Coordinated Aquatic Monitoring Program

CAMP Twelve Year Data Report (2008-2019)

Technical Document 5:

Lower Churchill River Region

Prepared by

Manitoba Hydro

And

North/South Consultants Inc.

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CAMP TWELVE YEAR DATA REPORT (2008-2019)

TECHNICAL DOCUMENT 5: LOWER CHURCHILL RIVER REGION

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2024

EXECUTIVE SUMMARY

This report presents the results of monitoring conducted under the Coordinated Aquatic Monitoring Program (CAMP) for years 1 through 12 (i.e., 2008/2009 through 2019/2020) in the Lower Churchill River Region. The Lower Churchill River Region extends from the outlet of Southern Indian Lake downstream of Manitoba Hydro's Missi Falls Control Structure (CS) to Hudson Bay. Waterbodies and sites where water quality and biological monitoring are conducted in this region over this period included six on-system and one off-system waterbodies as follows:

- Northern Indian Lake;
- the lower Churchill River at the Little Churchill River;
- Partridge Breast Lake;
- Fidler Lake;
- Billard Lake;
- the lower Churchill River at the Churchill Weir; and
- Gauer Lake (off-system).

Hydrology and sedimentation monitoring is conducted at additional sites within the region. Monitoring on-system waterbodies addresses the primary objective of CAMP – to monitor aquatic ecosystem health along Manitoba Hydro's hydraulic operating system. The off-system waterbodies were included in CAMP to provide regional information collected in a manner consistent with monitoring of on-system waterbodies that will assist in interpreting any observed environmental changes over time. Such comparisons are intended to help distinguish between hydroelectric-related effects and other external factors (e.g., climate change) in each CAMP region.

Monitoring was conducted annually at some waterbodies and river reaches and on a three-year rotation at other sites. Components monitored under CAMP in the Lower Churchill River Region presented in this report include the physical environment (water regime and sedimentation), water quality, benthic macroinvertebrates, fish community, and mercury in fish. Climatological data for the region are also included to provide supporting information to assist with interpretation of CAMP monitoring results.

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ABBREVIATIONS, ACRONYM, AND UNITS

ANN	Annual
CAMP	Coordinated Aquatic Monitoring Program
CL(s)	Confidence limit(s)
cms	Cubic metres per second
CONT	Continuous
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch-per-unit-effort
CRD	Churchill River Diversion
CS	Control structure(s)
DELTs	Deformities, Erosion, Lesions, and Tumours
DL(s)	Detection limit(s)
DO	Dissolved oxygen
ECCC	Environment and Climate Change Canada
EPT	Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)
FA	Fall
FLA	Fork length-at-age
FNU	Formazin nephelometric unit
GN	Standard gang index gill net
h	hour
IC	Ice-cover season
IQR	Interquartile range
KF	Fulton’s Condition Factor
m	Metre
m^2	Metre squared
Max	Maximum
µg/L	Micrograms per litre
mg/L	Milligrams per litre
Min	Minimum
mm	Millimetre
MWQSOGs	Manitoba Water Quality Standards, Objectives, and Guidelines
MWS	Manitoba Water Stewardship
n	Sample size or number of samples
n_F	Number of fish
n_S	Number of sites
ND	No data

no.	Number
NS	Nearshore
n_{spp}	Number of species caught in standard and small mesh gill nets
NTU	Nephelometric turbidity units
O+C	Oligochaeta and Chironomidae
OECD	Organization for Economic Cooperation and Development
OS	Offshore
OW	Open-water season
PAL	Protection of aquatic life
ppm	Parts per million
RCEA	Regional cumulative effects assessment
ROT	Rotational
RSA	Relative species abundance
RYCS	Relative year-class strength
SD	Standard deviation
SE	Standard error
SN	Small mesh index gillnet gang
SP	Spring
SU	Summer
T/day	Tonnes per day
TN	Total nitrogen
TOC	Total organic carbon
TP	Total phosphorus
TSS	Total suspended solids
WI	Winter
Wr	Relative weight
°C	Degrees Celsius

WATERBODY ABBREVIATIONS

Abbreviation	Waterbody
MISSI CS	Missi Falls Control Structure
NIL	Northern Indian Lake
LCR-FID	Lower Churchill River below Fidler Lake
LCR-LiCR	Lower Churchill River at the Little Churchill River
LCR-SR	Lower Churchill River at Swallow Rapids
LCR-RH	Lower Churchill River at Redhead Rapids
PBL	Partridge Breast Lake
FID	Fidler Lake
BIL	Billard Lake
LCR-WEIR	Lower Churchill River at the Churchill Weir
LCR-PUMP	Lower Churchill River at the CR30 Pumphouse
GAU-R	Gauer River
GAU	Gauer Lake

FISH SPECIES LIST

Abbreviation	Common Species Name	Species Name
ARGR	Arctic Grayling	*Thymallus arcticus*
BLSH	Blacknose Shiner	*Notropis heterolepis*
BURB	Burbot	*Lota lota*
CISC	Cisco	*Coregonus artedi*
EMSH	Emerald Shiner	*Notropis atherinoides*
LGPR	Logperch	*Percina caprodes*
LKCH	Lake Chub	*Couesius plumbeus*
LKST	Lake Sturgeon	*Acipenser fulvescens*
LKWH	Lake Whitefish	*Coregonus clupeaformis*
LNDC	Longnose Dace	*Rhinichthys cataractae*
LNSC	Longnose Sucker	*Catostomus catostomus*
NPDC	Northern Pearl Dace	*Margariscus nachtriebi*
NRDC	Northern Redbelly Dace	*Chrosomus eos*
NRPK	Northern Pike	*Esox lucius*
SAUG	Sauger	*Sander canadensis*
SLSC	Slimy Sculpin	*Cottus cognatus*
SPSC	Spoonhead Sculpin	*Cottus ricei*
SPSH	Spottail Shiner	*Notropis hudsonius*
TRPR	Trout-perch	*Percopsis omiscomaycus*
WALL	Walleye	*Sander vitreus*
WHSC	White Sucker	*Catostomus commersonii*
YLPR	Yellow Perch	*Perca flavescens*

1.0 INTRODUCTION

This report presents the results of monitoring conducted under the Coordinated Aquatic Monitoring Program (CAMP) for years 1 through 12 (i.e., 2008/2009 through 2019/2020) in the Lower Churchill River Region. The Lower Churchill River Region extends from the outlet of Southern Indian Lake downstream of Manitoba Hydro's Missi Falls Control Structure (CS) to Hudson Bay. Waterbodies and sites where water quality and biological monitoring are conducted in this region over this period included six on-system and one off-system waterbodies as follows:

- Northern Indian Lake;
- the lower Churchill River at the Little Churchill River;
- Partridge Breast Lake;
- Fidler Lake;
- Billard Lake;
- the lower Churchill River at the Churchill Weir; and
- Gauer Lake (off-system).

Hydrology and sedimentation monitoring is conducted at additional sites within the region (Table 1-1). Monitoring on-system waterbodies addresses the primary objective of CAMP – to monitor aquatic ecosystem health along Manitoba Hydro's hydraulic operating system. The off-system waterbodies were included in CAMP to provide regional information collected in a manner consistent with monitoring of on-system waterbodies that will assist in interpreting any observed environmental changes over time. Such comparisons are intended to help distinguish between hydroelectric-related effects and other external factors (e.g., climate change) in each CAMP region.

A summary of monitoring conducted by waterbody or river reach presented in this data report is provided in Table 1-1 and monitoring areas are shown in Figure 1-1. As noted in Table 1-1, monitoring was conducted annually at some waterbodies and river reaches and on a three-year rotation at other sites. Components monitored under CAMP in the Lower Churchill River Region presented in this report include the physical environment (water regime and sedimentation), water quality, benthic macroinvertebrates, fish community, and mercury in fish. Climatological data for the region are also included to provide supporting information to assist with interpretation of CAMP monitoring results.

Table 1-1. Lower Churchill River Region CAMP monitoring summary.

Waterbody/ Area	Abbreviation	On/Off-System		Component					
		On-System	Off-System	Water Regime	Sedimentation	Water Quality	Benthic Invertebrates	Fish Community	Fish Mercury
Missi Falls CS	MISSI CS	●		CONT	CONT				
Northern Indian Lake	NIL	●		CONT		ANN	ANN	ANN	ROT
Lower Churchill River below Fidler Lake	LCR-FID	●		CONT					
Lower Churchill River at the Little Churchill River	LCR-LiCR	●				ANN	ANN	ANN	ROT
Lower Churchill River at Swallow Rapids	LCR-SR	●		CONT					
Lower Churchill River at Redhead Rapids	LCR-RH	●		CONT					
Partridge Breast Lake	PBL	●				ROT	ROT	ROT	
Fidler Lake	FID	●				ROT	ROT	ROT	
Billard Lake	BIL	●		CONT		ROT	ROT	ROT	
Lower Churchill River at the Churchill Weir	LCR-WEIR	●				ROT	ROT	ROT	ROT
Lower Churchill River at the CR30 Pumphouse	LCR-PUMP	●		CONT					
Gauer River	GAU-R		●	CONT					
Gauer Lake	GAU		●			ANN	ANN	ANN	ROT

Notes:

1. CONT = site monitored continuously; ANN = site sampled each year; ROT = site sampled every 3 years.

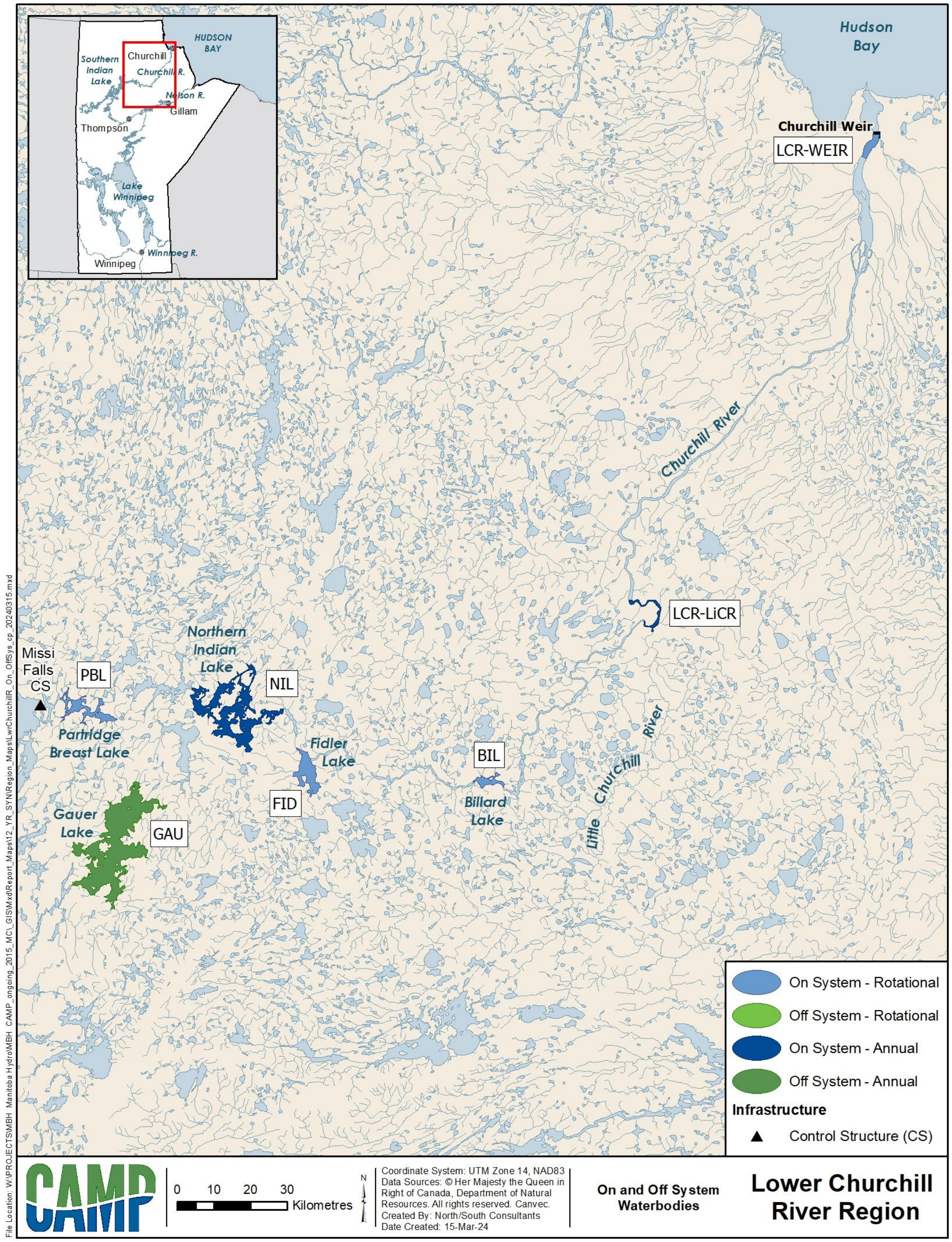


Figure 1-1. On-system and off-system waterbodies and river reaches sampled under CAMP in the Lower Churchill River Region: 2008-2019.

Photograph 1. Northern Indian Lake.

Photograph 2. The lower Churchill River at the Little Churchill River.

Photograph 3. Partridge Breast Lake.

Photograph 4. Fidler Lake.


Photograph 5. Billard Lake.


Photograph 6. The lower Churchill River at the Churchill Weir.

Photograph 7. Gauer Lake.

2.0 PHYSICAL ENVIRONMENT

2.1 INTRODUCTION

The following presents the results of the physical environment monitoring conducted from 2008 to 2019 in the Lower Churchill River Region. Seven waterbodies were monitored in the Lower Churchill River Region: six on-system sites (Partridge Breast Lake, Northern Indian Lake, Fidler Lake, Billard Lake, the lower Churchill River at the Little Churchill River, and the Churchill River upstream from the Churchill Weir): and one off-system site (Gauer Lake). In addition, a continuous water quality monitoring station is located at the Missi Falls CS. Though CAMP does not directly monitor climate, data from Environment and Climate Change Canada (ECCC) is included in reporting to contextualize the data collected under each CAMP component. For the lower Churchill River Region, meteorological conditions from ECCC's Churchill station are reported.

Three indicators (climate; water regime; and sedimentation) were selected for detailed reporting (Table 2.1-1). Metrics for these indicators include temperature, precipitation, water flow, level and variability, water temperature, continuous turbidity, and suspended sediment load (Table 2.1-1). A detailed description of these indicators is provided CAMP (2024).

A detailed description of the program design and sampling methods is provided in Technical Document 1, Sections 2.1 and 2.2.

Table 2.1-1. Physical Environment indicators and metrics.

Indicator	Metric	Units
Climate[1]	• Temperature	Degrees Celsius (°C)
	• Precipitation	Millimetres (mm)
Water Regime	• Flow	Cubic meters per second (cms)
	• Water Level and Variability	Metres (m)
	• Water Temperature	Duration of temperature in 5-degree Celsius increments (#days/5 °C)
Sedimentation	• Continuous Turbidity	Formazin nephelometric unit (FNU)
	• Suspended Sediment Load	Tonnes/day (T/day)

Notes:
1. Climate is not monitored through CAMP; data are included for reporting purposes only.

2.2 CLIMATE

In this section, mean monthly air temperatures and total monthly precipitation for each year in the monitoring program (2008-2020) are compared to ECCC climate normals to provide a summary of the Churchill station meteorological conditions. Climate normals are used to summarize the average climatic conditions of a particular location. As recommended by the World Meteorological Organization, ECCC calculates climate normals using a 30-year period (e.g., 1981-2010). The Churchill station is used herein to illustrate climate conditions in the Lower Churchill River Region.

Historical monthly average air temperature and total monthly precipitation during the monitoring period were calculated based on available daily data from ECCC at multiple stations. It is important to note that the use of multiple stations could introduce inhomogeneities in observations between various stations and the station used for climate normals (Climate ID: 5060600). For instances where datasets were missing more than 10% of the daily data in a month, monthly values were gap-filled using ERA5-Land data (Muñoz Sabater 2019). Seasonal and annual maps derived from ERA5-Land data are also provided in Appendices 2-1 and 2-2 to complement the station data and offer a broader spatial representation of temperature and precipitation conditions across Manitoba. Although the ERA5-Land data correlated well with the actual observed ECCC data for the Churchill station, it should be noted that ERA5-Land is a gridded reanalysis product, meaning the dataset combines modelled data with observations, and therefore may not provide an entirely accurate representation of observed climate.

2.2.1 TEMPERATURE

Figure 2.2-1 illustrates the mean monthly air temperatures (in °C) for each year during the monitoring period compared to the 1981-2010 normal mean temperature. As shown, air temperatures at this location follow a distinct seasonal pattern; warmer in the summer (warmest in July) and cooler in the winter (coldest in January). In general, recorded air temperatures for the monitoring period were consistent with the climate normal pattern. Some deviations can be seen, for example, 2009 recorded considerably cooler temperatures from May to August.

Table 2.2-1 summarizes the mean monthly air temperature data and categorizes each month in the monitoring period as "below normal", "near normal" or "above normal" conditions. It should be noted that the "near normal" category was subjectively defined as +/- 1°C of the ECCC climate normal. Months "below normal" are highlighted in blue, "near normal" are highlighted in grey, and “above normal” are highlighted in orange. Over the monitoring period, the months of January and September generally experienced warmer than normal conditions (≥ 7 out of 13 months above normal). On an annual basis, no distinct patterns in the data were identified as the majority of years in the monitoring period experienced near normal temperatures, with the exception of 2010 to 2012 which were above normal; 2010 had the warmest annual average temperature at -3.2ºC, while 2013 had the coolest annual average temperature at -6.9ºC. The maximum and minimum monthly average air temperatures during the monitoring period were 14.5ºC (July 2018) and -28.5ºC (January 2013), respectively.

Table 2.2-1. Churchill mean monthly and annual air temperature (in ˚C) compared to 1981-2010 normal.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	-24.3	-27.9	-21.3	-9.5	-0.6	6.7	12.9	14.3	6.0	1.2	-9.3	-26.3	-6.5
2009	-23.5	-23.1	-21.4	-8.4	-6.9	3.7	8.6	11.2	9.4	-0.5	-7.3	-21.2	-6.6
2010	-21.6	-19.4	-10.0	-2.9	-1.1	7.7	14.0	11.1	6.8	1.7	-8.0	-16.5	-3.2
2011	-24.2	-23.5	-20.5	-11.4	-2.4	7.7	14.2	13.0	10.3	1.7	-9.3	-19.3	-5.3
2012	-24.3	-17.8	-16.4	-9.1	-0.1	6.2	13.5	13.0	8.4	-0.2	-14.6	-21.8	-5.3
2013	-28.5	-24.1	-18.7	-12.8	0.4	10.6	13.6	11.9	8.8	-0.6	-14.9	-28.2	-6.9
2014	-26.2	-24.0	-22.3	-12.8	1.2	10.5	13.4	12.7	5.8	0.3	-15.7	-18.0	-6.2
2015	-26.1	-28.0	-19.8	-9.5	0.4	8.2	12.0	11.2	7.1	-0.8	-10.0	-14.6	-5.8
2016	-21.6	-27.2	-19.4	-13.1	0.1	8.4	11.5	12.6	8.5	-0.3	-5.3	-21.7	-5.6
2017	-20.9	-22.5	-19.5	-10.5	-0.8	8.0	14.4	14.2	8.4	-1.1	-14.9	-23.1	-5.7
2018	-25.0	-26.9	-16.1	-10.2	-1.9	8.5	14.5	12.6	3.9	-3.3	-15.5	-19.8	-6.6
2019	-27.8	-26.4	-15.7	-8.5	-1.0	7.1	14.1	10.7	8.2	1.2	-12.7	-21.1	-6.0
2020	-20.4	-23.7	-19.6	-11.7	-2.1	5.6	13.4	13.5	6.4	-2.4	-13.9	-19.1	-6.2
1981-2010 Normal	-26.0	-24.5	-18.9	-9.8	-1.0	7.0	12.7	12.3	6.4	-1.2	-12.7	-21.9	-6.5

Below Normal	Near Normal	Above Normal

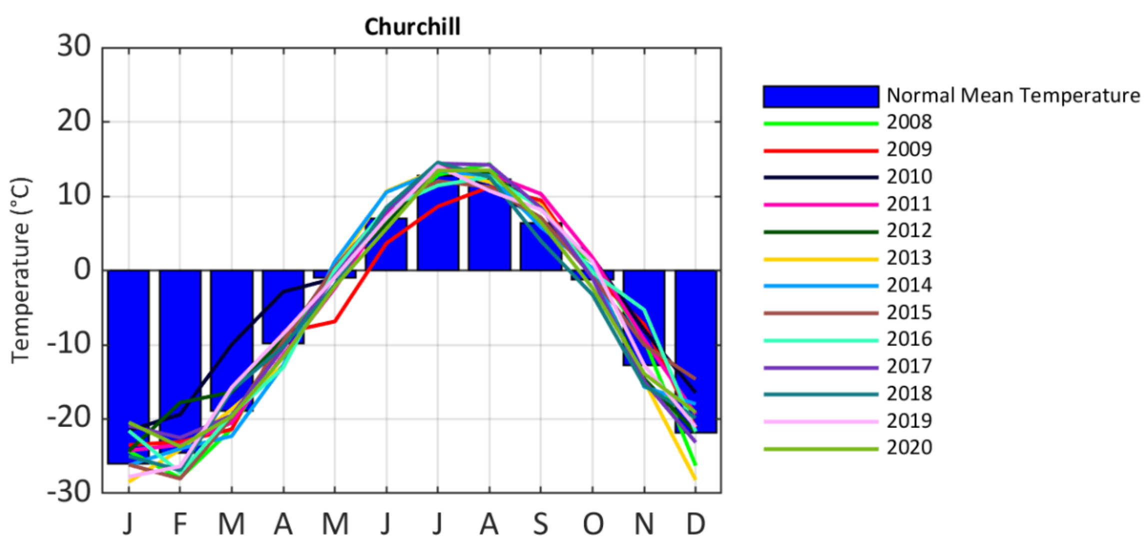


Figure 2.2-1. Churchill mean monthly air temperature (in °C) compared to 1981-2010 normal.

2.2.2 PRECIPITATION

Figure 2.2-2 illustrates the monthly total precipitation (in mm) for each year during the monitoring period compared to the 1981-2010 normal total precipitation. Total precipitation refers to the water equivalent of all types of precipitation. The total precipitation at Churchill follows a noticeable seasonal pattern, where generally the highest amount of precipitation falls during the late summer to early fall months (August and September) and the lowest amounts fall during the winter months (December to March). Overall, recorded precipitation for the monitoring period followed similar patterns to the climate normal. Some deviations can be seen, such as 2010, where the recorded total precipitation for July and August was much higher than normal and for 2013 (June), which recorded total precipitation well below the normal condition.

Table 2.2-2 summarizes the total monthly precipitation data and categorizes each month in the monitoring period as “below normal”, “near normal” or “above normal” conditions. It should be noted that the “near normal” was subjectively defined as +/- 10% of the ECCC climate normal. Months “below normal” are highlighted in light brown, “near normal” are highlighted in grey, and “above normal” are highlighted in green. Over the monitoring period, July and August generally experienced more than normal precipitation (≥ 7 out of 13 months above normal), while all other months (with the exception of September) generally experienced less than normal precipitation (≥ 7 out of 13 months below normal). On an annual basis, a pattern of drier conditions was identified as 8 out of 13 years in the monitoring period recorded below normal precipitation; 2017 had the highest annual total precipitation (472.1 mm), while 2018 had the lowest annual total precipitation (317.3 mm). The maximum and minimum monthly total precipitation recorded during the monitoring period were 182.1 mm (August 2010) and 0.6 mm (May 2011), respectively.

Table 2.2-2. Churchill total monthly and annual precipitation (in mm) compared to 1981-2010 normal.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	41.6	26.2	14.3	25.8	39.8	29.1	17.4	91.5	39.2	48.4	31.5	21.2	426.0
2009	31.3	9.6	30.1	7.4	60.1	49.9	91.2	22.6	69.1	36.6	21.9	12.3	442.1
2010	7.7	3.1	12.3	8.4	46.9	13.1	73.9	182.1	67.9	33.1	10.5	9.3	468.3
2011	5.9	4.8	5.8	8.8	0.6	40.7	60.5	84.8	26.0	112.3	19.0	21.6	390.8
2012	5.7	2.4	28.8	16.8	26.8	6.9	76.2	76.7	81.8	32.1	11.4	13.4	379.0
2013	8.8	5.9	6.6	7.7	32.9	2.4	71.5	74.1	45.7	50.4	12.6	4.7	323.3
2014	5.8	2.4	3.8	3.3	23.4	58.2	67.7	77.6	74.5	78.2	20.9	9.3	425.1
2015	10.1	5.9	6.0	5.5	13.6	47.7	117.9	27.2	44.8	41.6	12.9	13.0	346.2
2016	12.6	11.6	8.6	5.7	29.5	20.6	41.0	55.2	93.5	43.0	19.0	7.3	347.6
2017	10.6	16.4	77.9	22.2	19.1	29.7	82.6	51.2	66.7	70.6	13.4	11.8	472.1
2018	2.5	3.3	7.3	13.2	13.3	37.9	53.9	90.0	58.0	12.1	9.7	16.1	317.3
2019	11.3	4.3	3.1	15.4	7.8	53.4	30.0	152.8	26.7	35.7	25.5	7.4	373.4
2020	9.1	6.7	9.2	8.2	23.4	28.8	109.2	55.2	88.8	18.2	19.1	12.5	388.4
1981-2010 Normal	18.7	16.6	18.1	23.6	30.0	44.2	59.8	69.4	69.9	48.4	35.5	18.4	452.5

Below Normal	Near Normal	Above Normal

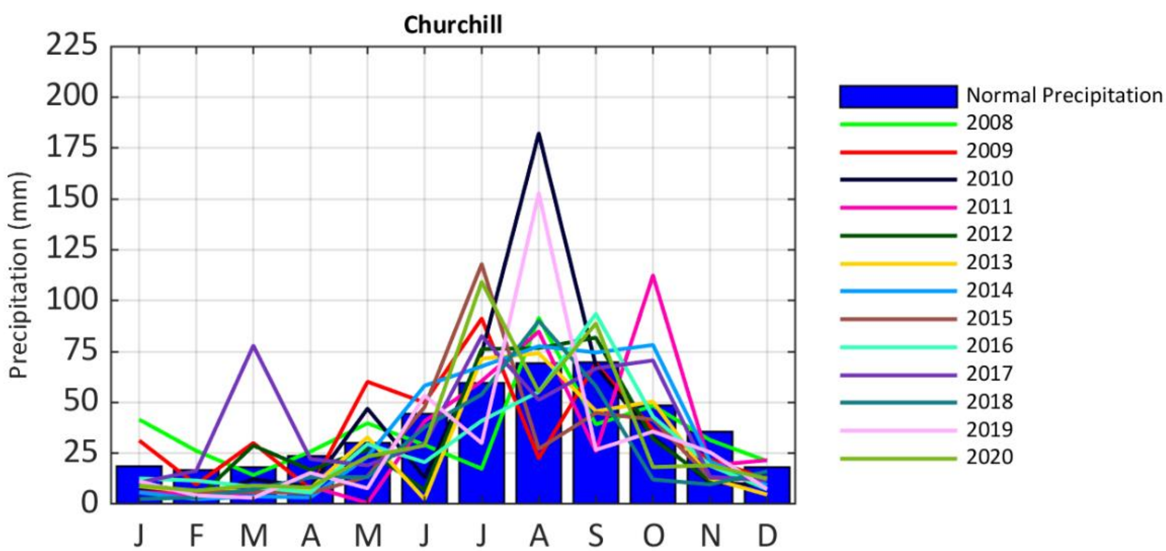


Figure 2.2-2. Churchill total monthly precipitation (in mm) compared to 1981-2010 normal.

2.3 WATER REGIME

Flows along the lower Churchill River are affected by the Churchill River Diversion (CRD) which diverts the majority of the upper Churchill River flow through the Rat-Burntwood River system to the Nelson River for power production. The Missi Falls CS releases the remaining portion of the upper Churchill River flow from Southern Indian Lake into the lower Churchill River. The lower Churchill River flows through a number of lakes where discharge is augmented by local inflows and inflows from tributaries along the way to the Churchill River Estuary at Hudson Bay. Additional information on the lower Churchill River water regime and CRD can be found in the Physical Environment Part IV section of the Regional Cumulative Effects Assessment – Phase II Report (RCEA 2015).

On-System Sites

On-system CAMP monitoring occurs on Partridge Breast Lake, Northern Indian Lake, Fidler Lake, Billard Lake, the lower Churchill River at the Little Churchill River, and the Churchill River upstream from the Churchill Weir (Figure 2.3-1). Water levels are measured on or near each of the lakes and along the Churchill River and about 16 km downstream of the confluence with the Little Churchill River at the gauge above Swallow Rapids. Inflow to the region is reported at the Missi Falls CS. Flow is also reported along at the lower Churchill River above Red Head Rapids at Water Survey of Canada gauge 06FD001.

Continuous water temperature is measured at the Missi Falls CS continuous water quality monitoring site. Monitoring started in 2018 and consists of measuring water temperature every 5 minutes and monthly site visits to verify the data. For the water temperature indicator, the continuous water temperature and the duration, in days, that water is below 1 ^{o}C and five-degree increments is reported.

Off-System Sites

CAMP monitors Gauer Lake as the off-system waterbody for this region. Gauer Lake is located along the Gauer River which is a tributary to the lower Churchill River. Water levels are not measured on Gauer Lake, but the level varies up and down with the measured flow in the Gauer River. Gauer River flow is reported at Water Survey of Canada gauge 06FA001 located on Thorsteinson Lake, which is about 20 km downstream from Gauer Lake (Figure 2.3-1).

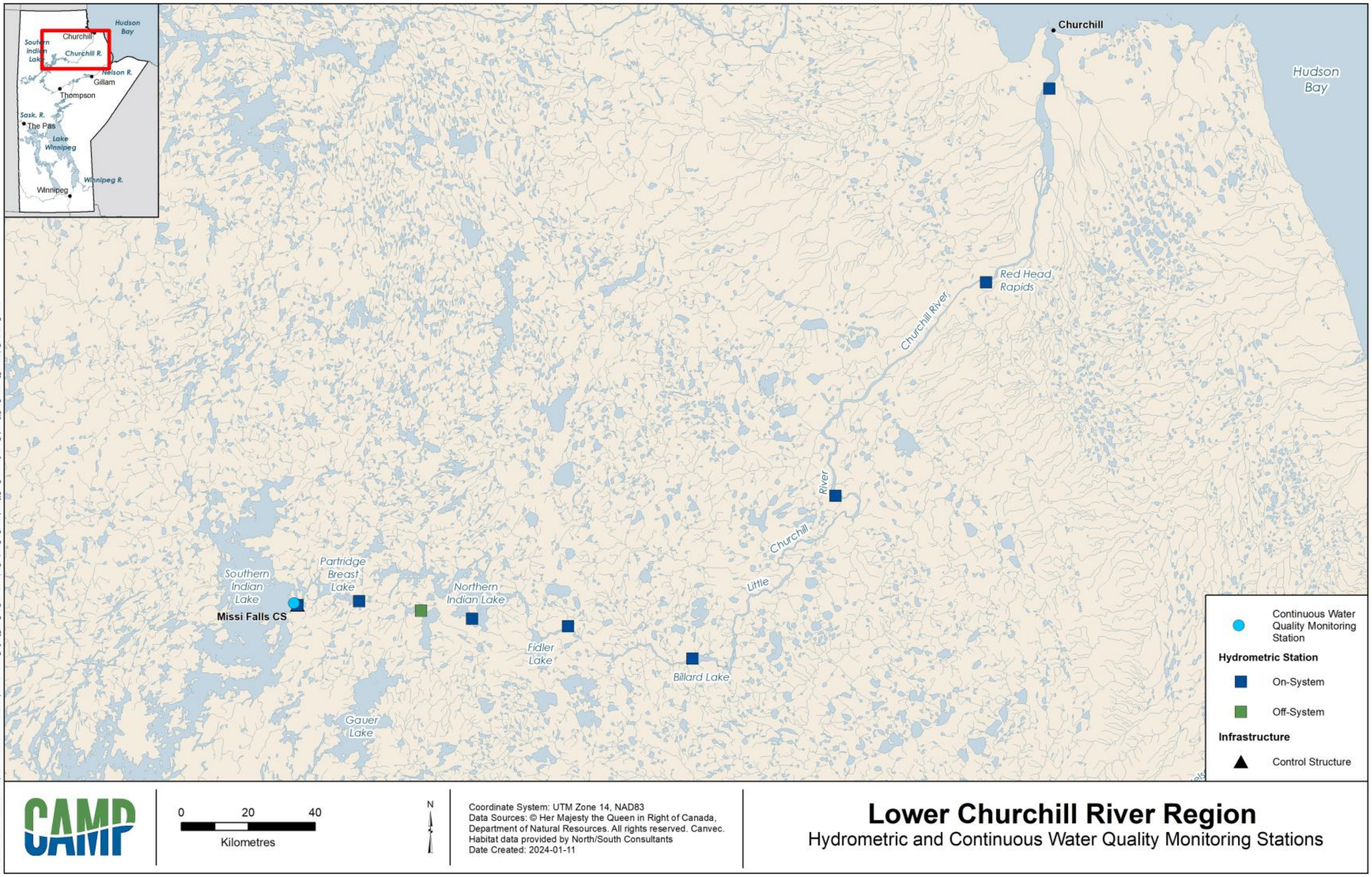


Figure 2.3-1. Hydrometric and continuous water quality monitoring stations in the Lower Churchill River Region.

2.3.1 FLOW

2.3.1.1 ON-SYSTEM SITES

Lower Churchill River at Missi Falls

From 2008 to 2020, flow conditions on the lower Churchill River downstream from Missi Falls ranged from dry to very wet and were more frequently above average than below average compared to the reference period from 1986 to 2015 (Figure 2.3-2 and Table 2.3-1). Monthly mean flow ranged from 17 to 2,110 cms with the overall mean from 2008 to 2020 at 319 cms. Very dry flow conditions, defined as lower than 10th percentile, did not occur in any months during the 2008 to 2020 CAMP monitoring period (Table 2.3-1). Flow conditions were very wet, defined as above the 90th percentile, in parts of ten years during CAMP, during the following months; August 2008, July to November 2009, August to September 2011, July 2012, October 2013, June to August 2014, May to September 2017, July to November 2018, August 2019 and May-December 2020 (Table 2.3-1).

Lower Churchill River above Redhead Rapids

From 2008 to 2020, flow conditions on the lower Churchill River above Red Head Rapids ranged from very dry to very wet and were more frequently above average than below average compared to the reference period from 1986 to 2015 (Figure 2.3-3 and Table 2.3-2). Monthly mean flow ranged from 82 to 3,830 cms with the overall mean from 2008 to 2020 at 531 cms. Very dry flow conditions, defined as lower than 10th percentile, occurred in parts of two years during the 2008 to 2020 CAMP monitoring period in April 2011 and March 2016 (Table 2.3-2). Flow conditions were very wet, defined as above the 90th percentile, in parts of nine years during CAMP, during the following months; June to November 2009, September 2010, September 2011, October 2013, June to August 2014, May to September 2017, August to September 2018, September 2019 and June-December 2020 (Table 2.3-2).

2.3.1.2 OFF-SYSTEM SITES

Gauer River

From 2008 to 2020, flow conditions on the Gauer River ranged from very dry to very wet and were more frequently above average than below average as compared to the reference period from 1980 to 2010 (Figure 2.3-4 and Table 2.3-3). The monthly mean values ranged from 6.1 to 127.3

cms with the overall average from 2008 to 2020 at 35.0 cms. Flow conditions were very dry (below 10th percentile) with coincident very low Gauer Lake levels during the following months; April 2013 and January 2019 (Table 2.3-3). Flow conditions were very wet (above 90th percentile) with coincident very high Gauer Lake levels during the following months; June to August 2009, September to October 2010, September 2011, June 2014, and June to July 2020 (Table 2.3-3).

Table 2.3-1. Lower Churchill River at Missi Falls monthly average flow (cms).

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	102	92	60	50	49	38	18	18	577	49	43	121	101
2009	531	90	60	49	48	48	422	1324	1188	1161	793	778	379
2010	113	114	89	88	80	26	17	18	170	369	158	121	103
2011	204	94	62	52	51	51	52	81	676	819	279	126	101
2012	157	92	62	50	49	72	368	465	134	208	49	124	213
2013	151	177	136	52	51	49	46	141	118	74	586	232	142
2014	297	91	74	63	62	92	602	988	594	395	269	215	106
2015	53	95	66	48	49	26	19	18	18	19	57	116	101
2016	60	91	61	49	48	31	19	20	69	27	67	121	121
2017	723	121	120	120	126	1217	2503	1716	1221	471	290	418	309
2018	441	217	217	216	217	248	301	535	705	736	855	653	371
2019	239	289	286	281	237	83	30	250	441	375	200	200	202
2020	1093	202	201	198	229	784	1113	2155	2058	2141	1953	1055	977

Very Dry	**Dry**	**Average**	**Wet**	**Very Wet**
Lower than 10th percentile	10th to 30th percentile	30th to 70th percentile	70th to 90th percentile	Higher than 90th percentile

Notes:

1. Percentiles calculated using 1986-2015 as the reference period.

Table 2.3-2. Lower Churchill River above Redhead Rapids monthly average flow (cms).

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	213	202	147	123	108	127	255	171	486	309	192	244	196
2009	820	130	102	94	96	157	856	2108	2041	1533	1201	861	596
2010	321	304	139	133	140	199	135	112	292	1205	680	318	196
2011	386	146	113	93	82	302	283	356	584	1396	691	343	232
2012	318	166	135	121	112	319	683	787	389	420	306	192	180
2013	328	163	139	119	105	291	350		254	243	800	697	369
2014	549	229	126	100	95	140	977	1715	1076	668	592	469	358
2015	246	227	142	93	121	284	375	275	411	323	311	207	172
2016	204	146	115	89	104	330	273	186	225	195	329	246	200
2017	1060	171	98	102	125	1067	3830	2548	1801	989	627	513	400
2018	635	296	243	224	218		653	719	881	1207	1040	715	533
2019	442	337	301	295	399	655	221	299	644	900	456	418	367
2020	1455	302	255	248	290	775	1770	2624	2881	2658	2759	1721	1120

Very Dry	Dry	Average	Wet	Very Wet
Lower than 10th percentile	10th to 30th percentile	30th to 70th percentile	70th to 90th percentile	Higher than 90th percentile

Notes:

1. Blank cell indicates no data.
2. Percentiles calculated using 1986-2015 as the reference period.

Table 2.3-3. Gauer River monthly average flow (cms).

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	26	28	20	16	15	41	62	43	28	19	21	21	16
2009	54	14	13	13	13	35	115	125	118	69	54	41	33
2010	38	23	17	13	14	16	21	11	31	127	96	56	34
2011	38	20	15	12	10	29	34	43	63	100	63	39	24
2012	37	13	10	10	20	75	69	53	32	48	45	37	28
2013	24	18	12	10	6	31	41	24	16	17	40	36	32
2014	42	30	24	16	11	56	97	90	55	28	32	34	29
2015	35	22	16	12	15	41	52	39	43	50	59	42	28
2016	32	22	17	17	17	31	59	52	42	23	37	41	29
2017	23	24	21	25	21	19				28	25	24	21
2018	34	18	18	13	10	79	74	52	38	50	33	17	11
2019	25	9	11	12	11	27	35	32	33	45	36	30	21
2020	44	16	14	14	21	41	125	108					31

Very Dry	Dry	Average	Wet	Very Wet
Lower than 10th percentile	10th to 30th percentile	30th to 70th percentile	70th to 90th percentile	Higher than 90th percentile

Notes:

1. Percentiles calculated using 1980-2010 as the reference period.

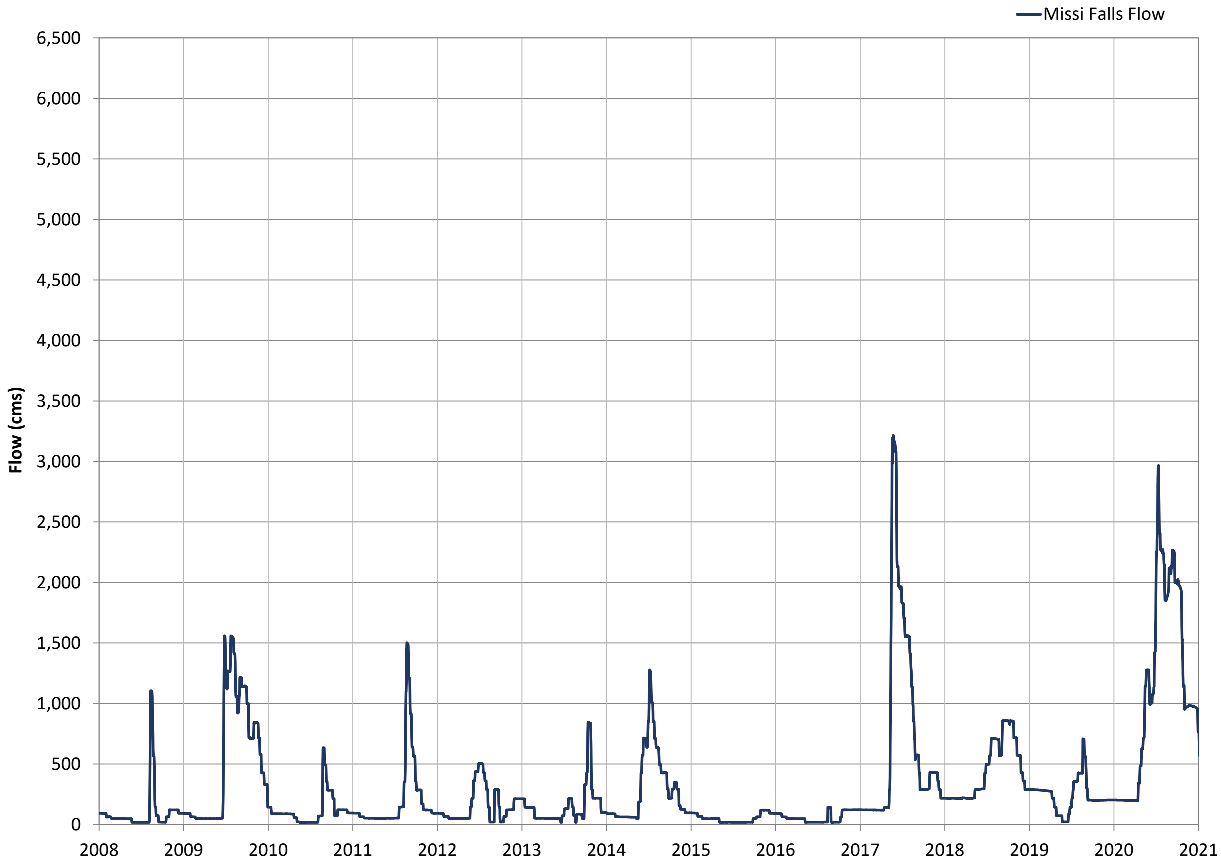


Figure 2.3-2. 2008-2020 Lower Churchill River at Missi Falls daily mean flow.

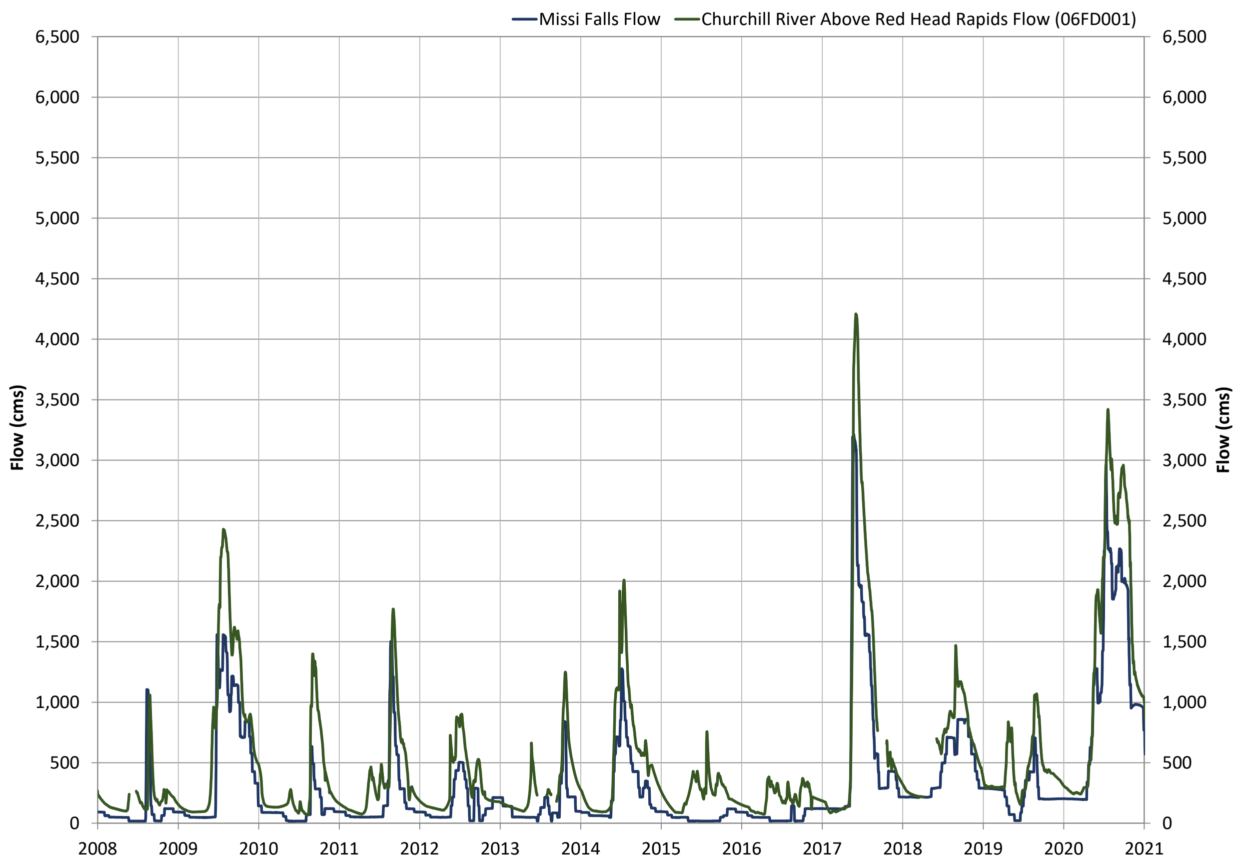


Figure 2.3-3. 2008-2020 Lower Churchill River at Missi Falls and above Redhead Rapids daily mean flow.

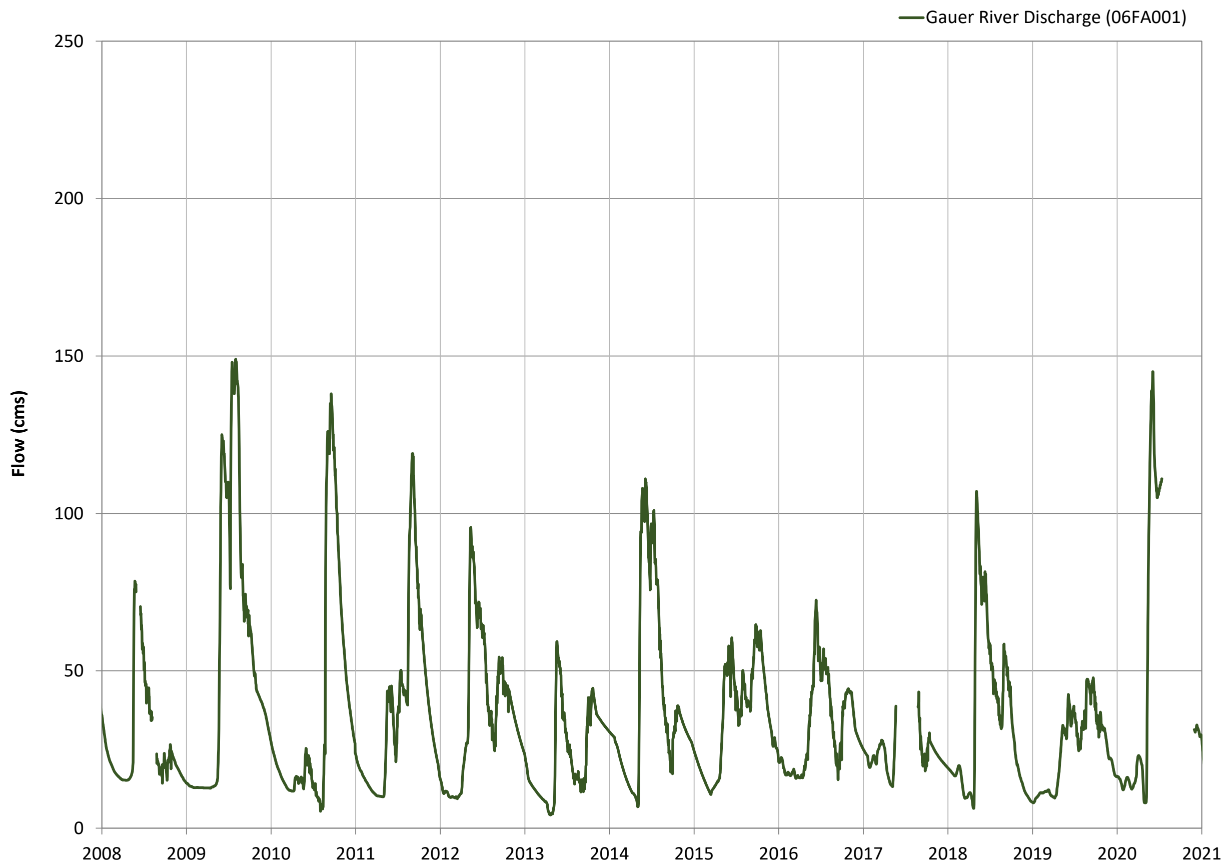


Figure 2.3-4. 2008-2020 Gauer River daily mean flow.

2.3.2 WATER LEVEL AND VARIABILITY

2.3.2.1 ON-SYSTEM SITES

Northern Indian Lake

Northern Indian Lake is located along the lower Churchill River downstream from Missi Falls and Partridge Breast Lake. Northern Indian Lake water levels generally follow the pattern set by water releases at Missi Falls (Figure 2.3-5). During the period from 2008-2020, Northern Indian Lake water levels were more than 0.5 m above the 2008-2020 average in 29 months and were lower than 0.5 m below the 2008-2020 average in 61 months (Table 2.3-4). Northern Indian Lake monthly water level variability was lower (below 0.25 m) in 80 months, moderate (between 0.25 and 0.75 m) in 41 months and higher (above 0.75 m) in 25 months (Table 2.3-5).

Lower Churchill River at the Little Churchill River

Water levels along the lower Churchill River at its confluence with the Little Churchill River are affected by both flow releases at Missi Falls and inflows from tributaries downstream from Missi Falls. Water levels at this location would follow a similar pattern to those of the nearest water level gauge above Swallow Rapids, which is about 16 km downstream of the confluence with the Little Churchill River (Figure 2.3-6). During the period from 2008-2020, Churchill River above Swallow Rapids water levels were more than 0.5 m above the 2008-2020 average in 22 months and were lower than 0.5 m below the 2008-2020 average in 25 months (Table 2.3-6). Churchill River above Swallow Rapids monthly water level variability was lower (below 0.25 m) in 68 months, moderate (between 0.25 and 0.75 m) in 63 months and higher (above 0.75 m) in 19 months (Table 2.3-7).

Partridge Breast Lake

Partridge Breast Lake is located along the lower Churchill River downstream from Missi Falls. Partridge Breast Lake water levels generally follow the pattern set by water releases at Missi Falls (Figure 2.3-7). Water level data for Partridge Breast Lake is available beginning in August 2009 and there are also several periods totalling 48 months with limited or missing data between then and 2020. During the period from August 2009 through 2020, Partridge Breast Lake water levels were more than 0.5 m above the 2009-2020 average in 23 months and lower than 0.5 m below the 2009-2020 average in 51 months (Table 2.3-8). Partridge Breast Lake monthly water level variability was lower (below 0.25 m) in 49 months, moderate (between 0.25 and 0.75 m) in 29 months, and higher (above 0.75 m) in 30 months (Table 2.3-9).

Fidler Lake

Fidler Lake is located on the lower Churchill River, downstream of Northern Indian Lake and upstream of the Churchill River at the Little Churchill River. Churchill River below Fidler Lake water levels generally follow the pattern set by water releases at Missi Falls and are also influenced by inflows from local tributaries (Figure 2.3-8). Churchill River below Fidler Lake water levels are referenced to an assumed datum. During the period from 2008-2020, Churchill River below Fidler Lake water levels were more than 0.5 m above the 2008-2020 average in 45 months and lower than 0.5 m below the 2008-2020 average in 86 months (Table 2.3-10). Churchill River below Fidler Lake monthly water level variability was lower (below 0.25 m) in 33 months, moderate (between 0.25 and 0.75 m) in 57 months, and higher (above 0.75 m) in 64 months (Table 2.3-11).

Billard Lake

Billard Lake is located on the lower Churchill River, downstream of Northern Indian Lake and upstream of the Churchill River at the Little Churchill River. Billard Lake water levels generally follow the pattern set by water releases at Missi Falls and are also influenced by inflows from local tributaries (Figure 2.3-9). During the period from 2008-2020, Billard Lake water levels were more than 0.5 m above the 2008-2020 average in 36 months and lower than 0.5 m below the 2008-2020 average in 71 months (Table 2.3-12). Billard Lake monthly water level variability was lower (below 0.25 m) in 70 months, moderate (between 0.25 and 0.75 m) in 48 months, and higher (above 0.75 m) in 35 months (Table 2.3-13).

Lower Churchill River at the CR30 Pumphouse

The lower Churchill River at the CR30 Pumphouse Lake is located near the Town of Churchill and about 6.5 km upstream from the Churchill Weir. Water levels at this location are affected by the amount of water flowing in the lower Churchill River and are also affected by a backwater effect from the Churchill Weir (Figure 2.3-10). During the period from 2008-2020, the lower Churchill River at the CR30 Pumphouse water levels were more than 0.5 m above the 2008-2020 average in 21 months and lower than 0.5 m below the 2008-2020 average in 12 months (Table 2.3-14). The lower Churchill River at the CR30 Pumphouse monthly water level variability was lower (below

0.25 m) in 68 months, moderate (between 0.25 and 0.75 m) in 60 months, and higher (above 0.75 m) in 21 months (Table 2.3-15).

2.3.2.2 OFF-SYSTEM SITES

Gauer Lake

Water levels are not recorded on off-system Gauer Lake. Water levels would have varied with Gauer River flow, which is measured downstream from Gauer Lake. As a result, Gauer Lake specific water levels are not provided but rather may be inferred/visualized from the Gauer River flow presented in Figure 2.3-4 and Table 2.3-3 above.

Table 2.3-4. Northern Indian Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	234.83	234.63	234.55	234.52	234.78	234.86	234.52	235.67	234.83	234.49	234.86	234.80
2009	234.72	234.60	234.47	234.46	234.54	235.46	237.80	237.80	237.25	236.60	236.36	235.70
2010	234.97	234.71	234.70	234.74	234.53	234.38	234.21	234.64	236.03	235.57		
2011	234.77	234.64	234.50	234.47	234.66	234.66	234.82	235.85	236.89	235.67	235.10	234.87
2012	234.77	234.66	234.57	234.51	235.06	235.63	235.89	235.12	235.08	234.79	234.92	235.15
2013	235.09	234.91	234.61	234.47	234.75	234.75	234.80	234.92	234.69	235.93	235.61	235.11
2014	234.79	234.67	234.56	234.53	234.88	236.18	237.10	236.29	235.70	235.37	235.31	234.85
2015	234.73	234.66	234.52	234.52	234.65	234.76	234.56	234.50	234.51	234.71	234.87	234.84
2016	234.74	234.62	234.49	234.54	234.64	234.70	234.58	234.60	234.55	234.68	234.95	234.89
2017	234.86	234.84	234.84	234.84	236.33	240.45			235.53	235.41		
2018				235.16		235.60	236.01	236.32	236.50	236.56	236.18	235.63
2019	235.31	235.29	235.21	235.25	234.88	234.63	235.13	235.77	235.84	235.20	235.13	235.13
2020	235.12	235.09	235.09	235.12	236.19	237.23	238.78	239.56	239.13	239.14	237.56	236.94

Lower	**Average**	**Higher**
Lower than 0.5 m below average	Within 0.5 m below and above average	More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-5. Northern Indian Lake monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.03	0.07	0.08	0.04	0.60	0.38	0.25	2.30	1.13	0.25	0.24	0.16
2009	0.02	0.17	0.06	0.02	0.36	2.39	1.07	1.49	0.38	0.97	0.28	0.66
2010	0.66	0.03	0.02	0.11	0.29	0.20	0.14	2.05	0.58	0.61		
2011	0.03	0.20	0.06	0.03	0.35	0.18	0.35	2.62	1.55	0.71	0.43	0.14
2012	0.07	0.12	0.07	0.09	0.75	0.61	0.31	1.09	0.89	0.60	0.14	0.26
2013	0.25	0.04	0.36	0.01	0.52	0.33	0.46	0.54	0.19	1.89	1.24	0.48
2014	0.11	0.15	0.03	0.00	0.84	1.10	1.22	0.92	0.39	0.27	0.61	0.19
2015	0.03	0.12	0.00	0.04	0.12	0.17	0.21	0.11	0.15	0.18	0.16	0.14
2016	0.04	0.19	0.04	0.02	0.12	0.19	0.12	0.36	0.50	0.47	0.05	0.07
2017	0.03	0.03	0.02	0.05	5.29	0.14			0.11	0.12		
2018				0.06		0.07	0.53	0.12	0.33	0.23	0.44	0.66
2019	0.06	0.09	0.59	0.20	0.31	0.19	0.93	0.45	1.01	0.14	0.03	0.07
2020	0.06	0.14	0.03	0.26	1.88	0.57	3.30	1.30	0.65	0.62	1.80	0.09

Lower Variability	Moderate Variability	Higher Variability
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

Table 2.3-6. Lower Churchill River above Swallow Rapids monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	133.58	133.39	133.30	133.27	133.40	133.17	132.82	133.31	133.06	132.81	133.18	133.39
2009	133.31	133.28	133.19	133.24	133.40	133.64	134.68	134.68	134.36	134.06	134.20	
2010				133.20	132.85	132.59	132.46	132.70	133.92	133.51	133.38	133.63
2011	133.44	133.23	133.16	133.13	133.28	132.94	133.12	133.44	134.29	133.57	133.41	133.64
2012	133.49	133.29	133.18	133.21	133.55	133.71	133.72	133.23	133.21	133.02	133.31	133.73
2013	133.76	133.52	133.28	133.12	133.36	132.96	132.79	132.93	132.78	133.58	134.07	133.93
2014	133.63	133.63	133.62	133.65	133.83	133.77	134.35	133.91	133.49	133.38	133.63	133.64
2015	133.47	133.38	133.28	133.31	133.29	133.15	133.02	133.20	133.13	133.14	133.28	133.68
2016	133.51	133.30	133.18	133.12	133.08	133.01	132.88	133.01	132.90	133.10	133.28	133.51
2017	133.65	133.56	133.69	133.83	134.56	135.93	135.14	134.64	133.79	133.40	134.09	134.49
2018	134.06	134.05	133.98	134.00	134.09	133.58	133.71	133.91	134.12	134.16	133.97	134.35
2019	134.18	134.08	134.09	134.10	133.34	132.87	133.10	133.58	133.81	133.32		
2020	133.78	133.67	133.68	133.77	134.11	134.56	135.17	135.45	135.25	135.29	135.52	135.32

Lower	**Average**	**Higher**
Lower than 0.5 m below average	Within 0.5 m below and above average	More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-7. Lower Churchill River above Swallow Rapids monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.24	0.14	0.03	0.20	0.98	0.44	0.27	1.38	0.93	0.25	0.54	0.25
2009	0.05	0.11	0.08	0.07	0.78	0.62	0.76	0.67	0.19	0.57	0.75	
2010				0.18	0.35	0.36	0.22	1.30	0.33	0.50	0.49	0.19
2011	0.26	0.14	0.06	0.10	0.56	0.28	0.41	1.38	0.79	0.37	0.42	0.15
2012	0.22	0.17	0.06	0.14	0.91	0.17	0.26	0.67	0.35	0.49	0.49	0.35
2013	0.33	0.03	0.39	0.07	0.85	0.49	0.19	0.26	0.24	1.17	0.49	0.51
2014	0.06	0.08	0.11	0.04	0.83	0.73	0.49	0.59	0.24	0.17	0.41	0.33
2015	0.24	0.13	0.06	0.16	0.41	0.17	0.66	0.57	0.28	0.18	0.44	0.16
2016	0.19	0.16	0.09	0.17	0.11	0.16	0.20	0.31	0.28	0.19	0.25	0.36
2017	0.21	0.12	0.21	0.06	2.01	0.68	0.62	0.55	0.76	0.13	0.95	0.64
2018	0.17	0.05	0.06	0.16	1.29	0.10	0.28	0.15	0.26	0.27	0.97	0.33
2019	0.27	0.03	0.02	0.18	0.98	0.18	0.52	0.53	0.58	0.13		
2020	0.14	0.07	0.03	0.14	0.53	0.28	1.20	0.56	0.22	0.35	0.22	0.27

Lower Variability	**Moderate Variability**	**Higher Variability**
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

Table 2.3-8. Partridge Breast Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008												
2009								245.57	246.29	244.74	244.50	243.60
2010						241.61	241.65	242.37	243.38	242.52	242.31	242.21
2011	242.22	242.19		241.99	242.04	242.00	242.15	244.17	244.85	242.96	242.39	242.31
2012	242.25	242.12	242.09	242.04	242.14	243.11	243.49	242.37	242.57	242.05	242.36	242.73
2013	242.64	242.51	242.03	242.01	242.02	241.92	242.40	242.34	242.16	244.04	242.81	242.47
2014	242.25	242.28				244.42	245.83	244.13	243.29	242.82	242.63	242.22
2015	242.33		242.08	242.11			241.73		241.67			242.30
2016		242.12		241.99		241.74	241.74	241.99	241.86	242.03	242.37	242.39
2017	242.41	242.44	242.47	242.40	242.93			246.31	242.92	242.92	243.35	243.06
2018	242.89	242.95	242.91	242.81	242.82	242.95	243.92	244.51	244.61	244.88	244.15	243.21
2019	243.18	243.12	243.07	242.89	242.32	241.89	242.79	243.53	243.41	242.66		242.70
2020	242.71	242.76	242.73	242.83	243.74	245.46	248.89	248.92	249.02	248.50	245.90	245.57

Lower	**Average**	**Higher**
Lower than 0.5 m below average	Within 0.5 m below and above average	More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-9. Partridge Breast Lake monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008												
2009								0.57	0.66	1.95	0.82	0.48
2010						0.06	0.06	2.63	1.28	0.89	0.12	0.15
2011	0.14	0.14		0.01	0.09	0.06	0.45	4.72	3.35	1.04	0.26	0.10
2012	0.06	0.20	0.08	0.20	0.44	0.94	0.48	1.42	1.22	0.69	0.07	0.31
2013	0.30	0.08	0.04	0.02	0.10	0.28	0.61	0.89	0.17	2.73	1.18	0.48
2014	0.10	0.12				0.19	3.18	1.45	0.49	0.35	0.74	0.15
2015	0.23											
2016						0.02	0.04	0.72	0.72	0.63	0.02	0.07
2017	0.03	0.07	0.09	0.07	3.14				0.01	0.15	0.74	0.86
2018	0.17	0.06	0.09	0.20	0.21	0.53	0.76	0.03	0.99	0.39	0.80	1.06
2019	0.37	0.11	0.17	0.39	0.39	0.35	1.06	1.19	1.86	0.04		0.09
2020	0.08	0.24	0.03	0.42	1.18	0.26	5.37	1.26	1.10	0.69	2.28	0.19

Lower Variability	**Moderate Variability**	**Higher Variability**
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

