and major tributaries were maintained by Golder Associates Ltd.

A total of 16 different stations were maintained on the Peace River between the WAC Bennett Dam (GMS) forebay and near the Pouce Coupe River's confluence with the Peace River. Five different stations were maintained on the following Peace River tributaries: Maurice Creek, Farrell Creek, Moberly River, Pine River, and Beatton River. Five more stations were maintained on tributaries to the Halfway River: Fiddes Creek, Cypress Creek, Chowade River, Colt Creek (a tributary to the Graham River), and Kobes Creek.

Temperature loggers were serviced opportunistically when field crews were in the vicinity conducting other Project-related surveys or during dedicated site visits. Data gaps exist in the data from 2021 for nearly all stations, with the exception of stations situated in the GMS and Peace Canyon Dam (PCN) forebays. Gaps are typically present where recorded data was indicative of the logger being out of water, frozen in ice, or buried by sediment.

Historical data collected between 2008 and 2014 under GMSWORKS-2, coupled with data collected under the FAHMFP between 2015 and 2021, provide a near-continuous 14-year dataset of water temperature data at select locations.

¹ The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program 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 or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

² "The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area."

³ "The plan shall include: 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."

⁴ Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at <https://www.sitecproject.com/document-library/environmental-management-plans-and-reports>.

ACKNOWLEDGEMENTS

We acknowledge this research was conducted on the traditional territory of Treaty 8 First Nations of Dunne Zaa, Cree, and Tse'khene cultural descent.

Site C Reservoir and Peace River Water Temperature Monitoring (Task 2b) is funded by BC Hydro's Site C Clean Energy Project. Golder Associates Ltd. would like to thank the following individuals for their contributions to the program:

BC Hydro

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
EAC	Environmental Assessment Certificate
Project	Site C Clean Energy Project
FAHMFP	Fisheries and Aquatic Habitat Monitoring and Follow-up Program
Mon-1b	Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program
FDS	Federal Decision Statement
Mon-8	Site C Reservoir Water and Sediment Quality Monitoring Program
Mon-9	Peace River Water and Sediment Quality Monitoring Program
Task 2b	Site C Reservoir and Peace River Water Temperature Monitoring
GMSWORKS-2	Peace River Baseline Total Dissolved Gas and Temperature Program
GMS	WAC Bennett Dam
PCN	Peace Canyon Dam
Mon-2	Peace River Fish Community Monitoring Program
WLR	Water License Requirements
WUP	Peace Project Water Use Plan

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APPENDICES

APPENDIX A

Water Temperature Monitoring Station Location Data

APPENDIX B

Water Temperature Summary Data - Inter-annual Comparison

1.0 INTRODUCTION

In accordance with Provincial Environmental Assessment Certificate (EAC) Condition No. 7⁵ and Federal Decision Statement Condition (FDS) Nos. 8.4.3⁶ and 8.4.4⁷ for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP⁸; BC Hydro 2015). The FAHMFP is designed to monitor different aspects of Peace River fish habitat or the response of the Peace River fish community to the construction and operation of the Project. The Site C Reservoir Water and Sediment Quality Monitoring Program (Mon-8) and the Peace River Water and Sediment Quality Monitoring Program (Mon-9) represent two components of the FAHMFP and Site C Reservoir and Peace River Water Temperature Monitoring represents one task within Mon-8/9 (Task 2b). Task 2b is not intended to address specific management questions or hypotheses under the FAHMFP. Instead, temperature data collected under Task 2b provides information to diagnose causes of observed changes in other FAHMFP programs (i.e., Site C Reservoir Fish Community Monitoring Program [Mon-1a], Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program [Mon-1b], and Peace River Fish Community Monitoring Program [Mon-2]) designed to monitor key indicator species of the Peace River.

In 2008, as part of the BC Hydro Peace Project Water Use Plan (WUP; BC Hydro 2007), Diversified Environmental Services (DES) began maintaining an array of water temperature loggers in the Peace River between the WAC Bennett Dam (GMS) forebay and 6.5 km downstream of the Pine River's confluence with the Peace River (GMSWORKS-2; e.g., DES 2010). Areas monitored under the array included upstream and downstream of GMS and Peace Canyon Dam (PCN) and upstream and downstream of the confluences of the following Peace River tributaries: the Halfway River, the Moberly River, and the Pine River. In 2016, management of the array was transitioned from the WUP to the FAHMFP (DES 2017, 2018, 2019, 2020; Golder 2021). Data from GMSWORKS-2 and the FAHMFP combined provide a continuous dataset of water temperature values at the above locations from 2008 to 2021. Data collection under Task 2b is currently scheduled through the remainder of Project construction and the first 10 years of Project operation.

With the transition from the WUP to the FAHMFP in 2016, three new monitoring stations were added to the array (i.e., the Peace River upstream of the Pouce Coupe River confluence and the mainstems of the Beaton and Pine rivers). These stations were added to Task 2b to collect the temperature data needed to help interpret results of the Peace River Fish Community Monitoring Program (Mon-2). In 2019, the array was expanded further to include Site C reservoir tributary sampling as part of the Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program (Mon-1b): the mainstems of the Chowade and Moberly rivers, and Colt, Cypress, Farrell, Kobes, and Fiddes creeks. A Maurice Creek station was added to the array in 2020.

This report summarizes the status of water temperature monitoring under Task 2b from 1 January to 31 December 2021; however, because data from late 2021 were not retrieved from some stations until early 2022, this report includes information from those 2022 site visits where appropriate.

⁵ The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program 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 or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

⁶ "The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area."

⁷ "The plan shall include: 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."

⁸ Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at <https://www.sitecproject.com/document-library/environmental-management-plans-and-reports>.

2.0 METHODS

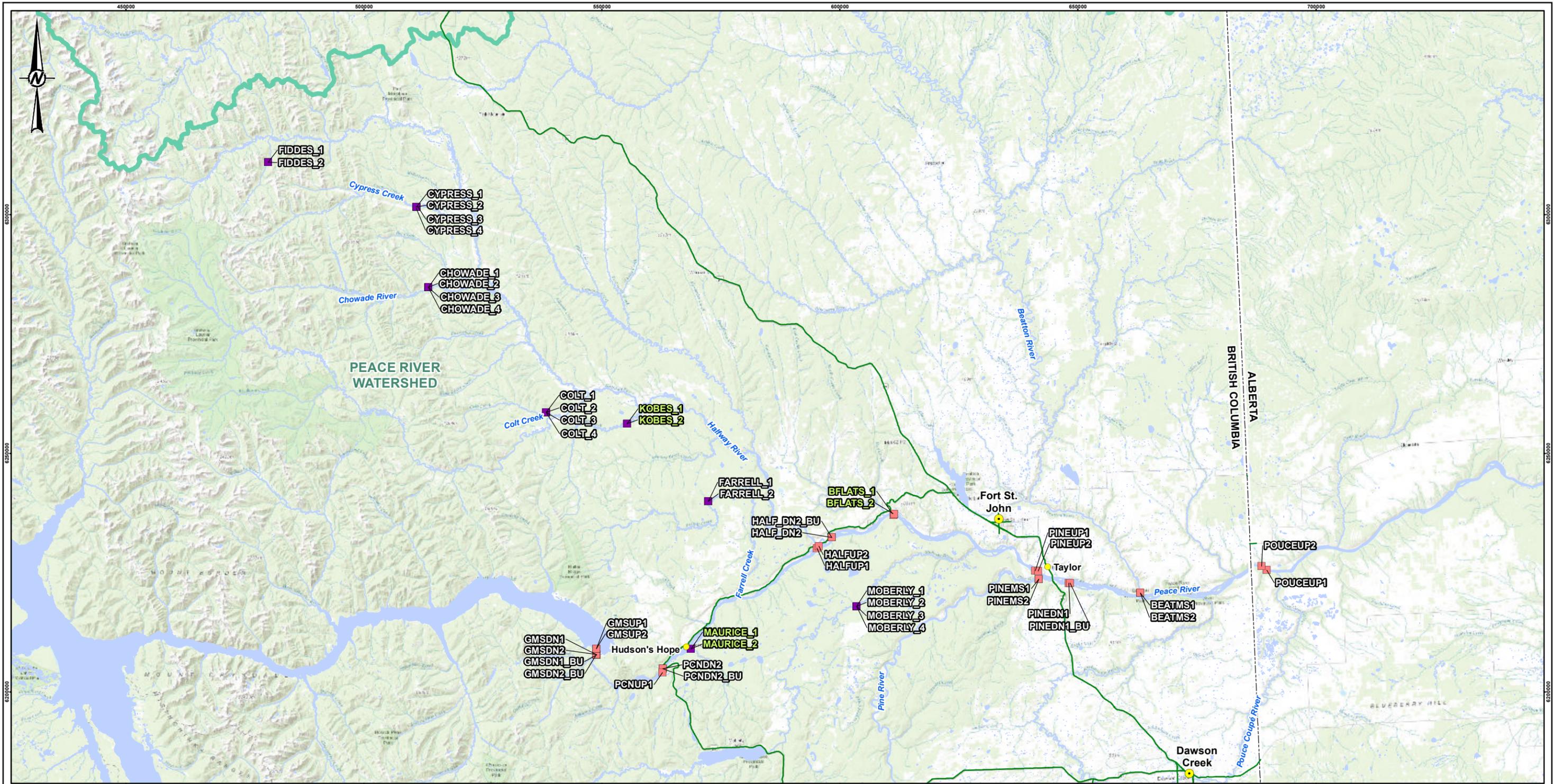
Six years of water temperature data were collected under Task 2b between 2016 and 2021; however, when coupled with water temperature data collected under GMSWORKS-2 between 2008 and 2016, 14 years of near-continuous water temperature data are available at select locations. An additional two years of data (2022 and 2023) are scheduled to be collected during river diversion and prior to reservoir filling and operation of the Project. Task 2b is also scheduled to continue for the first 10 years of Project operations.

2.1 Study Area

A station is defined as a single location where water temperature is monitored as part of the array. A single station can have a single temperature logger or multiple temperature loggers (e.g., to record temperatures at different depths or to provide a backup data source).

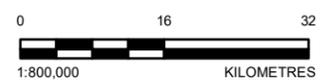
Station locations assessed as part of the 2021 study are summarized in Appendix A, Table A1 and Figure 1. Stations were located in the Peace River mainstem from the forebay of GMS downstream to near the Pouce Coupe River confluence and in the following tributaries (listed in upstream to downstream order): Maurice Creek, Farrell Creek, Fiddes Creek, Cypress Creek, Chowade River, Colt Creek, Kobes Creek, Moberly River, Pine River, and Beaton River.

In 2021, temperature loggers in the Peace River situated upstream of the Highway #29 bridge were maintained under BC Hydro's WUP. These loggers were downloaded and serviced by Diversified Environmental Services and the data were provided to Golder for analysis and inclusion in the Peace River Water Temperature Database.



LEGEND

PROJECT DATA		BASE DATA	
	TEMPERATURE LOGGER LOCATION		CITY
	PEACE RIVER MAINSTEM SITE		DISTRICT MUNICIPALITY
	TRIBUTARY SITE		ROAD
			WATERBODY
			PROVINCIAL BOUNDARY
			PEACE RIVER WATERSHED



CLIENT
BC HYDRO

CONSULTANT



YYYY-MM-DD	2022-09-09
DESIGNED	JS
PREPARED	LH/JG
REVIEWED	JS
APPROVED	DF

REFERENCE(S)

1. WATERBODY, FOREST AREA, PROVINCIAL BOUNDARY, CITY, DISTRICT MUNICIPALITY AND ROAD DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - CANADA.
2. WATERSHED DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - BRITISH COLUMBIA.
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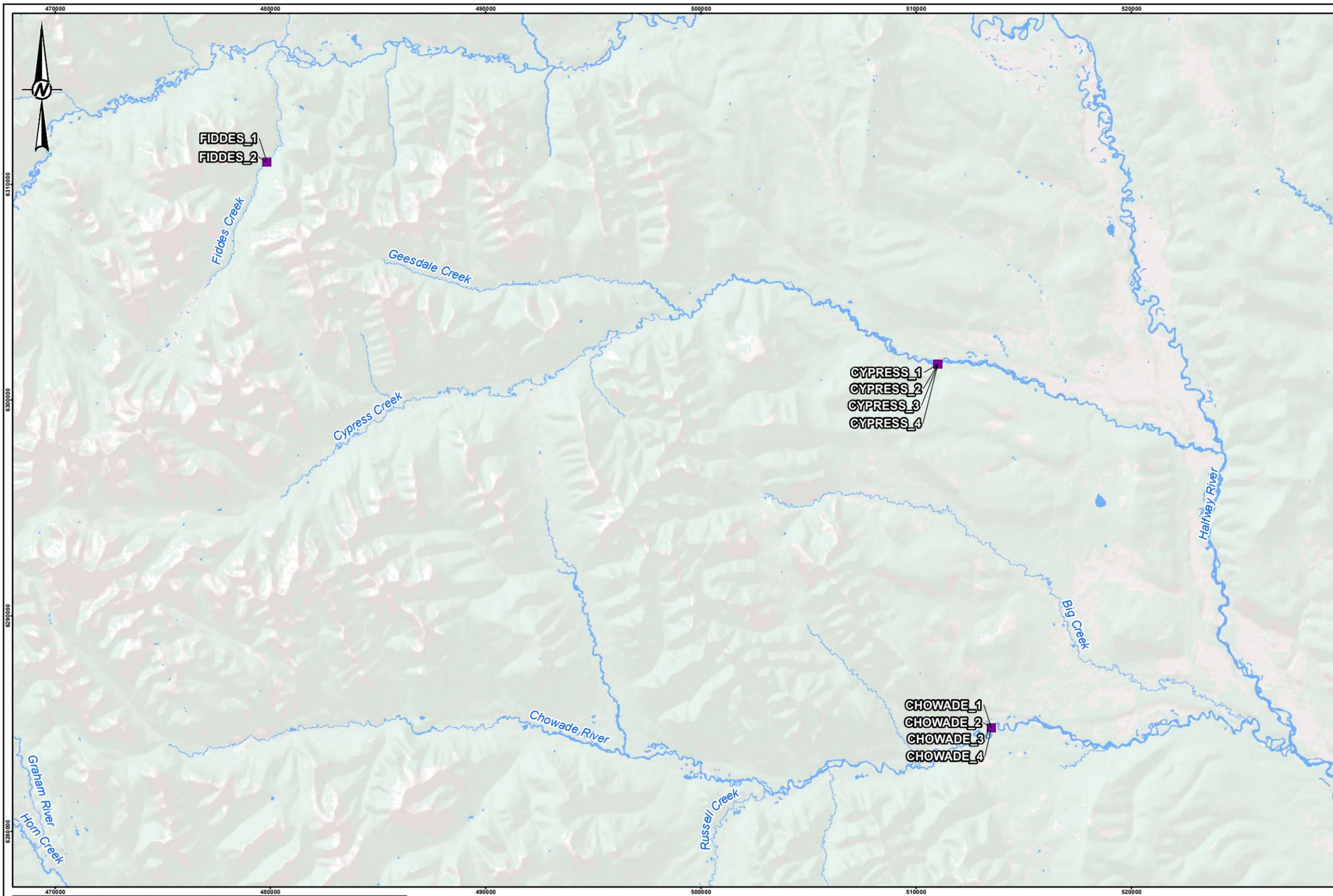
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SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

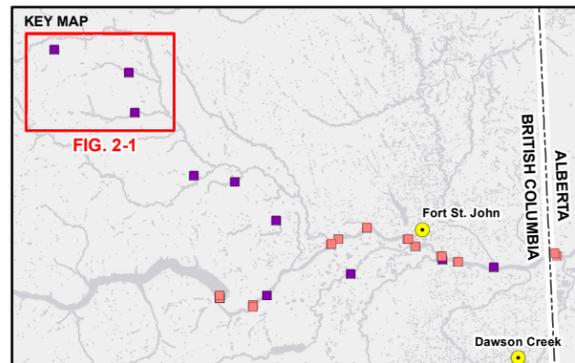
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- LEGEND**
- PROJECT DATA**
- TEMPERATURE LOGGER LOCATION**
- TRIBUTARY SITE
 - WOODED AREA
 - WATERCOURSE
 - WATERBODY



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BC HYDRO

CONSULTANT



YYYY-MM-DD	2022-09-02
DESIGNED	JS
PREPARED	LH/JG
REVIEWED	JS
APPROVED	DF

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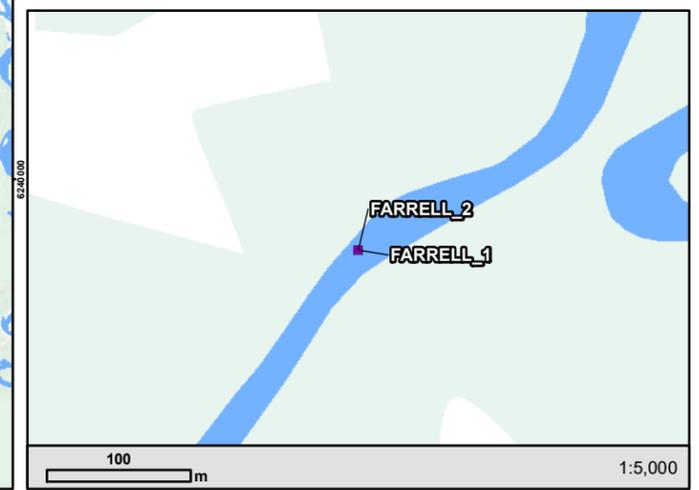
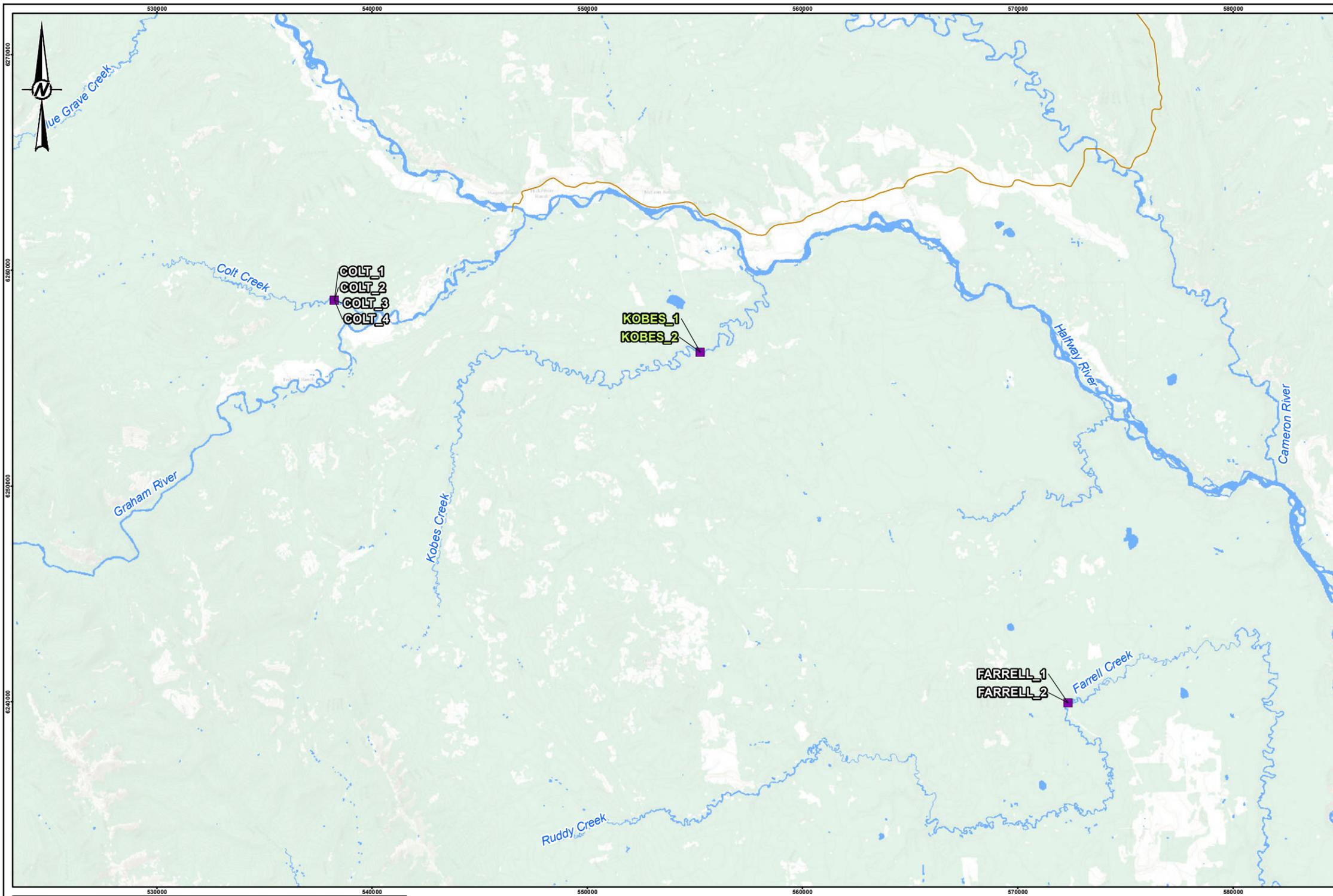
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SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

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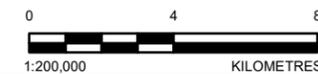
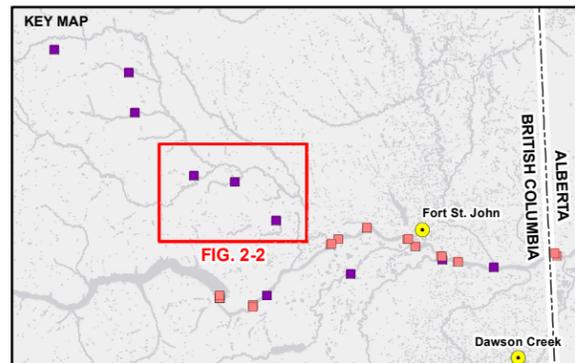
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- LEGEND**
- PROJECT DATA**
- TEMPERATURE LOGGER LOCATION
- TRIBUTARY SITE
- BASE DATA**
- LOCAL ROAD
 - - - RESOURCE / RECREATION ROAD
 - WOODED AREA
 - WATERBODY



CLIENT
BC HYDRO

CONSULTANT



YYYY-MM-DD	2022-09-02
DESIGNED	JS
PREPARED	LH/JG
REVIEWED	JS
APPROVED	DF

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PROJECT
SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

TITLE
OVERVIEW OF PEACE RIVER WATER TEMPERATURE MONITORING (TASK 2B) STATION LOCATIONS, 2021

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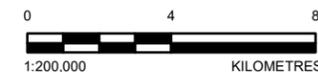
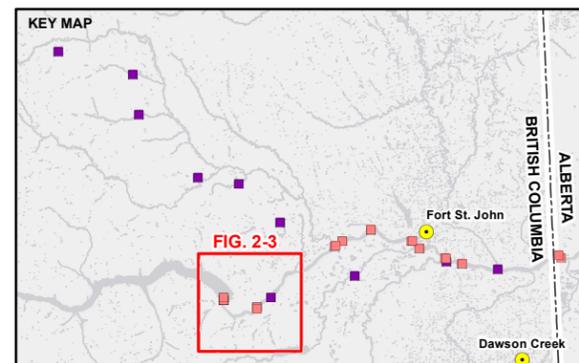
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LEGEND

PROJECT DATA		BASE DATA	
●	TEMPERATURE LOGGER LOCATION	●	DISTRICT MUNICIPALITY
■	PEACE RIVER MAINSTEM SITE	—	HIGHWAY
■	TRIBUTARY SITE	—	LOCAL ROAD
		- - -	RESOURCE / RECREATION ROAD
		■	WOODED AREA
		■	WATERBODY



CLIENT
BC HYDRO

CONSULTANT



YYYY-MM-DD	2022-09-02
DESIGNED	JS
PREPARED	LH
REVIEWED	JS
APPROVED	DF

REFERENCE(S)

1. FOREST AREA, DISTRICT MUNICIPALITY, WATERBODY AND WATERCOURSE DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – BRITISH COLUMBIA.
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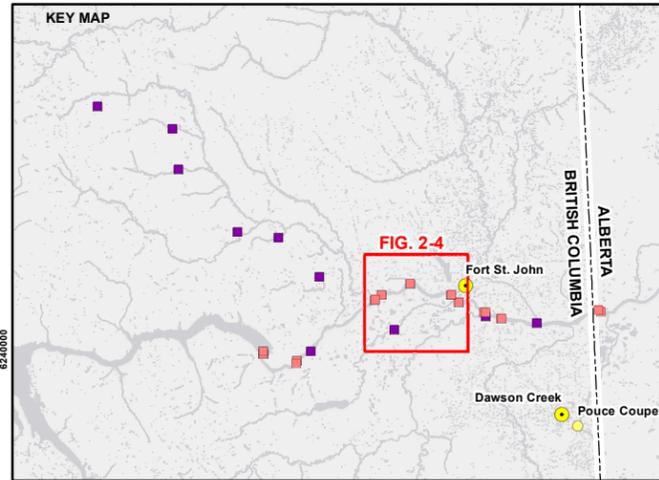
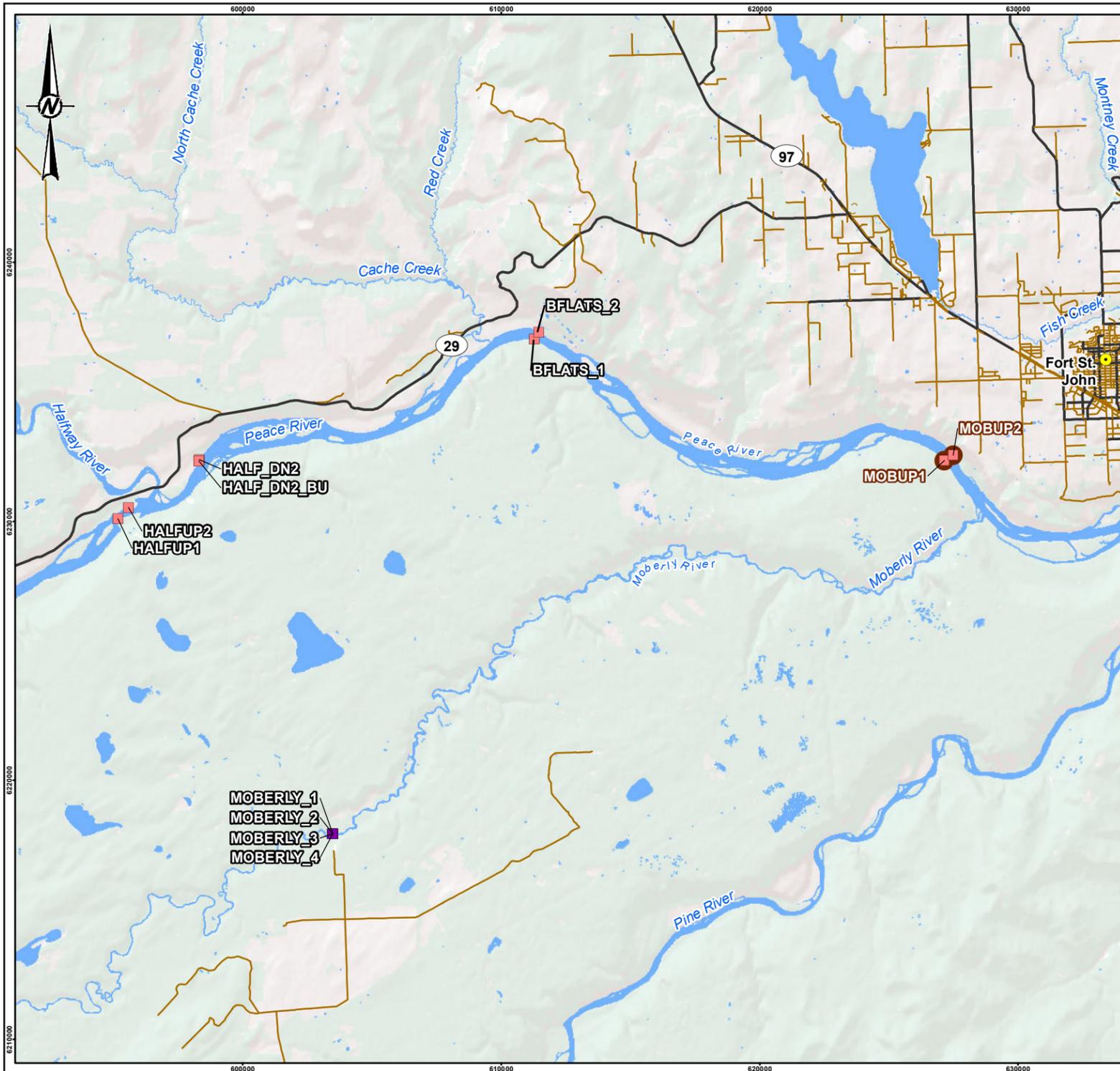
PROJECT
SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

TITLE
OVERVIEW OF PEACE RIVER WATER TEMPERATURE MONITORING (TASK 2B) STATION LOCATIONS, 2021

PROJECT NO.	CONTROL	REV.	FIGURE
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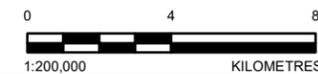
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LEGEND

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■	PEACE RIVER MAINSTEM SITE	—	HIGHWAY
■	TRIBUTARY SITE	—	LOCAL ROAD
●	DECOMMISSIONED IN 2020	—	RESOURCE / RECREATION ROAD
		■	WOODED AREA
		■	WATERBODY
			World Shaded Relief



REFERENCE(S)

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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

CONSULTANT

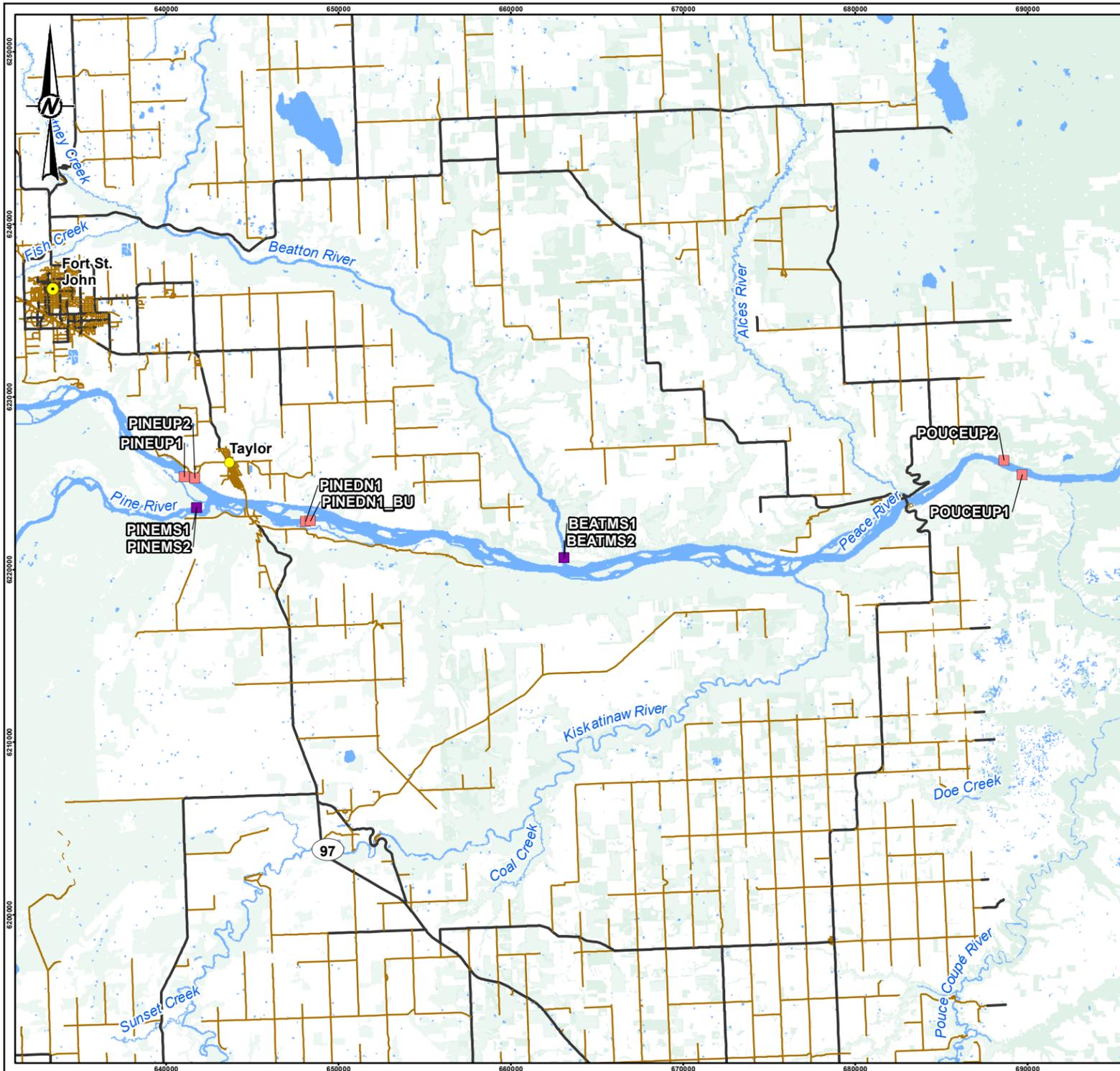
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	PREPARED	LH/JG
	REVIEWED	JS
	APPROVED	DF

TITLE
OVERVIEW OF PEACE RIVER WATER TEMPERATURE MONITORING (TASK 2B) STATION LOCATIONS, 2021

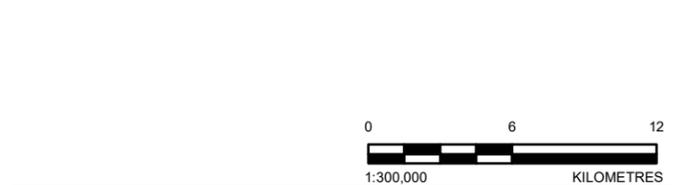
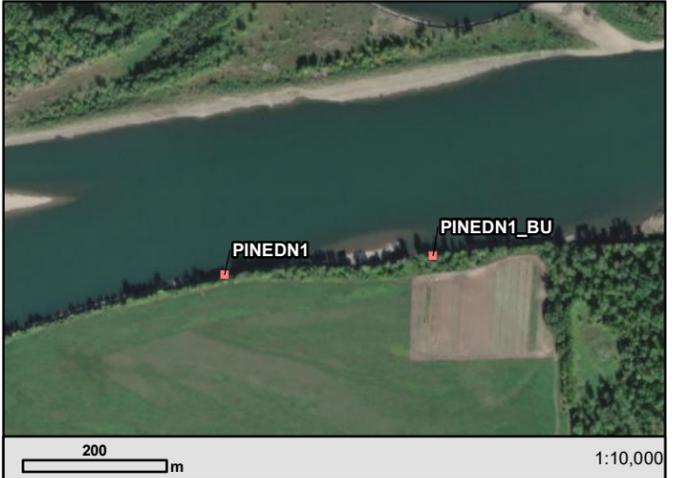
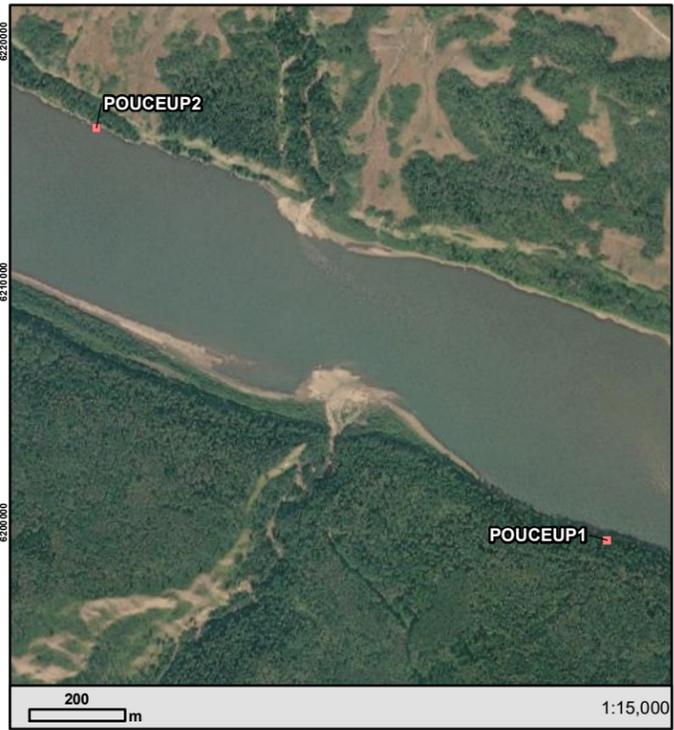
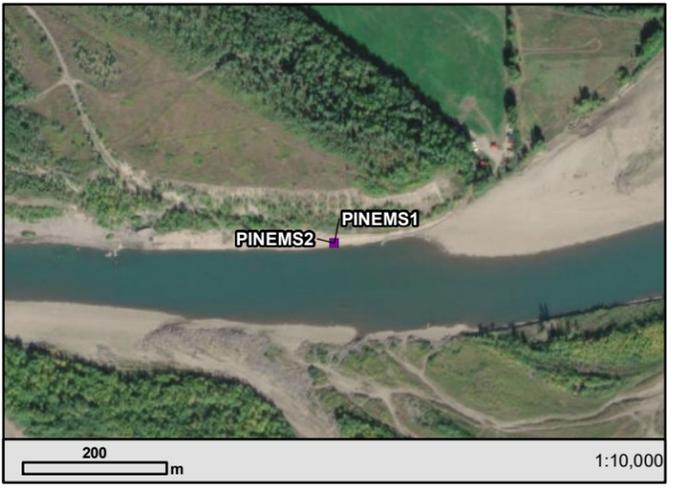
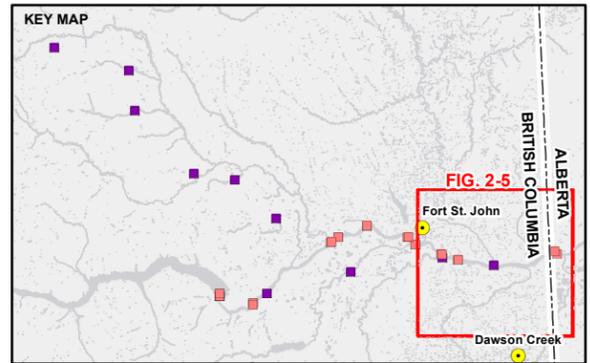
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- LEGEND**
- PROJECT DATA**
- TEMPERATURE LOGGER LOCATION
- PEACE RIVER MAINSTEM SITE
 - TRIBUTARY SITE
- BASE DATA**
- CITY
 - DISTRICT MUNICIPALITY
 - HIGHWAY
 - LOCAL ROAD
 - RESOURCE / RECREATION ROAD
 - WOODED AREA
 - WATERBODY



REFERENCE(S)

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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

CONSULTANT



YYYY-MM-DD	2022-09-02
DESIGNED	JS
PREPARED	LH/JG
REVIEWED	JS
APPROVED	DF

PROJECT
SITE C RESERVOIR AND PEACE RIVER WATER AND SEDIMENT QUALITY MONITORING PROGRAMS (MON-8/9)

TITLE
OVERVIEW OF PEACE RIVER WATER TEMPERATURE MONITORING (TASK 2B) STATION LOCATIONS, 2021

PROJECT NO.	CONTROL	REV.	FIGURE
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2.2 Station Setup

At each station, paired HOBO TidbiT v2 temperature loggers (Model #UTBI-001; Onset Computer Corporation, Bourne, MA, USA) or HOBO 8K Pendant temperature loggers (Model #UA-001-08; Onset Computer Corporation, Bourne, MA, USA) were deployed. The v2 temperature loggers have an accuracy of $\pm 0.2^{\circ}\text{C}$ and the Pendant 8K temperature loggers have an accuracy of $\pm 0.5^{\circ}\text{C}$. Both temperature logger models are initiated and downloaded using a HOBO waterproof optical shuttle (Model #U-DTW-1; Onset Computer Corporation, Bourne, MA). Generally, pendant temperature loggers are located at the more recently established stations and v2 temperature loggers are located at stations historically monitored under GMSWORKS-2. As the batteries in existing v2 temperature loggers expire, the loggers are replaced with the pendant-style temperature loggers. All temperature loggers were programmed to record water temperature in one-hour intervals, except for those installed in the Chowade and Moberly rivers and Colt, Cypress, Farrell, Fiddes, Kobes, and Maurice creeks, which were set to record at 15-minute intervals.

Temperature loggers were contained in metal 38 mm wide x 100 mm long perforated cylinders with threaded metal end caps (initially deployed during GMSWORKS-2) or in 102 mm diameter ABS (plastic) container with a single threaded end cap (initially deployed during Task 2b; Figure 2). Holes were drilled through the housing body and end caps to allow water to flow through them. The housings were ballasted with either 5 kg metal or concrete anchors and secured to shore with a metal cable or chain.



Figure 2: Examples of temperature logger housings deployed during the Site C Reservoir and Peace River Water Temperature Monitoring Program (Task 2b). The photo on the left denotes housings initially deployed during GMSWORKS-2. The photo on the right denotes housings initially deployed during Task 2b.

Over the spring, summer, and fall of 2021, temperature loggers were opportunistically downloaded by Golder staff when crews were participating in other field programs in the vicinity of stations and during dedicated station visits. During station visits in 2021 and previous years, many of the metal housings could not be opened in the field because of corrosion and needed to be brought into the warehouse to be opened. In 2021, all of the remaining stations downstream of the Highway #29 bridge that had metal housings were replaced with plastic ABS housings.

2.3 Data Compilation and Analysis

All raw temperature data collected in 2021 were compiled and imported into the Peace River Water Temperature Database (Attachment A). Subsequent data manipulation and figure production were completed in R v4.0.3 (R Core Team 2021).

Prior to generating figures, erroneous data were identified and removed from the dataset. In general, high daily variability in water temperatures were considered indicative of the logger being out of water (e.g., hourly temperature ranges of 20°C within a single day), low daily variability in water temperatures, especially when temperatures were close to 0°C, were interpreted as periods when a logger was frozen in ice, low daily variability in water temperature when temperatures were above 0°C, when loggers were found buried in sediment, were interpreted as the period during which they were buried. Temperatures less than 0°C were considered indicative of the logger being out of water. Data that met any of these criteria were removed from the final dataset. Temperature data records observed to depart from local trends were flagged and removed.

For stations where more than one temperature logger was present, and one logger was previously identified as the primary logger while the other identified as a backup logger (typically the mainstem stations), the R procedure queried the additional temperature logger to fill gaps in the main dataset when possible. For stations with multiple loggers at the same general location where none were considered the primary logger (typically tributary stations), the average value of the multiple temperature measurements from the same hour was used.

Daily average temperature values were calculated from the cleaned dataset and plotted. To facilitate annual comparisons, the mean, minimum, and maximum daily average temperatures were calculated for each day of the year for all other years with available data for each station.

3.0 RESULTS

At times, temperature loggers were buried in sediment or out of the water when crews arrived on site to download them. These instances are detailed in the following sections. The condition of the temperature logger at the time of download should be considered when interpreting results.

3.1 Upstream of Peace Canyon Dam

3.1.1 WAC Bennett Dam Forebay

Water temperatures in the GMS forebay were measured at two different water depths. Both temperature loggers were suspended from the northernmost steel buoy along the GMS spillway log boom. Station gmsUP1 was a logger suspended 1 m below the water surface (Figure3) and Station gmsUP2 was a logger suspended 10 m below the water surface (Figure4). Data were available for the entire 2021 study period for both gmsUP1 and gmsUP2.

Interannual comparisons of water temperature data for gmsUP1 and gmsUP2 are presented in Appendix B, Figures B1 and B2, respectively.

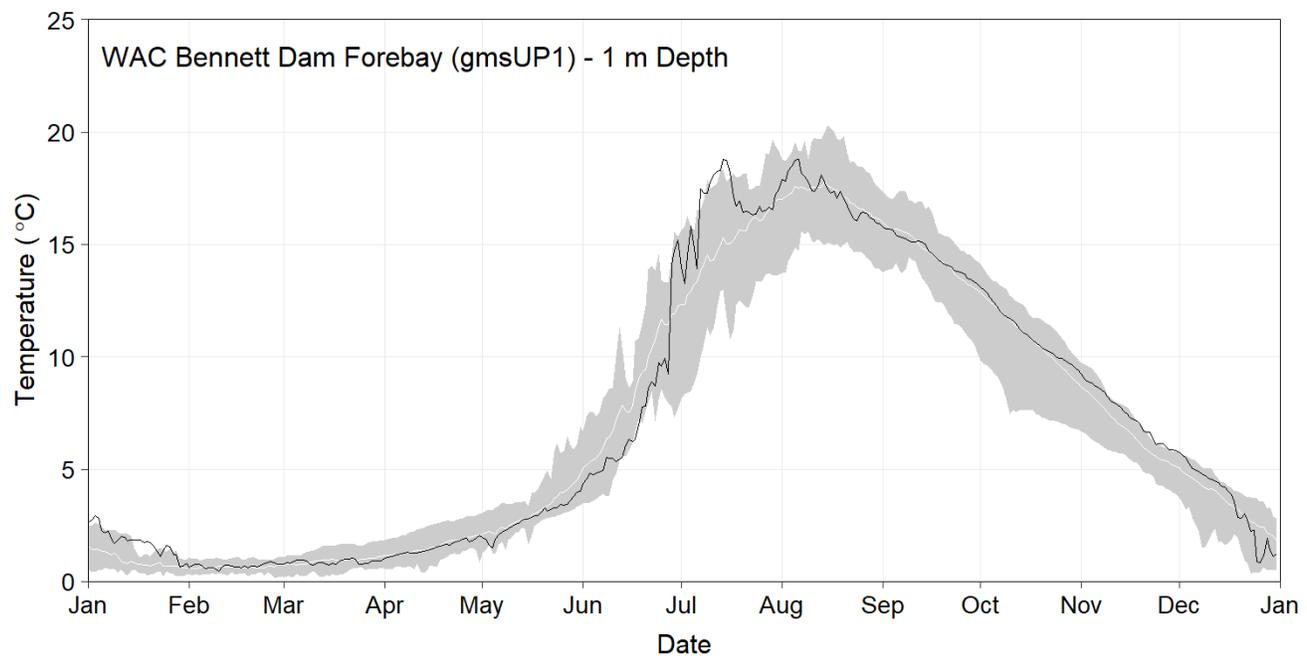


Figure 3: Mean daily water temperature (°C) for the WAC Bennett Dam (GMS) forebay 1 m below the water surface (gmsUP1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

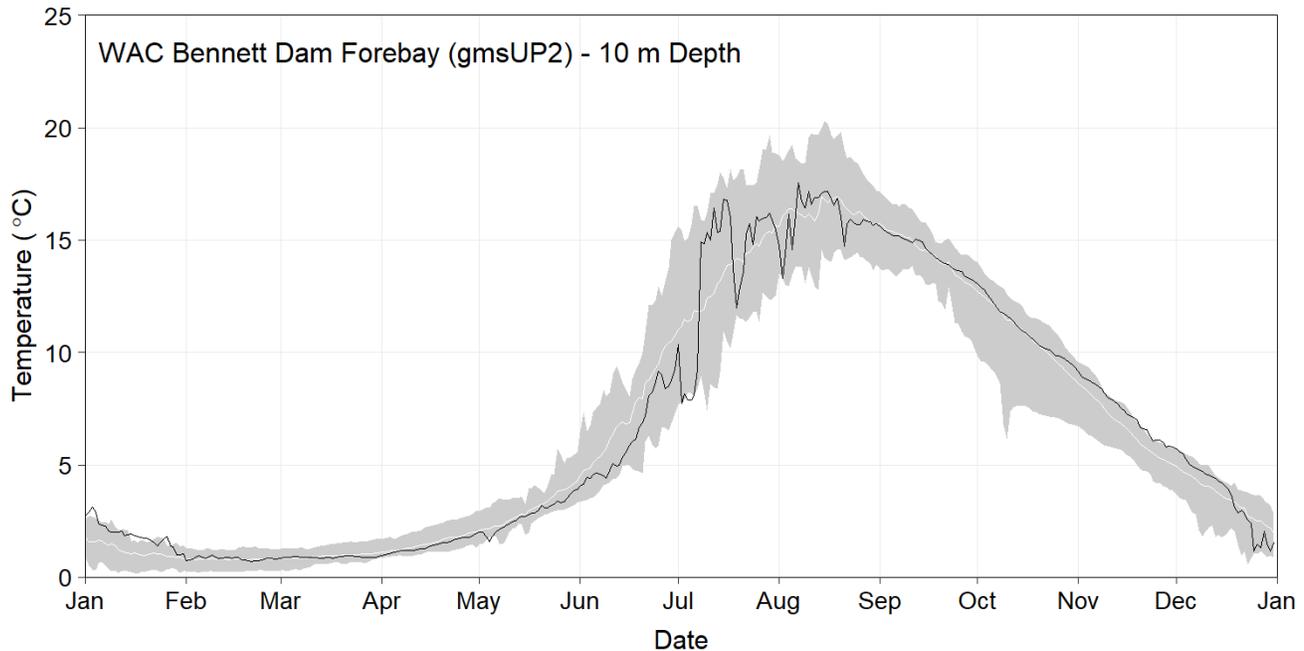


Figure 4: Mean daily water temperature (°C) for the WAC Bennett Dam (GMS) forebay 10 m below the water surface (gmsUP2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.1.2 WAC Bennett Dam Tailrace

GMS tailrace water temperatures were monitored by two different stations. Both stations were situated approximately 700 m downstream of the dam. Station gmsDN1 was located on the left bank (as viewed facing downstream) and was positioned to monitor water flowing out of the south tailrace manifold (Figure5). Station gmsDN2 was located on the right bank and was positioned to monitor water flowing out of the north tailrace manifold (Figure6). Each of these stations had backup temperature loggers (gmsDN1BU and gmsDN2BU). Data from Stations gmsDN1 and gmsDN2 were available for all of 2021, except for a brief dewatering of both stations on 8 June 2021.

Interannual comparisons of water temperature data for gmsDN1 and gmsDN2 are presented in Appendix B, Figures B3 and B4, respectively.

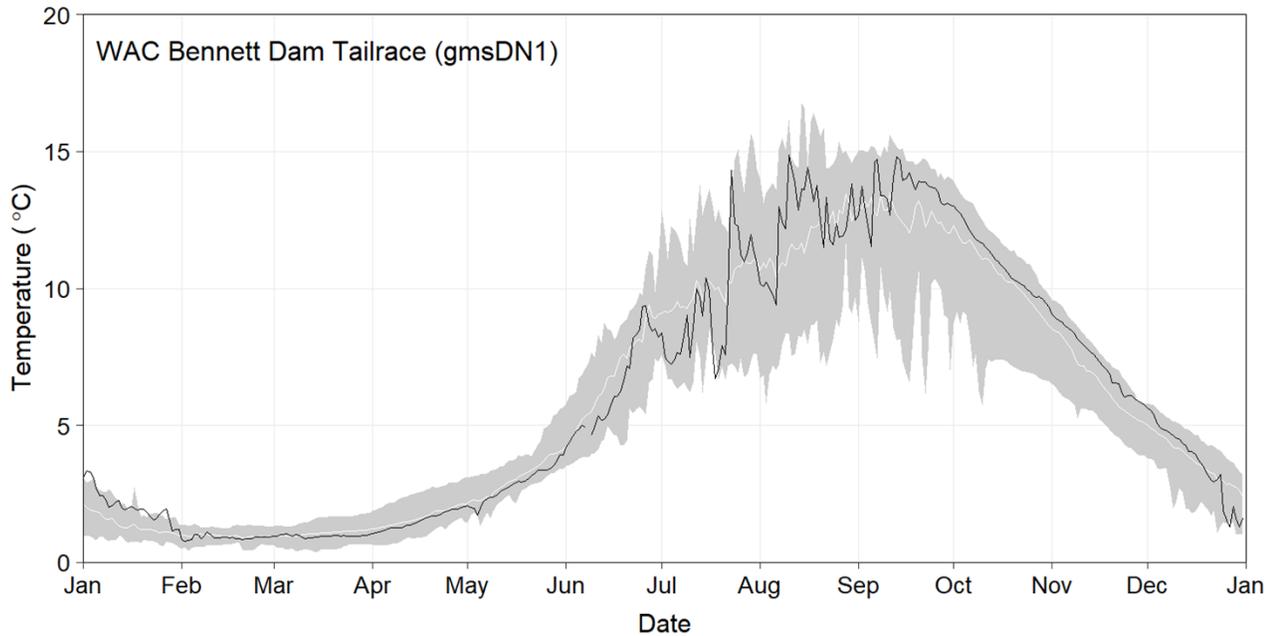


Figure 5: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the WAC Bennett Dam (GMS) tailrace (gmsDN1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

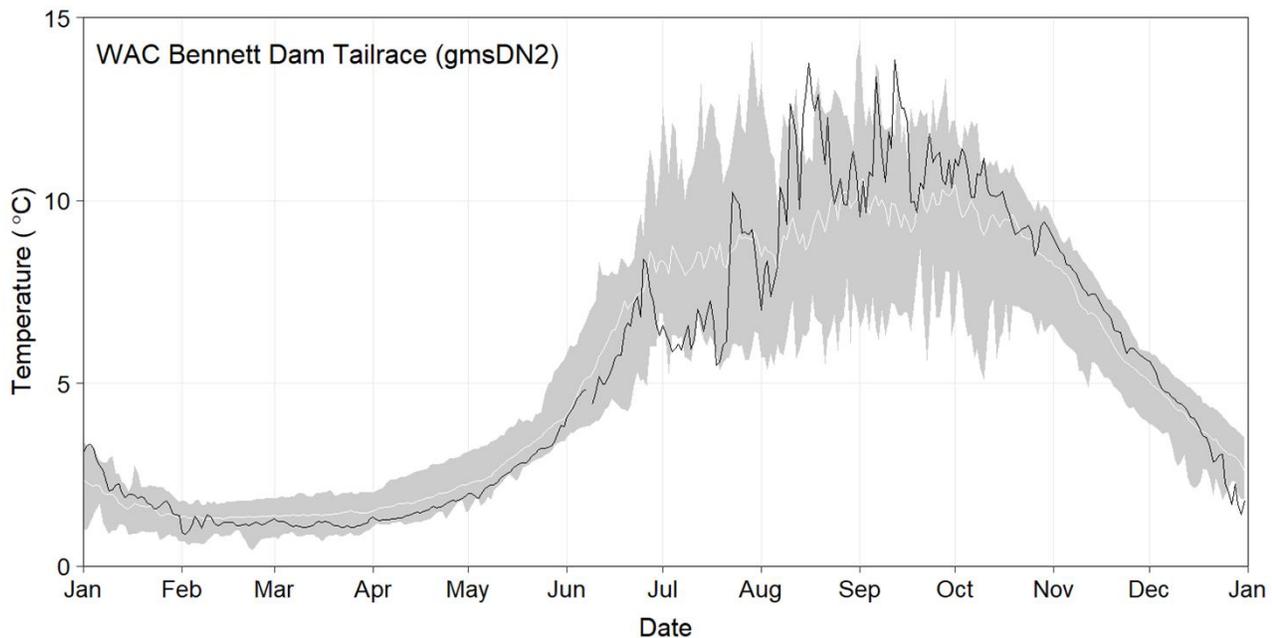


Figure 6: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the WAC Bennett Dam (GMS) tailrace (gmsDN2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.1.3 Peace Canyon Dam Forebay

Water temperatures in the PCN forebay (pcnUP1) were measured 1 m below the water surface at the anti-vortex log boom, which is located approximately 450 m upstream of the dam (Figure7). Data were available for the entire 2021 study period for pcnUP1.

Interannual comparisons of water temperature data for pcnUP1 are presented in Appendix B, Figure B5.

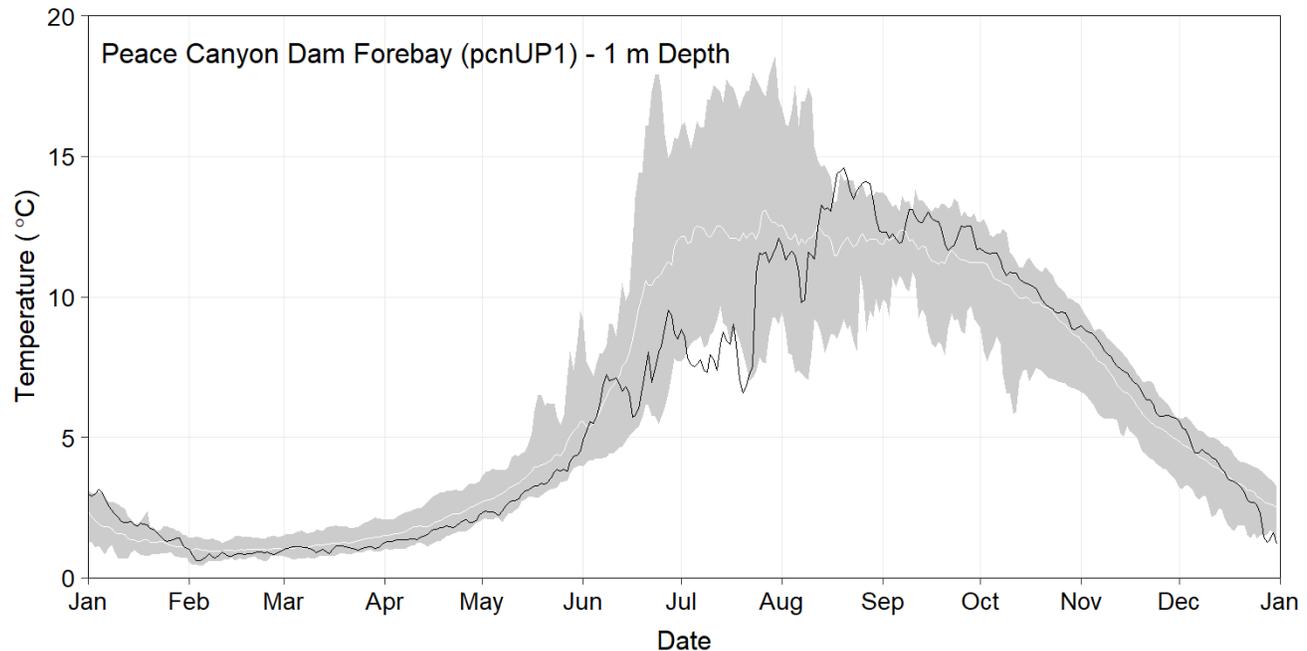


Figure 7: Mean daily water temperature (°C) for the Peace Canyon Dam (PCN) forebay 1 m below the water surface (pcnUP1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.2 Downstream of Peace Canyon Dam

3.2.1 Peace Canyon Dam Tailrace

PCN tailrace water temperatures were monitored by a single station (pcnDN2). The station was situated on the left bank approximately 200 m downstream of the dam (Figure8). This station had a backup temperature logger (pcnDN2BU). Data were available for the entire 2021 study period for pcnDN2.

Interannual comparisons of water temperature data for pcnDN2 are presented in Appendix B, Figure B6.

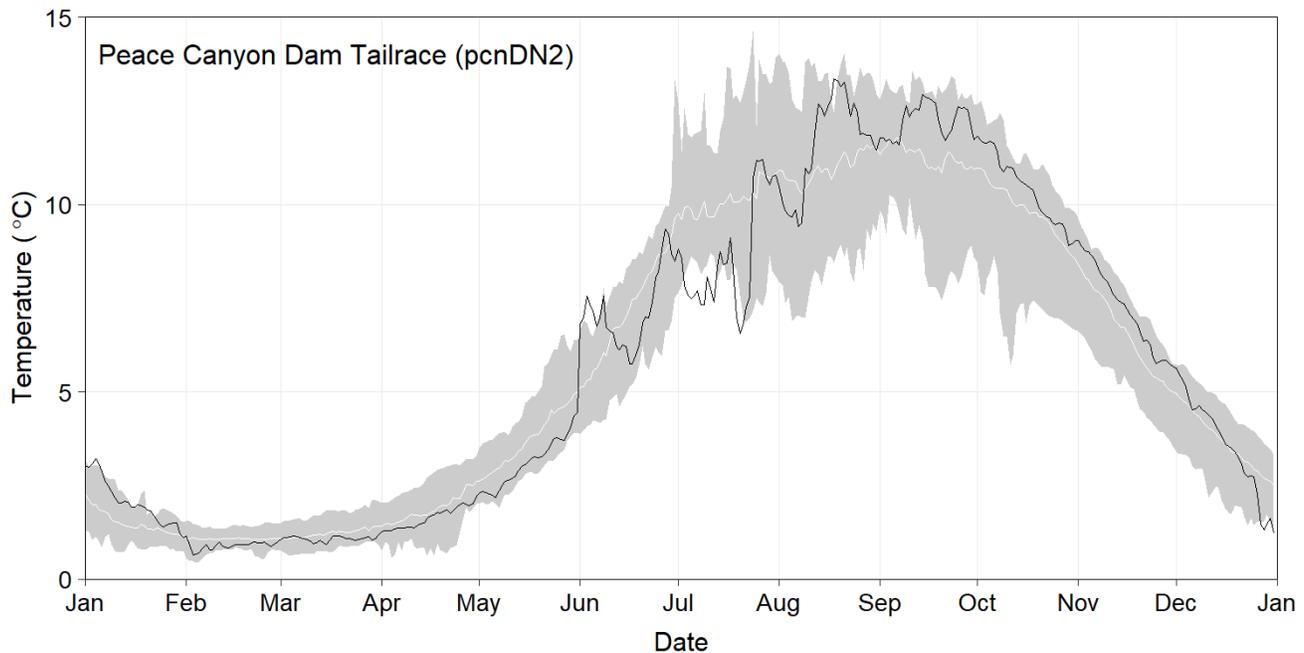


Figure 8: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace Canyon Dam (PCN) tailrace (pcnDN2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.2.2 Halfway River Confluence Area

In 2021, water temperatures in the Peace River were monitored at two different locations situated approximately 1 km upstream of the Halfway River's confluence with the Peace River. Station halfUP1 was located on the right bank and Station halfUP2 was located on the left bank. Field crews visited both stations on 10 May 2021, successfully downloading and redeploying both temperature loggers. During a site visit conducted on 3 May 2022, the field crew recovered both stations, which had metal housings. Replacement temperature loggers in ABS housings were installed at both the halfUP1 (serial # 20332123) and halfUP2 (serial # 21199315) stations.

For Station halfUP1 (Figure9), data were available from the beginning of 2021 to mid-May 2021 and then from mid-October to the end of 2021; this station was dewatered from mid-May to mid-October 2021. Station halfUP2 (Figure10) was dewatered for approximately one week in early June and dewatered intermittently between mid-August and mid-September.

Interannual comparisons of water temperature data for halfUP1 and halfUP2 are presented in Appendix B, Figures B7 and B8, respectively.

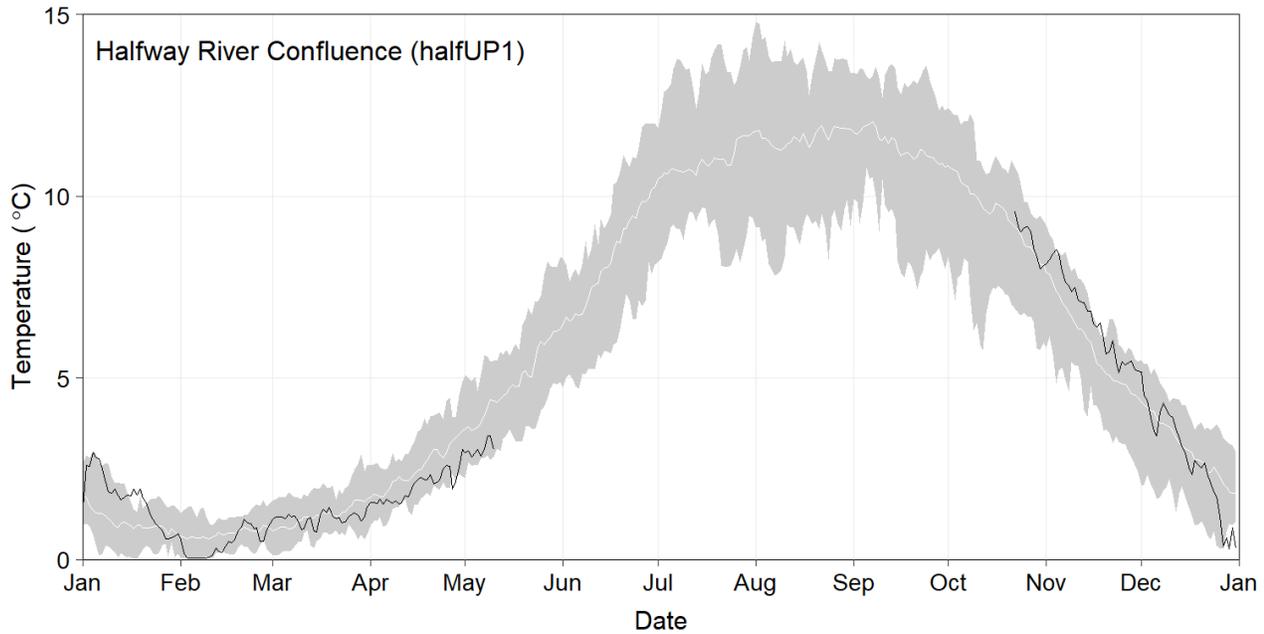


Figure 9: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Halfway River’s confluence with the Peace River (halfUP1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

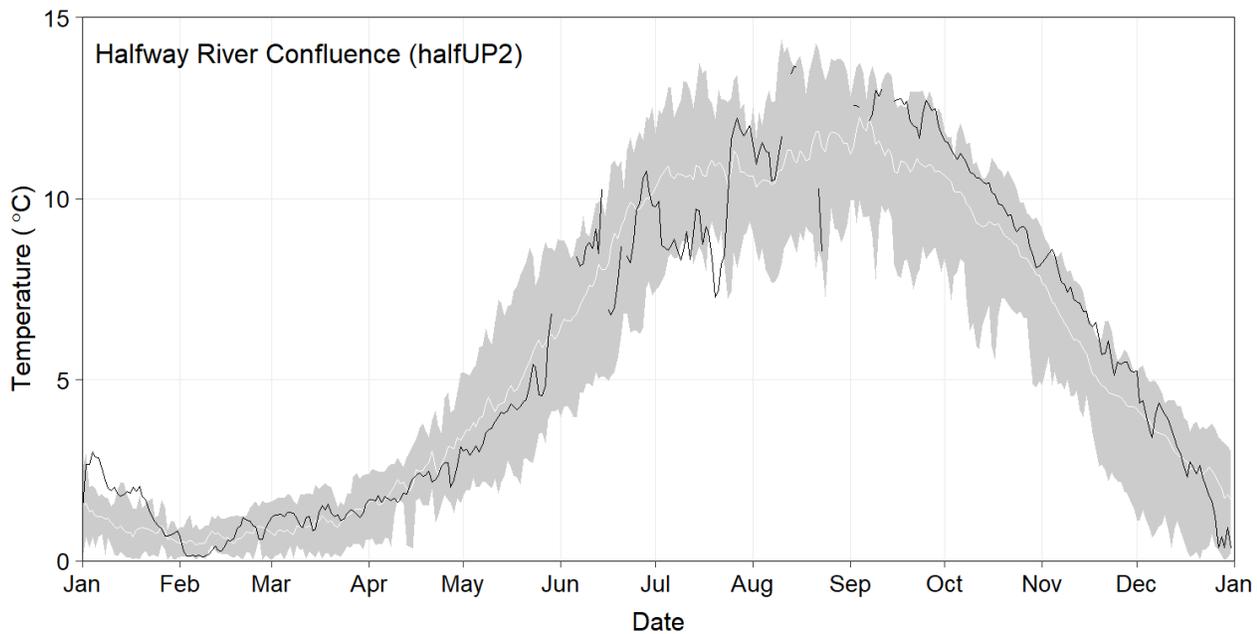


Figure 10: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Halfway River’s confluence with the Peace River (halfUP2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

Water temperatures in the Peace River were monitored at a single station on the left bank approximately 2.5 km downstream of the Halfway River's confluence with the Peace River (halfDN2; Figure 11). Field crews visited this station on 10 May 2021, successfully downloading and redeploying the halfDN2 temperature logger and a backup logger that was also installed at this station (halfDN2_BU). During a site visit conducted on 3 May 2022, the halfDN2 and halfDN2_BU stations were recovered. The halfDN2_BU temperature logger was replaced with a new logger (serial # 21199302) in an ABS housing. The halfDN2 station dewatered from late May to late June and from early August to late August of 2021. The backup logger dewatered less frequently, providing a more complete dataset for 2021. The data presented in Figure 11 are from the backup logger.

Interannual comparisons of water temperature data for halfDN2 are presented in Appendix B, Figure B9.

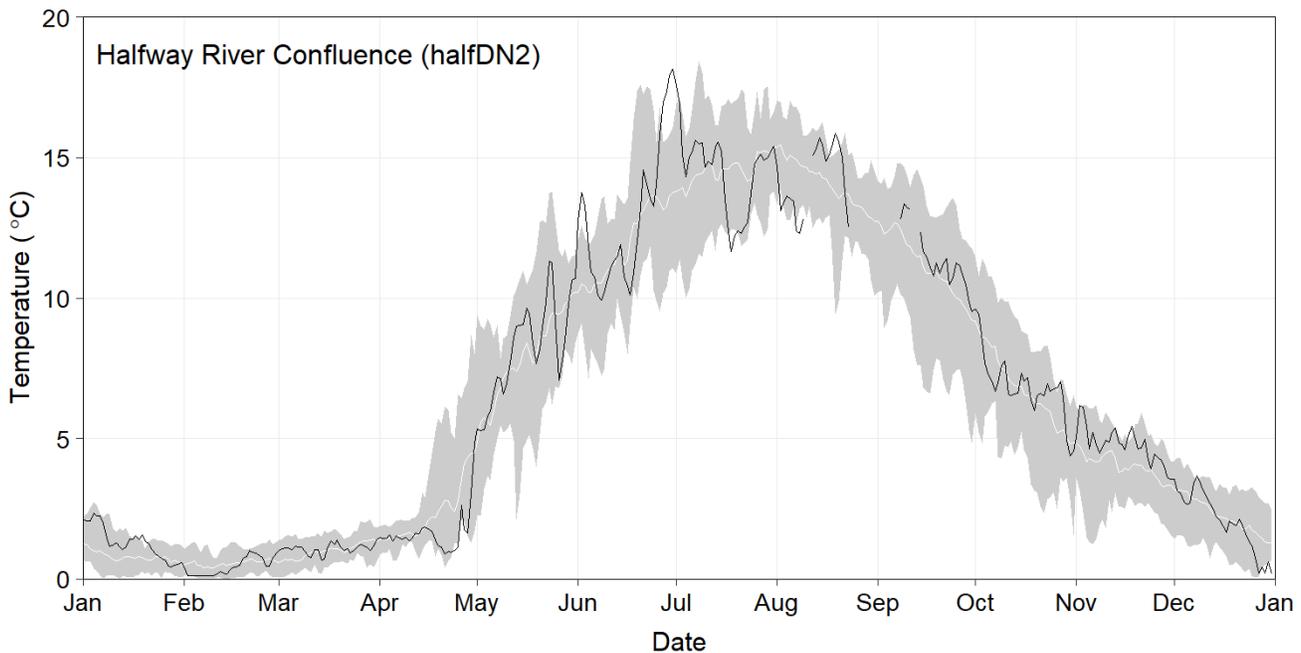


Figure 11: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River downstream of the Halfway River's confluence with the Peace River (halfDN2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.2.3 Bear Flats Area

In 2021, water temperatures in the Peace River were monitored at two different locations in the Bear Flats area situated approximately 18.0 km downstream of the Halfway River's confluence with the Peace River. Station BFlats_RDB was located on the right bank and Station BFlats_LDB was located on the left bank. These stations were first installed on 15 September 2020 (Golder 2021); data prior to this date are not available. These stations were intended to replace the previous stations mobUP1 and mobUP2, which were located closer to Site C but needed to be removed prior to river diversion because of construction activities. The two stations near Bear Flats provide an alternative location to monitor temperatures in the Peace River between the Halfway River and the Moberly River.

Field crews visited both stations on 10 May 2021, successfully downloading and redeploying both temperature loggers. During this site visit, the field crew noted that the BFlats_RDB temperature logger was out of the water when they arrived on site; it was redeployed into deeper water after it was downloaded. Field crews also visited both of these stations on 3 May 2022. During this site visit, the BFlats_LDB temperature logger was downloaded and redeployed. A replacement temperature logger (serial # 21164321) was deployed at BFlats_RDB in an ABS housing and the metal housing was returned to the warehouse where the temperature logger was subsequently recovered and downloaded.

Station BFlats_RDB dewatered from late May to mid-June 2021 and dewatered again from early August to mid-September (Figure12). Near-continuous data were available for this station for the remainder of 2021. Similar to Station BFlats_RDB, Station BFlats_LDB also dewatered from late May to mid-June 2021 and from early August to mid-September (Figure13). Station BFlats_LDB also dewatered for an approximately two-week period in early October. Near-continuous data were available for this station for the remainder of 2021.

Interannual comparisons of water temperature data for BFlats_RDB and BFlats_LDB are presented in Appendix B, Figures B10 and B11, respectively.

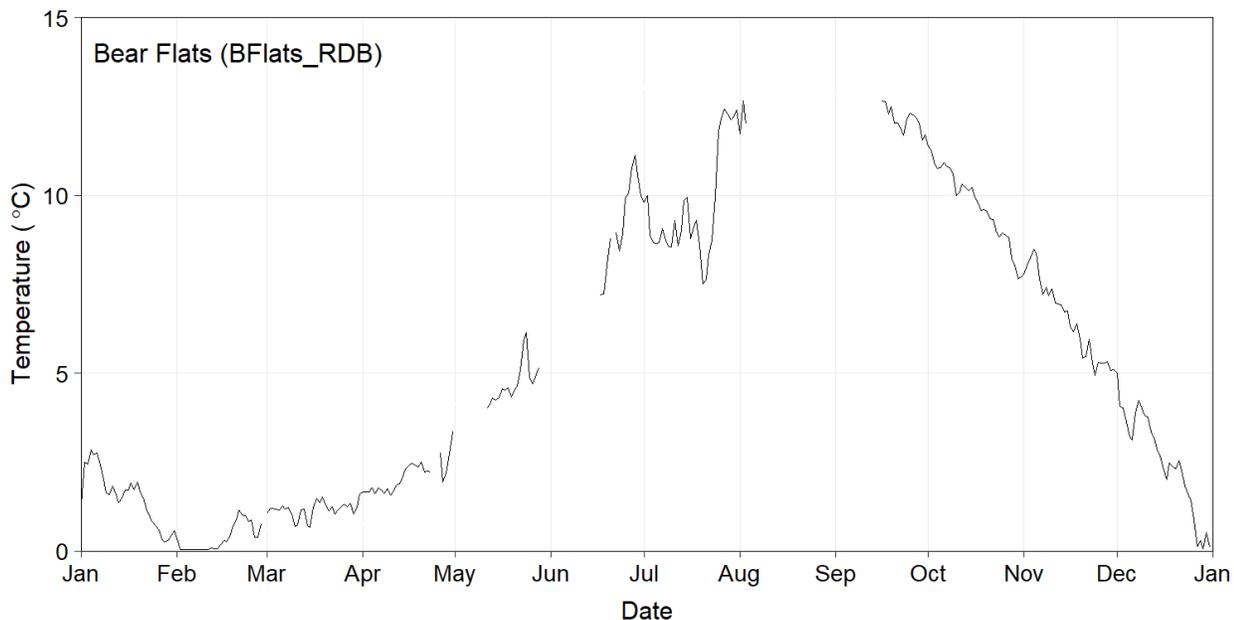


Figure 12: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River downstream of the Halfway River's confluence with the Peace River (BFlats_RDB; black line), 2021. This station was first installed in 2020; historical data are not available.