Table 2.3-10. Lower Churchill River below Fidler Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	23.97	23.55	23.29	23.25	23.67	23.39	22.56	25.43	23.55	22.47	23.69	24.17
2009	23.60	23.37	23.17	23.19	23.27	24.88	30.02	30.11	29.28	28.17	27.62	26.60
2010	24.85	23.78	23.54	23.33	22.61	22.32	22.09	22.90	26.89	25.21	24.14	24.00
2011	23.63	23.31	23.02	22.97	23.11	22.91	23.22	25.59	28.76	25.90	24.47	24.67
2012	24.09	23.48	23.12	23.11	24.27	25.57	26.47	24.33	23.96	23.26	24.59	24.91
2013	24.57	24.03	23.24	22.94	23.34	23.05	23.06	23.52	22.87	25.07	26.06	24.97
2014	23.97	23.60	23.36	23.34	23.95	26.93	28.98	27.57	25.93	24.90	25.40	24.27
2015	23.81	23.38	23.07	23.08	22.98	23.13	22.73	22.64	22.64	22.98	23.66	24.83
2016	23.93	23.43	23.07	22.95	22.93	22.98	22.71	22.71	22.72	22.92	23.83	24.11
2017	24.05	23.83	23.87	24.00	26.62	33.32	31.47	29.98	27.14	25.15	26.51	26.47
2018	25.38	25.23	24.86	24.81	25.65	25.69	26.64	27.49	27.88	28.03	27.58	26.61
2019	25.79	25.43	25.14	24.96	23.67	22.84	23.99	26.03	26.46	24.39	24.62	24.53
2020	24.41	24.33	24.30	24.45	25.75	29.32	31.06	32.19	31.69	31.75		

Lower Lower than 0.5 m below average	**Average** Within 0.5 m below and above average	**Higher** More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-11. Lower Churchill River below Fidler Lake monthly average water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.29	0.54	0.09	0.10	1.21	1.23	0.46	5.78	3.94	0.42	1.68	0.75
2009	0.22	0.31	0.10	0.04	0.59	4.69	1.93	2.05	0.66	1.91	0.45	1.27
2010	1.99	0.43	0.16	0.49	0.63	0.32	0.17	4.28	1.26	2.36	0.60	0.42
2011	0.31	0.45	0.09	0.09	0.31	0.39	0.77	6.00	2.70	1.95	1.17	0.62
2012	0.38	0.60	0.13	0.12	1.49	1.80	0.80	3.09	2.33	1.92	0.16	0.38
2013	0.70	0.16	0.92	0.12	0.86	0.84	0.98	1.33	0.39	5.14	2.98	1.33
2014	0.41	0.42	0.06	0.05	1.40	2.93	2.08	2.15	1.12	0.73	1.10	0.78
2015	0.25	0.48	0.14	0.20	0.21	0.38	0.43	0.29	0.31	0.32	1.31	1.06
2016	0.49	0.57	0.17	0.32	0.23	0.44	0.29	0.65	0.95	1.02	0.78	0.42
2017	0.44	0.06	0.14	0.18	8.47	1.62	1.64	2.00	2.22	0.43	1.69	1.43
2018	0.30	0.39	0.19	0.39	0.80	0.23	1.51	0.37	0.62	0.47	0.50	1.34
2019	0.07	0.42	0.15	0.75	1.15	0.40	2.69	1.15	2.68	0.69	0.55	0.22
2020	0.12	0.08	0.09	0.66	1.24	0.87	4.01	1.36	0.69	0.67		

Lower Variability	Moderate Variability	Higher Variability
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

Table 2.3-12. Billard Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	187.67	187.58	187.47	187.43	187.65	188.03	187.66	189.64	188.06	187.53	187.91	187.99
2009	187.98	187.93	187.83	187.84	187.88	188.63	191.29	191.42	190.75	190.29	190.39	189.98
2010	189.45	188.59	188.40	188.30	187.65	187.45	187.30	187.64	189.42	188.77	188.26	188.16
2011	188.02	187.90	187.78	187.75	187.95	187.80	187.99	188.91	190.52	189.07	188.54	
2012		187.91		187.76	188.41	188.87	189.28	188.45	188.24	188.05	188.08	188.47
2013	188.50	188.28	187.94	187.79	188.07	187.89	187.82	188.07	187.75	189.10	189.29	188.59
2014	188.12	188.07	188.05	188.10	188.39	189.47	190.60	189.77	188.94	188.52	188.66	188.18
2015	188.02	187.94	187.85	187.89	187.94	187.93	187.74	187.75	187.71	187.85	188.00	188.04
2016	187.98	187.87	187.73	187.72	187.83	187.84	187.68	187.67	187.70	187.82	188.13	188.15
2017	188.22	188.24	188.36	188.40	189.75	193.92	192.39	191.27	189.50	188.69	189.09	189.31
2018	188.76	188.70	188.70	188.70	189.05	188.94	189.31	189.70	189.98	190.06	190.21	189.71
2019	189.01	189.00	189.00	188.98	188.24	187.76	188.14	189.07	189.34	188.42	188.41	188.42
2020	188.45	188.50	188.50	188.61	189.67	190.81	192.06	192.99	192.52	192.61	191.68	191.18

Lower Lower than 0.5 m below average	**Average** Within 0.5 m below and above average	**Higher** More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-13. Billard Lake monthly average water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.04	0.20	0.04	0.11	0.85	0.55	0.18	0.98	1.71	0.21	0.41	0.12
2009	0.08	0.14	0.06	0.04	0.51	1.76	1.58	1.44	0.42	0.80	0.71	0.59
2010	0.56	0.02	0.03	0.15	0.06	0.31	0.17	1.83	0.66	0.79	0.14	0.22
2011	0.08	0.21	0.04	0.06	0.38	0.27	0.38	2.79	1.61	0.74	0.46	
2012		0.01		0.06	0.76	0.77	0.31	1.25	0.86	0.83	0.15	0.44
2013	0.30	0.05	0.50	0.03	0.56	0.51	0.46	0.56	0.30	2.18	1.27	0.73
2014	0.10	0.10	0.10	0.00	0.50	1.40	1.20	1.20	0.50	0.30	0.50	0.30
2015	0.10	0.10	0.10	0.20	0.30	0.20	0.50	0.50	0.20	0.10	0.20	0.10
2016	0.10	0.20	0.10	0.10	0.10	0.20	0.20	0.30	0.50	0.50	0.10	0.10
2017	0.10	0.10	0.10	0.00	4.60	1.30	1.40	1.30	1.50	0.30	0.60	0.80
2018	0.10	0.00	0.00	0.10	0.50	0.10	0.60	0.30	0.40	0.20	0.50	0.90
2019	0.10	0.10	0.00	0.20	0.90	0.30	1.10	0.60	1.20	0.30	0.20	0.10
2020	0.10	0.00	0.10	0.20	1.80	0.60	3.00	1.10	0.60	0.50	0.80	0.20

Lower Variability	Moderate Variability	Higher Variability
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

Table 2.3-14. Lower Churchill River at the CR30 Pumphouse monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	5.07				6.41	5.13	4.61	4.96	5.03	4.93	4.92	4.96
2009	4.99	5.07	5.09	5.12	5.34	6.07	5.99	5.97	5.74	5.59	5.65	5.40
2010	5.18	4.97		5.58	5.24	4.69	4.53	4.72	5.87	5.53	5.26	5.18
2011		4.91	4.88	4.86	5.55	5.15	5.10	5.29	5.94	5.58	5.12	4.97
2012	5.02	5.02	4.90	4.96	6.05	5.45	5.51	5.12	5.28	5.05		5.23
2013	5.36	5.28	5.11	4.94	5.69	4.96	4.56	5.23	5.25	5.85	6.02	5.85
2014	5.57	5.41	5.18	5.09	5.83	5.82	6.17	5.95	5.56	5.70	5.63	5.38
2015	5.24	5.26	5.15	5.13	5.89	5.42	5.27	5.64		5.22	5.00	5.06
2016	5.04	5.00	4.98	4.99	5.38	5.09	4.84	4.99	5.01	5.33	5.13	5.11
2017	5.31	5.24	5.32	5.38	6.14	6.67	6.15	5.89	5.44	5.30	5.38	5.59
2018	5.54	5.58	5.62	5.58	6.23	5.37	5.39	5.47	5.78	5.91	5.92	5.75
2019	5.61	5.84	5.89	5.80	5.73	4.92	4.94	5.28	5.52	5.17	5.14	5.22
2020	5.30	5.39	5.49	5.56	6.21	5.96	6.19	6.34	6.23	6.26	6.78	6.81

Lower	**Average**	**Higher**
Lower than 0.5 m below average	Within 0.5 m below and above average	More than 0.5 m above average

Notes:

1. Blank cell indicates no data.

Table 2.3-15. Lower Churchill River at the CR30 Pumphouse monthly average water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.11				0.77	1.36	0.31	1.12	0.54	0.39	0.29	0.09
2009	0.17	0.13	0.09	0.04	0.82	1.47	0.40	0.12	0.05	0.40	0.32	0.28
2010	0.46	0.07		0.14	0.50	0.72	0.54	1.70	0.39	0.32	0.62	0.09
2011		0.06	0.04	0.04	1.64	0.88	0.50	1.08	0.52	0.35	0.65	0.12
2012	0.08	0.20	0.09	0.15	1.90	0.27	0.21	0.65	0.72	0.55		0.31
2013	0.14	0.07	0.38	0.04	1.95	0.94	0.48	0.31	0.35	0.89	0.64	0.31
2014	0.09	0.24	0.13	0.11	1.45	0.39	0.25	0.15	0.07	0.32	0.48	0.32
2015	0.07	0.08	0.14	0.22	1.07	0.45	0.45	0.55		0.57	0.37	0.18
2016	0.12	0.08	0.04	0.20	0.43	0.23	0.18	0.45	0.38	0.28	0.59	0.23
2017	0.16	0.07	0.09	0.05	2.49	0.54	0.35	0.27	0.41	0.25	0.39	0.08
2018	0.18	0.15	0.08	0.19	0.79	0.20	0.17	0.18	0.44	0.76	0.28	0.42
2019	0.19	0.14	0.06	0.10	0.53	0.63	0.26	0.72	0.51	0.24	0.19	0.24
2020	0.12	0.10	0.08	0.06	1.40	1.09	0.68	0.36	0.19	0.18	1.12	0.44

Lower Variability	**Moderate Variability**	**Higher Variability**
Below 0.25 m	0.25 to 0.75 m	Above 0.75 m

Notes:

1. Blank cell indicates no data.

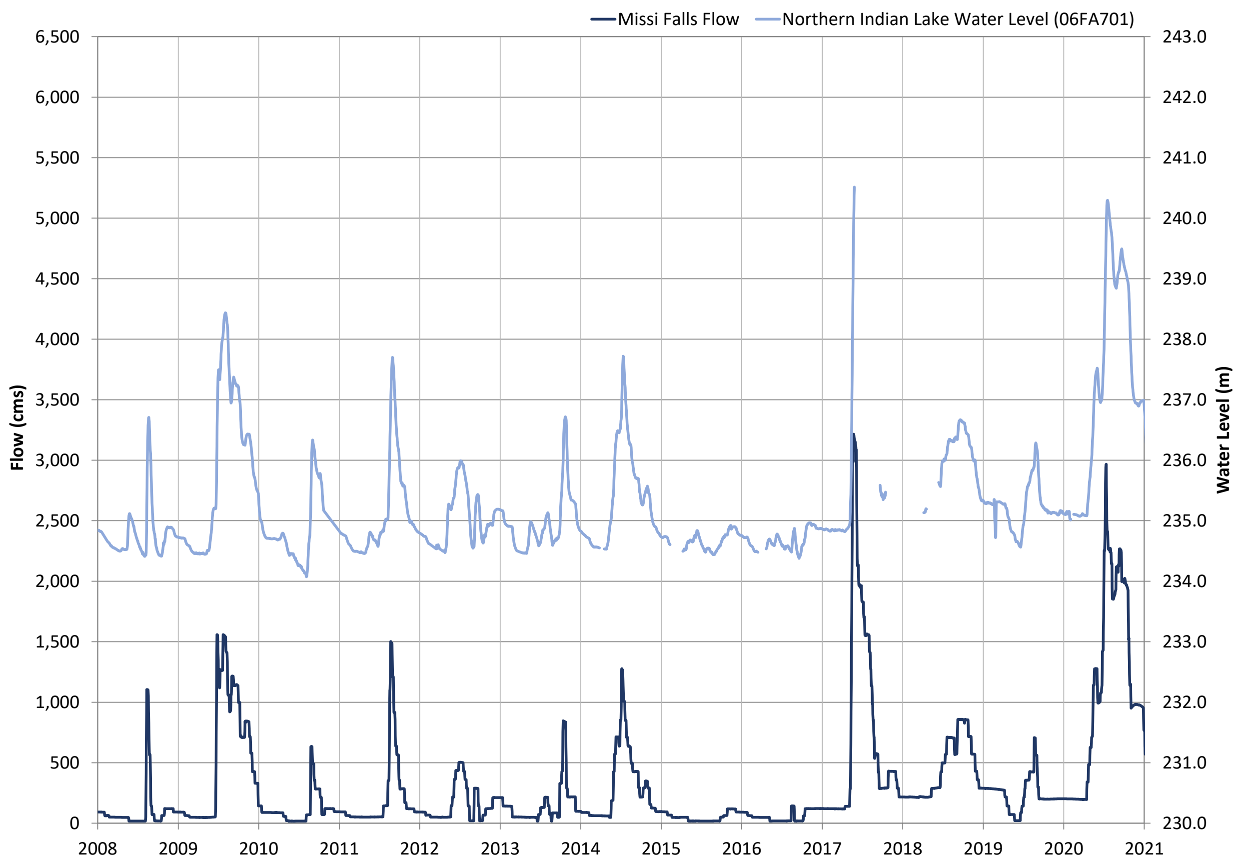


Figure 2.3-5. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and Northern Indian Lake daily mean water level.

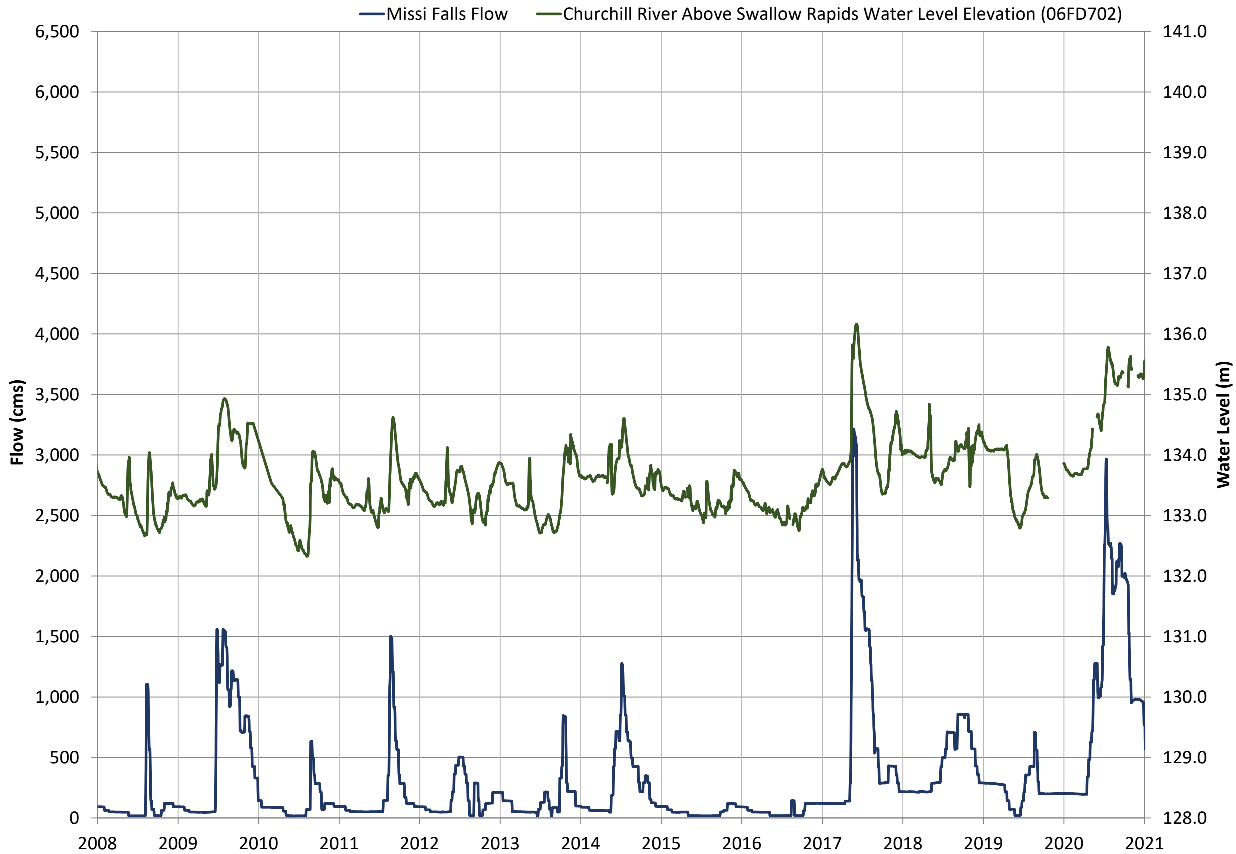


Figure 2.3-6. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and lower Churchill River above Swallow Rapids daily mean water level.

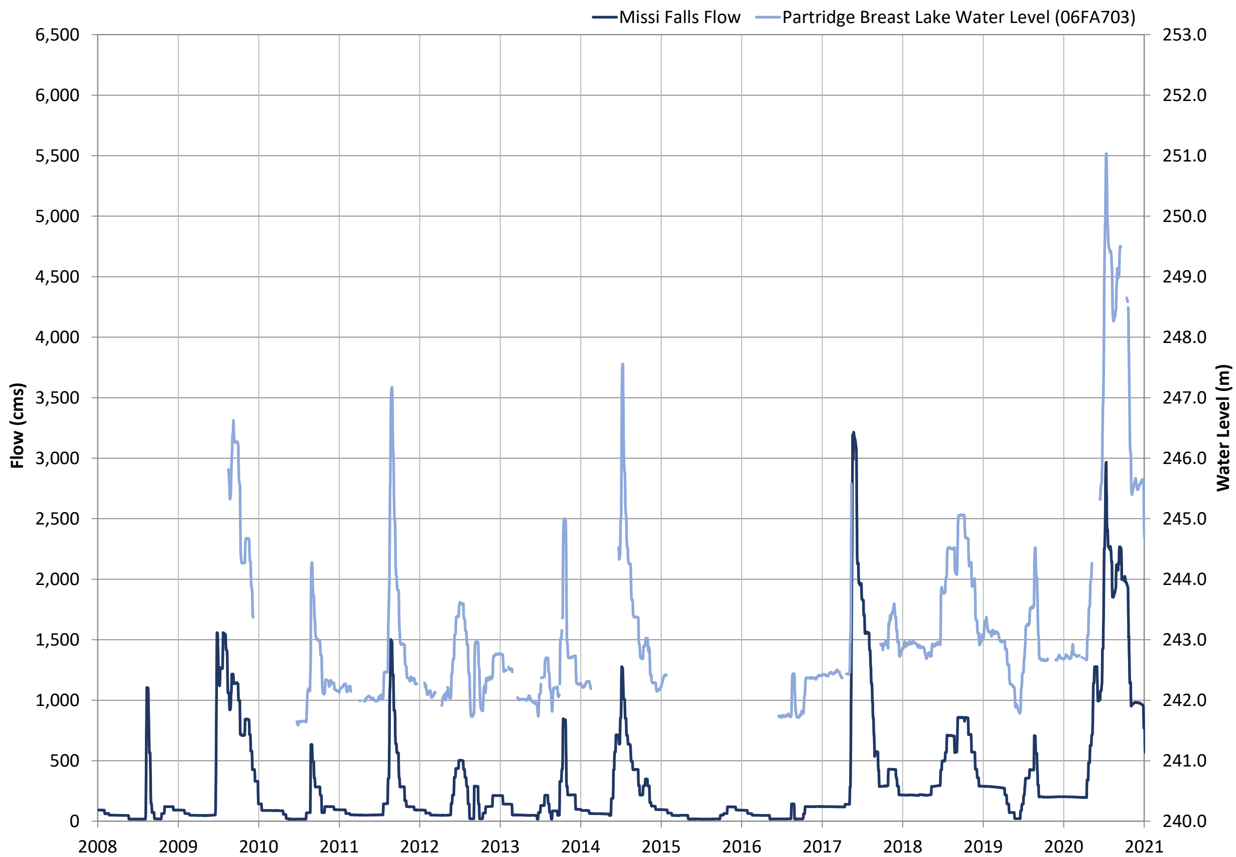


Figure 2.3-7. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and Partridge Breast Lake daily mean water level.

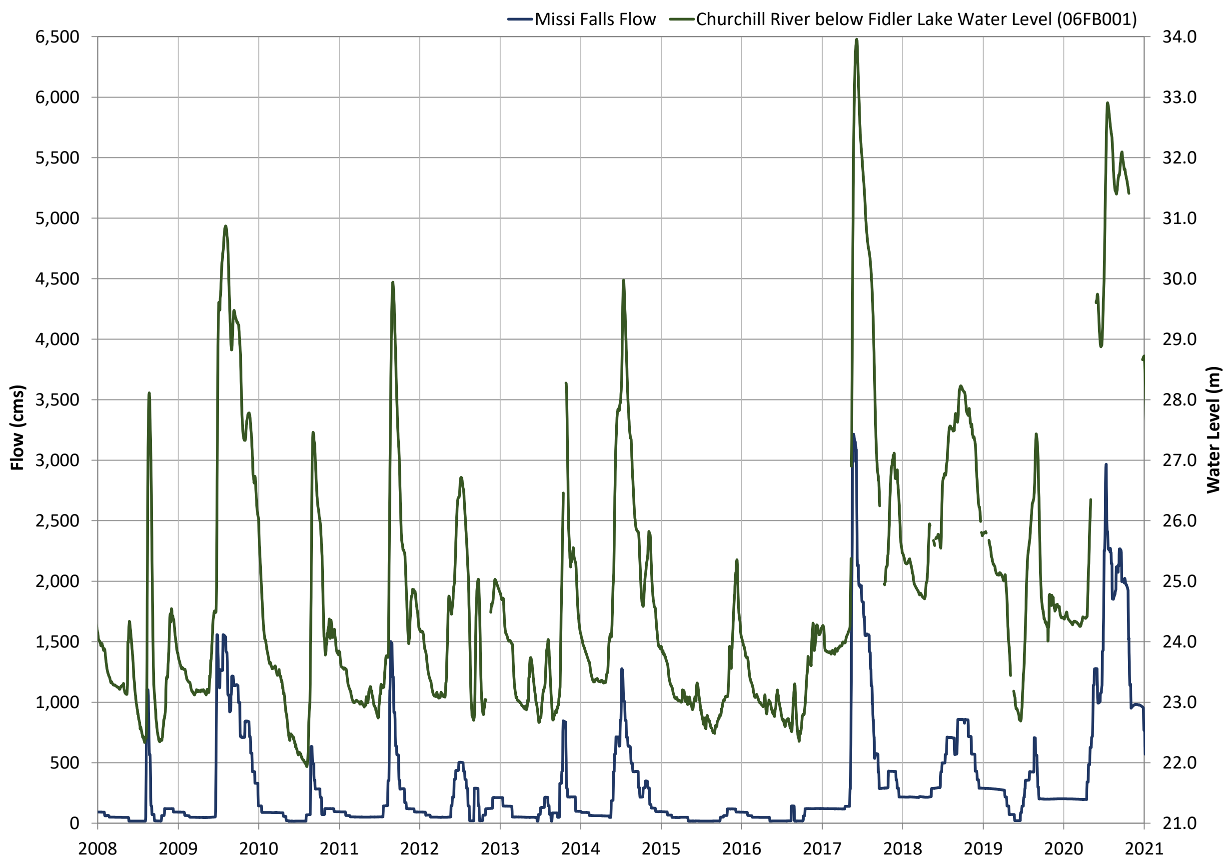


Figure 2.3-8. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and lower Churchill River below Fidler Lake daily mean water level.

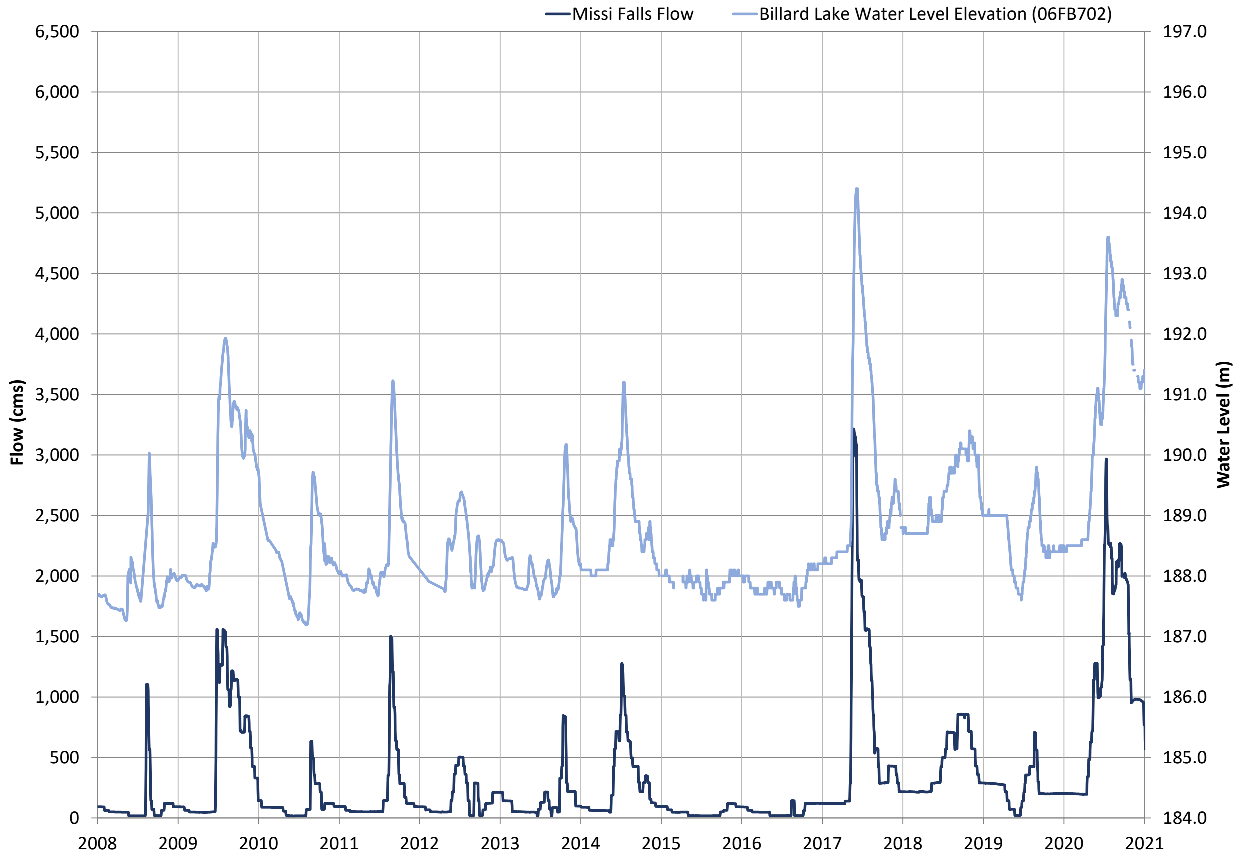


Figure 2.3-9. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and Billard Lake daily mean water level.

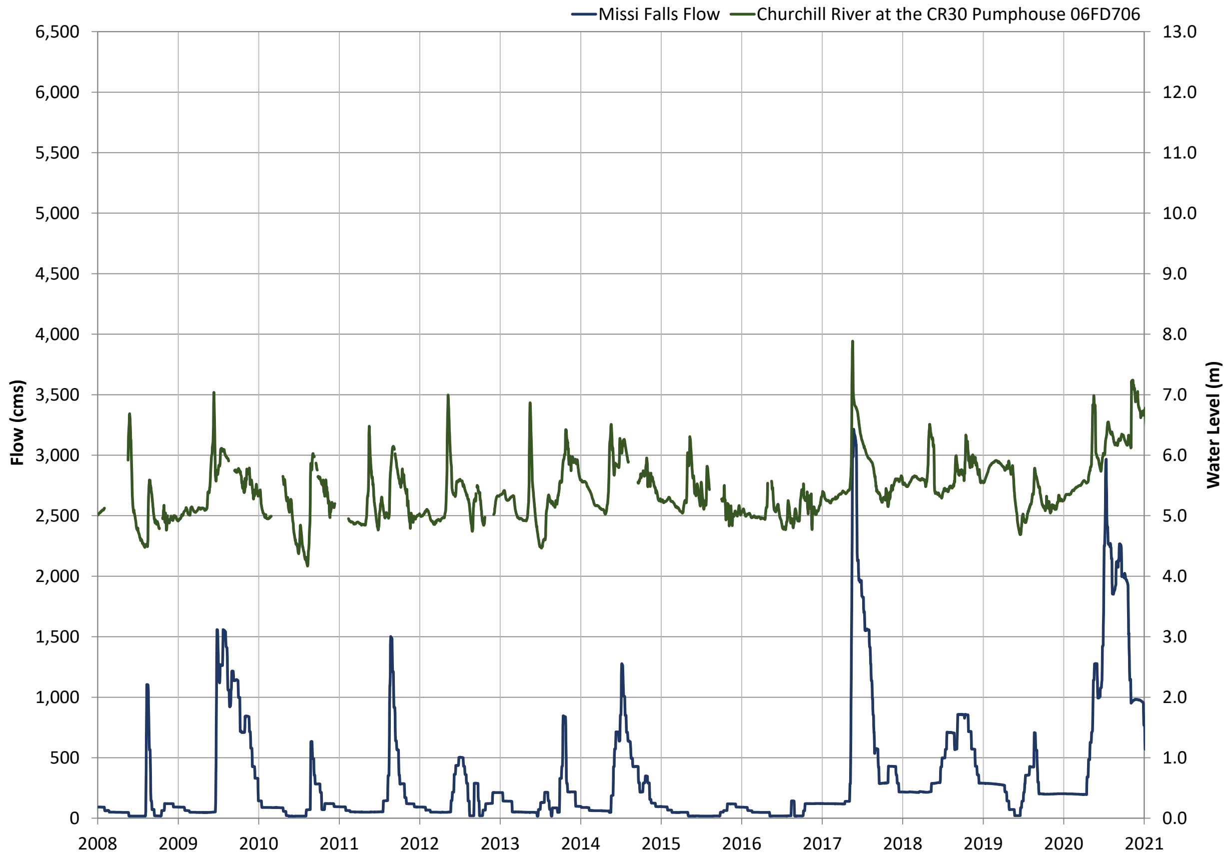


Figure 2.3-10. 2008-2020 Lower Churchill River at Missi Falls daily mean flow and lower Churchill River at the CR30 Pumphouse daily mean water level.

2.3.3 WATER TEMPERATURE

2.3.3.1 ON-SYSTEM SITES

Missi Falls Control Structure

Water temperature in the lower Churchill River Region is monitored at the continuous water quality monitoring station located at the Missi Falls CS (Figure 2.3-1). Water temperatures drop to near 0°C during the winter period. Temperatures peaked around 19°C in August 2018 and July 2019 during the two summers since monitoring has started. During the 2019 summer monitoring period, the only full summer period monitored to date, there were several periods when the water temperature dropped quickly including a 7°C drop over a span of eight days at the end of June 2019 (Figure 2.3-11).

The duration, in days, that water temperature is within different temperature ranges is used as a metric (Table 2.3-16). The number of days that the water temperature was below 1°C, which is used as a proxy-metric for the duration of the ice-cover period, was 171 days in 2018. In summer, there were no days above 20°C in the two years of monitoring.

2.3.3.2 OFF-SYSTEM SITES

There are no continuous monitoring off-system sites in this region.

Table 2.3-16. 2017-19 Missi Falls CS water temperature ranges.

Monitoring Year[1]	Number of Days in Temperature Range[2]					
	<1 °C	1-5 °C	5-10 °C	10-15 °C	15-20 °C	>20 °C
2017						
2018	171					0
2019			56	72	18	0

Notes:

1. Period <1°C is for the entire winter period (e.g., 2017 monitoring year is from Nov 2017 to May 2018).
2. The duration has been estimated using data from nearby gauging stations to infill missing data when available.

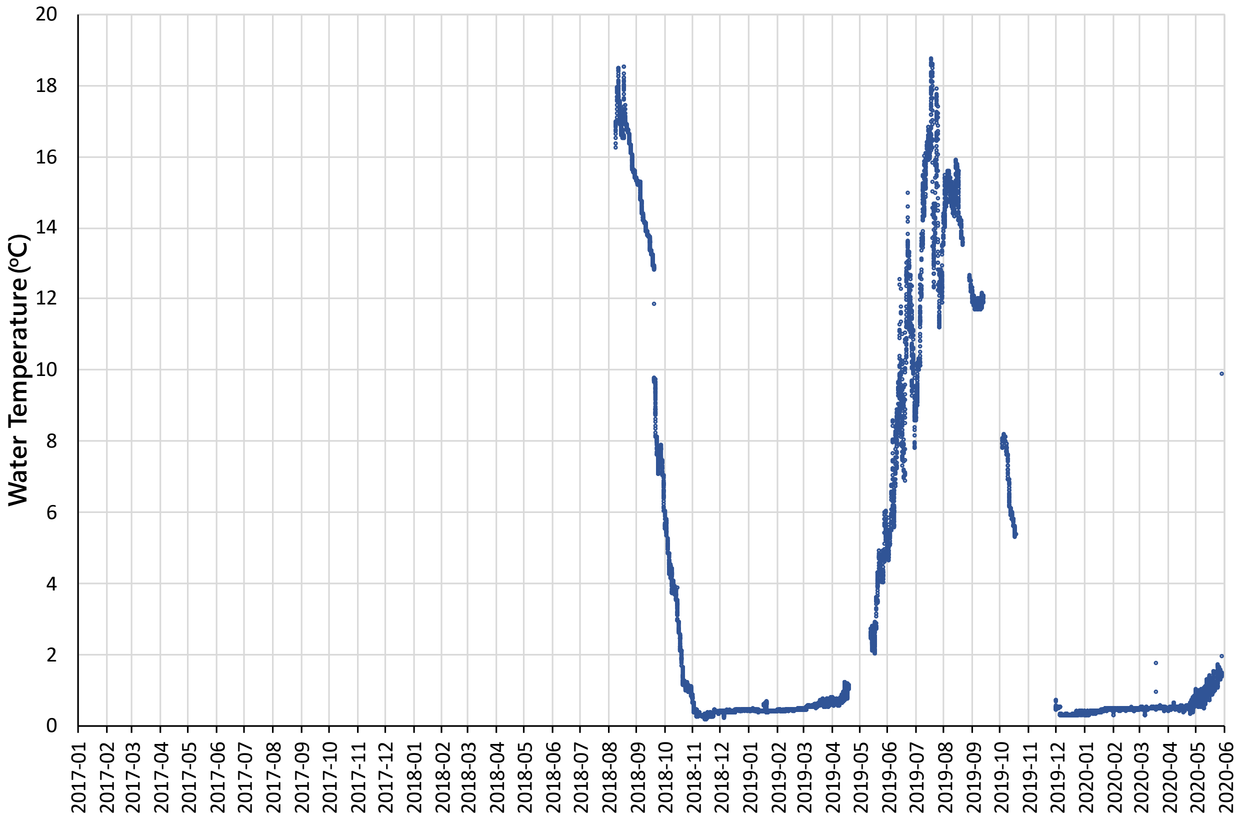


Figure 2.3-11. 2017-2019 Missi Falls Control Structure continuous water temperature.

2.4 SEDIMENTATION

The following presents the results of sedimentation monitoring conducted in the lower Churchill River Region. Monitoring occurred on-system at the continuous water quality monitoring site located at the Missi Falls CS (Figure 2.3-1). Monitoring started in 2018 (Table 2.4-1) and consists of measuring turbidity every 5 minutes and monthly site visits to verify the data and collect water samples for measuring total suspended solids (TSS) used in calculating the sediment load. For the sedimentation indicator, two metrics (continuous turbidity and suspended sediment load) were selected for detailed reporting (Table 2.4-2).

Table 2.4-1. 2008-2019 sedimentation sampling inventory.

Waterbody/ Area	Sampling Year											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Missi Falls CS											●	●

Table 2.4-2. Sedimentation indicators and metrics.

Indicator	Metric	Units
Sedimentation	Continuous turbidity	FNU
	Suspended sediment load	T/day

2.4.1 CONTINUOUS TURBIDITY

2.4.1.1 ON-SYSTEM SITES

Missi Falls Control Structure

Turbidity in the lower Churchill River Region is monitored at the continuous water quality monitoring station located at the Missi Falls CS. The average monthly turbidity ranged from 7.7 to 25.5 FNU (Table 2.4-3, Figure 2.4-1) with the hourly turbidity over the complete monitoring period ranging from 6 to 58 FNU (Figure 2.4-2).

The continuous data set at the Missi Falls CS is relatively short and will take more data to confirm patterns and trends in the data. The data set shows greater variability and higher turbidity during the open-water period than during the ice-cover months.

2.4.1.2 OFF-SYSTEM SITES

There are no continuous monitoring off-system sites in this region.

Table 2.4-3. 2017-2019 Missi Falls CS average monthly turbidity.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017												
2018										13.4	11.8	9.5
2019	8.8	9.3	9.1	9.1	8.2	7.7	7.6	25.5		13.1		13.5
2020	10.7	10.2	10.1	10.1								

Notes:

1. Monthly data only shown for months with more than 15 days of data.

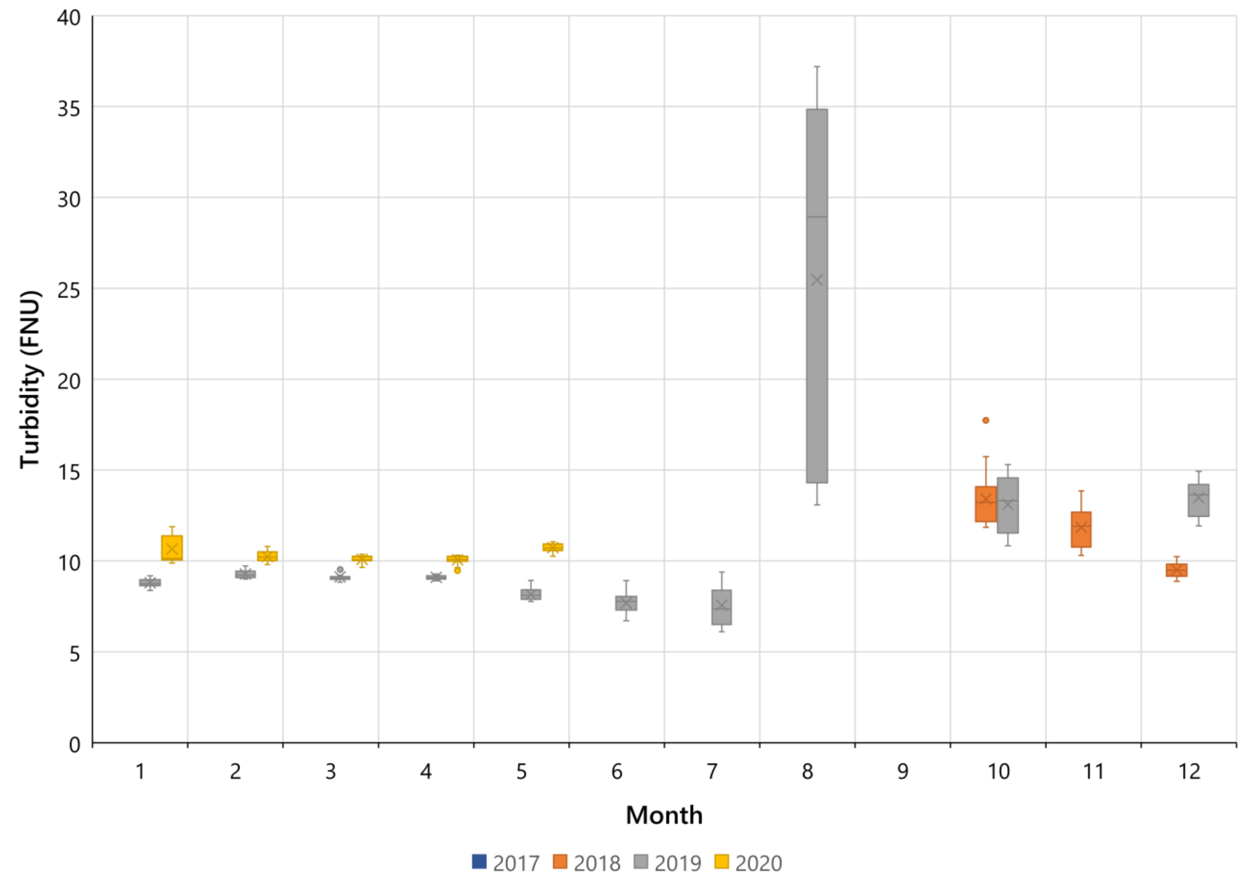


Figure 2.4-1. 2017-2019 Missi Falls CS monthly turbidity.

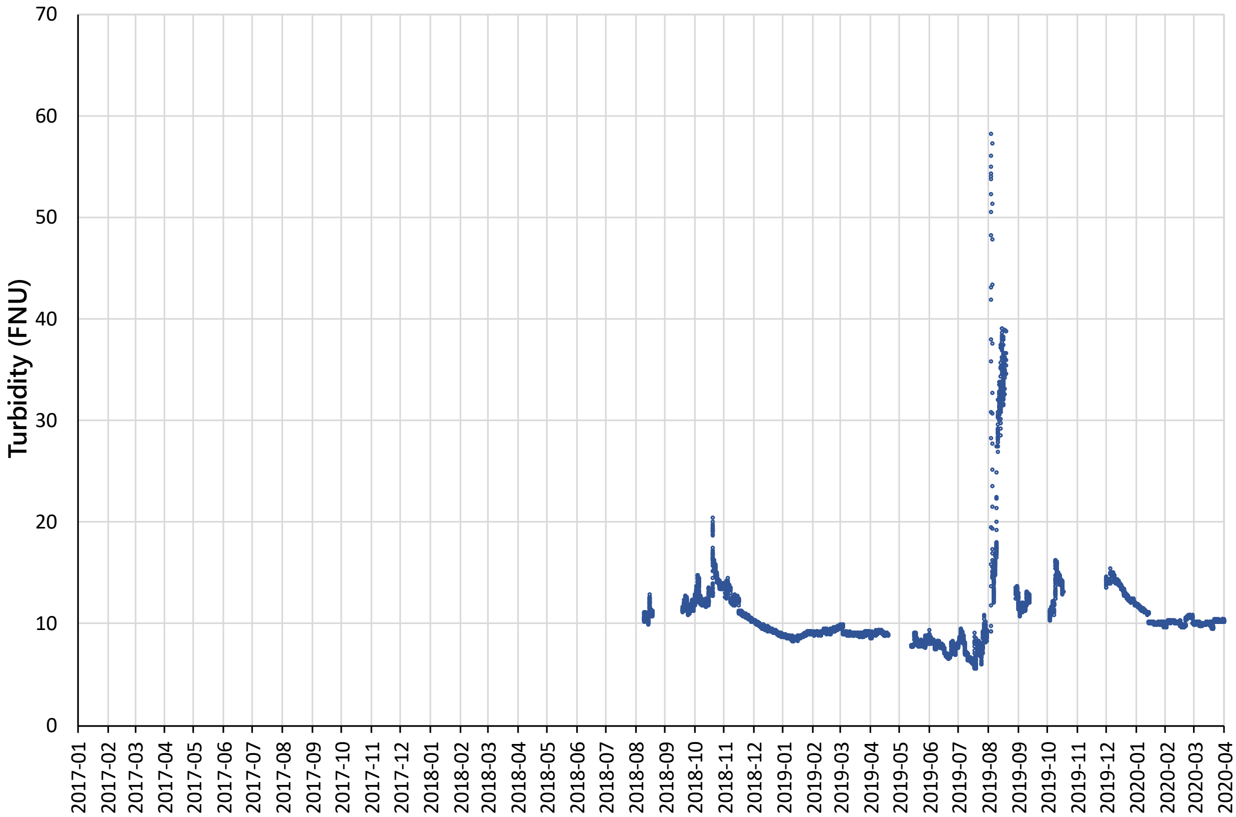


Figure 2.4-2. 2017-2019 Missi Falls CS continuous turbidity.

2.4.2 SUSPENDED SEDIMENT LOAD

2.4.2.1 ON-SYSTEM SITES

MISSI FALLS CONTROL STRUCTURE

Sediment load is estimated using the discharge data, continuous turbidity data (Figure 2.4-2) and water samples collected to correlate the turbidity to TSS. The average monthly sediment load ranged from 22 to 416 T/day (Table 2.4-4, Figure 2.4-3). Although there is limited data to make observations about, the was a peak observed each open-water period (Figure 2.3-4).

2.4.2.2 OFF-SYSTEM SITES

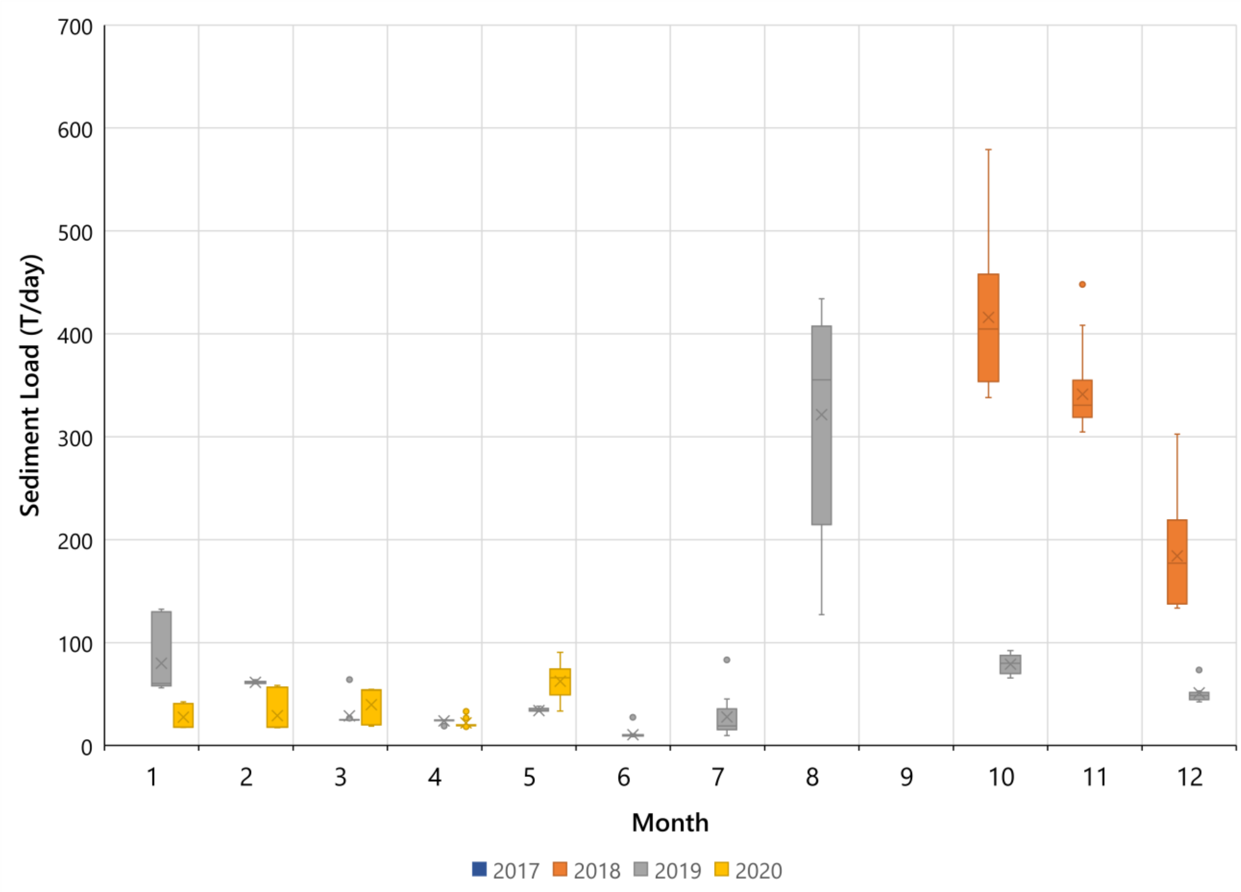
There are no continuous monitoring off-system sites in this region.

Table 2.4-4. 2017-19 Missi Falls CS average monthly sediment load.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017												
2018										416	341	184
2019	80	61	29	24	34	10	28	321		79		51
2020	27	30	39	22								

Notes:

1. Monthly average only shown for months with more than 15 days of data.
2. Some months are missing TSS measurements to estimate the load.



*Monthly data only shown for months with more than 15 days of data.

Figure 2.4-3. 2017-2019 Missi Falls CS monthly sediment load.

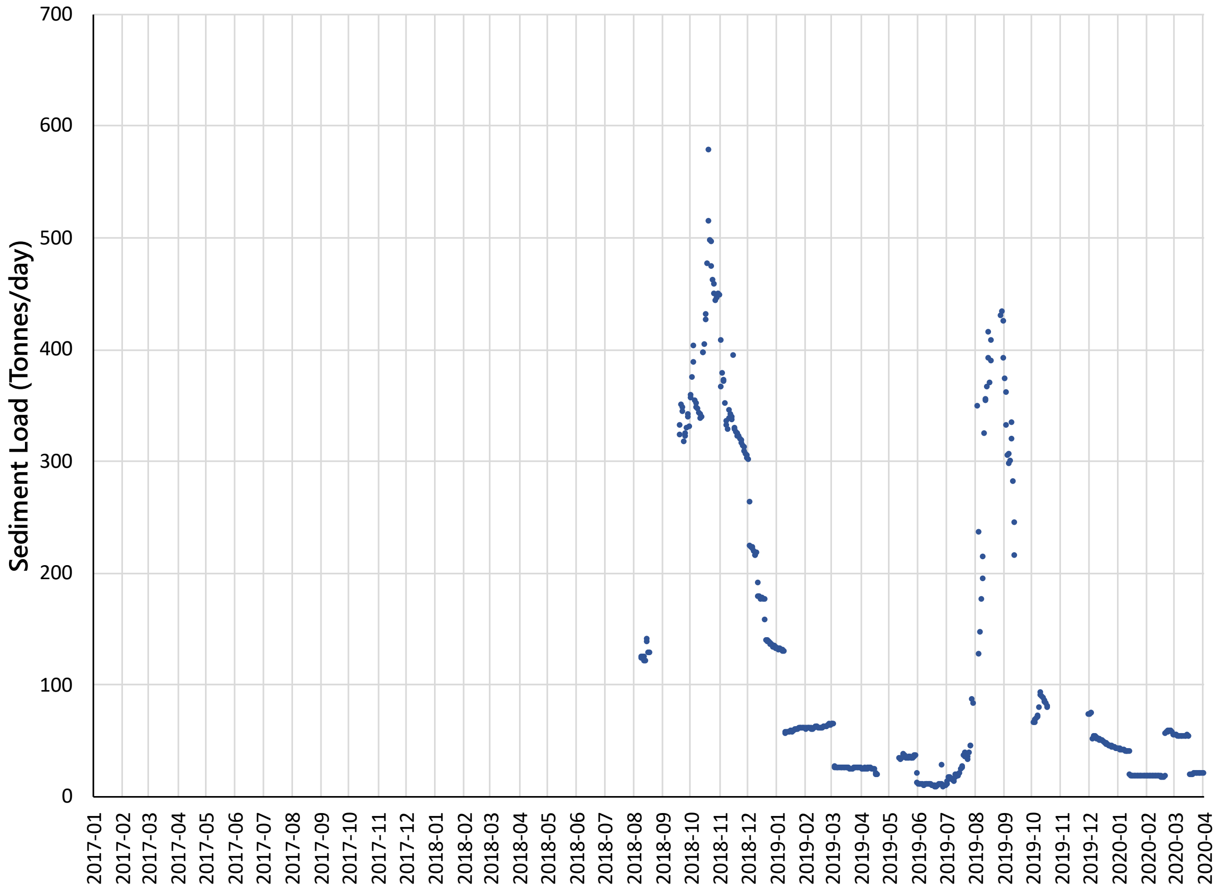
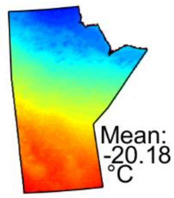
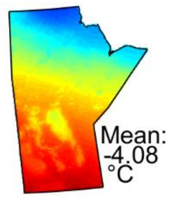
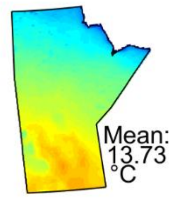
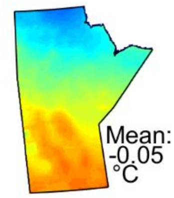
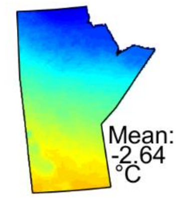
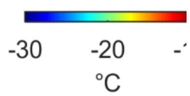
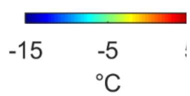
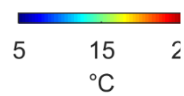
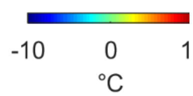
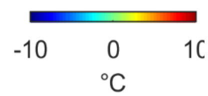
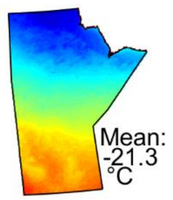
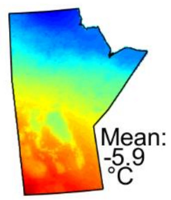
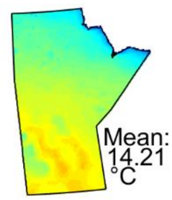
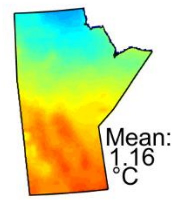
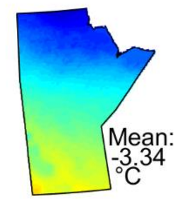
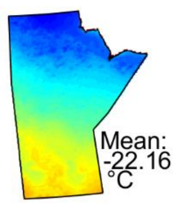
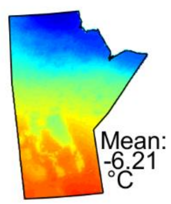
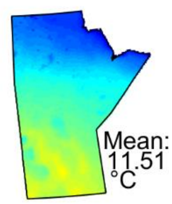
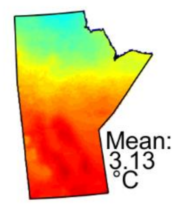
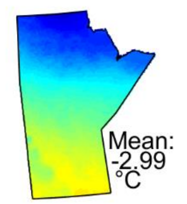
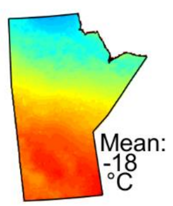
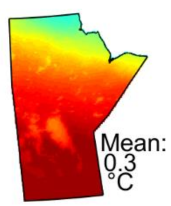
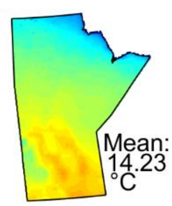
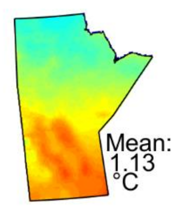
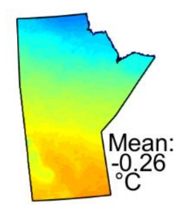
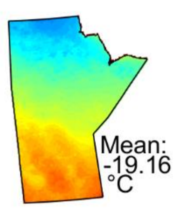
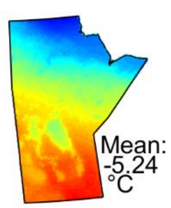
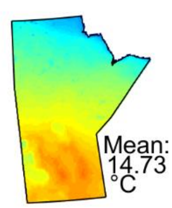
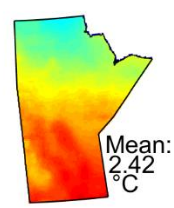
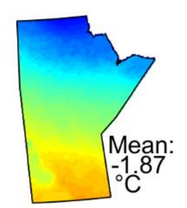
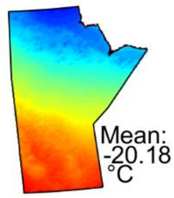
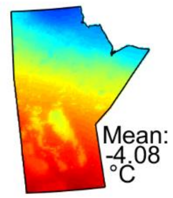
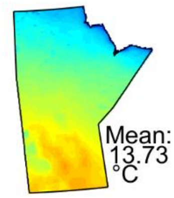
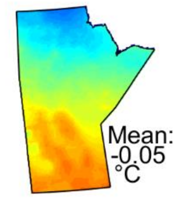
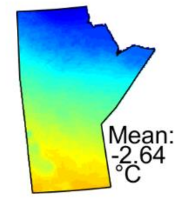
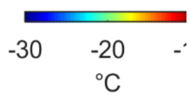
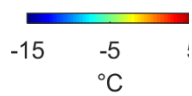
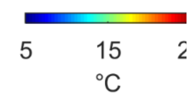
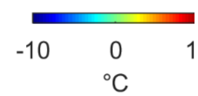
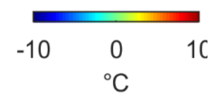
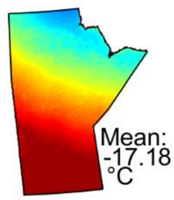
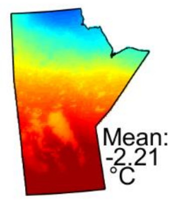
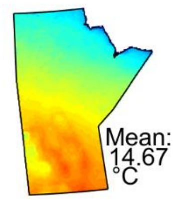
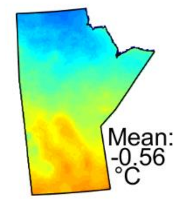
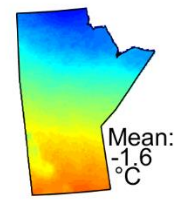
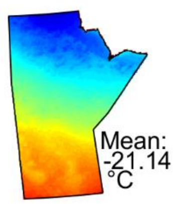
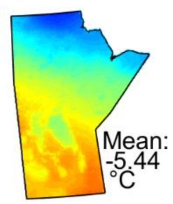
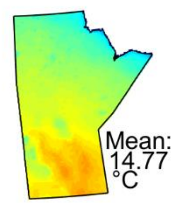
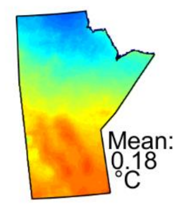
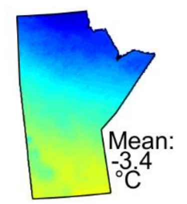
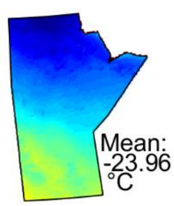
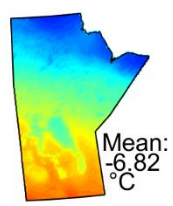
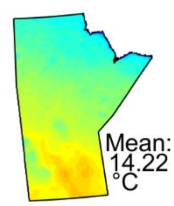
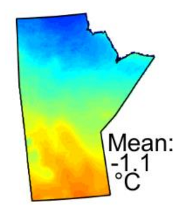
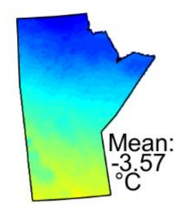
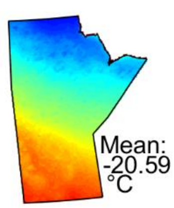
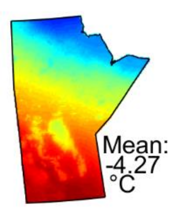
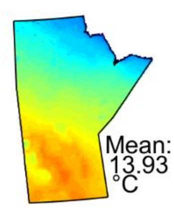
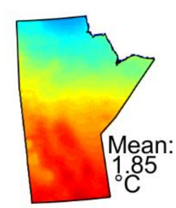
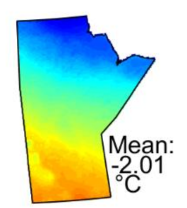
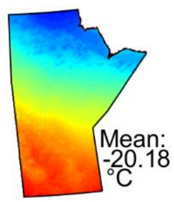
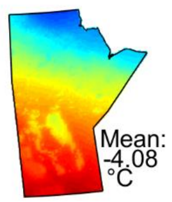
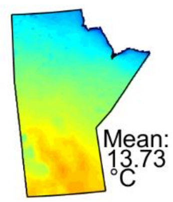
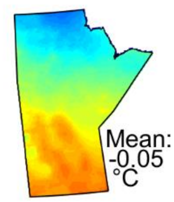
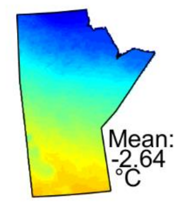
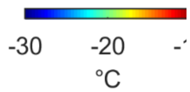
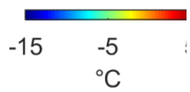
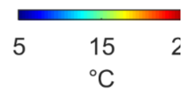
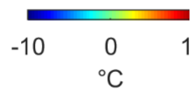
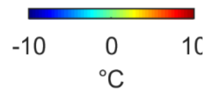
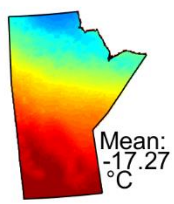
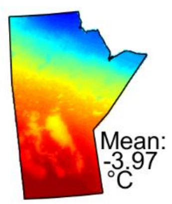
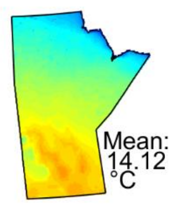
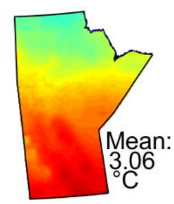
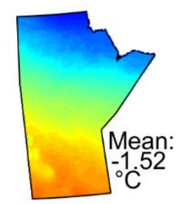
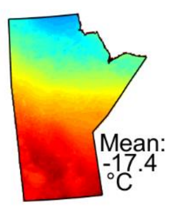
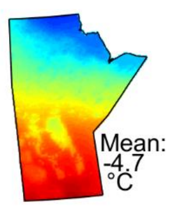
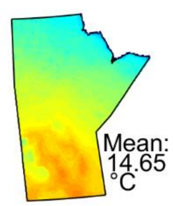
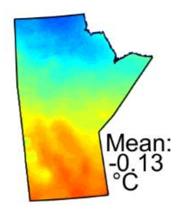
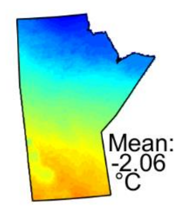
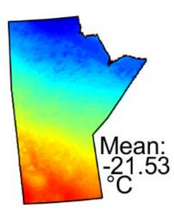
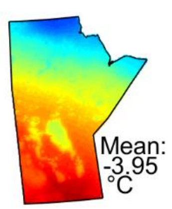
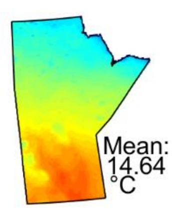
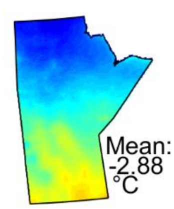
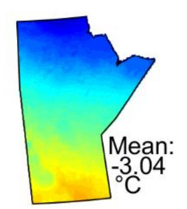
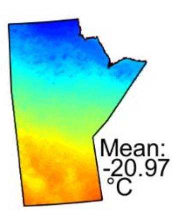
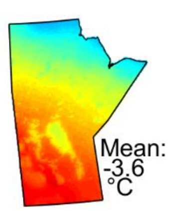
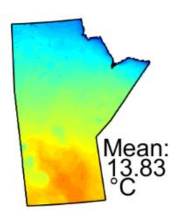
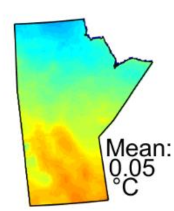
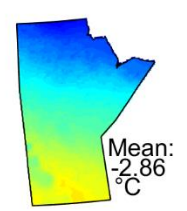
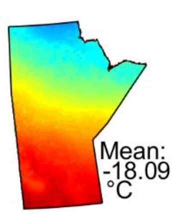
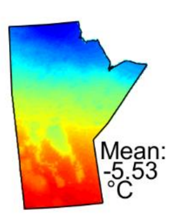
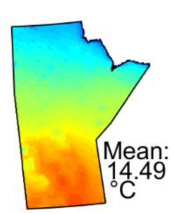
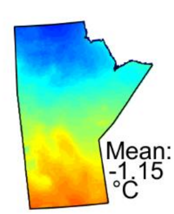
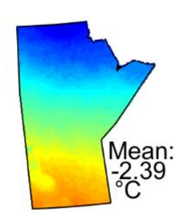


Figure 2.4-4. 2017-2019 Missi Falls CS daily sediment load.