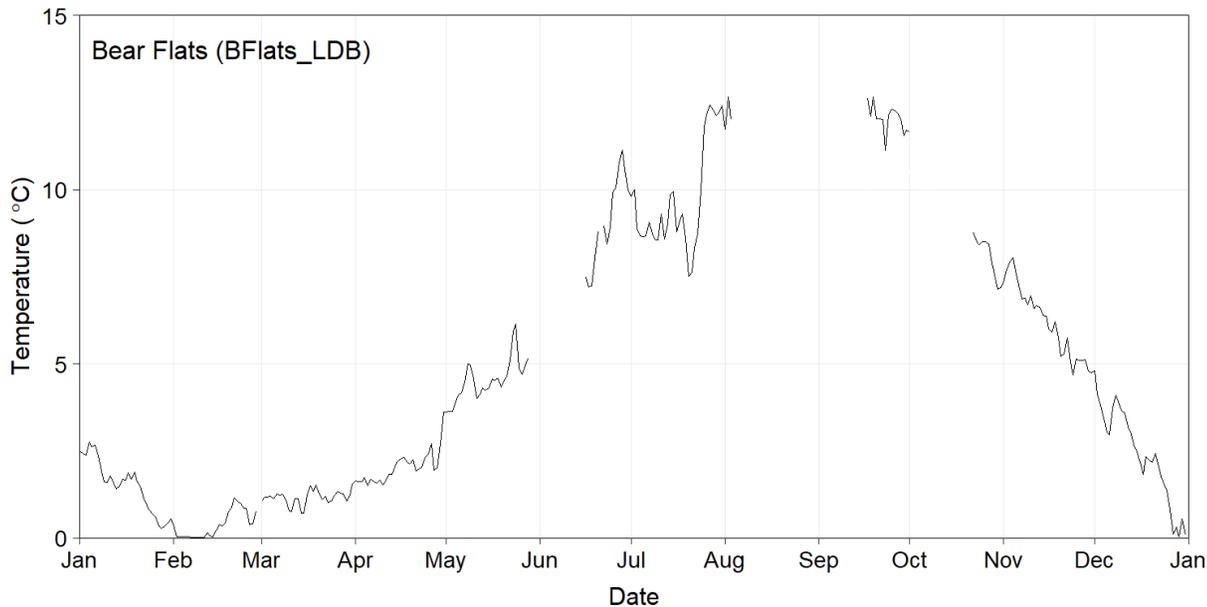


Figure 13: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River downstream of the Halfway River's confluence with the Peace River (BFlats_LDB; black line), 2021. This station was first installed in 2020; historical data are not available.

3.2.4 Pine River Confluence Area

In 2021, water temperatures in the Peace River were monitored at two different locations situated approximately 2.0 km upstream of the Pine River's confluence with the Peace River. Station pineUP1 was located on the right bank and Station pineUP2 was located on the left bank. Field crews visited these stations on 18 May 2021. During this site visit, the pineUP2 logger was successfully located, downloaded, and redeployed; however, the pineUP1 logger could not be located. Field crews conducted another site visit on 18 August 2021, at which time they recovered, downloaded, and redeployed the pineUP1 temperature logger. Both the pineUP1 and pineUP2 temperature loggers were also recovered and downloaded during a site visit conducted on 15 May 2022. The pineUP1 temperature logger (serial # 10669747) had a low battery and was replaced (replaced with serial # 10635067). During this site visit, the metal housings for pineUP1 and pineUP2 were replaced with ABS housings.

Data from Station pineUP1 were, at times, lower than 0°C in January and February 2021, which is indicative of the logger being out of the water, resulting in intermittent data during this period (Figure 15). Continuous data were available for this station from mid-February to the end of 2021. Continuous data were available for the duration of 2021 at Station pineUP2 (Figure 15).

Interannual comparisons of water temperature data for pineUP1 and pineUP2 are presented in Appendix B, Figures B12 and B13, respectively.

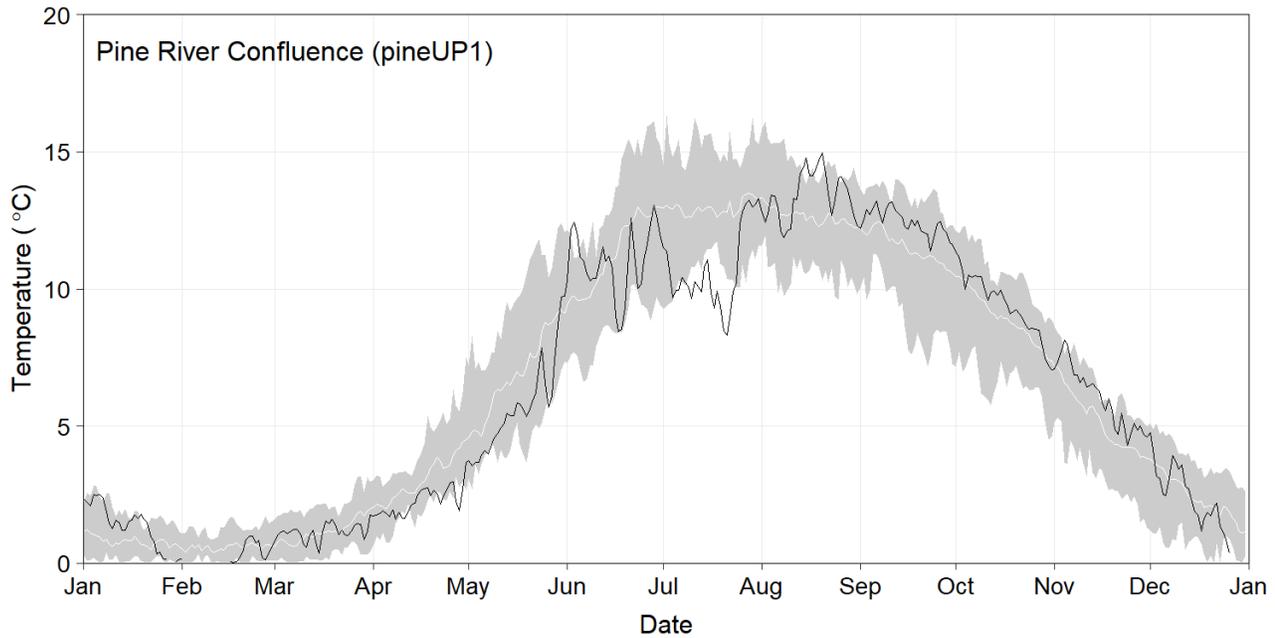


Figure 14: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Pine River’s confluence with the Peace River (pineUP1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

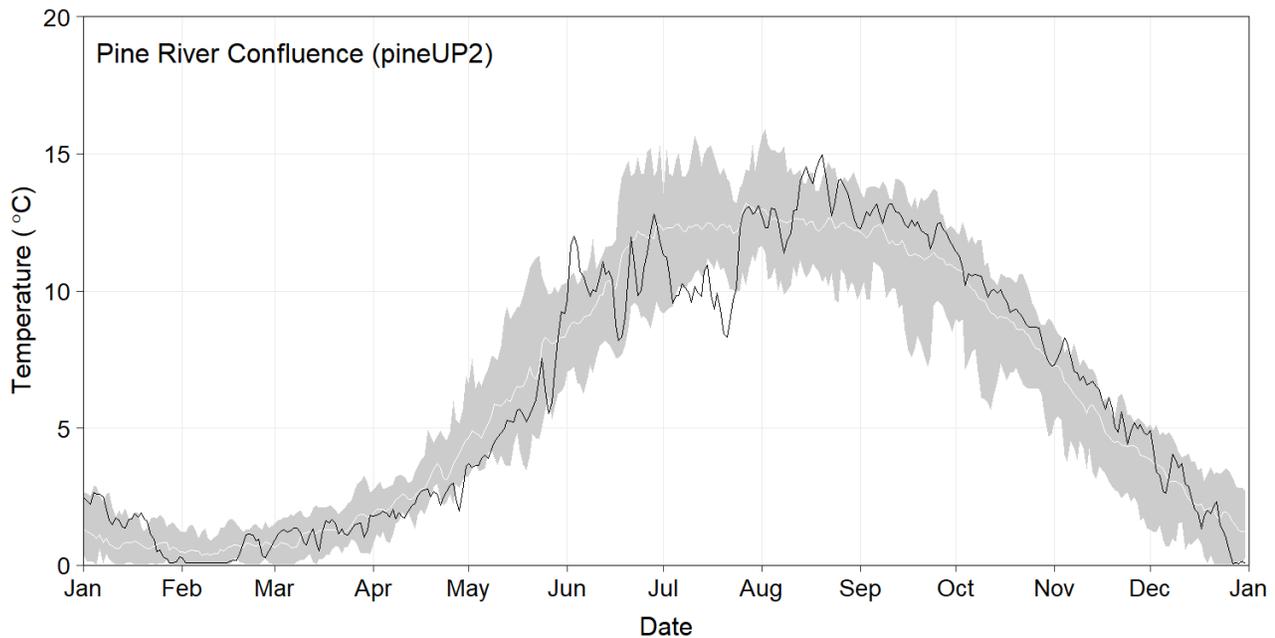


Figure 15: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Pine River’s confluence with the Peace River (pineUP2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

Water temperatures in the Peace River were monitored at a single station on the right bank approximately 6.5 km downstream of the Pine River's confluence with the Peace River (pineDN1; Figure 17). A second temperature logger (pineDN1_BU) provides a backup data source for this station. Temperature loggers at this station were recovered, downloaded, and redeployed during site visits conducted on 30 April 2021 and 17 May 2022. During the 17 May 2022 site visit, the station's metal housing was replaced with an ABS housing.

Data between January and June 2021 were not available for pineDN1, likely due to dewatering; therefore, data from the pineDN1 backup logger (i.e., pineDN1BU) were used for this time period.

Interannual comparisons of water temperature data for pineDN1 are presented in Appendix B, Figure B14.

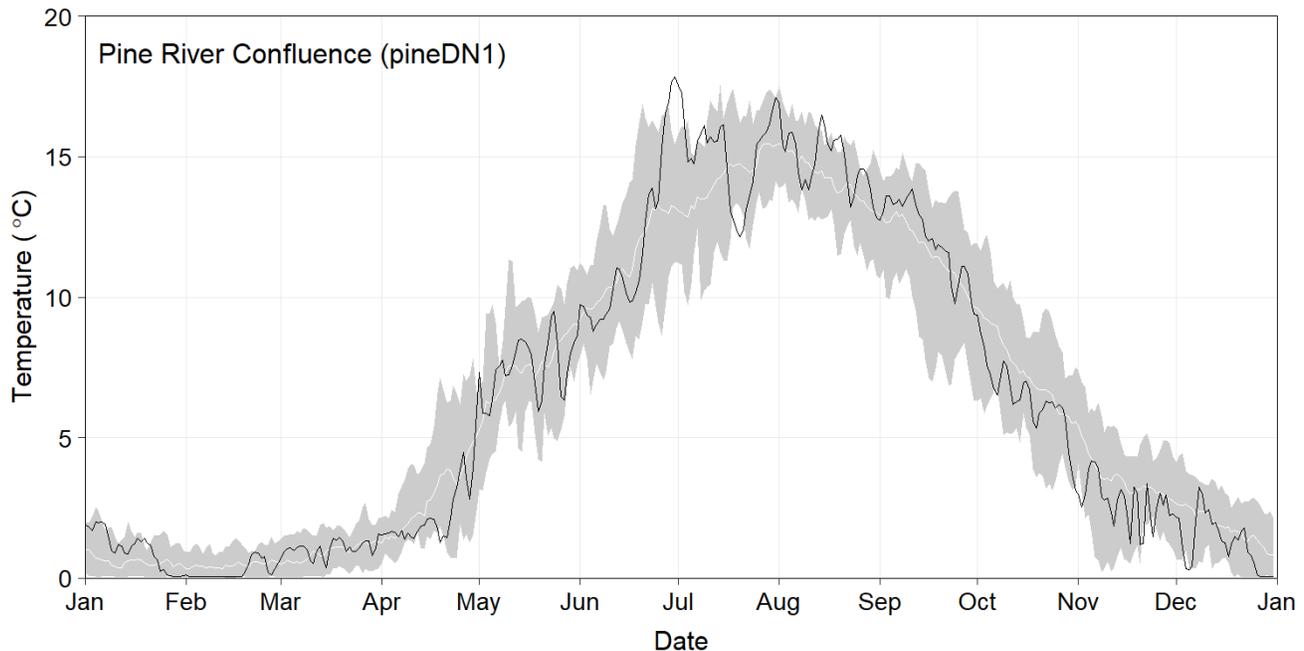


Figure 16: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River downstream of the Pine River's confluence with the Peace River (pineDN1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.2.5 Pouce Coupe River Confluence Area

In 2021, water temperatures in the Peace River were monitored at two different locations upstream of the Pouce Coupe River's confluence with the Peace River. Station pouceUP1 was located approximately 2.4 km upstream of the confluence on the right bank and Station pouceUP2 was located approximately 3.3 km upstream of the confluence on the left bank. Field crews visited both stations on 4 May 2021 and successfully recovered, downloaded, and redeployed both temperature loggers. During a site visit conducted on 25 September 2021, the pouceUP1 station was recovered, but the metal housing could not be opened. A replacement temperature logger (serial # 21163914) was deployed in an ABS housing and the metal housing was brought to the warehouse, where the temperature logger was recovered and downloaded. The pouceUP2 station was recovered and downloaded. Due to its low battery (56%), this temperature logger was replaced during this site visit (new serial # 21163914). During a site visit conducted on 16 May 2022, the field crew noted that the metal cable

securing the pouceUP1 temperature logger was severed; this temperature logger was not recovered and a replacement logger was installed (serial # 10887852). The pouceUP2 temperature logger was recovered, downloaded, and redeployed during this May 2022 site visit.

Data from Station pouceUP1 were highly variable from late January to mid-February and at times, were lower than 0°C, which are indicative of the logger being out of the water. As such, data are not available for this station during this time period (Figure 18). Data collected after the 4 May 2021 site visit are not available due to the severed cable noted during the subsequent site visit (see above).

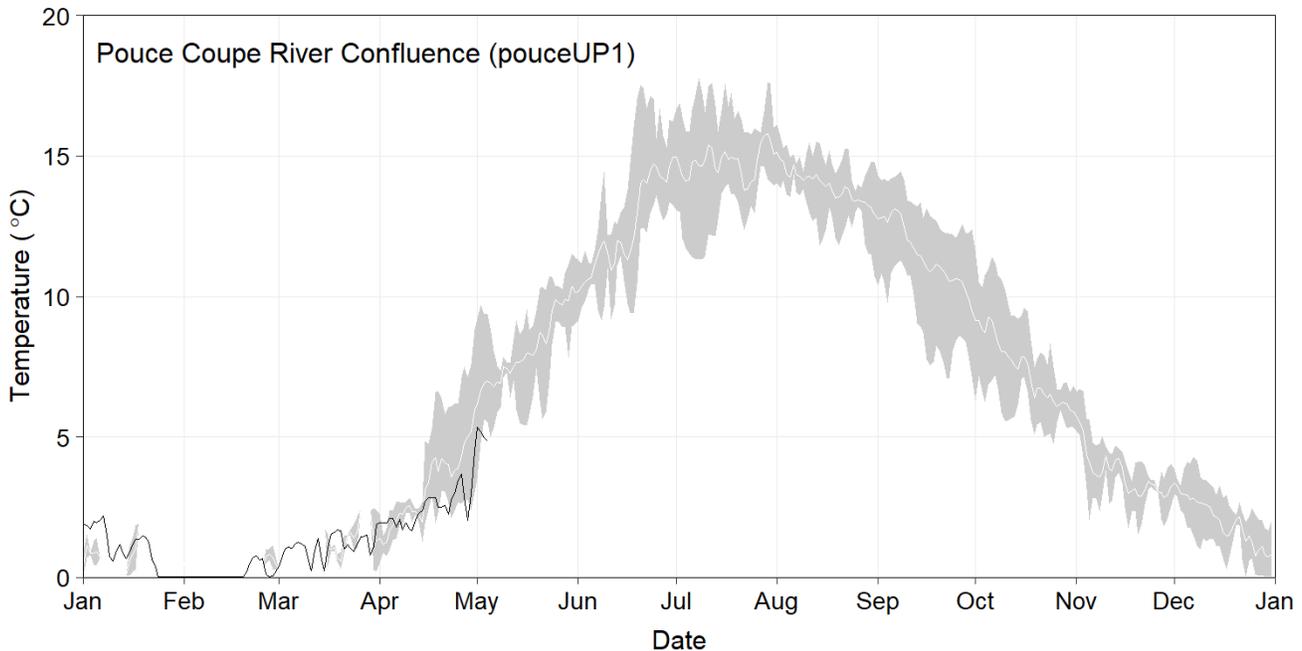


Figure 17: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Pouce Coupe River's confluence with the Peace River (pouceUP1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

Similar to Station pouceUP1, data from Station pouceUP2 suggested this logger was also out of the water from late January to mid-February (Figure 18). Data from late July to mid-September were considered spurious and removed from the dataset. During this time period, the temperature logger was likely dewatered for extended periods; however, this cannot be confirmed with the available data and the logger was underwater when the crew arrived on site in late September. Continuous data were available for this station from mid-September to the end of 2021.

Interannual comparisons of water temperature data for pouceUP1 and pouceUP2 are presented in Appendix B, Figures B15 and B16, respectively.

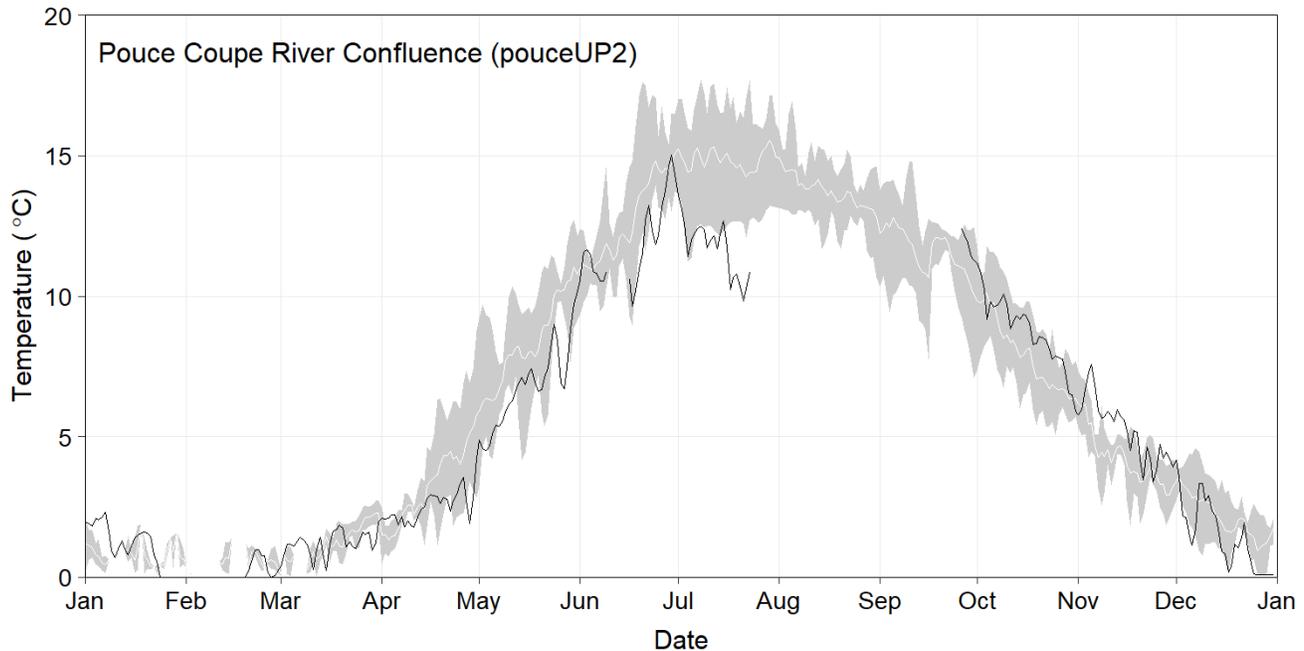


Figure 18: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Pouce Coupe River's confluence with the Peace River (pouceUP2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at the station between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3 Peace River Tributaries

In the spring of 2016, temperature loggers were installed in the mainstems of the Pine and Beatton rivers. In the summer of 2019, temperature loggers were installed in the mainstems of the Moberly River and Farrell Creek and in the mainstems of the following Halfway River tributaries: the Chowade River and Colt (a tributary to the Graham River), Cypress, Kobes, and Fiddes creeks. In the summer of 2020, temperature loggers were installed in the mainstem of Maurice Creek. Due to the remote location of most of these tributaries, some stations are only visited once per year in the summer when crews are in the area. For these remote stations, data from 2021 is from downloads that occurred in the summer of 2021 and summer of 2022. Data from each tributary are presented below.

3.3.1 Peace River Mainstem Tributaries

3.3.1.1 Maurice Creek

One station was established in Maurice Creek on 8 August 2020 approximately 1.0 km upstream of Maurice Creek's confluence with the Peace River. To provide a backup data source, two loggers were installed at this station (Maurice_1 and Maurice_2); however, only one logger (Maurice_1) was recovered when the station was visited on 3 August 2021 (Figure 19). During the site visit on July 31, 2022, one of the loggers was downloaded and the other logger was not recovered. The recovered logger was not redeployed because of insufficient battery. Two new loggers were deployed at the same station (serial # 21418950 and serial # 21418911).

Interannual comparisons of water temperature data for Maurice Creek are presented in Appendix B, Figure B17.

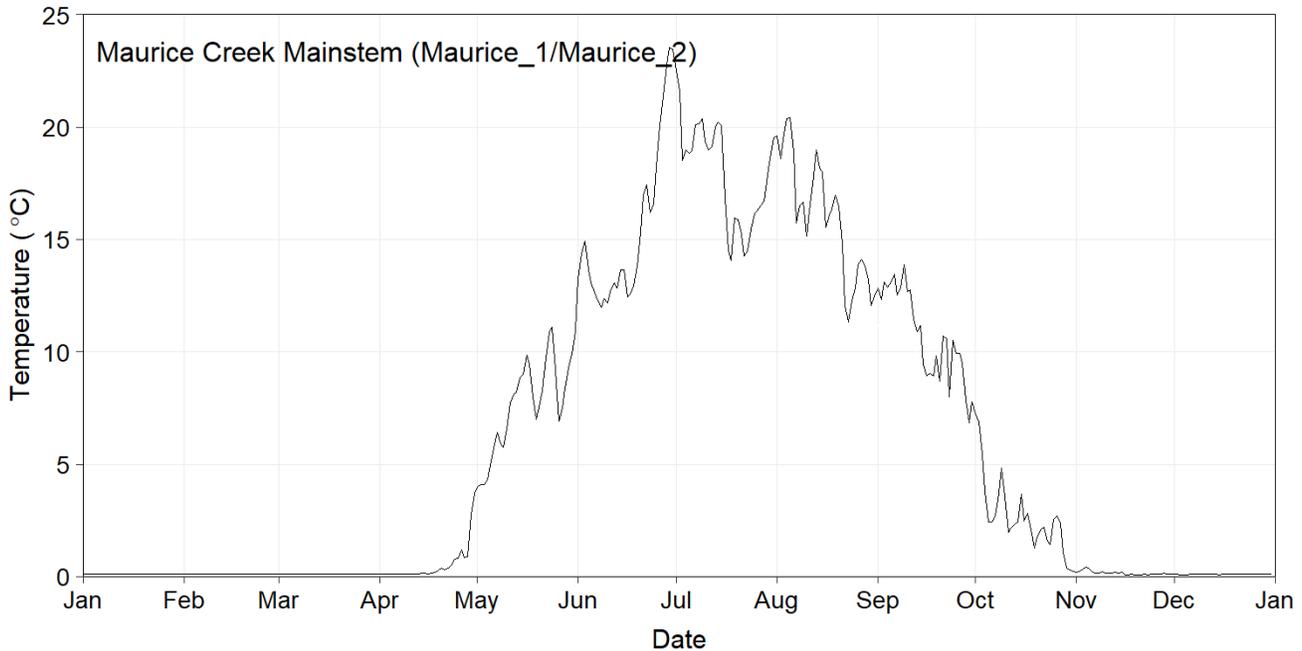


Figure 19: Mean daily water temperature (°C) for Maurice Creek (Maurice; black line), 2021.

3.3.1.2 Farrell Creek

In 2021, water temperatures in Farrell Creek were monitored at one location situated approximately 62.5 km upstream of Farrell Creek’s confluence with the Peace River. To provide a backup data source, two different loggers were installed at this location (Farrell_1 and Farrell_2). Field crews visited this station on 18 July 2021 and recovered both loggers. A computer-related issue (incorrect software drivers) prevented them from downloading both loggers; they were redeployed without being downloaded. Both loggers were recovered, downloaded, and redeployed during a subsequent site visit on 2 August 2021. A third logger was installed as an additional backup on 2 August 2021. On 4 August 2022, all three loggers were successfully downloaded and redeployed.

Continuous temperature data are available for Farrell Creek for the entire year in 2021 (Figure20).

Interannual comparisons of water temperature data for Farrell Creek are presented in Appendix B, Figure B18.

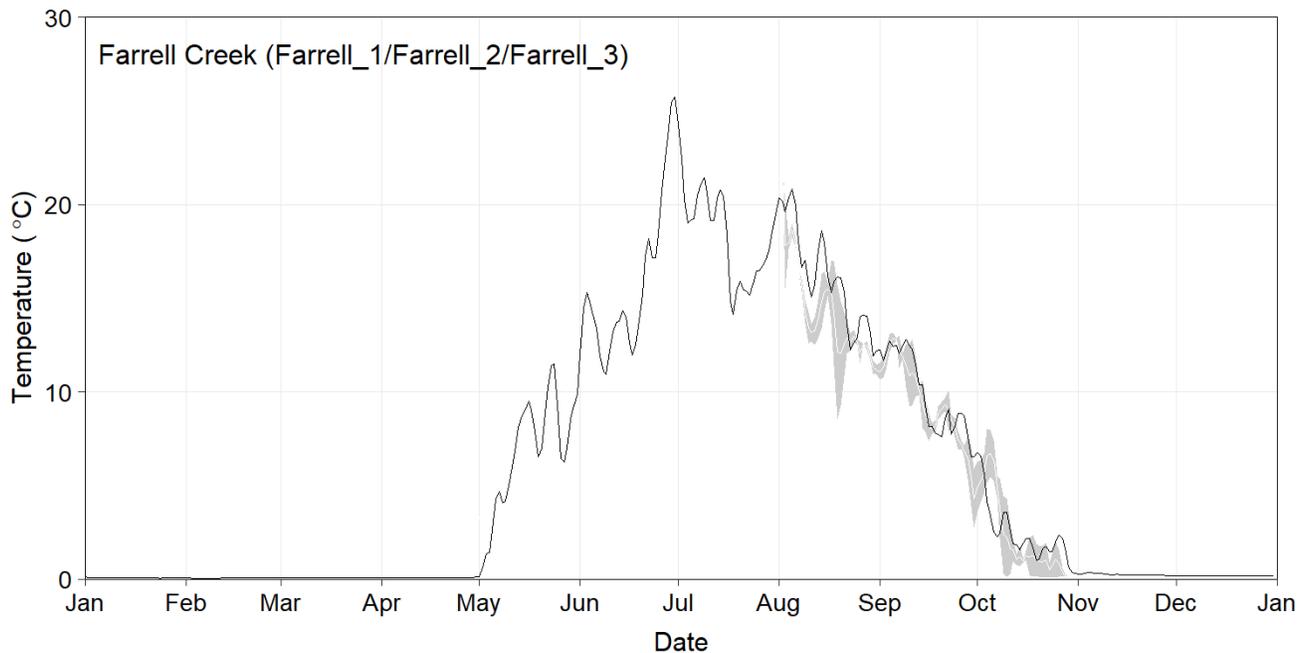


Figure 20: Mean daily water temperature (°C) for Farrell Creek (Farrell_1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at these stations between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.1.3 Moberly River

In 2021, water temperatures in the Moberly River were monitored at one location situated approximately 42.6 km upstream of the Moberly River's confluence with the Peace River (i.e., near the North Monias Road Bridge). To provide a backup data source, two temperature loggers (Moberly_1 and Moberly_2) were installed at this station. Field crews visited the Moberly River station on 30 July 2021. The Moberly_1 temperature logger was successfully downloaded and redeployed; however, the Moberly_2 temperature logger could not be located. A new temperature logger (serial # 21065252) was installed to replace this missing temperature logger. During this site visit, an additional two temperature loggers (serial # 21065251 and serial # 21065264) were installed to provide additional data sources at this location. During the site visit in the summer of 2022, none of the four loggers were retrieved. Three of the loggers had cables that had been severed and the fourth logger had large rip-rap boulders that had fallen onto the cable and preventing retrieval. New loggers were deployed on the right bank (serial # 21418934) and left bank (serial # 21418936).

Continuous data are available for this station from 1 January to 30 July in 2021 (Figure 21). Data are not available for the remainder of the year because none of the four loggers were recovered.

Interannual comparisons of water temperature data for the Moberly River are presented in Appendix B, Figure B19.

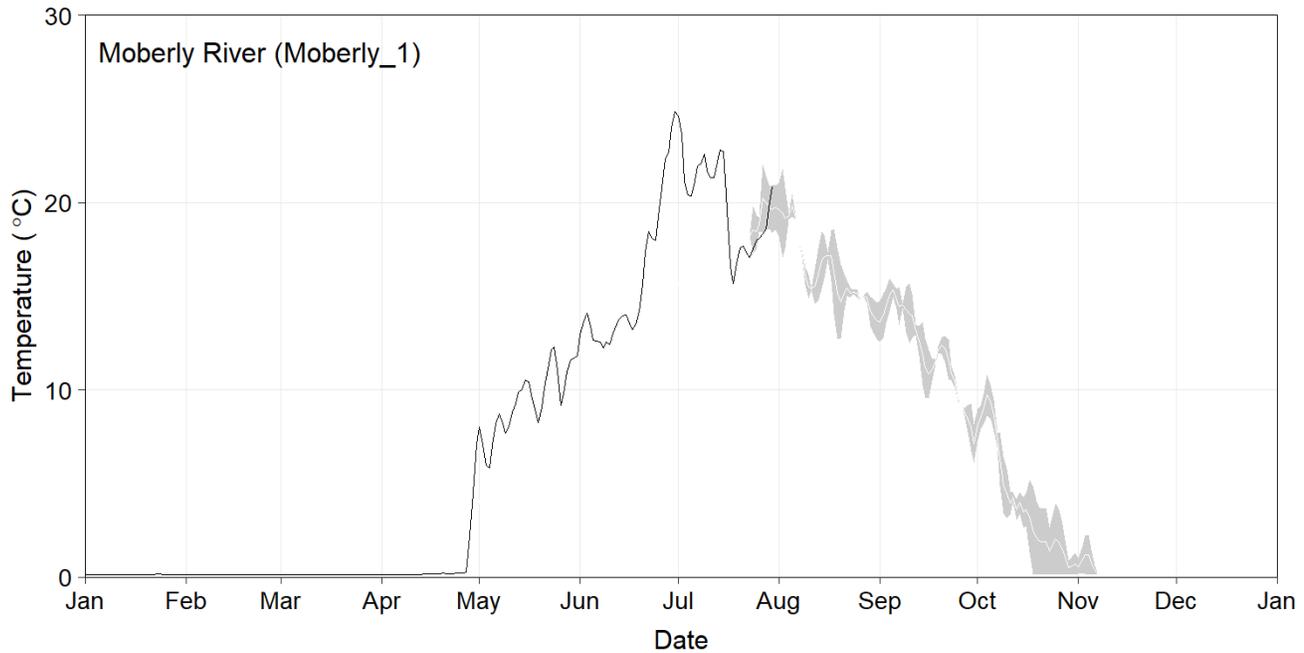


Figure 21: Mean daily water temperature (°C) for the Moberly River (Moberly_1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at these stations between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.1.4 Pine River

In 2021, water temperatures in the Pine River were monitored at one location situated on the left bank of the river approximately 1.5 km upstream of the Pine River’s confluence with the Peace River. To provide a backup data source, two temperature loggers (pineMS1 and pineMS2) were installed at this station. Stations pineMS1 and pineMS2 were recovered (18 and 19 August 2022, respectively) and redeployed (19 August 2022 and 2 September 2022, respectively) with ABS housings. The pineMS1 and pineMS2 temperature loggers were also recovered, downloaded, and redeployed during a site visit conducted on 15 May 2022.

Continuous data were available at this station for the entire year in 2021 (Figure22).

Interannual comparisons of water temperature data for the Pine River are presented in Appendix B, Figure B20.

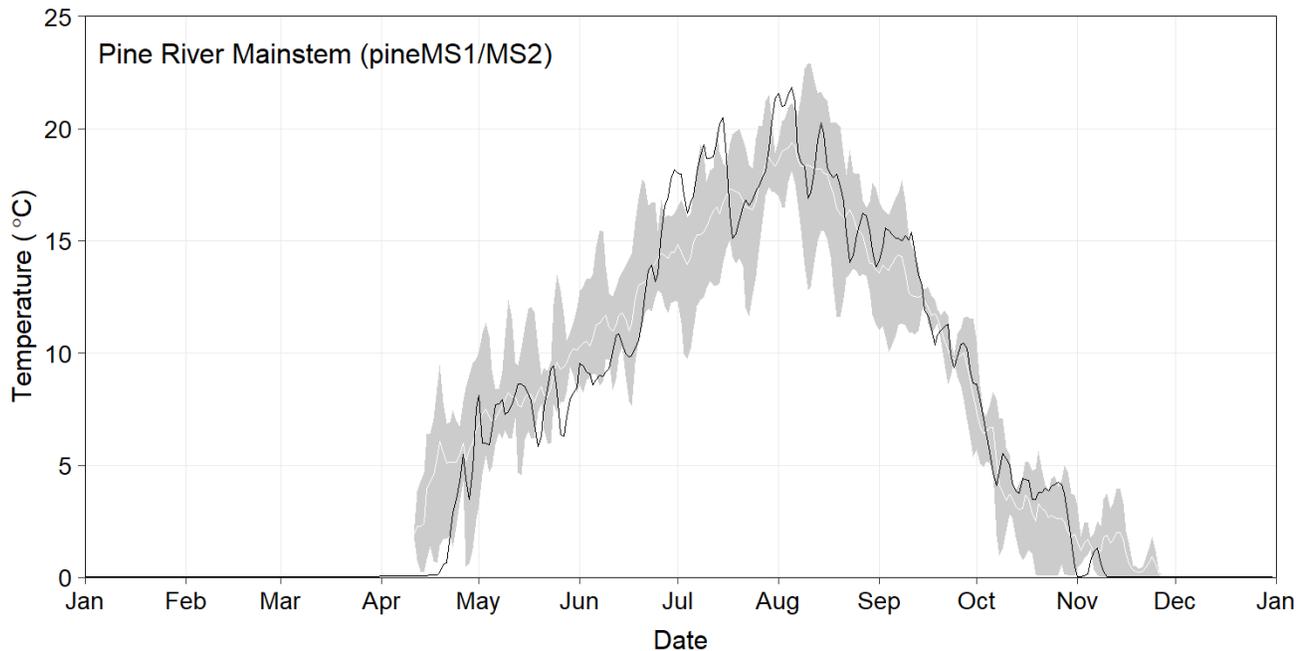


Figure 22: Mean daily water temperature (°C) for the Pine River (PineMS1 and PineMS2 combined; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at these stations between 2016 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.1.5 *Beaton River*

In 2021, water temperatures in the Beaton River were monitored at one location situated on the left bank of the river approximately 1.0 km upstream of the Beaton River's confluence with the Peace River. To provide a backup data source, two temperature loggers (BeatMS1 and BeatMS2) were installed at this station. Field crews retrieved both temperature loggers during a site visit conducted on 30 April 2021. Neither temperature loggers would download and staff noted condensation inside both loggers. The faulty temperature logger for BeatMS1 (serial # 20182029) was replaced with a new temperature logger (serial # 20182025) and the faulty temperature logger for BeatMS2 (serial # 20182025) was also replaced with a new temperature logger (serial # 20182028). The two faulty temperature loggers were returned to the manufacturer for potential data recovery; however, the recovery was unsuccessful. The BeatMS1 and BeatMS2 loggers could not be recovered during a site visit conducted in October 2021. During a site visit conducted on 15 May 2022, the field crew noted that the metal cables securing the two loggers to shore were both broken. The faulty temperature loggers, coupled with two lost temperature loggers, resulted in the complete loss of temperature data for the Beaton River mainstem in 2021. On 17 May 2022, new loggers were installed at BeatMS1 (serial # 21163866) and BeatMS2 (serial # 21164322).

While water temperature data for the Beaton River are not available for 2021, interannual comparisons of water temperature data for the Beaton River during previous study years are provided in Appendix B, Figure B21.

3.3.2 Halfway River Tributaries

3.3.2.1 Fiddes Creek

In 2021, water temperatures in Fiddes Creek were monitored at one location approximately 7.2 km upstream of Fiddes Creeks' confluence with the Halfway River. To provide a backup data source, two temperature loggers (Fiddes_1 and Fiddes_2) were installed at this station. Both temperature loggers were downloaded on 31 July 2021 and 2 August 2022.

From early February to late April, recorded temperatures were consistently less than 0°C, suggesting that the loggers were frozen in ice. Continuous data were available from early May to end of 2021 (Figure 23).

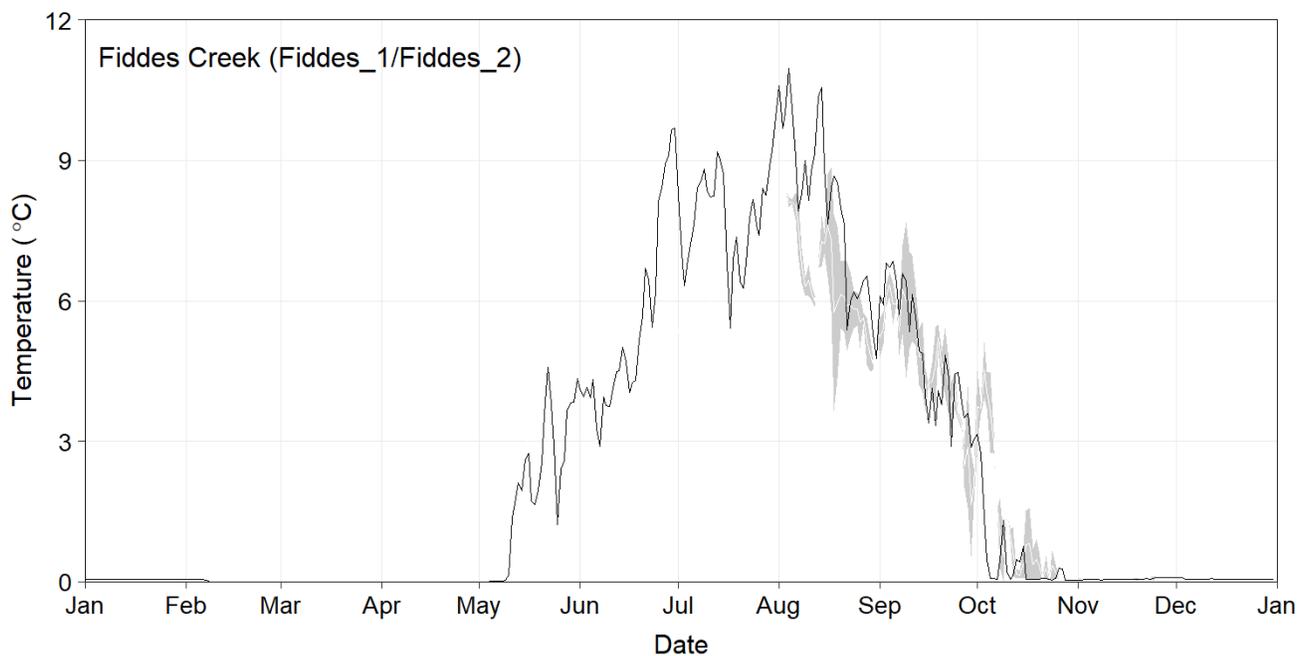


Figure 23: Mean daily water temperature (°C) for Fiddes Creek (Fiddes_1 and Fiddes_2; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at this station between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.2.2 Cypress Creek

In 2021, water temperatures in Cypress Creek were monitored at one location approximately 17.6 km upstream of Cypress Creeks' confluence with the Halfway River. To provide a backup data source, two temperature loggers (Cypress_1 and Cypress_2) were installed at this station. These temperature loggers were assessed during a site visit conducted on 31 July 2021. At the time of that visit, only one logger was found and downloaded. Field crews deployed two additional loggers at this location to provide additional backup data sources (serial # 21065261 and serial # 21065250). On 28 July 2022, two loggers were successfully retrieved, downloaded, and redeployed.

Temperature values below zero suggest that the logger was frozen in ice or out of water from early January to late April 2021 (Figure 25). Continuous data were available from late April to end of 2021.

Interannual comparisons of water temperature data for Cypress Creek are presented in Appendix B, Figure B22.

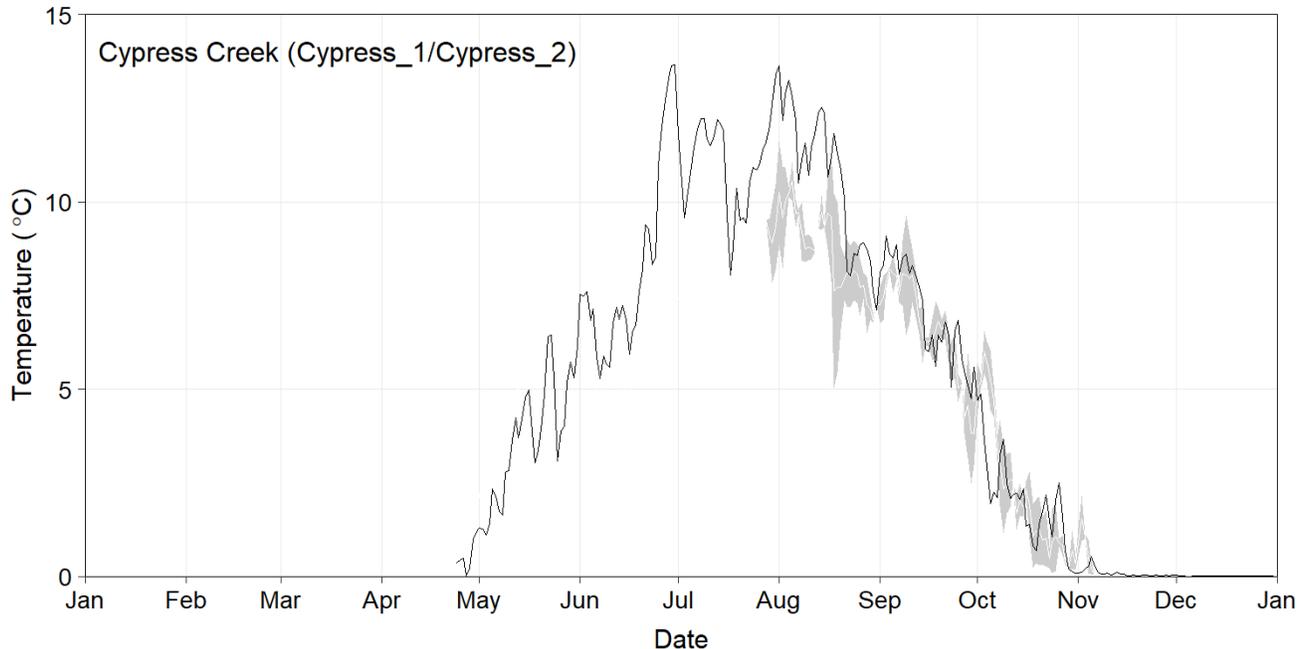


Figure 24: Mean daily water temperature (°C) for Cypress Creek (Cypress_1; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at this station between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.2.3 Chowade River

In 2021, water temperatures in the Chowade River were monitored at one location approximately 20.9 km upstream of the Chowade River's confluence with the Halfway River. To provide a backup data source, two temperature loggers (Chowade_1 and Chowade_2) were installed at this station. These loggers were assessed during a site visit conducted on 31 July 2021. Both loggers were found out of water at the time of the site visit but were successfully downloaded and redeployed into deeper water. To provide additional backup data sources, two additional loggers were installed at this station (serial # 21065253 and serial # 21065260). On 28 July 2022, three of the loggers were retrieved, downloaded, and redeployed and the fourth logger was missing.

A review of the data suggests that both temperature loggers downloaded in 2021 were frozen in ice or were out of water from early January to late April 2021. Continuous data were available from late April to late July and from early August to end of 2021. Data from Chowade_1, Chowade_2, and Chowade_4 are combined and presented in Figure 26.

Interannual comparisons of water temperature data for the Chowade River are presented in Appendix B, Figure B23.

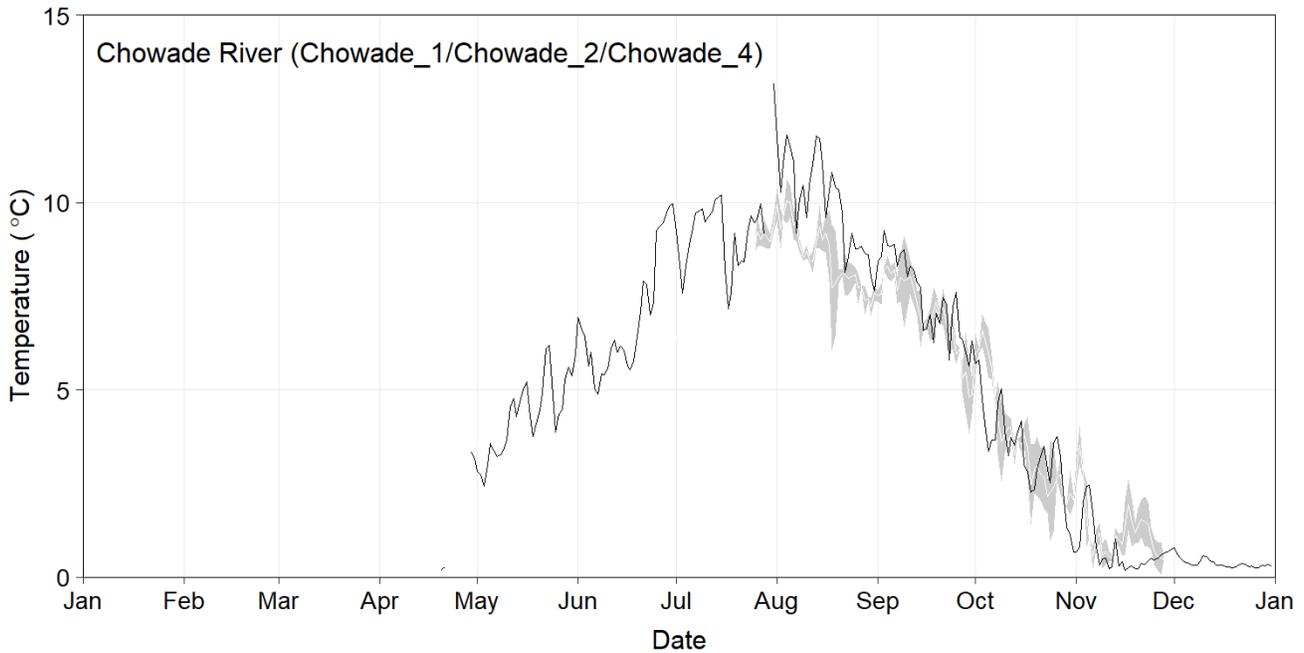


Figure 25: Mean daily water temperature (°C) for the Chowade River (Chowade_1, Chowade_2, and Chowade_4 combined; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at this station between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.2.4 *Colt Creek*

In 2021, water temperatures in Colt Creek were monitored at one location approximately 3.1 km upstream of Colt Creek’s confluence with the Graham River. To provide a backup data source, two temperature loggers (Colt_1 and Colt_2) were installed at this station. These loggers were assessed during a site visit conducted on 23 July 2021. Both loggers were located and downloaded during this site visit. Two additional loggers (serial # 21087158 and serial # 21065263) were installed to provide additional backup data sources at this location. On 30 July 2022, all four loggers were retrieved, downloaded, and redeployed.

Continuous data were available for the whole year in 2021. Data from Colt_1, Colt_2, Colt_3, and Colt_4 are combined and presented in Figure27.

Interannual comparisons of water temperature data for Colt Creek are presented in Appendix B, Figure B23.

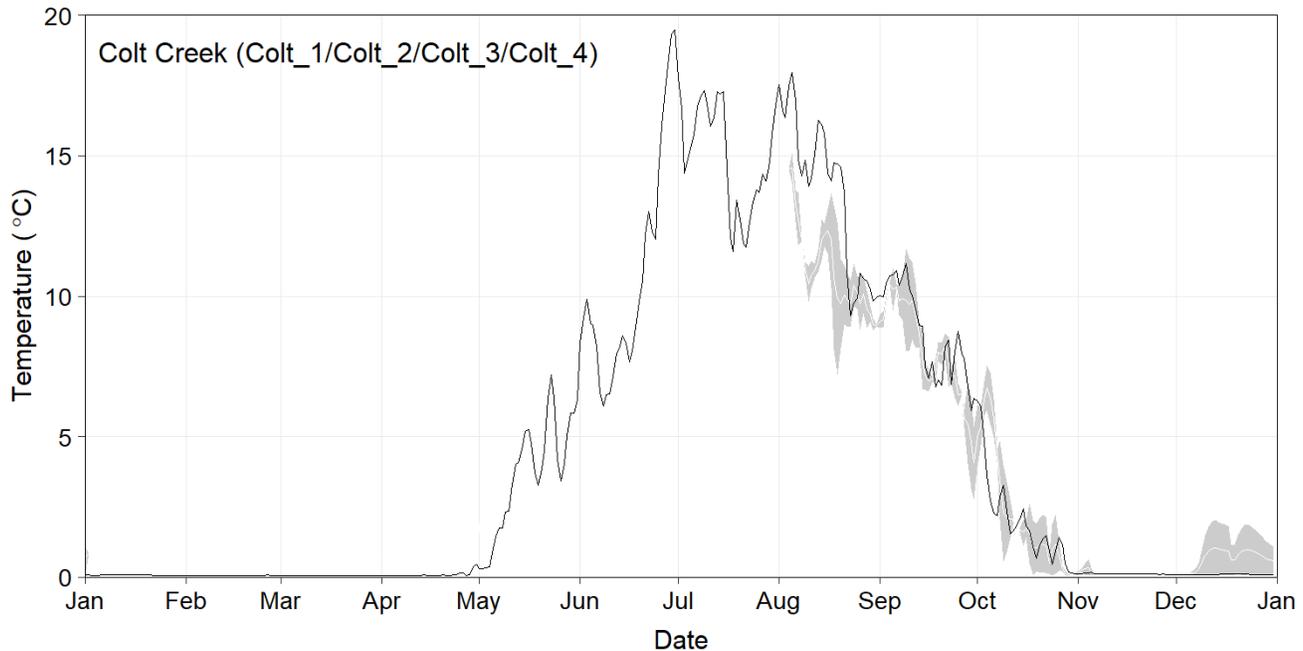


Figure 26: Mean daily water temperature (°C) for Colt Creek (Colt_1, Colt_2, Colt_3, and Colt_4; black line), 2021. The shaded area represents minimum and maximum water temperatures recorded at this station between 2019 and 2020. The white line represents average mean daily water temperatures over the same period.

3.3.2.5 Kobes Creek

In 2021, water temperatures in Kobes Creek were monitored at one location approximately 11.0 km upstream of Kobes Creek's confluence with the Halfway River. To provide a backup data source, two temperature loggers (Kobes_1 and Kobes_2) were installed at this station. These loggers were assessed during a site visit conducted on 23 July 2021. Both loggers were located and downloaded during this site visit and two additional loggers were deployed as back-up. On 3 August 2022, all four loggers were retrieved, and three of the loggers were successfully downloaded; two of these were redeployed and one was replaced because of low battery (new serial # 10930722). The fourth logger did not provide useable data due to software malfunction and was redeployed.

Continuous data were available for this station for the whole year in 2021 (Figure 27).

Interannual comparisons of water temperature data for Kobes Creek are presented in Appendix B, Figure B25.

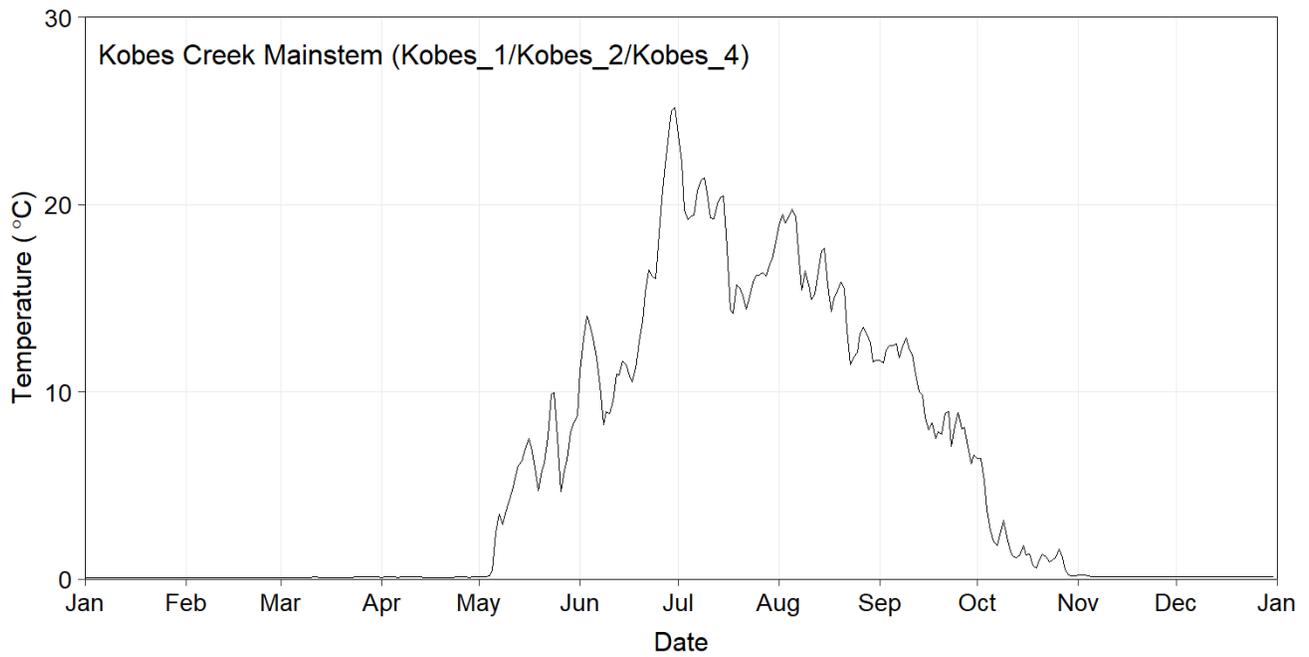


Figure 27: Mean daily water temperature (°C) for Kobes Creek (Kobes_1, Kobes_2, Kobes_3 combined; black line), 2021.

4.0 DISCUSSION

The 2021 study was the sixth year of the Site C Reservoir and Peace River Water Temperature Monitoring Program (Task 2b), a multi-year water temperature monitoring program at select Peace River mainstem and Peace River tributary locations. When coupled with water temperature data collected under BC Hydro's WLR Peace River Baseline TDG and Temperature Monitoring Program (GMSWORK-2), a near-continuous water temperature dataset exists for select locations from 2008 through to 2021.

Task 2b is not intended to address specific management questions or hypotheses under the FAHMFP. Instead, temperature data collected under Task 2b provides information to diagnose causes of observed changes in other FAHMFP programs (i.e., Site C Reservoir Fish Community Monitoring Program [Mon-1a], Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program [Mon-1b], and Peace River Fish Community Monitoring Program [Mon-2]) designed to monitor key indicator species of the Peace River.

5.0 CLOSURE

We trust that this report provides the information required. If there are any questions or require further detail, please contact the undersigned.

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Senior Fisheries Biologist



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DF/SR/syd

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APPENDIX A

**Water Temperature Monitoring
Station Location Data**

Table A1 Summary of Peace River Water Temperature Monitoring station locations, 2021. Loggers are presented in upstream to downstream order

Station Name	River Km ^a	Stream Name	Location Description	First Year of Monitoring	Current Serial Number	Battery (%) ^b	UTM Coordinates			Comment
							Zone	Easting	Northing	
gmsUP1	-1.0	Peace River	WAC Bennett Forebay - Shallow	2008	10676155	100%	10V	548841	6209022	
gmsUP2	-1.0	Peace River	WAC Bennett Forebay - Deep	2008	10676160	100%	10V	548841	6209022	
gmsDN1	0.7	Peace River	GMS Tailrace - LDB	2008	10635063	100%	10V	548881	6207761	
gmsDN1BU	0.7	Peace River	GMS Tailrace - LDB	2008	20332152	86%	10V	548881	6207761	
gmsDN2	0.7	Peace River	GMS Tailrace - RDB	2008	10669739	86%	10V	548828	6207836	
gmsDN2BU	0.7	Peace River	GMS Tailrace - RDB	2008	20332121	100%	10V	548828	6207836	
pcnUP1	19.9	Peace River	Peace Canyon Forebay - Shallow	2008	10635067	100%	10U	562710	6204068	
pcnDN2	20.8	Peace River	Peace Canyon Tailrace - LDB	2008	10156317	86%	10U	562803	6204854	
pcnDN2BU	20.8	Peace River	Peace Canyon Tailrace - LDB	2008	10635061	86%	10U	562803	6204854	
HalfUP1	64.0	Peace River	Halfway Confluence – RDB upstream	2008	20332123	100%	10V	595165	6230094	Serial # 20332123 was replaced in May 2022.
HalfUP2	64.3	Peace River	Halfway Confluence – LDB upstream	2008	21199315	93%	10V	595569	6230541	Serial # 20030829 was replaced in May 2022.
HalfDN2	68.3	Peace River	Halfway Confluence – LDB downstream	2008	10669748	86%	10V	598313	6232378	
HalfDN2BU	68.3	Peace River	Halfway Confluence – LDB downstream	2008	21199302	100%	10V	598286	6232332	Serial # 20182030 was replaced in May 2022.
BFlats_RDB	83.5	Peace River	Peace River – Bear Flats RDB	2020	21164321	100%	10V	611280	6237044	Serial # 10887852 was replaced in May 2022.
BFlats_LDB	83.5	Peace River	Peace River – Bear Flats LDB	2020	20655180	93%	10V	611453	6237303	
PineUP1	119.5	Peace River	Pine Confluence - RDB upstream	2008	10635067	73%	10V	641034	6225375	Serial # 10669747 was replaced in May 2022.
PineUP2	120.0	Peace River	Pine Confluence - LDB upstream	2008	20655135	93%	10V	641653	6225304	
PineDN1	126.8	Peace River	Pine Confluence - RDB downstream	2008	20655185	93%	10V	648073	6222796	
PineDN1BU	126.9	Peace River	Pine Confluence - RDB downstream	2008	10893055	86%	10V	648362	6222823	
PouceUP1	171.4	Peace River	Pouce Coupe confluence - RDB upstream	2016	10887852	100%	11V	316873	6225211	Serial # 20655184 was replaced in May 2022.
PouceUP2	170.5	Peace River	Pouce Coupe confluence - LDB upstream	2016	21163914	86%	11V	315887	6226158	
Maurice_1	0.8	Maurice Creek	Approximately 1.0 km upstream from confluence	2020	20182301	-	10V	568663	6209018	
Maurice_2	0.8	Maurice Creek	Approximately 1.0 km upstream from confluence	2020	20823375	-	10V	568663	6209018	
Farrell_1	62.5	Farrell Creek	Downstream of Kobes Creek Road bridge	2019	20615716	-	10V	572332	6239949	
Farrell_2	62.5	Farrell Creek	Downstream of Kobes Creek Road bridge	2019	20655128	-	10V	572332	6239949	
Fiddes_1 ^c	7.2	Fiddes Creek	Approximately 7.2 km upstream from confluence	2019	20615751	100%	10V	479836	6311013	
Fiddes_2 ^c	7.2	Fiddes Creek	Approximately 7.2 km upstream from confluence	2019	20562511	100%	10V	479836	6311013	
Cypress_1 ^c	17.6	Cypress Creek	Upstream of Cypress Creek bridge	2019	20562503	-	10V	511008	6301673	
Cypress_2 ^c	17.6	Cypress Creek	Upstream of Cypress Creek bridge	2019	20655127	-	10V	511008	6301673	
Cypress_3 ^c	17.6	Cypress Creek	Upstream of Cypress Creek bridge	2021	21065250	100%	10V	511008	6301673	New station installed on 31 July 2021.
Cypress_4 ^c	17.6	Cypress Creek	Upstream of Cypress Creek bridge	2021	21065261	100%	10V	511008	6301673	New station installed on 31 July 2021.
Chowade_1 ^c	20.9	Chowade River	Downstream of Chowade River bridge	2019	20615714	-	10V	513503	6284788	
Chowade_2 ^c	20.9	Chowade River	Downstream of Chowade River bridge	2019	20615748	-	10V	513507	6284799	
Chowade_3 ^c	20.9	Chowade River	Downstream of Chowade River bridge	2021	21065253	100%	10V	513507	6284799	New station installed on 31 July 2021.
Chowade_4 ^c	20.9	Chowade River	Downstream of Chowade River bridge	2021	21065260	100%	10V	513507	6284799	New station installed on 31 July 2021.
Colt_1 ^c	3.1	Colt Creek	Upstream of Mile 95 Road bridge	2019	20823376	-	10V	538236	6258610	
Colt_2 ^c	3.1	Colt Creek	Upstream of Mile 95 Road bridge	2019	20615749	-	10V	538236	6258610	
Colt_3 ^c	3.1	Colt Creek	Upstream of Mile 95 Road bridge	2021	21087158	100%	10V	538236	6258610	New station installed on 23 July 2021.
Colt_4 ^c	3.1	Colt Creek	Upstream of Mile 95 Road bridge	2021	21065263	100%	10V	538236	6258610	New station installed on 23 July 2021.
Kobes_1 ^c	11.5	Kobes Creek	Bridge near RiverKm 11.0	2020	20562512	-	10V	555239	6256203	
Kobes_2 ^c	11.5	Kobes Creek	Bridge near RiverKm 11.0	2020	20182165	-	10V	555239	6256203	
Moberly_1	42.6	Moberly River	Downstream of North Monias Road bridge	2019	20182026	85%	10V	603472	6217933	
Moberly_2	42.6	Moberly River	Downstream of North Monias Road bridge	2019	21065252	100%	10V	603472	6217933	Serial # 20182165 was replaced on 30 July 2021.
Moberly_3	42.6	Moberly River	Downstream of North Monias Road bridge	2021	21065251	100%	10V	603472	6217933	New station installed on 30 July 2021.
Moberly_4	42.6	Moberly River	Downstream of North Monias Road bridge	2021	21065264	100%	10V	603472	6217933	New station installed on 30 July 2021.
PineMS1	2.2	Pine River	LDB upstream of confluence	2016	10893069	73%	10V	641762	6223599	
PineMS2	2.2	Pine River	LDB upstream of confluence	2016	21163913	86%	10V	641762	6223599	
BeatMS1	0.9	Beatton River	LDB upstream of confluence	2016	20182028	96%	10V	663101	6220759	Serial # 20182029 was replaced on 30 April 2021 with Serial # 20182025; Serial # 20182025 was replaced on 17 May 2022.
BeatMS2	0.9	Beatton River	LDB upstream of confluence	2016	21164322	96%	10V	663101	6220759	Serial # 20182027 was replaced on 30 April 2021 with Serial # 20182028; Serial # 20182028 was replaced on 17 May 2022.

^a Peace River River Km values are measured downstream from the base of WAC Bennett Dam. Tributary River km values are measured upstream from the stream's confluence with the Peace River.

^b Battery percentage (%) recorded at the time of logger's most recent download.

^c Tributary River km values are measured upstream from the stream's or river's confluence with the Graham or Halfway River.

APPENDIX B

**Water Temperature Summary Data
- Interannual Comparison**

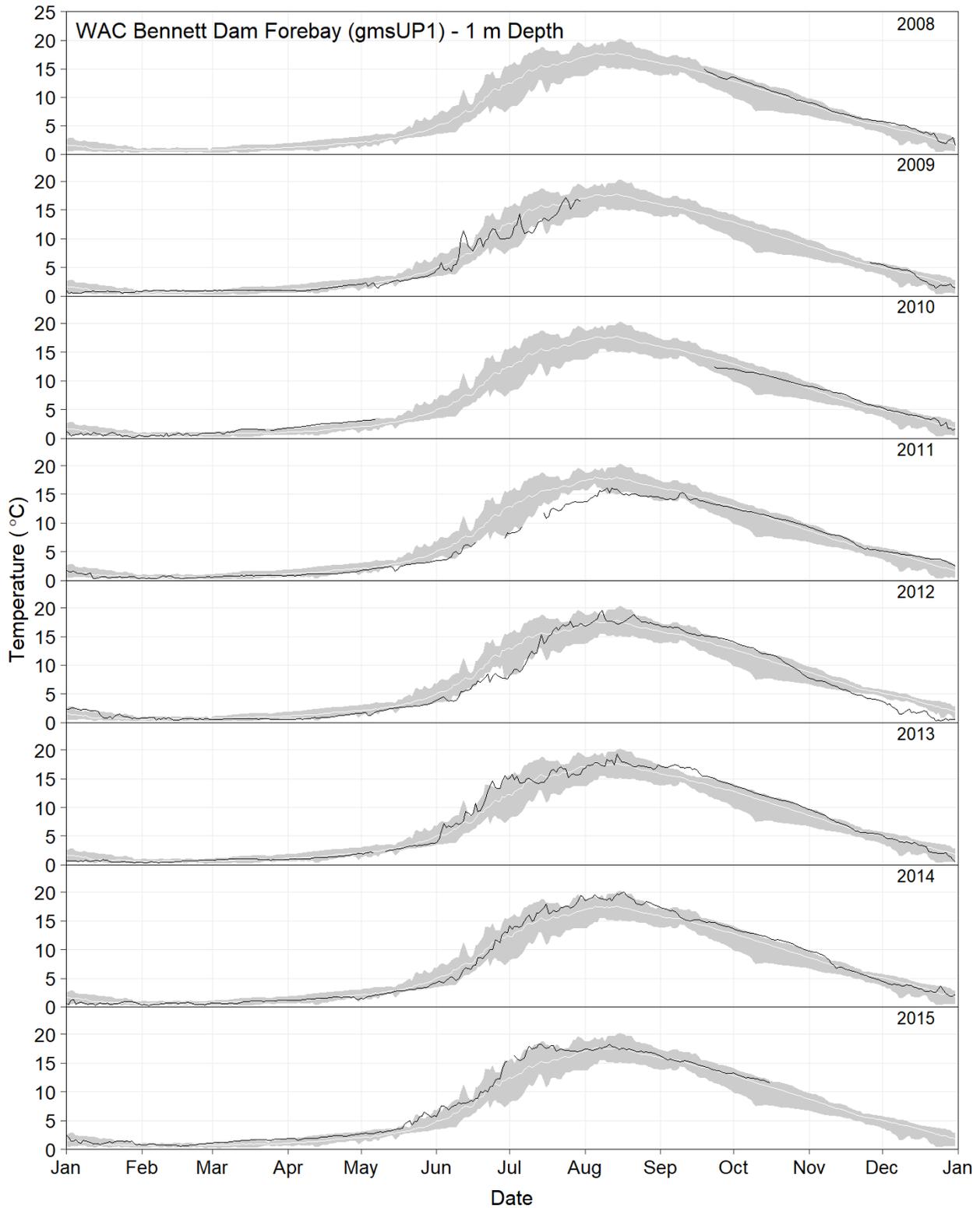


Figure B1: Mean daily water temperature (°C) for WAC Bennett Dam Forebay 1 m below the water surface (gmsUP1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

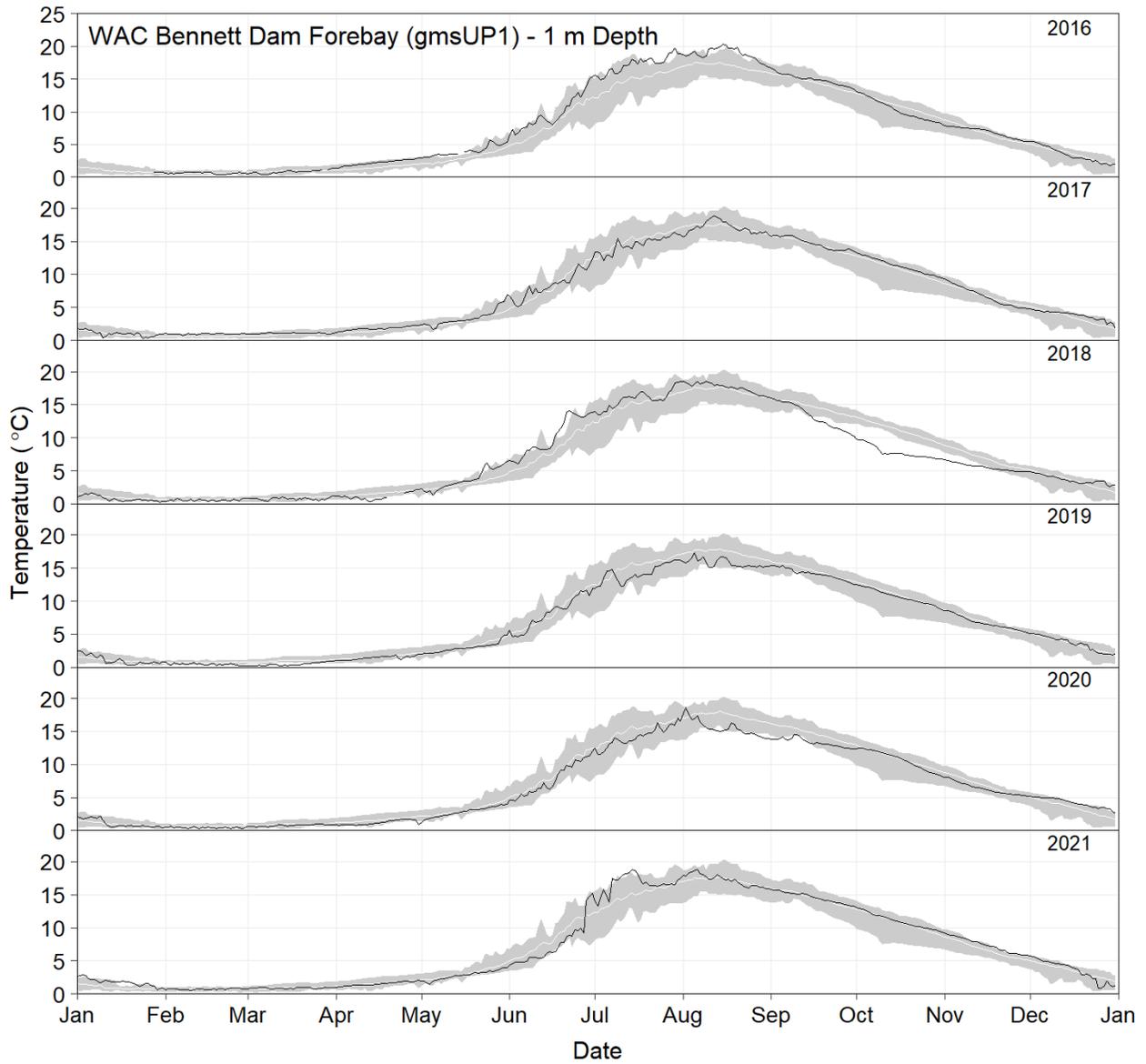


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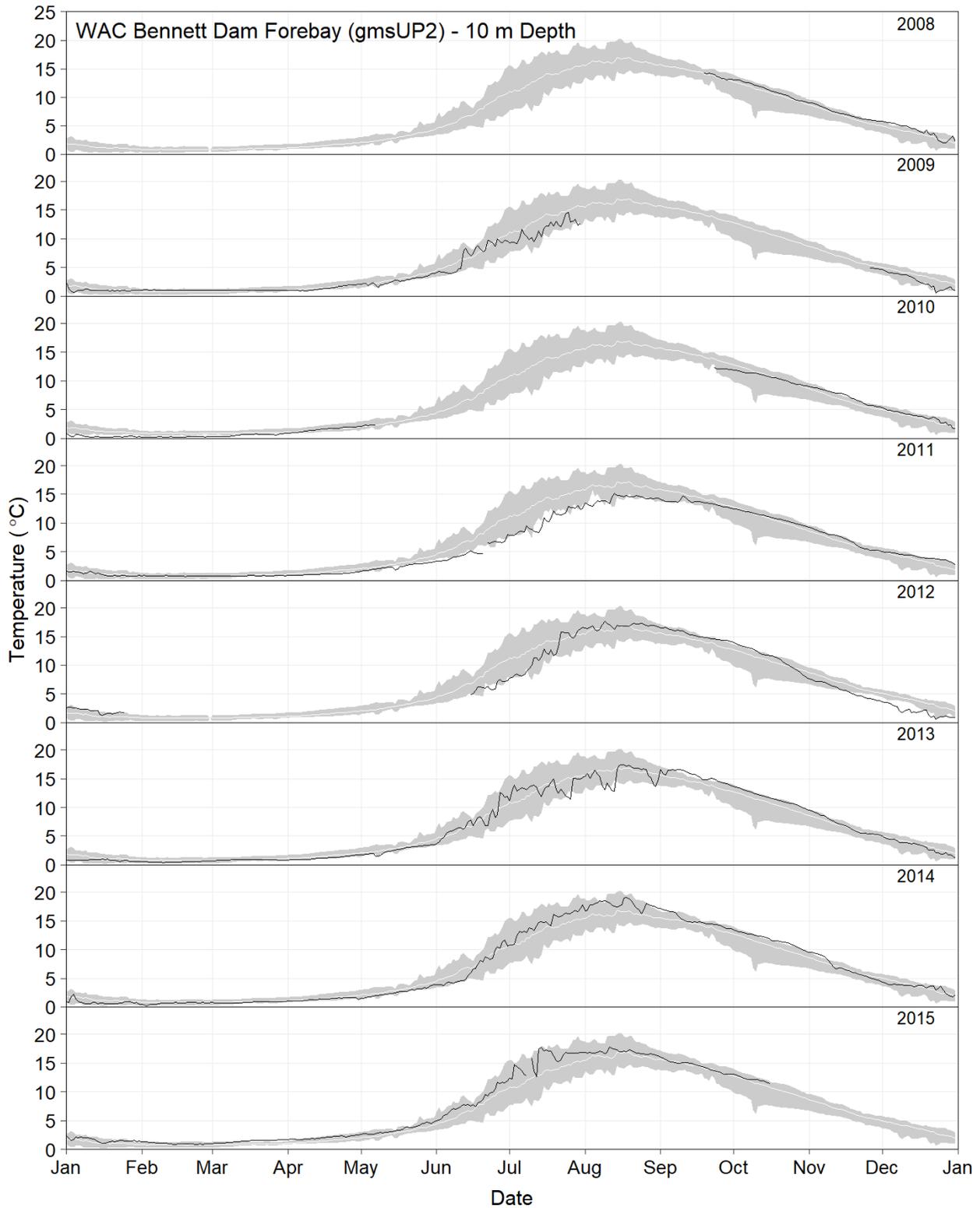