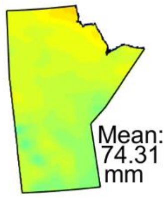
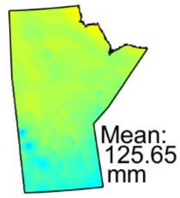
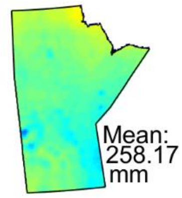
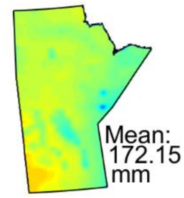
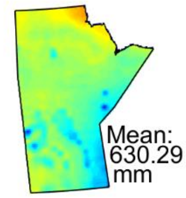
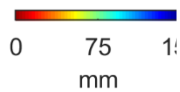
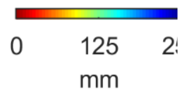
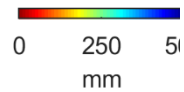
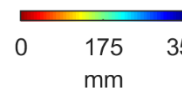
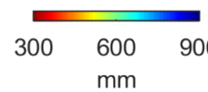
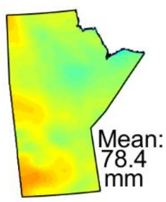
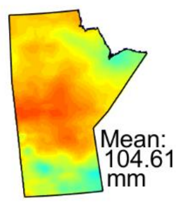
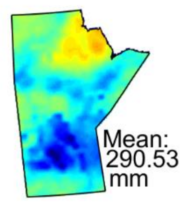
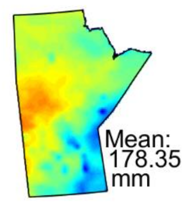
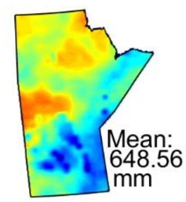
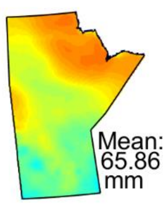
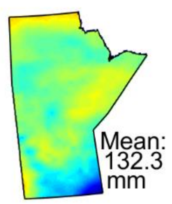
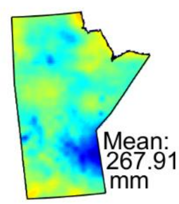
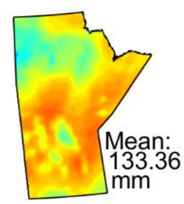
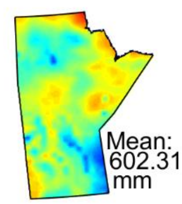
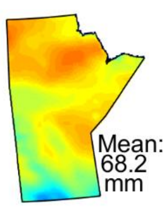
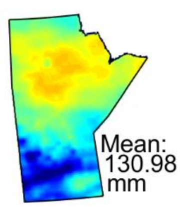
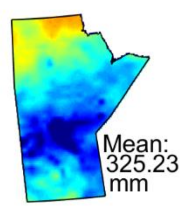
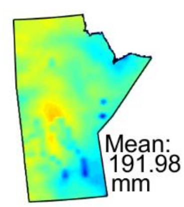
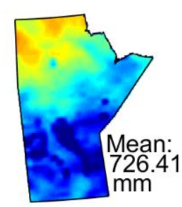
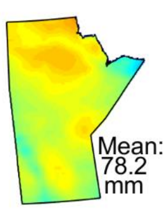
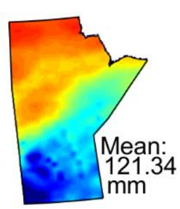
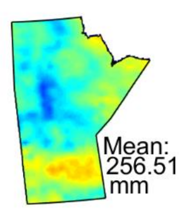
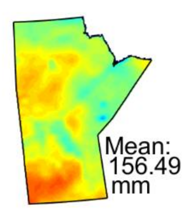
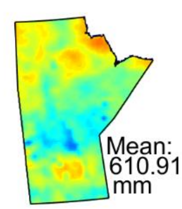
APPENDIX 2-1. SEASONAL AND ANNUAL TEMPERATURE NORMALS DERIVED FROM ERA5-LAND DATA

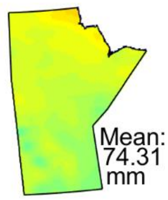
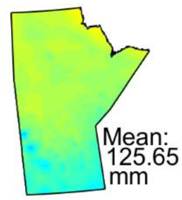
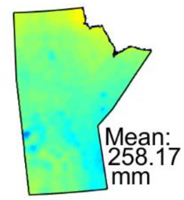
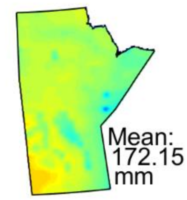
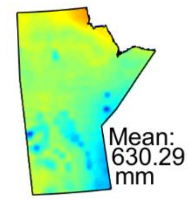
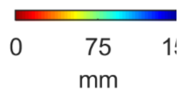
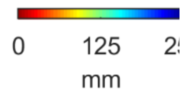
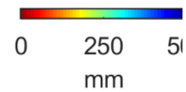
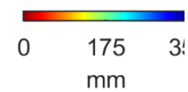
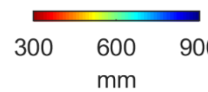
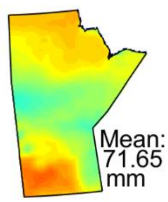
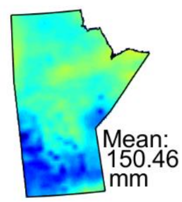
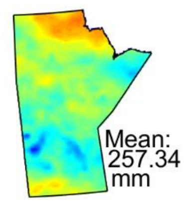
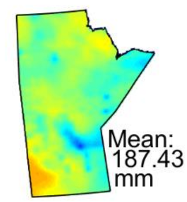
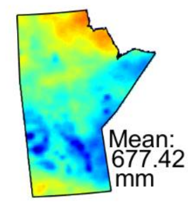
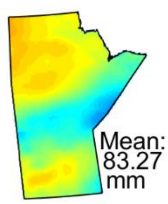
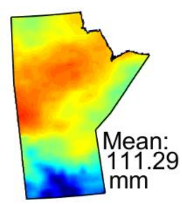
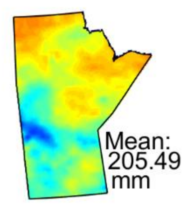
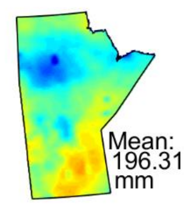
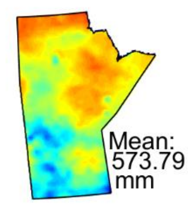
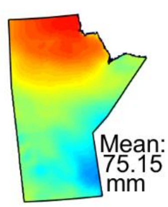
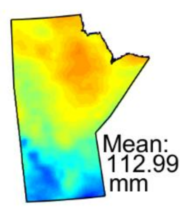
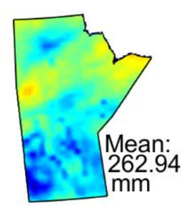
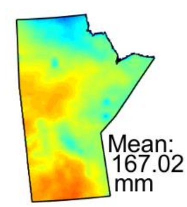
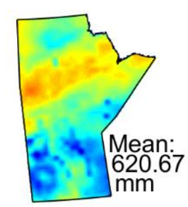
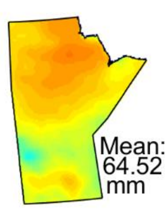
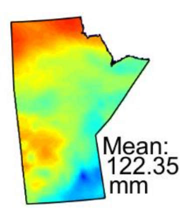
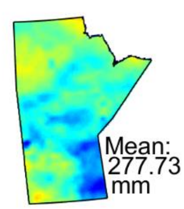
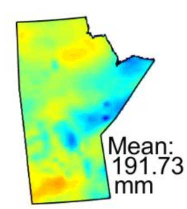
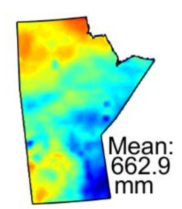
Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2008					
2009					
2010					
2011					

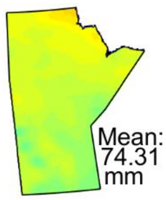
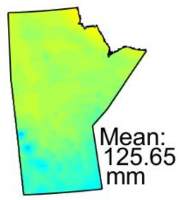
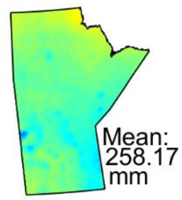
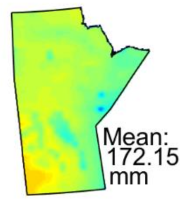
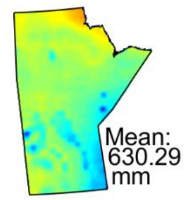
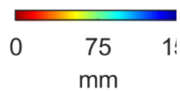
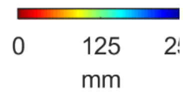
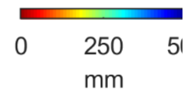
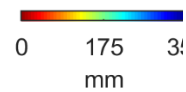
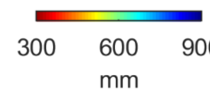
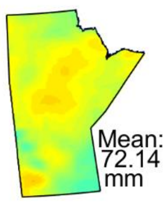
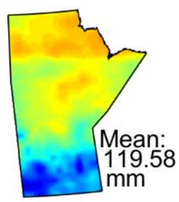
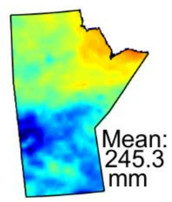
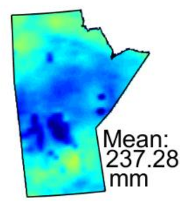
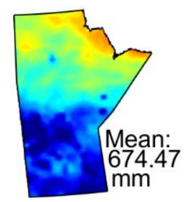
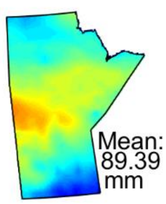
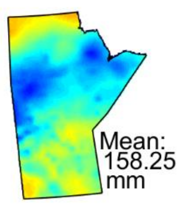
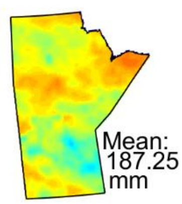
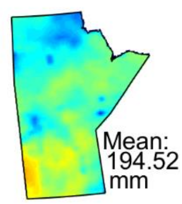
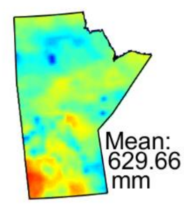
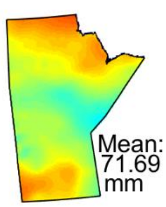
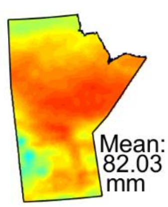
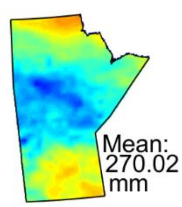
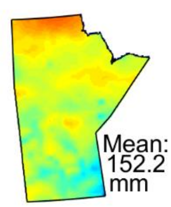
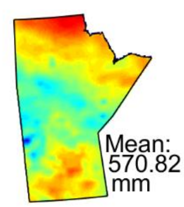
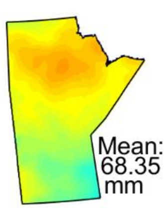
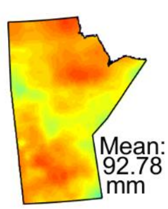
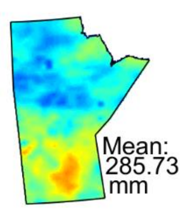
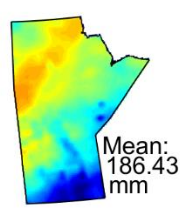
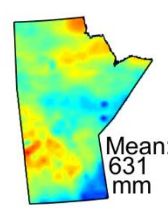
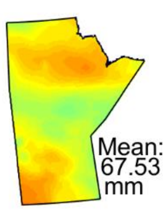
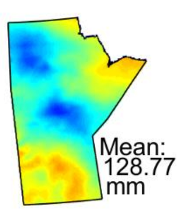
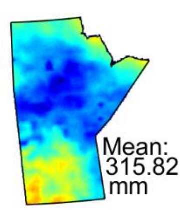
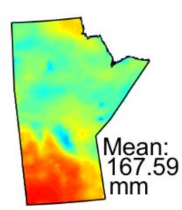
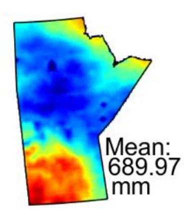
Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2012					
2013					
2014					
2015					

Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2016					
2017					
2018					
2019					
2020					

APPENDIX 2-2. SEASONAL AND PRECIPITATION NORMALS DERIVED FROM ERA5-LAND DATA

Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2008					
2009					
2010					
2011					

Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2012					
2013					
2014					
2015					

Year	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)	Annual
Normals (1981-2010)					
					
2016					
2017					
2018					
2019					
2020					

3.0 WATER QUALITY

3.1 INTRODUCTION

The following presents the results of water quality monitoring conducted from 2008 to 2019 in the Lower Churchill River Region. Seven sites were monitored in the Lower Churchill River Region: two on-system annual sites (Northern Indian Lake and the lower Churchill River at the Little Churchill River); four on-system rotational sites (Partridge Breast, Fidler, and Billard lakes and the lower Churchill River at the Churchill Weir); and one off-system annual site (Gauer Lake; Table 3.1-1 and Figure 3.1-1). Annual sites are sampled each year, whereas rotational sites are sampled once every three years on a rotational basis and are therefore limited to three or four years of data for the 12-year period.

The CAMP water quality program includes four sampling periods (referred to as spring, summer, fall, and winter) per monitoring year (i.e., April-March) typically at a single location within each waterbody or area of a waterbody/river reach. Over the 12-year period, water quality sampling was conducted at each sampling location during each sampling period (i.e., n=48 for annual sites) with the following exceptions (Table 3.1-1; Appendix 3-1):

- sampling in the lower Churchill River at the Churchill Weir was initiated in 2014; therefore, only two years of sampling were conducted for this rotational site (i.e., n=8);
- a deeper location in the south basin of Gauer Lake was sampled in 2008 rather than the shallower target location in the north basin that was sampled in all subsequent years; and
- sampling could not be completed in the lower Churchill River at the Little Churchill River in two winters and one spring; therefore, only 10 winter samples and 11 spring samples were collected over the 12-year period (i.e., n=45). These exceptions to sampling at the lower Churchill River at the Little Churchill River occurred due to:
  - thin ice in the winter of 2009;
  - an inability to find sufficient water to sample in winter 2013; and
  - high water in spring 2017.

A detailed description of the program design and sampling methods is provided in Technical Document 1, Section 2.3.

Three indicators (dissolved oxygen (DO); water clarity; and nutrients/trophic status) were selected for detailed reporting (Table 3.1-2). Metrics for these indicators include DO and its supporting metric temperature/stratification, Secchi disk depth, turbidity, TSS, total phosphorus (TP), total nitrogen (TN), and chlorophyll *a* (Table 3.1-2). A detailed description of these indicators is provided in CAMP (2024).

Table 3.1-1. 2008-2019 Water quality sampling inventory.

Waterbody/ Area	Sampling Year [1]											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NIL	●	●	●	●	●	●	●	●	●	●	●	●
LCR-LiCR	●	●[2]	●	●	●	●[3]	●	●	●	●[4]	●	●
PBL		●			●			●			●	
FID				●			●			●		
BIL			●			●			●			●
LCR-WEIR							●			●		
GAU	●	●	●	●	●	●	●	●	●	●	●	●

Notes:

1. Sampling year is from April-March.
2. No winter sample collected due to unsafe ice conditions.
3. No winter sample collected due to an inability to locate sufficient water for sampling.
4. No spring sample collected due to unsafe conditions associated with high water.

Table 3.1-2. Water quality indicators and metrics.

Indicator	Metric	Units
Dissolved Oxygen	• Dissolved oxygen (DO)	milligrams per litre (mg/L) and percent (%) saturation
	• Temperature/stratification [1]	°C
Water Clarity	• Secchi disk depth	m
	• Turbidity	Nephelometric turbidity units (NTU)
	• Total suspended solids (TSS)	mg/L
Nutrients and Trophic Status	• Total phosphorus (TP)	mg/L
	• Total nitrogen (TN)	mg/L
	• Chlorophyll *a*	micrograms per litre (µg/L)

Notes:

1. Supporting metric.

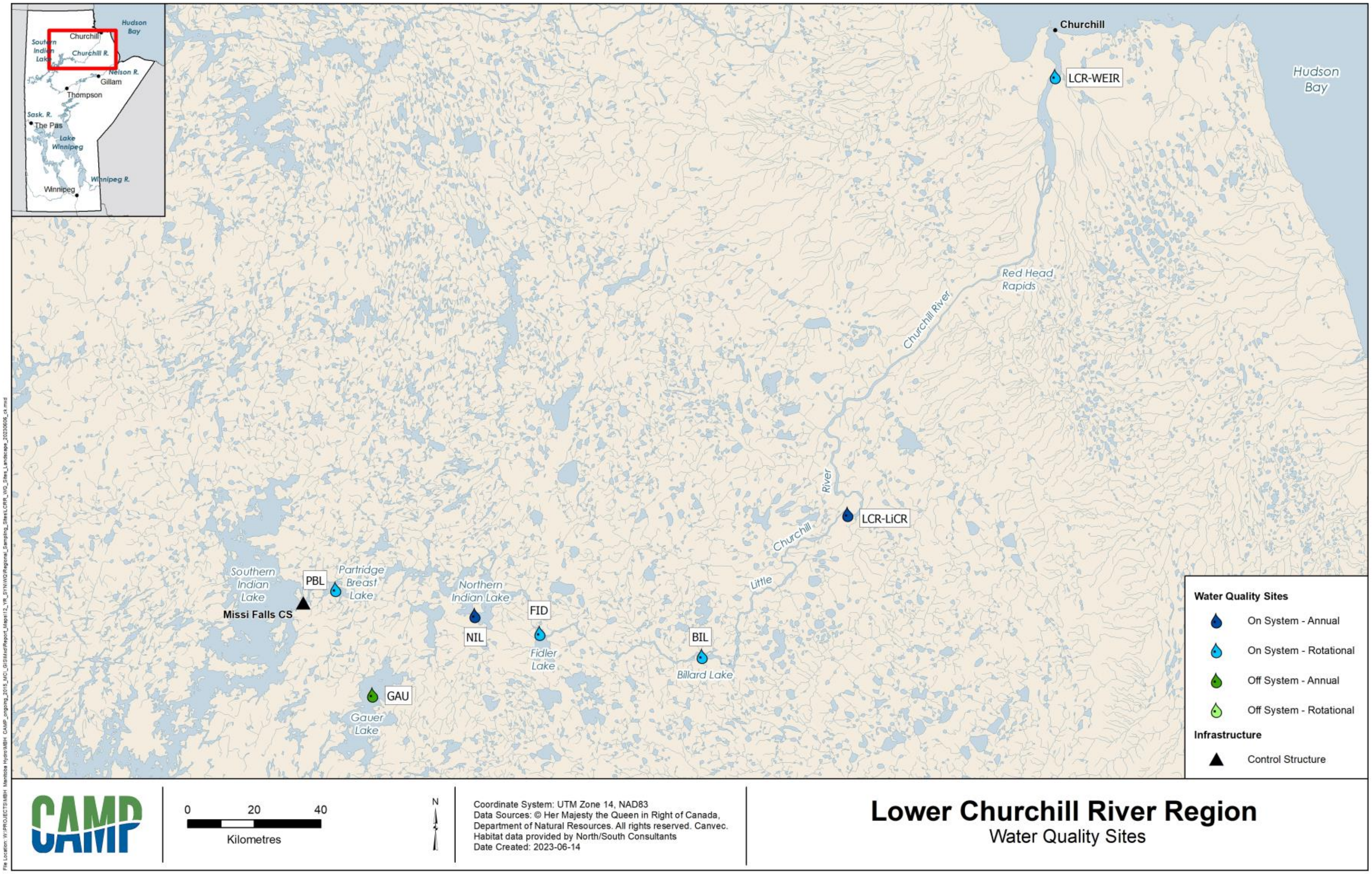


Figure 3.1-1. 2008-2019 Lower Churchill River Region water quality sites.

3.2 DISSOLVED OXYGEN

3.2.1 DISSOLVED OXYGEN

3.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Northern Indian Lake was well-oxygenated year-round and DO concentrations throughout the water column consistently met the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOGs) instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Manitoba Water Stewardship [MWS] 2011; Table 3.2-1).

Northern Indian Lake was thermally stratified during three spring sampling events (2008, 2015, and 2017) and one summer sampling event (2013) over the 12 years of monitoring (Table 3.2-1 and Figure 3.2-1).

DO concentrations were similar throughout the water column during each sampling period (Figure 3.2-2). During the open-water season, DO concentrations ranged from 8.67 to 12.71 mg/L at the surface and 7.76 to 13.44 mg/L near the bottom (maximum site water depth = 28.3 m). During the ice-cover season, DO concentrations ranged from 13.67 to 15.45 mg/L at the surface and 12.17 to 15.25 mg/L near the bottom (Table 3.2-2 and Figure 3.2-3).

DO concentrations varied between seasons with seasonal mean DO concentrations being higher in winter and spring when the water was cooler, and lower in the summer and fall when the water was warmer (Figure 3.2-4).

DO saturation was near 100% at both the surface and near the bottom during each season sampled (Figure 3.2-5). During the open-water season, surface DO saturation ranged from 92.0 to 115.2% with a mean of 100.7% and a median of 99.3% over the 12 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 94.8 to 105.2% and were within or near the interquartile range (IQR) of 97.2 to 102.0% (Table 3.2-2 and Figure 3.2-6). Bottom DO saturation during the open-water season ranged from 71.2 to 116.4% with a mean of 96.3% and median of 96.2% over the 12 years of monitoring. Mean bottom

DO saturation levels in the open-water season were similar from year to year ranging 89.0 to 102.9% and were within or near the IQR of 93.9 to 99.6% (Table 3.2-2 and Figure 3.2-7).

During the ice-cover season, DO saturation at the surface ranged from 95.9 to 114.3% with a mean of 104.2% and a median of 103.8%. The IQR was 100.1 to 107.3% (Table 3.2-2 and Figure 3.2-8). Bottom DO saturation during the ice-cover season ranged from 91.8 to 112.4% with a mean of 101.0% and a median of 99.5%. The IQR was 95.1 to 107.1% (Table 3.2-2 and Figure 3.2-9).

Lower Churchill River at the Little Churchill River

The lower Churchill River at the Little Churchill River was well-oxygenated year-round and DO concentrations at the surface consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-1). Only surface data are available for this site.

DO concentrations at the surface ranged from 8.81 to 12.93 mg/L during the open-water season, and from 13.20 to 16.08 mg/L during the ice-cover season (Table 3.2-2 and Figure 3.2-10). DO concentrations varied between seasons with seasonal mean DO concentrations being higher in winter when the water was cooler, and lower during the open-water season when the water was warmer (Figure 3.2-4).

DO saturation was near 100% at the surface during each season sampled (Figure 3.2-5). During the open-water season, surface DO saturation ranged from 94.0 to 119.6% with a mean of 102.1% and a median of 99.5% over the 12 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 96.9 to 109.5% and were within or near the IQR of 98.2 to 105.5% (Table 3.2-2 and Figure 3.2-6).

During the ice-cover season, DO saturation at the surface ranged from 91.0 to 117.4% with a mean of 101.5% and a median of 100.8%. The IQR was 97.6 to 103.1% (Table 3.2-2 and Figure 3.2-8).

ROTATIONAL SITES

Partridge Breast Lake

Partridge Breast Lake was well-oxygenated year-round and DO concentrations throughout the water column consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-1).

Partridge Breast Lake was isothermal and DO concentrations were similar throughout the water column during each season sampled (Table 3.2-1, and Figures 3.2-1 and 3.2-2). During the open-water season, DO concentrations ranged from 9.13 to 13.16 mg/L at the surface and 8.86 to 12.97 mg/L near the bottom (maximum site water depth = 16.6 m). During the ice-cover season, DO concentrations ranged from 14.98 to 15.80 mg/L at the surface and 14.33 to 15.57 mg/L near the bottom (Table 3.2-2 and Figure 3.2-11).

DO saturation in Partridge Breast Lake was near 100% at both the surface and near the bottom of the water column during each sampling period. During the open-water season, surface DO saturation ranged from 94.8 to 121.0% with a mean of 104.1% and a median of 102.0% over the four years of monitoring. Mean surface DO saturation levels in the open-water season ranged from 100.5 to 107.5% and were within the IQR of 99.8 to 108.5% (Table 3.2-2 and Figure 3.2-6). Bottom DO saturation during the open-water season ranged from 87.5 to 116.6% with a mean of 101.2% and a median of 102.4% over the four years of monitoring. Mean bottom DO saturation levels in the open-water season ranged from 95.3 to 104.6% and were within or near the IQR of 97.2 to 106.6% (Table 3.2-2 and Figure 3.2-7).

During the ice-cover season, DO saturation at the surface ranged from 104.7 to 116.9% with a mean of 112.8% (Table 3.2-2 and Figure 3.2-8). Bottom DO saturation during the ice-cover season ranged from 100.7 to 115.6% with a mean of 110.0% (Table 3.2-2 and Figure 3.2-9).

Fidler Lake

Fidler Lake was well-oxygenated year-round and DO concentrations throughout the water column consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-1).

Fidler Lake was isothermal and DO concentrations were similar throughout the water column during each season sampled (Table 3.2-1, and Figures 3.2-1 and 3.2-2). During the open-water season, DO concentrations ranged from 8.57 to 11.43 mg/L at the surface and 8.57 to 11.12 mg/L near the bottom (maximum site water depth = 14.5 m). In winter 2017, the DO concentration was 13.84 mg/L at the surface and 13.85 mg/L near the bottom (Table 3.2-2 and Figure 3.2-12).

DO saturation in Fidler Lake was near 100% at both the surface and near the bottom of the water column during each sampling period. During the open-water season, surface DO saturation ranged from 92.5 to 109.5% with a mean of 99.0% and a median of 98.8% over the three years of monitoring. Mean surface DO saturation levels in the open-water season ranged from 95.8 to

102.8% and were within or near the IQR of 94.2 to 101.4% (Table 3.2-2 and Figure 3.2-6). Bottom DO saturation during the open-water season ranged from 92.5 to 106.2% with a mean of 97.4% and a median of 97.1% over the three years of monitoring. Mean bottom DO saturation levels in the open-water season ranged from 94.4 to 100.4% and were within or near the IQR of 93.7 to 98.9% (Table 3.2-2 and Figure 3.2-7).

During the ice-cover season, DO saturation was 89.9% at the surface and 90.0% near the bottom in 2017 (Table 3.2-2 and Figures 3.2-8 and 3.2-9).

Billard Lake

Billard Lake was well-oxygenated year-round and DO concentrations throughout the water column consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-1).

Billard Lake was isothermal and DO concentrations were similar throughout the water column during each season sampled (Table 3.2-1, and Figures 3.2-1 and 3.2-2). During the open-water season, DO concentrations ranged from 8.93 to 11.23 mg/L at the surface and 8.95 to 11.21 mg/L near the bottom (maximum site water depth = 10.3 m). During the ice-cover season, DO concentrations ranged from 13.35 to 15.08 mg/L at the surface and 13.05 to 14.85 mg/L near the bottom (Table 3.2-2 and Figure 3.2-13).

DO saturation in Billard Lake was near 100% at both the surface and near the bottom of the water column during each sampling period. During the open-water season, surface DO saturation ranged from 93.9 to 113.6% with a mean of 102.2% and a median of 100.6% over the four years of monitoring. Mean surface DO saturation levels in the open-water season ranged from 99.1 to 108.7% and were within or near the IQR of 98.3 to 105.6% (Table 3.2-2 and Figure 3.2-6). Bottom DO saturation during the open-water season ranged from 92.6 to 105.9% with a mean of 100.1% and a median of 99.8% over the four years of monitoring. Mean bottom DO saturation levels in the open-water season ranged from 98.7 to 103.0% and were within or near the IQR of 98.1 to 101.8% (Table 3.2-2 and Figure 3.2-7).

During the ice-cover season, DO saturation at the surface ranged from 92.8 to 104.4% with a mean of 99.3% (Table 3.2-2 and Figure 3.2-8). Bottom DO saturation during the ice-cover season ranged from 94.1 to 102.8% with a mean of 97.8% (Table 3.2-2 and Figure 3.2-9).

Lower Churchill River at the Churchill Weir

The lower Churchill River at the Churchill Weir was well-oxygenated year-round and DO concentrations throughout the water column consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-1).

The lower Churchill River at the Churchill Weir was isothermal and DO concentrations were similar throughout the water column during each season sampled (Table 3.2-1, and Figures 3.2-1 and 3.2-2). During the open-water season, DO concentrations ranged from 8.94 to 12.25 mg/L at the surface and 8.92 to 12.31 mg/L near the bottom (maximum site water depth = 4.5 m). In winter 2017, the DO concentration was 13.14 mg/L at the surface and 13.17 mg/L near the bottom (Table 3.2-2 and Figure 3.2-14).

During the open-water season, surface DO saturation ranged from 93.5 to 113.4% with a mean of 99.6% and a median of 97.3% over the two years of monitoring. Mean surface DO saturation levels in the open-water season were 98.5% in 2014 and 100.8% in 2017 and were within or near the IQR of 95.2 to 100.6% (Table 3.2-2 and Figure 3.2-6). Bottom DO saturation during the open-water season ranged from 93.1 to 113.7% with a mean of 99.0% and a median of 96.7% over the two years of monitoring. Mean bottom DO saturation levels in the open-water season were 96.9% in 2014 and 101.1% in 2017 and were within or near the IQR of 95.3 to 98.2% (Table 3.2-2 and Figure 3.2-7).

During the ice-cover season, DO saturation was 88.5% at the surface and 88.7% near the bottom in 2017 (Table 3.2-2 and Figures 3.2-8 and 3.2-9).

3.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Gauer Lake was well-oxygenated near the surface and DO concentrations near the surface met the MWQSOGs during all sampling periods. DO concentrations decreased with water depth and fell below the MWQSOGs instantaneous minimum objective for cold-water aquatic life during one winter sampling event (2008) over the 12 years of monitoring (Table 3.2-3).

Gauer Lake was isothermal with two exceptions, including: spring 2008 (a deeper location was sampled in 2008) when thermal stratification was observed near the surface and at depth (thermoclines at 0-1 m and 11-12 m); as well as, summer 2013 when thermal stratification was observed near the surface (thermocline at 0-1 m; Table 3.2-3 and Figure 3.2-1).

Gauer Lake was well-oxygenated and DO concentrations were similar throughout the water column during each spring, summer, and fall sampling event (Figure 3.2-2). During the open-water season, DO concentrations ranged from 8.53 to 12.40 mg/L at the surface and 8.03 to 12.46 mg/L near the bottom (maximum site water depth = 15.0 m; Table 3.2-4 and Figure 3.2-15).

During the ice-cover season, Gauer Lake was well-oxygenated near the surface; however, DO concentrations decreased with depth during most winter sampling events. Although DO concentrations throughout the water column typically met protection of aquatic life (PAL) guidelines, DO concentrations fell below the MWQSOGs instantaneous minimum objective for cold-water aquatic life (8.0 mg/L) near the bottom of the water column in winter 2018 when a deeper location in the south basin of the lake was sampled (depth = 12.5 m; median depth during ice-cover season = 2.7 m; Tables 3.2-3 and 3.2-4, and Figure 3.2-2). During the ice-cover season, DO concentrations ranged from 12.41 to 14.71 mg/L at the surface and from 4.06 to 14.07 mg/L near the bottom (Table 3.2-4 and Figure 3.2-15). The decrease in DO concentrations with depth occurred despite the lake being isothermal in winter (Table 3.2-3 and Figure 3.2-1).

DO concentrations varied between seasons with seasonal mean DO concentrations being higher in winter when the water was cooler, and lower in the open-water season when the water was warmer (Figure 3.2-16).

DO saturation was near 100% at the surface during each season sampled (Figure 3.2-17). In the open-water season, surface DO saturation ranged from 93.2 to 113.5% with a mean of 99.5% and a median of 98.8% over the 12 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 94.4 to 105.5% and were within or near the IQR of 95.9 to 102.2%. During the ice-cover season, surface DO saturation ranged from 87.7 to 109.3% with a mean of 98.2% and a median of 99.3%. The IQR for the ice-cover season was 90.8 to 104.7% (Table 3.2-4 and Figure 3.2-18).

No clear seasonal difference was observed for percent saturation near the bottom of the water column; however, mean DO saturation was lowest in winter (83.7%) and highest in the open-water season (96.6, 100.1, and 98.1% in spring, summer, and fall, respectively; Figure 3.2-17). During the open-water season, bottom DO saturation ranged from 72.7 to 111.3% with a mean of 98.2% and a median of 97.8% over the 12 years of monitoring. Mean bottom DO saturation levels in the open-water season ranged from 86.4 to 104.9% and were within or near the IQR of 95.9 to 100.2% in 11 of the 12 years of monitoring. Mean bottom DO saturation was below the IQR in 2008. During the ice-cover season, bottom DO saturation ranged from 31.1 to 104.6% with a mean of 83.7% and a median of 88.8%. The IQR for the ice-cover season was 79.3 to 101.6%. Bottom DO saturation was within or near the IQR in most winters but was below the IQR in 2008 (Table 3.2-4 and Figure 3.2-18).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

Table 3.2-1. 2008-2019 On-system sites summary of thermal stratification and DO concentrations.

Metric	Sampling Year	Surface or Bottom	NIL				LCR-LiCR				PBL				FID				BIL				LCR-WEIR			
			Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover
			SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI
Thermal Stratification	2008		2008	No	No	No	No Data																			
	2009		No	No	No	No					No	No	No	No												
	2010		No	No	No	No													No	No	No	No				
	2011		No	No	No	No									No	No	No	No								
	2012		No	No	No	No					No	No	No	No												
	2013		No	2013	No	No													No	No	No	No				
	2014		No	No	No	No									No	No	No	No					No	No	No	No
	2015		2015	No	No	No					No	No	No	No												
	2016		No	No	No	No													No	No	No	No				
	2017		2017	No	No	No									No	No	No	No					No	No	No	No
	2018		No	No	No	No					No	No	No	No												
	2019		No	No	No	No													No	No	No	No				
DO met MWQSOGs PAL objectives	2008	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes																
		Bottom	Yes	Yes	Yes	Yes																				
	2009	Surface	Yes	Yes	Yes	Yes	ND	ND	ND		ND	ND	ND	Yes												
		Bottom	Yes	Yes	Yes	Yes					ND	ND	ND	Yes												
	2010	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes									Yes	Yes	Yes	Yes				
		Bottom	Yes	Yes	Yes	Yes													Yes	Yes	Yes	Yes				
	2011	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND					Yes	Yes	Yes	ND								
		Bottom	Yes	Yes	Yes	ND									Yes	Yes	Yes	ND								
	2012	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes												
		Bottom	Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes												
	2013	Surface	Yes	Yes	ND	ND	Yes	Yes	Yes										Yes	Yes	Yes	ND				
		Bottom	Yes	Yes	ND	ND													Yes	Yes	Yes	ND				
	2014	Surface	Yes	Yes	ND	ND	Yes	Yes	Yes	ND					Yes	Yes	Yes	ND					Yes	Yes	Yes	ND
		Bottom	Yes	Yes	ND	ND									Yes	Yes	Yes	ND					Yes	Yes	Yes	ND
	2015	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND												
		Bottom	Yes	Yes	Yes	ND					Yes	Yes	Yes	ND												
	2016	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes									Yes	Yes	Yes	Yes				
		Bottom	Yes	Yes	Yes	Yes													Yes	Yes	Yes	Yes				
	2017	Surface	Yes	Yes	Yes	Yes		Yes	Yes	Yes					Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes									Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes
	2018	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes												
		Bottom	Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes												
	2019	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes									Yes	Yes	Yes	Yes				
		Bottom	Yes	Yes	Yes	Yes													Yes	Yes	Yes	Yes				

Notes:

1. SP = spring; SU = summer; FA = fall; WI = winter.
2. ND = No data.
3. MWQSOGs = Manitoba Water Quality Standards, Objectives, and Guidelines; PAL = Protection of aquatic life.
4. DO concentrations were compared to the most stringent MWQSOGs instantaneous minimum PAL objectives for each season; i.e., 5 mg/L for cool-water early life for the open-water season and 8 mg/L for cold-water early life the ice-cover season.
5. Cells with a year indicated denote instances of stratification or non-compliance with MWQSOGs instantaneous minimum objectives.
6. As only surface data are available for riverine sites (i.e., LCR-LiCR) assessment of thermal stratification and bottom dissolved oxygen concentrations are not provided for these locations.
7. [ ] = Sampling did not occur.

Table 3.2-2. 2008-2019 On-system sites DO, water depth, and ice thickness summary statistics.

Site	Statistic	Dissolved Oxygen								Water Depth at Site (m)		Ice Thickness at Site (m)
		DO - Surface (mg/L)		DO - Bottom (mg/L)		DO Saturation - Surface (%)		DO Saturation - Bottom (%)				
		OW	IC	OW	IC	OW	IC	OW	IC	OW	IC	IC
NIL	Mean	10.20	14.56	9.95	14.01	100.7	104.2	96.3	101.0	14.4	9.1	0.89
	Median	10.12	14.60	9.73	14.07	99.3	103.8	96.2	99.5	13.8	9.4	0.90
	Minimum	8.67	13.67	7.76	12.17	92.0	95.9	71.2	91.8	4.5	4.5	0.62
	Maximum	12.71	15.45	13.44	15.25	115.2	114.3	116.4	112.4	28.3	16.8	1.24
	SD	1.03	0.64	1.27	1.05	5.64	6.70	7.94	7.34	6.92	3.08	0.16
	SE	0.176	0.227	0.218	0.371	0.97	2.37	1.36	2.60	1.15	0.89	0.05
	Lower Quartile	9.44	14.05	9.06	13.46	97.2	100.1	93.9	95.1	8.6	7.3	0.79
	Upper Quartile	10.71	15.05	10.68	14.74	102.0	107.3	99.6	107.1	19.3	10.0	0.91
	n	34	8	34	8	34	8	34	8	36	12	12
	% Detections	100	100	100	100	100	100	100	100	-	-	-
LCR-LiCR	Mean	10.37	14.45	-	-	102.1	101.5	-	-	4.5	3.6	0.74
	Median	10.36	14.29	-	-	99.5	100.8	-	-	4.2	3.5	0.70
	Minimum	8.81	13.20	-	-	94.0	91.0	-	-	2.2	2.6	0.56
	Maximum	12.93	16.08	-	-	119.6	117.4	-	-	7.2	4.6	0.91
	SD	1.06	0.96	-	-	6.60	8.38	-	-	1.37	0.72	0.13
	SE	0.188	0.364	-	-	1.17	3.17	-	-	0.24	0.23	0.04
	Lower Quartile	9.34	13.85	-	-	98.2	97.6	-	-	3.4	3.1	0.63
	Upper Quartile	10.91	14.93	-	-	105.5	103.1	-	-	5.6	4.2	0.87
	n	32	7	-	-	32	7	-	-	34	10	10
	% Detections	100	100	-	-	100	100	-	-	-	-	-
PBL	Mean	10.95	15.51	10.66	15.08	104.1	112.8	101.2	110.0	12.4	10.4	0.78
	Median	10.58	-	10.07	-	102.0	-	102.4	-	12.5	-	-
	Minimum	9.13	14.98	8.86	14.33	94.8	104.7	87.5	100.7	5.7	7.7	0.68
	Maximum	13.16	15.80	12.97	15.57	121.0	116.9	116.6	115.6	16.6	13.5	0.91
	SD	1.49	0.46	1.58	0.66	7.77	7.00	8.89	8.11	3.33	2.38	0.10
	SE	0.496	0.265	0.528	0.382	2.59	4.04	2.96	4.68	0.96	1.19	0.05
	Lower Quartile	9.81	-	9.42	-	99.8	-	97.2	-	10.0	-	-
	Upper Quartile	12.12	-	12.12	-	108.5	-	106.6	-	15.5	-	-
	n	9	3	9	3	9	3	9	3	12	4	4
	% Detections	100	100	100	100	100	100	100	100	-	-	-

Table 3.2-2. continued.

Site	Statistic	Dissolved Oxygen								Water Depth at Site (m)		Ice Thickness at Site (m)
		DO - Surface (mg/L)		DO - Bottom (mg/L)		DO Saturation - Surface (%)		DO Saturation - Bottom (%)				
		OW	IC	OW	IC	OW	IC	OW	IC	OW	IC	IC
FID	Mean	9.85	13.84	9.71	13.85	99.0	89.9	97.4	90.0	9.0	7.6	0.91
	Median	10.08	-	9.96	-	98.8	-	97.1	-	9.9	-	-
	Minimum	8.57	13.84	8.57	13.85	92.5	89.9	92.5	90.0	1.7	6.9	0.79
	Maximum	11.43	13.84	11.12	13.85	109.5	89.9	106.2	90.0	14.5	9.0	1.05
	SD	0.86	-	0.77	-	5.27	-	4.38	-	3.89	1.18	0.13
	SE	0.286	-	0.258	-	1.76	-	1.46	-	1.30	0.68	0.08
	Lower Quartile	9.31	-	9.17	-	94.2	-	93.7	-	6.6	-	-
	Upper Quartile	10.25	-	9.98	-	101.4	-	98.9	-	11.7	-	-
	n	9	1	9	1	9	1	9	1	9	3	3
	% Detections	100	100	100	100	100	100	100	100	-	-	-
BIL	Mean	10.23	14.05	10.10	13.81	102.2	99.3	100.1	97.8	6.0	5.8	0.90
	Median	10.47	-	10.13	-	100.6	-	99.8	-	5.7	-	-
	Minimum	8.93	13.35	8.95	13.05	93.9	92.8	92.6	94.1	2.8	2.9	0.65
	Maximum	11.23	15.08	11.21	14.85	113.6	104.4	105.9	102.8	10.3	8.2	1.15
	SD	0.83	0.91	0.75	0.93	5.66	5.93	3.59	4.47	2.43	2.22	0.20
	SE	0.241	0.525	0.215	0.539	1.63	3.42	1.04	2.58	0.70	1.11	0.10
	Lower Quartile	9.63	-	9.47	-	98.3	-	98.1	-	4.6	-	-
	Upper Quartile	10.86	-	10.68	-	105.6	-	101.8	-	7.0	-	-
	n	12	3	12	3	12	3	12	3	12	4	4
	% Detections	100	100	100	100	100	100	100	100	-	-	-
LCR-WEIR	Mean	10.22	13.14	10.17	13.17	99.6	88.5	99.0	88.7	3.8	1.8	1.17
	Median	9.98	-	9.87	-	97.3	-	96.7	-	4.2	-	-
	Minimum	8.94	13.14	8.92	13.17	93.5	88.5	93.1	88.7	2.6	1.3	1.12
	Maximum	12.25	13.14	12.31	13.17	113.4	88.5	113.7	88.7	4.5	2.4	1.21
	SD	1.27	-	1.30	-	7.31	-	7.46	-	0.77	-	-
	SE	0.519	-	0.530	-	2.99	-	3.05	-	0.32	-	-
	Lower Quartile	9.24	-	9.22	-	95.2	-	95.3	-	3.4	-	-
	Upper Quartile	10.86	-	10.75	-	100.6	-	98.2	-	4.3	-	-
	n	6	1	6	1	6	1	6	1	6	2	2
	% Detections	100	100	100	100	100	100	100	100	-	-	-

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.

Table 3.2-3. 2008-2019 Off-system sites summary of thermal stratification and DO concentrations.

Metric	Sampling Year	Surface or Bottom	GAU			
			Open-Water			Ice-Cover
			SP	SU	FA	WI
Thermal Stratification	2008		2008	No	No	No
	2009		No	No	No	No
	2010		No	ND	No	No
	2011		No	No	No	No
	2012		No	No	No	No
	2013		No	2013	No	No
	2014		No	No	No	No
	2015		No	No	No	No
	2016		No	No	No	No
	2017		No	No	No	No
	2018		No	No	No	No
	2019		No	No	No	No
DO met MWQSOGs PAL objectives	2008	Surface	Yes	ND	Yes	Yes
		Bottom	Yes	ND	Yes	2008
	2009	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes
	2010	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	ND	Yes	Yes
	2011	Surface	Yes	Yes	Yes	ND
		Bottom	Yes	Yes	Yes	ND
	2012	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes
	2013	Surface	Yes	Yes	ND	ND
		Bottom	Yes	Yes	ND	ND
	2014	Surface	Yes	Yes	ND	ND
		Bottom	Yes	Yes	ND	ND
	2015	Surface	Yes	Yes	Yes	ND
		Bottom	Yes	Yes	Yes	ND
	2016	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes
	2017	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes
	2018	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes
	2019	Surface	Yes	Yes	Yes	Yes
		Bottom	Yes	Yes	Yes	Yes

Notes:

1. SP = spring; SU = summer; FA = fall; WI = winter; DO = dissolved oxygen; MWQSOG = Manitoba Water Quality Standards, Objectives, and Guidelines; PAL = Protection of Aquatic Life.
2. ND = No data.
3. DO concentrations were compared to the most stringent MWQSOGs instantaneous minimum PAL objectives for each season; i.e., 5 mg/L for cool-water early life for the open-water season and 8 mg/L for cold-water early life the ice-cover season.
4. Cells with a year indicated denote instances of stratification or non-compliance with MWQSOGs instantaneous minimum objectives.
5. [ ] = Sampling did not occur.

Table 3.2-4. 2008-2019 Off-system sites DO, water depth, and ice thickness summary statistics.

Site	Statistic	Dissolved Oxygen								Water Depth at Site (m)		Ice Thickness at Site (m)
		DO - Surface (mg/L)		DO - Bottom (mg/L)		DO Saturation - Surface (%)		DO Saturation - Bottom (%)				
		OW	IC	OW	IC	OW	IC	OW	IC	OW	IC	IC
GAU	Mean	10.06	13.61	10.00	11.31	99.5	98.2	98.2	83.7	4.7	3.4	0.93
	Median	9.95	13.87	10.03	12.15	98.8	99.3	97.8	88.8	3.8	2.7	0.97
	Minimum	8.53	12.41	8.03	4.06	93.2	87.7	72.7	31.1	2.5	1.5	0.75
	Maximum	12.40	14.71	12.46	14.07	113.5	109.3	111.3	104.6	15.0	12.5	1.15
	SD	0.94	0.93	0.96	3.25	4.86	8.09	6.47	24.2	2.71	2.90	0.13
	SE	0.163	0.329	0.169	1.15	0.85	2.86	1.14	8.57	0.45	0.84	0.04
	Lower Quartile	9.35	12.75	9.29	10.95	95.9	90.8	95.9	79.3	3.2	2.5	0.83
	Upper Quartile	10.77	14.25	10.60	13.41	102.2	104.7	100.2	101.6	5.0	2.9	0.99
	n	33	8	32	8	33	8	32	8	36	12	12
	% Detections	100	100	100	100	100	100	100	100	-	-	-

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.

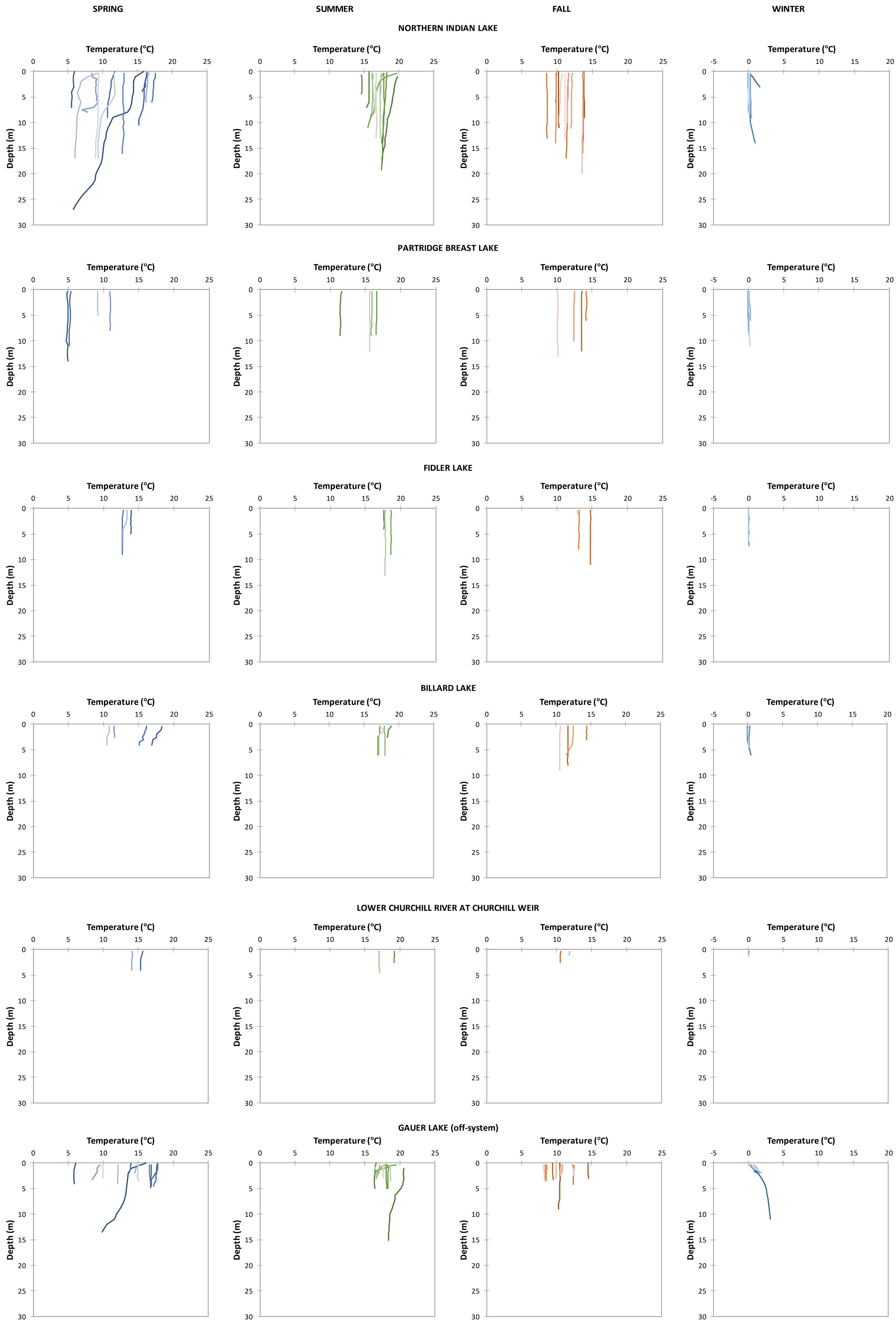


Figure 3.2-1. 2008-2019 On-system and off-system water temperature depth profiles.

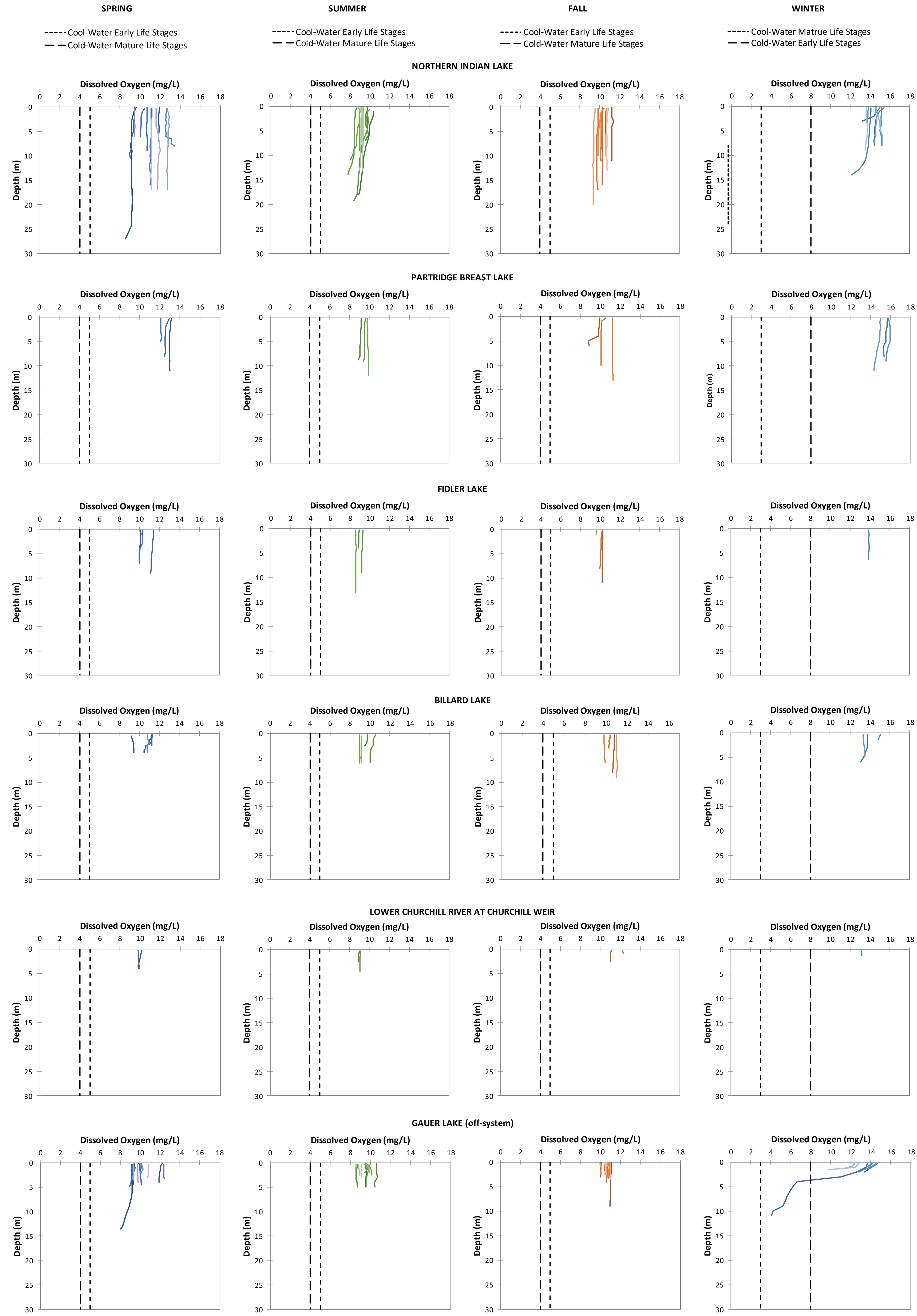


Figure 3.2-2. 2008-2019 On-system and off-system dissolved oxygen depth profiles and comparison to instantaneous minimum objectives for the protection of aquatic life.

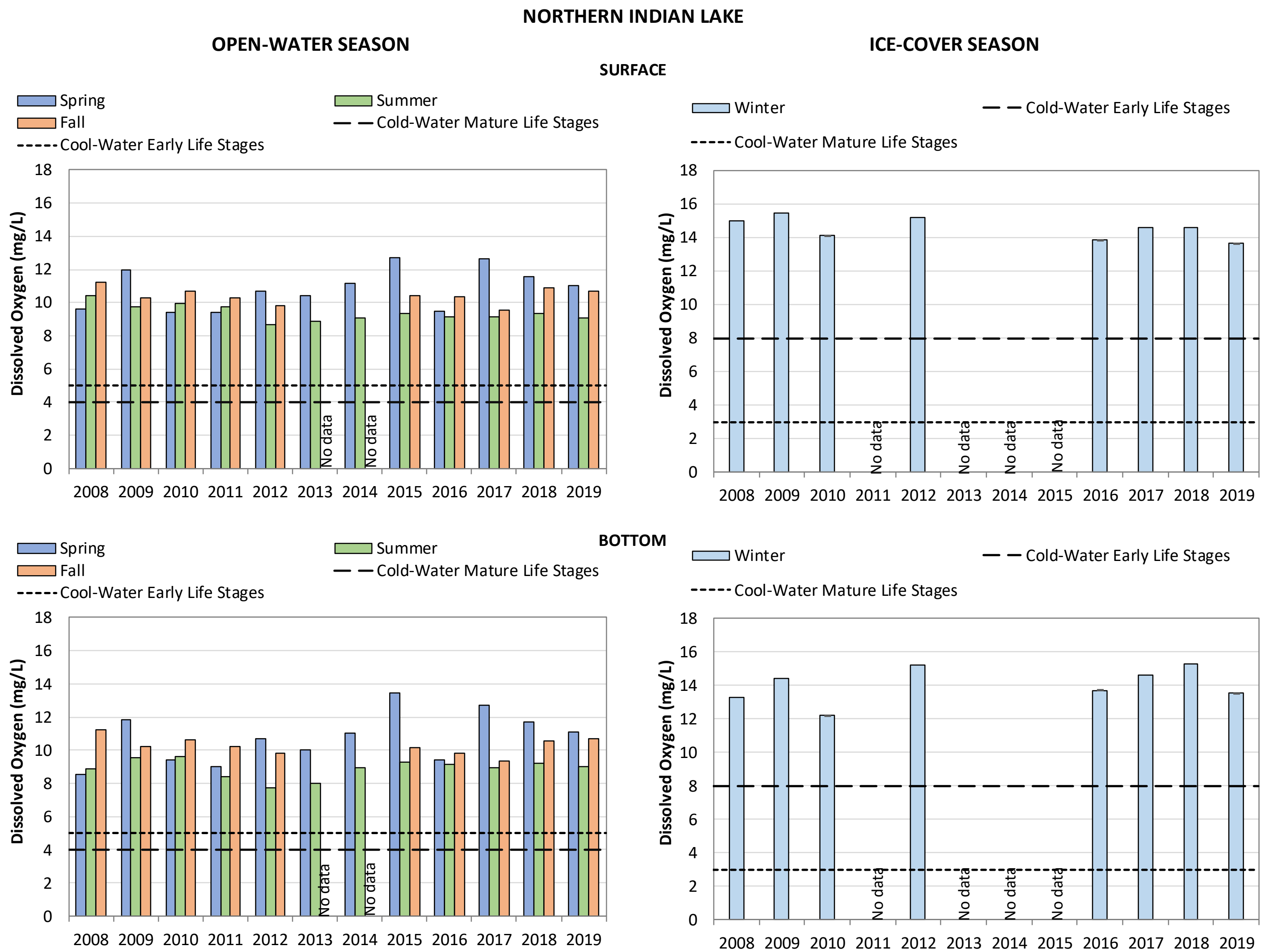


Figure 3.2-3. 2008-2019 Northern Indian Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

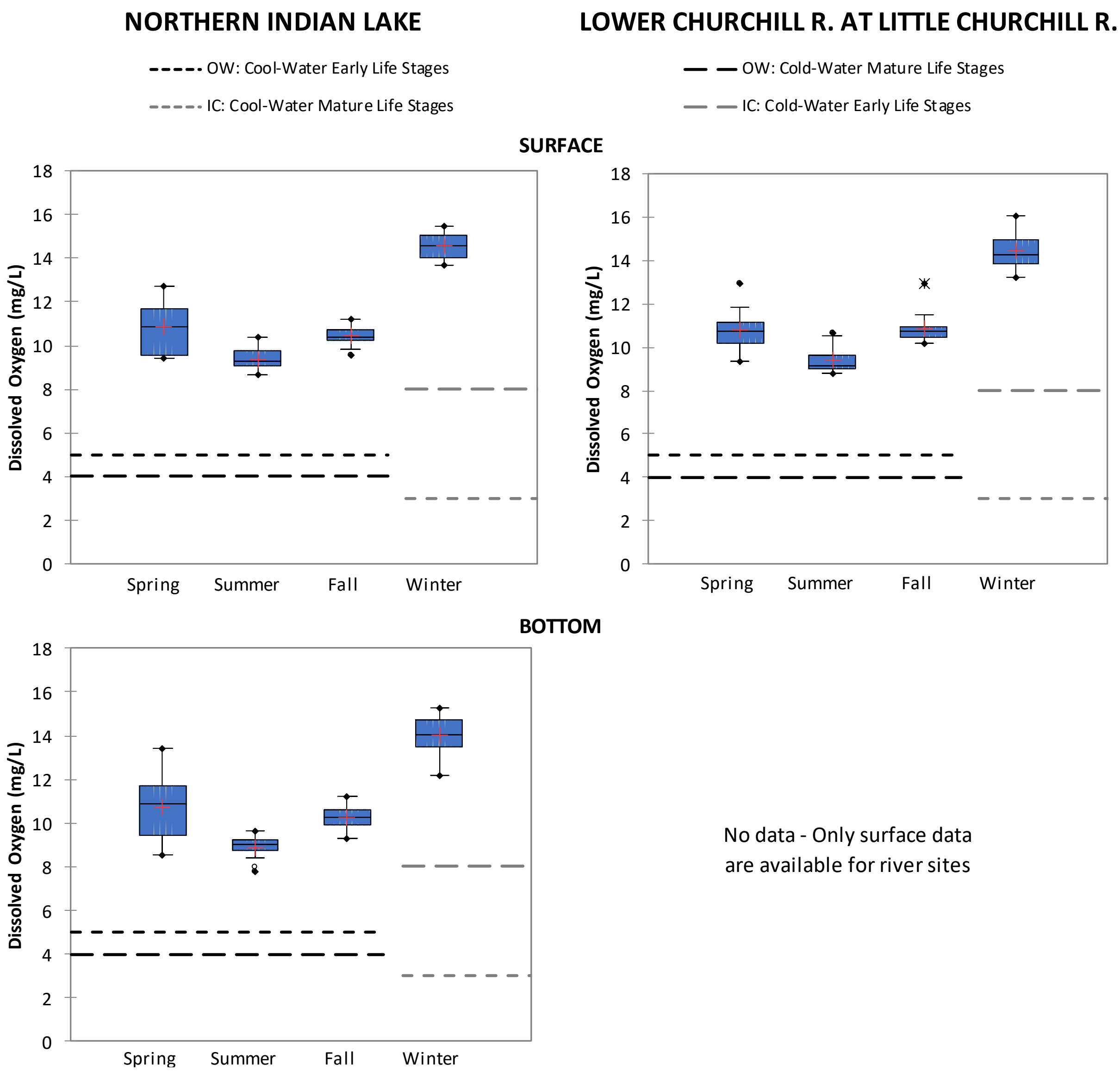


Figure 3.2-4. 2008-2019 On-system seasonal surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

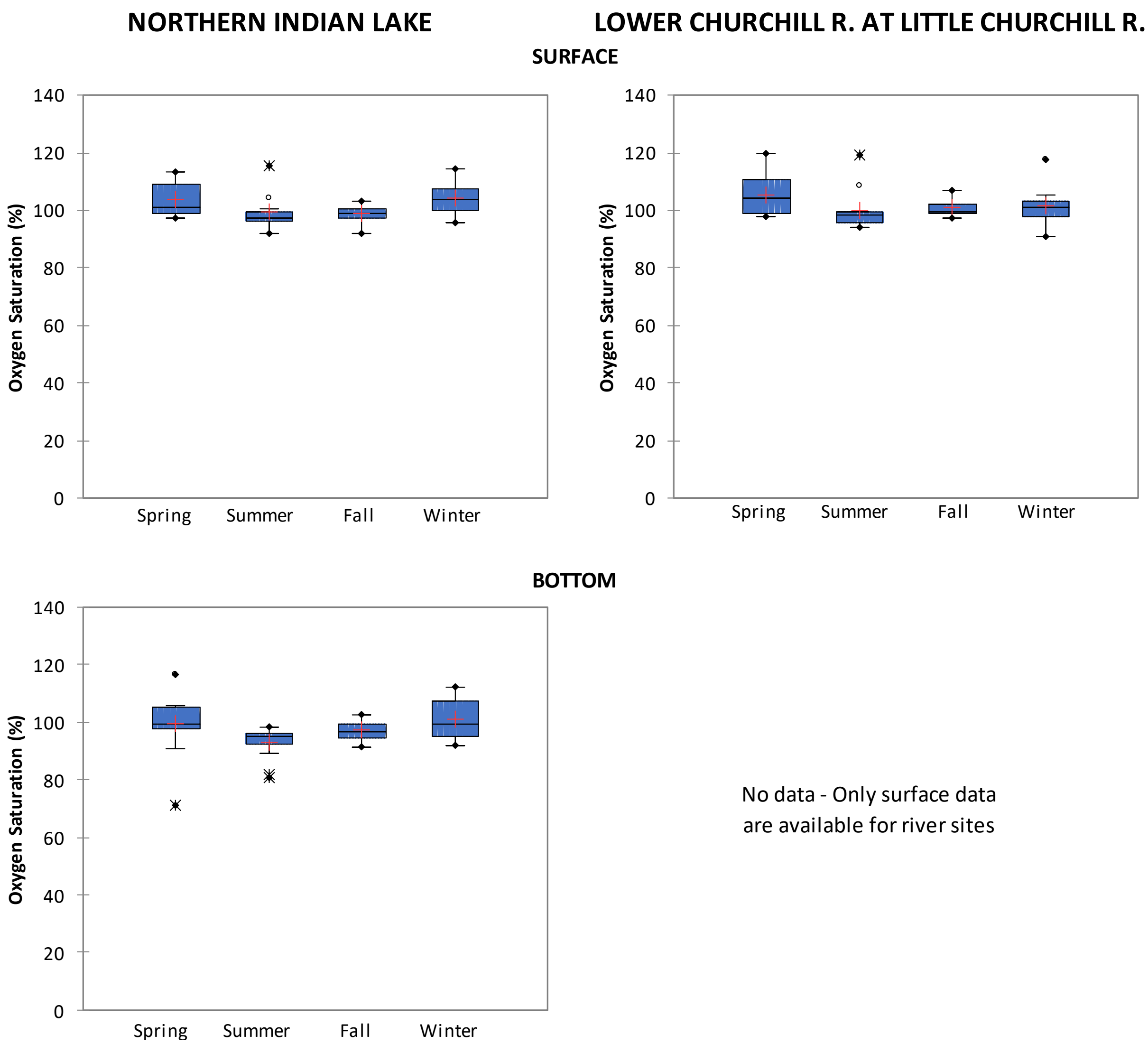


Figure 3.2-5. 2008-2019 On-system seasonal surface and bottom dissolved oxygen saturation.

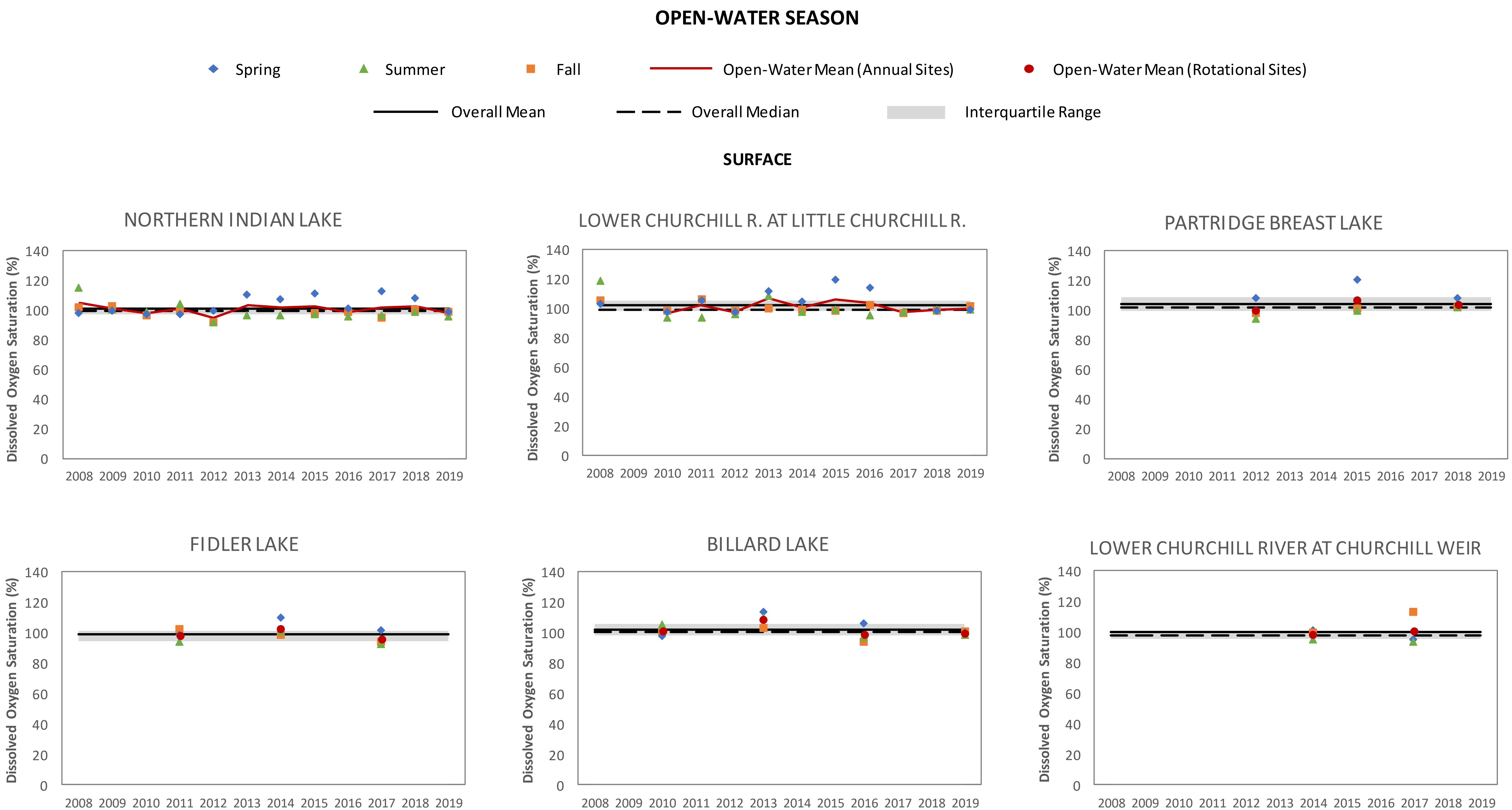


Figure 3.2-6. 2008-2019 On-system sites open-water season surface dissolved oxygen saturation.

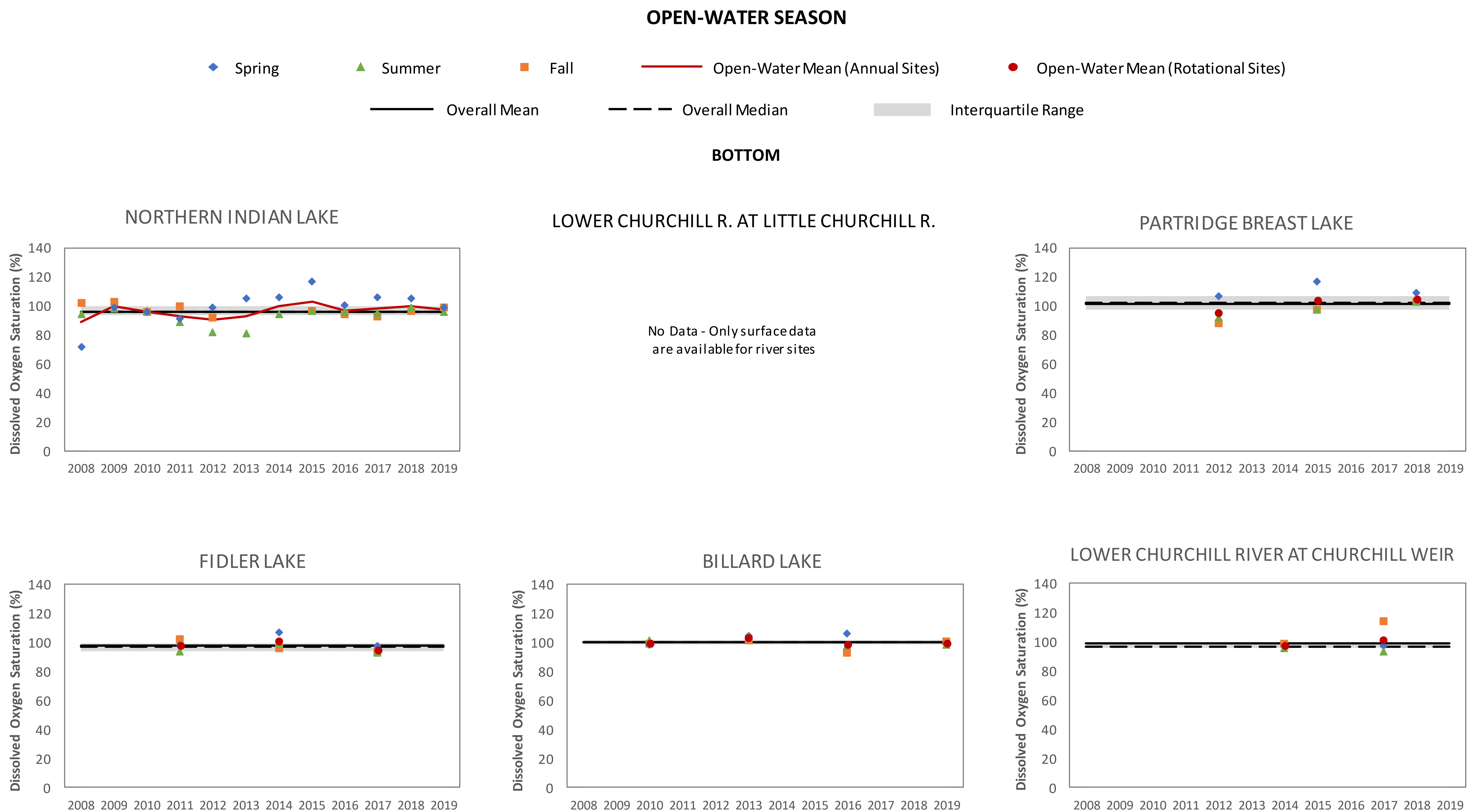


Figure 3.2-7. 2008-2019 On-system sites open-water season bottom dissolved oxygen saturation.

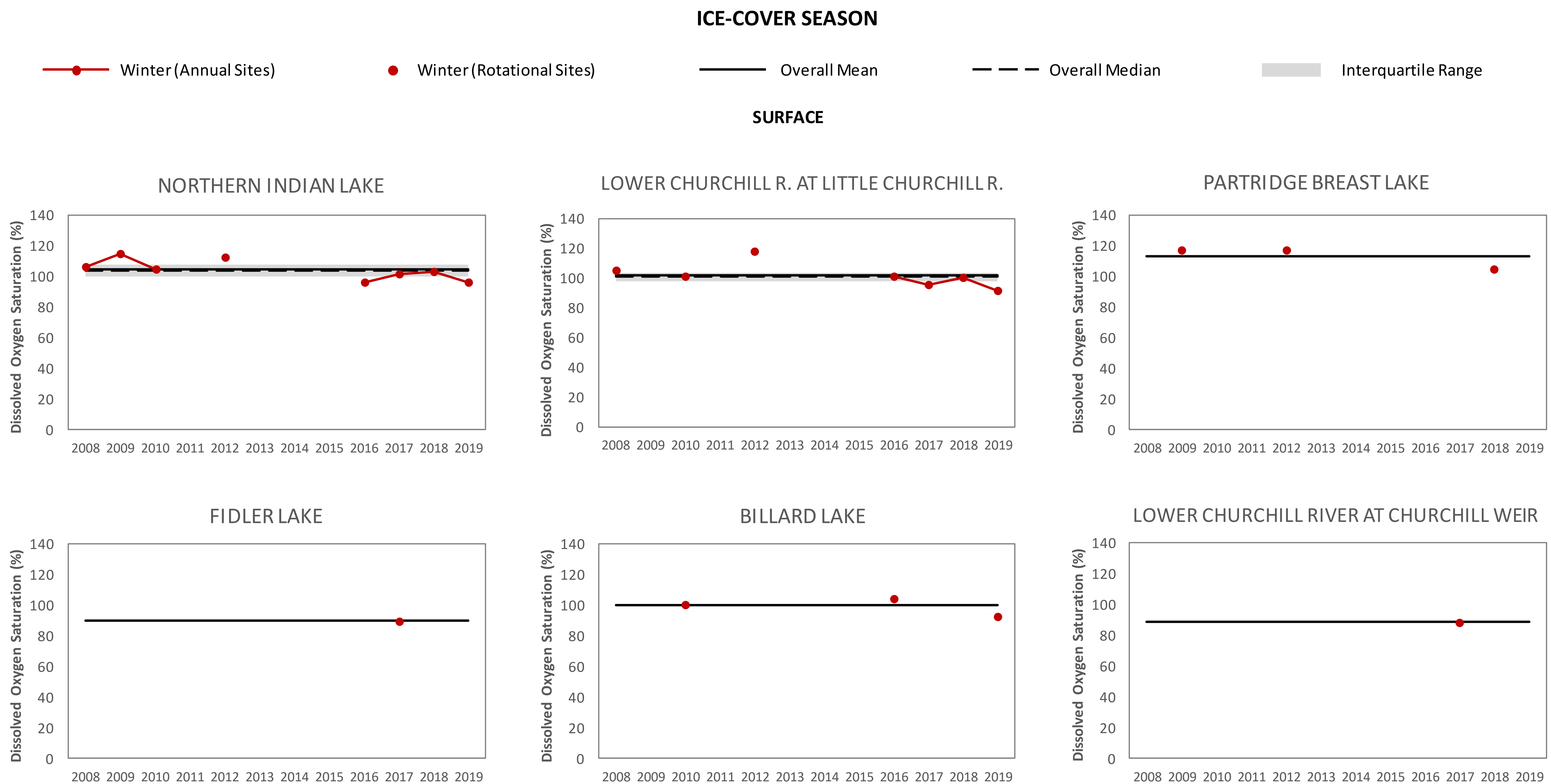


Figure 3.2-8. 2008-2019 On-system sites ice-cover season surface dissolved oxygen saturation.

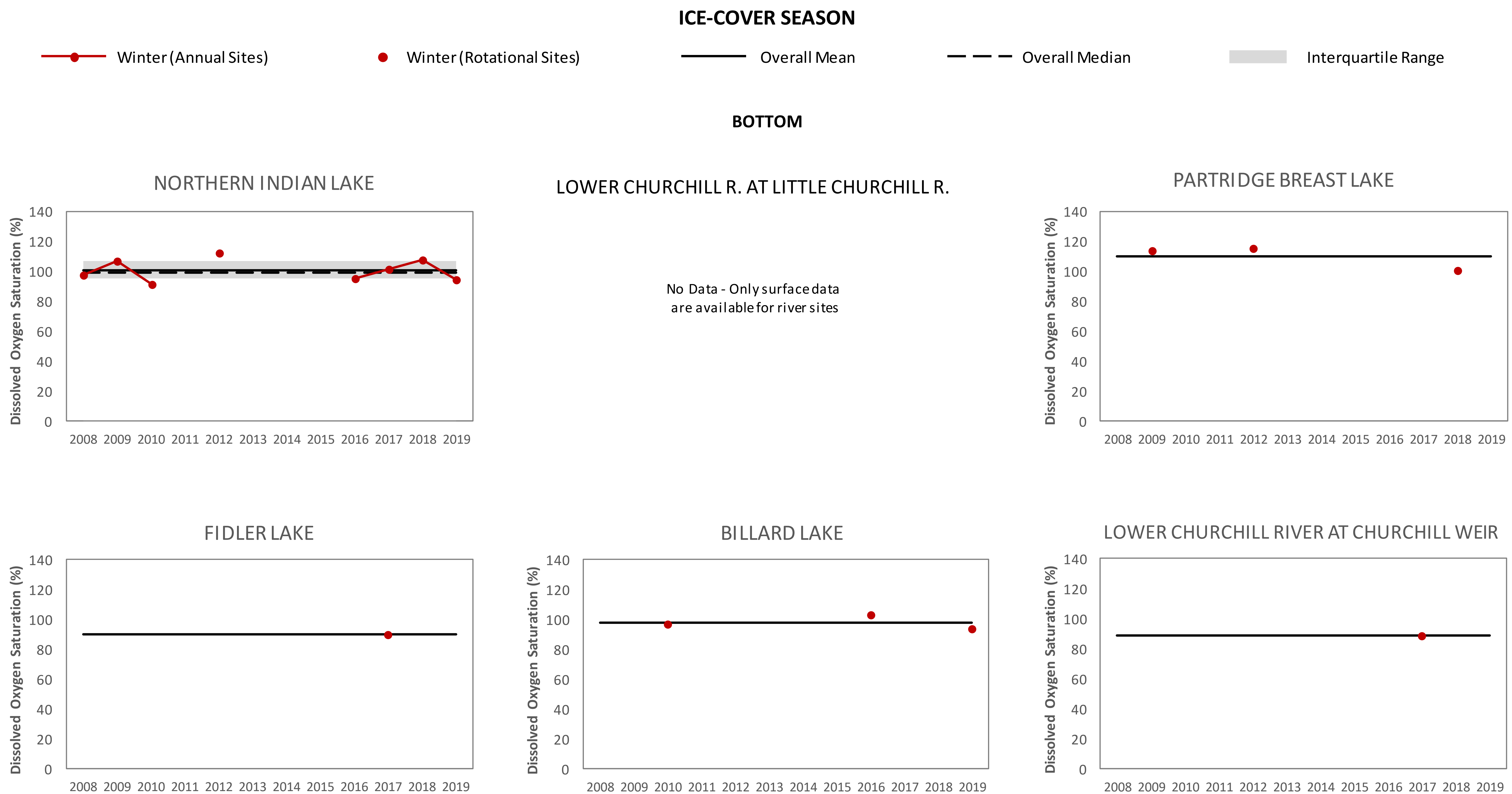


Figure 3.2-9. 2008-2019 On-system sites ice-cover season bottom dissolved oxygen saturation.

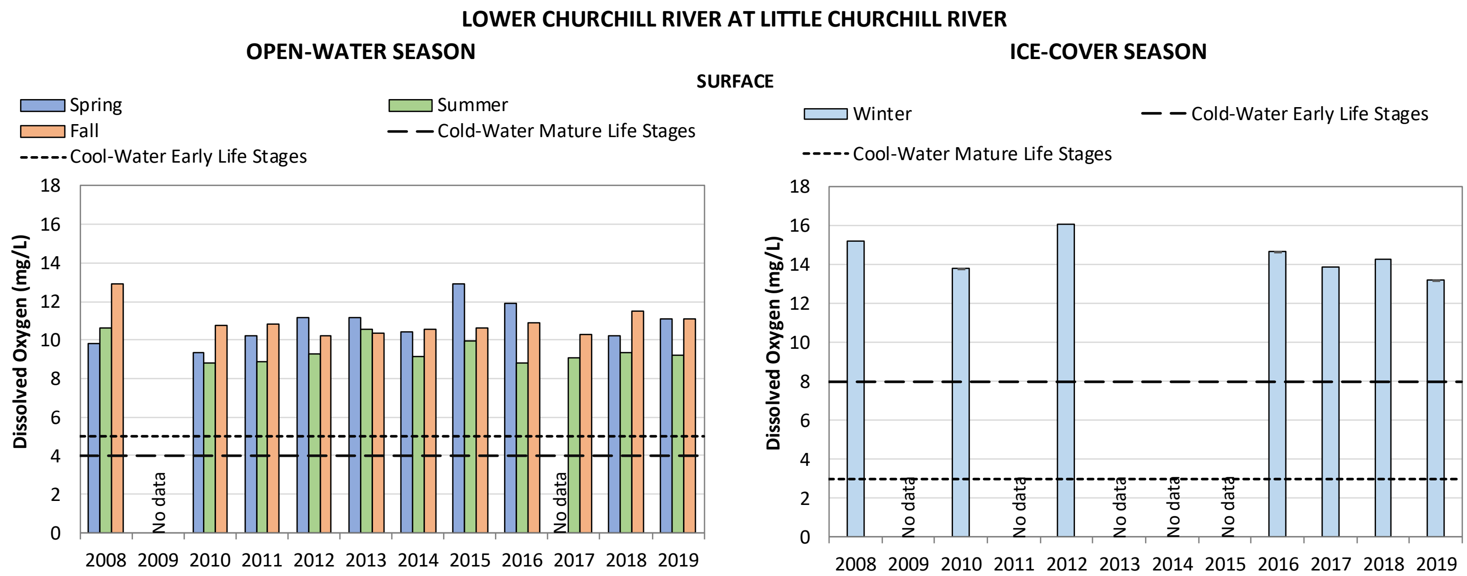


Figure 3.2-10. 2008-2019 Lower Churchill River at the Little Churchill River surface dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

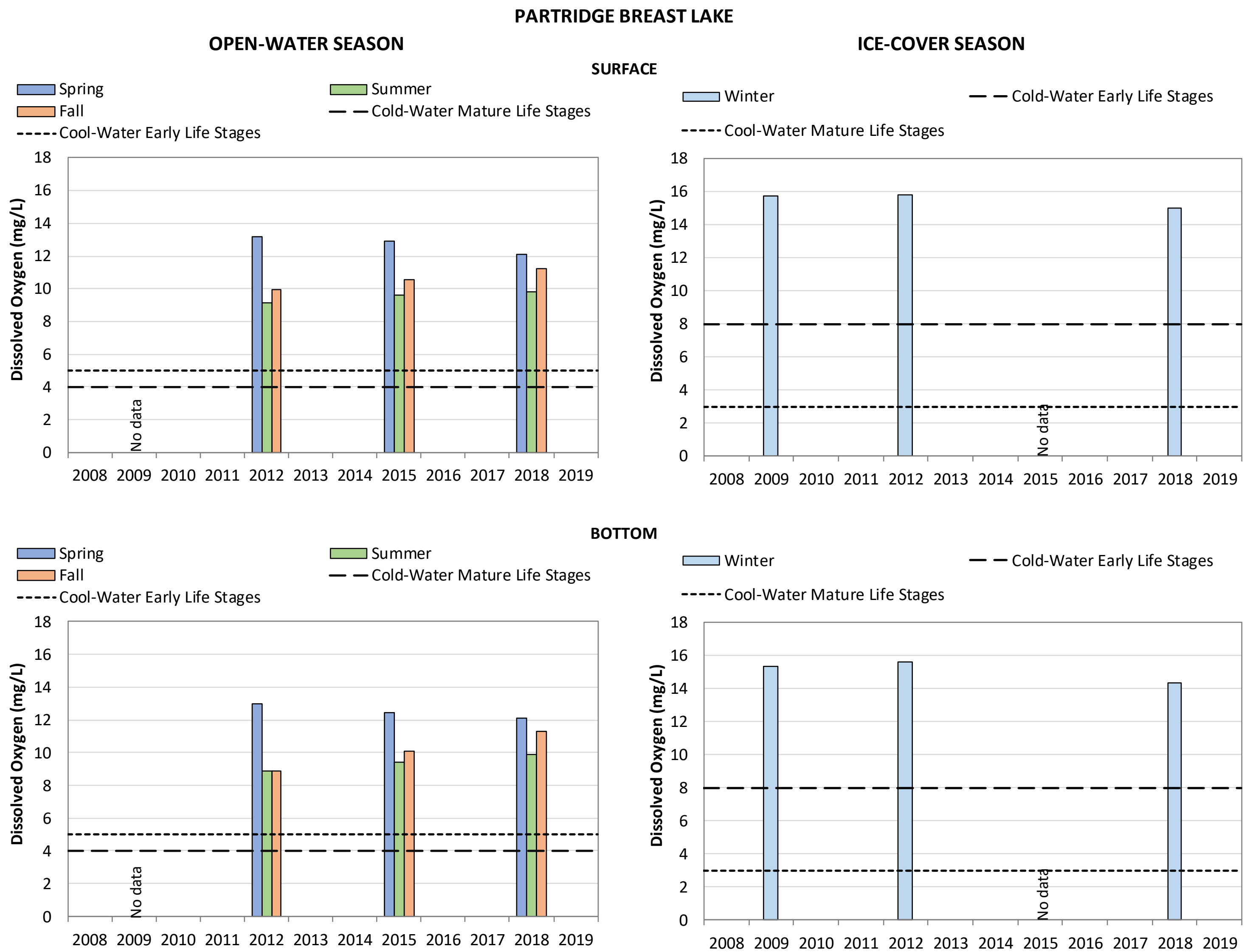


Figure 3.2-11. 2008-2019 Partridge Breast Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

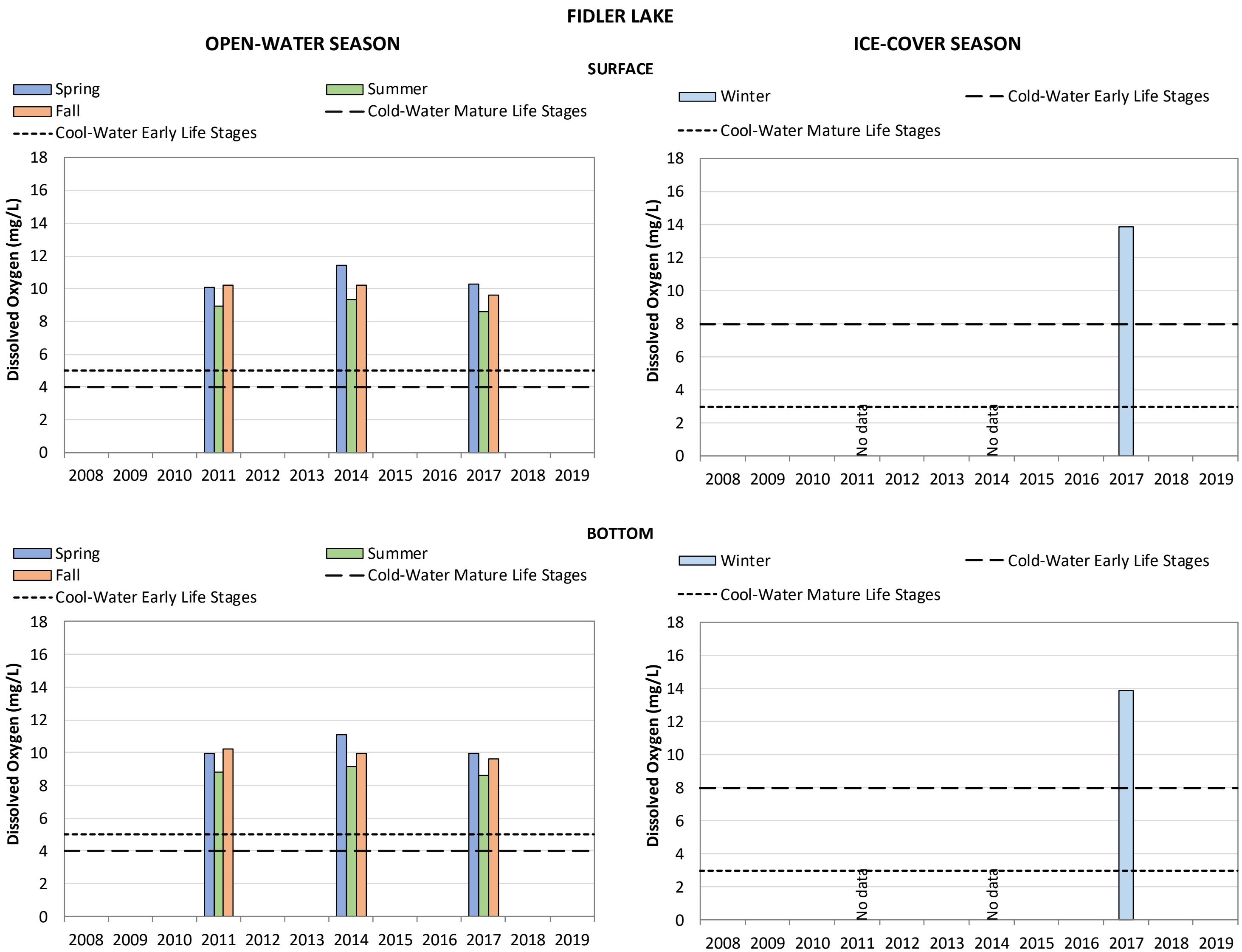


Figure 3.2-12. 2008-2019 Fidler Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

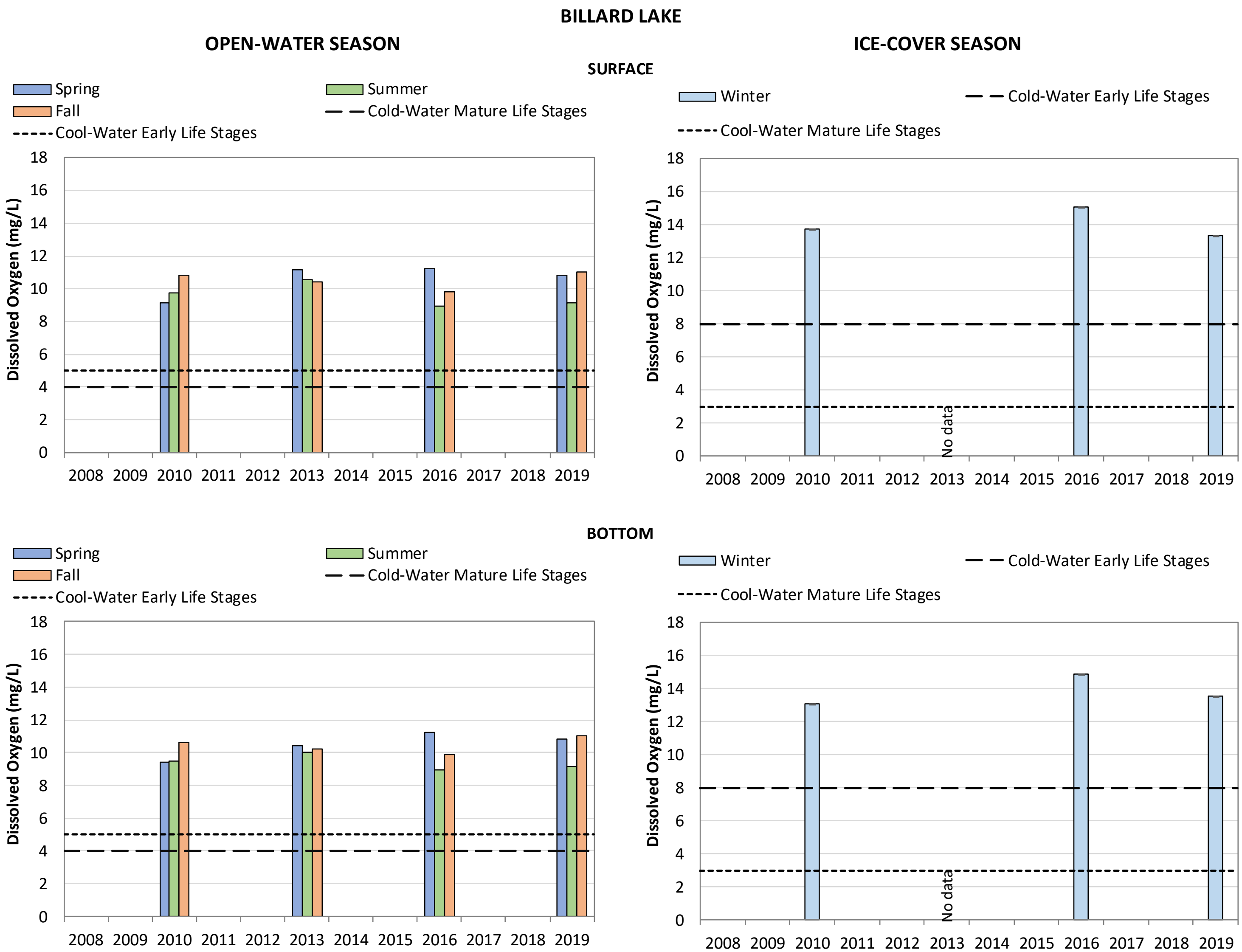


Figure 3.2-13. 2008-2019 Billard Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

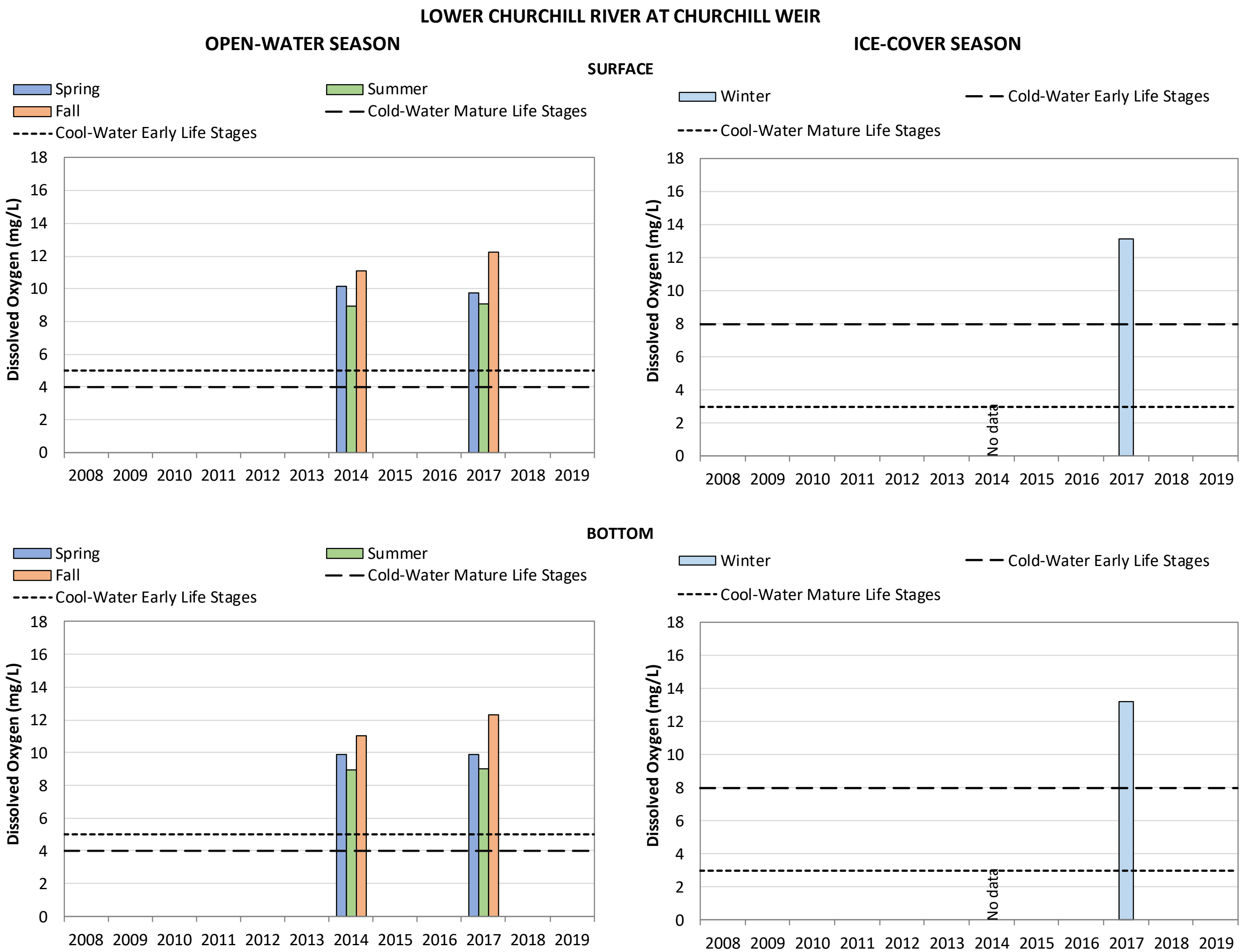


Figure 3.2-14. 2008-2019 Lower Churchill River at the Churchill Weir surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

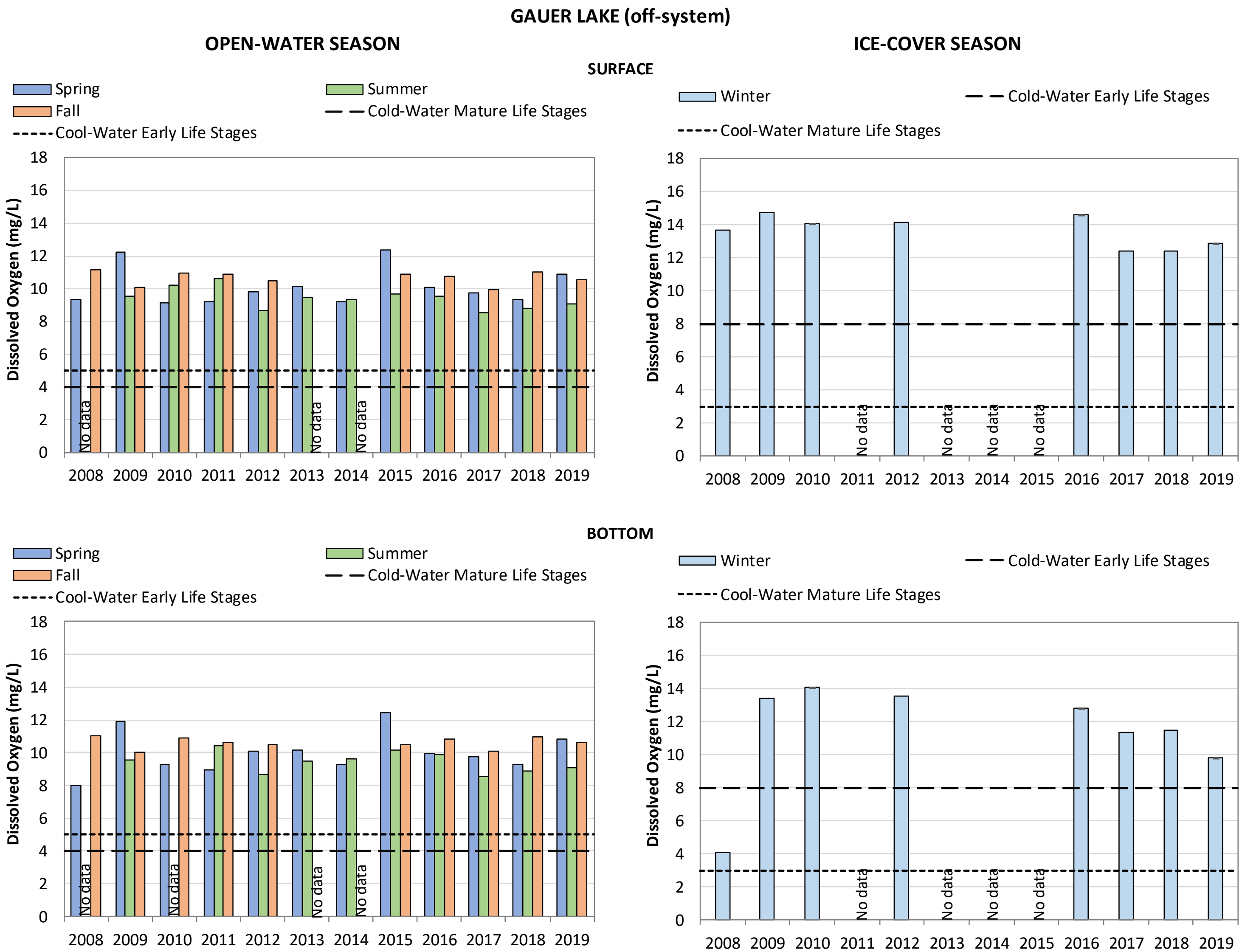


Figure 3.2-15. 2008-2019 Gauer Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

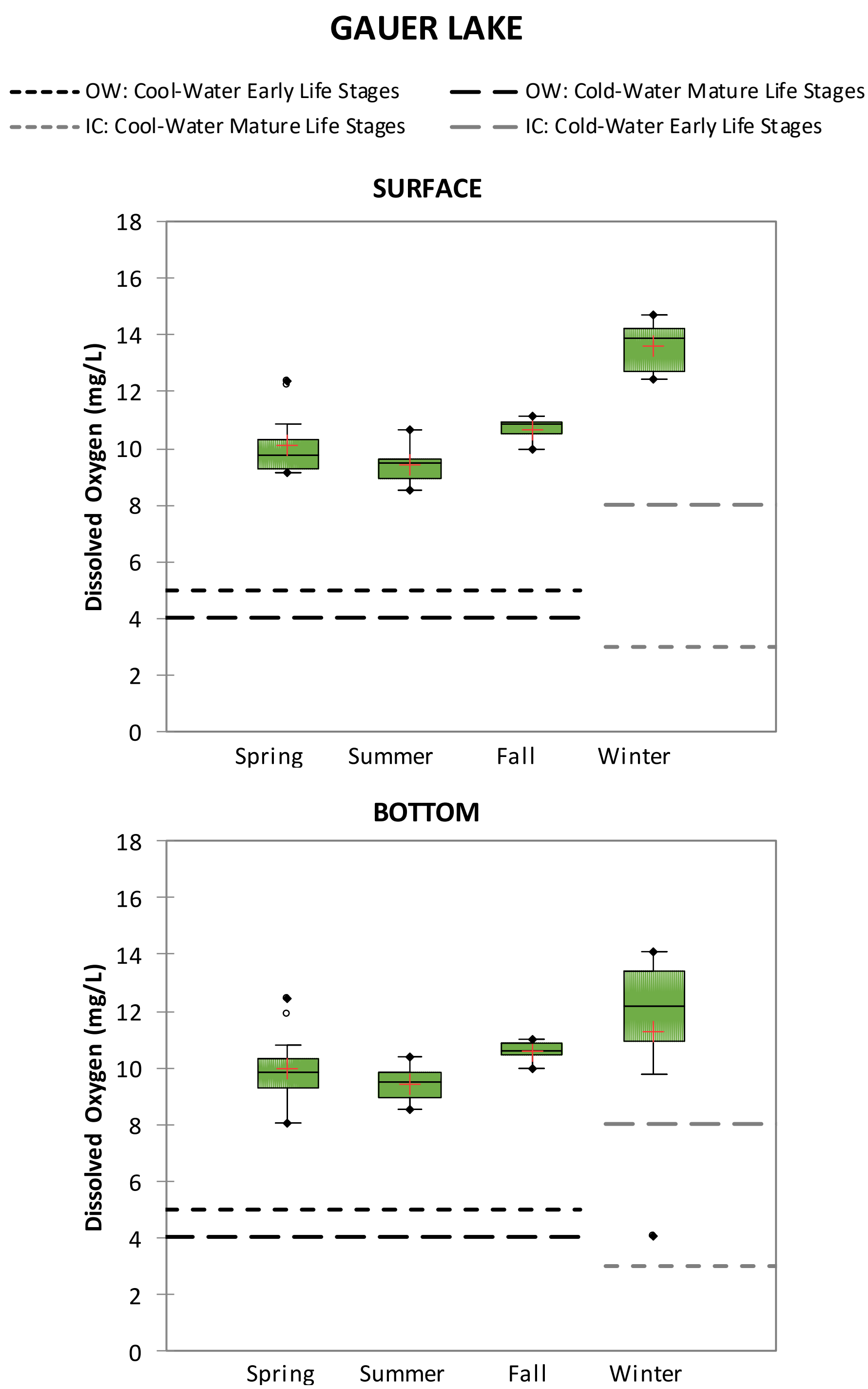


Figure 3.2-16. 2008-2019 Off-system seasonal surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

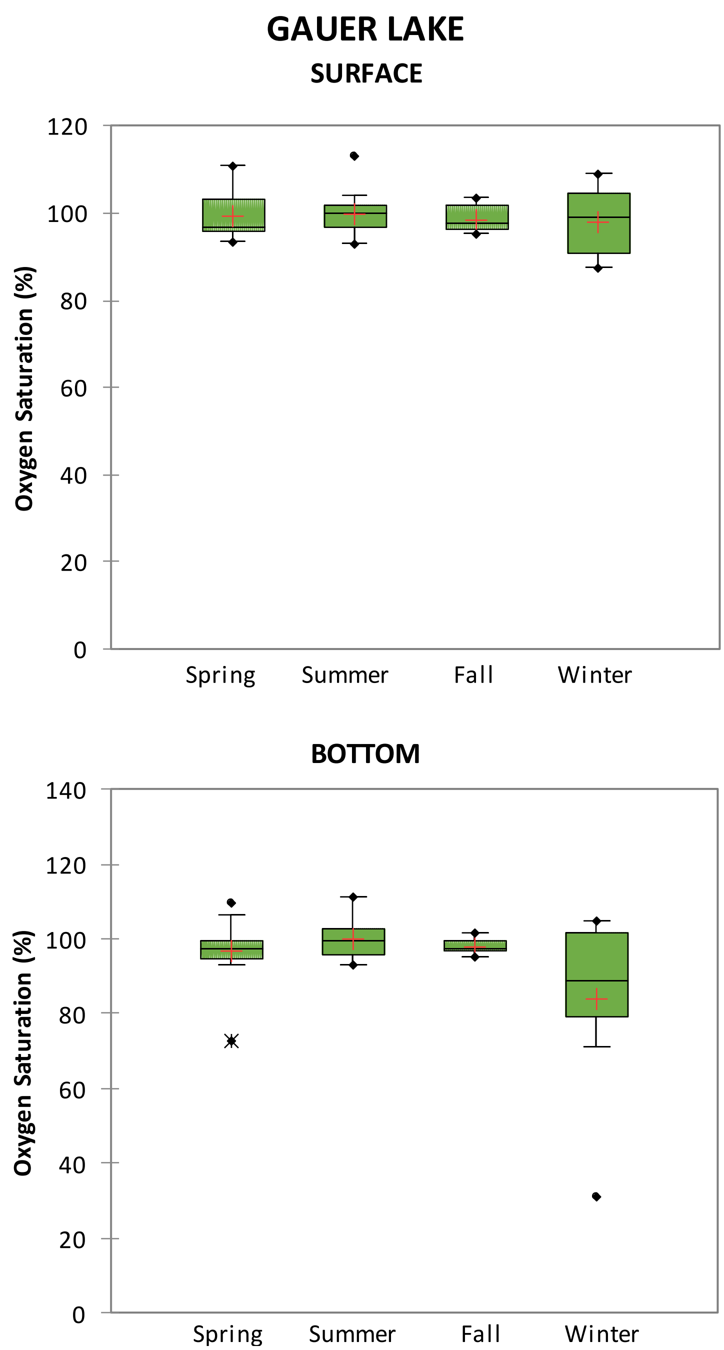


Figure 3.2-17. 2008-2019 Off-system seasonal surface and bottom dissolved oxygen saturation.

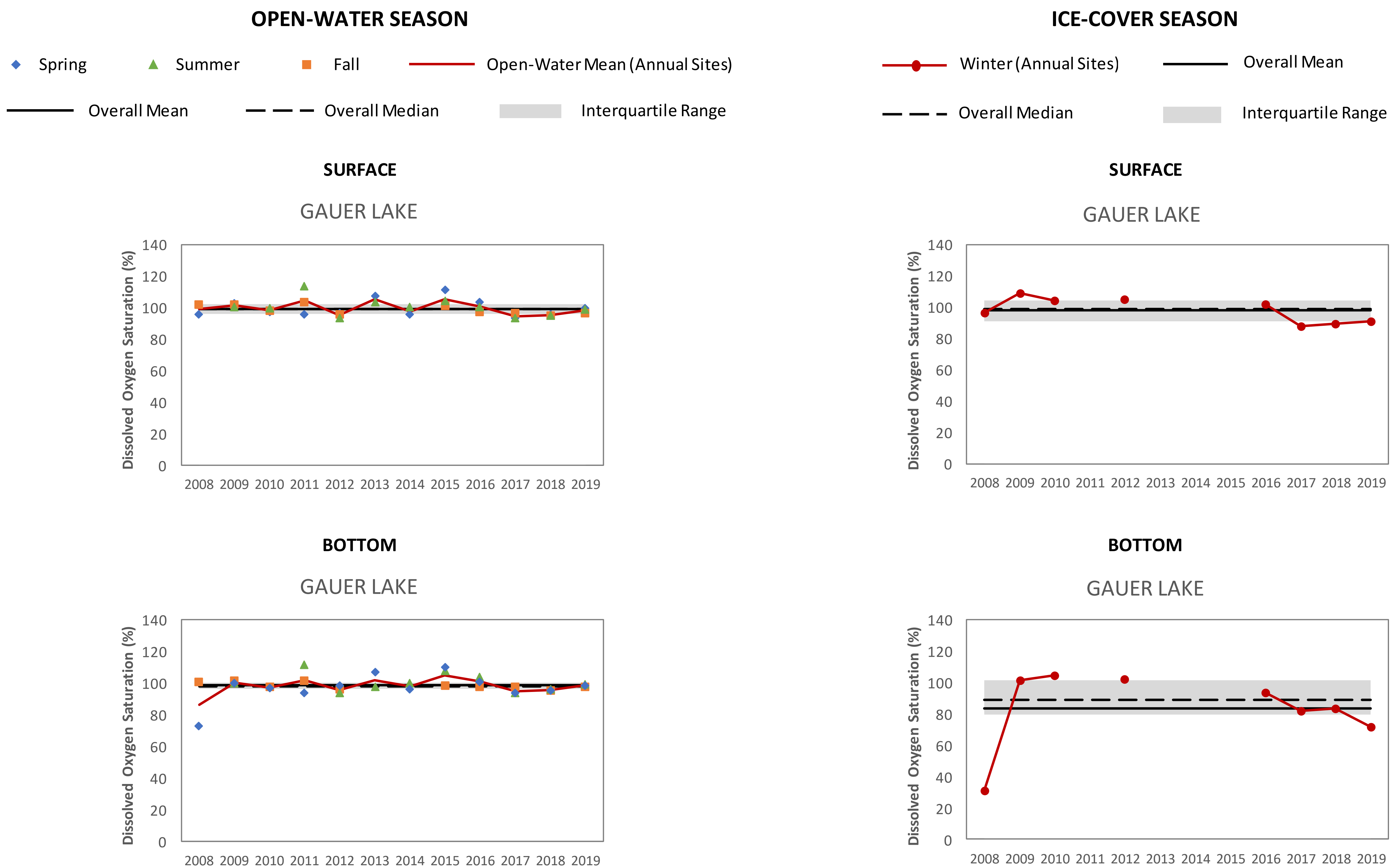


Figure 3.2-18. 2008-2019 Off-system open-water and ice-cover seasons surface and bottom dissolved oxygen saturation.

3.3 WATER CLARITY

3.3.1 SECCHI DISK DEPTH

3.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Secchi disk depth in Northern Indian Lake ranged from 0.75 to 3.00 m during the open-water season. The mean and median measurements for the 12 years of monitoring were 1.42 m and 1.34 m, respectively. Mean annual Secchi disk depths ranged from 0.78 to 2.02 m and were within the IQR (1.09 to 1.68 m) in seven of the 12 years of monitoring. Mean Secchi disk depths were below the IQR in 2018 and 2019 and above the IQR in 2008, 2009, and 2015 (Table 3.3-1 and Figure 3.3-1).

No clear seasonality was observed for Secchi disk depth in Northern Indian Lake over the 12 years of monitoring. However, the mean Secchi disk depth was lowest in summer (1.33 m) and highest in spring (1.48 m; Figure 3.3-2).

Lower Churchill River at the Little Churchill River

Secchi disk depths are not available for riverine sites therefore there are no data for this site.

ROTATIONAL SITES

Partridge Breast Lake

Secchi disk depth in Partridge Breast Lake ranged from 0.65 to 1.65 m during the open-water season. The mean was 1.05 m, the median was 1.03 m, and the IQR was 0.82 to 1.20 m for the four years of monitoring. Mean annual Secchi disk depths ranged from 0.93 to 1.14 m and were within the IQR in all years (Table 3.3-1 and Figure 3.3-1).

Fidler Lake

Secchi disk depth in Fidler Lake ranged from 1.00 to 1.95 m during the open-water season. The mean was 1.39 m, the median was 1.36 m, and the IQR was 1.18 to 1.56 m for the three years of monitoring. Mean annual Secchi disk depths ranged from 1.18 to 1.58 m and were within the IQR in 2014 and 2017 but were above the IQR in 2011 (Table 3.3-1 and Figure 3.3-1).

Billard Lake

Secchi disk depth in Billard Lake ranged from 0.95 to 2.05 m during the open-water season. The mean was 1.43 m, the median was 1.40 m, and the IQR was 1.05 to 1.70 m for the four years of monitoring. Mean annual Secchi disk depths ranged from 1.02 to 1.78 m and were within the IQR in 2010 and 2013 but were below the IQR in 2019 and above the IQR in 2016 (Table 3.3-1 and Figure 3.3-1).

Lower Churchill River at the Churchill Weir

Secchi disk depth in the lower Churchill River at the Churchill Weir ranged from 0.40 to 1.90 m during the open-water season. The mean was 1.29 m, the median was 1.33 m, and the IQR was 1.23 to 1.54 m for the two years of monitoring. Mean annual Secchi disk depths were 1.12 m in 2017 and 1.47 m in 2014 and were within the IQR in 2014 but below the IQR in 2017 (Table 3.3-1 and Figure 3.3-1).

3.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Secchi disk depth in Gauer Lake ranged from 1.00 to 3.50 m during the open-water season. The mean and median measurements for the 12 years of monitoring were 1.90 m and 1.68 m, respectively. Mean annual Secchi disk depths ranged from 1.45 to 2.68 m and were within the IQR (1.46 to 2.25 m) in eight of the 12 years of monitoring. Mean Secchi disk depths were below the IQR in 2010 and above the IQR in 2008, 2015, and 2019 (Table 3.3-2 and Figure 3.3-3).

No clear seasonality was observed for Secchi disk depth in Gauer Lake over the 12 years of monitoring. However, the mean Secchi disk depth was lowest in summer (1.61 m) and highest in spring (2.42 m; Figure 3.3-4).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

Table 3.3-1. 2008-2019 On-system sites water clarity metric summary statistics.

Site	Statistic	Secchi Disk Depth (m)		Turbidity (NTU)		TSS (mg/L)	
		OW	IC	OW	IC	OW	IC
NIL	Mean	1.42	-	5.19	5.28	3.5	<2.0
	Median	1.34	-	4.36	4.51	3.6	<2.0
	Minimum	0.75	-	1.50	0.25	<2.0	<2.0
	Maximum	3.00	-	12.0	11.9	6.8	<2.0
	SD	0.498	-	2.44	3.63	1.52	-
	SE	0.083	-	0.407	1.05	0.25	-
	Lower Quartile	1.09	-	3.59	2.77	2.6	<2.0
	Upper Quartile	1.68	-	5.96	8.40	4.6	<2.0
	n	36	-	36	12	36	12
	% Detections	100	-	100	100	89	0
LCR-LiCR	Mean	-	-	5.08	4.77	5.3	<2.0
	Median	-	-	4.40	3.48	4.3	<2.0
	Minimum	-	-	1.17	1.80	<2.0	<2.0
	Maximum	-	-	10.0	11.4	20.0	2.0
	SD	-	-	2.50	3.26	4.07	-
	SE	-	-	0.423	1.03	0.69	-
	Lower Quartile	-	-	2.84	2.58	2.8	<2.0
	Upper Quartile	-	-	6.85	6.33	6.1	<2.0
	n	-	-	35	10	35	10
	% Detections	-	-	100	100	86	10
PBL	Mean	1.05	-	7.72	5.99	3.8	<2.0
	Median	1.03	-	6.88	-	3.7	-
	Minimum	0.65	-	3.83	1.73	<2.0	<2.0
	Maximum	1.65	-	14.8	11.0	6.0	<2.0
	SD	0.289	-	3.17	4.34	1.46	-
	SE	0.083	-	0.915	2.17	0.42	-
	Lower Quartile	0.82	-	5.95	-	2.9	-
	Upper Quartile	1.20	-	9.53	-	4.9	-
	n	12	-	12	4	12	4
	% Detections	100	-	100	100	92	0

Table 3.3-1. continued.

Site	Statistic	Secchi Disk Depth (m)		Turbidity (NTU)		TSS (mg/L)	
		OW	IC	OW	IC	OW	IC
FID	Mean	1.39	-	4.76	6.60	3.9	<2.0
	Median	1.36	-	4.30	-	4.0	-
	Minimum	1.00	-	2.99	3.00	2.4	<2.0
	Maximum	1.95	-	6.44	12.1	5.6	<2.0
	SD	0.310	-	1.12	4.84	0.95	-
	SE	0.110	-	0.374	2.79	0.32	-
	Lower Quartile	1.18	-	4.15	-	3.2	-
	Upper Quartile	1.56	-	5.80	-	4.4	-
	n	8	-	9	3	9	3
	% Detections	100	-	100	100	100	0
BIL	Mean	1.43	-	4.70	5.02	4.2	<2.0
	Median	1.40	-	3.62	-	3.8	-
	Minimum	0.95	-	2.23	2.89	2.0	<2.0
	Maximum	2.05	-	8.67	8.99	9.6	<2.0
	SD	0.397	-	2.58	2.79	2.11	-
	SE	0.115	-	0.744	1.39	0.61	-
	Lower Quartile	1.05	-	2.64	-	2.8	-
	Upper Quartile	1.70	-	7.12	-	4.9	-
	n	12	-	12	4	12	4
	% Detections	100	-	100	100	100	0
LCR-WEIR	Mean	1.29	-	5.26	5.95	5.6	<2.0
	Median	1.33	-	4.73	-	5.8	-
	Minimum	0.40	-	3.50	3.06	<2.0	<2.0
	Maximum	1.90	-	9.09	8.84	12.4	<2.0
	SD	0.504	-	2.02	-	4.04	-
	SE	0.206	-	0.823	-	1.65	-
	Lower Quartile	1.23	-	4.09	-	2.9	-
	Upper Quartile	1.54	-	5.42	-	6.5	-
	n	6	-	6	2	6	2
	% Detections	100	-	100	100	83	0

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.

Table 3.3-2. 2008-2019 Off-system sites water clarity metric summary statistics.

Site	Statistic	Secchi Disk Depth (m)		Turbidity (NTU)		TSS (mg/L)	
		OW	IC	OW	IC	OW	IC
GAU	Mean	1.90	-	2.05	0.74	3.1	<2.0
	Median	1.68	-	2.00	0.56	3.5	<2.0
	Minimum	1.00	-	0.10	0.20	<2.0	<2.0
	Maximum	3.50	-	4.20	1.69	6.4	<2.0
	SD	0.658	-	0.943	0.460	1.62	-
	SE	0.113	-	0.157	0.133	0.27	-
	Lower Quartile	1.46	-	1.34	0.41	<2.0	<2.0
	Upper Quartile	2.25	-	2.63	1.01	4.1	<2.0
	n	34	-	36	12	36	12
	% Detections	100	-	100	100	69	0

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.

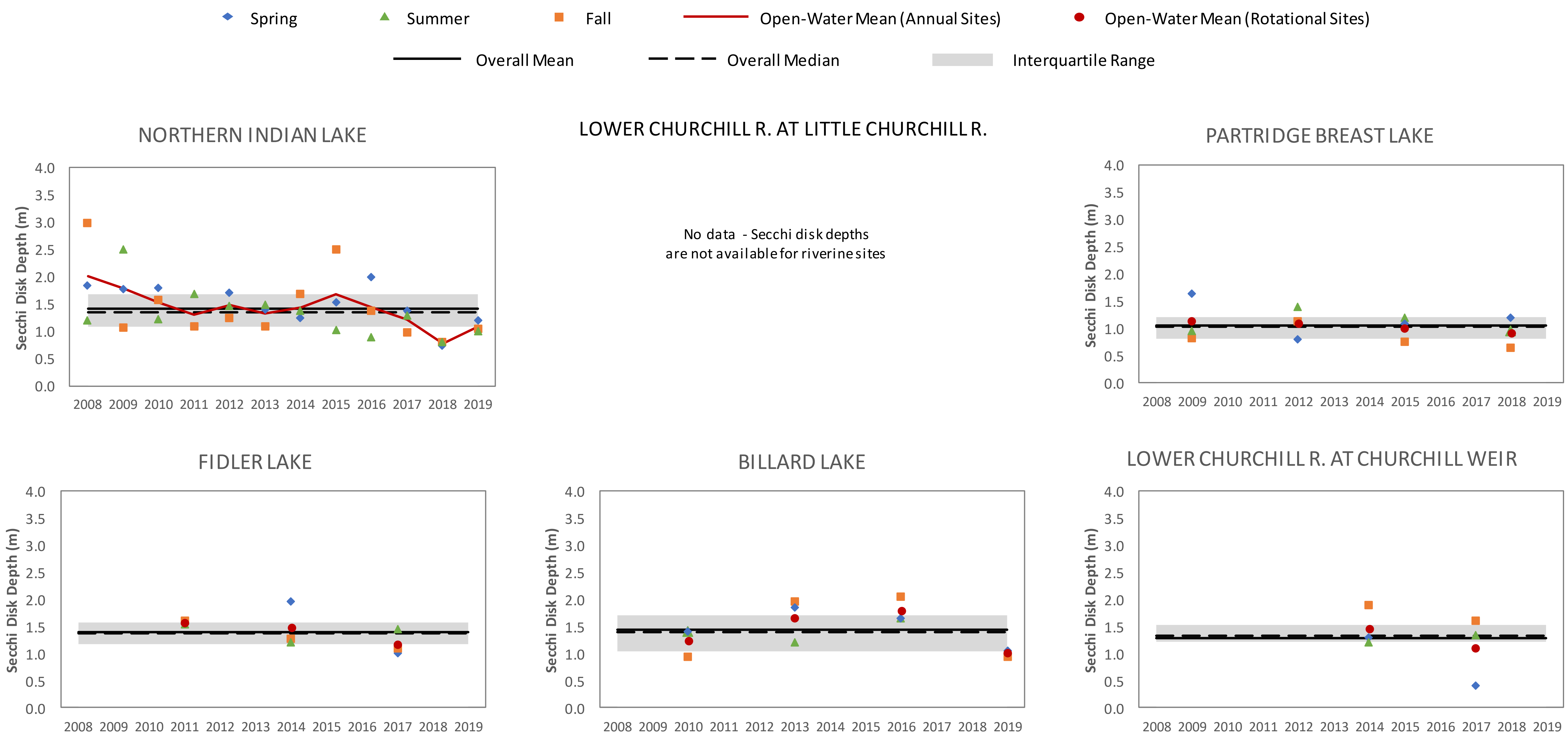


Figure 3.3-1. 2008-2019 On-system open-water season Secchi disk depths.

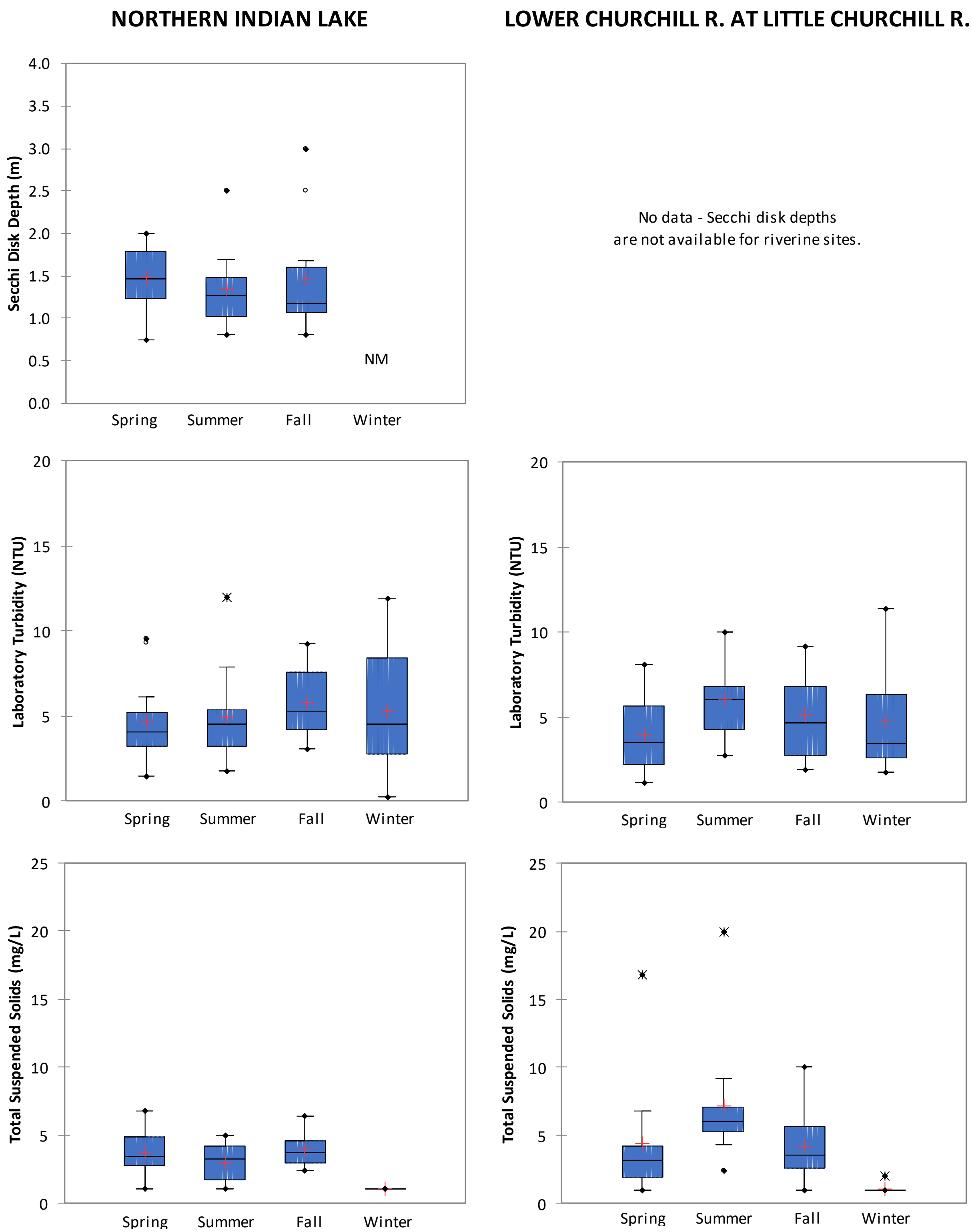


Figure 3.3-2. 2008-2019 On-system seasonal Secchi disk depth, turbidity, and TSS concentrations.