Figure B2: Mean daily water temperature (°C) for WAC Bennett Dam Forebay 10 m below the water surface (gmsUP2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

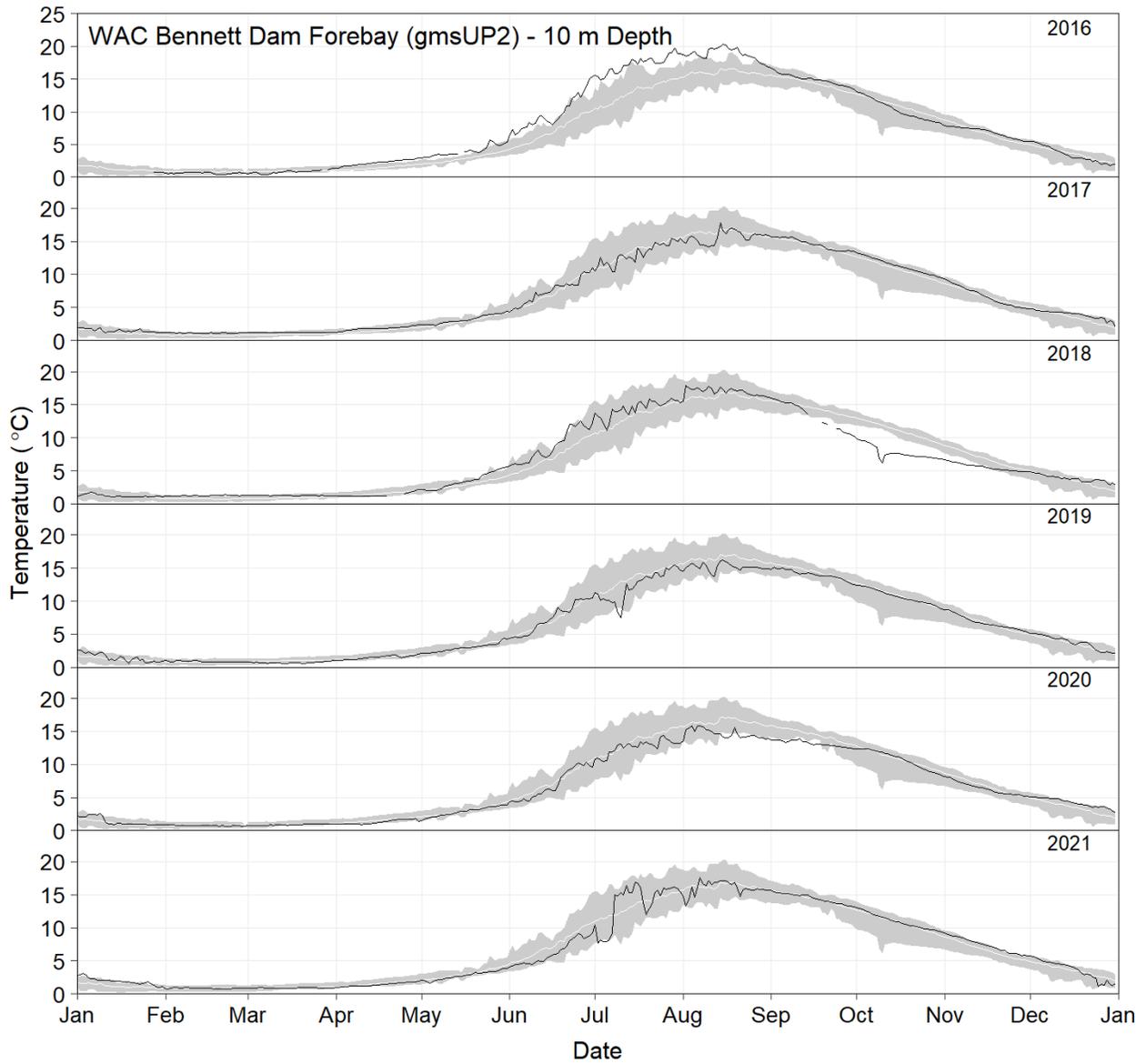


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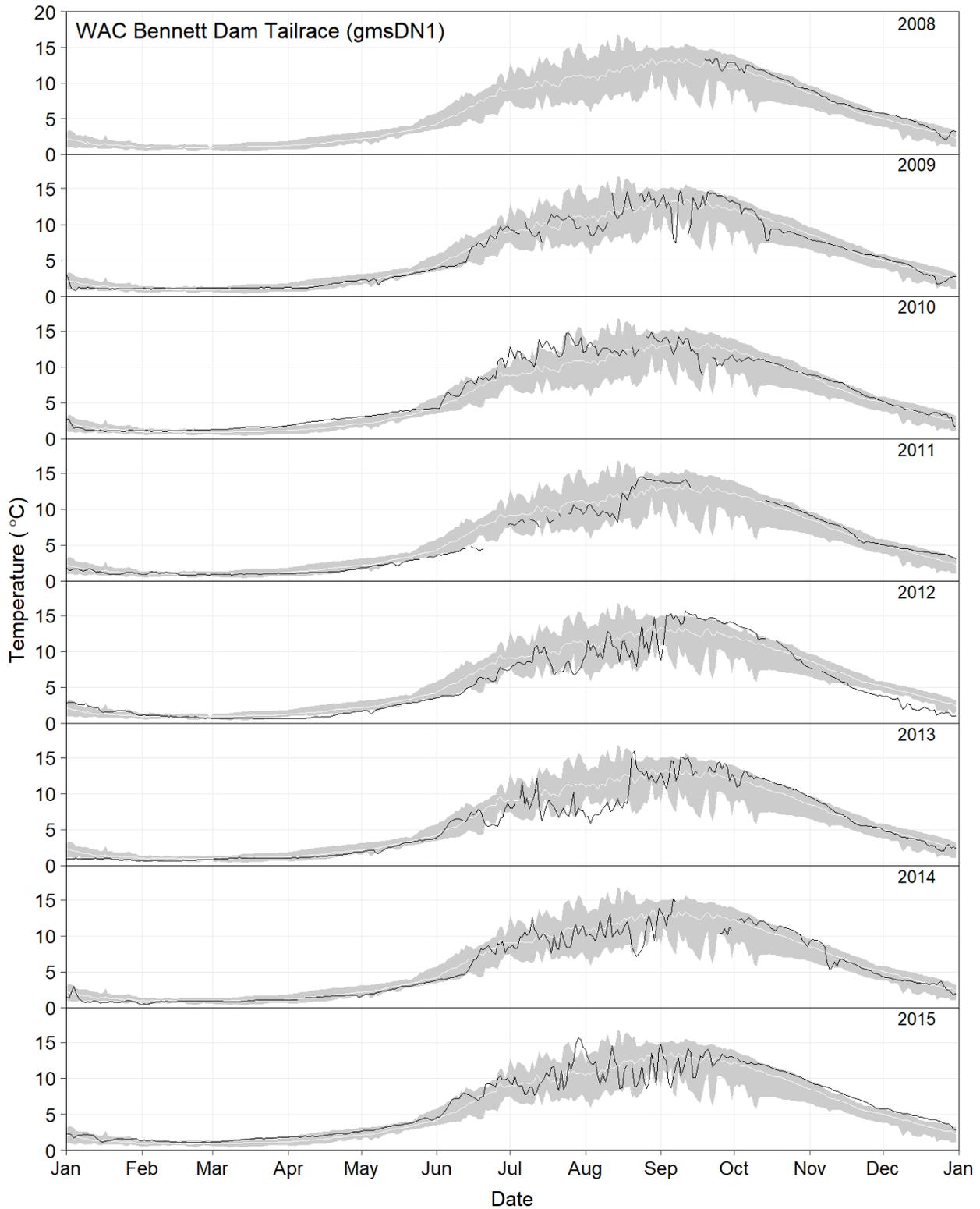


Figure B3: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River downstream of the WAC Bennett Dam Tailrace (gmsDN1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

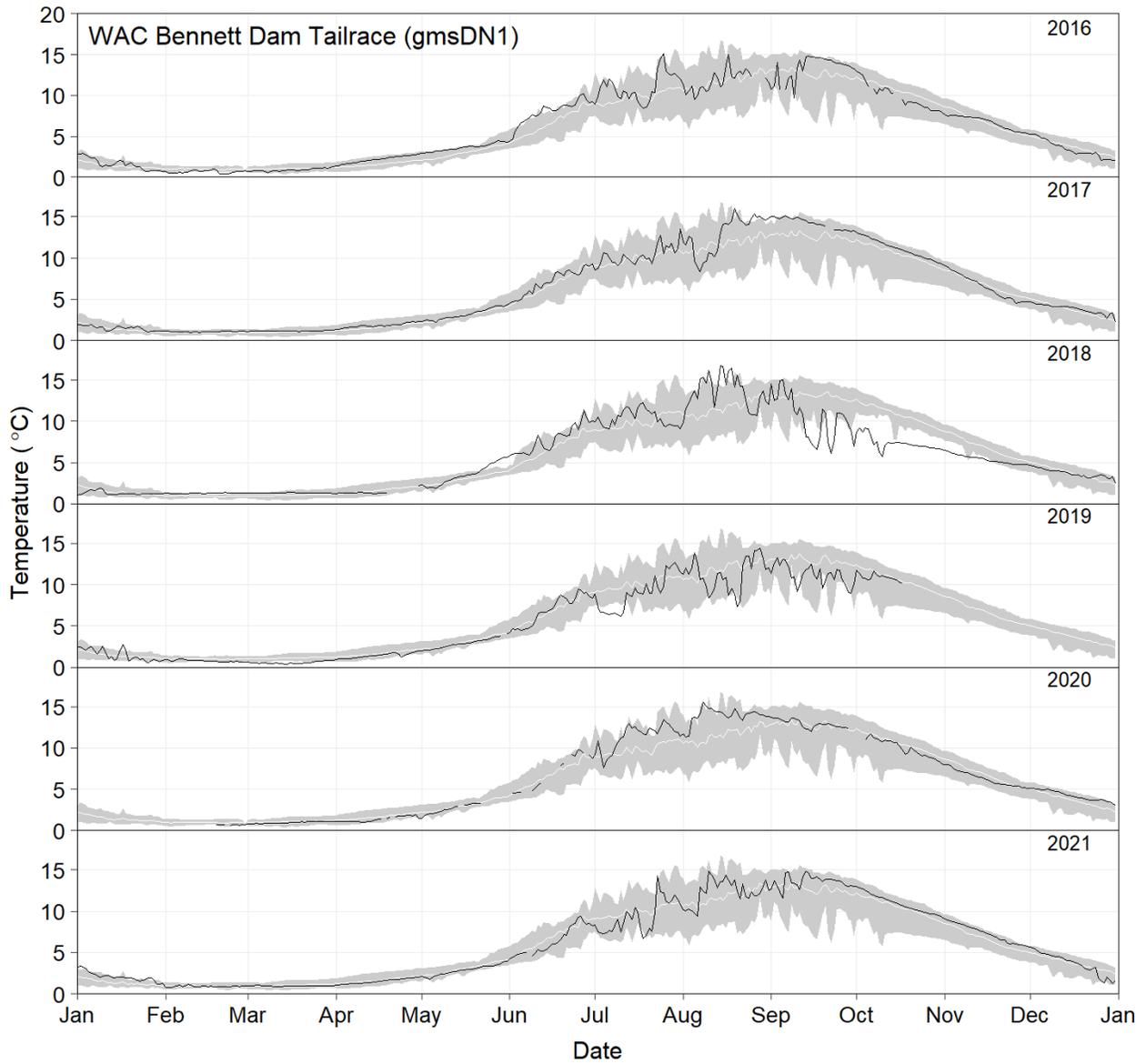


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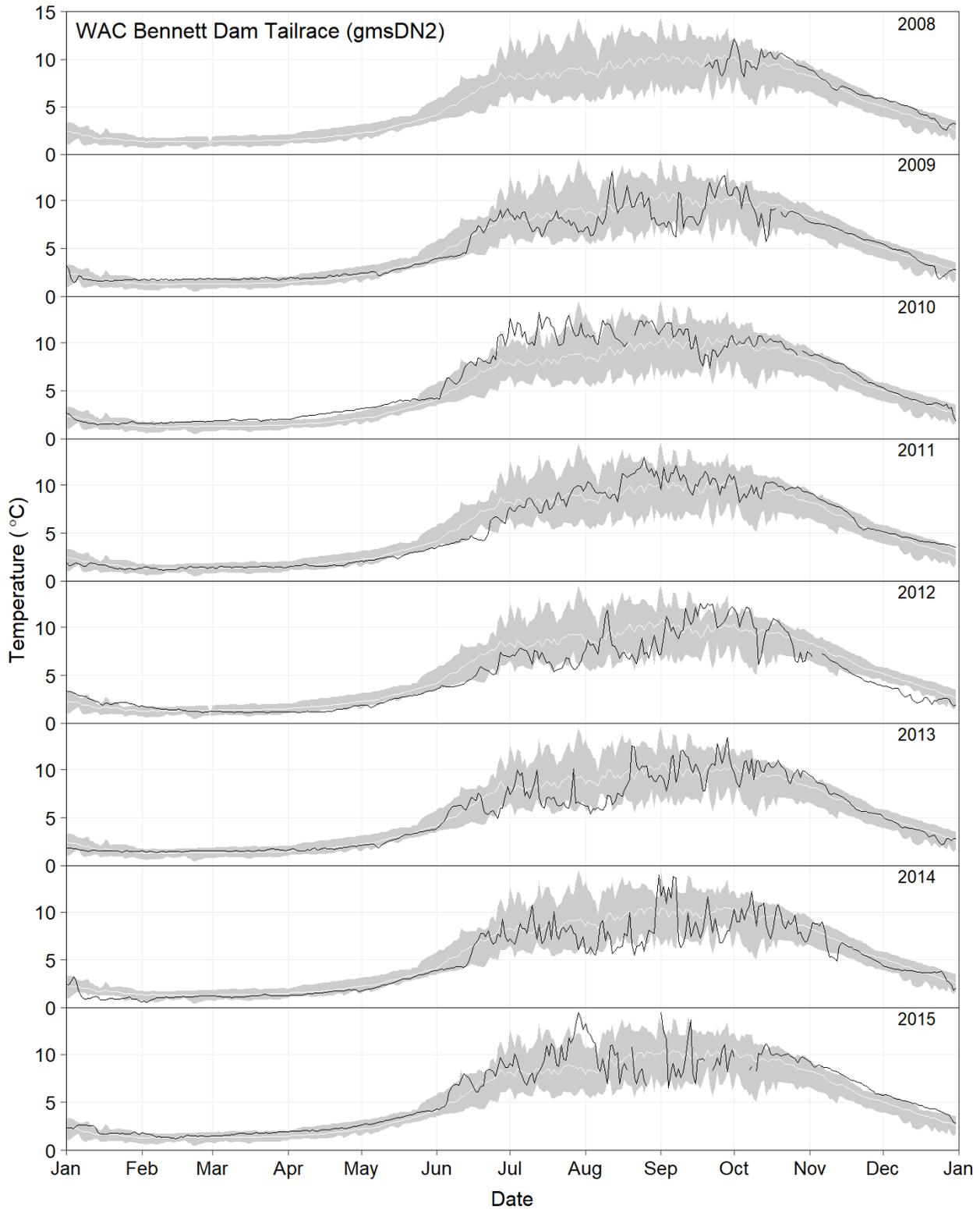


Figure B4: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River downstream of the WAC Bennett Dam Tailrace (gmsDN2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

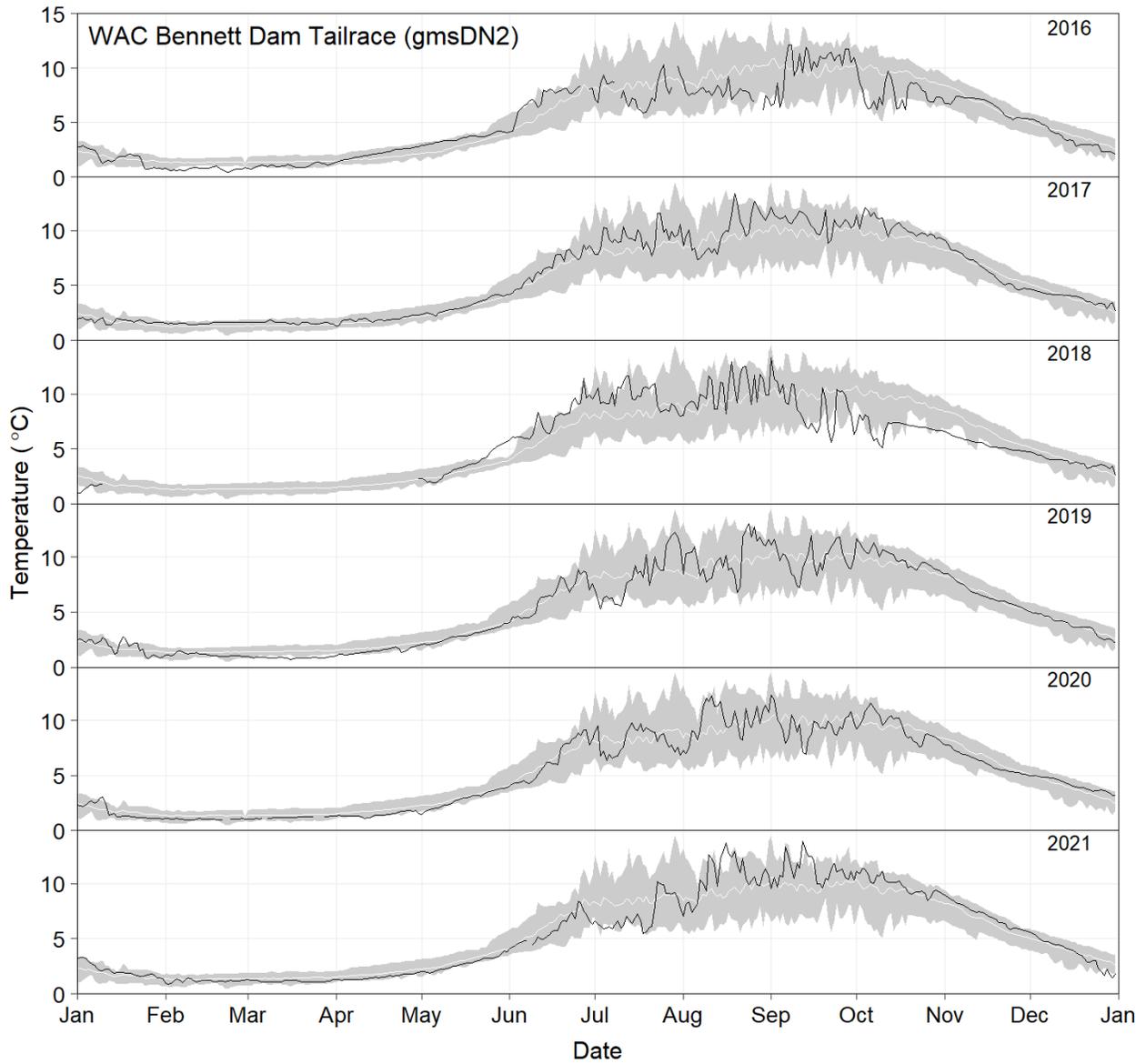


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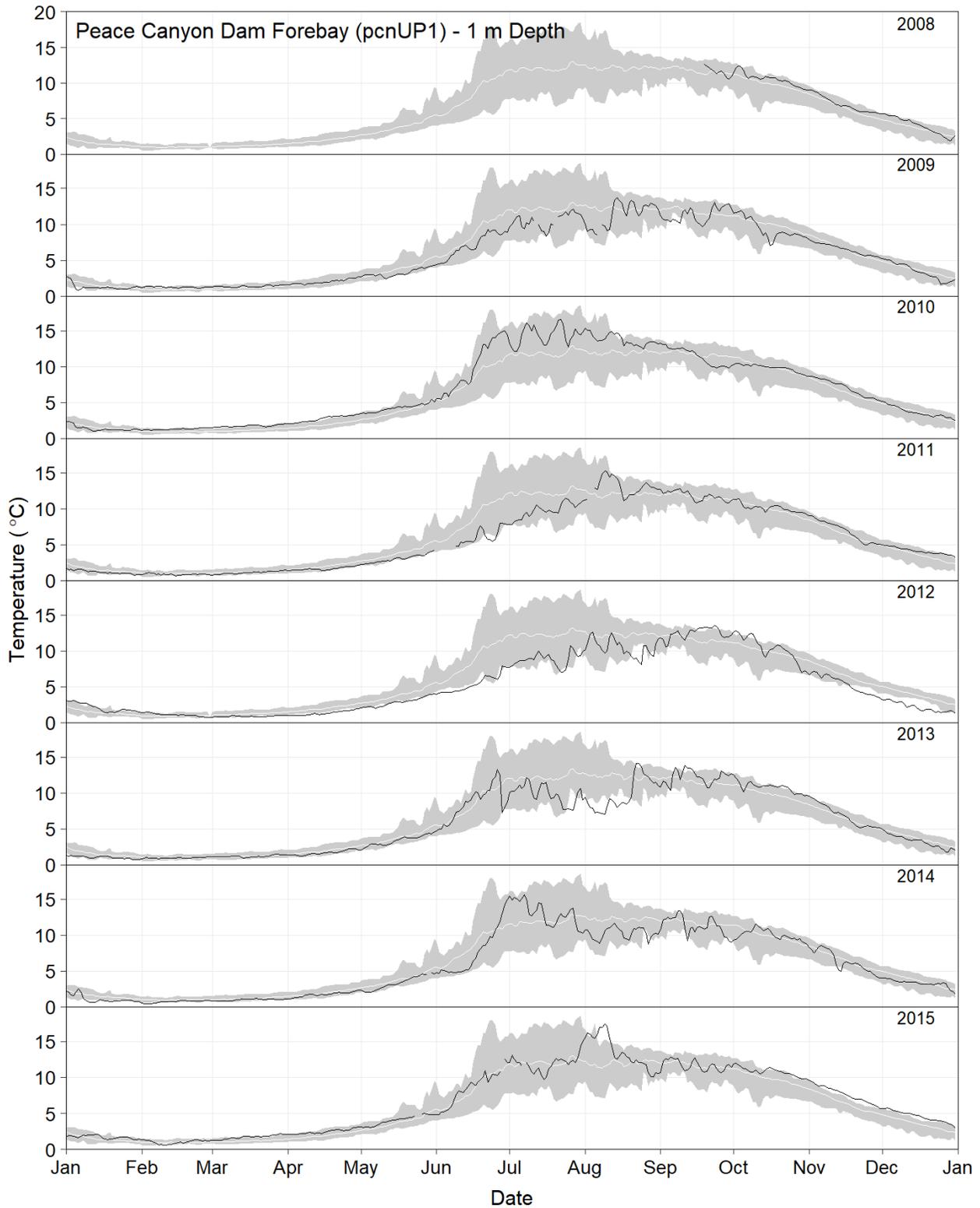


Figure B5: Mean daily water temperature (°C) for Peace Canyon Dam Forebay 1 m below the water surface (pcnUP1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

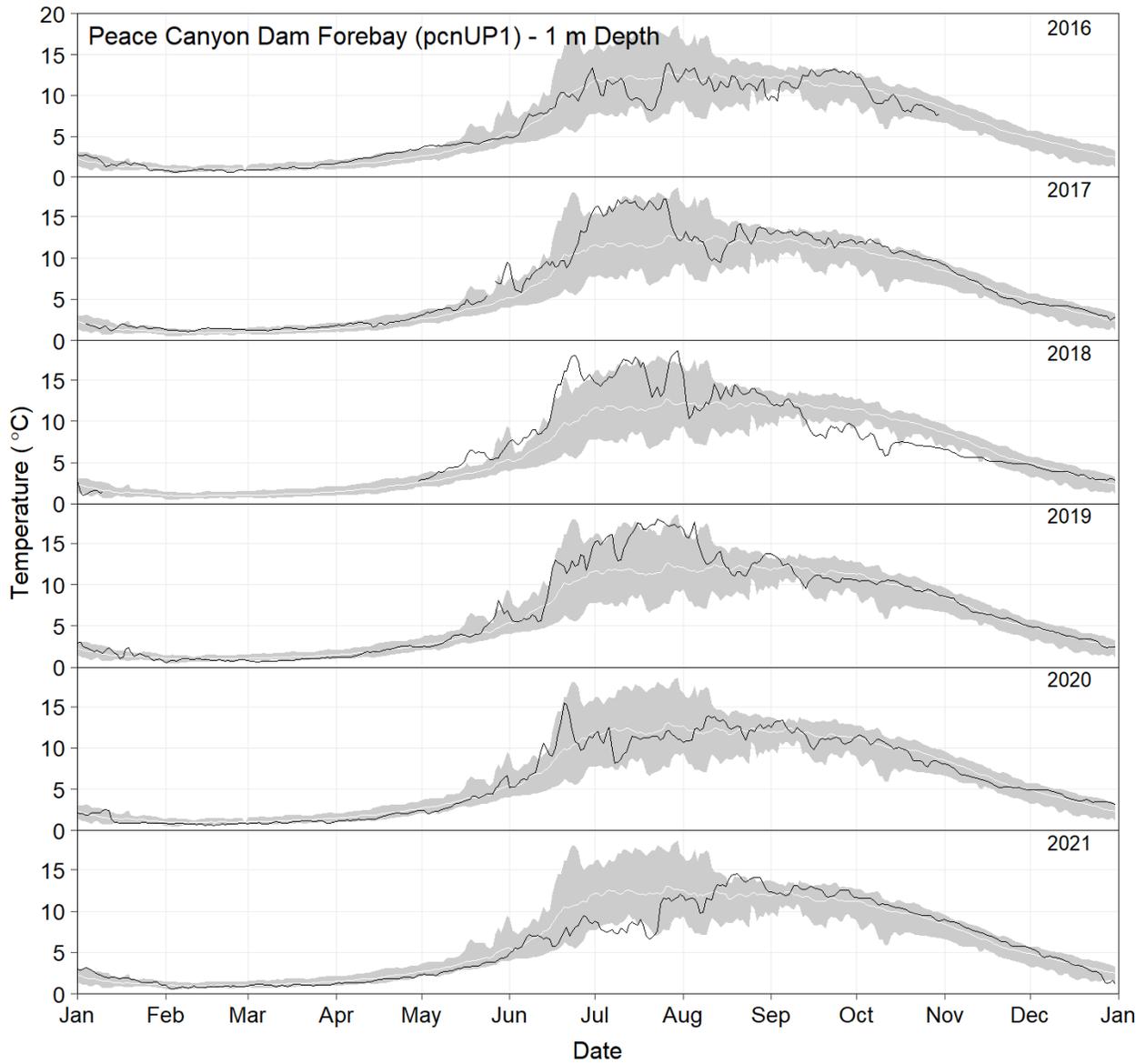


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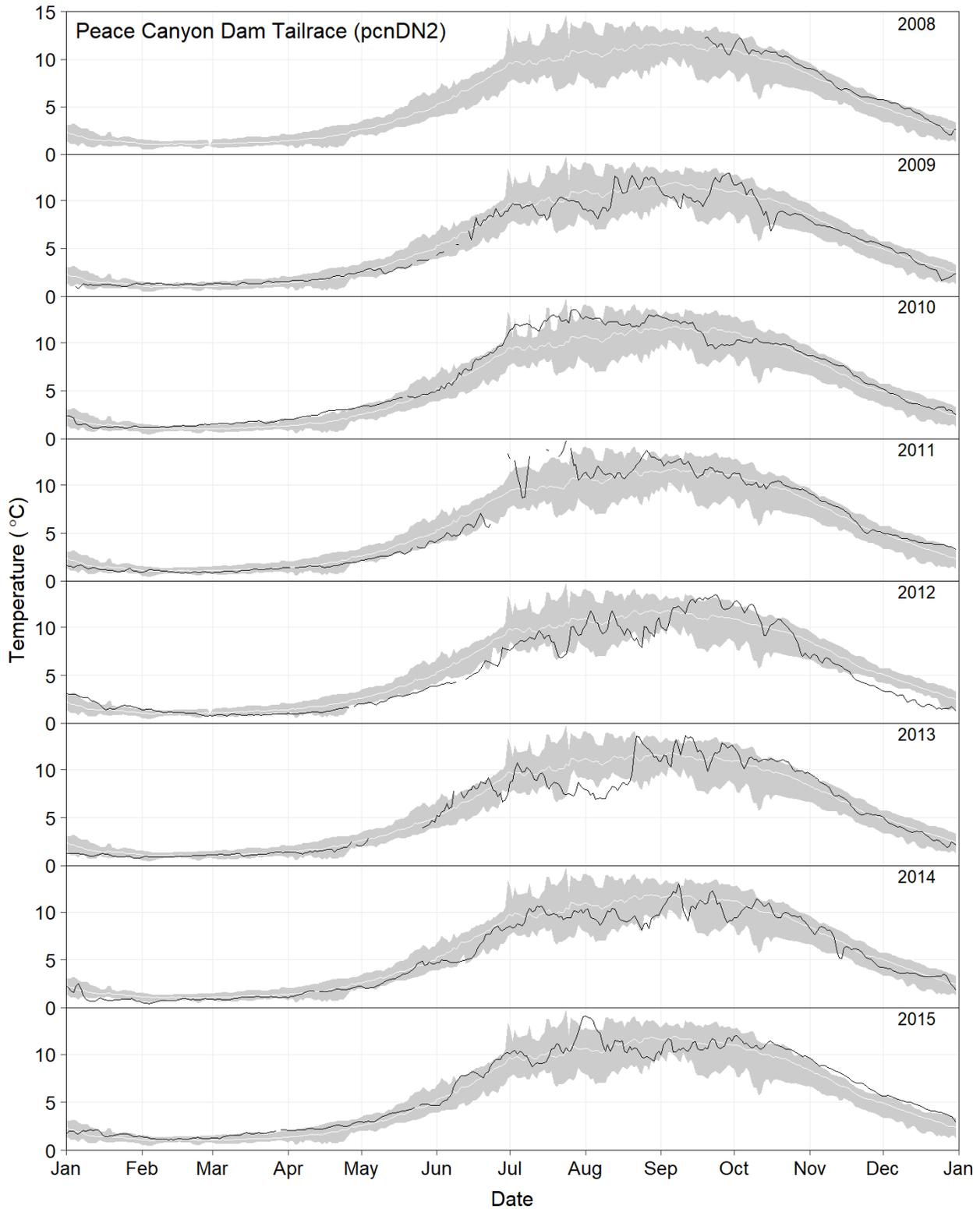


Figure B6: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River downstream of the Peace Canyon Dam Tailrace (pcnDN2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

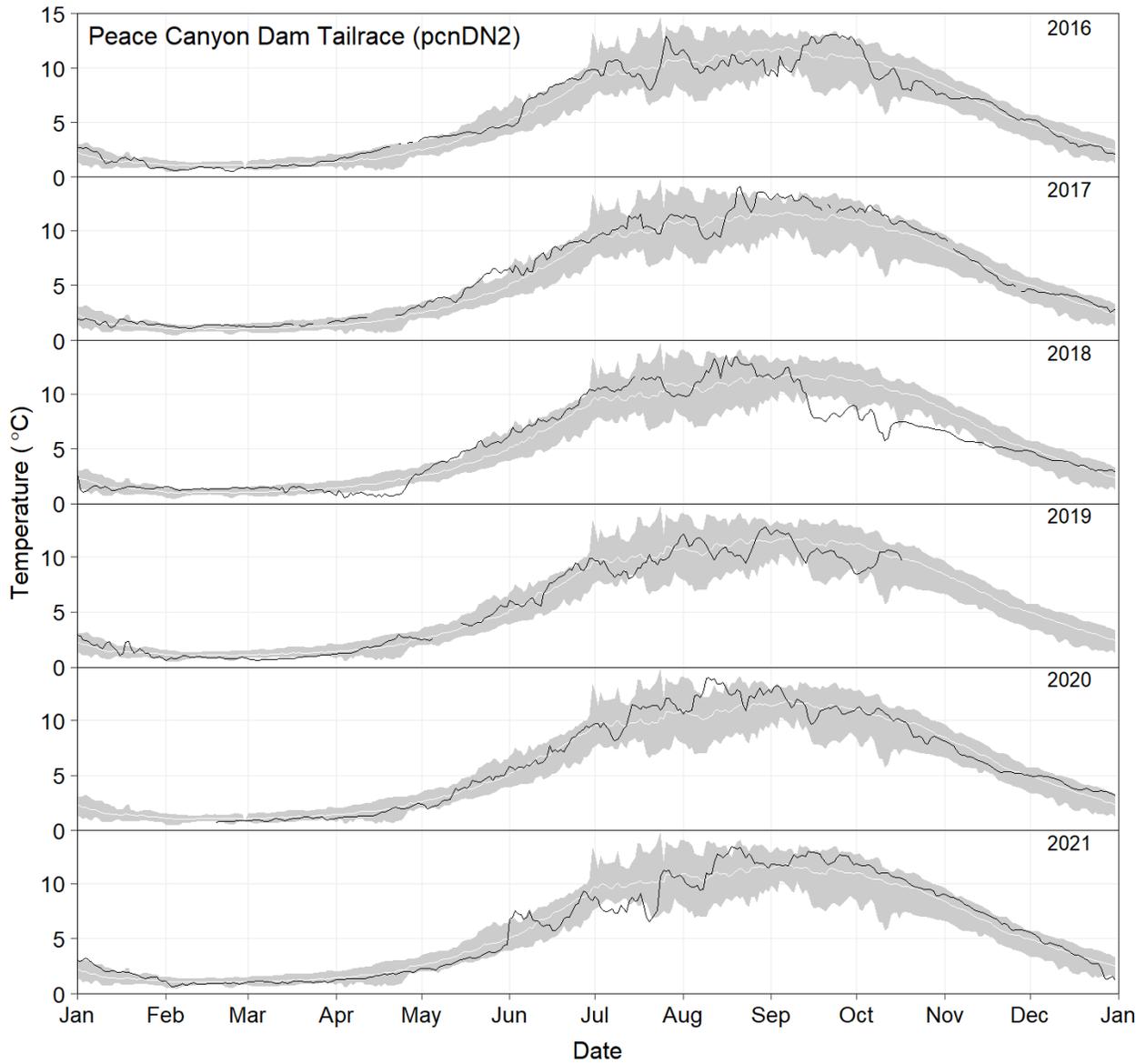


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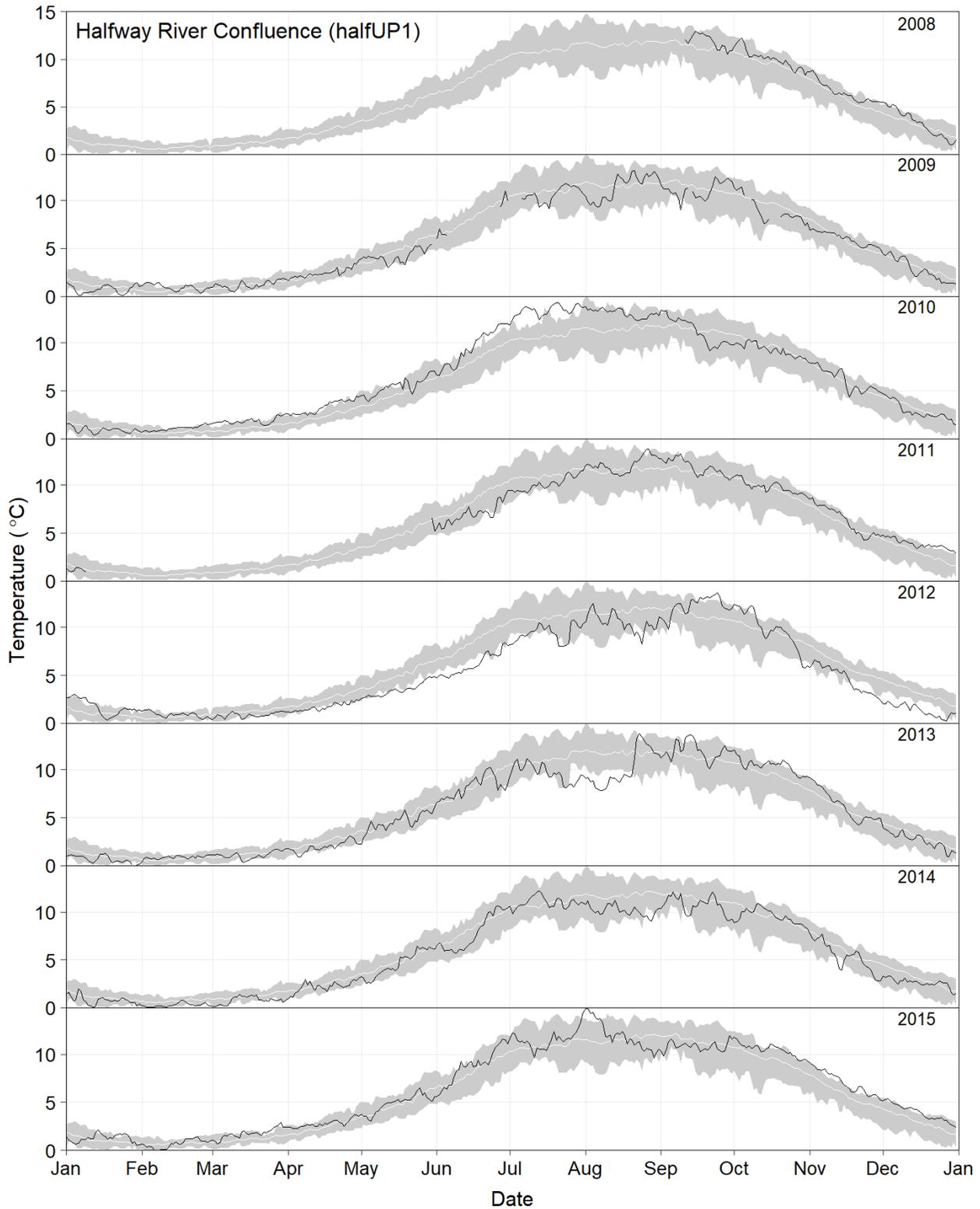