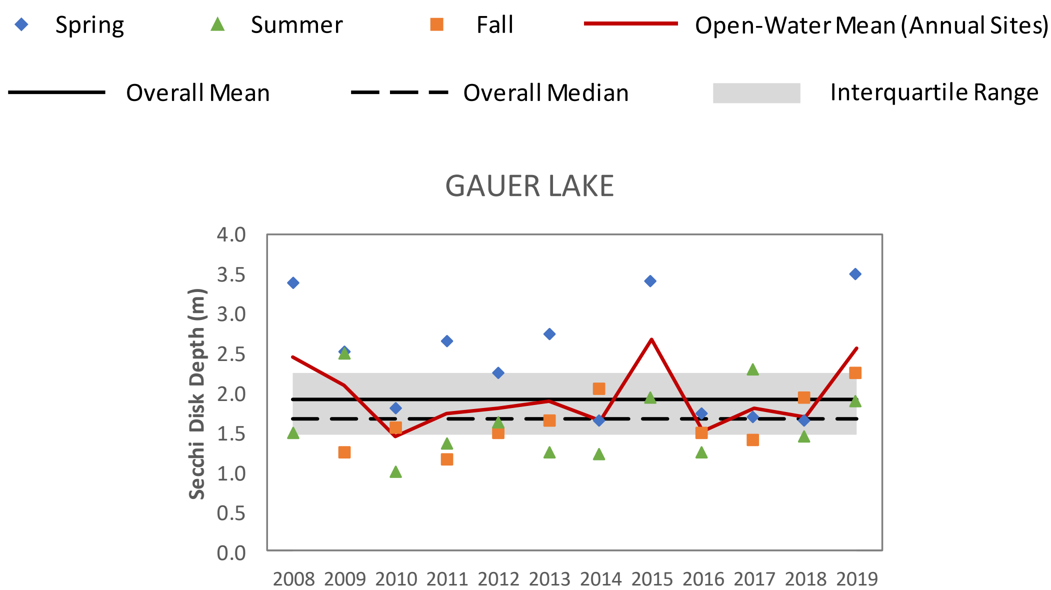


Figure 3.3-3. 2008-2019 Off-system open-water season Secchi disk depths.

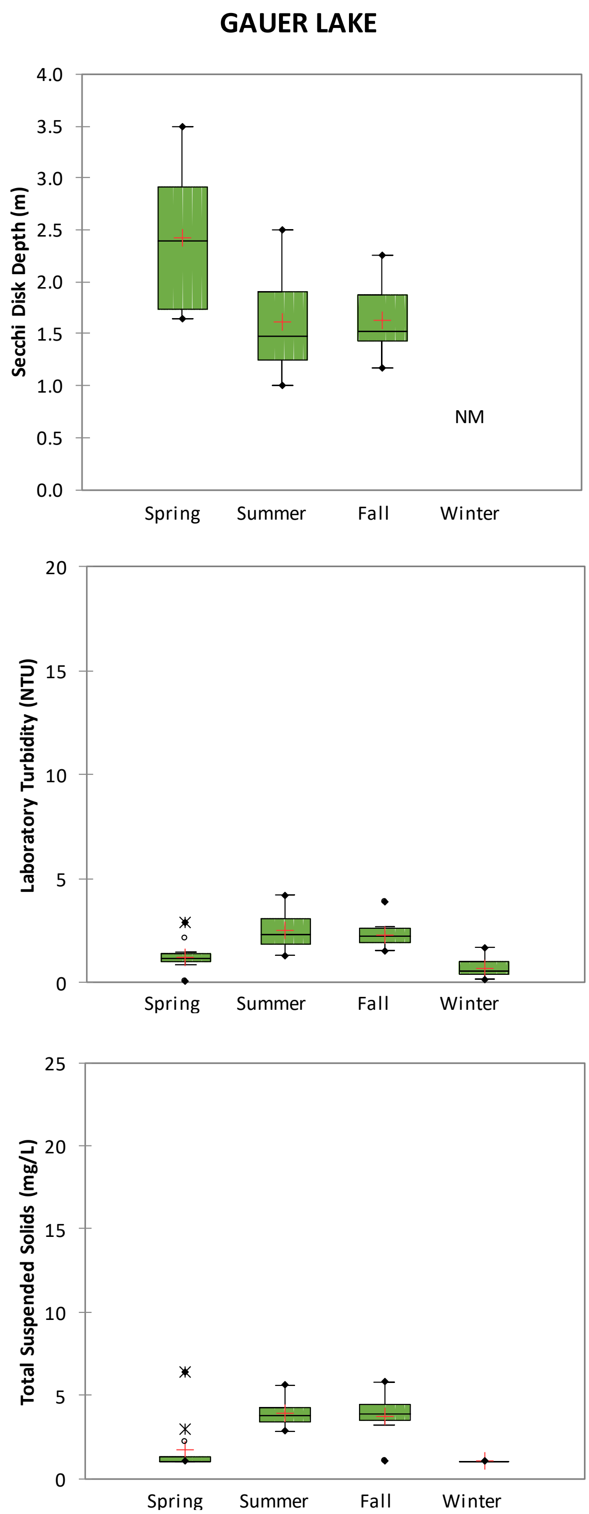


Figure 3.3-4. 2008-2019 Off-system seasonal Secchi disk depth, turbidity, and TSS concentrations.

3.3.2 TURBIDITY

3.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Turbidity in Northern Indian Lake ranged from 1.50 to 12.0 NTU during the open-water season. The mean and median turbidity for the 12 years of monitoring were 5.19 NTU and 4.36 NTU, respectively. Open-water season mean annual turbidity ranged from 3.57 to 10.3 NTU and was within the IQR (3.59 to 5.96 NTU) in nine of the 12 years. Mean turbidity was above the IQR in 2017, 2018, and 2019 (Table 3.3-1 and Figure 3.3-5).

Turbidity in the ice-cover season ranged from 0.25 to 11.9 NTU, with a mean of 5.28 NTU and median of 4.51 NTU for the 12 years of monitoring. The IQR was 2.77 to 8.40 NTU (Table 3.3-1 and Figure 3.3-6).

No clear seasonality was observed for turbidity in Northern Indian Lake over 12 years of monitoring. However, the lowest mean turbidity occurred in spring (4.72 NTU) and the highest in fall (5.83 NTU; Figure 3.3-2).

Lower Churchill River at the Little Churchill River

Turbidity in the lower Churchill River at the Little Churchill River ranged from 1.17 to 10.0 NTU during the open-water season. The mean and median turbidity for the 12 years of monitoring were 5.08 NTU and 4.40 NTU, respectively. Open-water season mean annual turbidity ranged from 2.68 to 8.80 NTU and was within the IQR (2.84 to 6.85 NTU) in nine of the 12 years. Mean turbidity was below the IQR in 2013 and above the IQR in 2018 and 2019 (Table 3.3-1 and Figure 3.3-5).

Turbidity in the ice-cover season ranged from 1.80 to 11.4 NTU, with a mean of 4.77 NTU and median of 3.48 NTU for the 10 years of monitoring. The IQR was 2.58 to 6.33 NTU (Table 3.3-1 and Figure 3.3-6).

No clear seasonality was observed for turbidity over 12 years of monitoring. However, the lowest mean turbidity occurred in spring (4.01 NTU) and the highest in summer (6.03 NTU; Figure 3.3-2).

ROTATIONAL SITES

Partridge Breast Lake

Turbidity in Partridge Breast Lake ranged from 3.83 to 14.8 NTU during the open-water season. The mean was 7.72 NTU, the median was 6.88 NTU, and the IQR was 5.95 to 9.53 NTU for the four years of monitoring. Mean annual turbidity in the open-water season ranged from 5.77 to 12.2 NTU and was within the IQR in 2009 and 2015 but below the IQR in 2012 and above the IQR in 2018 (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged from 1.73 to 11.0 NTU, with a mean of 5.99 NTU (Table 3.3-1 and Figure 3.3-6).

Fidler Lake

Turbidity in Fidler Lake ranged from 2.99 to 6.44 NTU during the open-water season. The mean was 4.76 NTU, the median was 4.30 NTU, and the IQR was 4.15 to 5.80 NTU for the three years of monitoring. Mean annual turbidity in the open-water season ranged from 3.72 to 5.33 NTU and was within the IQR in 2014 and 2017 but below the IQR in 2011 (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged from 3.00 to 12.1 NTU, with a mean of 6.60 NTU (Table 3.3-1 and Figure 3.3-6).

Billard Lake

Turbidity in Billard Lake ranged from 2.23 to 8.67 NTU during the open-water season. The mean was 4.70 NTU, the median was 3.62 NTU, and the IQR was 2.64 to 7.12 NTU for the four years of monitoring. Mean annual turbidity in the open-water season ranged from 2.57 to 7.98 NTU and was within the IQR in 2010 and 2013 but below the IQR in 2016 and above the IQR in 2019 (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged from 2.89 to 8.99 NTU, with a mean of 5.02 NTU (Table 3.3-1 and Figure 3.3-6).

Lower Churchill River at the Churchill Weir

Turbidity in the lower Churchill River at the Churchill Weir ranged from 3.50 to 9.09 NTU during the open-water season. The mean was 5.26 NTU, the median was 4.73 NTU, and the IQR was 4.09 to 5.42 NTU for the two years of monitoring. Mean annual turbidity in the open-water season was

4.07 m in 2014 and 6.46 m in 2017 and was below the IQR in 2014 and above the IQR in 2017 (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged was 3.06 NTU in 2014 and 8.84 NTU in 2018, with a mean of 5.95 NTU (Table 3.3-1 and Figure 3.3-6).

3.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Turbidity in Gauer Lake ranged from 0.10 to 4.20 NTU during the open-water season. The mean and median turbidity for the 12 years of monitoring were 2.05 NTU and 2.00 NTU, respectively. Open-water season mean annual turbidity ranged from 1.13 to 2.93 NTU and was within the IQR (1.34 to 2.63 NTU) in eight of the 12 years. Mean turbidity was below the IQR in 2009 and above the IQR in 2011, 2014, and 2015 (Table 3.3-2 and Figure 3.3-7).

Turbidity in the ice-cover season ranged from 0.20 to 1.69 NTU, with a mean of 0.74 NTU and median of 0.56 NTU for the 12 years of monitoring. The IQR was 0.41 to 1.01 NTU (Table 3.3-2 and Figure 3.3-7).

Turbidity was lower in spring and winter (means were 1.28 and 0.74 NTU, respectively) than in summer and fall (means were 2.54 and 2.32 NTU, respectively) over the 12 years of monitoring (Figure 3.3-4).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

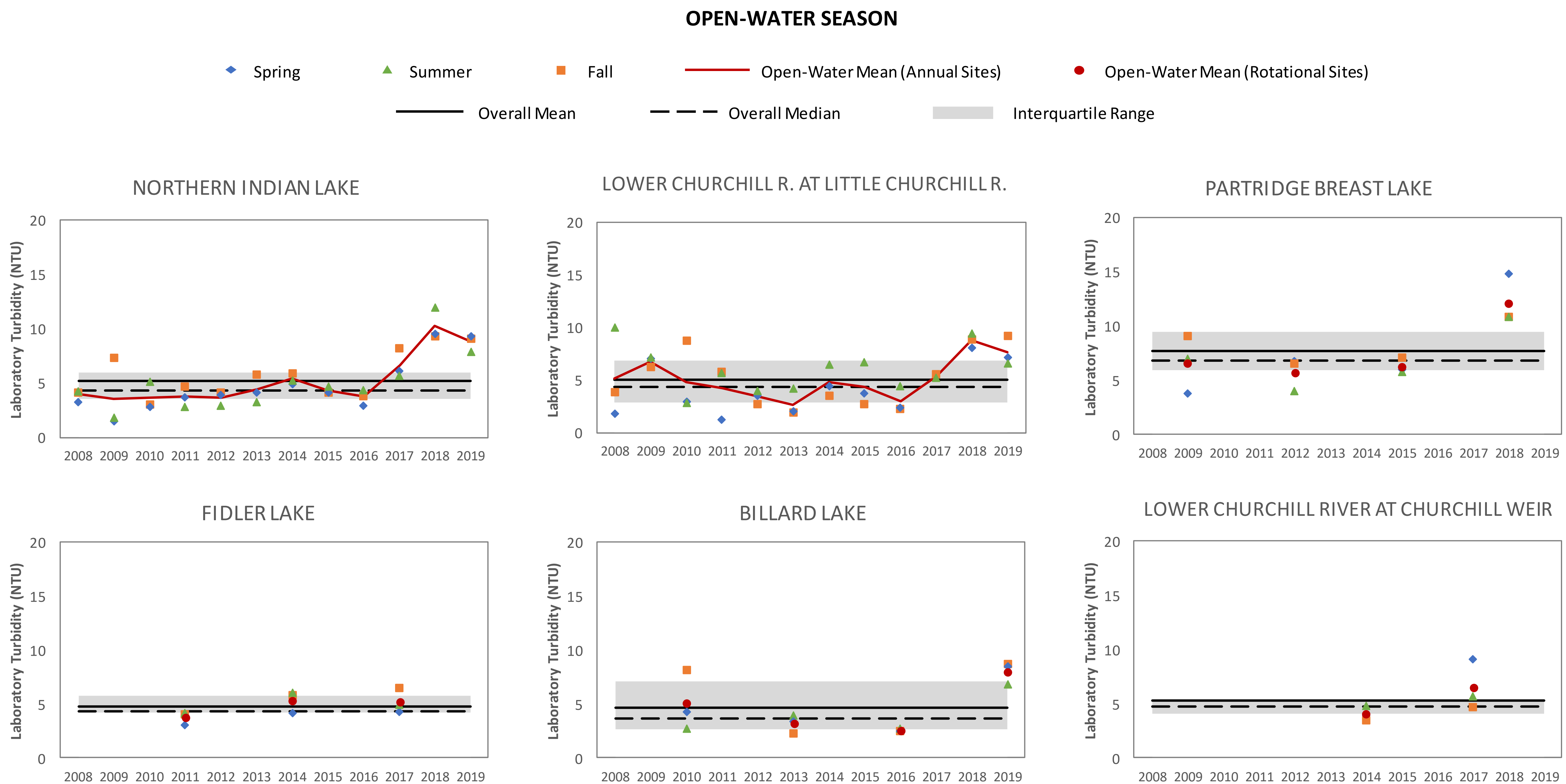


Figure 3.3-5. 2008-2019 On-system open-water season turbidity levels.

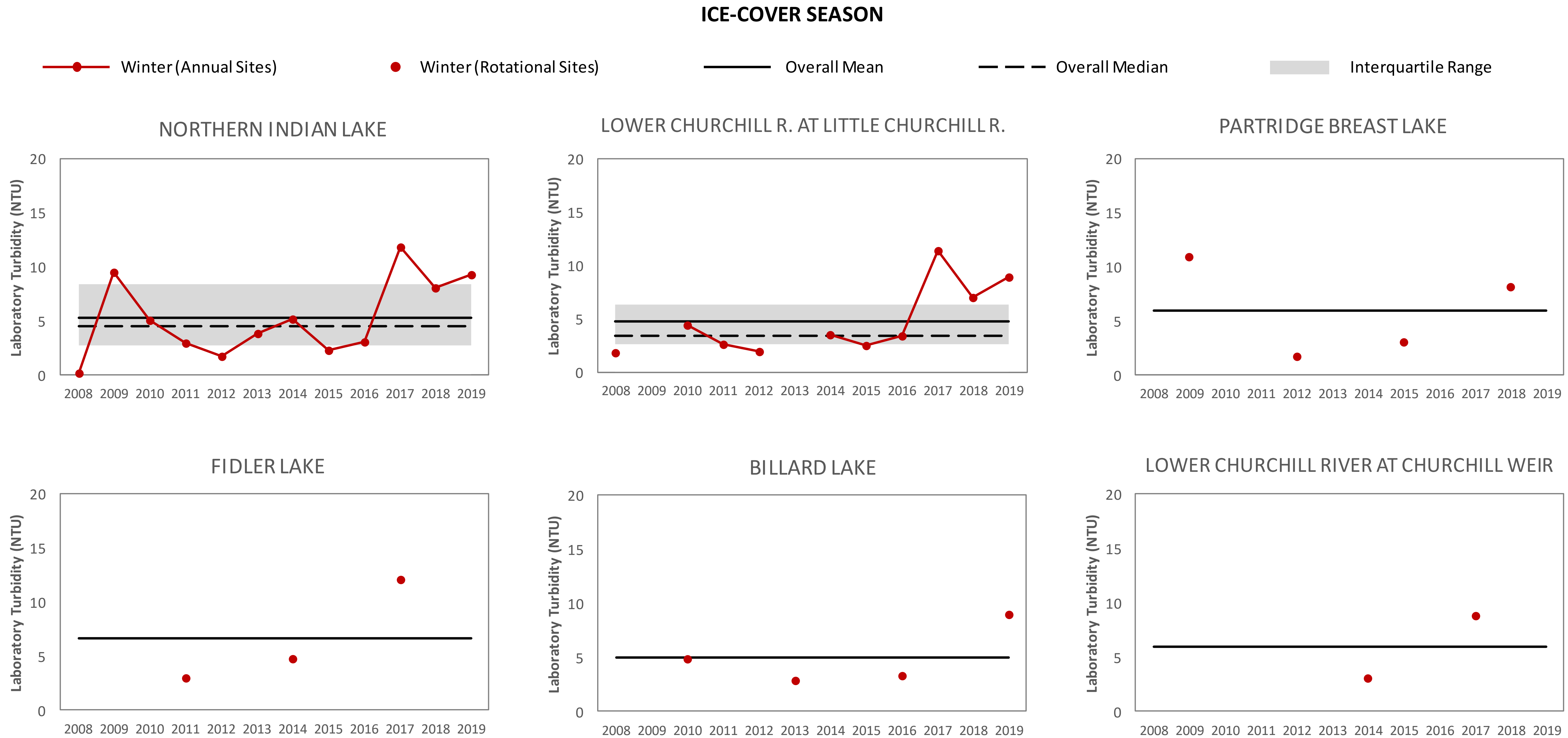
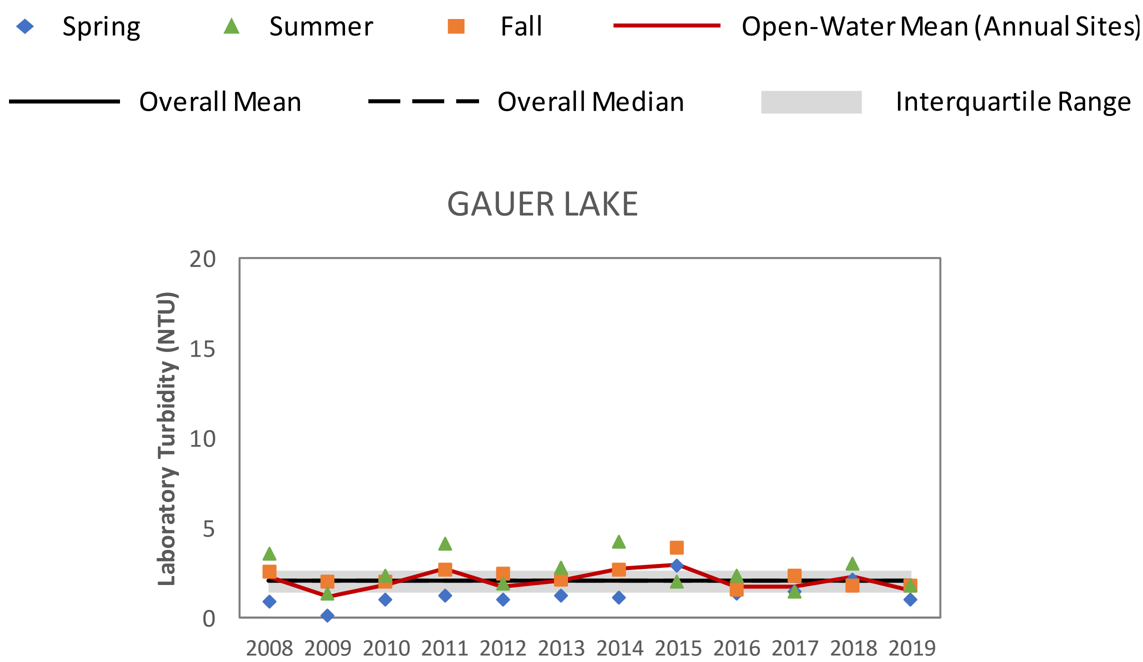


Figure 3.3-6. 2008-2019 On-system ice-cover season turbidity levels.

OPEN-WATER SEASON



ICE-COVER SEASON

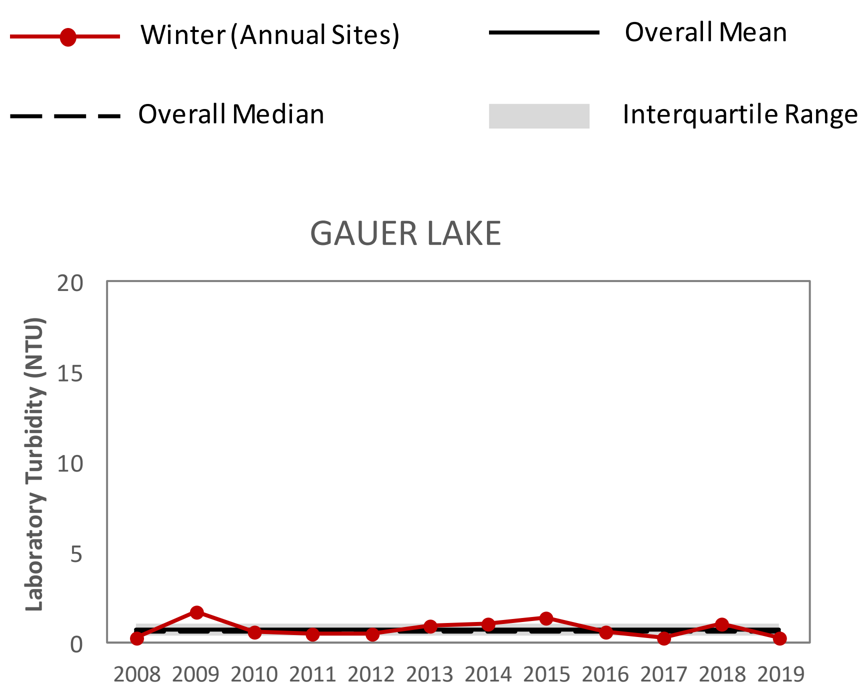


Figure 3.3-7. 2008-2019 Off-system open-water and ice-cover season turbidity levels.

3.3.3 TOTAL SUSPENDED SOLIDS

3.3.3.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

TSS concentrations in Northern Indian Lake ranged from <2.0 to 6.8 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 3.5 mg/L and 3.6 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from 2.1 to 4.9 mg/L and were within the IQR (2.6 to 4.6 mg/L) in 10 of the 12 years. Mean TSS concentrations were below the IQR in 2009 above the IQR in 2014. TSS concentrations were above the detection limit (DL; 2.0 mg/L) in most samples collected in the open-water season (percent detections = 89; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season were consistently below the DL (2.0 mg/L) over the 12 years of monitoring (Table 3.3-1 and Figure 3.3-9).

TSS concentrations in Northern Indian Lake were lower in winter (mean <2.0 mg/L) than during the open-water season. No clear seasonality was observed for TSS concentrations in the open-water season; however, the lowest mean TSS concentration occurred in summer (2.9 mg/L) and the highest in fall (3.9 mg/L; Figure 3.3-2).

Lower Churchill River at the Little Churchill River

TSS concentrations in the lower Churchill River at the Little Churchill River ranged from <2.0 to 20.0 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 5.3 mg/L and 4.3 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from 2.7 to 10.5 mg/L and were within the IQR (2.8 to 6.1 mg/L) in eight of the 12 years. Mean TSS concentrations were below the IQR in 2013 and above the IQR in 2008, 2009, and 2011. TSS concentrations were above the DL (2.0 mg/L) in most samples collected in the open-water season (percent detections = 86; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season ranged from <2.0 to 2.0 mg/L, with both a mean and median of <2.0 mg/L over the 10 years of monitoring. The IQR was below the analytical DL of

2.0 mg/L. TSS concentrations were below the DL (2.0 mg/L) in all but one winter (2012) over the 10 years of monitoring (percent detections = 10; Table 3.3-1 and Figure 3.3-9).

TSS concentrations in the lower Churchill River at the Little Churchill River were lower in winter (mean = <2.0 mg/L) than in summer (mean = 7.1 mg/L) over the 12 years of monitoring (Figure 3.3-2).

ROTATIONAL SITES

Partridge Breast Lake

TSS concentrations in Partridge Breast Lake ranged from <2.0 to 6.0 mg/L during the open-water season. The mean was 3.8 mg/L, the median was 3.7 mg/L, and the IQR was 2.9 to 4.9 mg/L for the four years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 3.1 to 4.9 mg/L and were within the IQR in all years. TSS concentrations were typically above the DL (2.0 mg/L) during the open-water season (percent detections = 92; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season were consistently below the DL (2.0 mg/L) for the four years of monitoring (Table 3.3-1 and Figure 3.3-9).

Fidler Lake

TSS concentrations in Fidler Lake ranged from 2.4 to 5.6 mg/L during the open-water season. The mean was 3.9 mg/L, the median was 4.0 mg/L, and the IQR was 3.2 to 4.4 mg/L for the three years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 3.3 to 4.3 mg/L and were within the IQR in all years. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season were consistently below the DL (2.0 mg/L) for the three years of monitoring (Table 3.3-1 and Figure 3.3-9).

Billard Lake

TSS concentrations in Billard Lake ranged from 2.0 to 9.6 mg/L during the open-water season. The mean was 4.2 mg/L, the median was 3.8 mg/L, and the IQR was 2.8 to 4.9 mg/L for the four years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 2.9 to 5.5 mg/L and were within the IQR in three of the four years. The mean TSS concentration was above the IQR in 2010. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season were consistently below the DL (2.0 mg/L) for the four years of monitoring (Table 3.3-1 and Figure 3.3-9).

Lower Churchill River at the Churchill Weir

TSS concentrations in the lower Churchill River at the Churchill Weir ranged from <2.0 to 12.4 mg/L during the open-water season. The mean was 5.6 mg/L, the median was 5.8 mg/L, and the IQR was 2.9 to 6.5 mg/L for the two years of monitoring. Mean annual TSS concentrations in the open-water season were 4.5 mg/L in 2014 and 6.7 mg/L in 2017 and were within the IQR in 2014 and above the IQR in 2017. TSS concentrations were typically above the DL (2.0 mg/L) during the open-water season (percent detections = 83; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season were below the DL (2.0 mg/L) in the two years of monitoring (Table 3.3-1 and Figure 3.3-9).

3.3.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

TSS concentrations in Gauer Lake ranged from <2.0 to 6.4 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 3.1 mg/L and 3.5 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from <2.0 to 4.7 mg/L and were within the IQR (<2.0 to 4.1 mg/L) in 11 of the 12 years. Mean TSS concentrations were above the IQR in 2010. TSS concentrations were above the DL (2.0 mg/L) in approximately two thirds of the samples collected in the open-water season (percent detections = 69; Table 3.3-2 and Figure 3.3-10).

TSS concentrations in the ice-cover season were consistently below the DL (2.0 mg/L) over the 12 years of monitoring (Table 3.3-2 and Figure 3.3-10).

TSS concentrations in Gauer Lake were lower in spring and winter (mean for both was <2.0 mg/L) than in summer and fall (means were 3.9 and 3.7 mg/L, respectively) over the 12 years of monitoring (Figure 3.3-4).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

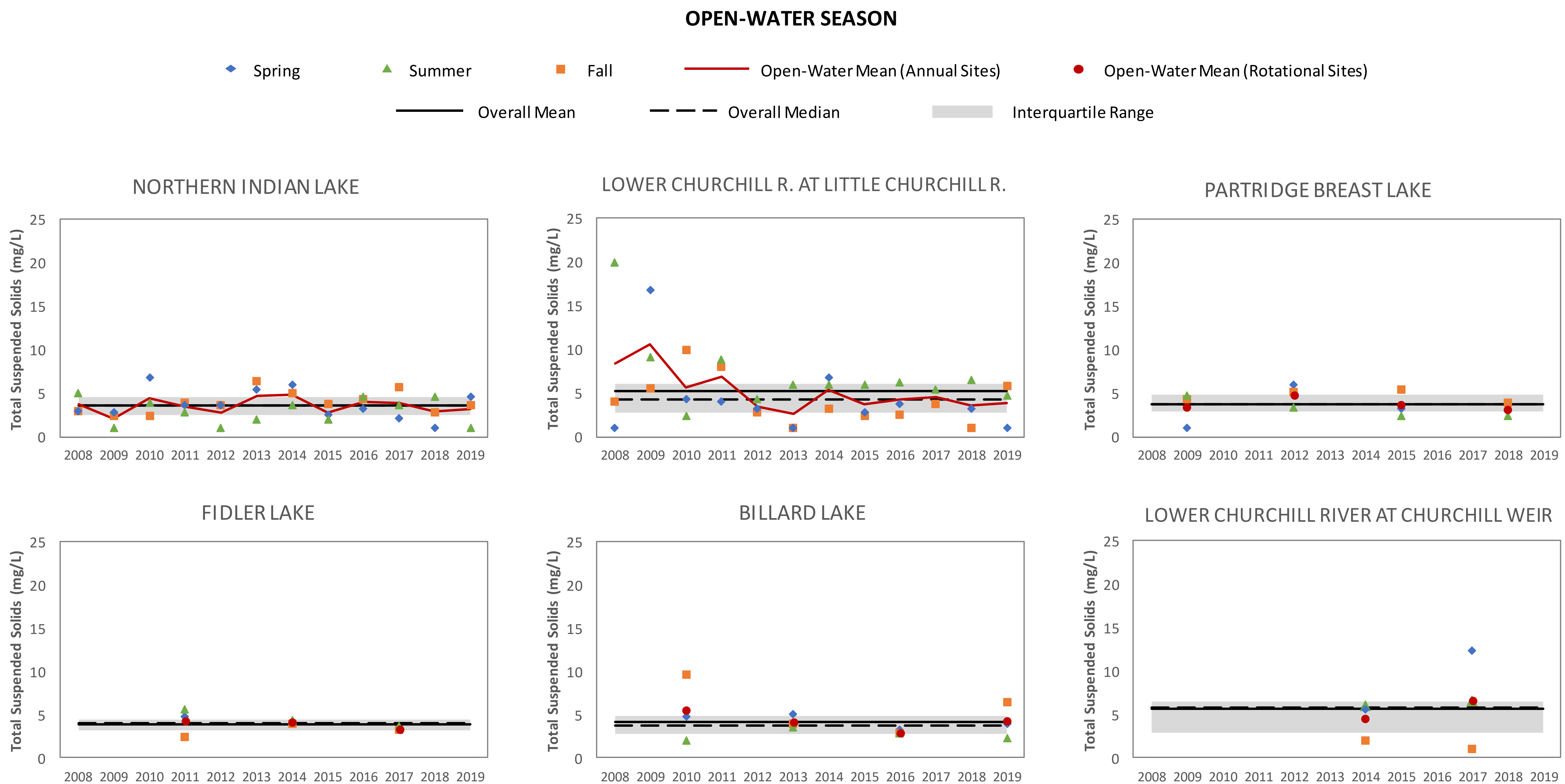


Figure 3.3-8. 2008-2019 On-system open-water season TSS concentrations.

ICE-COVER SEASON

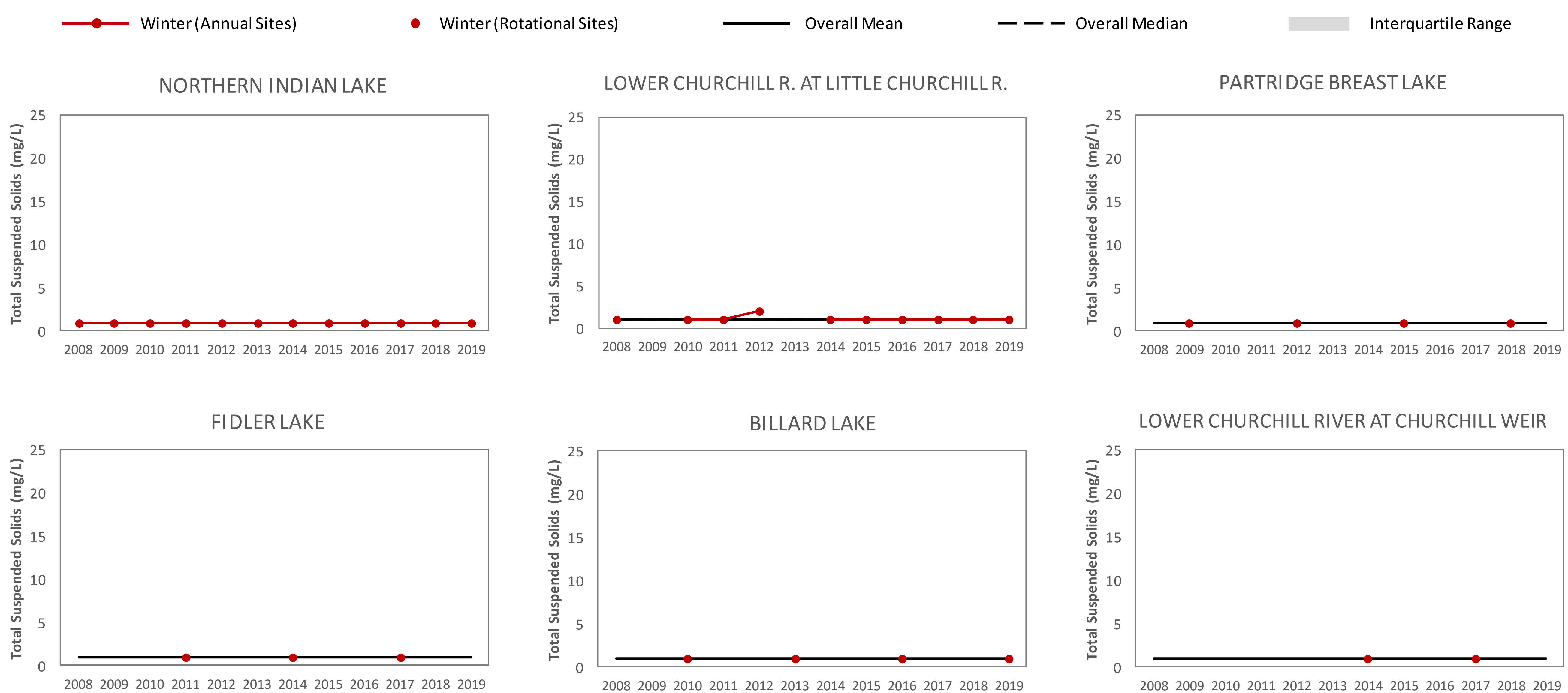


Figure 3.3-9. 2008-2019 On-system ice-cover season TSS concentrations.

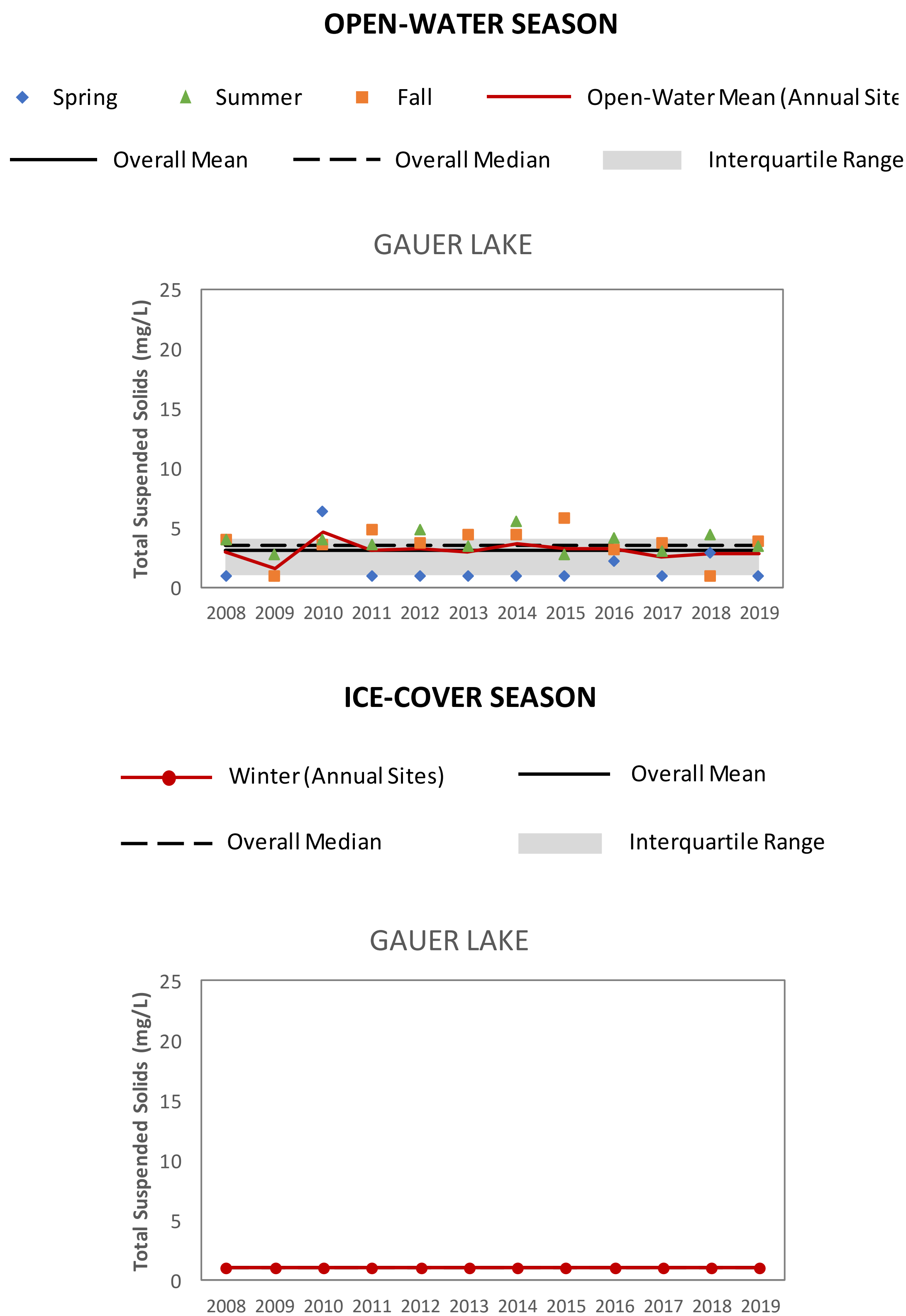


Figure 3.3-10. 2008-2019 Off-system open-water and ice-cover season TSS concentrations.

3.4 NUTRIENTS AND TROPHIC STATUS

3.4.1 TOTAL PHOSPHORUS

3.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

TP concentrations in Northern Indian Lake ranged from 0.008 to 0.033 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.016 mg/L and 0.015 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.013 to 0.020 mg/L and were within the IQR (0.013 to 0.019 mg/L) in 10 of the 12 years. Mean TP concentrations were above the IQR in 2009 and 2010 (Table 3.4-1 and Figure 3.4-1).

TP concentrations in the ice-cover season ranged from 0.008 to 0.027 mg/L, with both a mean and median of 0.016 mg/L for the 12 years of monitoring. The IQR was 0.013 to 0.018 mg/L (Table 3.4-1 and Figure 3.4-2).

No clear seasonality was observed for TP in Northern Indian Lake over the 12 years of monitoring. However, mean TP concentrations were lowest in spring (0.014 mg/L) and highest in fall (0.019 mg/L; Figure 3.4-3).

Northern Indian Lake was mesotrophic (0.010 to 0.020 mg/L) based on the 2008-2019 mean open-water season TP concentration (0.016 mg/L). Mean annual TP concentrations (0.013 to 0.020 mg/L) in the open-water season were within the mesotrophic range (0.010 to 0.020 mg/L) in 10 of the 12 years of monitoring. Mean TP concentrations were on the mesotrophic to meso-eutrophic boundary (i.e., 0.020 mg/L) in 2009 and 2010 (Table 3.4-2).

Lower Churchill River at the Little Churchill River

TP concentrations in lower Churchill River at the Little Churchill River ranged from 0.011 to 0.031 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.017 mg/L and 0.016 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.013 to 0.023 mg/L and were within the IQR (0.013 to 0.019 mg/L) in nine of the 12 years of monitoring. Mean TP concentrations were above the IQR in 2008, 2009, and 2018 (Table 3.4-1 and Figure 3.4-1).

TP concentrations in the ice-cover season ranged from 0.008 to 0.023 mg/L, with a mean of 0.014 mg/L and median of 0.013 mg/L for the 10 years of monitoring. The IQR was 0.009 to 0.018 mg/L (Table 3.4-1 and Figure 3.4-2).

No clear seasonality was observed for TP in the lower Churchill River at the Little Churchill River over the 12 years of monitoring. However, mean TP concentrations were lowest in winter (0.014 mg/L) and highest in summer (0.019 mg/L; Figure 3.4-3).

The lower Churchill River at the Little Churchill River was mesotrophic (0.010 to 0.020 mg/L) based on the 2008-2019 mean open-water season TP concentration (0.017 mg/L). Mean annual TP concentrations (0.013 to 0.023 mg/L) in the open-water season were within the mesotrophic range (0.010 to 0.020 mg/L) in nine of the 12 years of monitoring. Mean TP concentrations were on the mesotrophic to meso-eutrophic boundary (i.e., 0.020 mg/L) in 2008 and 2009 and within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2018 (Table 3.4-3).

ROTATIONAL SITES

Partridge Breast Lake

TP concentrations in Partridge Breast Lake ranged from 0.010 to 0.028 mg/L during the open-water season. The mean and median were both 0.016 mg/L and the IQR was 0.014 to 0.017 mg/L for the four years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.014 to 0.020 mg/L and were within the IQR in three of the four years. The mean TP concentration was above the IQR in 2018 (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.008 to 0.027 mg/L, with a mean of 0.017 mg/L (Table 3.4-1 and Figure 3.4-2).

Partridge Breast Lake was mesotrophic (0.010 to 0.020 mg/L) based on the mean of the open-water season TP concentrations for the four years of monitoring (0.016 mg/L). Open-water season mean annual TP concentrations (0.014 to 0.020 mg/L) were also within the mesotrophic range in three of the four years of monitoring. Mean TP concentrations were on the mesotrophic to meso-eutrophic boundary (i.e., 0.020 mg/L) in 2018 (Table 3.4-2).

Fidler Lake

TP concentrations in Fidler Lake ranged from 0.013 to 0.019 mg/L during the open-water season. The mean was 0.015 mg/L, the median was 0.014 mg/L, and the IQR was 0.013 to 0.017 mg/L for the three years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.014 to 0.016 mg/L and were within the IQR in all years (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.010 to 0.023 mg/L, with a mean of 0.015 mg/L (Table 3.4-1 and Figure 3.4-2).

Fidler Lake was mesotrophic (0.010 to 0.020 mg/L) based on the mean of the open-water season TP concentrations for the three years of monitoring (0.015 mg/L). Open-water season mean annual TP concentrations (0.014 to 0.016 mg/L) were also within the mesotrophic range each of the three years of monitoring (Table 3.4-2).

Billard Lake

TP concentrations in Billard Lake ranged from 0.008 to 0.023 mg/L during the open-water season. The mean and median were both 0.016 mg/L and the IQR was 0.013 to 0.018 mg/L for the four years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.014 to 0.017 mg/L and were within the IQR in all years (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.012 to 0.022 mg/L, with a mean of 0.017 mg/L (Table 3.4-1 and Figure 3.4-2).

Billard Lake was mesotrophic (0.010 to 0.020 mg/L) based on the mean of the open-water season TP concentrations for the four years of monitoring (0.016 mg/L). Open-water season mean annual TP concentrations (0.014 to 0.017 mg/L) were also within the mesotrophic range each of the four years of monitoring (Table 3.4-2).

Lower Churchill River at the Churchill Weir

TP concentrations in the lower Churchill River at the Churchill Weir ranged from 0.011 to 0.021 mg/L during the open-water season. The mean and median were both 0.016 mg/L and the IQR was 0.014 to 0.019 mg/L for the two years of monitoring. Mean annual TP concentrations in the open-water season were 0.015 mg/L in 2014 and 0.017 mg/L in 2017 and were within the IQR in both years of monitoring (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.011 to 0.020 mg/L, with a mean of 0.015 mg/L (Table 3.4-1 and Figure 3.4-2).

The lower Churchill River at the Churchill Weir was mesotrophic (0.010 to 0.020 mg/L) based on the mean of the open-water season TP concentrations for the two years of monitoring (0.016 mg/L). Open-water season mean annual TP concentrations (0.015 and 0.017 mg/L in 2014 and 2017, respectively) were also within the mesotrophic range both years of monitoring (Table 3.4-2).

3.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

TP concentrations in Gauer Lake ranged from 0.007 to 0.036 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.017 mg/L and 0.016 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.012 to 0.024 mg/L and were within the IQR (0.014 to 0.021 mg/L) in 10 of the 12 years of monitoring. Mean TP concentrations were below the IQR in 2019 and above the IQR in 2010 (Table 3.4-4 and Figure 3.4-4).

TP concentrations in the ice-cover season ranged from 0.010 to 0.016 mg/L, with both a mean and median of 0.013 mg/L for the 12 years of monitoring. The IQR was 0.012 to 0.016 mg/L (Table 3.4-4 and Figure 3.4-4).

TP concentrations in Gauer Lake were lower in spring and winter (means were 0.015 mg/L and 0.013 mg/L, respectively) than in fall (mean = 0.020 mg/L) over the 12 years of monitoring (Figure 3.4-5).

Gauer Lake was mesotrophic (0.010 to 0.020 mg/L) based on the 2008-2019 mean open-water season TP concentration (0.017 mg/L). Mean annual TP concentrations (0.012 to 0.024 mg/L) in the open-water season were within the mesotrophic range (0.010 to 0.020 mg/L) in eight of the 12 years of monitoring. Mean TP concentrations were on the mesotrophic to meso-eutrophic boundary (i.e., 0.020 mg/L) in 2008 and 2016 and within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2010 and 2011 (Table 3.4-5).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

Table 3.4-1. 2008-2019 On-system sites TP, TN, and chlorophyll *a* summary statistics.

Site	Statistic	TP (mg/L)		TN (mg/L)		Chlorophyll *a* (µg/L)	
		OW	IC	OW	IC	OW	IC
NIL	Mean	0.016	0.016	0.32	0.36	3.66	1.00
	Median	0.015	0.016	0.33	0.37	3.54	<1.0
	Minimum	0.008	0.008	<0.20	<0.20	1.27	<1.0
	Maximum	0.033	0.027	0.97	0.55	9.00	4.01
	SD	0.0049	0.0053	0.148	0.106	1.57	1.08
	SE	0.0008	0.0015	0.025	0.032	0.261	0.312
	Lower Quartile	0.013	0.013	0.25	0.35	2.75	<1.0
	Upper Quartile	0.019	0.018	0.37	0.39	4.44	1.00
	n	36	12	36	11	36	12
	% Detections	100	100	89	91	100	67
LCR-LiCR	Mean	0.017	0.014	0.34	0.35	3.45	<0.60
	Median	0.016	0.013	0.32	0.37	3.05	<0.60
	Minimum	0.011	0.008	<0.20	<0.20	1.20	<0.60
	Maximum	0.031	0.023	0.81	0.45	10.0	0.76
	SD	0.0046	0.0053	0.130	0.098	1.69	-
	SE	0.0008	0.0017	0.022	0.031	0.285	-
	Lower Quartile	0.013	0.009	0.26	0.33	2.54	<0.60
	Upper Quartile	0.019	0.018	0.42	0.40	3.95	<0.60
	n	35	10	35	10	35	10
	% Detections	100	100	94	90	100	20
PBL	Mean	0.016	0.017	0.25	0.33	4.45	0.76
	Median	0.016	-	0.29	-	2.99	-
	Minimum	0.010	0.008	<0.20	0.23	1.50	<0.60
	Maximum	0.028	0.027	0.34	0.46	11.1	2.14
	SD	0.0049	0.0078	0.080	0.099	3.12	0.92
	SE	0.0014	0.0039	0.023	0.050	0.901	0.460
	Lower Quartile	0.014	-	0.23	-	2.58	-
	Upper Quartile	0.017	-	0.30	-	5.83	-
	n	12	4	12	4	12	4
	% Detections	100	100	83	100	100	50

Table 3.4-1. continued.

Site	Statistic	TP (mg/L)		TN (mg/L)		Chlorophyll *a* (µg/L)	
		OW	IC	OW	IC	OW	IC
FID	Mean	0.015	0.015	0.37	0.33	2.72	1.03
	Median	0.014	-	0.33	-	2.86	-
	Minimum	0.013	0.010	0.24	0.31	<0.60	<0.60
	Maximum	0.019	0.023	0.62	0.36	4.58	2.48
	SD	0.0024	0.0070	0.126	0.029	1.40	1.26
	SE	0.0008	0.0040	0.045	0.017	0.465	0.727
	Lower Quartile	0.013	-	0.30	-	1.91	-
	Upper Quartile	0.017	-	0.40	-	3.44	-
	n	9	3	8	3	9	3
	% Detections	100	100	100	100	89	33
BIL	Mean	0.016	0.017	0.27	0.37	3.23	1.12
	Median	0.016	-	0.30	-	3.09	-
	Minimum	0.008	0.012	<0.20	0.28	1.72	<0.60
	Maximum	0.023	0.022	0.43	0.43	5.46	2.48
	SD	0.0039	0.0041	0.113	0.064	0.92	1.04
	SE	0.0011	0.0021	0.033	0.032	0.264	0.522
	Lower Quartile	0.013	-	0.21	-	2.67	-
	Upper Quartile	0.018	-	0.34	-	3.54	-
	n	12	4	12	4	12	4
	% Detections	100	100	75	100	100	50
LCR-WEIR	Mean	0.016	0.015	0.26	0.34	2.27	<0.60
	Median	0.016	-	0.29	-	2.29	-
	Minimum	0.011	0.011	<0.20	0.26	1.34	<0.60
	Maximum	0.021	0.020	0.34	0.41	3.05	<0.60
	SD	0.0040	-	0.094	-	0.76	-
	SE	0.0016	-	0.042	-	0.310	-
	Lower Quartile	0.014	-	0.27	-	1.72	-
	Upper Quartile	0.019	-	0.31	-	2.92	-
	n	6	2	5	2	6	2
	% Detections	100	100	80	100	100	0

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.
3. TN statistics exclude the following suspect values from spring 2014: 4.25 mg/L at LCR-LiCR; 0.83 mg/L at FID; and <0.20 mg/L from LCR-WEIR.
4. TN statistics for NIL exclude a suspect value of 2.35 mg/L from winter 2018.

Table 3.4-2. 2008-2019 On-system trophic status for lakes and reservoirs based on TP, TN, and chlorophyll *a* open-water season mean concentrations.

Trophic Categories	Total Phosphorus (mg/L)					Total Nitrogen (mg/L)					Chlorophyll *a* (µg/L)				
Ultra-oligotrophic	<0.004														
Oligotrophic	0.004-0.010					<0.350					<2.5				
Mesotrophic	0.010-0.020					0.350-0.650					2.5-8				
Meso-eutrophic	0.020-0.035														
Eutrophic	0.035-0.100					0.651-1.20					8-25				
Hypereutrophic	> 0.100					>1.20					>25				
References	CCME (1999; updated to 2024)					Nürnberg (1996)					OECD (1982)				
Sampling Year	**NIL**	**PBL**	**FID**	**BIL**	**LCR-WEIR**	**NIL**	**PBL**	**FID**	**BIL**	**LCR-WEIR**	**NIL**	**PBL**	**FID**	**BIL**	**LCR-WEIR**
2008	0.015	-	-	-	-	0.34	-	-	-	-	4.67	-	-	-	-
2009	0.020	0.015	-	-	-	<0.20	0.29	-	-	-	2.93	1.90	-	-	-
2010	0.020	-	-	0.017	-	0.40	-	-	0.30	-	1.45	-	-	3.74	-
2011	0.016	-	0.015	-	-	0.37	-	0.50	-	-	3.95	-	3.44	-	-
2012	0.013	0.014	-	-	-	0.29	0.21	-	-	-	4.27	5.34	-	-	-
2013	0.013	-	-	0.014	-	0.23	-	-	0.21	-	4.46	-	-	2.99	-
2014	0.016	-	0.014	-	0.015	0.28	-	0.28	-	0.32	2.81	-	2.05	-	2.51
2015	0.013	0.015	-	-	-	0.32	0.25	-	-	-	3.30	2.63	-	-	-
2016	0.017	-	-	0.016	-	0.36	-	-	0.33	-	4.07	-	-	2.80	-
2017	0.017	-	0.016	-	0.017	0.53	-	0.31	-	0.23	3.18	-	2.67	-	2.04
2018	0.015	0.020	-	-	-	0.24	0.27	-	-	-	5.06	7.92	-	-	-
2019	0.018	-	-	0.017	-	0.31	-	-	0.24	-	3.75	-	-	3.39	-
Overall (2008-2019)	0.016	0.016	0.015	0.016	0.016	0.32	0.25	0.37	0.27	0.26	3.66	4.45	2.72	3.23	2.27

Notes:

1. CCME = Canadian Council of Ministers of the Environment.
2. OECD = Organization for Economic Cooperation and Development.
3. TN values for FID exclude suspect value of 0.83 mg/L from spring 2014.
4. TN values for LCR-WEIR exclude suspect value of <0.20 mg/L from spring 2014.

Table 3.4-3. 2008-2019 On-system trophic status for riverine sites based on TP, TN, and chlorophyll *a* open-water season mean concentrations.

Trophic Categories	**Total Phosphorus (mg/L)**	**Total Nitrogen (mg/L)**	**Chlorophyll *a* (µg/L)**
Ultra-oligotrophic	<0.004		
Oligotrophic	0.004-0.010	<0.7	<10
Mesotrophic	0.010-0.020	0.7-1.5	10-30
Meso-eutrophic	0.020-0.035		
Eutrophic	0.035-0.100	>1.5	>30
Hypereutrophic	> 0.100		
References	CCME (1999; updated to 2024)	Dodds et al. (1998)	Dodds et al. (1998)
Sampling Year	**LCR-LiCR**	**LCR-LiCR**	**LCR-LiCR**
2008	0.020	0.55	5.67
2009	0.020	0.37	2.93
2010	0.017	0.33	1.89
2011	0.014	0.45	4.90
2012	0.013	0.32	3.77
2013	0.014	0.29	3.43
2014	0.016	0.28	2.39
2015	0.014	0.34	3.06
2016	0.018	0.40	2.35
2017	0.018	0.23	3.06
2018	0.023	0.26	4.21
2019	0.015	0.27	3.55
Overall (2008-2019)	0.017	0.34	3.45

Notes:

1. CCME = Canadian Council of Ministers of the Environment.
2. TN values for LCR-LiCR exclude suspect value of 4.25 mg/L from spring 2014.

Table 3.4-4. 2008-2019 Off-system sites TP, TN, and chlorophyll *a* summary statistics.

Site	Statistic	TP (mg/L)		TN (mg/L)		Chlorophyll *a* (µg/L)	
		OW	IC	OW	IC	OW	IC
GAU	Mean	0.017	0.013	0.40	0.45	6.93	1.30
	Median	0.016	0.013	0.42	0.45	6.44	1.15
	Minimum	0.007	0.010	<0.20	0.35	1.24	<0.60
	Maximum	0.036	0.016	0.64	0.56	21.0	2.48
	SD	0.0059	0.0021	0.134	0.065	4.96	0.50
	SE	0.0010	0.0006	0.022	0.019	0.827	0.143
	Lower Quartile	0.014	0.012	0.32	0.39	3.11	1.08
	Upper Quartile	0.021	0.016	0.50	0.49	9.26	1.46
	n	36	12	36	12	36	12
	% Detections	100	100	94	100	100	92

Notes:

1. OW = Open-water season; IC = Ice-cover season.
2. SD = standard deviation; SE = standard error; n = number of samples.

Table 3.4-5. 2008-2019 Off-system trophic status for lakes and reservoirs based on TP, TN, and chlorophyll *a* open-water season mean concentrations.

Trophic Categories	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Chlorophyll *a* (µg/L)
Ultra-oligotrophic	<0.004		
Oligotrophic	0.004-0.010	<0.350	<2.5
Mesotrophic	0.010-0.020	0.350-0.650	2.5-8
Meso-eutrophic	0.020-0.035		
Eutrophic	0.035-0.100	0.651-1.20	8-25
Hypereutrophic	> 0.100	>1.20	>25
References	CCME (1999; updated to 2024)	Nürnberg (1996)	OECD (1982)
Sampling Year	**GAU**	**GAU**	**GAU**
2008	0.020	0.46	9.33
2009	0.016	0.23	5.60
2010	0.024	0.49	1.70
2011	0.021	0.51	10.0
2012	0.014	0.38	6.20
2013	0.015	0.38	7.26
2014	0.018	0.45	12.0
2015	0.015	0.36	5.78
2016	0.020	0.45	5.16
2017	0.018	0.47	5.79
2018	0.016	0.34	7.61
2019	0.012	0.32	6.65
Overall (2008-2019)	0.017	0.40	6.93

Notes:

1. CCME = Canadian Council of Ministers of the Environment.
2. OECD = Organization for Economic Cooperation and Development.

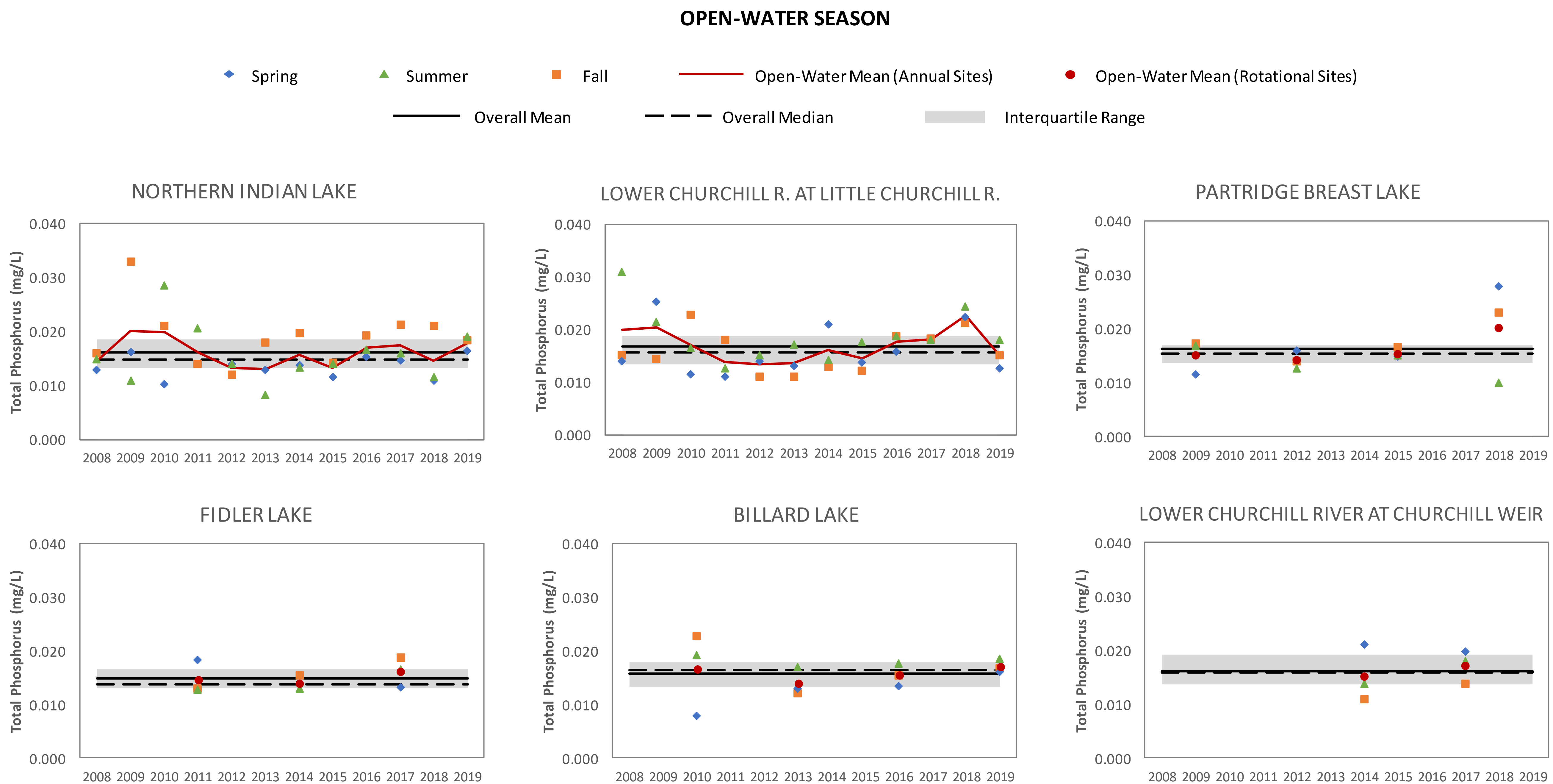


Figure 3.4-1. 2008-2019 On-system open-water season TP concentrations.

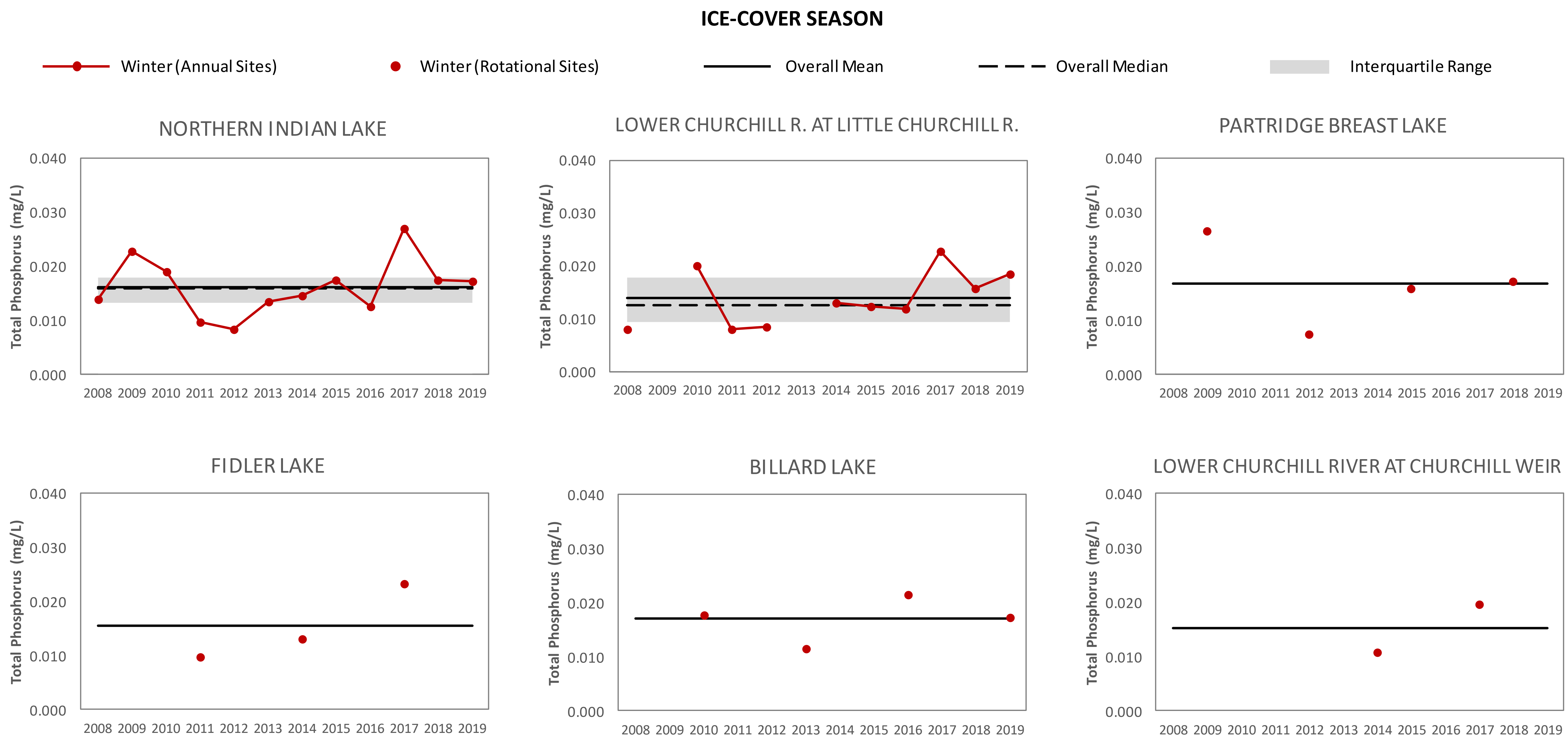
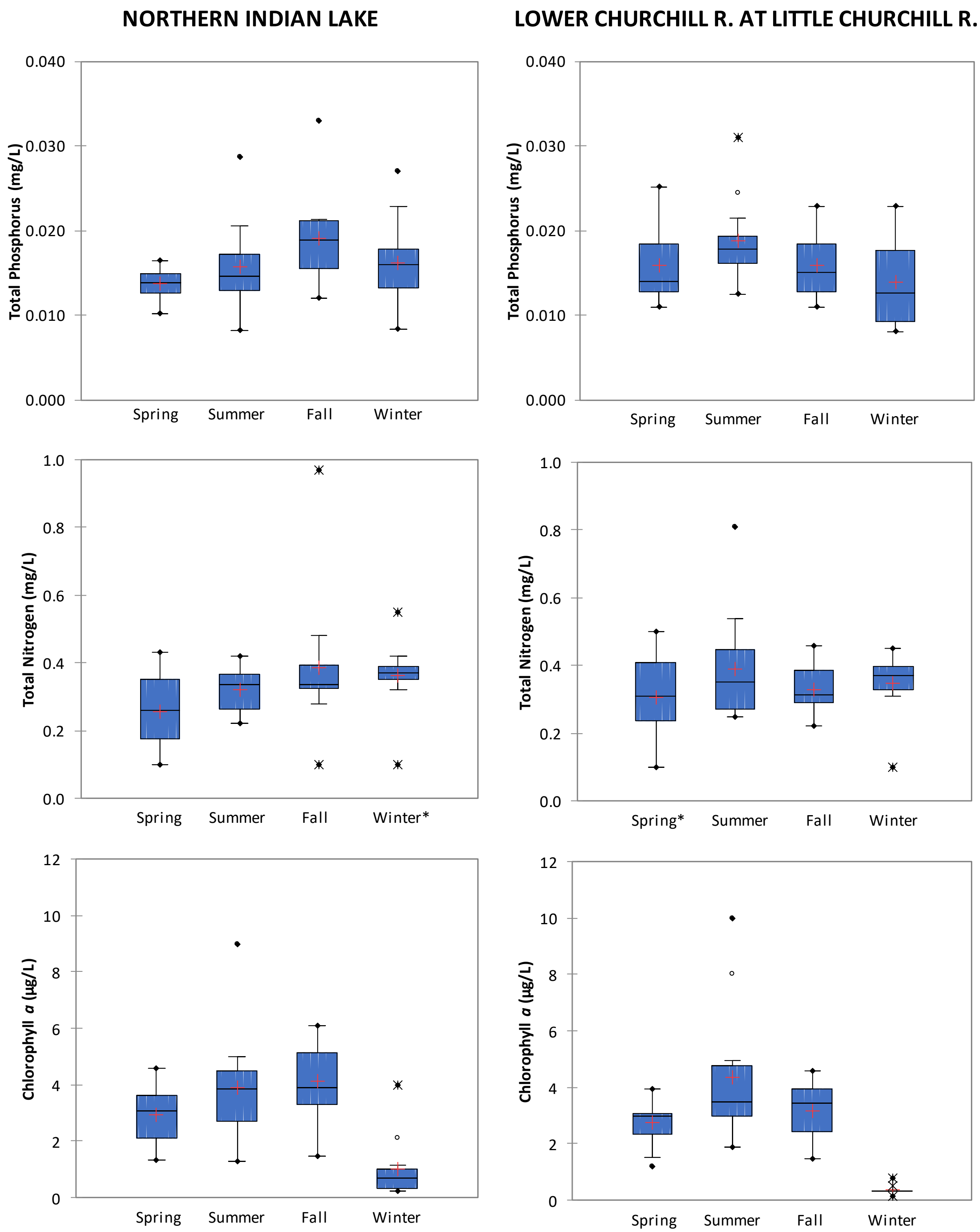


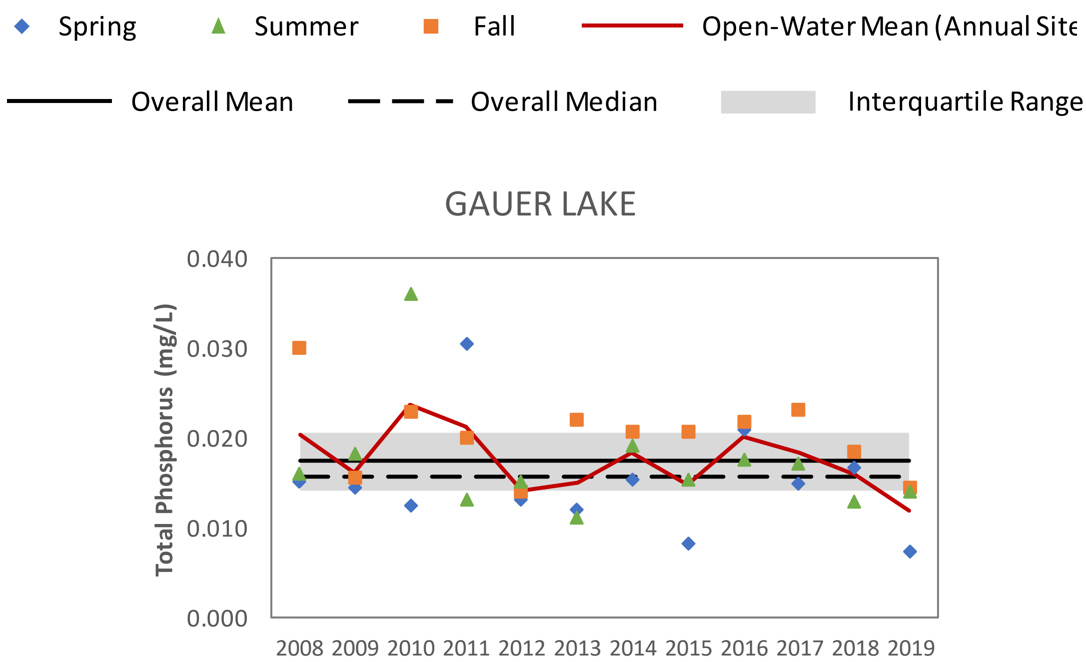
Figure 3.4-2. 2008-2019 On-system ice-cover season TP concentrations.



*Plots exclude the following suspect values: TN of 2.35 mg/L at NIL in winter 2018; and TN of 4.25 mg/L at LCR-LiCR in spring 2014.

Figure 3.4-3. 2008-2019 On-system seasonal total phosphorus, total nitrogen, and chlorophyll *a* concentrations.

OPEN-WATER SEASON



ICE-COVER SEASON

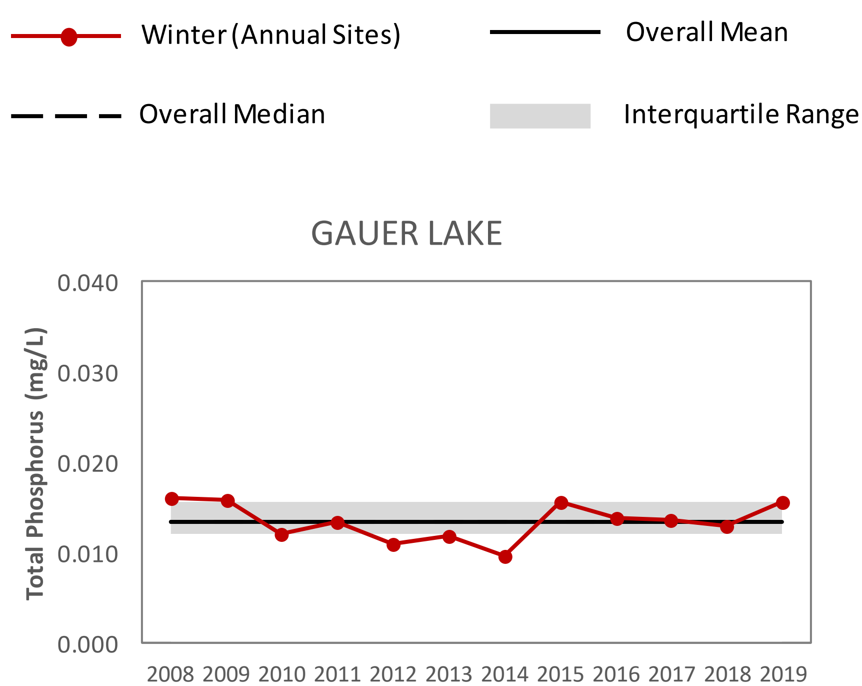


Figure 3.4-4. 2008-2019 Off-system open-water and ice-cover season TP concentrations.

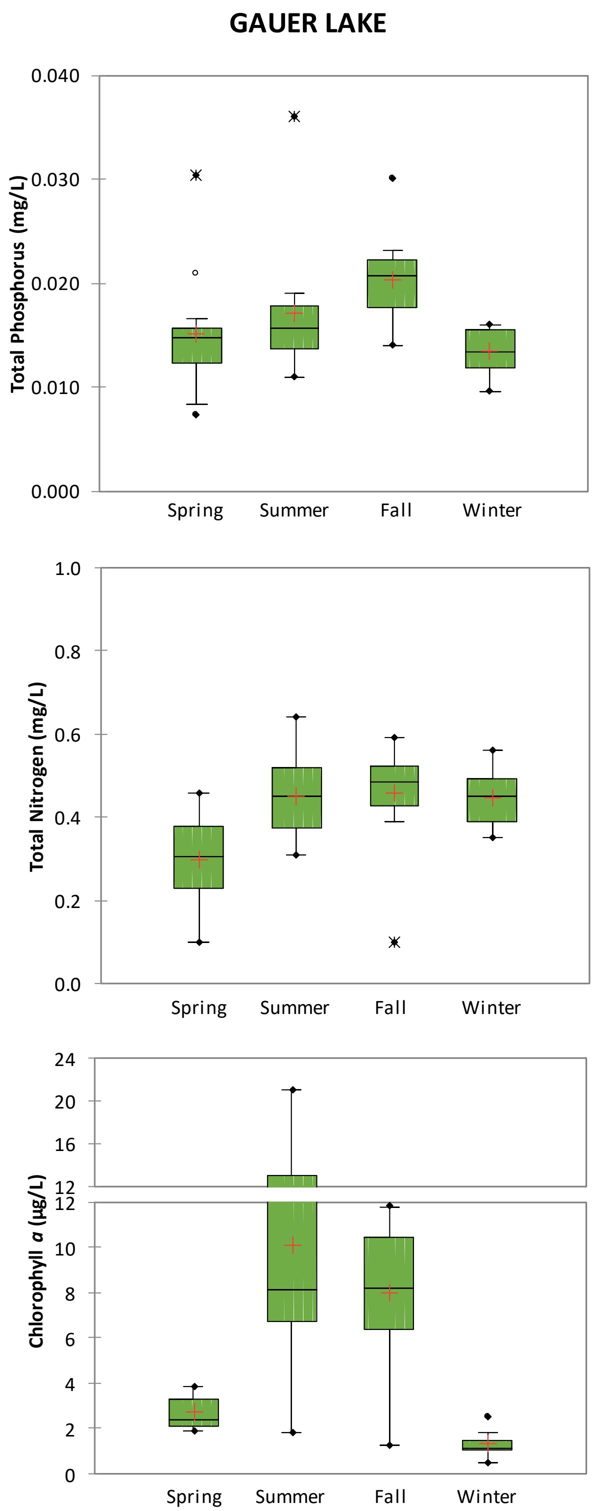


Figure 3.4-5. 2008-2019 Off-system seasonal total phosphorus, total nitrogen, and chlorophyll *a* concentrations.

3.4.2 TOTAL NITROGEN

3.4.2.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

TN concentrations in Northern Indian Lake ranged from <0.20 to 0.97 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.32 mg/L and 0.33 mg/L, respectively. Open-water season mean annual TN concentrations ranged from <0.20 to 0.53 mg/L and were within the IQR (0.25 to 0.37 mg/L) in seven of the 12 years. Mean TN concentrations were below the IQR in 2009, 2013, and 2018 and above the IQR in 2010 and 2017 (Table 3.4-1 and Figure 3.4-6).

TN concentrations in the ice-cover season ranged from <0.20 to 0.55 mg/L, with a mean of 0.36 mg/L and a median of 0.37 mg/L for the 12 years of monitoring. The IQR was 0.35 to 0.39 mg/L. TN concentrations were typically within or near the IQR but were below the IQR in 2016 and above the IQR in 2009 (Table 3.4-1 and Figure 3.4-7).[1]

No clear seasonality was observed for TN in Northern Indian Lake over the 12 years of monitoring. However, mean TN concentrations were lowest in spring (0.25 mg/L) and highest in fall (0.39 mg/L; Figure 3.4-3).

Northern Indian Lake was oligotrophic (<0.350 mg/L) based on the 2008-2019 mean open-water season TN concentration (0.32 mg/L). Mean annual TN concentrations (<0.20 to 0.53 mg/L) in the open-water season were within the oligotrophic range (i.e., <0.350 mg/L) in eight of the 12 years of monitoring. Mean TN concentrations were in the mesotrophic range (0.350 to 0.650 mg/L) in 2010, 2011, 2016, and 2017 (Table 3.4-2).

[1] A suspect value of 2.35 mg/L from winter 2018 has been excluded from the data reported for Northern Indian Lake for the ice-cover season.

Lower Churchill River at the Little Churchill River

TN concentrations in the lower Churchill River at the Little Churchill River ranged from <0.20 to 0.81 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.34 mg/L and 0.32 mg/L, respectively. Open-water season mean annual TN concentrations ranged from 0.23 to 0.55 mg/L and were within the IQR (0.26 to 0.42 mg/L) in nine of the 12 years. Mean TN concentrations were below the IQR in 2017 and above the IQR in 2008 and 2011 (Table 3.4-1 and Figure 3.4-6).[2]

TN concentrations in the ice-cover season ranged from <0.20 to 0.45 mg/L, with a mean of 0.35 mg/L and a median of 0.37 mg/L for the 10 years of monitoring. The IQR was 0.33 to 0.40 mg/L. TN concentrations were typically within or near the IQR but were below the IQR in 2016 (Table 3.4-1 and Figure 3.4-7).

No clear seasonality was observed for TN over the 12 years of monitoring. However, mean TN concentrations were lowest in spring (0.31 mg/L) and highest in summer (0.39 mg/L; Figure 3.4-3).

The lower Churchill River at the Little Churchill River was oligotrophic (<0.7 mg/L) based on the 2008-2019 mean open-water season TN concentration (0.34 mg/L). Mean annual TN concentrations (0.23 to 0.55 mg/L) in the open-water season were also within the oligotrophic range in each year of monitoring (Table 3.4-3).

ROTATIONAL SITES

Partridge Breast Lake

TN concentrations in Partridge Breast Lake ranged from <0.20 to 0.34 mg/L during the open-water season. The mean was 0.25 mg/L, the median was 0.29 mg/L, and the IQR was 0.23 to 0.30 mg/L for the four years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.21 to 0.29 mg/L and were within the IQR in three of the four years. The mean TN concentration was below the IQR in 2012 (Table 3.4-1 and Figure 3.4-6).

During the ice-cover season, TN concentrations ranged from 0.23 to 0.46 mg/L, with a mean of 0.33 mg/L (Table 3.4-1 and Figure 3.4-7).

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[2] A suspect value of 4.25 mg/L from spring 2014 has been excluded from the data reported for the lower Churchill River at the the Little Churchill River for the open-water season.

Partridge Breast Lake was oligotrophic (<0.350 mg/L) based on the mean of the open-water season TN concentrations for the four years of monitoring (0.25 mg/L). Open-water season mean annual TN concentrations (0.21 to 0.29 mg/L) were also within the oligotrophic range in each year of monitoring (Table 3.4-2).

Fidler Lake

TN concentrations in Fidler Lake ranged from 0.24 to 0.62 mg/L during the open-water season. The mean was 0.37 mg/L, the median was 0.33 mg/L, and the IQR was 0.30 to 0.40 mg/L for the three years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.28 to 0.50 mg/L and were within the IQR in 2017 but were below the IQR in 2014 and above the IQR in 2011 (Table 3.4-1 and Figure 3.4-6).[3]

During the ice-cover season, TN concentrations ranged from 0.31 to 0.36 mg/L, with a mean of 0.33 mg/L (Table 3.4-1 and Figure 3.4-7).

Fidler Lake was mesotrophic (0.350 to 0.650 mg/L) based on the mean of the open-water season TN concentrations for the three years of monitoring (0.37 mg/L). Open-water season mean annual TN concentrations (0.28 to 0.50 mg/L) were also within the mesotrophic range in 2011 but were in the oligotrophic range (i.e.,<0.350 mg/L) in 2014 and 2017 (Table 3.4-2).

Billard Lake

TN concentrations in Billard Lake ranged from <0.20 to 0.43 mg/L during the open-water season. The mean was 0.27 mg/L, the median was 0.30 mg/L, and the IQR was 0.21 to 0.34 mg/L for the four years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.21 to 0.33 mg/L and were within the IQR in all four years of monitoring (Table 3.4-1 and Figure 3.4-6).

During the ice-cover season, TN concentrations ranged from 0.28 to 0.43 mg/L, with a mean of 0.37 mg/L (Table 3.4-1 and Figure 3.4-7).

Billard Lake was oligotrophic (<0.350 mg/L) based on the mean of the open-water season TN concentrations for the four years of monitoring (0.27 mg/L). Open-water season mean annual TN

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[3] A suspect value of 0.83 mg/L from spring 2014 has been excluded from the data reported for Fidler Lake the open-water season.

concentrations (0.21 to 0.33 mg/L) were also within the oligotrophic range in each year of monitoring (Table 3.4-2).

Lower Churchill River at the Churchill Weir

TN concentrations in the lower Churchill River at the Churchill Weir ranged from <0.20 to 0.34 mg/L during the open-water season. The mean was 0.26 mg/L, the median was 0.29 mg/L, and the IQR was 0.27 to 0.31 mg/L for the two years of monitoring. Mean annual TN concentrations in the open-water season were 0.23 and 0.32 mg/L in 2017 and 2014, respectively. TN concentrations were below the IQR in 2017 and above the IQR in 2014 (Table 3.4-1 and Figure 3.4-6).[4]

During the ice-cover season, TN concentrations were 0.26 mg/L in 2014 and 0.41 mg/L in 2017 with a mean of 0.34 mg/L (Table 3.4-1 and Figure 3.4-7).

The lower Churchill River at the Churchill Weir was oligotrophic (<0.350 mg/L) based on the mean of the open-water season TN concentrations for the two years of monitoring (0.26 mg/L). Open-water season mean annual TN concentrations (0.32 and 0.23 mg/L in 2014 and 2017, respectively) were also within the oligotrophic range in both years of monitoring (Table 3.4-2).

3.4.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

TN concentrations in Gauer Lake ranged from <0.20 to 0.64 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.40 mg/L and 0.42 mg/L, respectively. Open-water season mean annual TN concentrations ranged from 0.23 to 0.51 mg/L and were within the IQR (0.32 to 0.50 mg/L) in 10 of the 12 years. Mean TN concentrations were below the IQR in 2009 and above the IQR in 2011 (Table 3.4-4 and Figure 3.4-8).

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[4] A suspect value of <0.20 mg/L from spring 2014 has been excluded from the data reported for the lower Churchill River at the Churchill Weir for the open-water season.

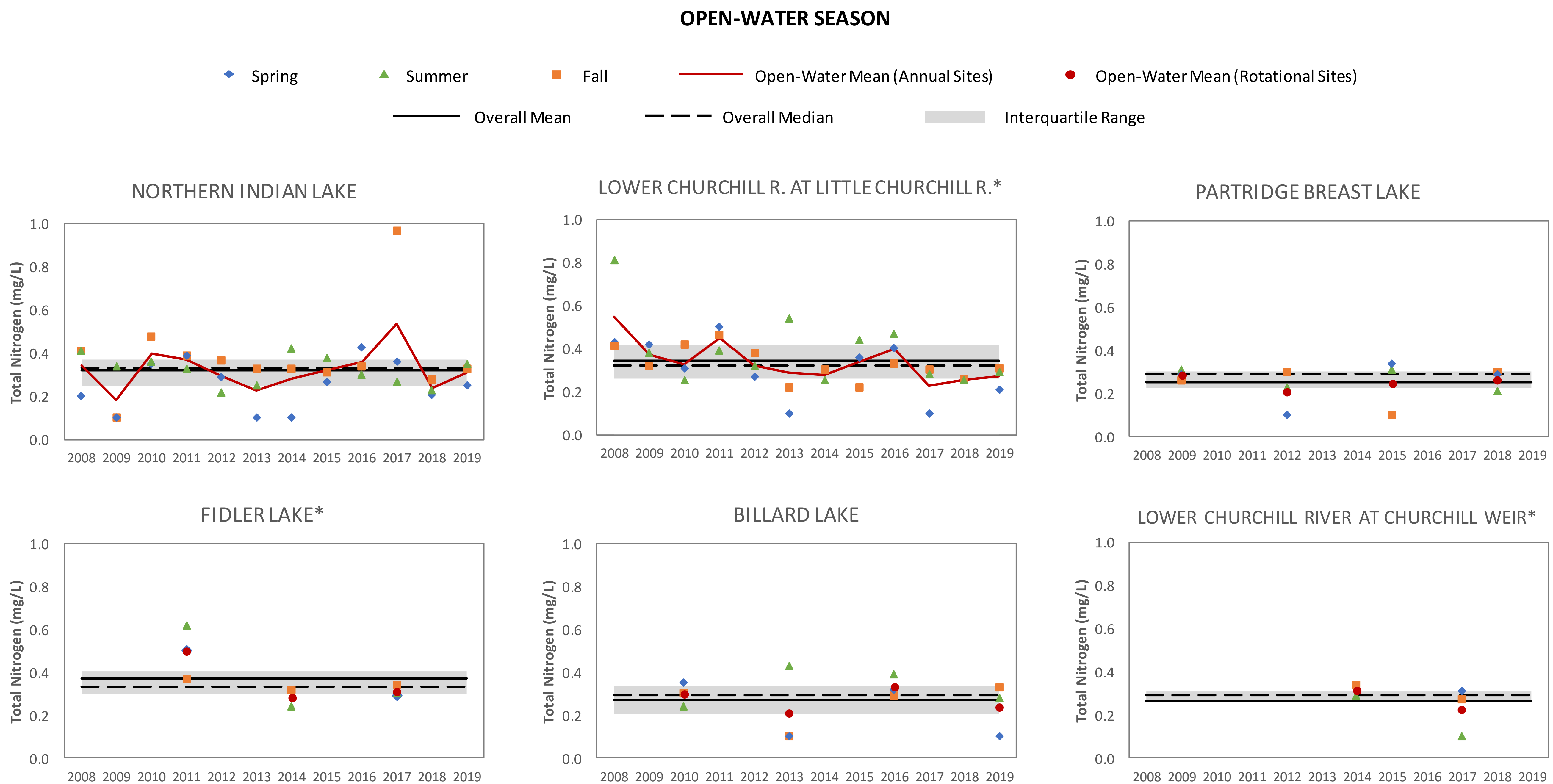
TN concentrations in the ice-cover season ranged from 0.35 to 0.56 mg/L, with both a mean and median of 0.45 mg/L for the 12 years of monitoring. The IQR was 0.39 to 0.49 mg/L (Table 3.4-4 and Figure 3.4-8).

Over the 12 years of monitoring, TN concentrations in Gauer Lake were lower in spring (mean = 0.30 mg/L) than in summer, fall, and winter (seasonal means ranged from 0.45 to 0.46 mg/L; Figure 3.4-5).

Gauer Lake was mesotrophic (0.350 to 0.650 mg/L) based on the 2008-2019 mean open-water season TN concentration (0.40 mg/L). Mean annual TN concentrations (0.23 to 0.51 mg/L) in the open-water season were within the mesotrophic range (0.350 to 0.650 mg/L) in nine of the 12 years of monitoring. Mean TN concentrations were in the oligotrophic range (<0.350 mg/L) in 2009, 2018, and 2019 (Table 3.4-5).

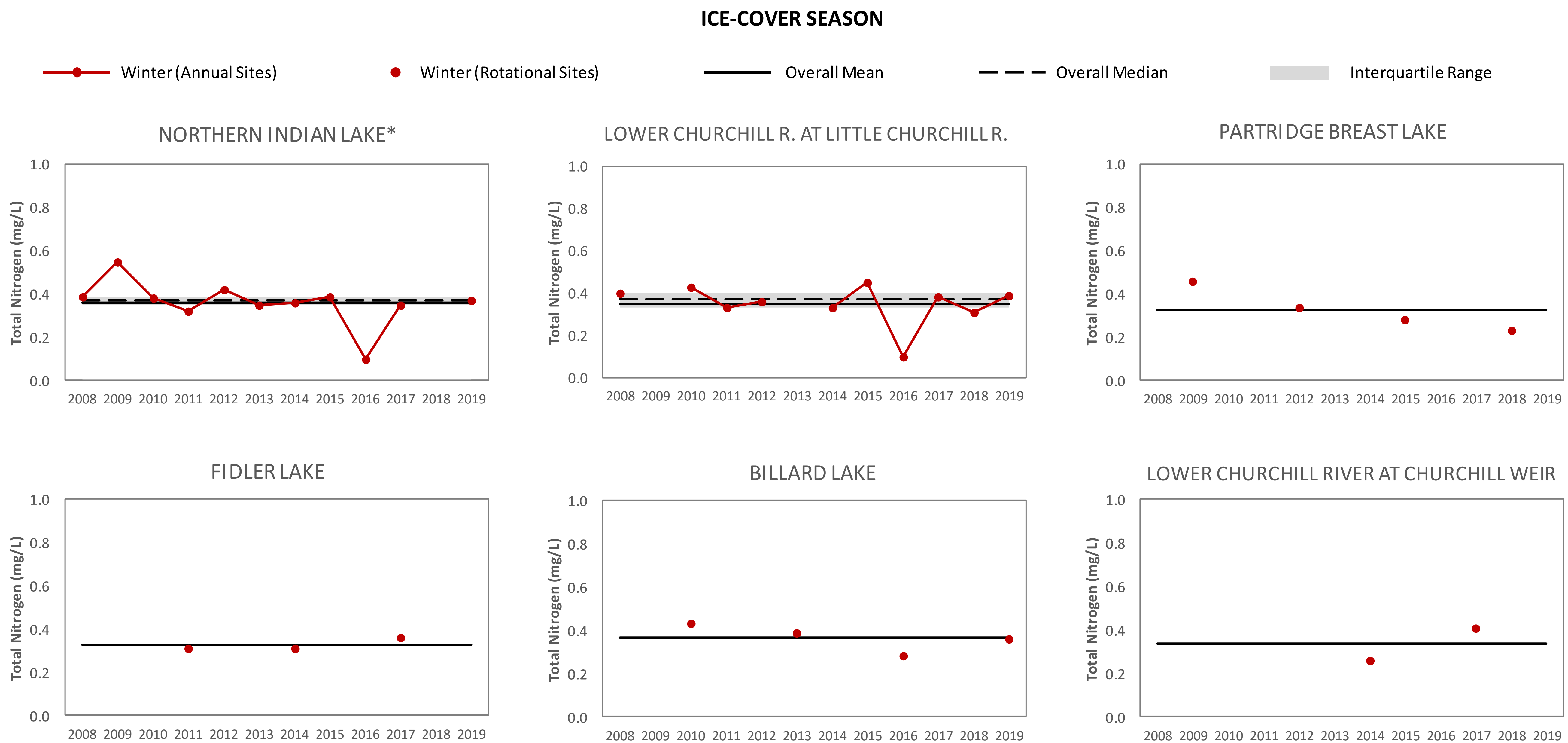
ROTATIONAL SITES

There are no off-system rotational sites in this region.



*Plots exclude the following suspect values from spring 2014: 4.25 mg/L at LCR-LiCR; 0.83 mg/L at FID; and <0.20 mg/L at LCR-WEIR.

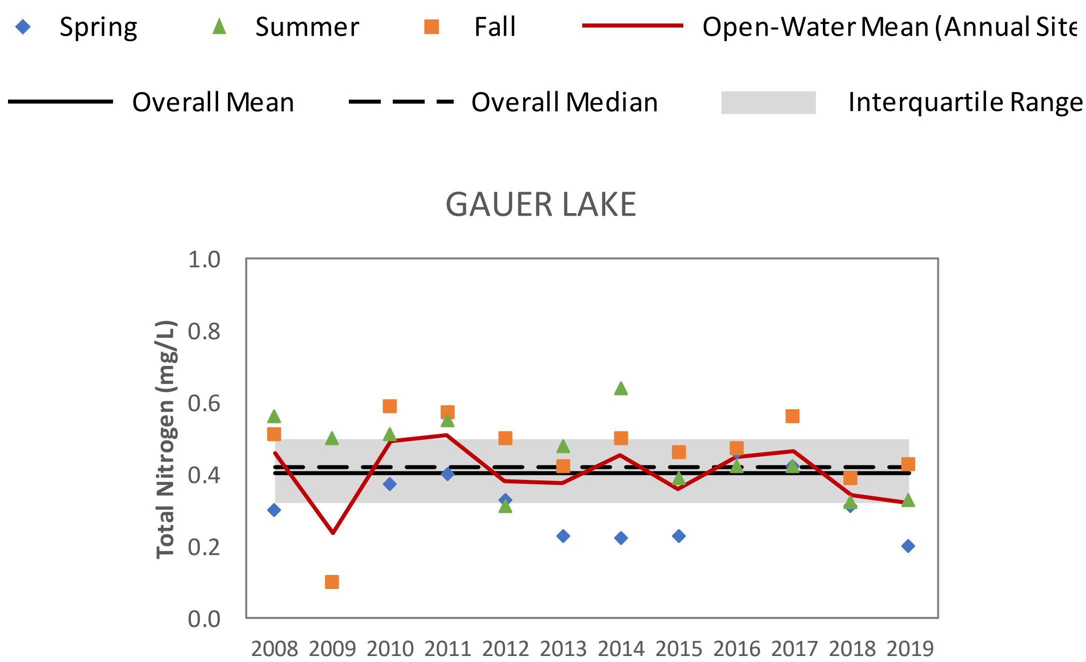
Figure 3.4-6. 2008-2019 On-system open-water season TN concentrations.



*Excludes suspect value of 2.35 mg/L at NIL from winter 2018.

Figure 3.4-7. 2008-2019 On-system ice-cover season TN concentrations

OPEN-WATER SEASON



ICE-COVER SEASON

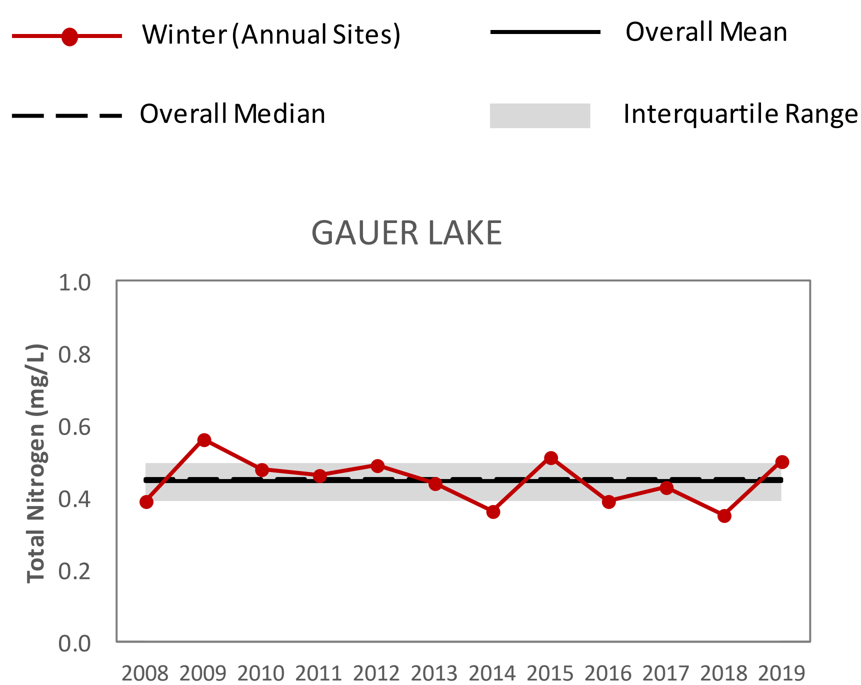


Figure 3.4-8. 2008-2019 Off-system open-water and ice-cover season TN concentrations.

3.4.3 CHLOROPHYLL *A*

3.4.3.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Chlorophyll *a* concentrations in Northern Indian Lake ranged from 1.27 to 9.00 µg/L during the open-water season. The mean and median for the 12 years of monitoring were 3.66 µg/L and 3.54 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.45 to 5.06 µg/L and were within the IQR (2.75 to 4.44 µg/L) in eight of the 12 years. Mean chlorophyll *a* concentrations were below the IQR in 2010 and above the IQR in 2008, 2013, and 2018 (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season ranged from <1.0 to 4.01 µg/L, with a mean of 1.00 µg/L and median of <1.0 µg/L for the 12 years of monitoring. The IQR was <1.0 to 1.00 µg/L. Chlorophyll *a* concentrations were typically within or near the IQR but were above the IQR in 2013 and 2014 (Table 3.4-1 and Figure 3.4-10).

Chlorophyll *a* concentrations were lower in the winter (mean = 1.00 µg/L), frequently below the DL (0.050-1.0 µg/L; percent detection = 67), compared to the open-water season (Table 3.4-1). No clear seasonality was observed within the open-water season; however, mean chlorophyll *a* concentrations during the open-water season were lowest in spring (2.95 µg/L) and highest in fall (4.12 µg/L; Figure 3.4-3).

Northern Indian Lake was mesotrophic (2.5 to 8 µg/L) based on the 2008-2019 mean open-water season chlorophyll *a* concentration (3.66 µg/L). Mean annual chlorophyll *a* concentrations (1.45 to 5.06 µg/L) in the open-water season were also within the mesotrophic range in 11 of the 12 years of monitoring. Mean chlorophyll *a* concentrations were within the oligotrophic range (<2.5 µg/L) in 2010 (Table 3.4-2).

Lower Churchill River at the Little Churchill River

Chlorophyll *a* concentrations in the lower Churchill River at the Little Churchill River ranged from 1.20 to 10.0 µg/L during the open-water season. The mean and median for the 12 years of monitoring were 3.45 µg/L and 3.05 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.89 to 5.67 µg/L and were within the IQR (2.54 to 3.95 µg/L) in six of the 12 years. Mean chlorophyll *a* concentrations were below the IQR in 2010, 2014, and 2016 and above the IQR in 2008, 2011, and 2018 (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 to 0.76 µg/L, with both a mean and median of <0.60 µg/L for the 10 years of monitoring. The IQR was below the analytical DL of 0.60 µg/L (Table 3.4-1 and Figure 3.4-10).

Chlorophyll *a* concentrations were lower in the winter (mean = <0.60 µg/L), typically below the DL (0.10-1.0 µg/L; percent detection = 20), compared to the open-water season (Table 3.4-1). No clear seasonality was observed within the open-water season; however, mean chlorophyll *a* concentrations during the open-water season were lowest in spring (2.73 µg/L) and highest in summer (4.36 µg/L; Figure 3.4-3).

The lower Churchill River at the Little Churchill River was oligotrophic (<10 µg/L) based on the 2008-2019 mean open-water season chlorophyll *a* concentration (3.45 µg/L). Mean annual chlorophyll *a* concentrations (1.89 to 5.67 µg/L) in the open-water season were also within the oligotrophic range in each year of monitoring (Table 3.4-3).

ROTATIONAL SITES

Partridge Breast Lake

Chlorophyll *a* concentrations in Partridge Breast Lake ranged from 1.50 to 11.1 µg/L during the open-water season. The mean was 4.45 µg/L, the median was 2.99 µg/L, and the IQR was 2.58 to 5.83 µg/L for the four years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 1.90 to 7.92 µg/L and were within the IQR in 2012 and 2015 but were below the IQR in 2009 and above the IQR in 2018 (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations ranged from <0.60 to 2.14 µg/L during the ice-cover season. The mean chlorophyll *a* concentration for the four years of monitoring was 0.76 µg/L. Chlorophyll *a* concentrations were below the DL (0.050-0.60 µg/L) in two of the four years of monitoring (percent detection = 50; Table 3.4-1 and Figure 3.4-10).

Partridge Breast Lake was mesotrophic (2.5 to 8 µg/L) based on the mean of the open-water season chlorophyll *a* concentrations for the four years of monitoring (4.45 µg/L). Open-water season mean annual chlorophyll *a* concentrations (1.90 to 7.92 µg/L) were also within the mesotrophic range in three of the four years of monitoring. The exception was 2009 when the mean chlorophyll *a* concentration was within the oligotrophic range (<2.5 µg/L; Table 3.4-2).

Fidler Lake

Chlorophyll *a* concentrations in Fidler Lake ranged from <0.60 to 4.58 µg/L during the open-water season. The mean was 2.72 µg/L, the median was 2.86 µg/L, and the IQR was 1.91 to 3.44 µg/L for the three years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 2.05 to 3.44 µg/L and were within the IQR in all three years of monitoring (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations ranged from <0.60 to 2.48 µg/L during the ice-cover season. The mean chlorophyll *a* concentration for the three years of monitoring was 1.03 µg/L. Chlorophyll *a* concentrations were below the DL (0.60 µg/L) in two of the three years of monitoring (percent detection = 33; Table 3.4-1 and Figure 3.4-10).

Fidler Lake was mesotrophic (2.5 to 8 µg/L) based on the mean of the open-water season chlorophyll *a* concentrations for the three years of monitoring (2.72 µg/L). Open-water season mean annual chlorophyll *a* concentrations (2.05 to 3.44 µg/L) were also within the mesotrophic range in 2011 and 2017 but was within the oligotrophic range (<2.5 µg/L) in 2014 (Table 3.4-2).

Billard Lake

Chlorophyll *a* concentrations in Billard Lake ranged from 1.72 to 5.46 µg/L during the open-water season. The mean was 3.23 µg/L, the median was 3.09 µg/L, and the IQR was 2.67 to 3.54 µg/L for the four years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 2.80 to 3.74 µg/L and were within the IQR in three of the four years of monitoring. The mean chlorophyll *a* concentration was above the IQR in 2010 (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations ranged from <0.60 to 2.48 µg/L during the ice-cover season. The mean chlorophyll *a* concentration for the four years of monitoring was 1.12 µg/L. Chlorophyll *a* concentrations were below the DL (0.10-0.60 µg/L) in two of the four years of monitoring (percent detection = 50; Table 3.4-1 and Figure 3.4-10).

Billard Lake was mesotrophic (2.5 to 8 µg/L) based on the mean of the open-water season chlorophyll *a* concentrations for the four years of monitoring (3.23 µg/L). Open-water season mean annual chlorophyll *a* concentrations (2.80 to 3.74 µg/L) were also within the mesotrophic range in each year of monitoring (Table 3.4-2).

Lower Churchill River at the Churchill Weir

Chlorophyll *a* concentrations in the lower Churchill River at the Churchill Weir ranged from 1.34 to 3.05 µg/L during the open-water season. The mean was 2.27 µg/L, the median was 2.29 µg/L, and the IQR was 1.72 to 2.92 µg/L for the two years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season were 2.04 and 2.51 µg/L in 2017 and 2014, respectively, and were within the IQR in both years of monitoring (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season were consistently below the DL (0.60 µg/L) in both years of monitoring (Table 3.4-1 and Figure 3.4-10).

The lower Churchill River at the Churchill Weir was oligotrophic (<2.5 µg/L) based on the mean of the open-water season chlorophyll *a* concentrations for the two years of monitoring (2.27 µg/L). Open-water season mean annual chlorophyll *a* concentrations were also within the oligotrophic range in 2017 (2.04 µg/L) but were within the mesotrophic range (2.5 to 8.5 µg/L) in 2014 (2.51 µg/L; Table 3.4-2).

3.4.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Chlorophyll *a* concentrations in Gauer Lake ranged from 1.24 to 21.0 µg/L during the open-water season. The mean and median for the 12 years of monitoring were 6.93 µg/L and 6.44 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.70 to 12.0 µg/L and were within the IQR (3.11 to 9.26 µg/L) in eight of the 12 years. Mean chlorophyll *a* concentrations were below the IQR in 2010 and above the 2008, 2011, and 2014 (Table 3.4-4 and Figure 3.4-11).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 to 2.48 µg/L, with a mean of 1.30 µg/L and median of 1.15 µg/L for the 12 years of monitoring. The IQR was 1.08 to 1.46 µg/L (Table 3.4-3 and Figure 3.4-11).

On average, chlorophyll *a* concentrations were lower in spring and winter (2.70 and 1.30 µg/L, respectively) than in summer and fall (10.1 and 7.99 µg/L, respectively) over the 12 years of monitoring (Figure 3.4-5).

Gauer Lake was mesotrophic (<2.5 to 8 µg/L) based on the 2008-2019 mean open-water season chlorophyll *a* concentration (6.93 µg/L). Mean annual chlorophyll *a* concentrations (1.70 to 12.0 µg/L) in the open-water season were also within the mesotrophic range in eight of the 12 years of monitoring. Mean annual chlorophyll *a* concentrations were within the oligotrophic range (<2.5 µg/L) in 2010 and within the eutrophic range (8 to 25 µg/L) in 2008, 2011, and 2014 (Table 3.4-4).

ROTATIONAL SITES

There are no off-system rotational sites in this region.

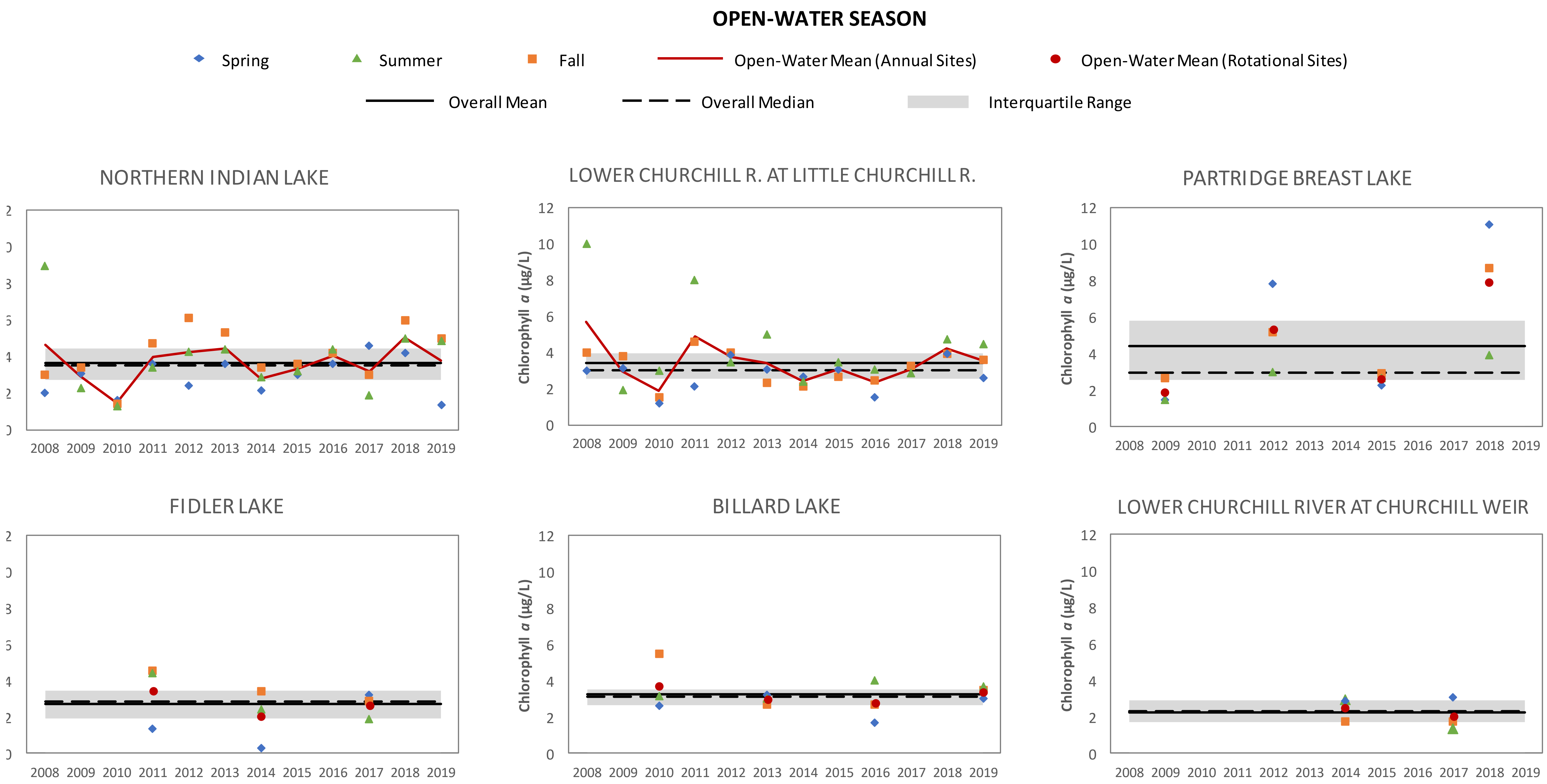


Figure 3.4-9. 2008-2019 On-system open-water season chlorophyll *a* concentrations.

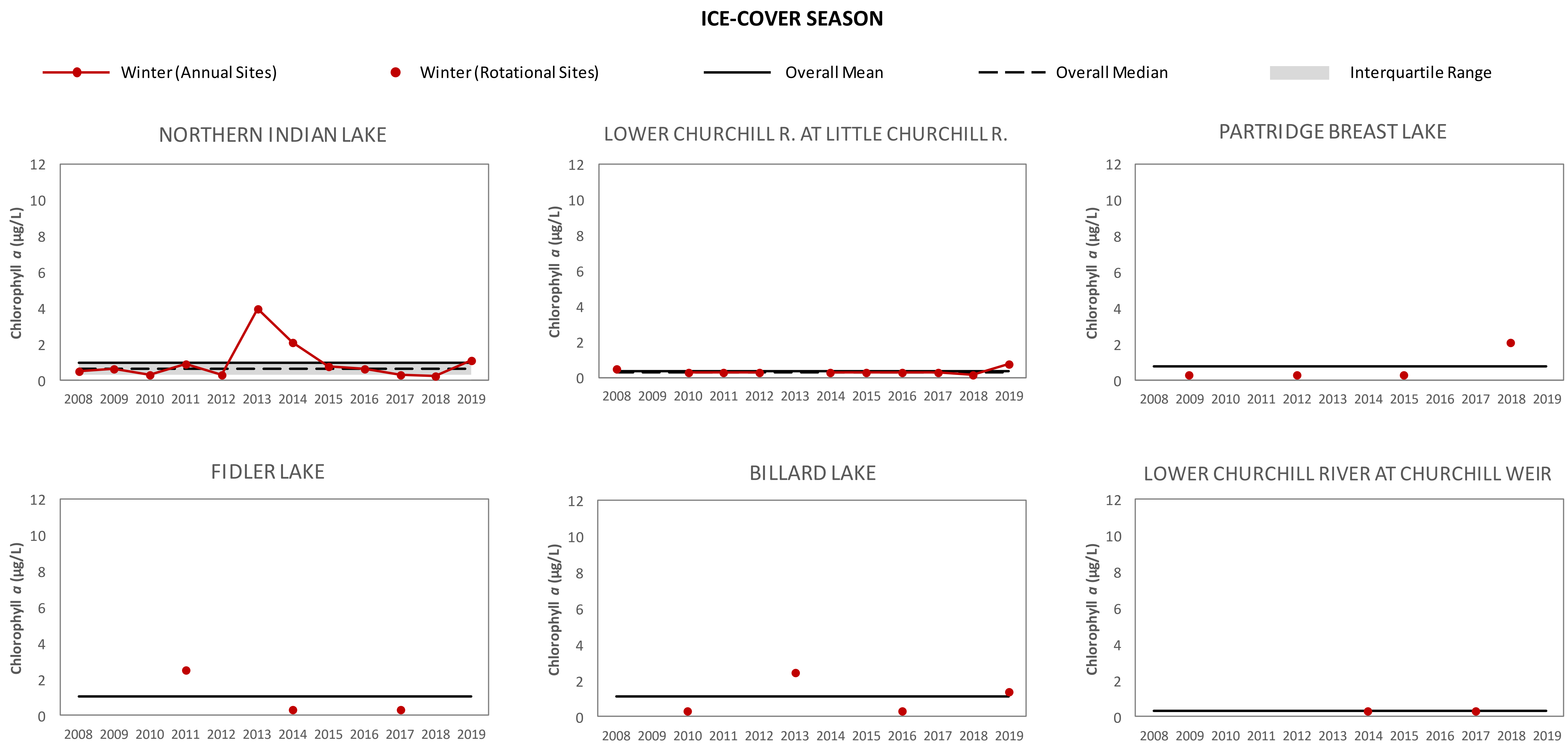
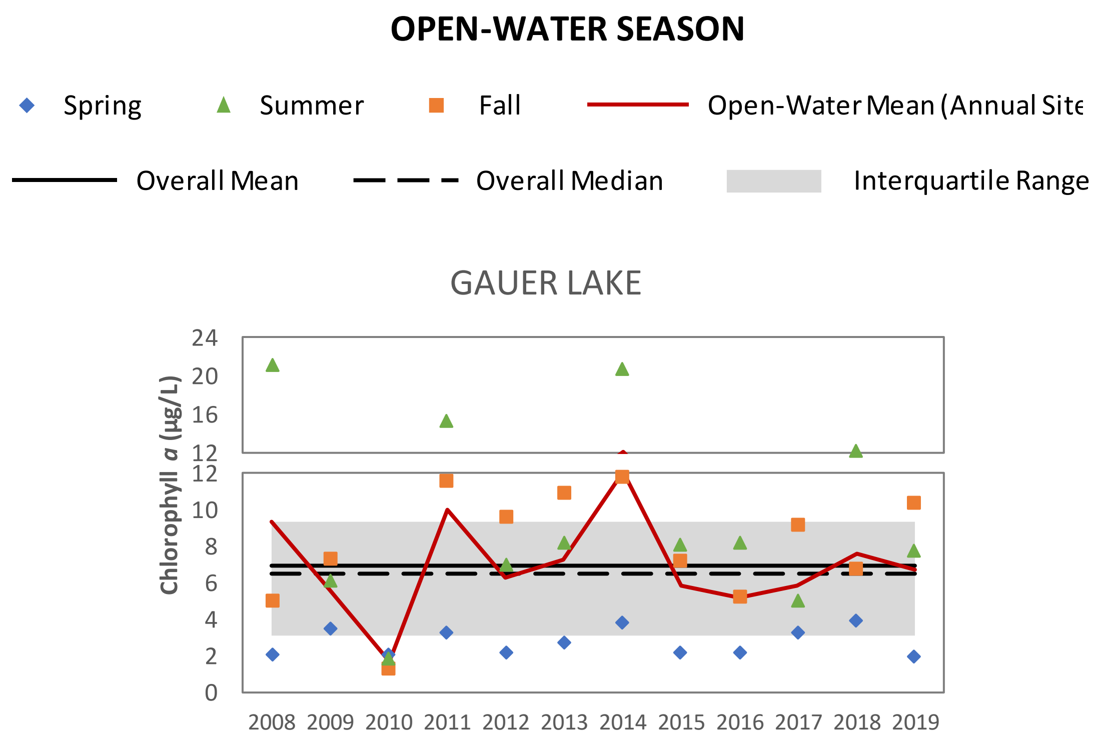


Figure 3.4-10. 2008-2019 On-system ice-cover season chlorophyll *a* concentrations.



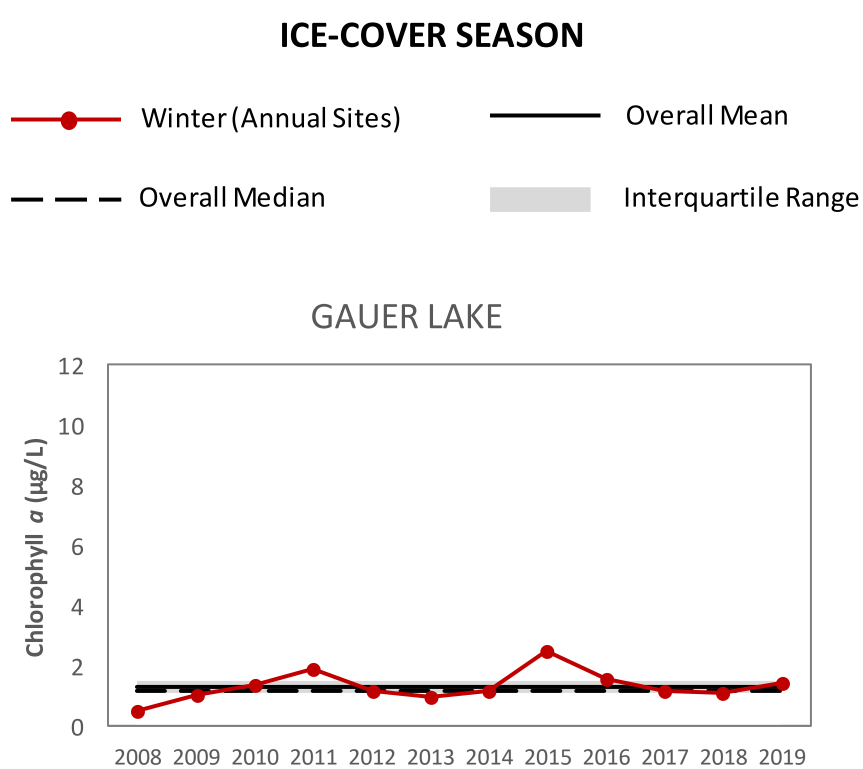


Figure 3.4-11. 2008-2019 Off-system open-water and ice-cover season chlorophyll *a* concentrations.

APPENDIX 3-1. WATER QUALITY SAMPLING SITES: 2008-2019

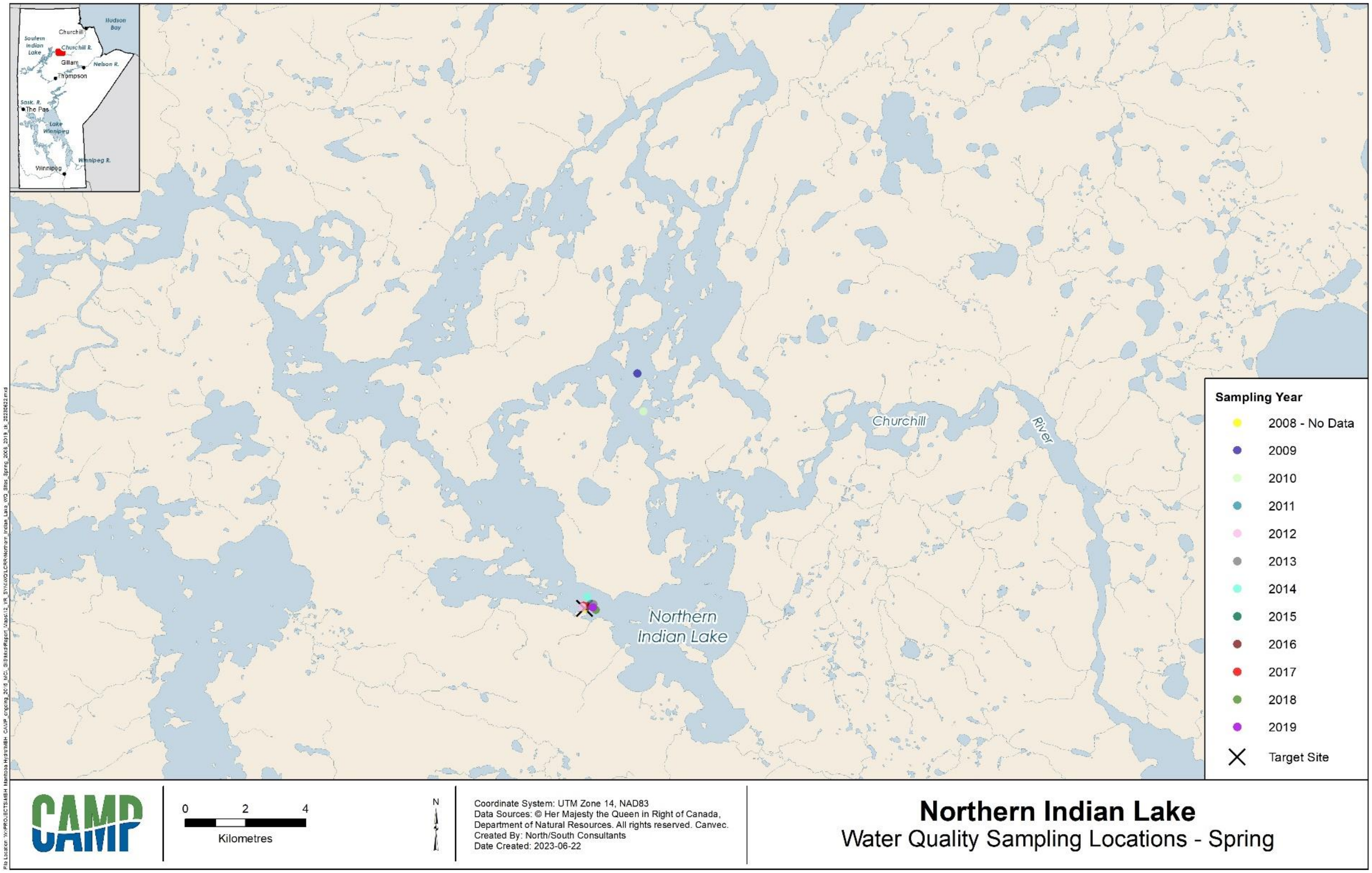


Figure A3-1-1. Spring water quality sampling locations: Northern Indian Lake.

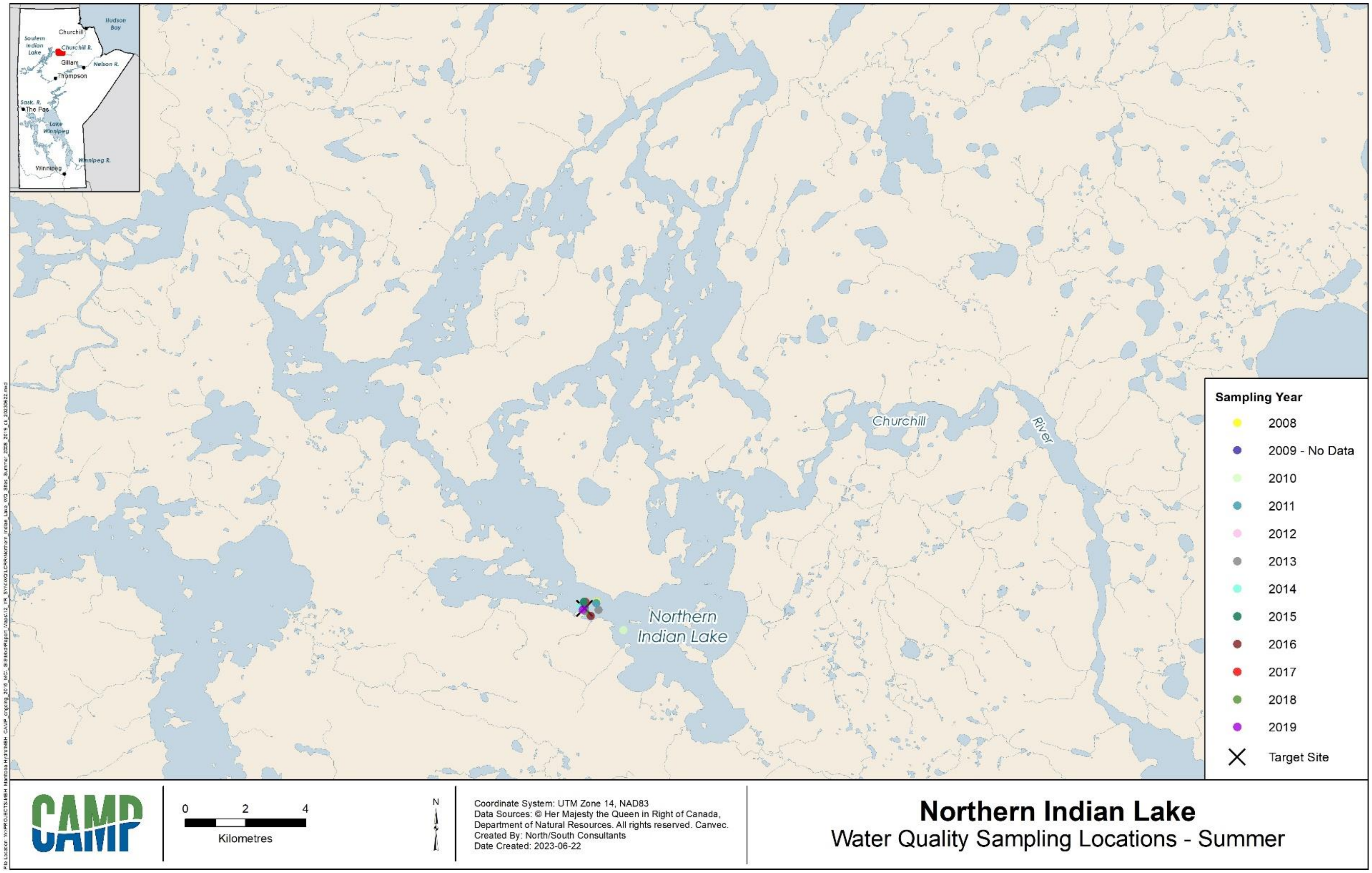


Figure A3-1-2. Summer water quality sampling locations: Northern Indian Lake.

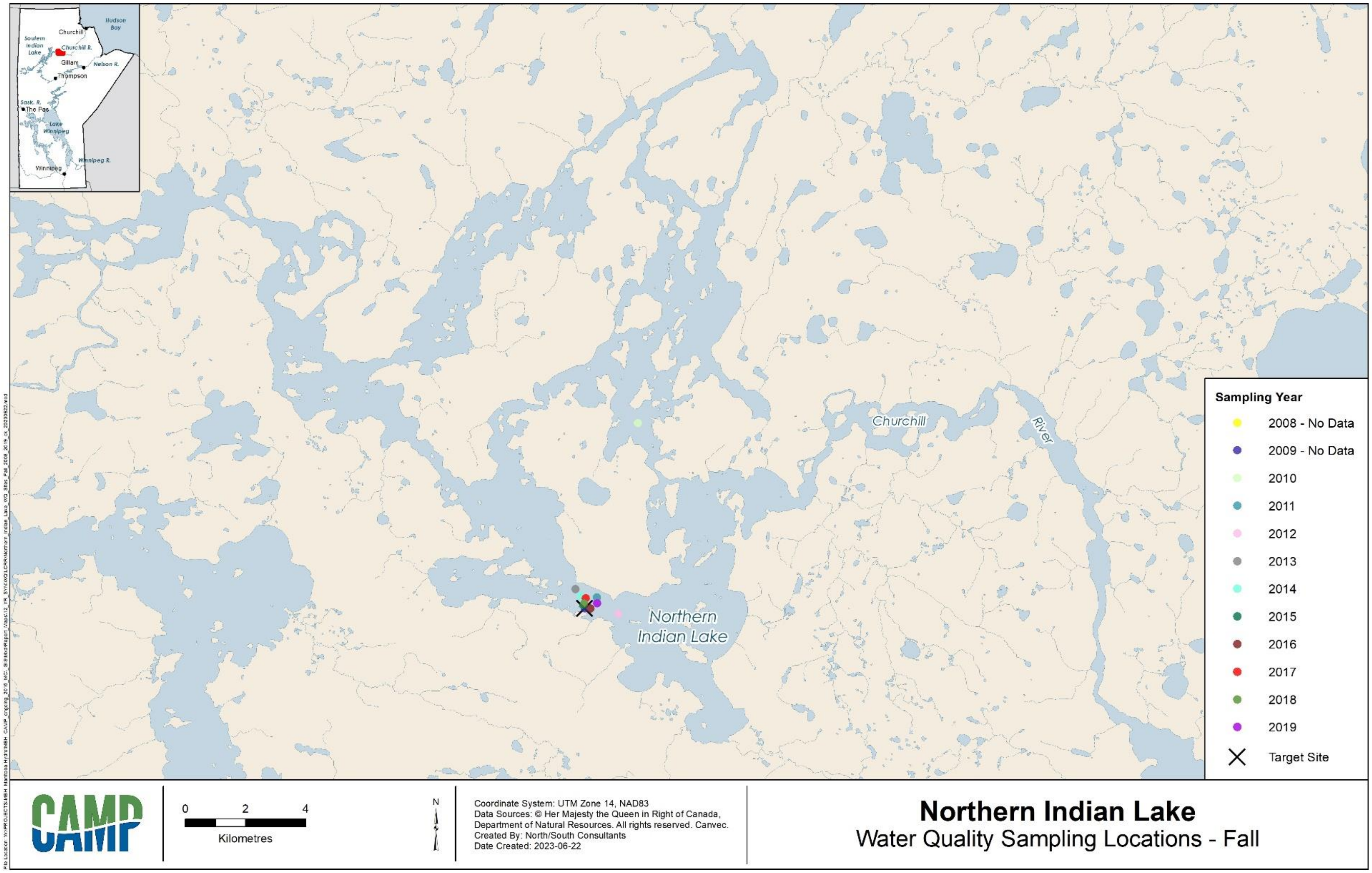


Figure A3-1-3. Fall water quality sampling locations: Northern Indian Lake.