Figure B7: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Halfway River’s confluence with the Peace River (halfUP1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

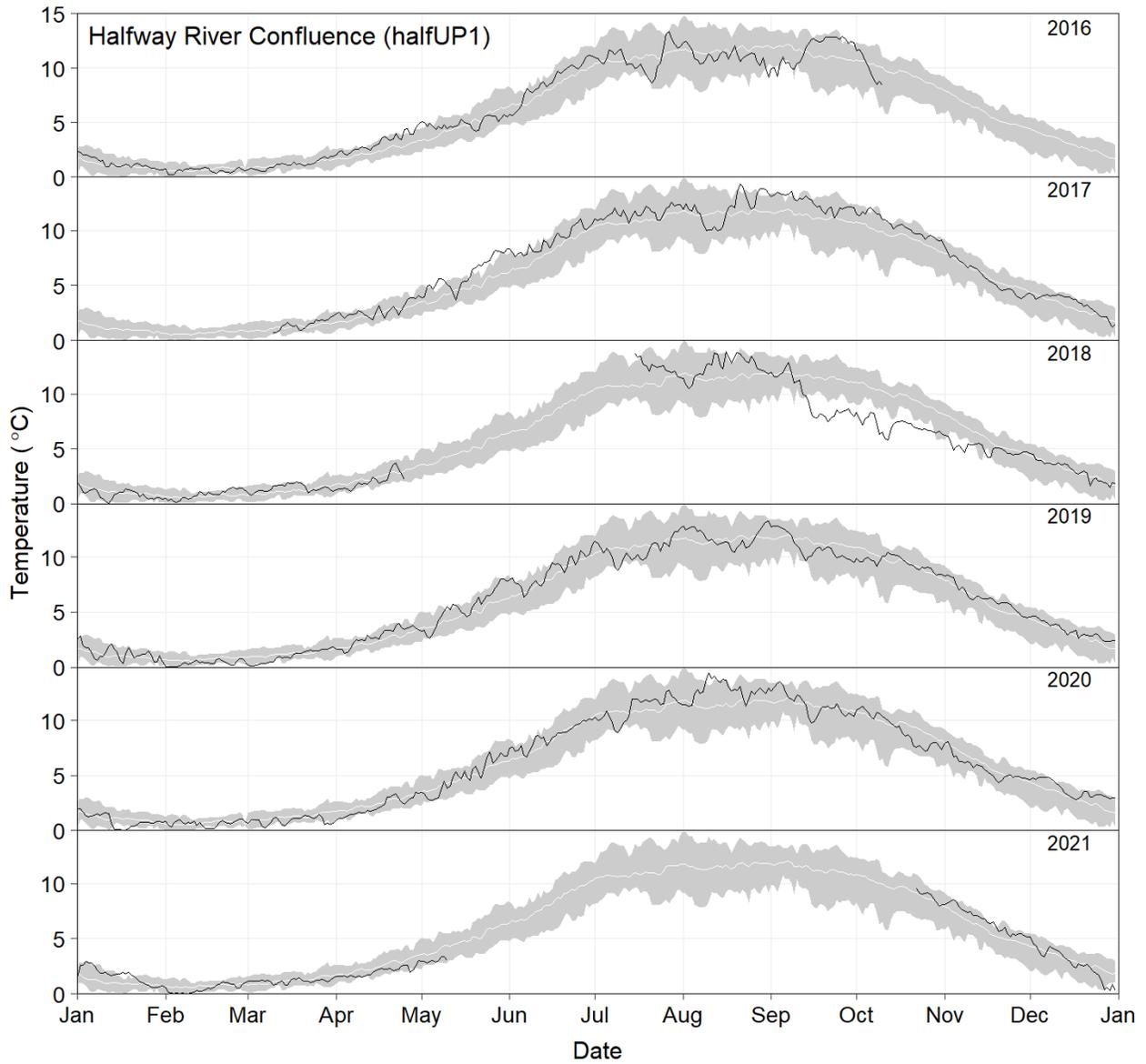


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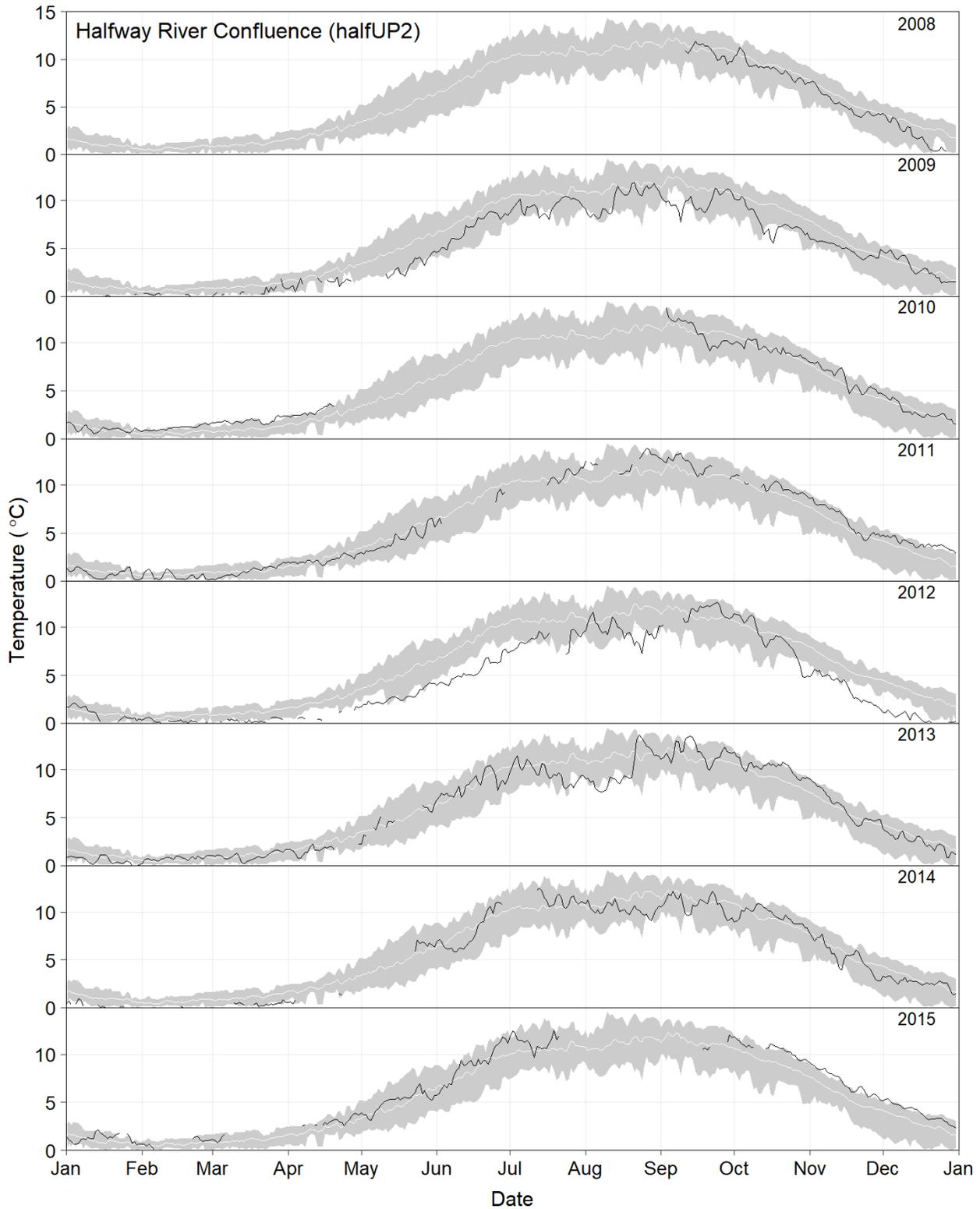


Figure B8: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Halfway River’s confluence with the Peace River (halfUP2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

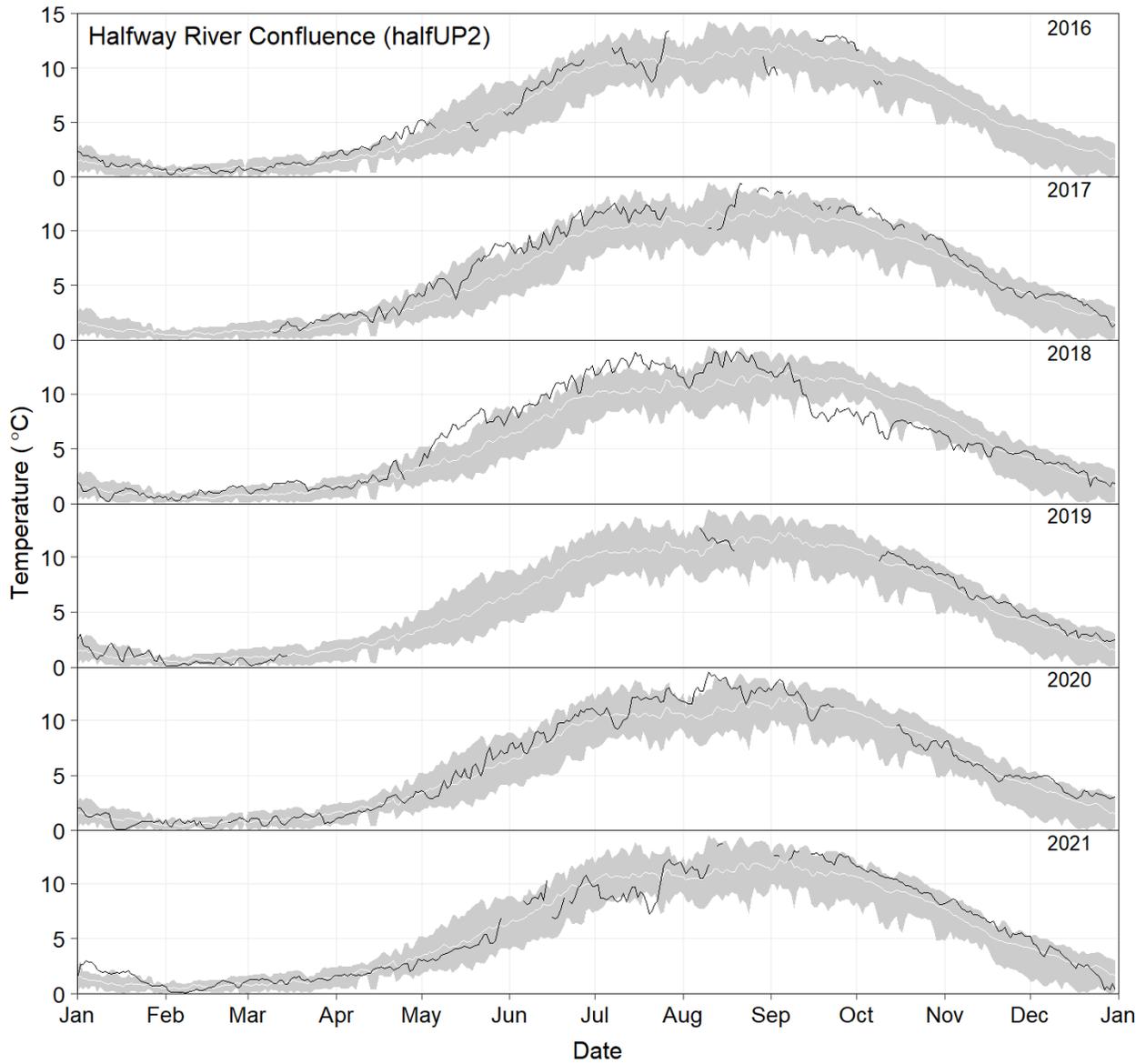


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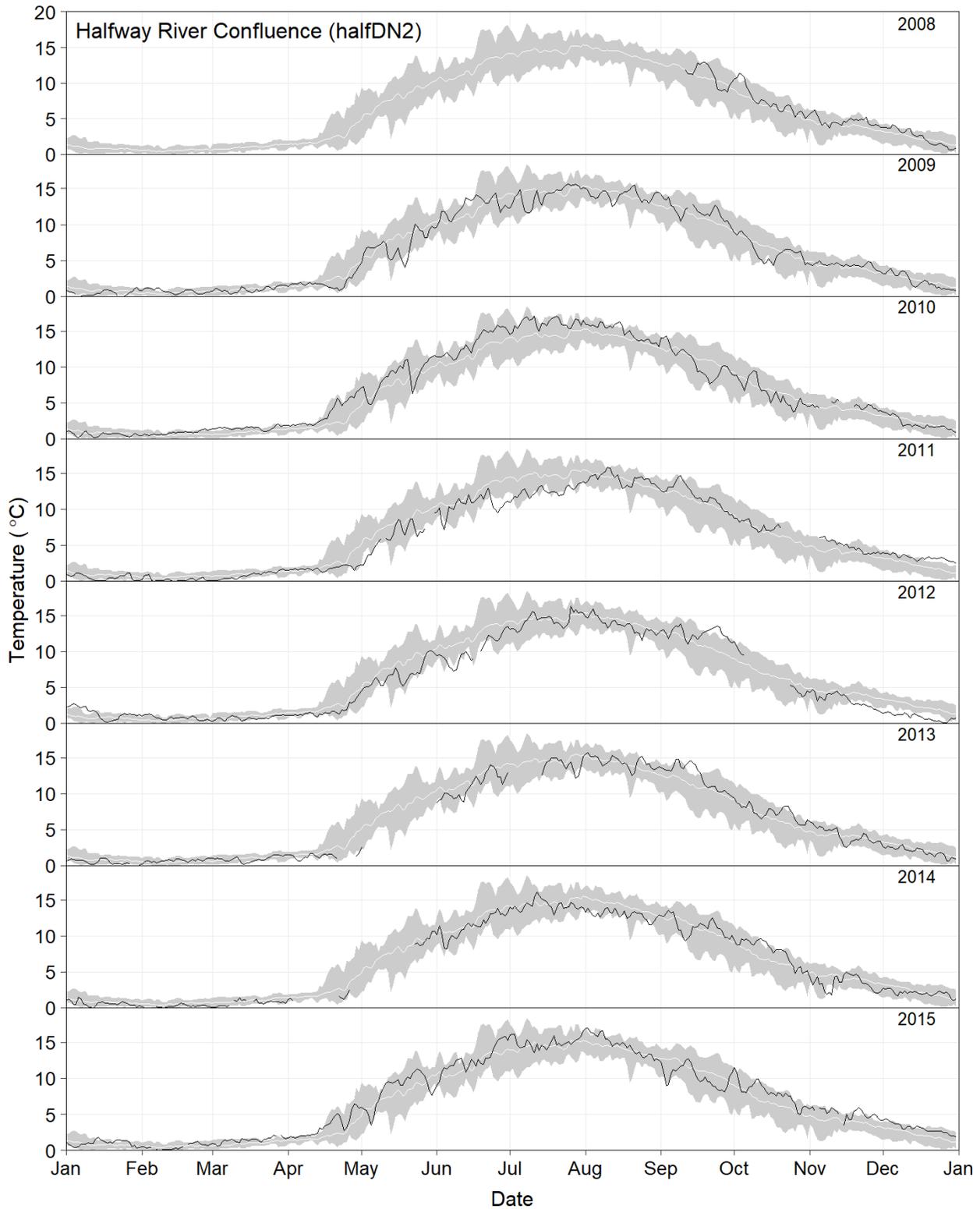


Figure B9: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River downstream of the Halfway River’s confluence with the Peace River (halfDN2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

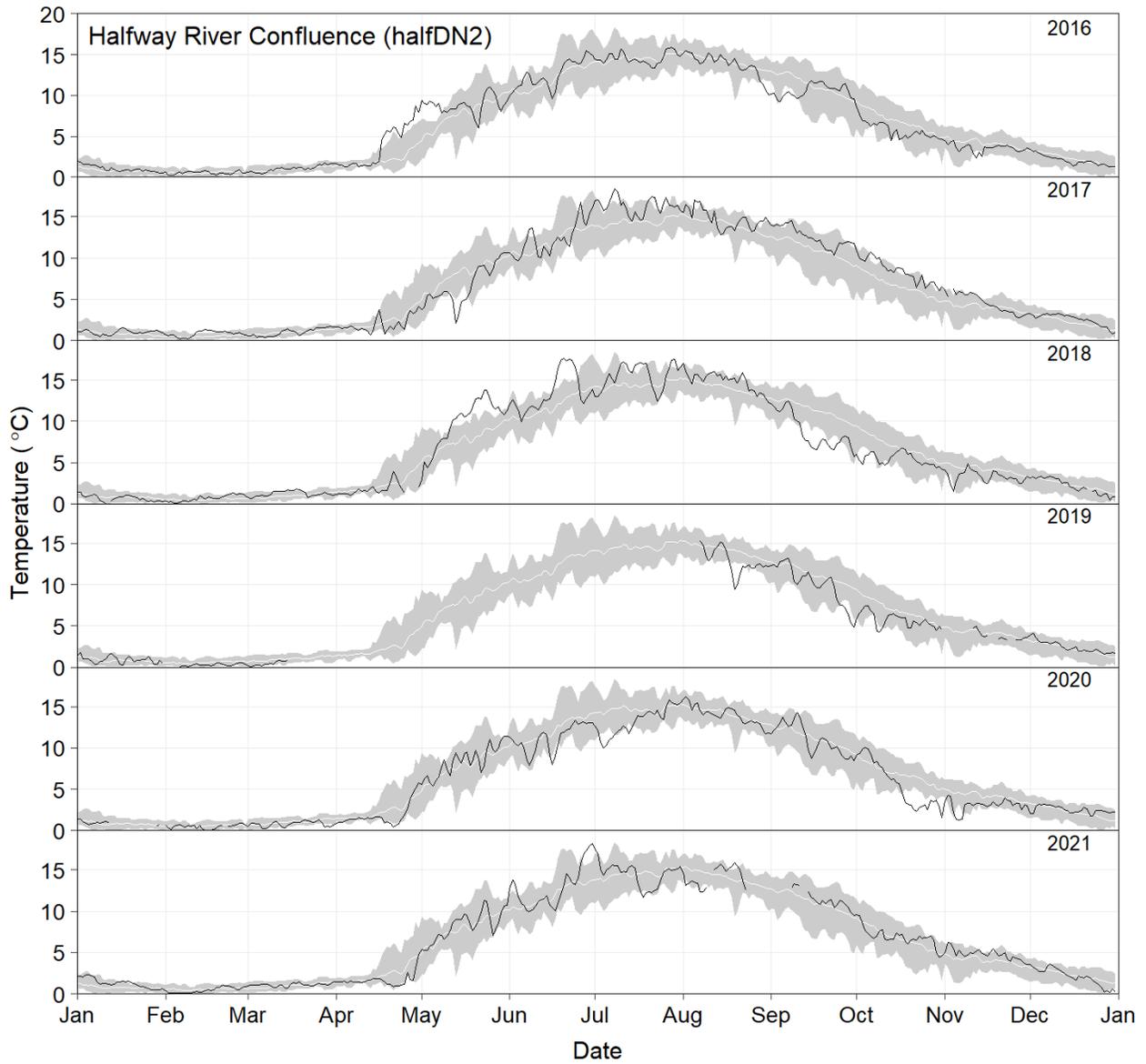


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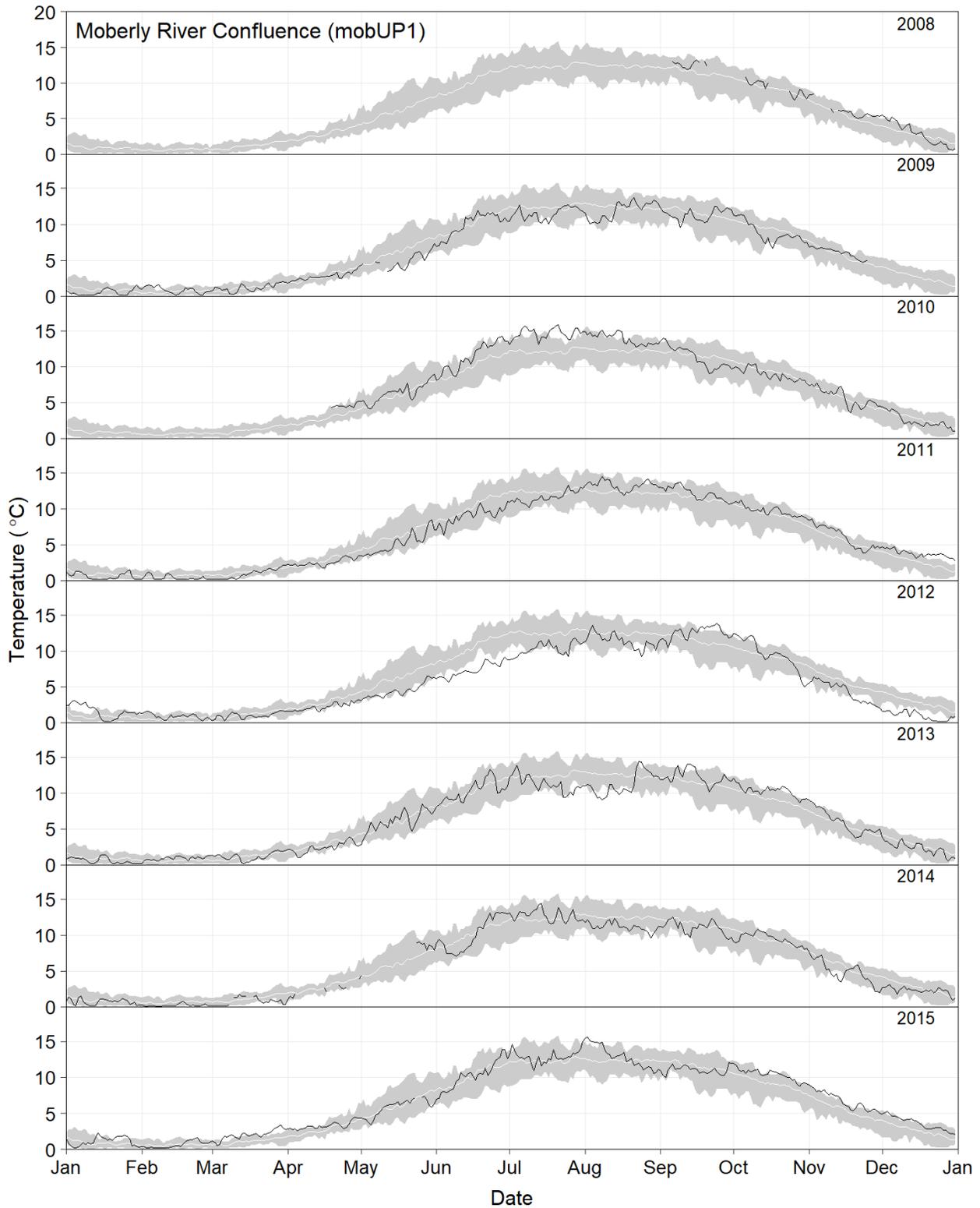


Figure B10: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Moberly River’s confluence with the Peace River (mobUP1; black line), 2008 to 2020. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

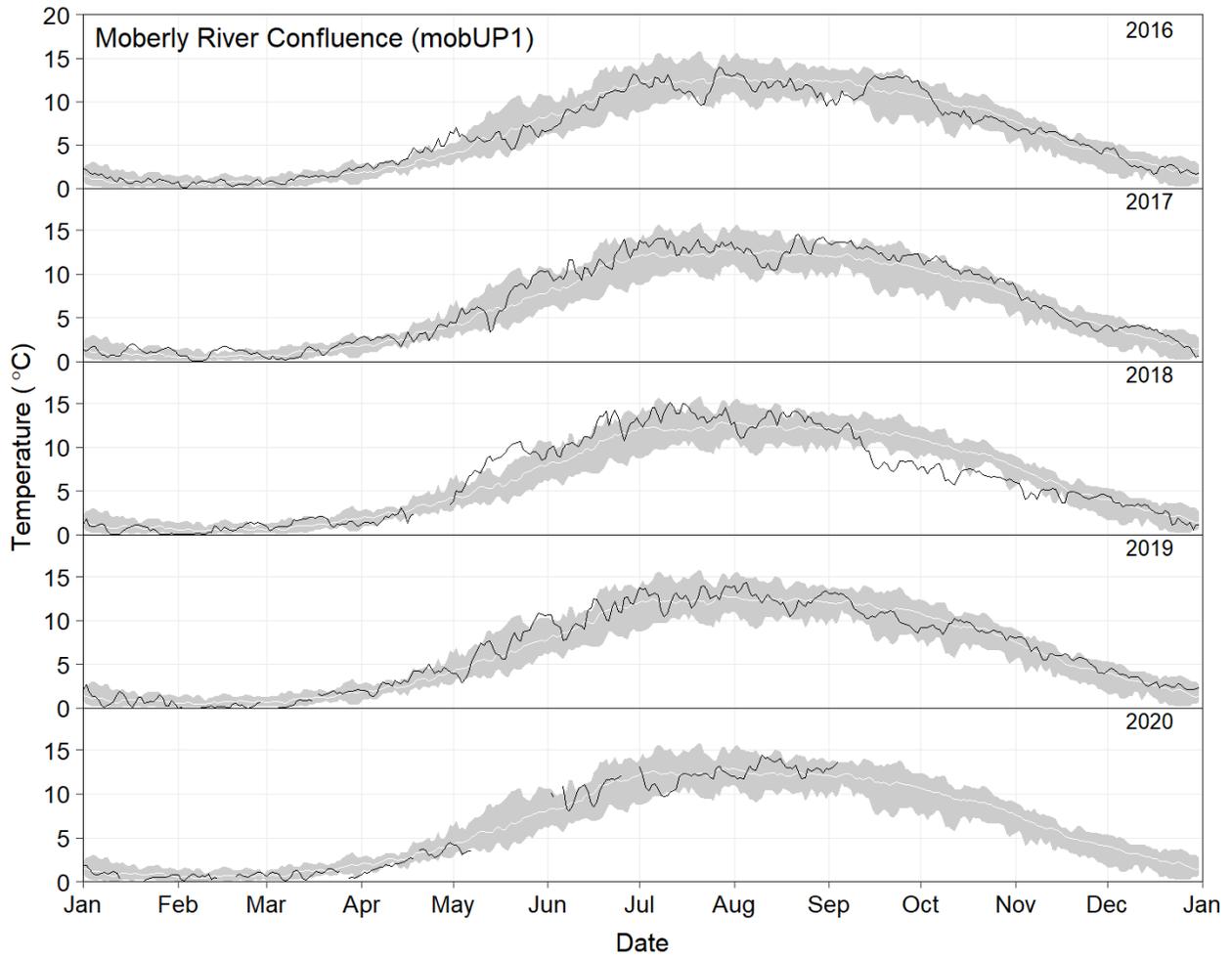


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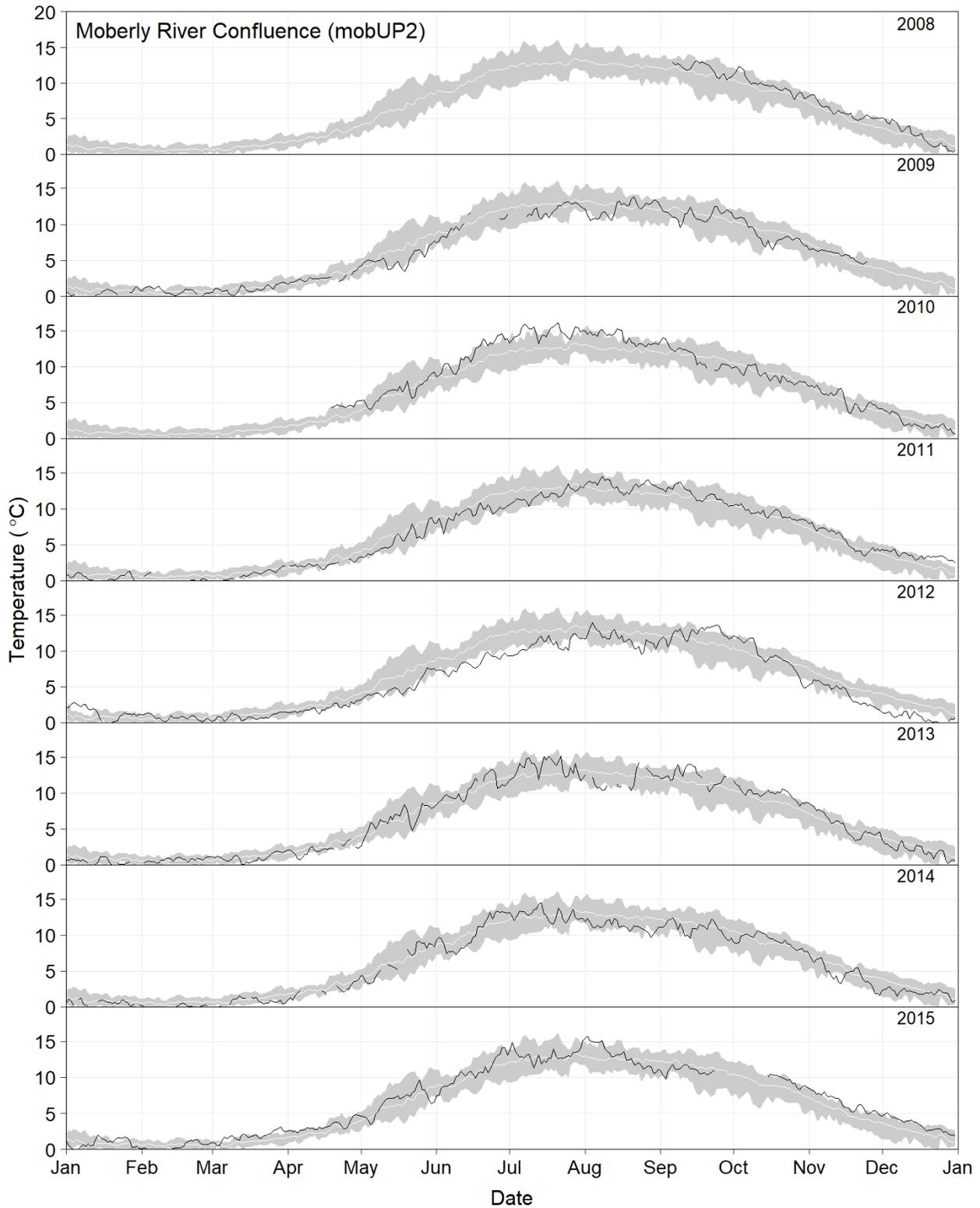


Figure B11: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Moberly River’s confluence with the Peace River (mobUP2; black line), 2008 to 2020. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

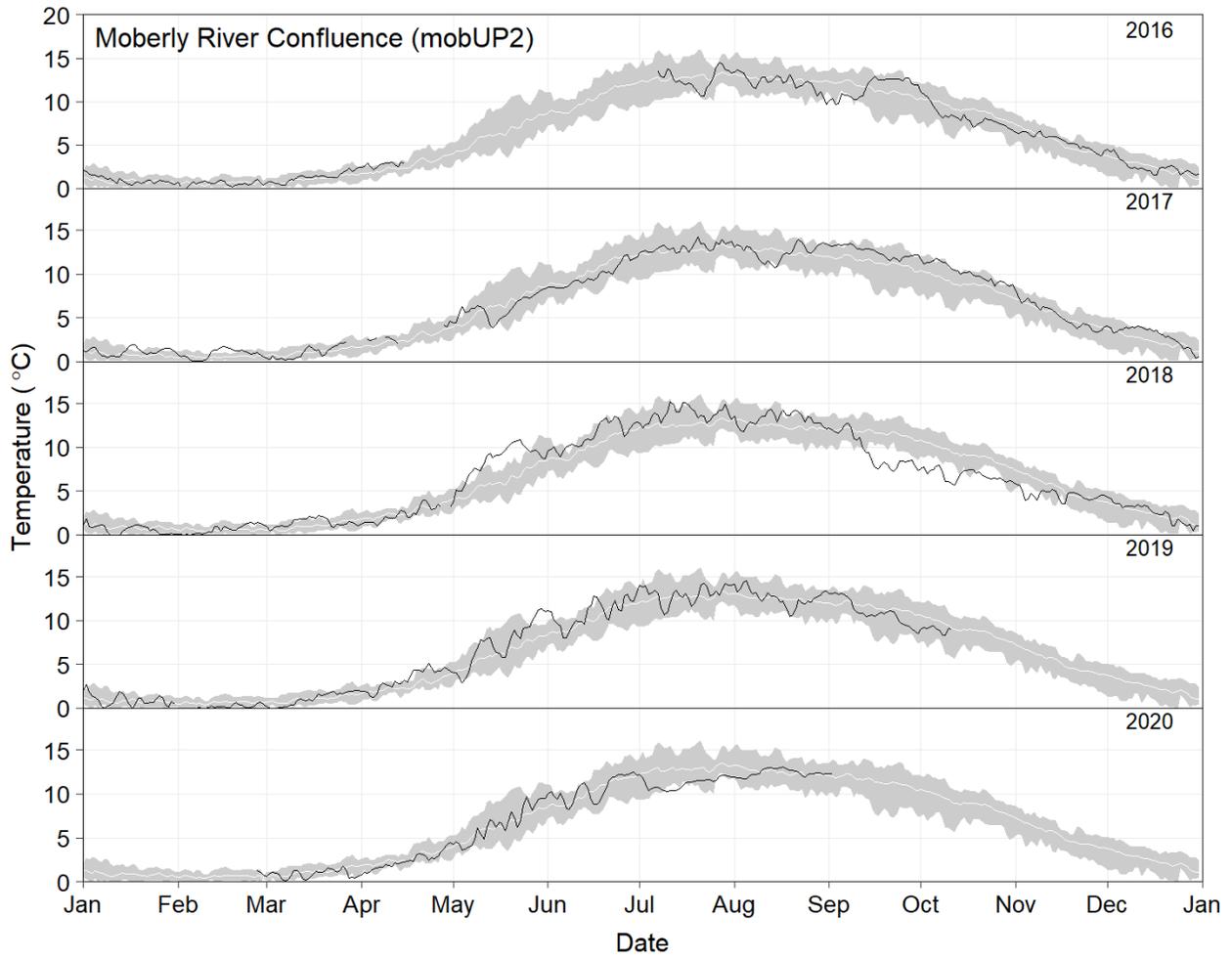


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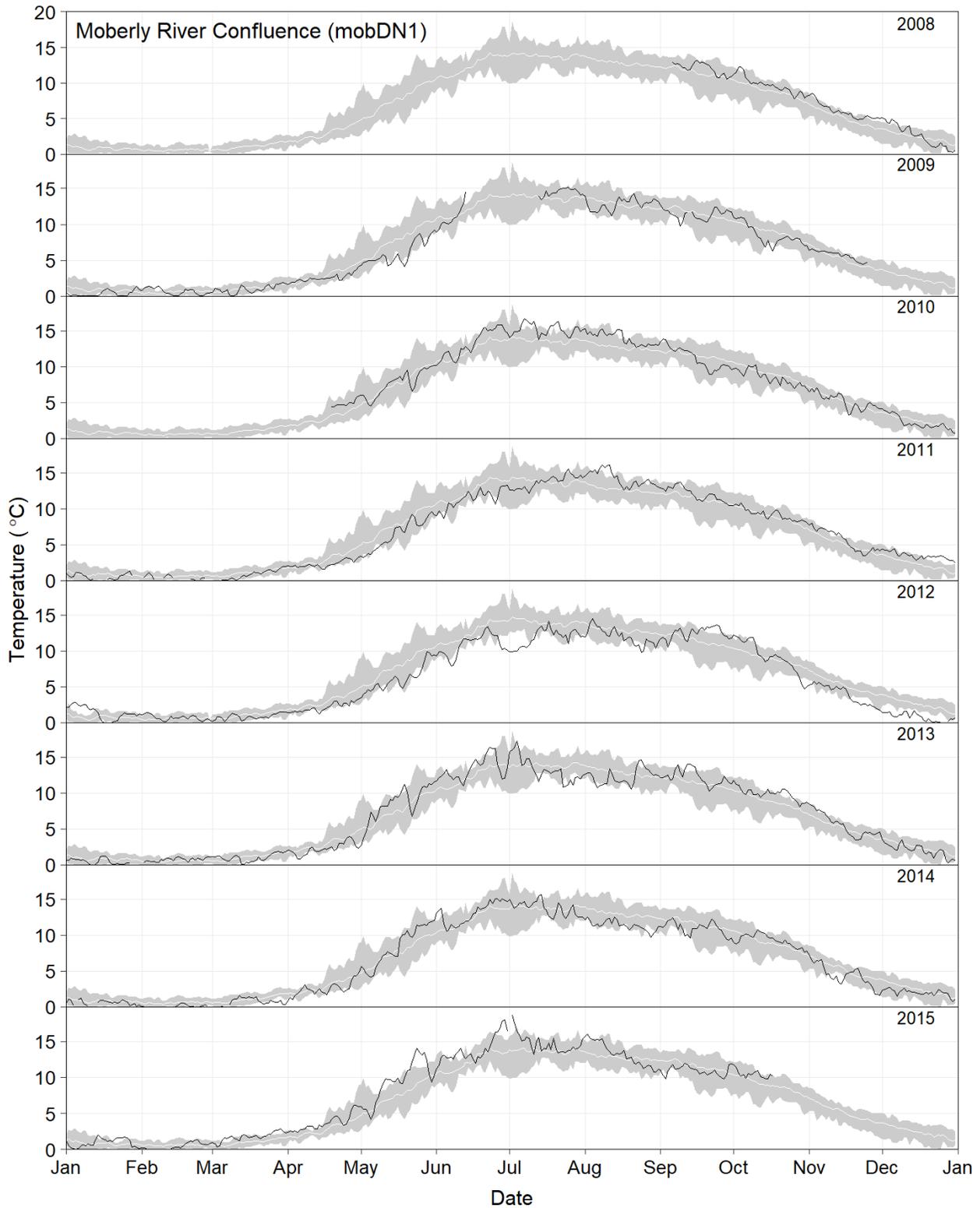


Figure B12: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River downstream of the Moberly River’s confluence with the Peace River (mobDN1; black line), 2008 to 2020. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2020. The white line represents average mean daily water temperatures over the same period.