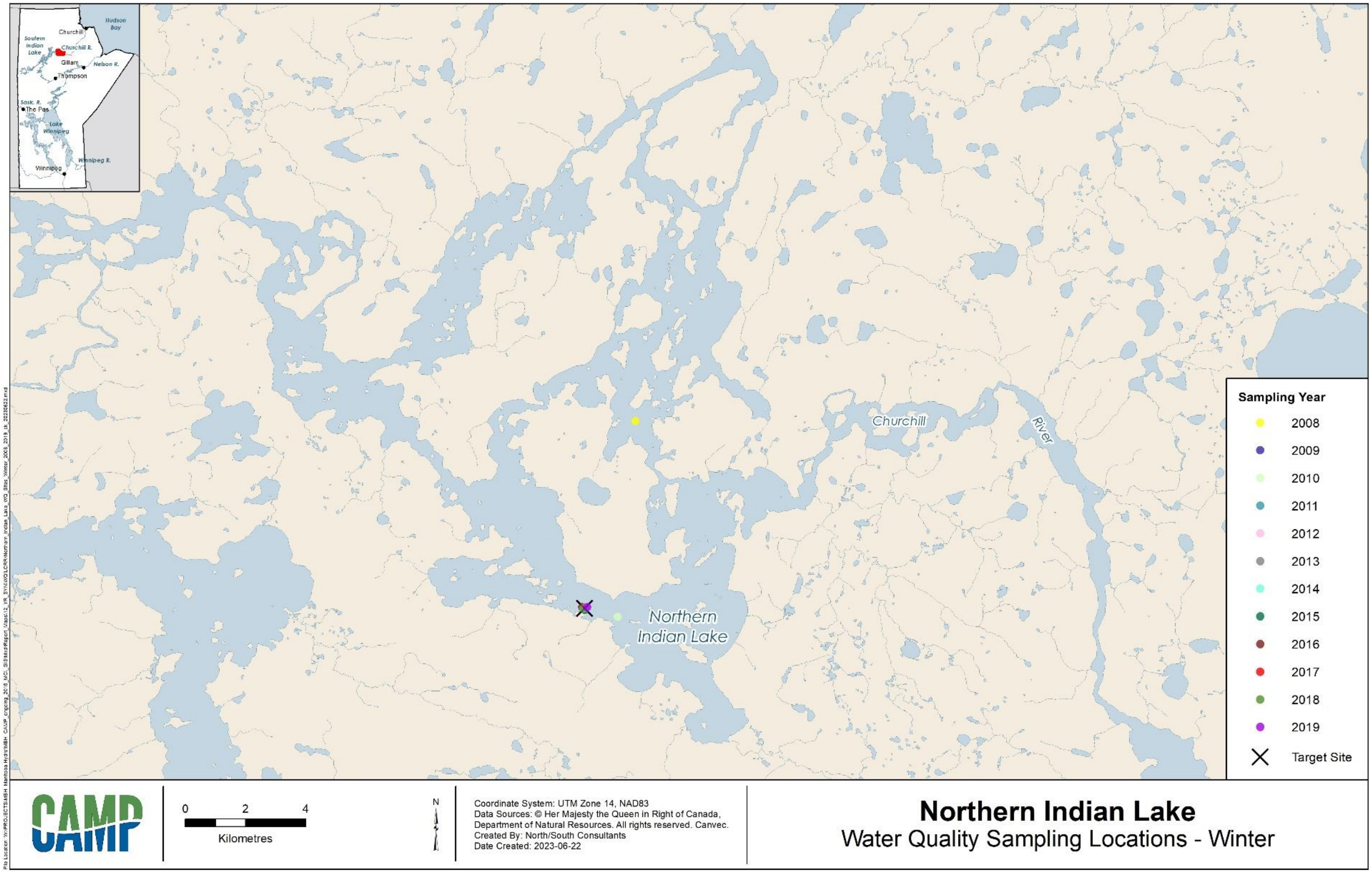


Figure A3-1-4. Winter water quality sampling locations: Northern Indian Lake.

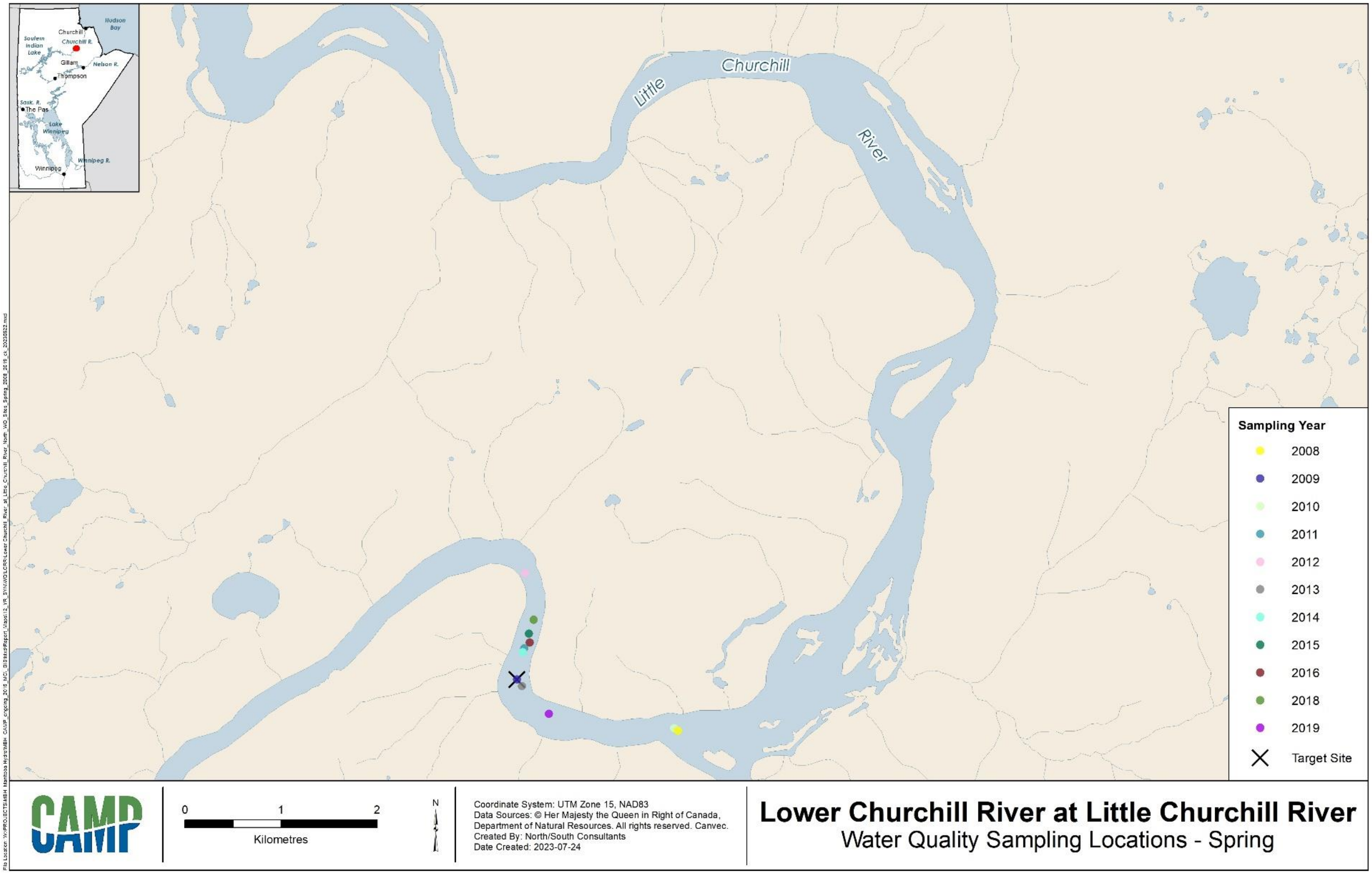


Figure A3-1-5. Spring water quality sampling locations: The lower Churchill at the Little Churchill River.

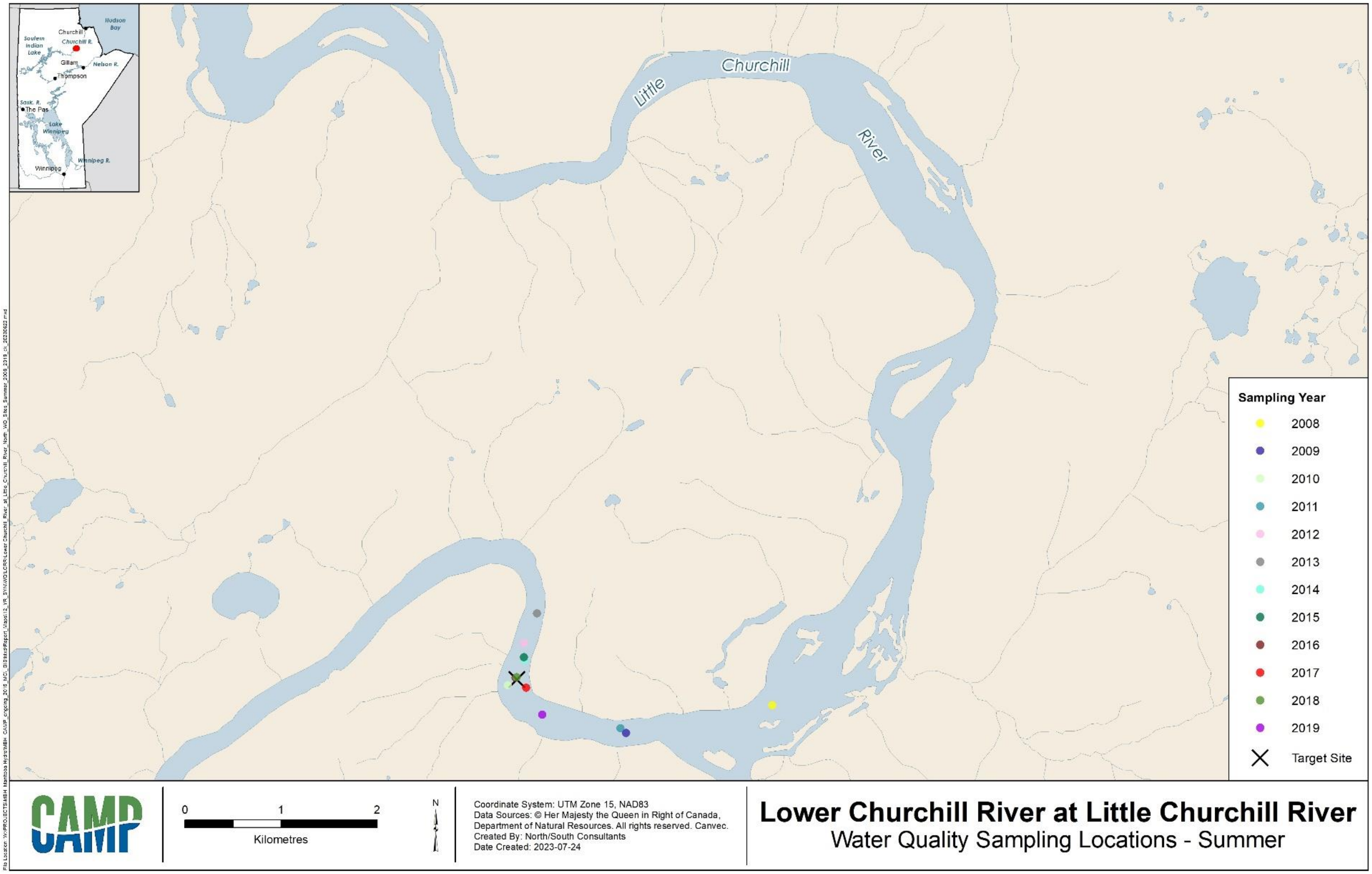


Figure A3-1-6. Summer water quality sampling locations: The lower Churchill at the Little Churchill River.

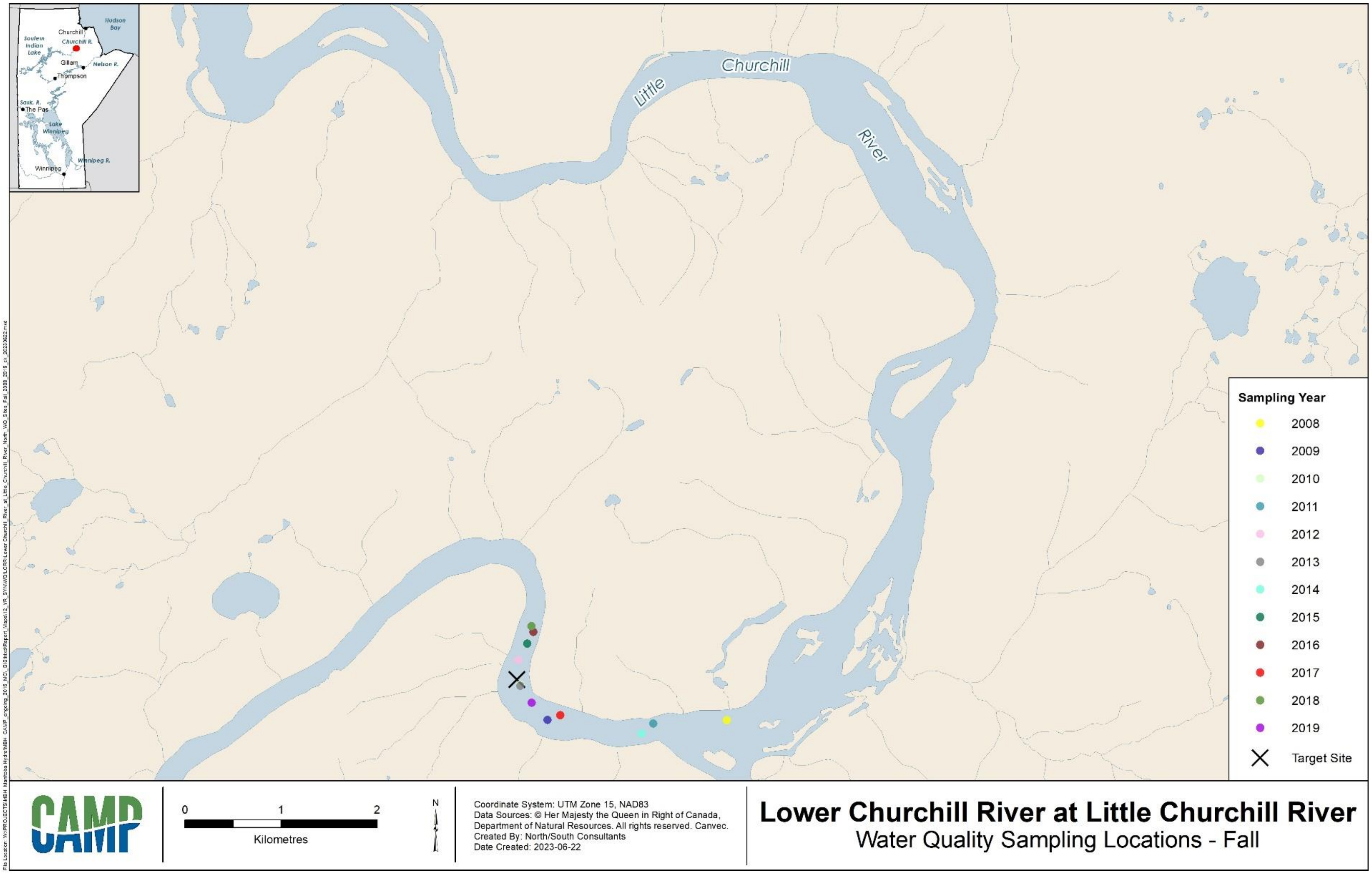


Figure A3-1-7. Fall water quality sampling locations: The lower Churchill at the Little Churchill River.

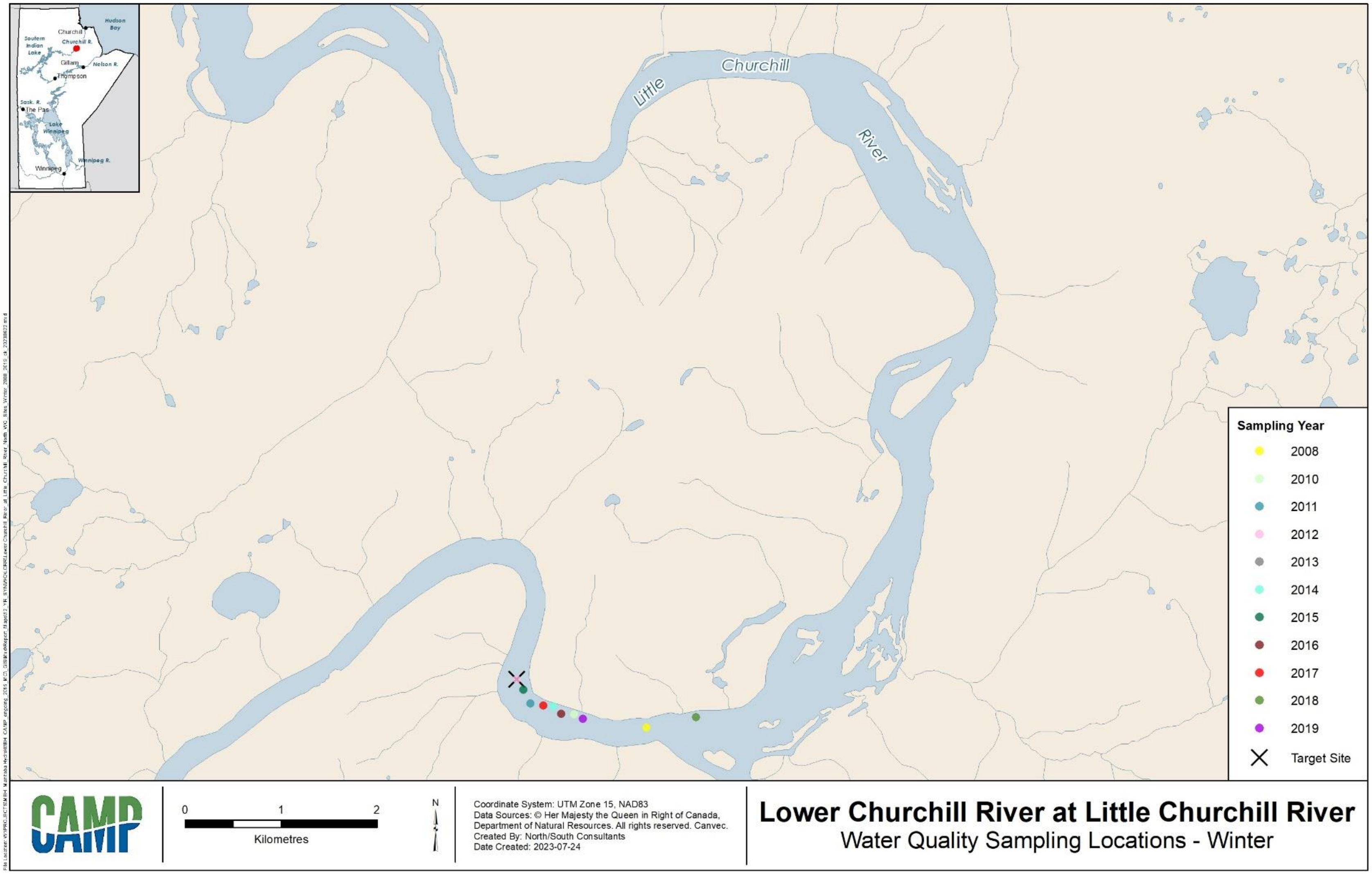


Figure A3-1-8. Winter water quality sampling locations: The lower Churchill at the Little Churchill River.

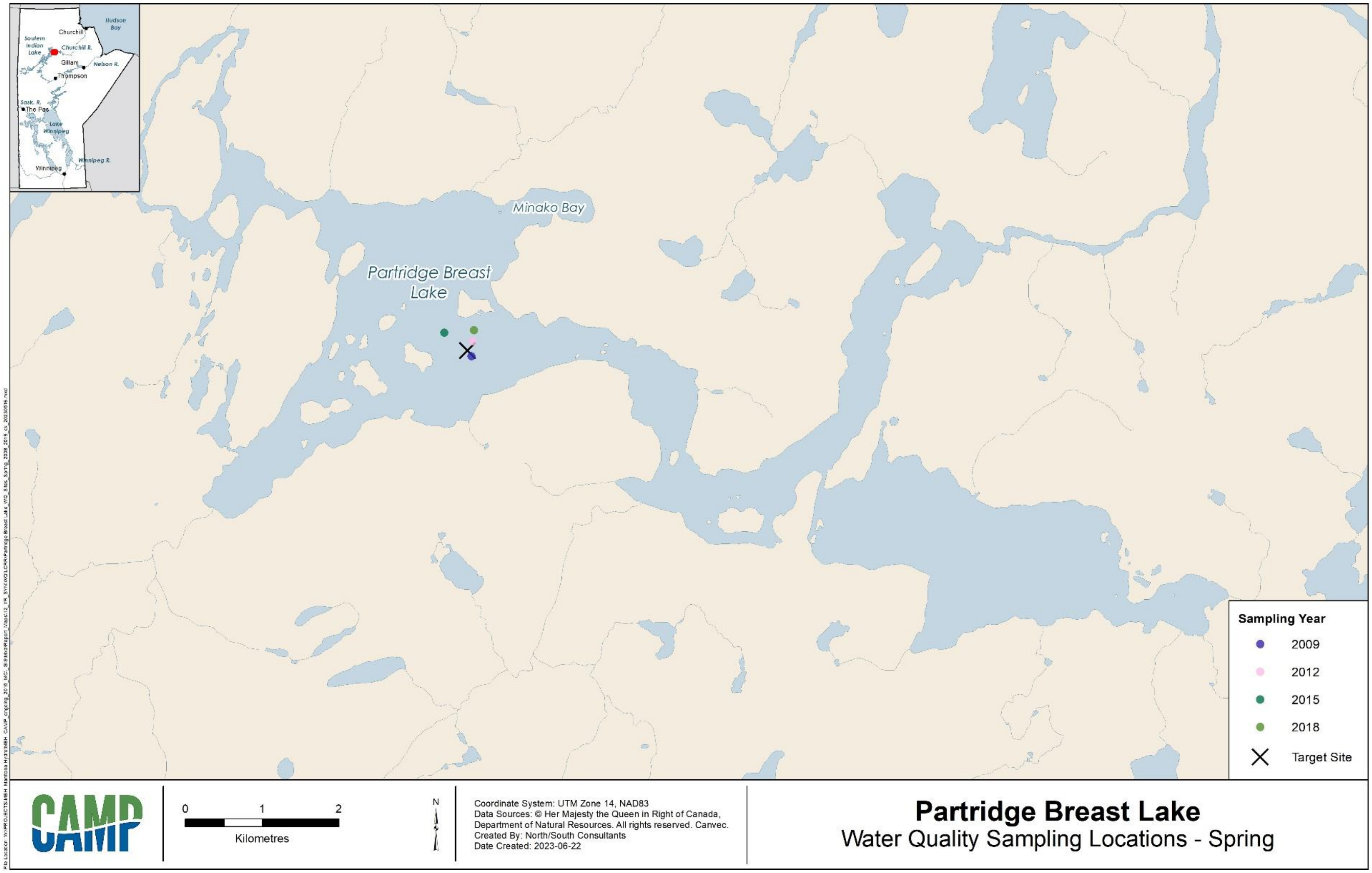


Figure A3-1-9. Spring water quality sampling locations: Partridge Breast Lake.

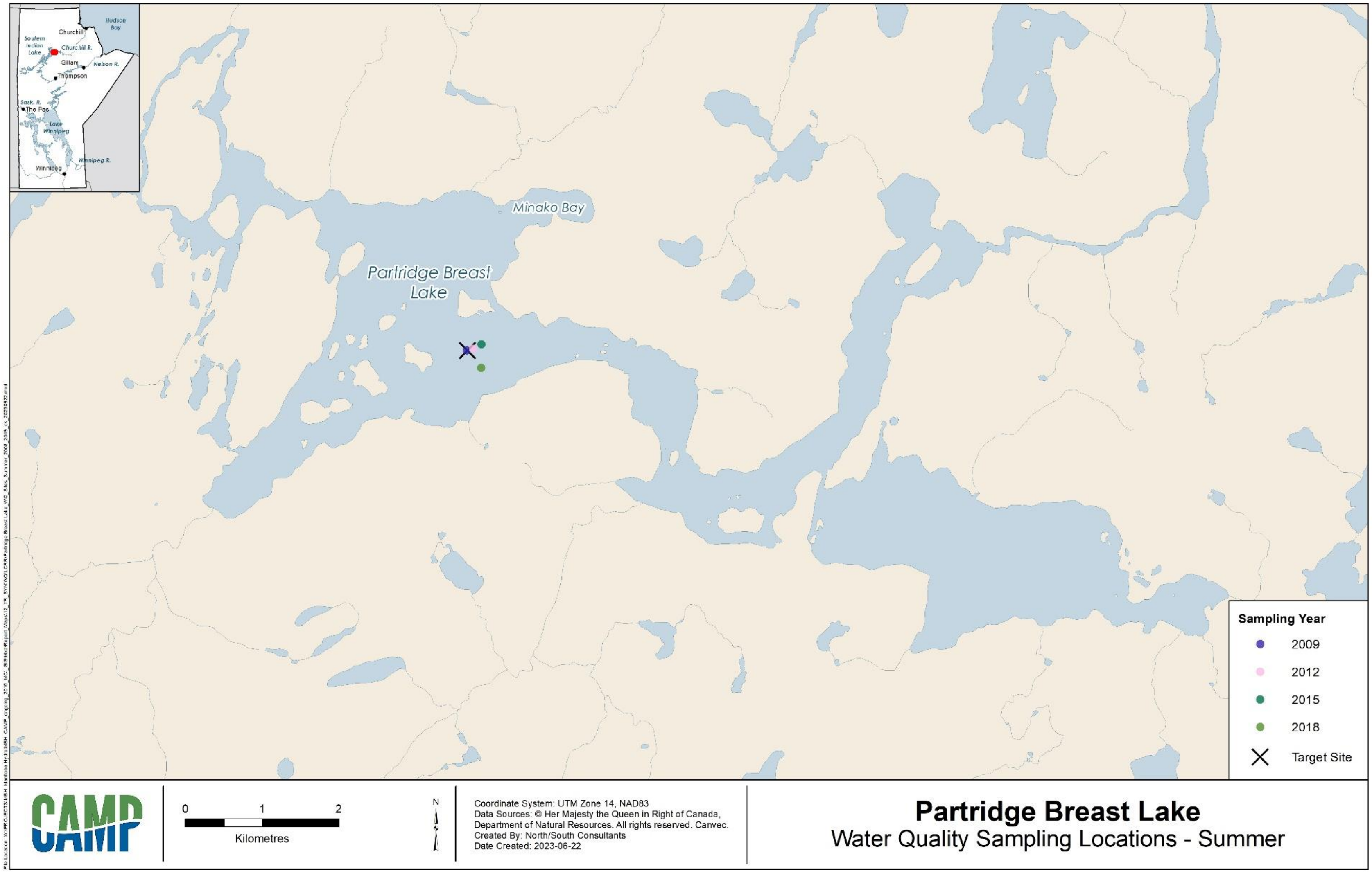


Figure A3-1-10. Summer water quality sampling locations: Partridge Breast Lake.

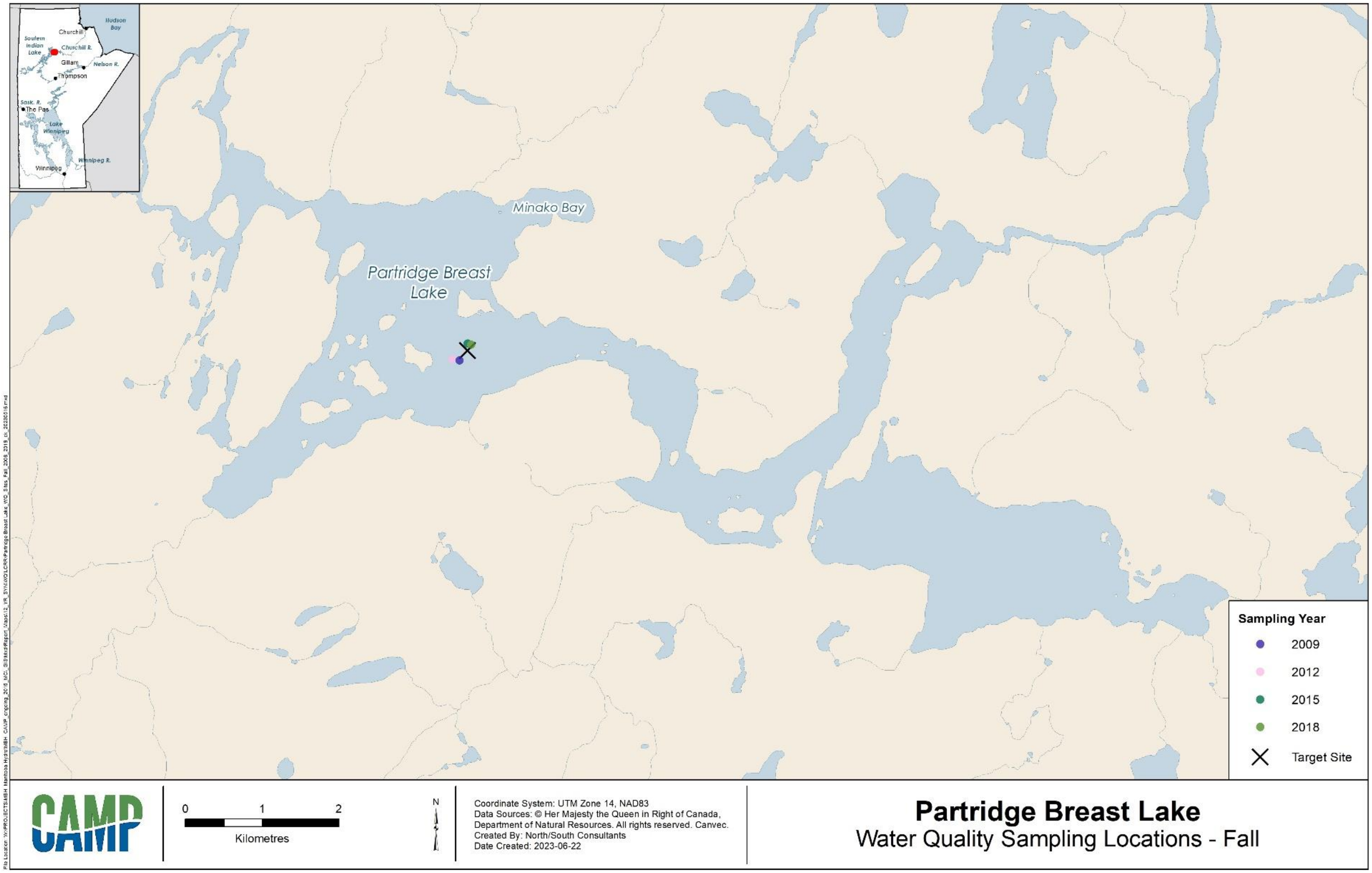


Figure A3-1-11. Fall water quality sampling locations: Partridge Breast Lake.

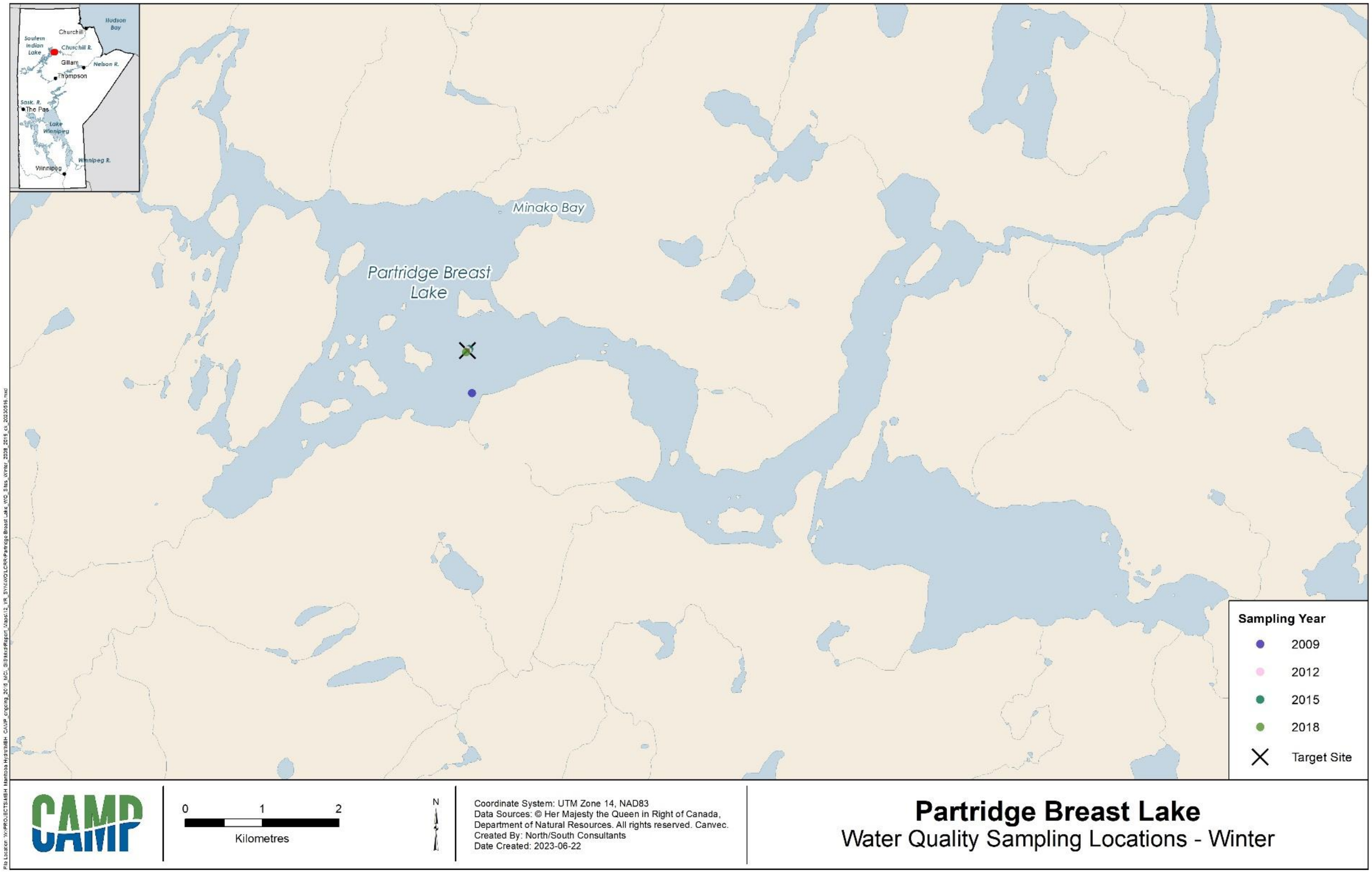


Figure A3-1-12. Winter water quality sampling locations: Partridge Breast Lake.

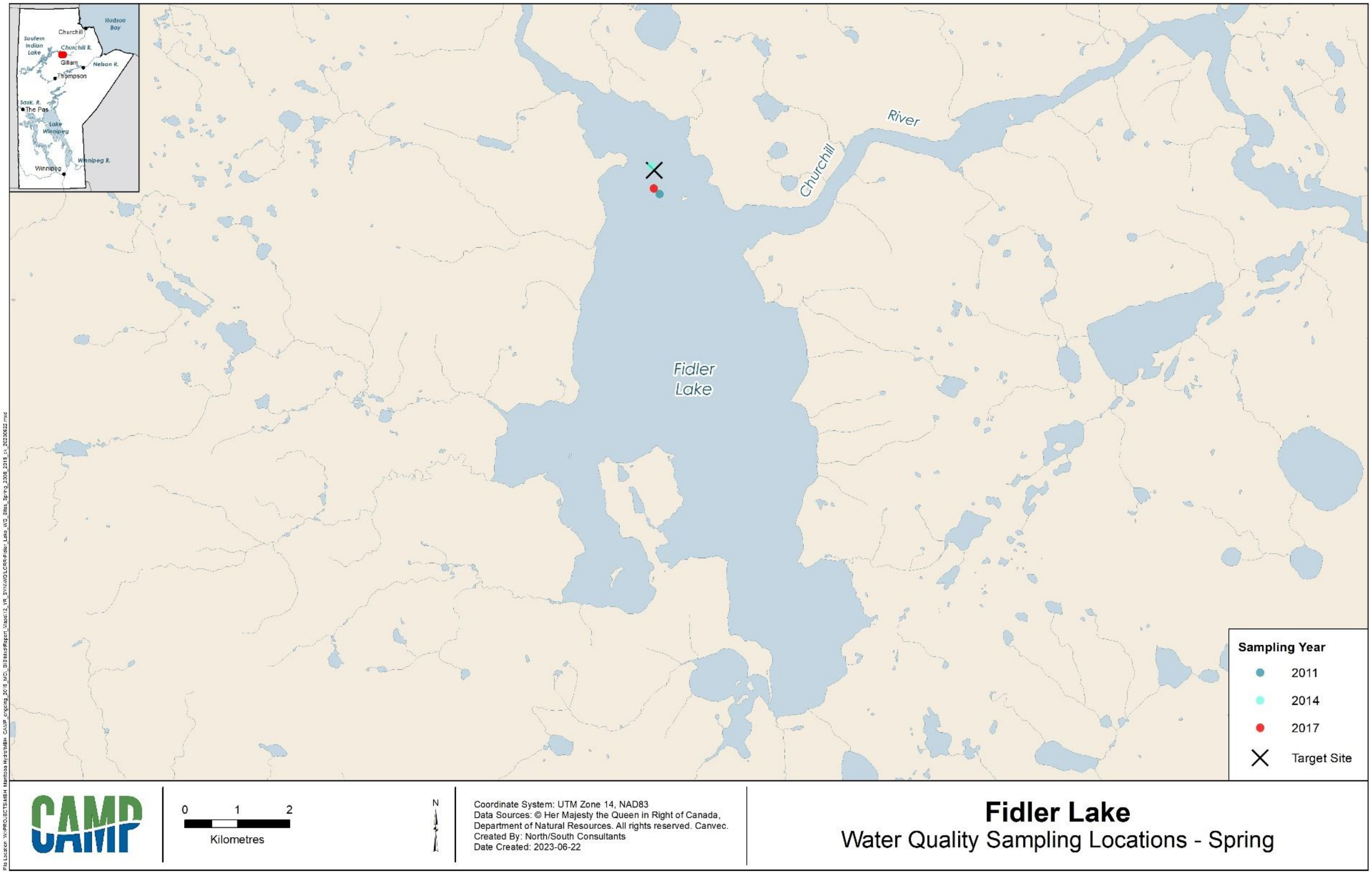


Figure A3-1-13. Spring water quality sampling locations: Fidler Lake.

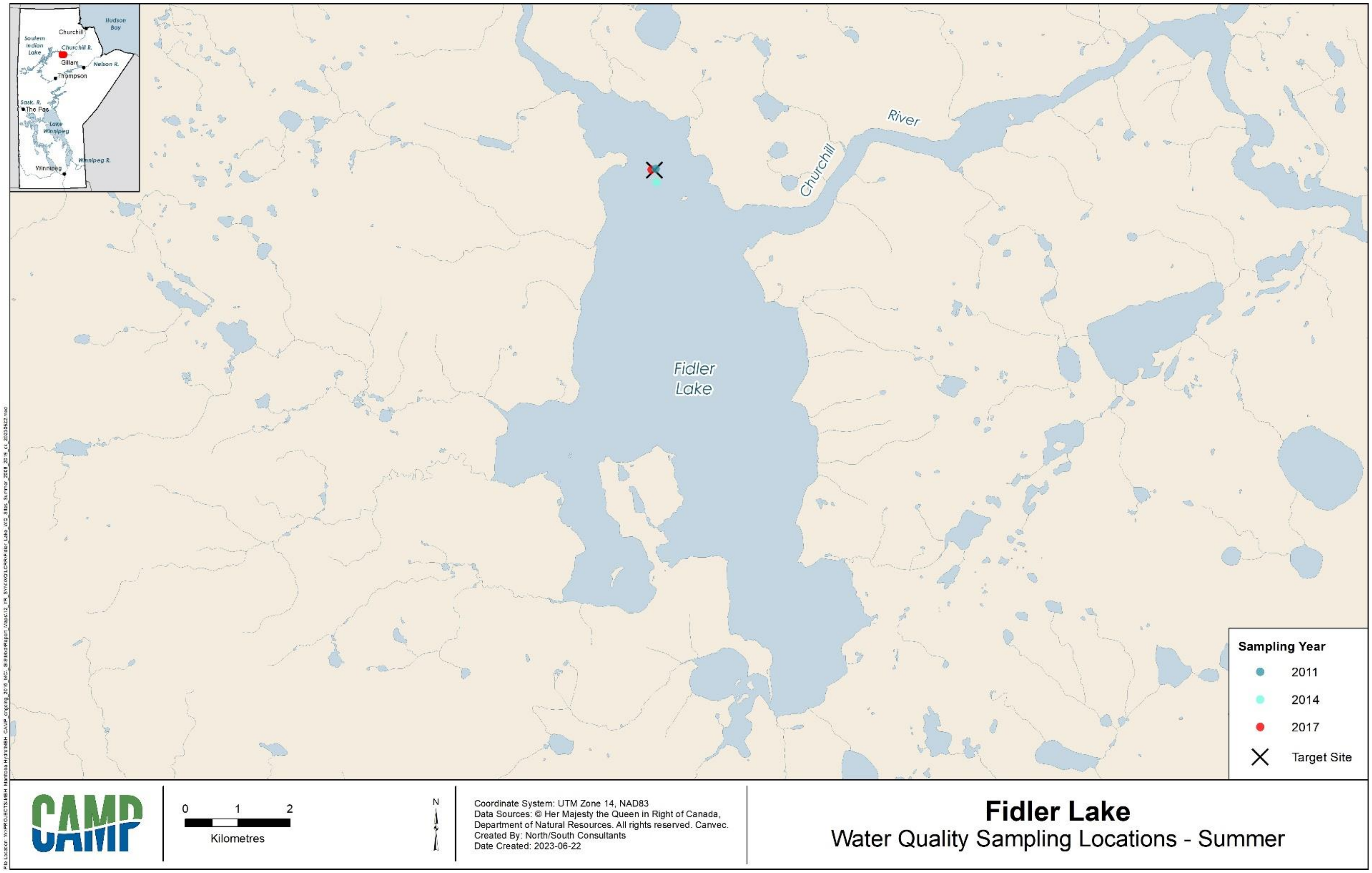


Figure A3-1-14. Summer water quality sampling locations: Fidler Lake.

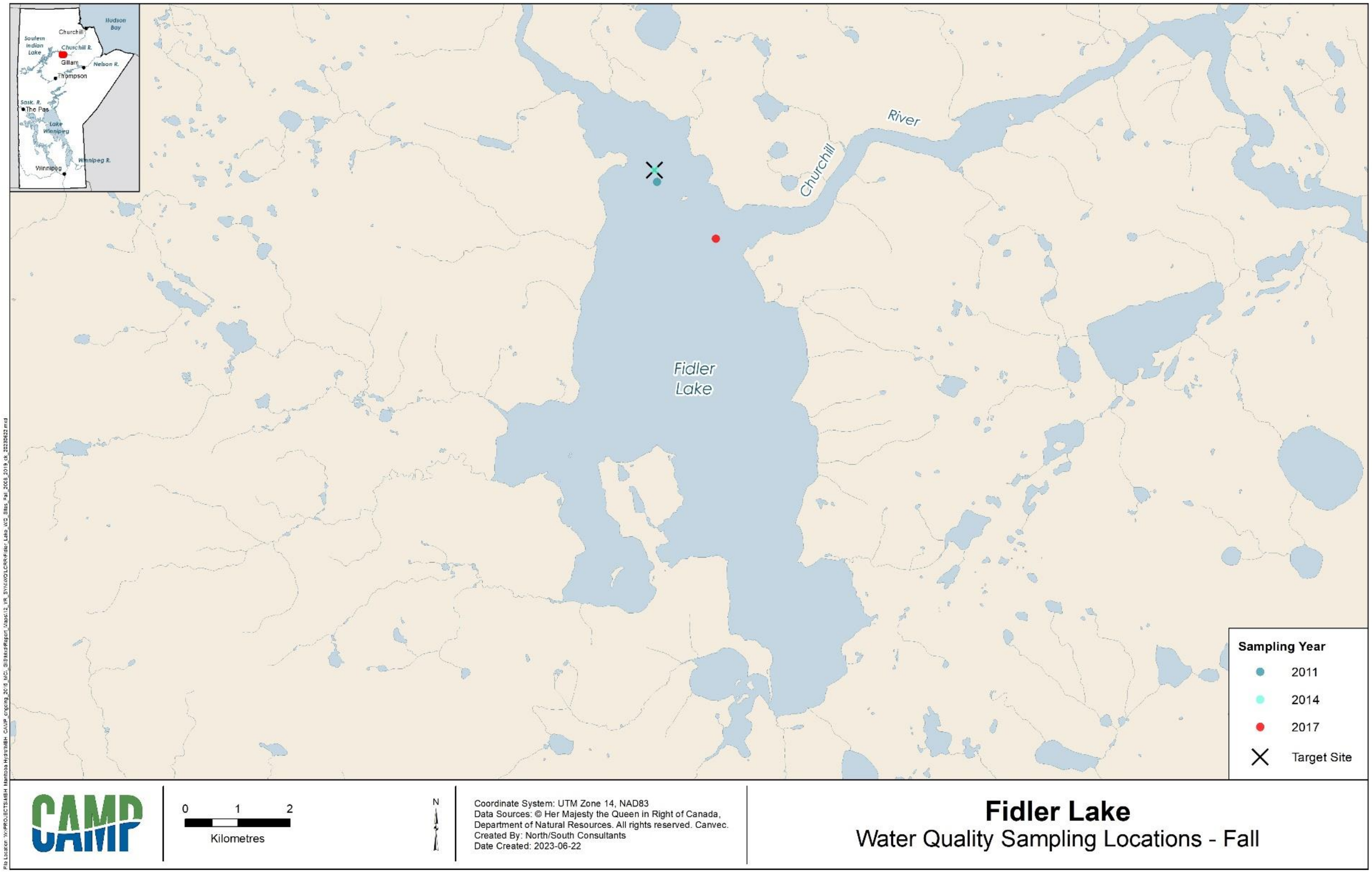


Figure A3-1-15. Fall water quality sampling locations: Fidler Lake.

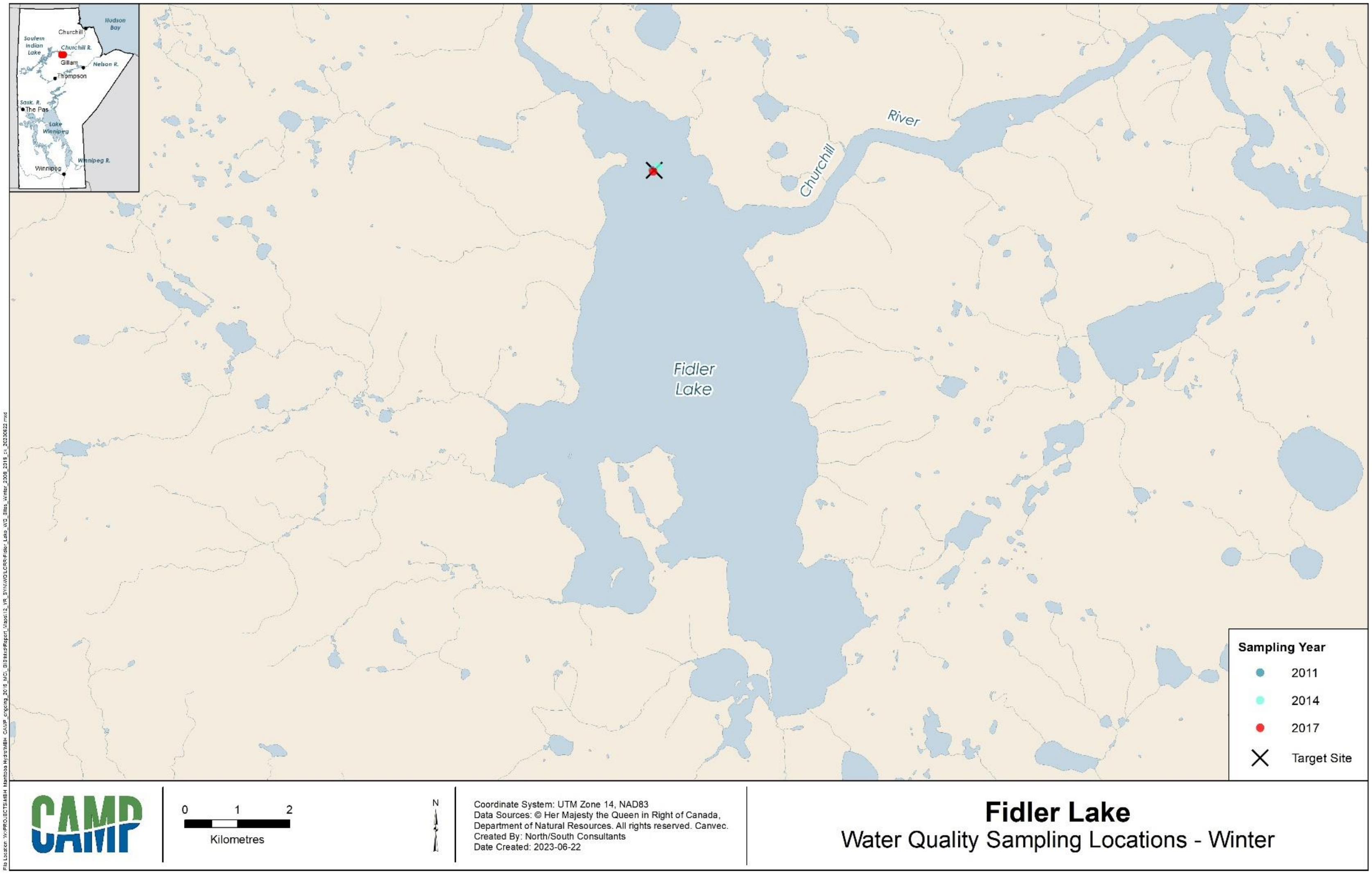


Figure A3-1-16. Winter water quality sampling locations: Fidler Lake.

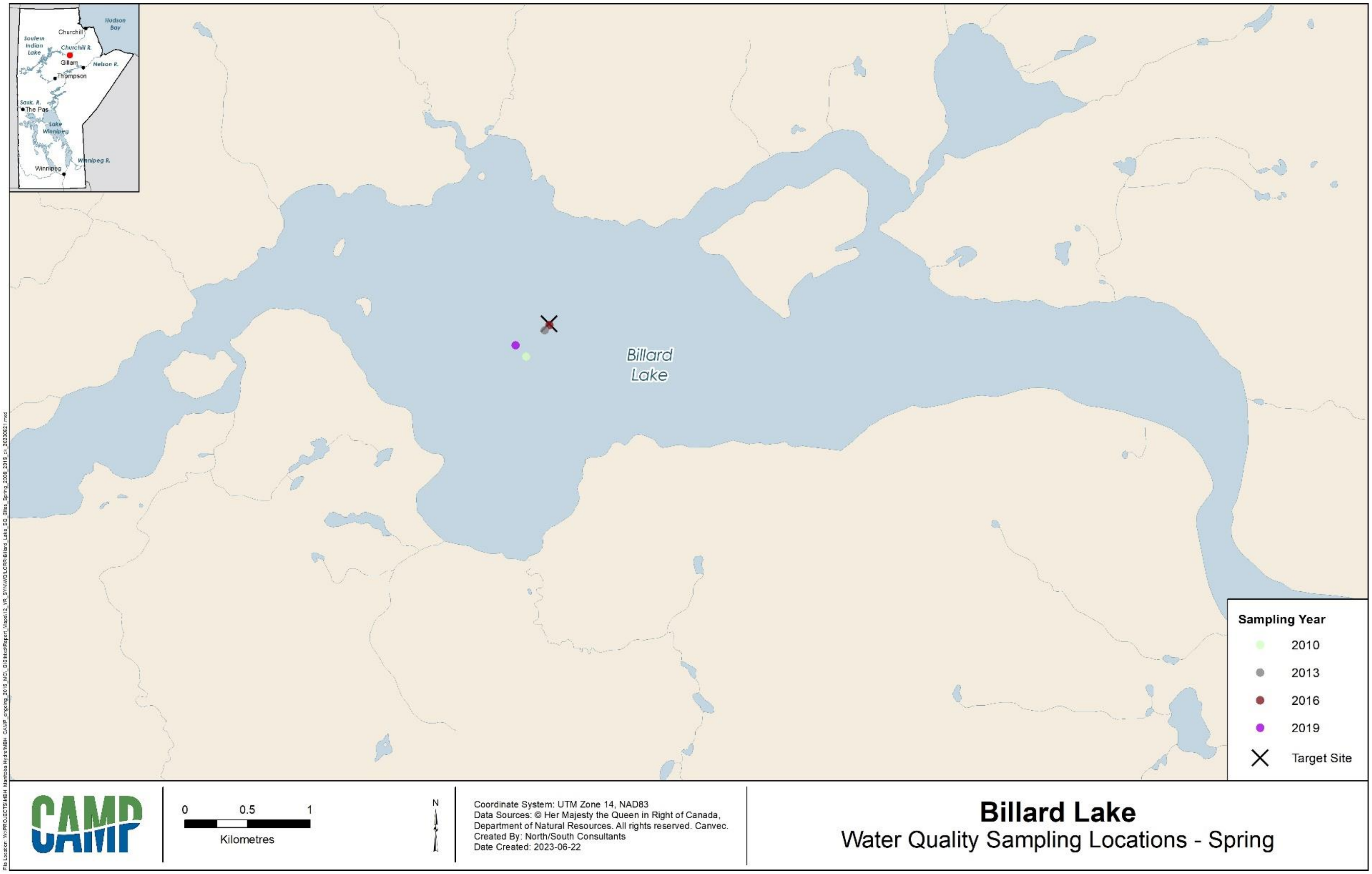


Figure A3-1-17. Spring water quality sampling locations: Billard Lake.

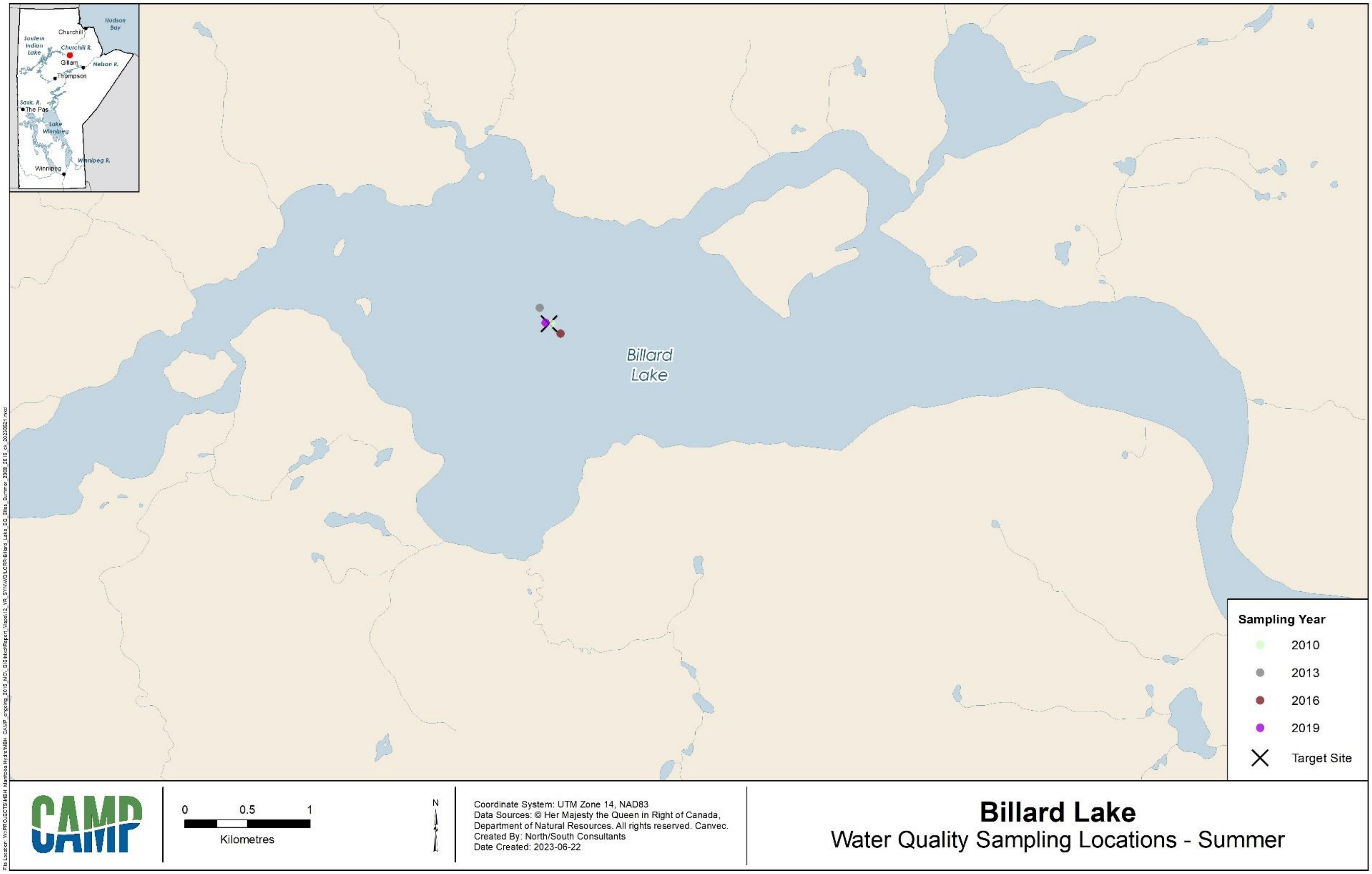


Figure A3-1-18. Summer water quality sampling locations: Billard Lake.

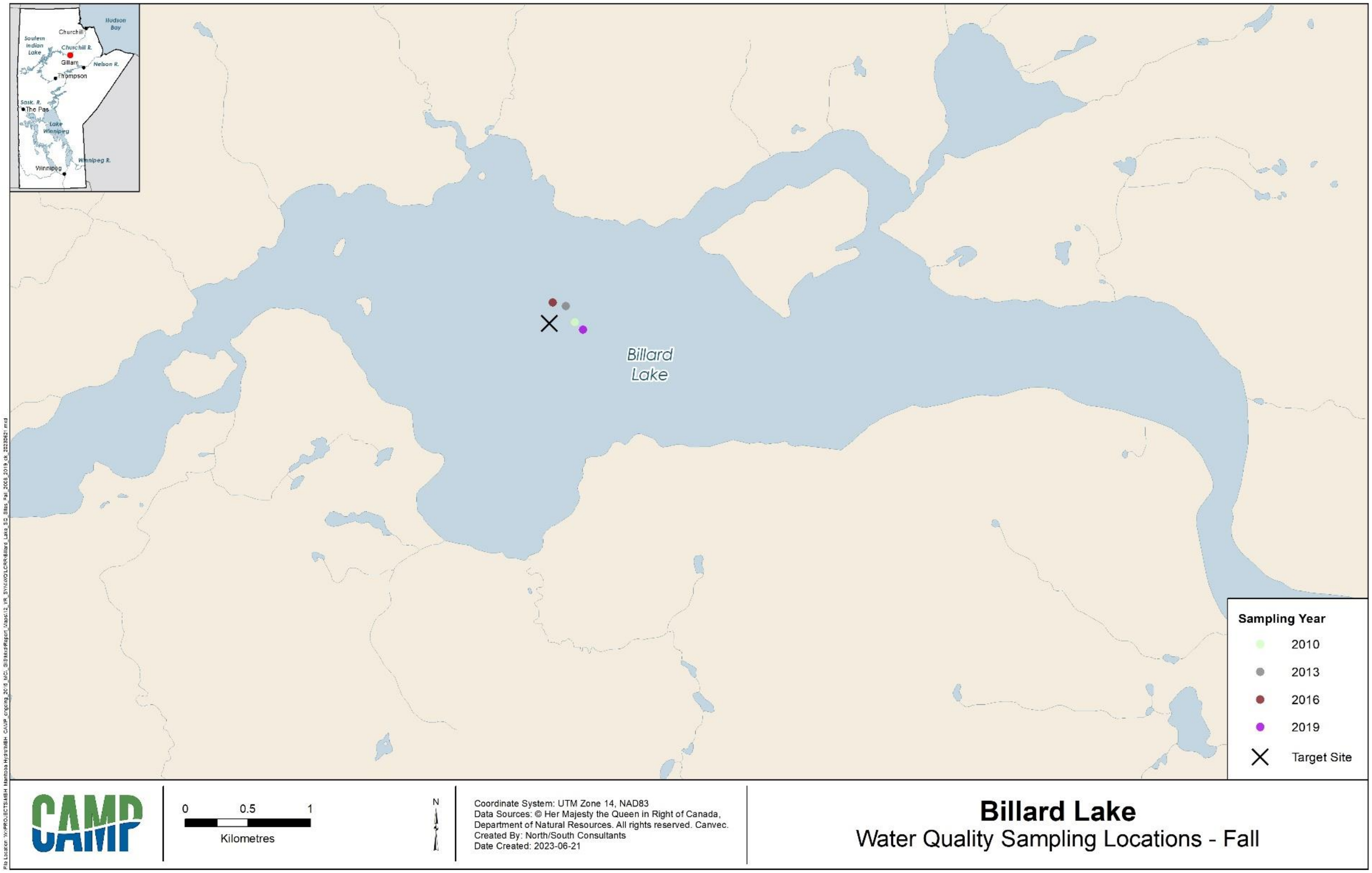


Figure A3-1-19. Fall water quality sampling locations: Billard Lake.