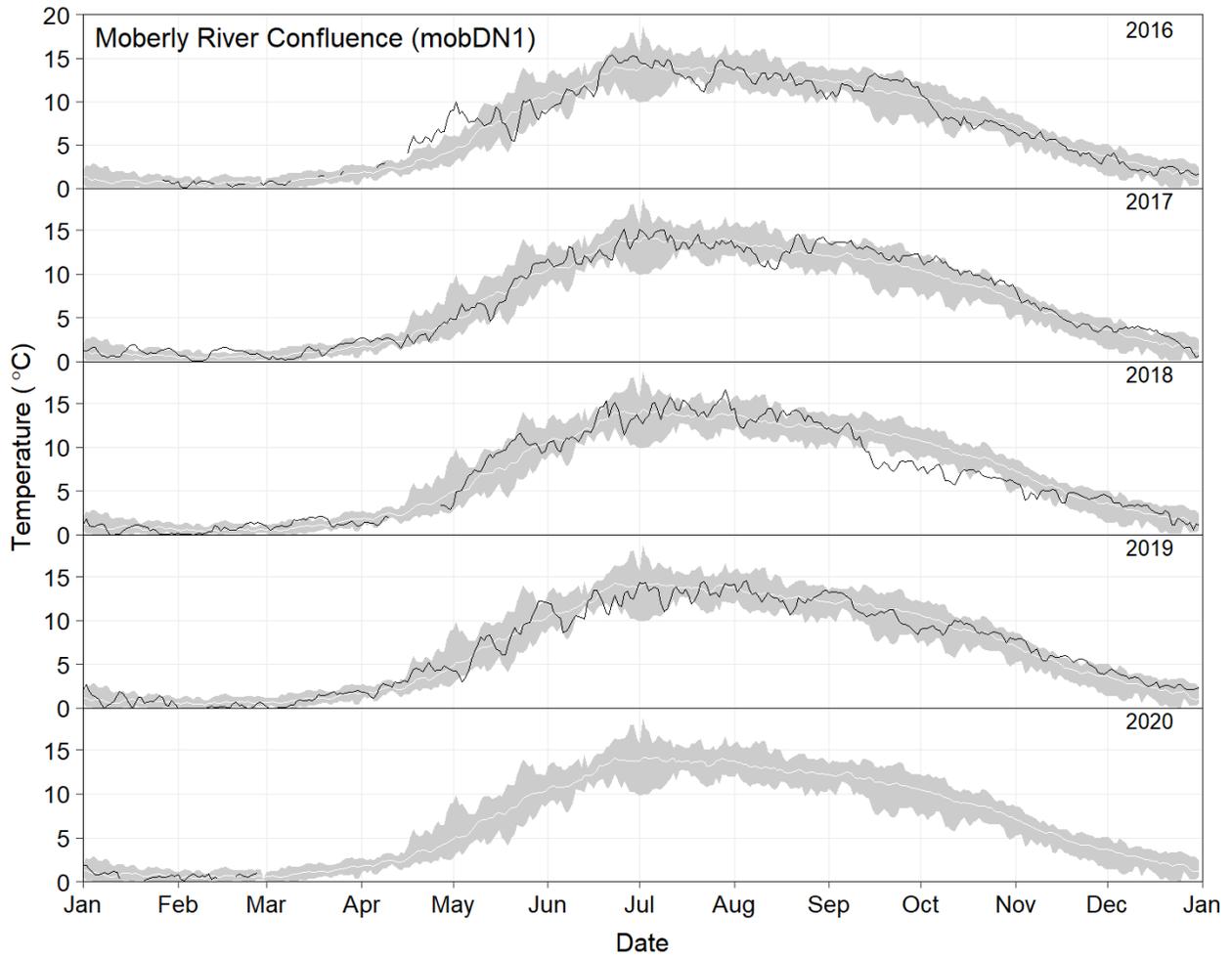


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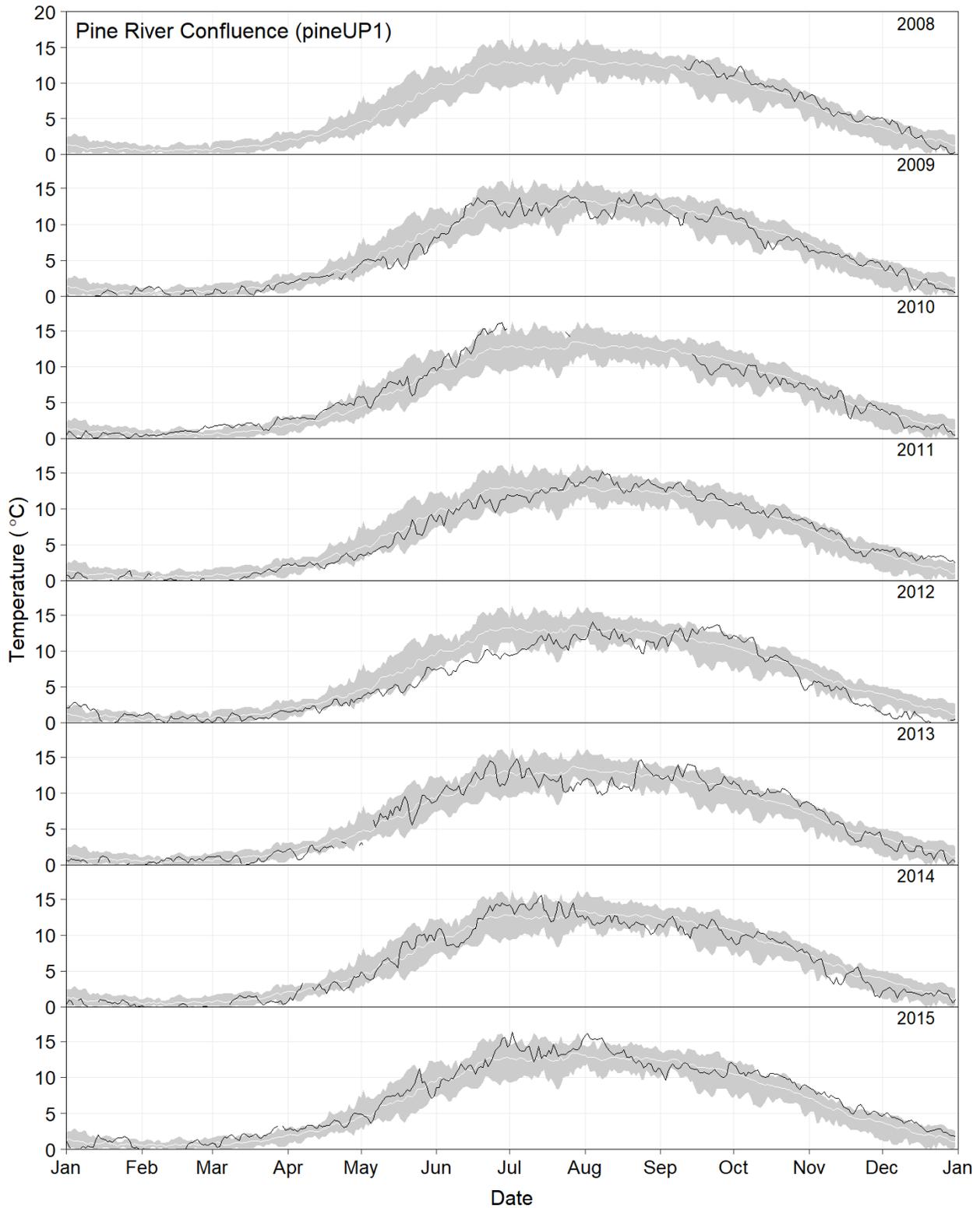


Figure B13: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Pine River’s confluence with the Peace River (pineUP1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

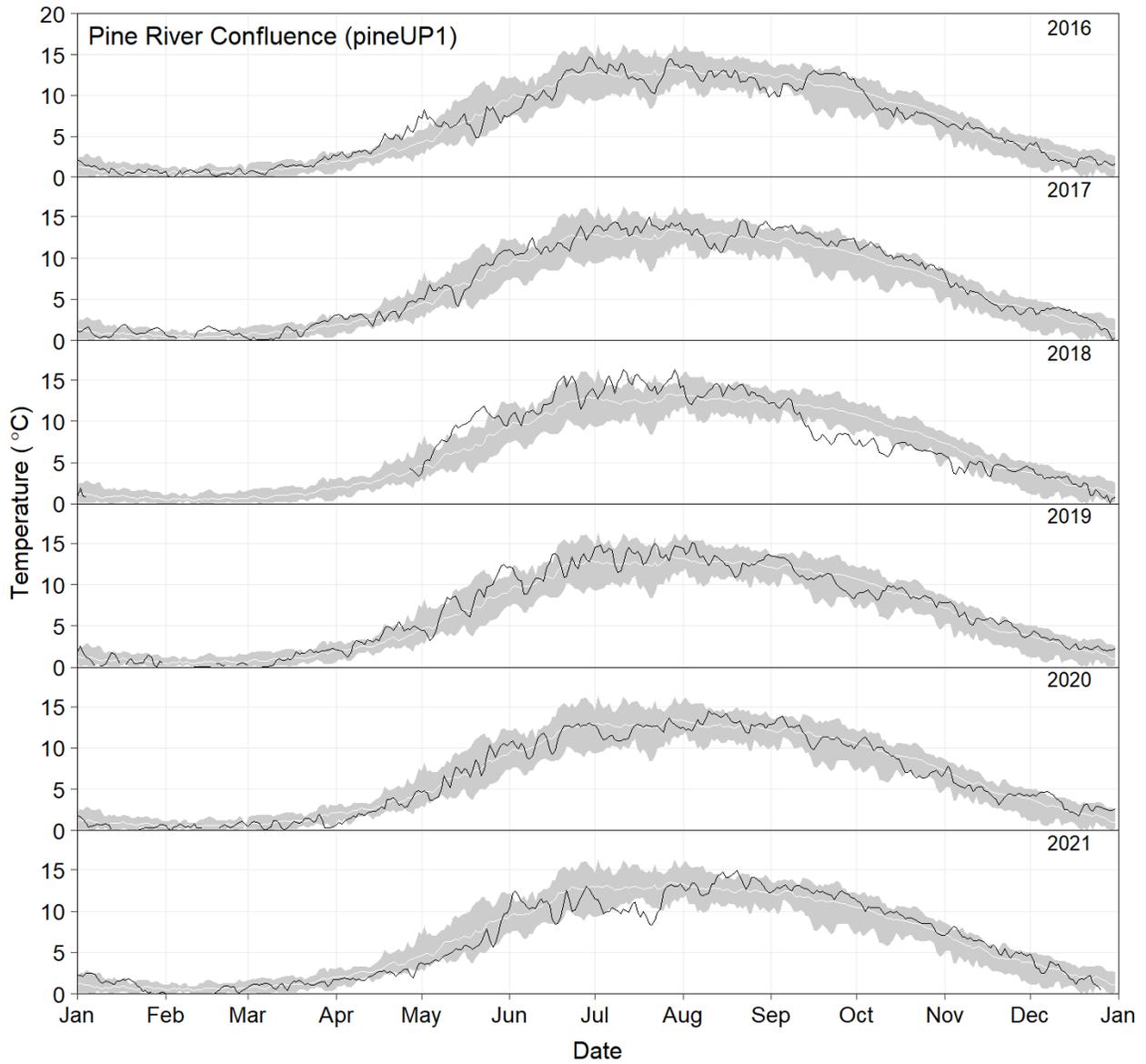


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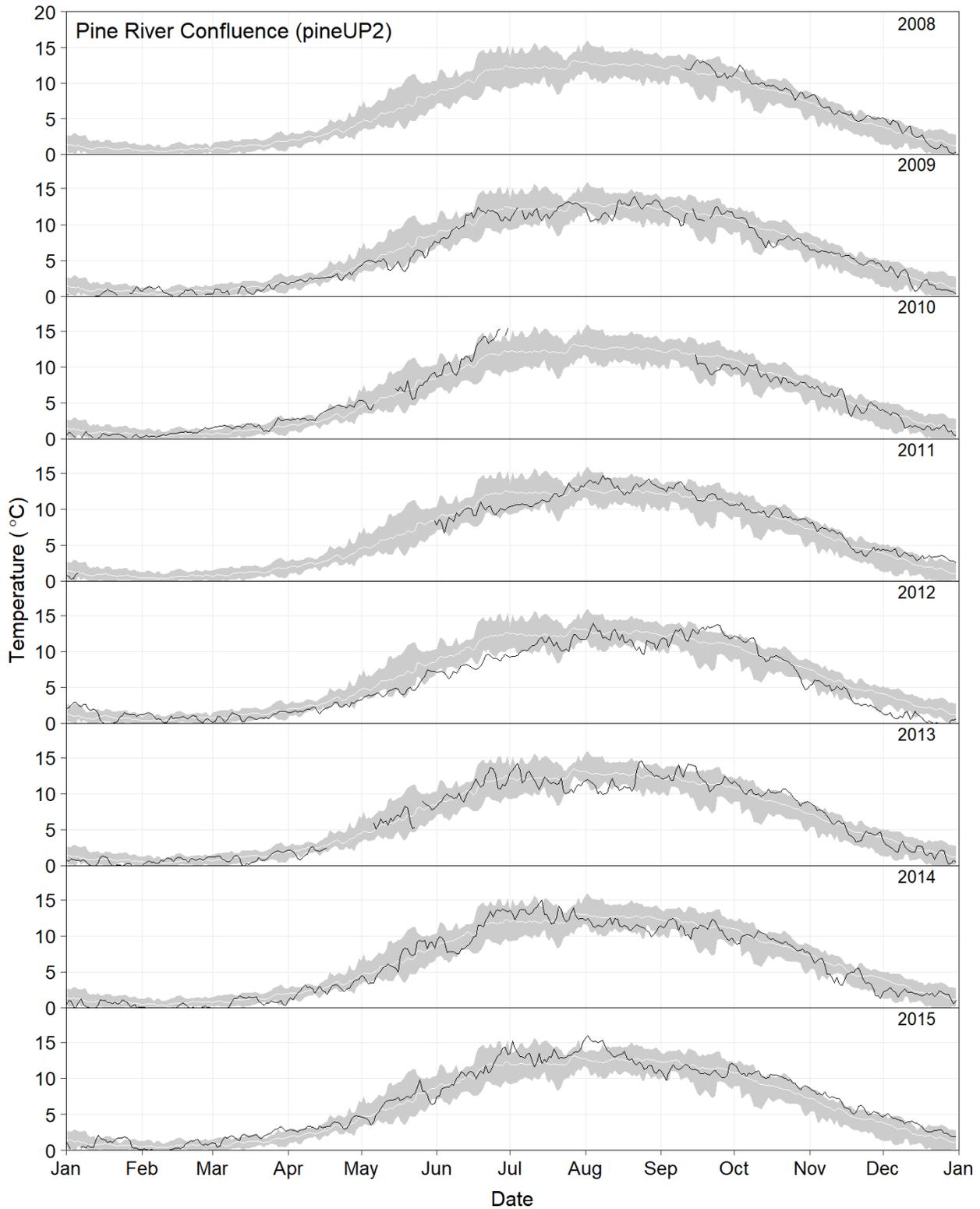


Figure B14: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Pine River’s confluence with the Peace River (pineUP2; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

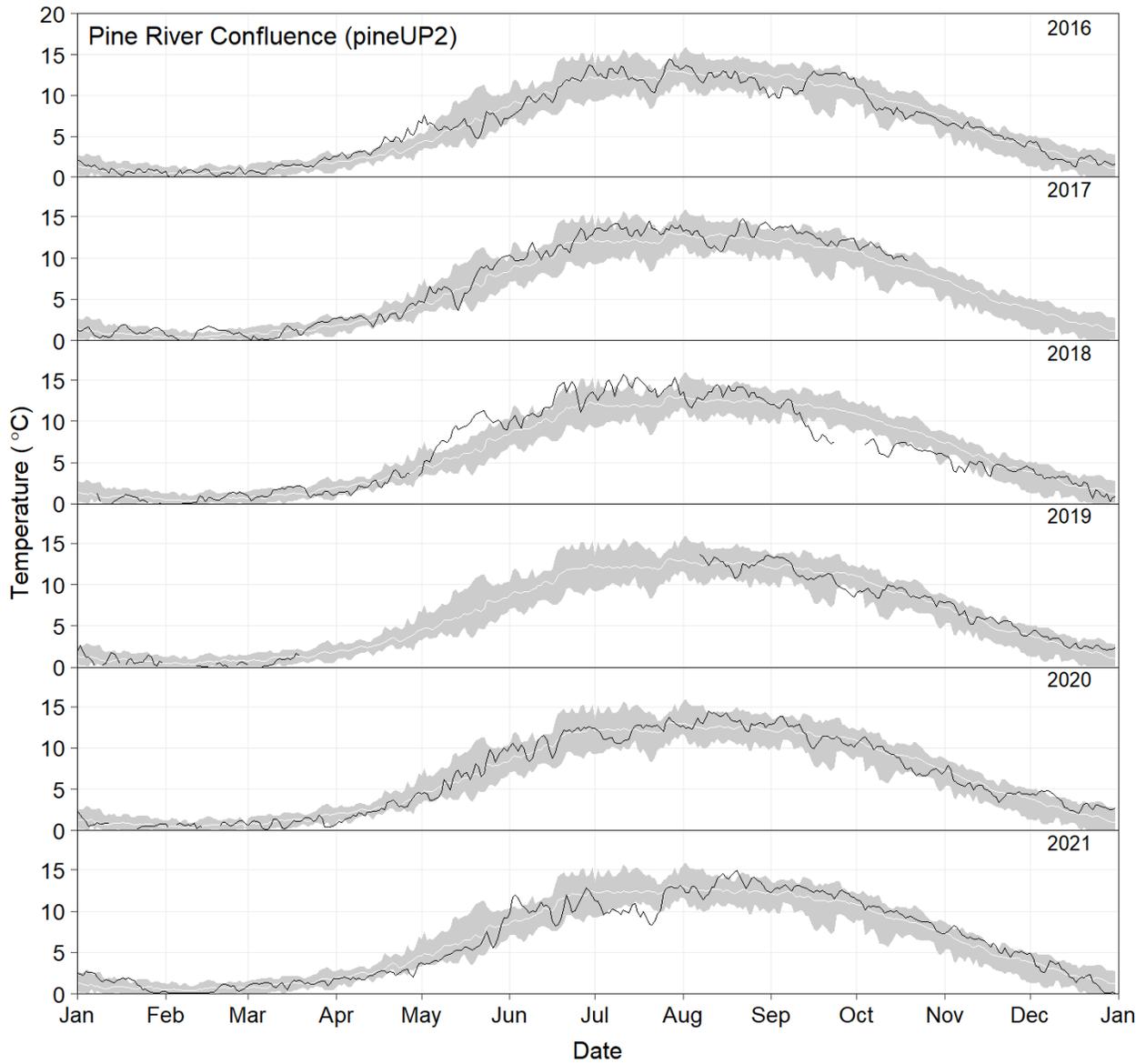


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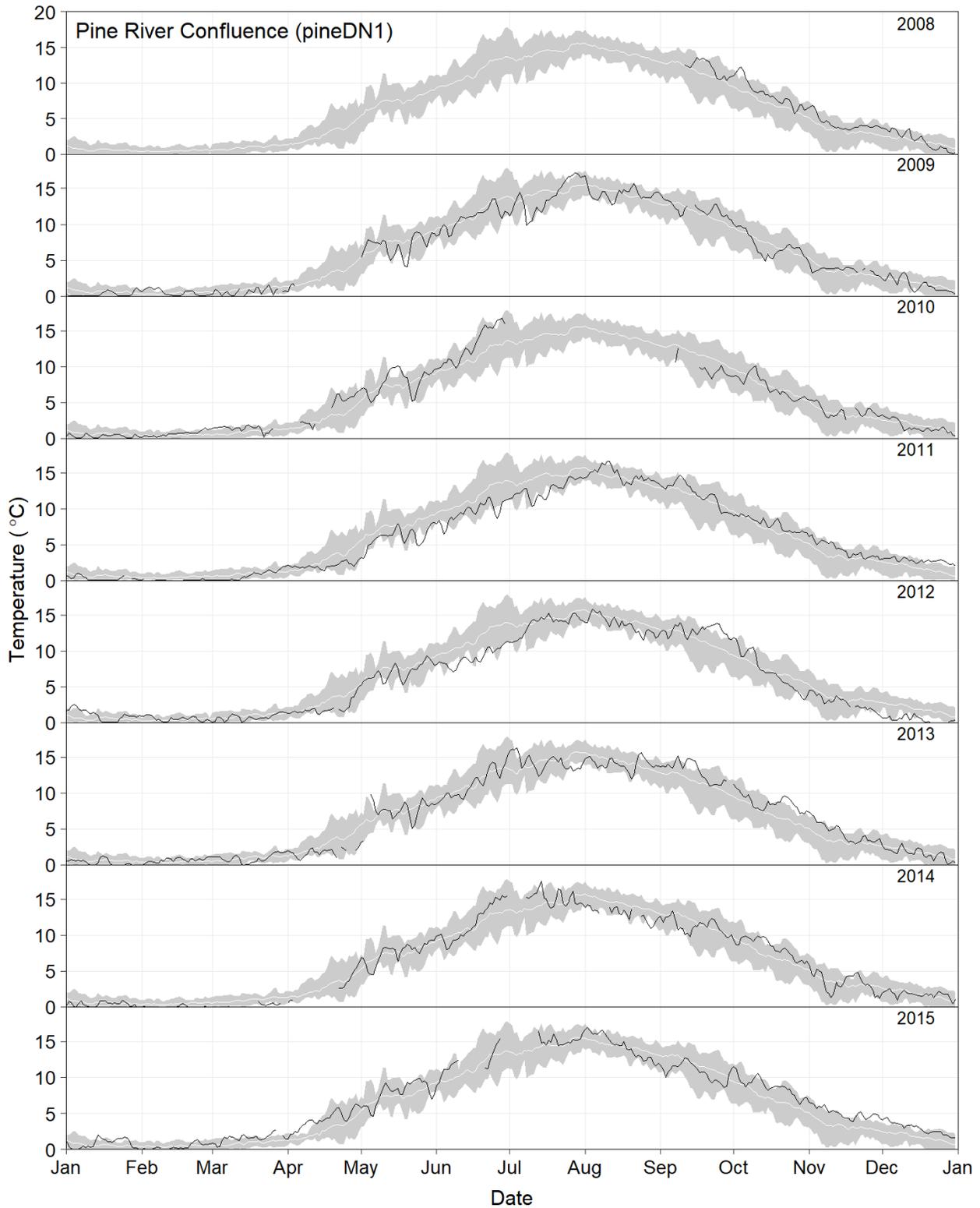


Figure B15: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River downstream of the Pine River’s confluence with the Peace River (pineDN1; black line), 2008 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2008 and 2021. The white line represents average mean daily water temperatures over the same period.

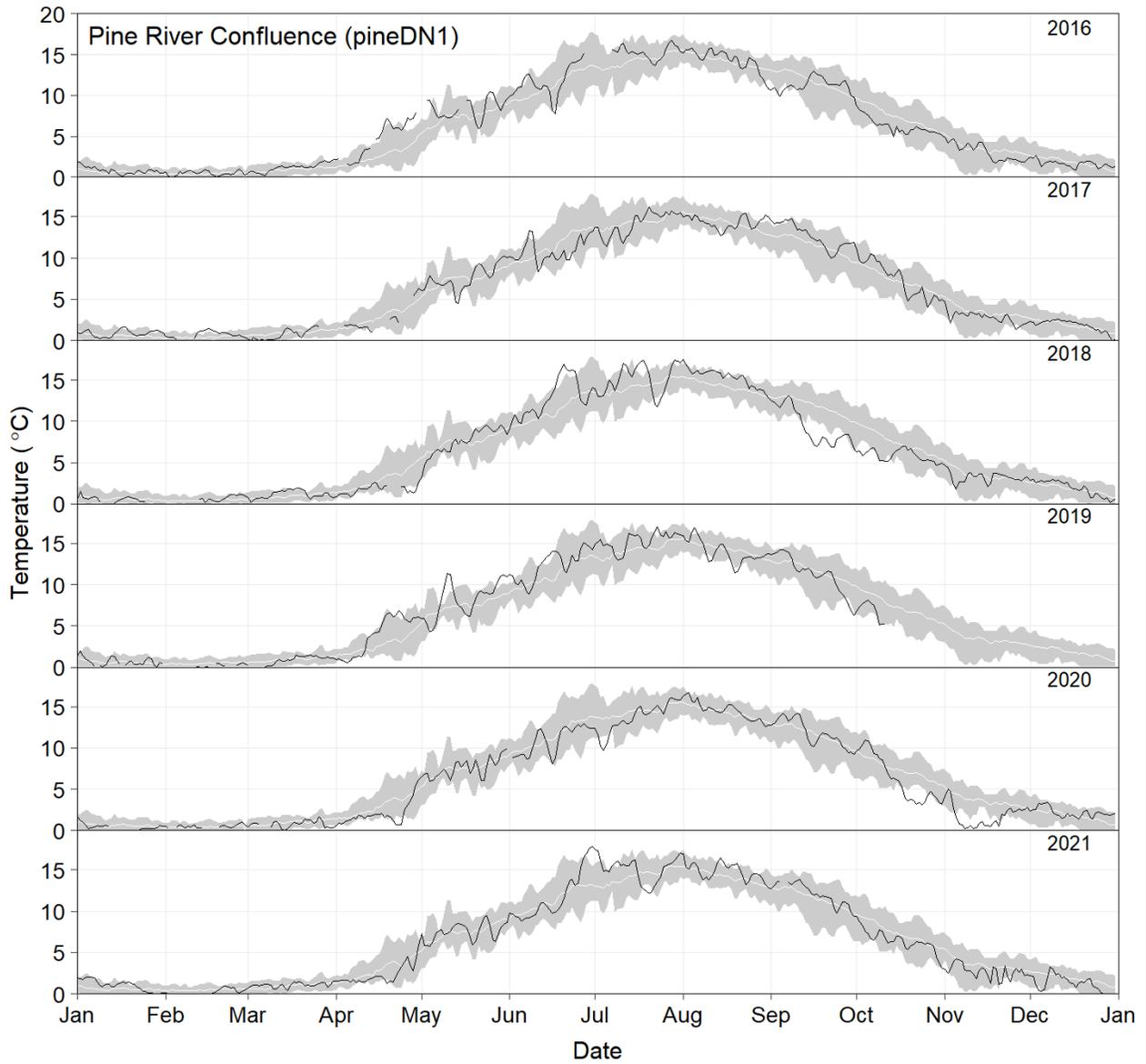


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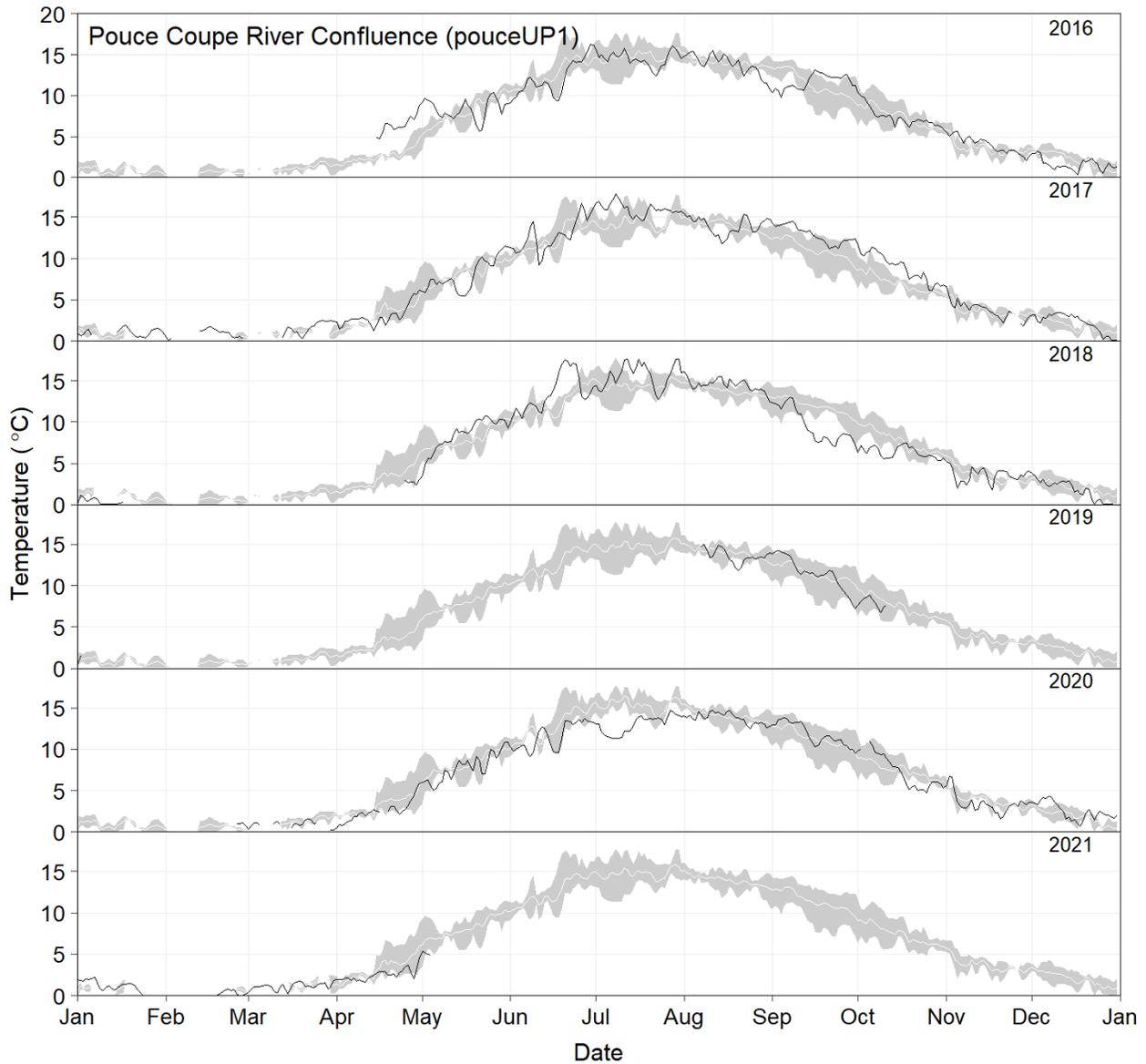


Figure B16: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Peace River upstream of the Pouce Coupe River’s confluence with the Peace River (pouceUP1; black line), 2016 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2016 and 2021. The white line represents average mean daily water temperatures over the same period.

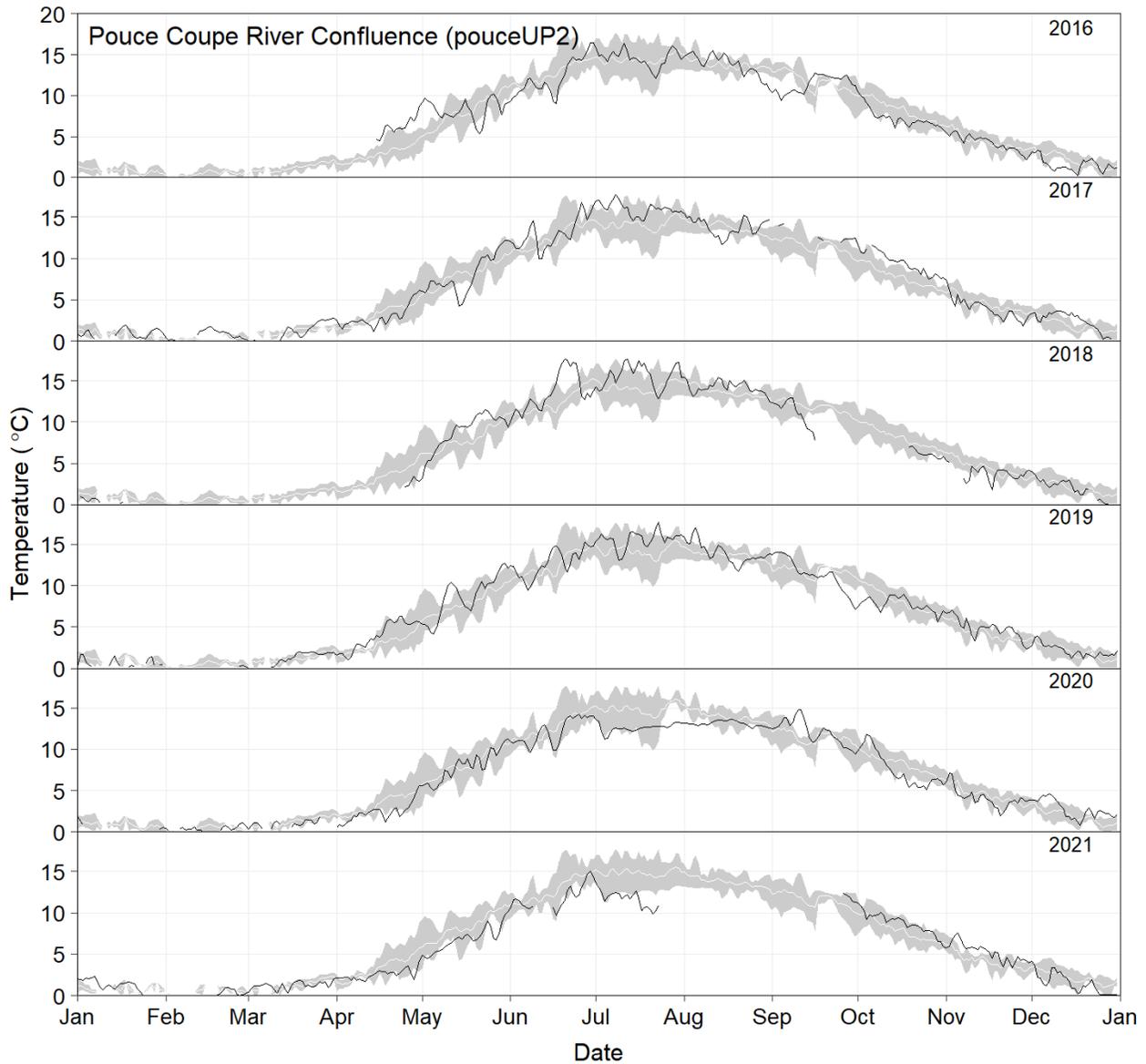


Figure B17: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Peace River upstream of the Pouce Coupe River’s confluence with the Peace River (pouceUP2; black line), 2016 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2016 and 2021. The white line represents average mean daily water temperatures over the same period.

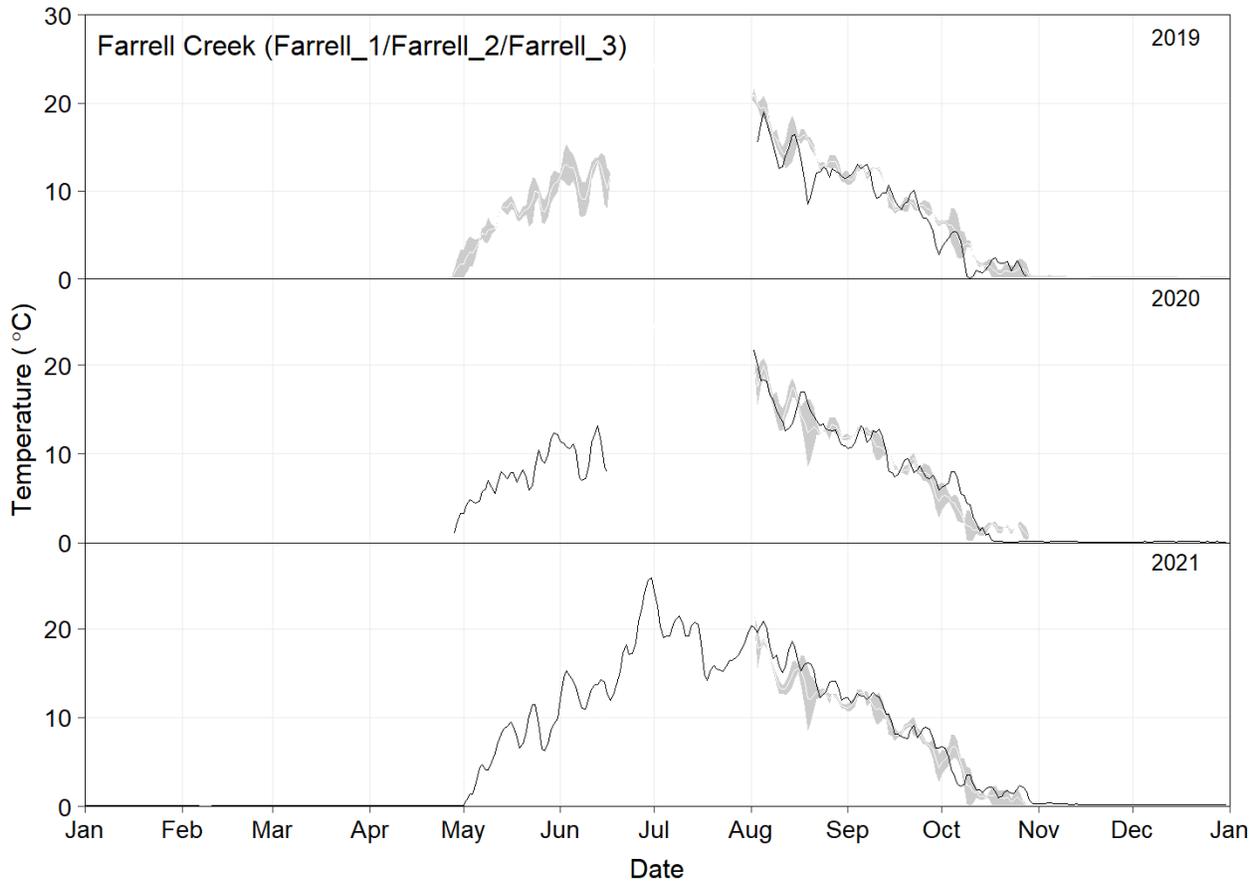


Figure B18: Mean daily water temperature (°C) for Farrell Creek (Farrell_1, Farrell_2, and Farrell_3 combined; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

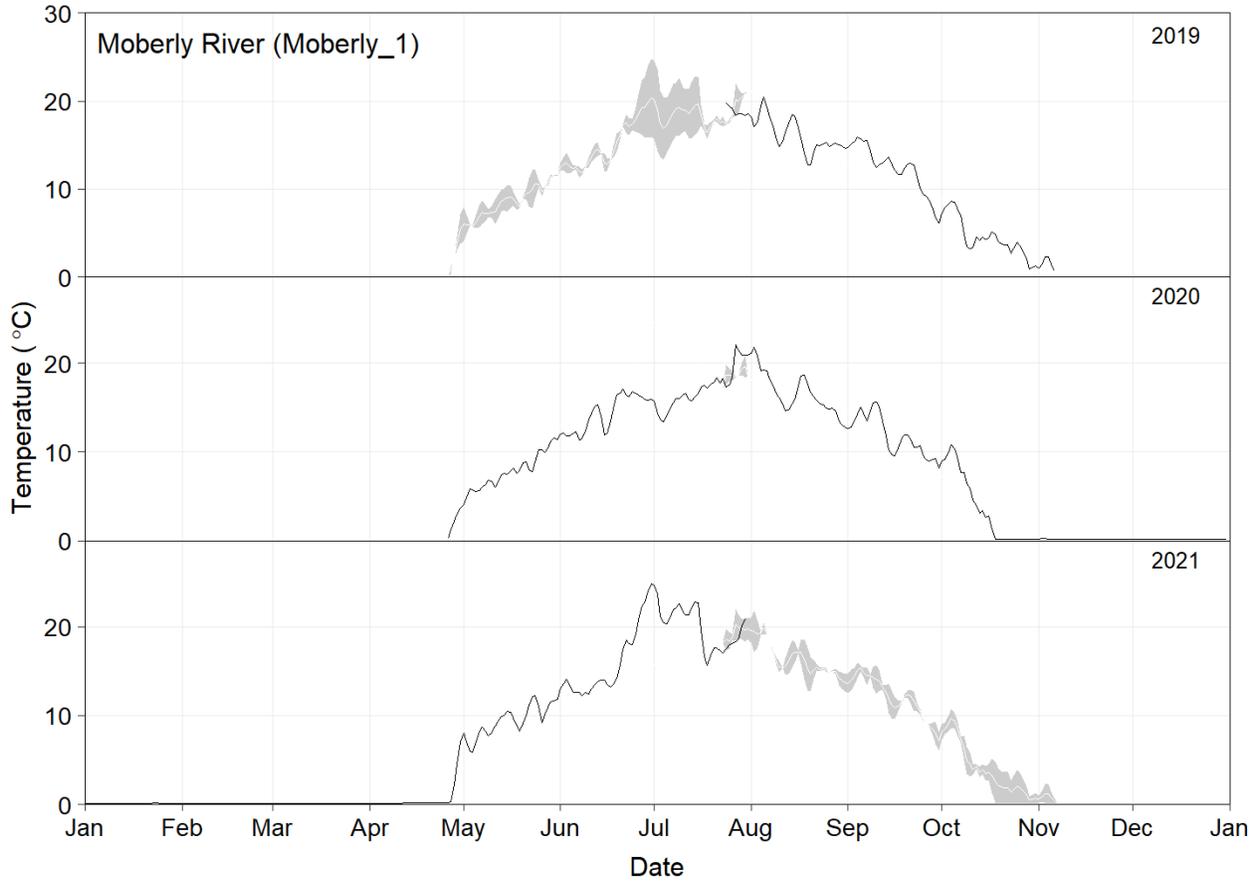


Figure B19: Mean daily water temperature (°C) for Moberly River (Moberly_1; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

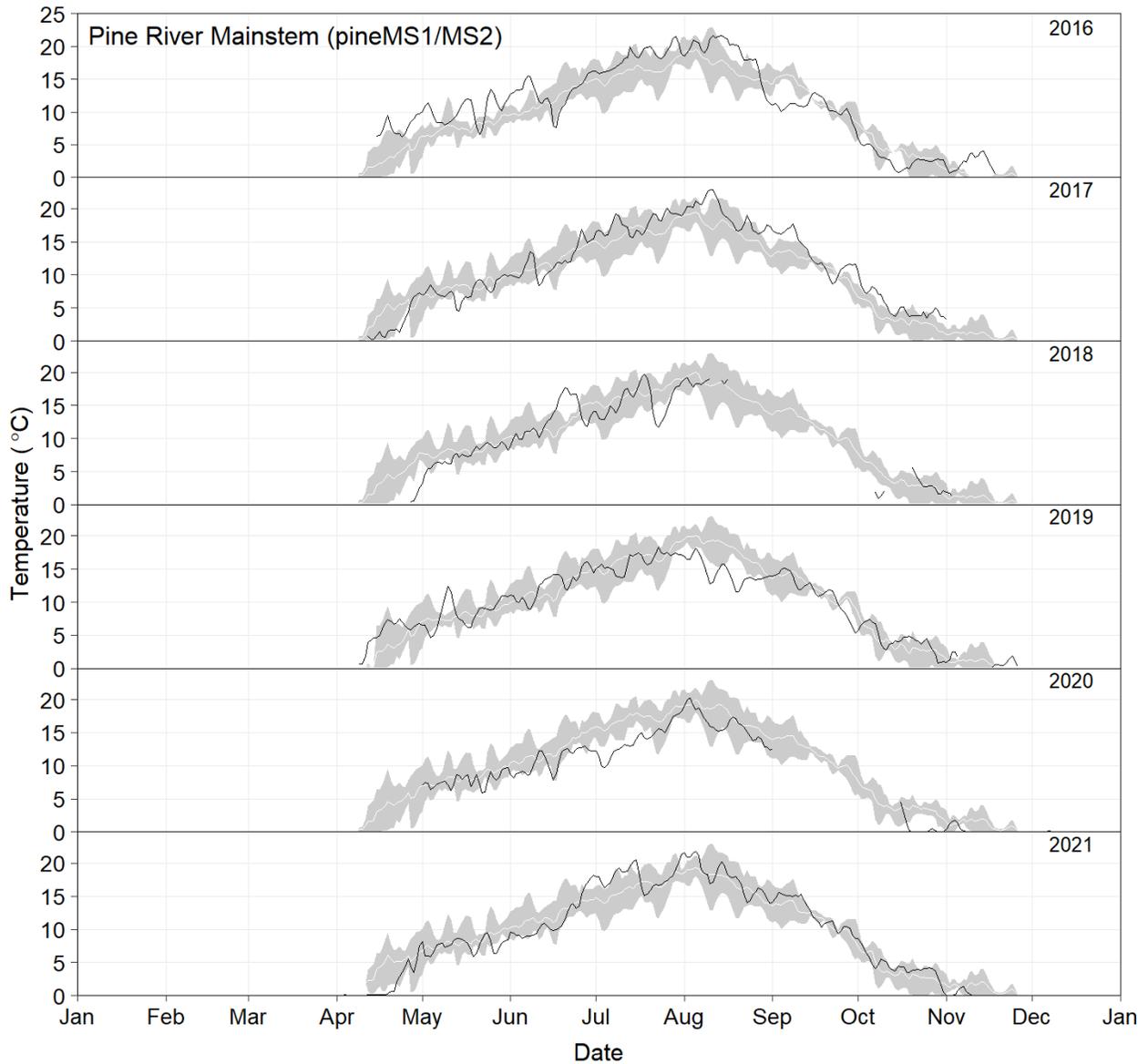


Figure B20: Mean daily water temperature (°C) for Pine River Mainstem (pineMS1 and MS2 combined; black line), 2016 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2016 and 2021. The white line represents average mean daily water temperatures over the same period.

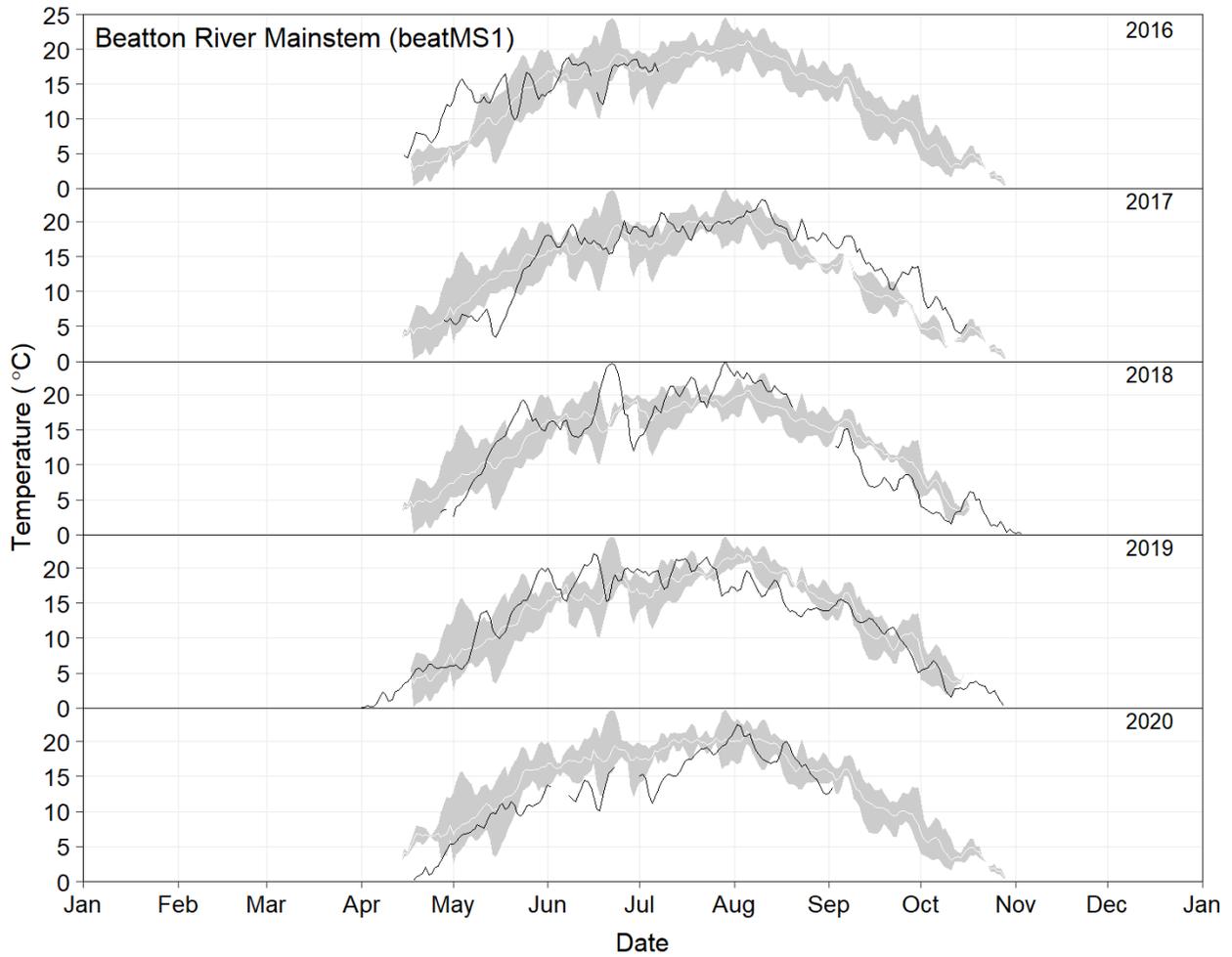


Figure B21: Mean daily water temperature (°C) for Beatton River Mainstem (beatMS1; black line), 2016 to 2020. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2016 and 2020. The white line represents average mean daily water temperatures over the same period.

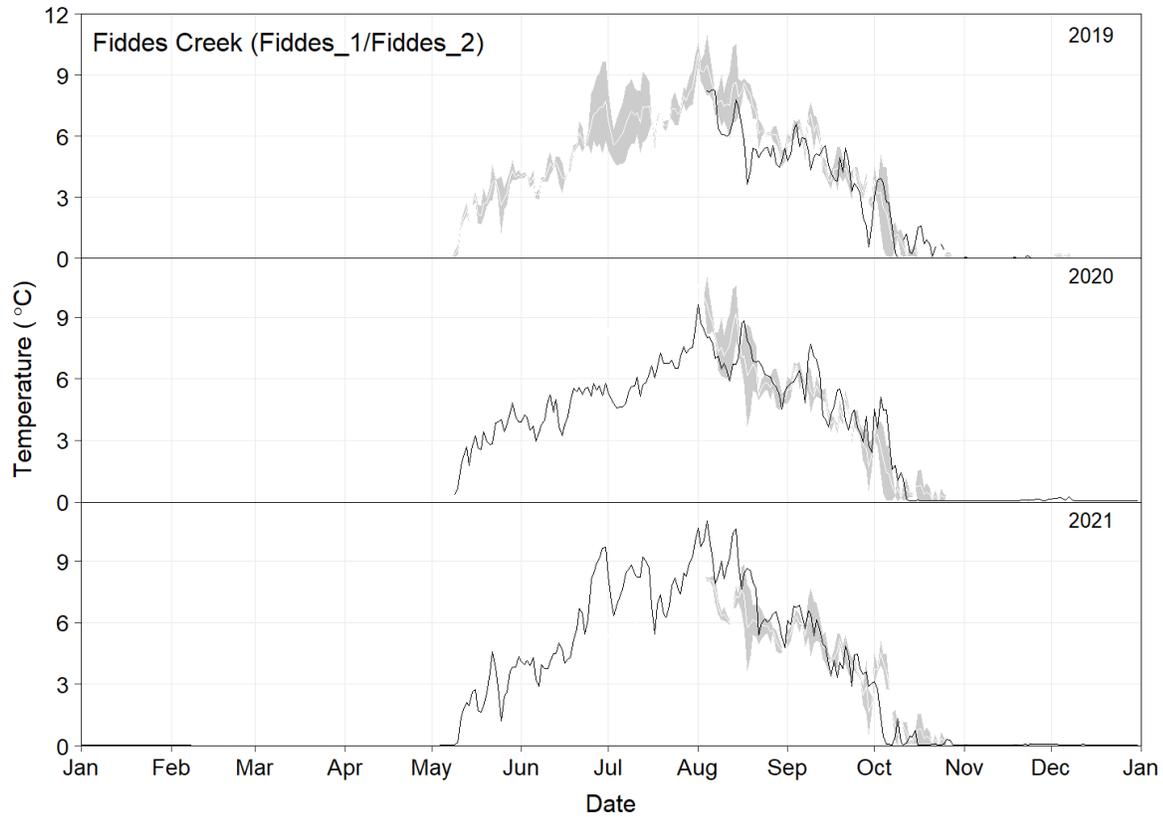


Figure B22: Mean daily water temperature (°C) for Fiddes Creek (Fiddes_1 and Fiddes_2 combined; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

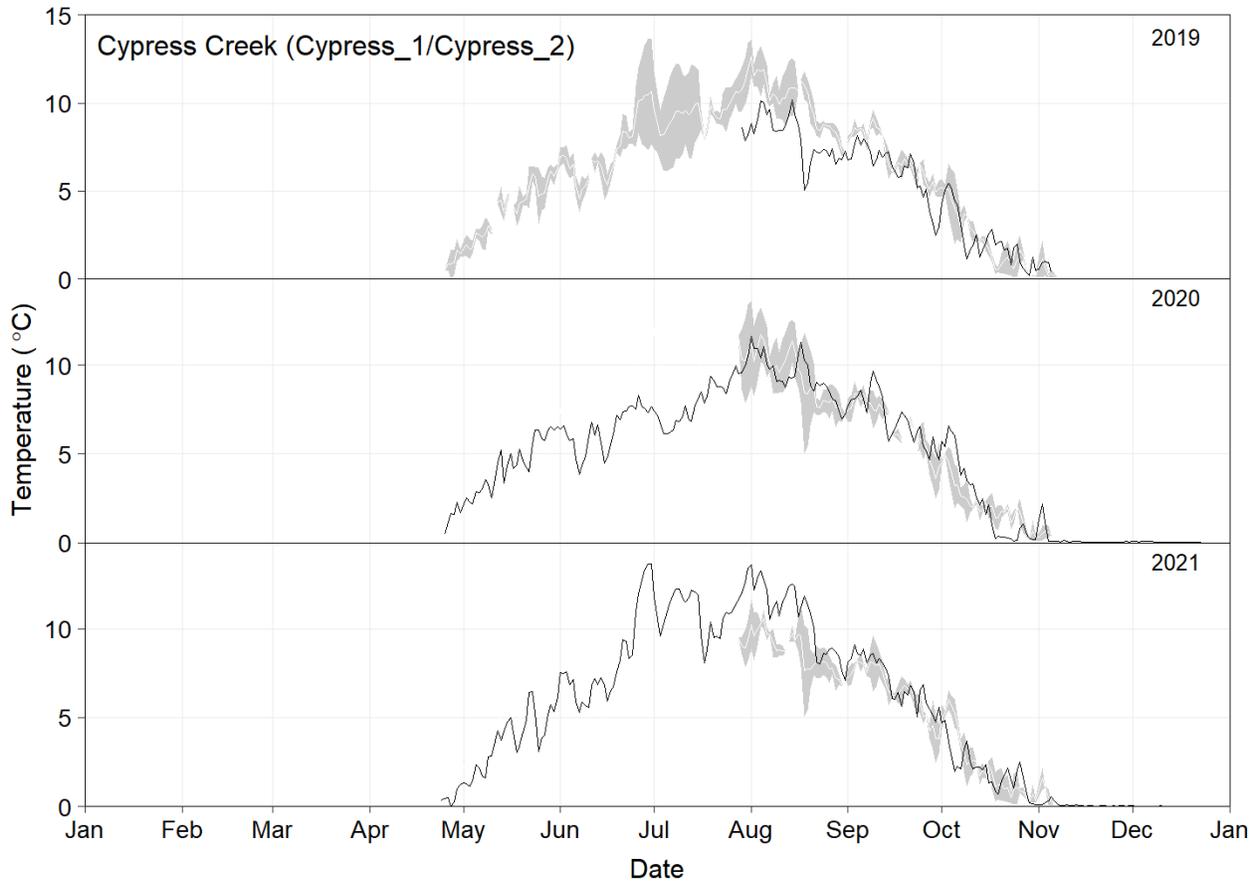


Figure B23: Mean daily water temperature (°C) for Cypress Creek (Cypress_1 and Cypress_2 combined; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

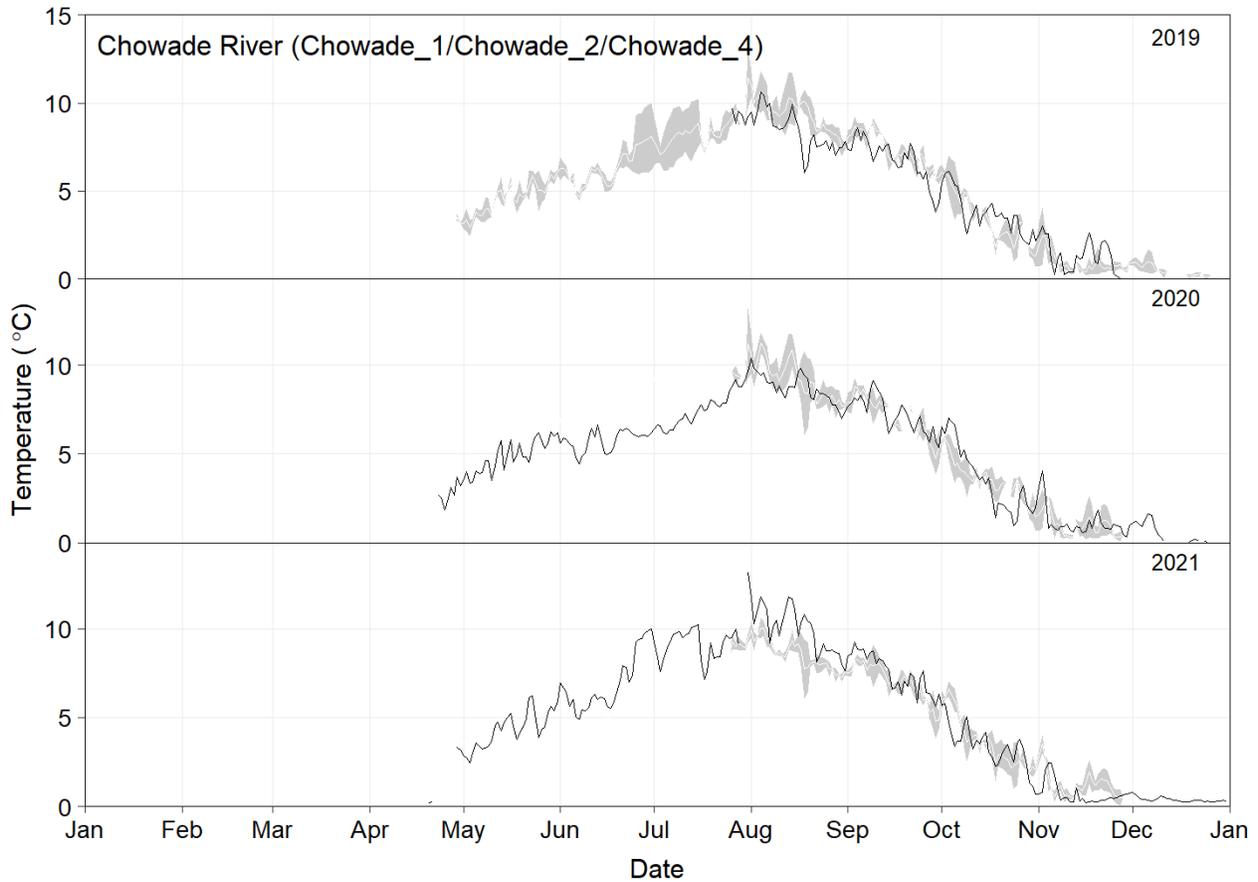


Figure B24: Mean daily water temperature (°C) for Chowade River (Chowade_1, Chowade_2, and Chowade_4 combined; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

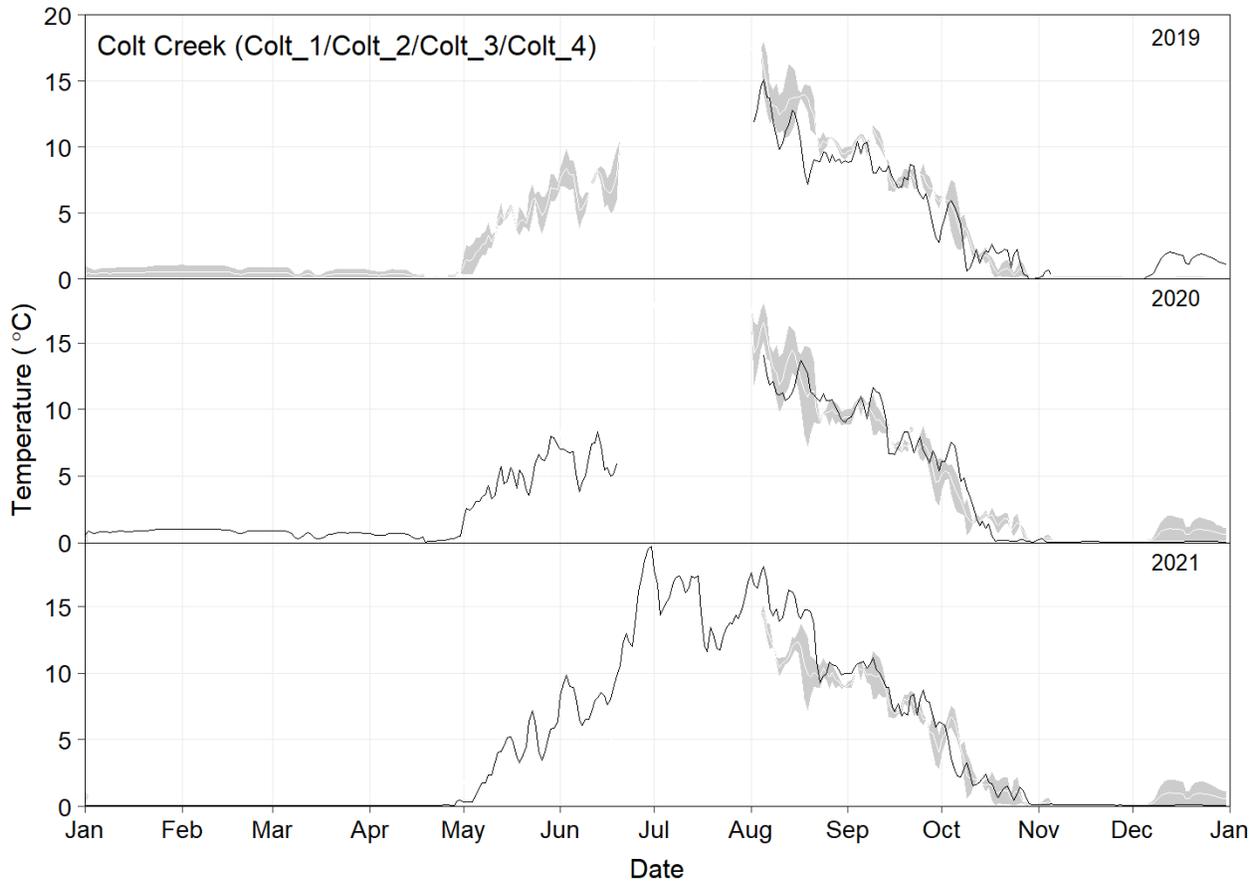


Figure B25: Mean daily water temperature (°C) for Colt Creek (Colt_1, Colt_2, Colt_3, and Colt_4 combined; black line), 2019 to 2021. The shaded area represents minimum and maximum water temperatures recorded at the station during other study years between 2019 and 2021. The white line represents average mean daily water temperatures over the same period.

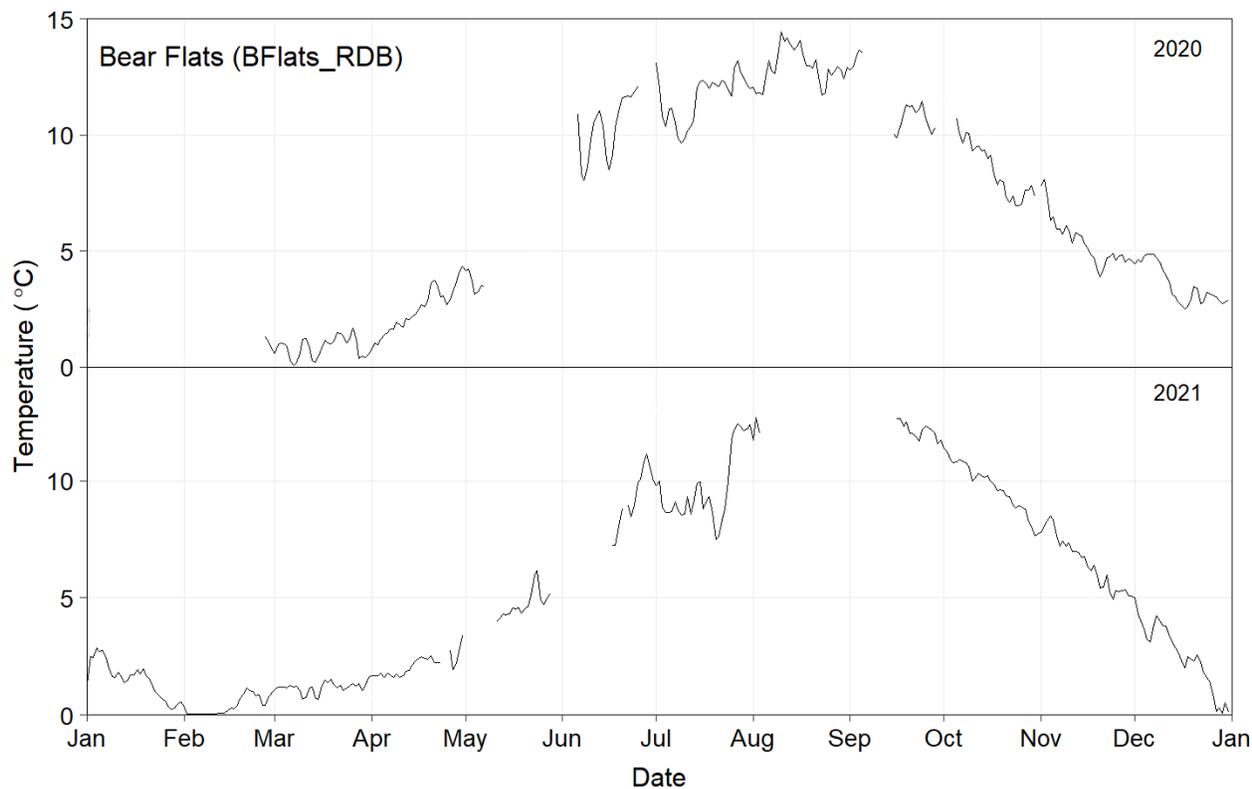


Figure B26: Mean daily water temperature (°C) for the right bank (as viewed facing downstream) of the Bear Flats (BFlats_RDB; black line), 2020 to 2021.

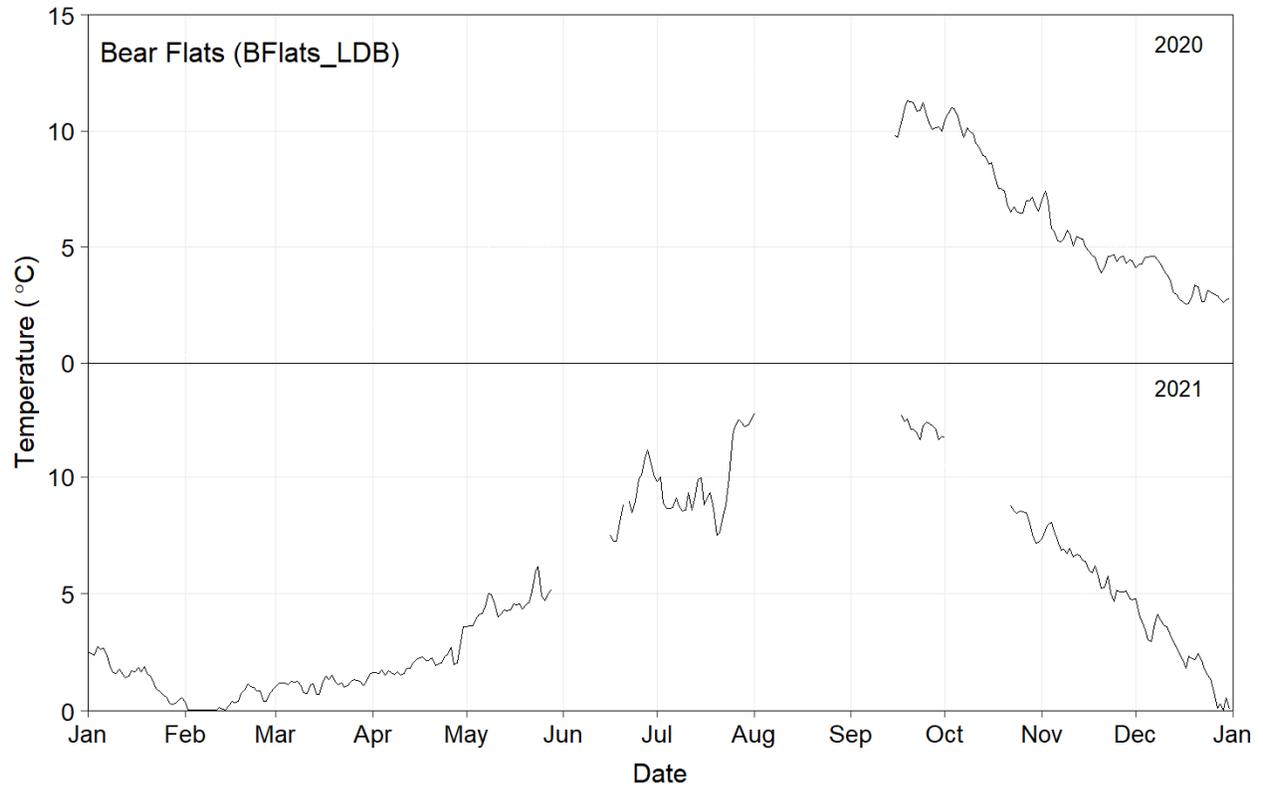


Figure B27: Mean daily water temperature (°C) for the left bank (as viewed facing downstream) of the Bear Flats (BFlats_LDB; black line), 2020 to 2021.



Figure B28: Mean daily water temperature (°C) for Kobes Creek Mainstem (Kobes_1, Kobes_2, and Kobes_4 combined; black line), 2020 to 2021.

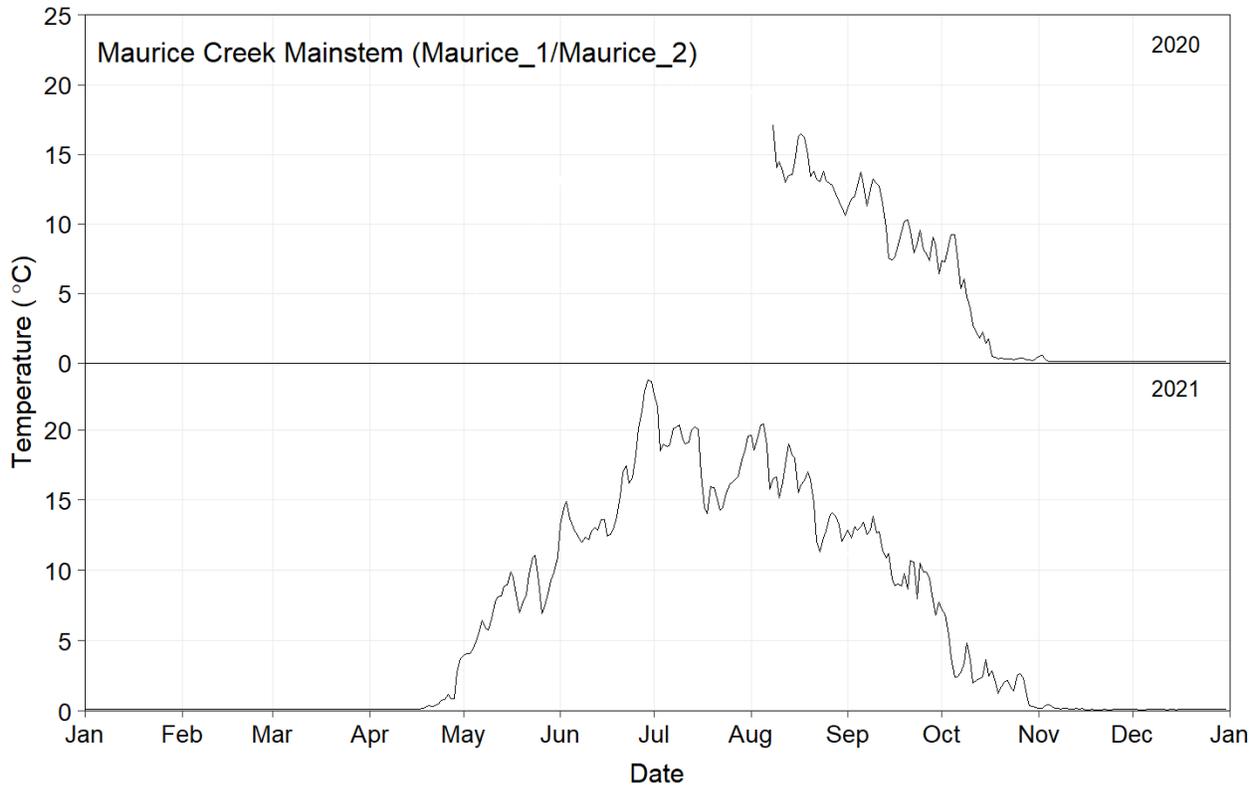


Figure B29: Mean daily water temperature (°C) for Maurice Creek Mainstem (Maurice_1 and Maurice_2 combined; black line), 2020 to 2021.



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