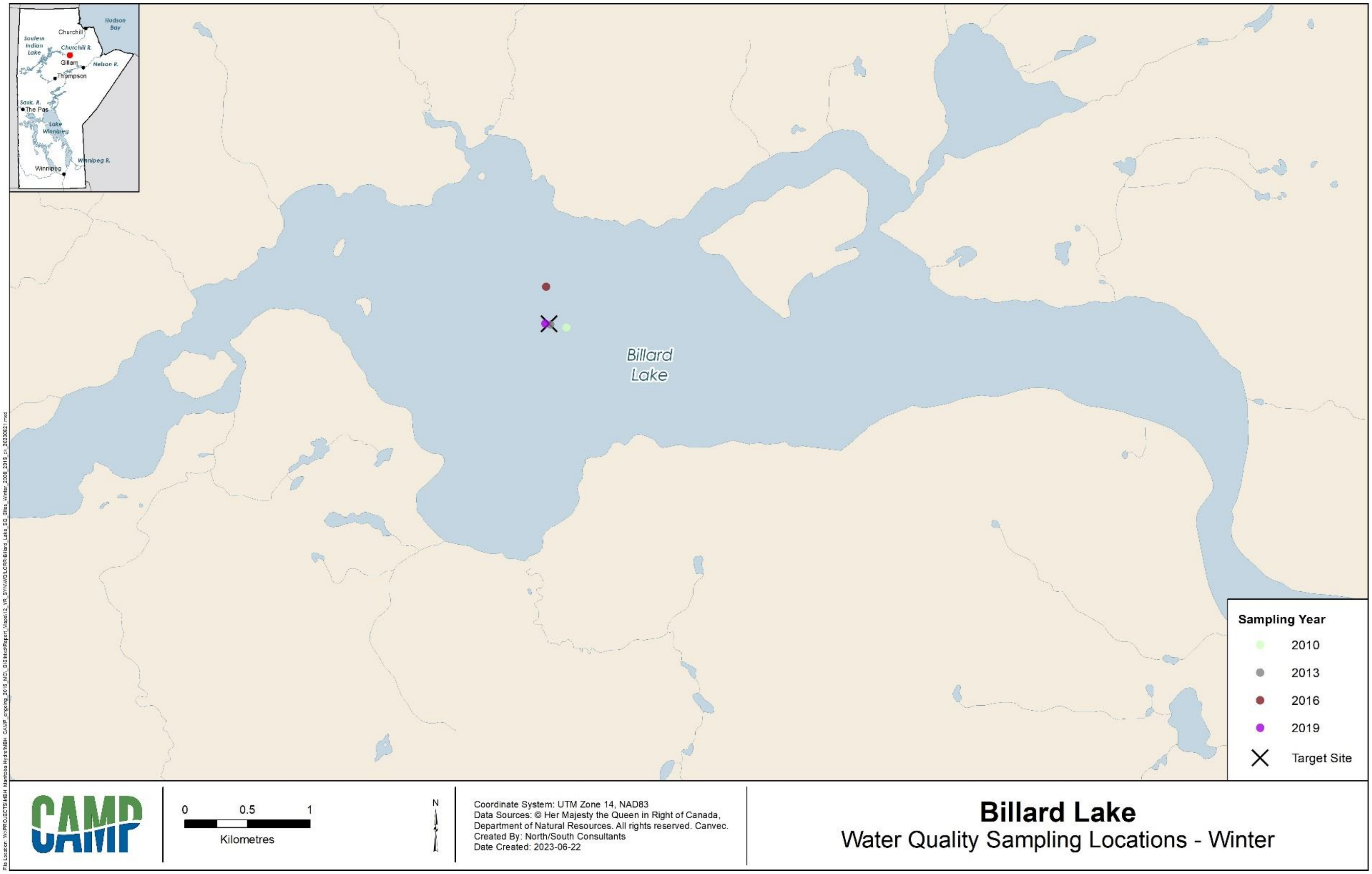


Figure A3-1-20. Winter water quality sampling locations: Billard Lake.

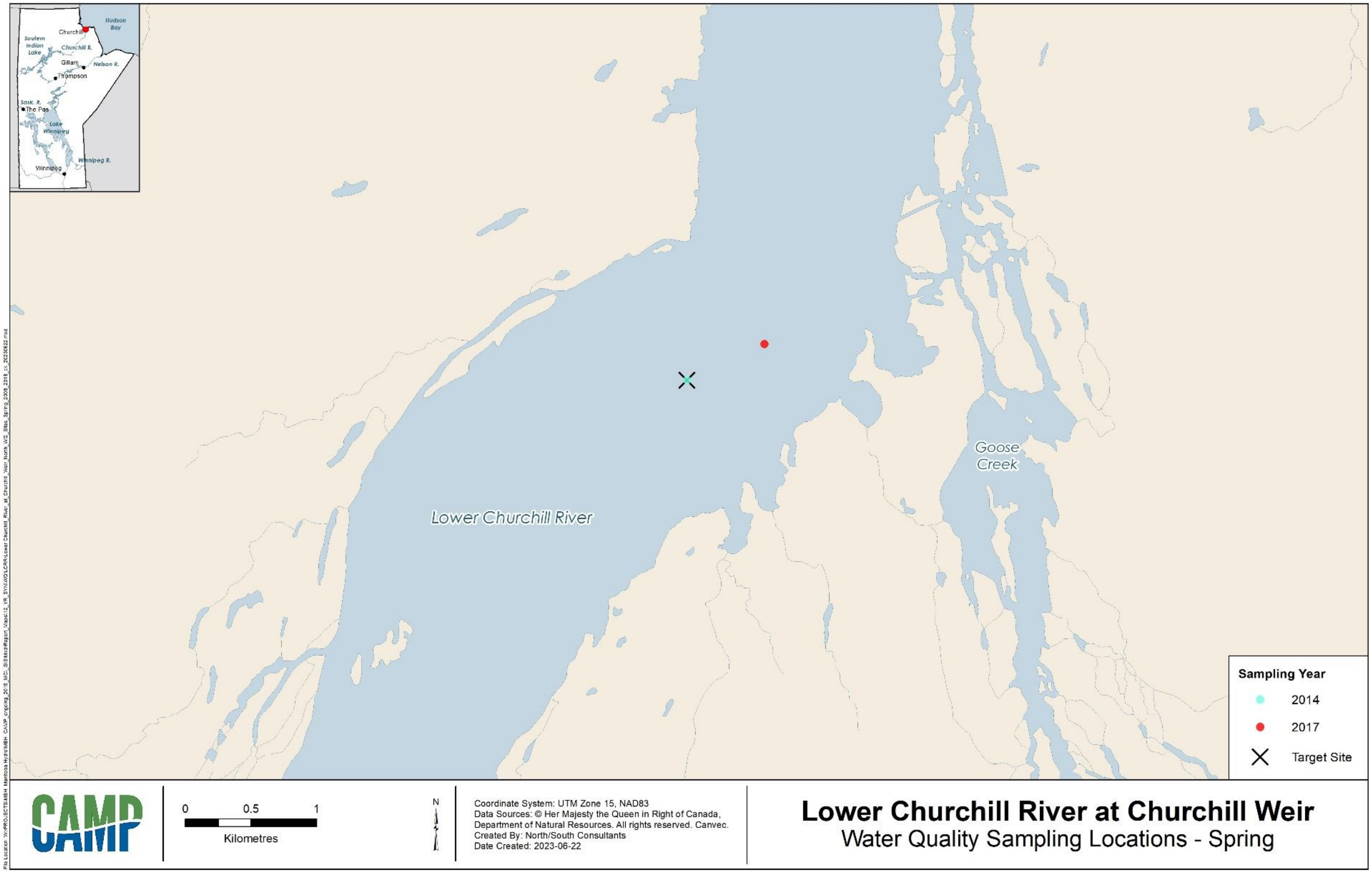


Figure A3-1-21. Spring water quality sampling locations: The lower Churchill River at the Churchill Weir.

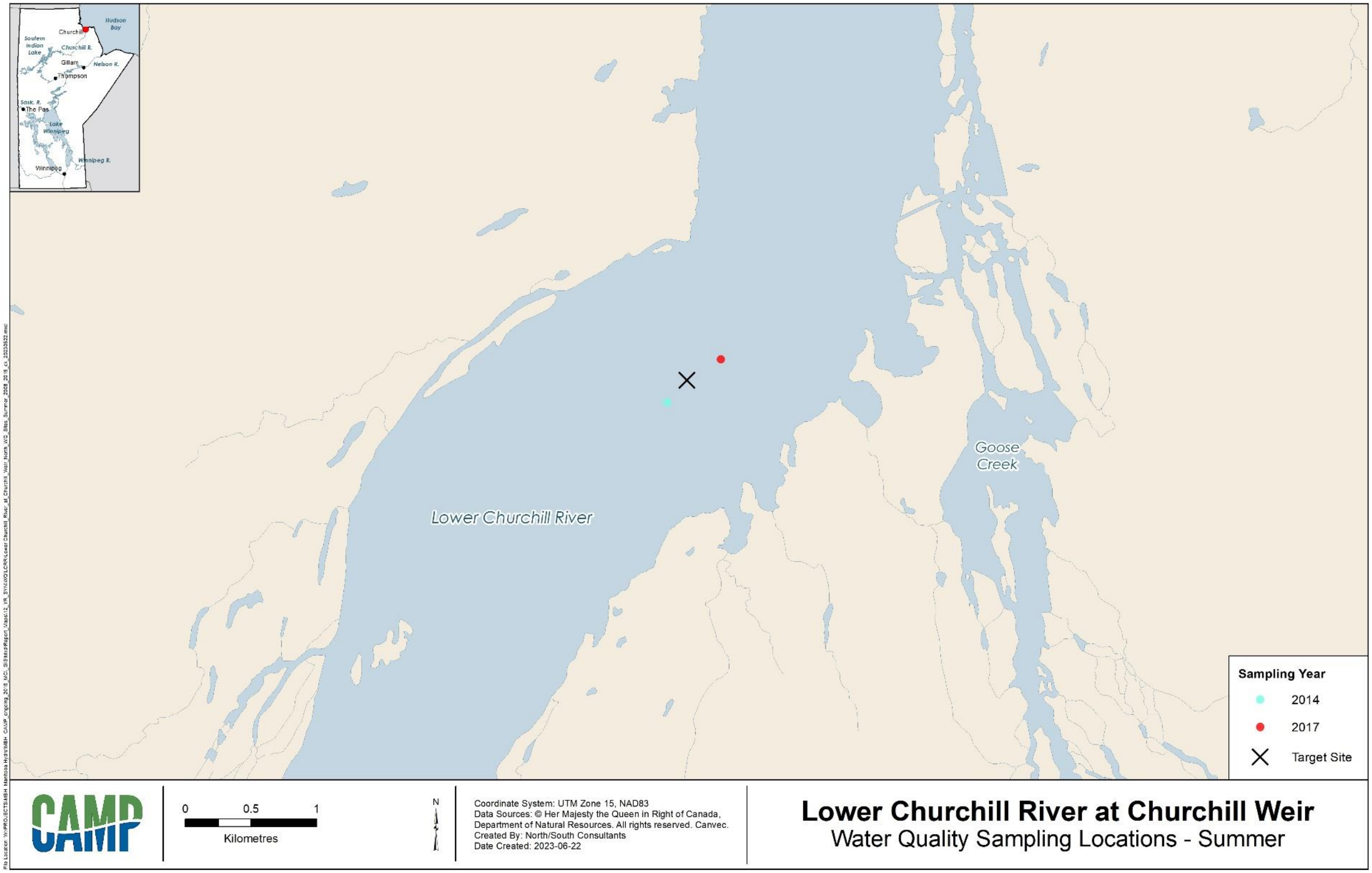


Figure A3-1-22. Summer water quality sampling locations: The lower Churchill River at the Churchill Weir.

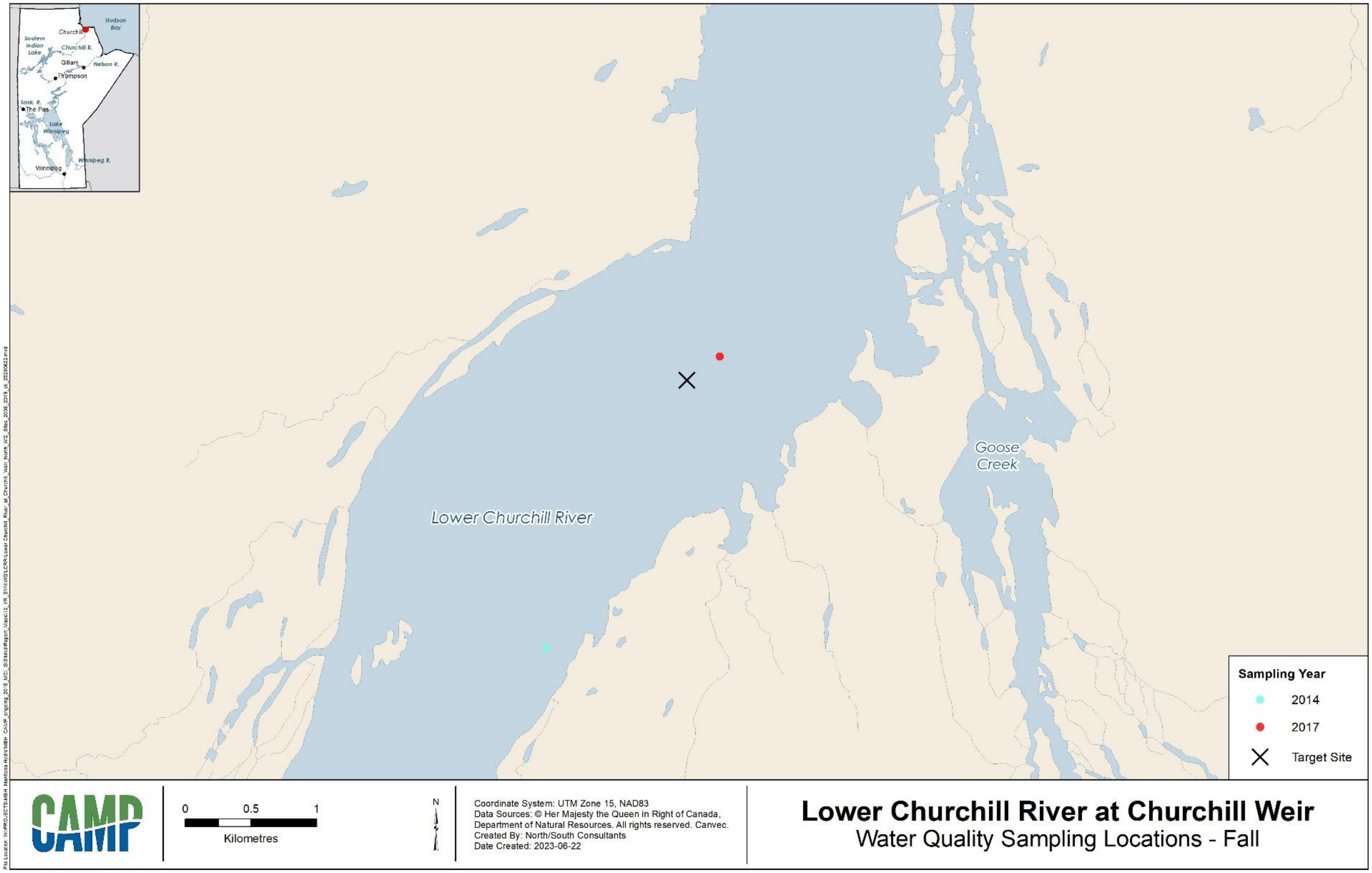


Figure A3-1-23. Fall water quality sampling locations: The lower Churchill River at the Churchill Weir.

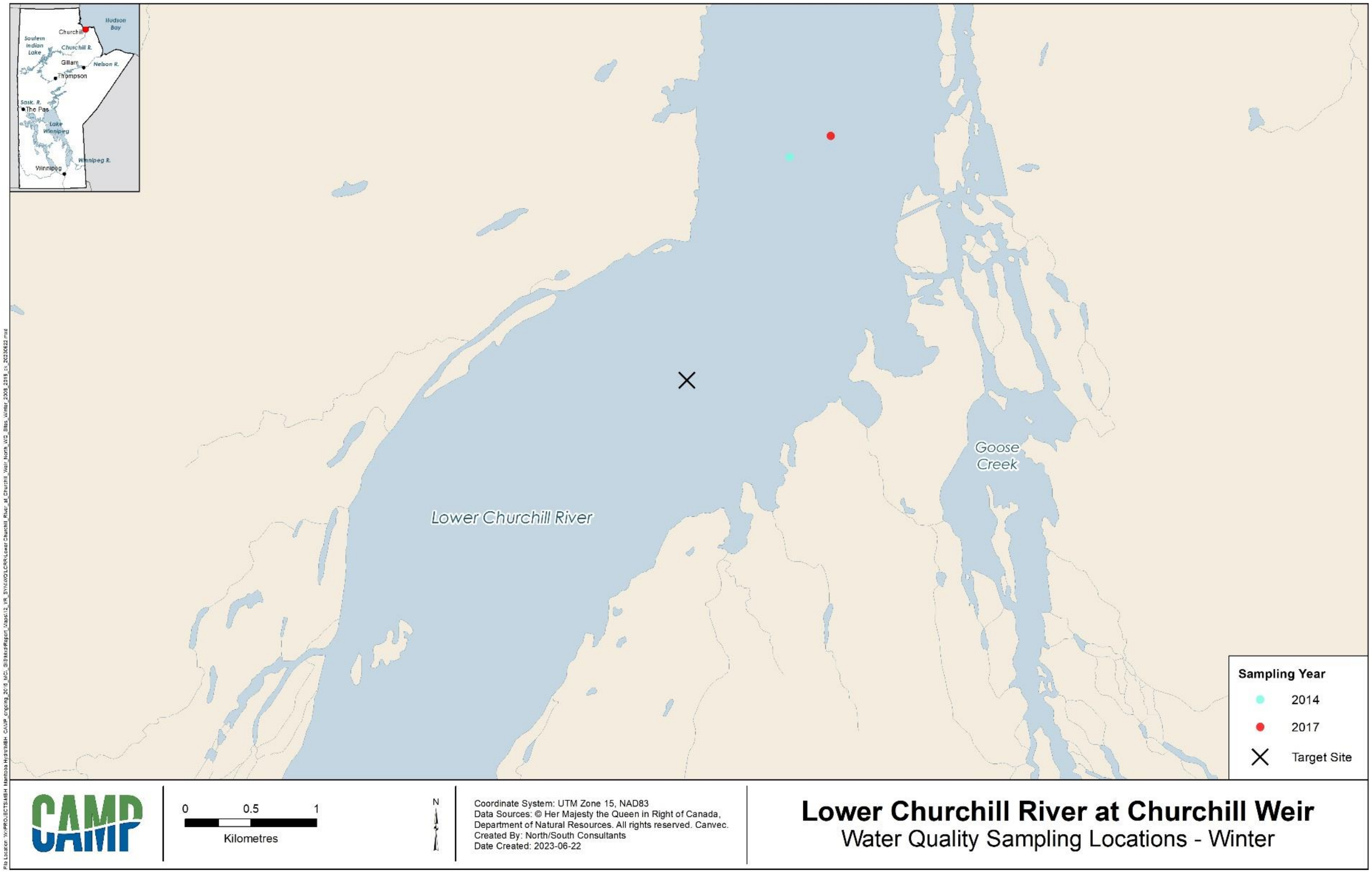


Figure A3-1-24. Winter water quality sampling locations: The lower Churchill River at the Churchill Weir.

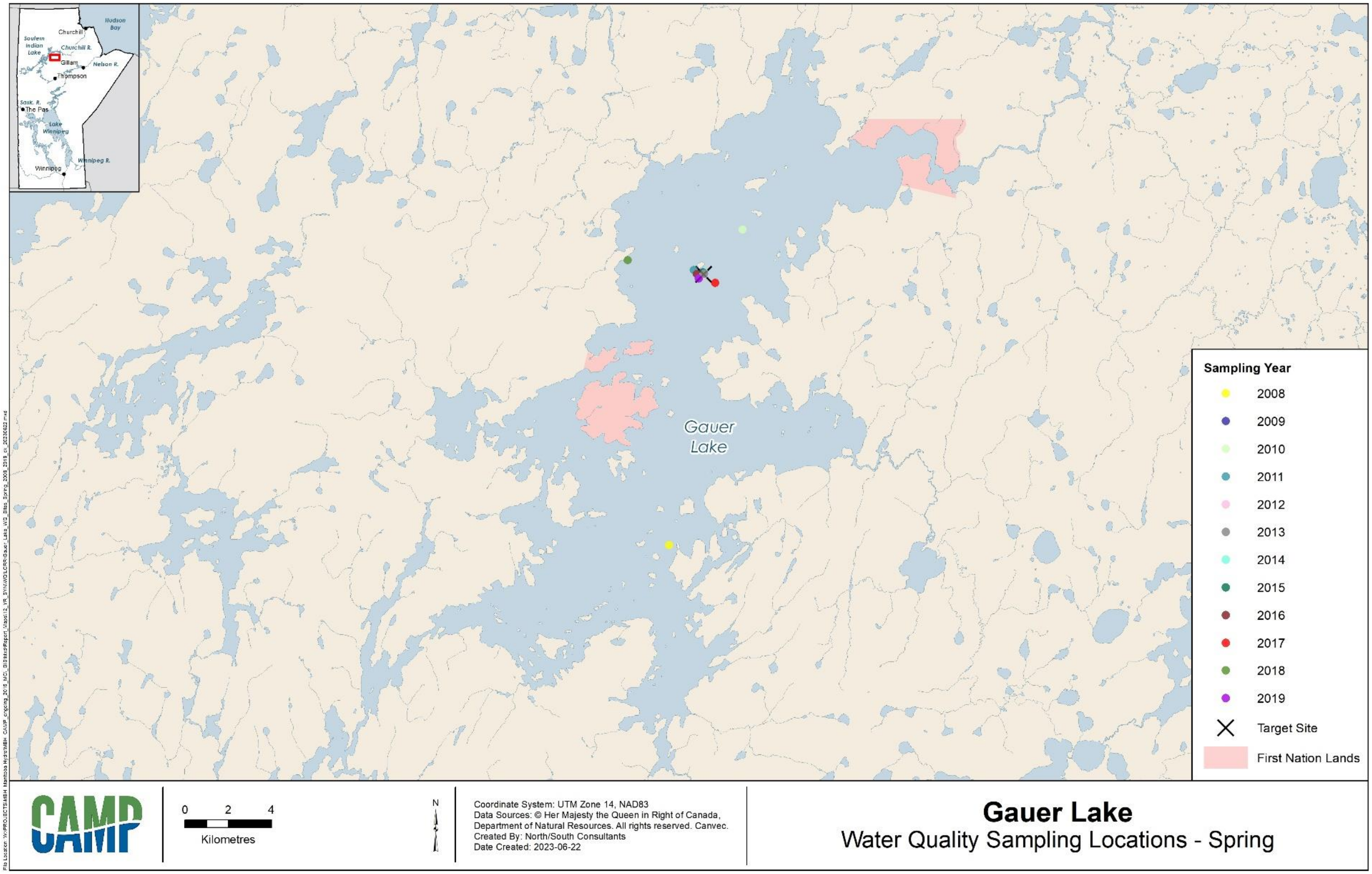


Figure A3-1-25. Spring water quality sampling locations: Gauer Lake.

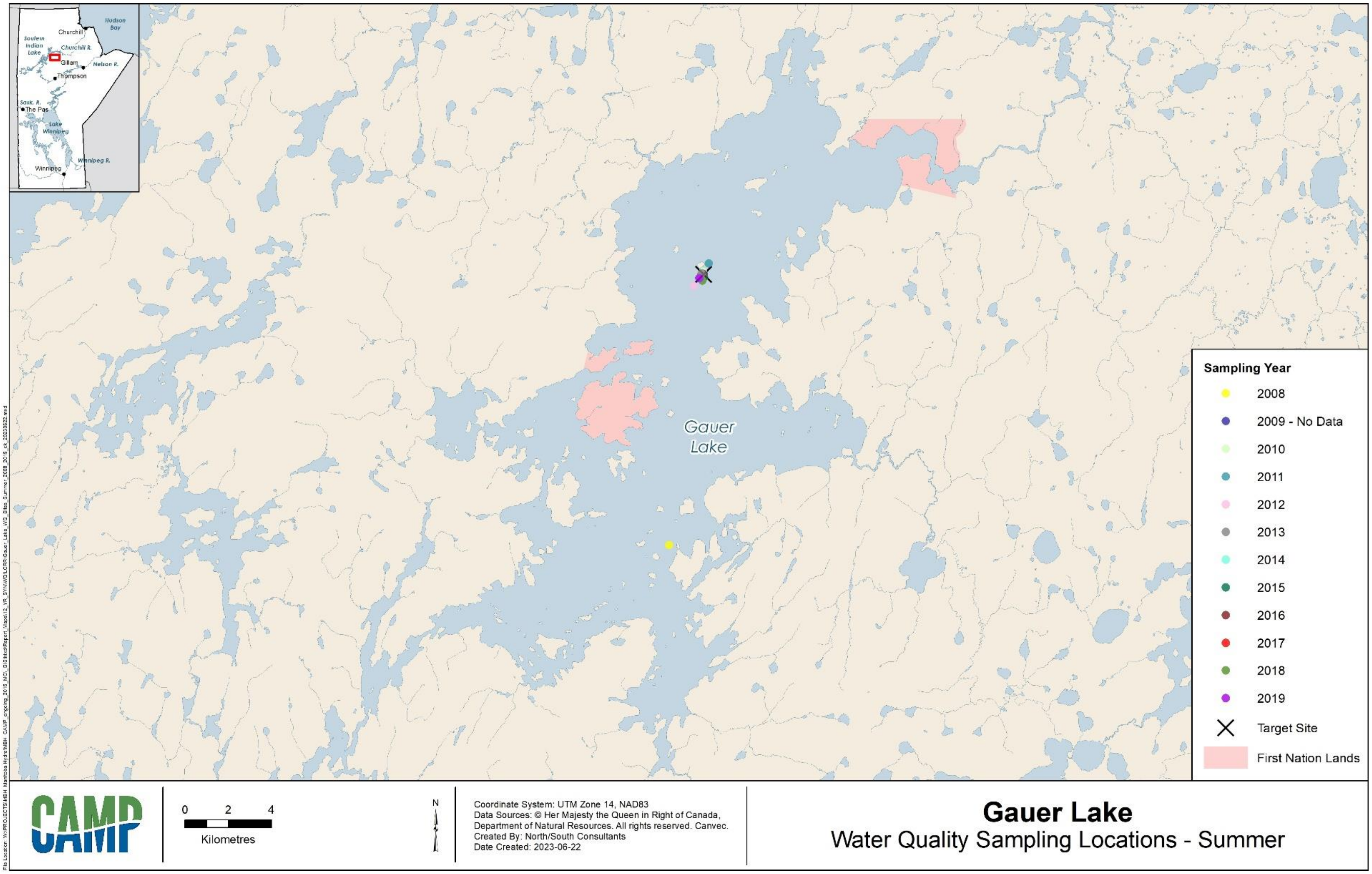


Figure A3-1-26. Summer water quality sampling locations: Gauer Lake.

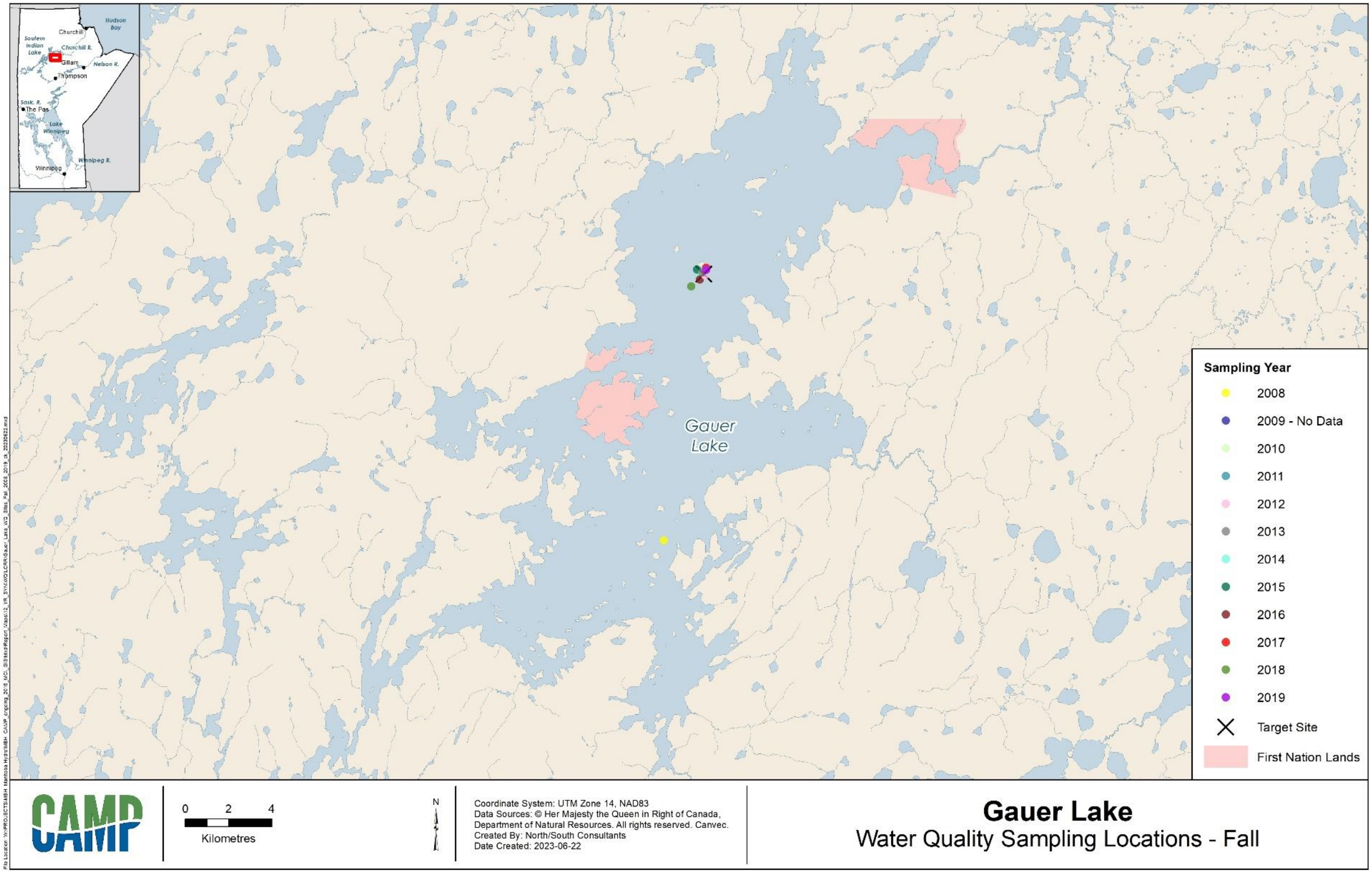


Figure A3-1-27. Fall water quality sampling locations: Gauer Lake.

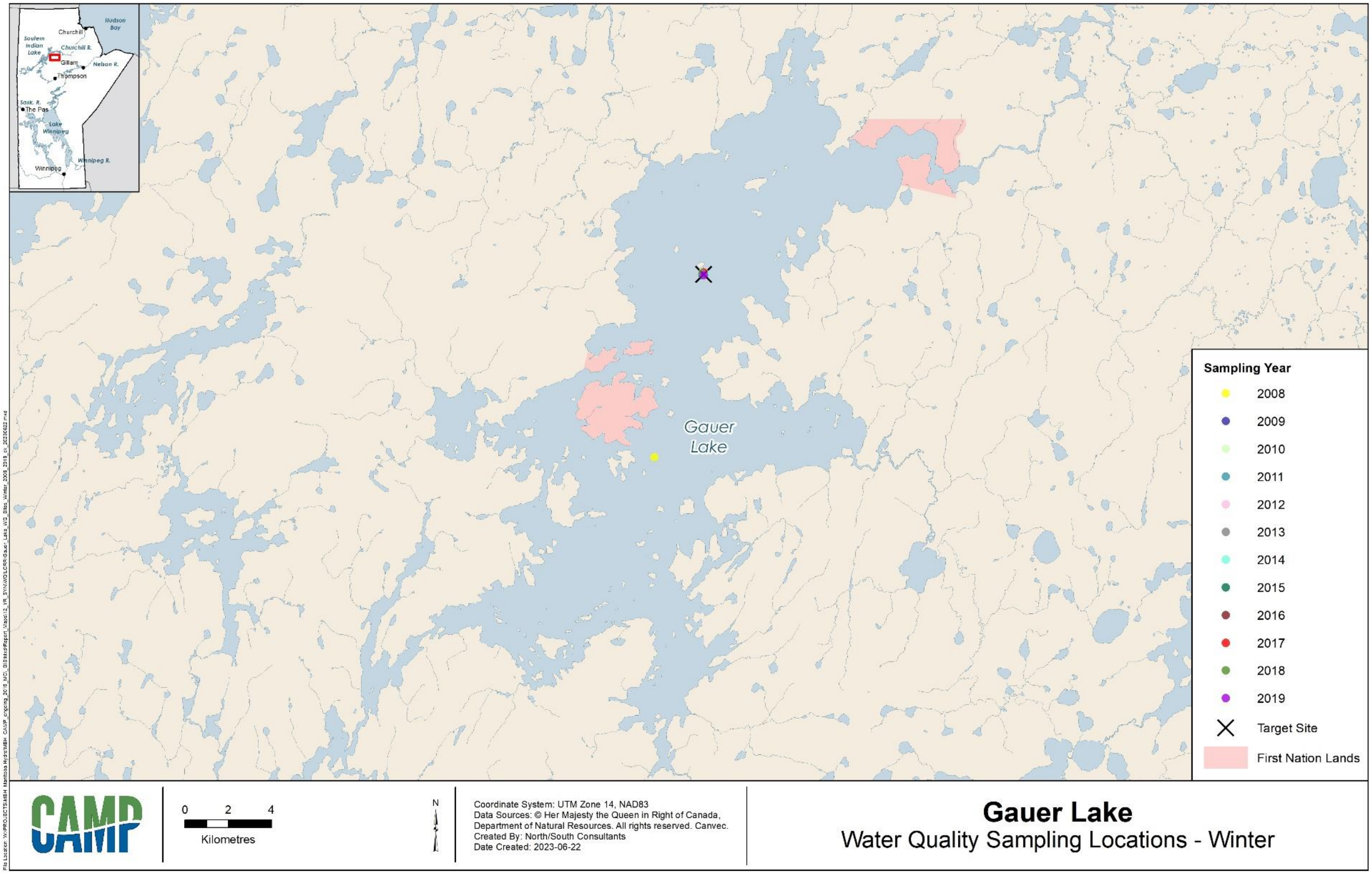


Figure A3-1-28. Winter water quality sampling locations: Gauer Lake.

4.0 BENTHIC INVERTEBRATES

4.1 INTRODUCTION

The following presents the results of the benthic invertebrate community monitoring conducted from 2010-2019 in the Lower Churchill River Region. The 2008 and 2009 benthic invertebrate datasets were excluded due to a significant change in the sampling design in 2010.

Seven waterbodies were monitored in the Lower Churchill River Region: two on-system annual sites (Northern Indian Lake and lower Churchill River at the Little Churchill River), four on-system rotational sites (Partridge Breast Lake, Fidler Lake, Billard Lake, and the lower Churchill River at the Churchill Weir); and one off-system annual site (Gauer Lake; Table 4.1-1 and Figure 4.1-1).

Two sampling polygons (nearshore [NS] and offshore [OS]) defined by water depth, flow, and substrate composition were sampled in each waterbody in late summer/fall per year (Appendix 4-1). Five benthic invertebrate samples were collected in each polygon for a total of ten invertebrate samples per waterbody per year. Five sediment samples were also collected in each polygon (where possible) to provide supporting information on substrate composition, total organic carbon (TOC), and texture. Dominant benthic substrate and sediment composition results are presented in Appendix 4-2. Sampling was completed at many sites as planned over the period of 2010-2019 with the following exceptions.

- The offshore polygon location at the Northern Indian Lake site in 2013 was moved northeast of the target area due to lower water level at the time of sampling and miscommunication with the field crew (Figure A4-1-1).
- The nearshore and offshore polygon locations at the Northern Indian Lake site in 2014 were moved southeast due to motor failure and high wind which prevented access to the target sampling areas.
- Sampling at the targeted Northern Indian Lake offshore polygon location resumed in 2015, then was sampled in the southeast area again in 2016 to 2019.
- The nearshore sampling polygon location at the lower Churchill River at the Little Churchill River site in 2012 was moved south of the target area (across the channel) due to the high-water level at the time of sampling (Figure A4-1-2).
- Fewer than five offshore samples were collected at the lower Churchill River at the Little Churchill River site in 2011 (n=4) and 2014 (n=1), when fast water and coarse/compact substrate made sample collection challenging in the 5 to 10 m water depth range.

- Sampling was not completed at the lower Churchill River at the Little Churchill River site in 2017 and 2018 due to high-water levels and flows at the time of sampling.
- Benthic invertebrate samples were not collected from the lower Churchill River at the Little Churchill River in 2019 due to a pause in monitoring as sampling methods are reviewed.
- The nearshore sampling polygon location at the Fidler Lake site in 2014 was moved southeast of the target area due to high water at the time of sampling (Figure A4-1-7).

Four benthic invertebrate indicators (abundance, community composition, taxonomic richness, and diversity) were selected for detailed reporting (Table 4.1-2). Metrics for these indicators that are presented herein include: total invertebrate abundance or total invertebrate density; the Ephemeroptera, Plecoptera, and Trichoptera (EPT) Index; the Oligochaeta and Chironomidae (O+C) Index; total taxa richness; EPT taxa richness; and Hill's effective richness (Hill's Index). A detailed description of these indicators is provided in CAMP (2024).

A detailed description of the program design and sampling methods are provided Technical Document 1, Section 2.4.

Table 4.1-1. 2010 to 2019 Benthic invertebrate sampling inventory.

Site	Sampling Year											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NIL	-[1]	-[1]	●	●	●	●	●	●	●	●	●	●
LCR-LiCR	-[1]	-[1]	●	●[2]	●	●	●[2]	●	●	-[3]	-[3]	-[4]
PBL		-[1]			●			●			●	
FID				●			●			●		
BIL			●			●			●			●
LCR-WEIR[5]							●			●		
GAU	-[1]	-[1]	●	●	●	●	●	●	●	●	●	●

Notes:

1. Dataset excluded from analysis and reporting due to change in sampling design in 2010.
2. Less than five offshore samples due to coarse/compact substrate and/or high-water velocity.
3. Site not sampled due to high water level and flow.
4. Site not sampled due to a pause in monitoring as sampling methods are reviewed.
5. Annual sampling at LCR-WEIR began in 2014.

Table 4.1-2. Benthic invertebrate indicators and metrics.

Indicators	Metrics	Units
Abundance	• Total Invertebrate Abundance	Number (no.) per sample
	• Total Invertebrate Density	no. per square metre (m^2)
Community Composition	• Relative Proportions of Major Invertebrate Groups	%
	• EPT Index	%
	• O+C Index	%
Taxonomic Richness	• Total Taxa Richness	no. of families
	• EPT Taxa Richness	no. of families
Diversity	• Hill’s Effective Richness (Hill's Index)	value

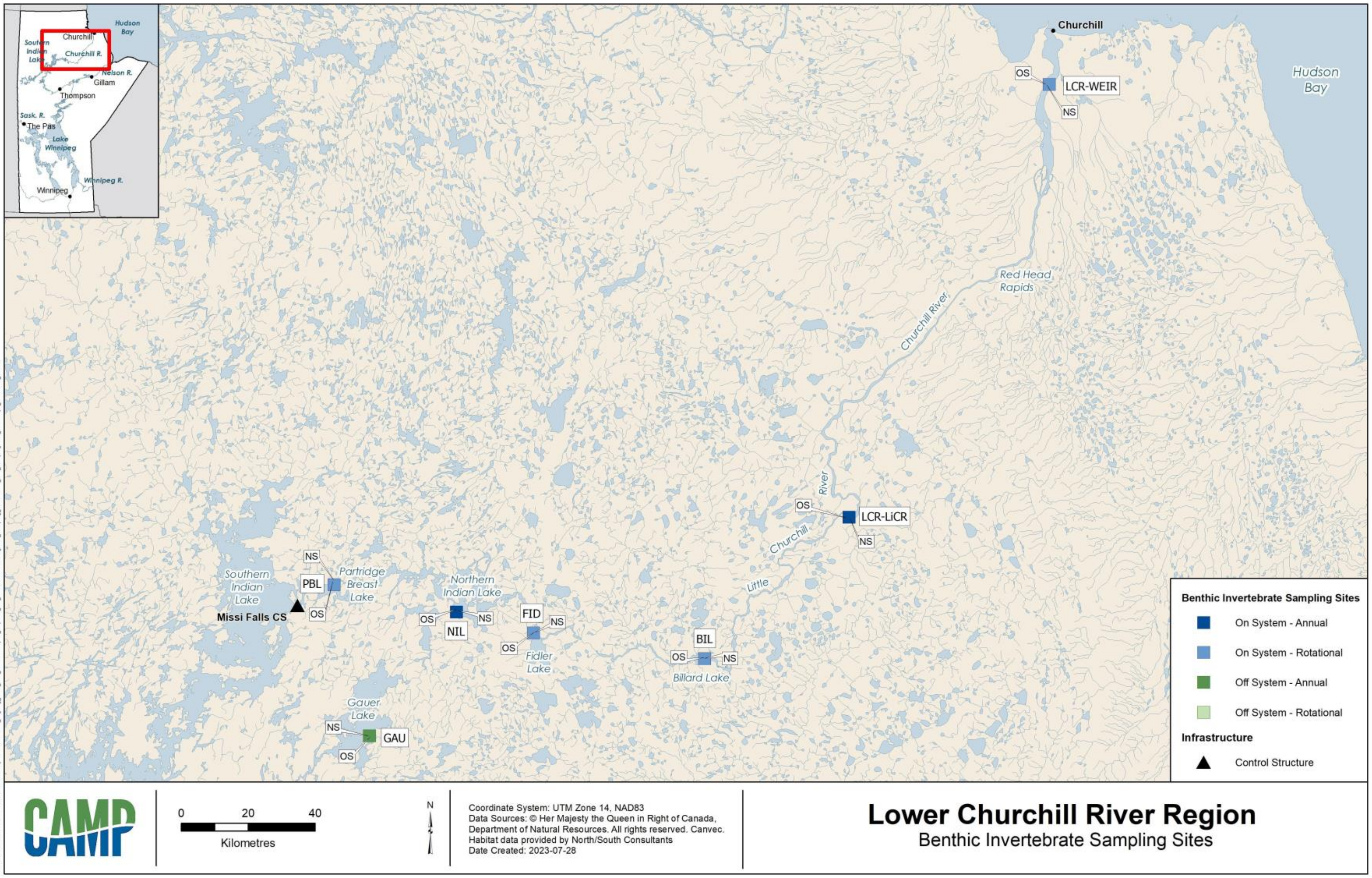


Figure 4.1-1. 2010-2019 Benthic invertebrate nearshore (NS) and offshore (OS) sampling sites.

4.2 ABUNDANCE

4.2.1 TOTAL INVERTEBRATE ABUNDANCE

4.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 361 invertebrates per sample (2010) to 7,825 invertebrates per sample (2012; Figure 4.2-1). The overall mean abundance was 2,719 invertebrates per sample, the overall median abundance was 1,757 invertebrates per sample, and the IQR was 1,181 to 2,780 invertebrates per sample. Annual means were below the IQR in 2010 and 2016, and above the IQR in 2012 and 2017.

Offshore Habitat

Annual mean abundance (density) over the ten years of monitoring ranged from 1,775 invertebrates per m^2 (2011, n=4) to 4,793 invertebrates per m^2 (2015; Figure 4.2-2). The overall mean abundance was 3,111 invertebrates per m^2, the overall median abundance was 2,886 invertebrates per m^2, and the IQR was 2,417 to 4,155 invertebrates per m^2. Annual means were below the IQR in 2010 and 2011, and above the IQR in 2015 and 2016.

Lower Churchill River at the Little Churchill River

Nearshore Habitat

Annual mean abundance over the seven years of monitoring ranged from 1,016 invertebrates per sample (2015) to 10,206 invertebrates per sample (2014; Figure 4.2-1). The overall mean abundance was 2,933 invertebrates per sample, the overall median abundance was 1,712 invertebrates per sample, and the IQR was 1,398 to 2,545 invertebrates per sample. Annual means were below the IQR in 2012 and 2015, and above the IQR in 2013 and 2014.

Offshore Habitat

Annual mean abundance (density) over the seven years of monitoring ranged from 462 invertebrates per m^2 (2014) to 3,717 invertebrates per m^2 (2013; Figure 4.2-2). The overall mean abundance was 1,571 invertebrates per m^2, the overall median abundance was 988 invertebrates per m^2, and the IQR was 555 to 2,435 invertebrates per m^2. Annual means were below the IQR in 2012, 2014 and 2016, and above the IQR in 2013.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean abundance over the three years of monitoring ranged from 3,495 invertebrates per sample (2018) to 5,827 invertebrates per sample (2012; Figure 4.2-1). The overall mean abundance was 4,877 invertebrates per sample, the overall median abundance was 4,382 invertebrates per sample, and the IQR was 3,687 to 5,578 invertebrates per sample. Annual means were below the IQR in 2018, and above the IQR in 2012.

Offshore Habitat

Annual mean abundance (density) over the three years of monitoring ranged from 1,241 invertebrates per m^2 (2012) to 2,343 invertebrates per m^2 (2015; Figure 4.2-2). The overall mean abundance was 1,625 invertebrates per m^2, the overall median abundance was 1,688 invertebrates per m^2, and the IQR was 1,140 to 1,948 invertebrates per m^2. Annual means were within the IQR, except in 2015 (above).

Fidler Lake

Nearshore Habitat

Annual mean abundance over the three years of monitoring ranged from 162 invertebrates per sample (2011) to 4,467 invertebrates per sample (2014; Figure 4.2-1). The overall mean abundance was 2,753 invertebrates per sample, the overall median abundance was 2,870 invertebrates per sample, and the IQR was 203 to 4,242 invertebrates per sample. Annual means were below the IQR in 2011, and above the IQR in 2014.

Offshore Habitat

Annual mean abundance (density) over the three years of monitoring ranged from 470 invertebrates per m^2 (2011) to 958 invertebrates per m^2 (2017; Figure 4.2-2). The overall mean abundance was 753 invertebrates per m^2, the overall median abundance was 808 invertebrates per m^2, and the IQR was 483 to 1,096 invertebrates per m^2. Annual means were within the IQR, except in 2011 (below).

Billard Lake

Nearshore Habitat

Annual mean abundance over the four years of monitoring ranged from 337 invertebrates per sample (2019) to 1,140 invertebrates per sample (2016; Figure 4.2-1). The overall mean abundance was 797 invertebrates per sample, the overall median abundance was 614 invertebrates per sample, and the IQR was 397 to 1,098 invertebrates per sample. Annual means were below the IQR in 2019, and above the IQR in 2016.

Offshore Habitat

Annual mean abundance (density) over the four years of monitoring ranged from 2,435 invertebrates per m^2 (2010) to 4,063 invertebrates per m^2 (2019; Figure 4.2-2). The overall mean abundance was 3,346 invertebrates per m^2, the overall median abundance was 3,268 invertebrates per m^2, and the IQR was 2,391 to 3,668 invertebrates per m^2. Annual means were within the IQR, except in 2013 and 2019 (above).

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean abundance over the two years of monitoring ranged from 5,523 invertebrates per sample (2017) to 5,768 invertebrates per sample (2014; Figure 4.2-1). The overall mean abundance was 5,646 invertebrates per sample, the overall median abundance was 5,951 invertebrates per sample, and the IQR was 4,067 to 6,718 invertebrates per sample. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean abundance (density) over the two years of monitoring ranged from 326 invertebrates per m^2 (2017) to 5,757 invertebrates per m^2 (2014; Figure 4.2-2). The overall mean abundance was 3,041 invertebrates per m^2, the overall median abundance was 1,904 invertebrates per m^2, and the IQR was 220 to 5,436 invertebrates per m^2 Annual means were within the IQR, except in 2014 (above).

4.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

<u>Gauer Lake</u>

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 125 invertebrates per sample (2013) to 701 invertebrates per sample (2015; Figure 4.2-1). The overall mean abundance was 347 invertebrates per sample, the overall median abundance was 216 invertebrates per sample, and the IQR was 139 to 408 invertebrates per sample. Annual means were below the IQR in 2013, and above the IQR in 2010, 2011 and 2015.

Offshore Habitat

Annual mean abundance (density) over the ten years of monitoring ranged from 1,570 invertebrates per m^2 (2017) to 5,079 invertebrates per m^2 (2013; Figure 4.2-2). The overall mean abundance was 2,837 invertebrates per m^2, the overall median abundance was 2,741 invertebrates per m^2, and the IQR was 1,713 to 3,643 invertebrates per m^2. Annual means were below the IQR in 2017, and above the IQR in 2010, 2012 and 2013.

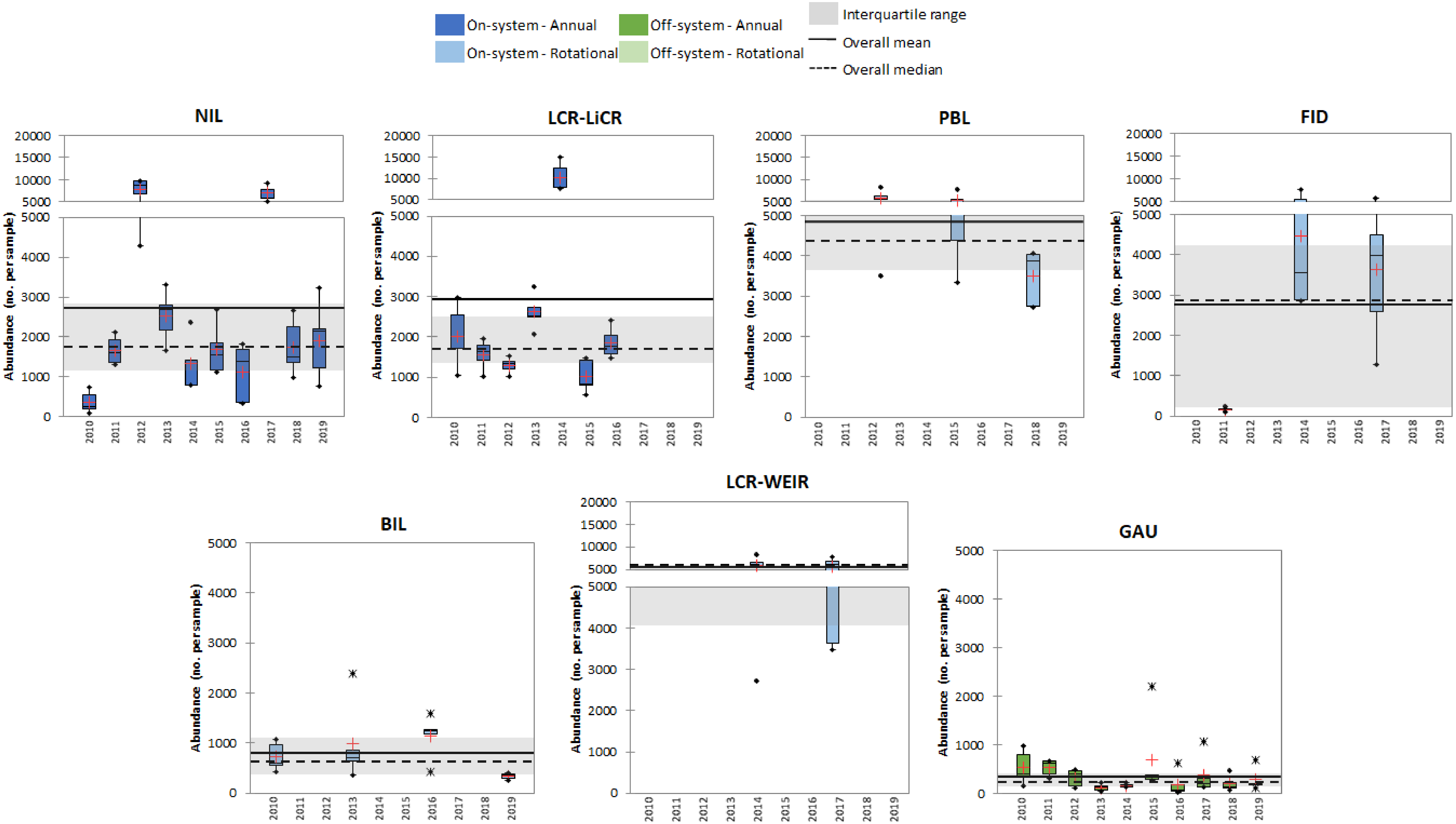


Figure 4.2-1. 2010 to 2019 Nearshore benthic invertebrate abundance (total no. per sample; LCR-LiCR 2017 to 2019 n=0).

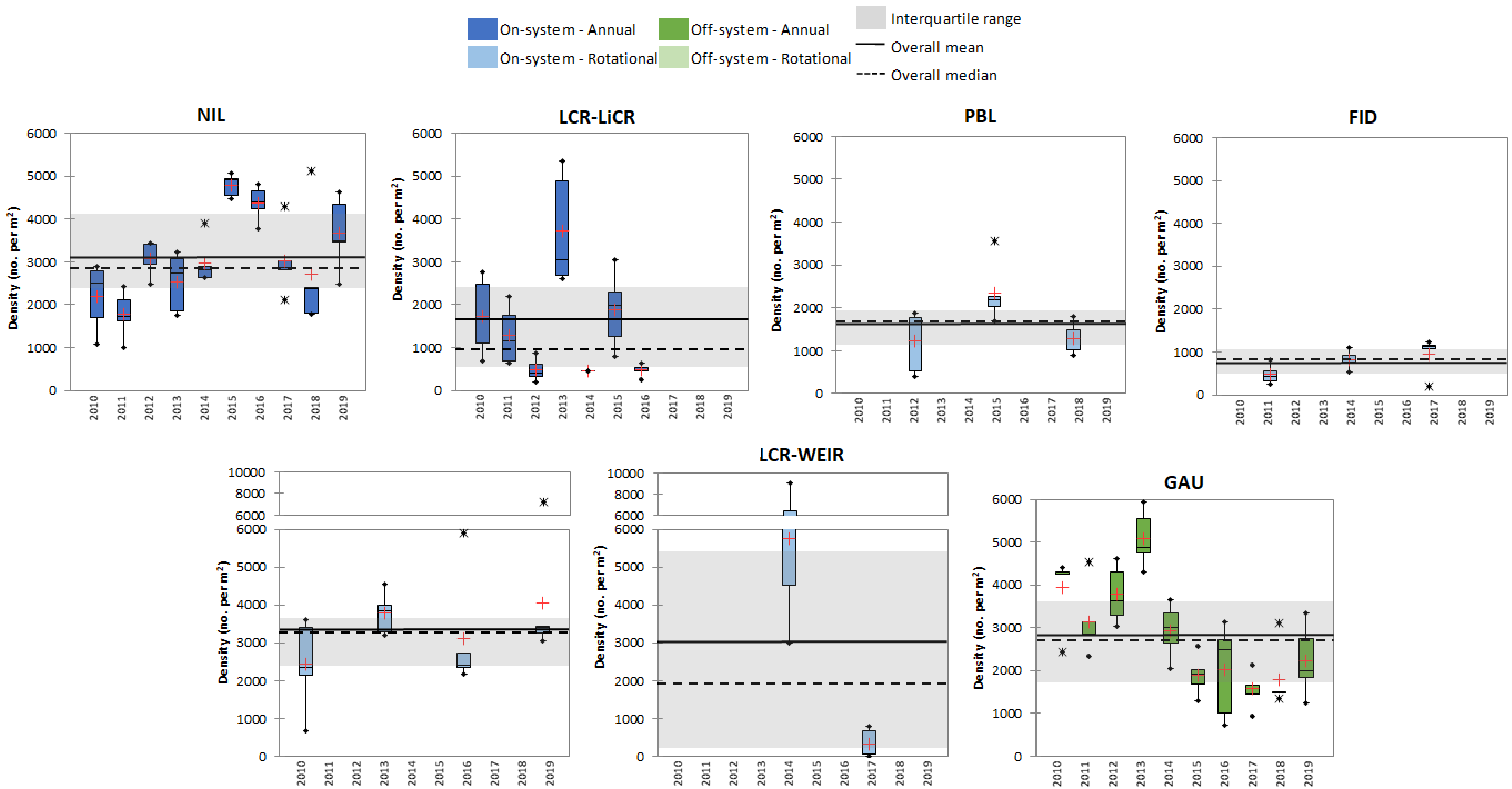


Figure 4.2-2. 2010 to 2019 Offshore benthic invertebrate abundance (density, total no. per m^2; LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

4.3 COMMUNITY COMPOSITION

4.3.1 RELATIVE ABUNDANCE

4.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Nearshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-1). Oligochaeta (29%) and Other Diptera (46%, mainly Tipulidae) dominated in 2010. Chironomidae (non-biting midges) was the dominant taxon in 2011 (39%), 2014 (60%), 2015 (42%), 2018 (41%), and 2019 (45%). Amphipoda (freshwater shrimps, mainly Hyalellidae) dominated in 2012 (38%). Oligochaeta (aquatic segmented worms, 18%), Amphipoda (23%, mainly Hyalellidae), Chironomidae (19%), and Ephemeroptera (mayflies, 17%, mainly Caenidae) were the dominant taxa in 2013. Oligochaeta (16%) and Bivalvia (clams, Sphaeriidae, 23%) dominated in 2016. Oligochaeta (32%) and Amphipoda (28%, mainly Hyalellidae) were dominant in 2017.

Offshore Habitat

Amphipoda (freshwater shrimps, mainly Pontoporeiidae) dominated the benthic invertebrate community composition in eight of the ten years of monitoring (2010, 2011, 2012, 2014, 2015, 2017, 2018, and 2019; Table 4.3-2). Among those years, mean annual relative abundances of Amphipoda ranged from 40% (2018) to 82% (2015). Bivalvia (clams, Sphaeriidae, 27%) and Chironomidae (non-biting midges, 36%) were the dominant taxa in 2013. Bivalvia (Sphaeriidae, 27%) and Ephemeroptera (mayflies, 32%, mainly Ephemeridae) dominated in 2016.

Lower Churchill River at the Little Churchill River

Nearshore Habitat

Benthic invertebrate community composition varied over the seven years of monitoring (2010 to 2016; Table 4.3-3). Corixidae (water boatmen) dominated in 2010 (66%) and 2011 (65%). Ephemeroptera (mayflies, 37%, mainly Ephemeridae) dominated in 2012. Ephemeroptera (25%, mainly Baetiscidae) and Corixidae (25%) were co-dominant in 2013. Amphipoda (mainly

Hyalellidae) was the dominant taxon in 2014 (53%) and 2016 (39%). Bivalvia (clams, Sphaeriidae, 48%) dominated in 2015.

Offshore Habitat

Benthic invertebrate community composition varied over the seven years of monitoring (2010 to 2016; Table 4.3-4). Chironomidae (non-biting midges) dominated in 2010 (83%), 2013 (50%), and 2015 (63%). Bivalvia (clams, 44%, mainly Sphaeriidae) was the dominant taxon in 2011 (n=4). Bivalvia (Sphaeriidae, 28%) and Chironomidae (27%) were nearly co-dominant in 2012. Oligochaeta (34%) and Chironomidae (31%) were nearly co-dominant in 2014 (n=1). Ephemeroptera (mayflies, Ephemeridae, 51%) dominated in 2016.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2012, 2015, and 2018; Table 4.3-5). Oligochaeta (aquatic segmented worms, 32%) and Ephemeroptera (mayflies, 26%, mainly Caenidae) were the dominant taxa in 2012. Oligochaeta (21%), Amphipoda (freshwater shrimps, 28%, mainly Hyalellidae), and Ephemeroptera (18%, mainly Caenidae) dominated in 2015. Corixidae (water boatmen, 27%) was the dominant taxon in 2018.

Offshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2012, 2015, and 2018; Table 4.3-6). Chironomidae (non-biting midges, 57%) was the dominant taxon in 2012. Amphipoda (freshwater shrimps, 69%, mainly Pontoporeiidae) was the dominant group in 2015. Chironomidae (30%) and Ephemeroptera (mayflies, Ephemeridae, 47%) dominated in 2018.

Fidler Lake

Nearshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2011, 2014, and 2017; Table 4.3-7). Oligochaeta (aquatic segmented worms, 29%) and Gastropoda (snails, 31%, mainly Lymnaeidae and Planorbidae) were the dominant taxa in 2011. Corixidae (water boatmen, 51%) dominated in 2014. Chironomidae (non-biting midges, 43%) dominated in 2017.

Offshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2011, 2014, and 2017; Table 4.3-8). Amphipoda (freshwater shrimps, Pontoporeiidae, 32%) and Chironomidae (non-biting midges, 26%) were the dominant taxa in 2011. Chironomidae (51%) dominated in 2014. Amphipoda (Pontoporeiidae, 30%) and Ephemeroptera (mayflies, Ephemeridae, 41%) dominated in 2017.

Billard Lake

Nearshore Habitat

Benthic invertebrate community composition varied over the four years of monitoring (2010, 2013, 2016, and 2019; Table 4.3-9). Oligochaeta (aquatic segmented worms) dominated in 2010 (50%) and 2016 (42%). Chironomidae (non-biting midges, 30%) and Ephemeroptera (mayflies, 26%, mainly Caenidae) were the dominant taxa in 2013. Oligochaeta (38%) and Corixidae (35%) were nearly co-dominant in 2019.

Offshore Habitat

Bivalvia (clams, Sphaeriidae) and Chironomidae (non-biting midges) dominated the benthic invertebrate community composition in three of the four years of monitoring (2010, 2016, and 2019; Table 4.3-10). Among those years, mean annual relative abundances of Bivalvia ranged from 44% (2016) to 65% (2010); and mean annual relative abundances of Chironomidae ranged from 20% (2019) to 37% (2016). Oligochaeta (26%), Bivalvia (Sphaeriidae, 25%), and Chironomidae (44%) dominated in 2013.

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Benthic invertebrate community composition varied over the two years of monitoring (2014, and 2017; Table 4.3-11). Chironomidae (non-biting midges, 53%) was the dominant taxon in 2014. Chironomidae (42%) and Ephemeroptera (mayflies, 44%, mainly Leptophlebiidae) in 2017.

Offshore Habitat

Benthic invertebrate community composition varied over the two years of monitoring (2014, and 2017; Table 4.3-12). Bivalvia (clams, Sphaeriidae, 53%) was the dominant taxon in 2014. Bivalvia (35%, mainly Sphaeriidae) and Chironomidae (non-biting midges, 37%) dominated in 2017.

4.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Corixidae (water boatmen) dominated the benthic invertebrate community composition in the first five of the ten years of monitoring (2010 to 2014; Table 4.3-13). Among those years, mean annual relative abundances of Corixidae ranged from 40% (2014) to 90% (2010). Amphipoda (freshwater shrimps, mainly Hyalellidae) then dominated in 2015 (28%), 2016 (43%), and 2019 (31%). Oligochaeta (aquatic segmented worms, 35%) and Amphipoda (24%, mainly Hyalellidae) dominated in 2017. Gastropoda (snails, 40%, mainly Lymnaeidae and Physidae) was the dominant taxon in 2018.

Offshore Habitat

Chironomidae (non-biting midges) dominated the benthic invertebrate community composition in eight of the ten years of monitoring (2010 to 2013, 2015, 2016, 2018, and 2019; Table 4.3-14). Among those years, mean annual relative abundances of Chironomidae ranged from 36% (2015) to 59% (2013). Bivalvia (clams, Sphaeriidae, 39%) and Chironomidae (31%) were the dominant taxa in 2014. Oligochaeta (aquatic segmented worms, 28%), Bivalvia (Sphaeriidae, 42%), and Chironomidae (24%) dominated in 2017.

Table 4.3-1. 2010 to 2019 Northern Indian Lake nearshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Oligochaeta	29%	14%	9%	18%	22%	11%	16%	32%	5%	20%
Amphipoda	<1%	20%	38%	23%	1%	30%	11%	28%	<1%	4%
Bivalvia	12%	<1%	<1%	3%	<1%	3%	23%	0%	0%	0%
Gastropoda	2%	2%	11%	7%	5%	1%	15%	1%	25%	10%
Ceratopogonidae	<1%	1%	1%	3%	0%	1%	1%	<1%	0%	2%
Chironomidae	3%	39%	24%	19%	60%	42%	14%	17%	41%	45%
Other Diptera	46%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	1%
Ephemeroptera	<1%	18%	11%	17%	2%	3%	8%	21%	1%	<1%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	0%	4%	3%	3%	2%	1%	2%	0%	<1%	<1%
Corixidae	4%	1%	2%	5%	5%	2%	5%	1%	26%	11%
Coleoptera	2%	1%	1%	1%	<1%	5%	6%	<1%	3%	7%
All other taxa	<1%	<1%	<1%	1%	3%	1%	1%	1%	<1%	1%

Table 4.3-2. 2010 to 2019 Northern Indian Lake offshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Oligochaeta	3%	3%	1%	5%	2%	1%	1%	2%	2%	<1%
Amphipoda	42%	41%	46%	12%	64%	82%	18%	51%	40%	80%
Bivalvia	5%	7%	9%	27%	17%	11%	27%	17%	12%	11%
Gastropoda	<1%	<1%	1%	0%	<1%	<1%	<1%	2%	1%	<1%
Ceratopogonidae	1%	<1%	1%	<1%	1%	<1%	2%	1%	1%	<1%
Chironomidae	36%	17%	9%	36%	8%	4%	17%	5%	24%	6%
Other Diptera	0%	<1%	0%	<1%	<1%	0%	<1%	0%	0%	0%
Ephemeroptera	13%	30%	34%	16%	8%	2%	32%	22%	19%	2%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	<1%	<1%	<1%	<1%	0%	<1%	1%	0%	0%	<1%
Corixidae	0%	0%	0%	3%	0%	0%	<1%	0%	1%	0%
Coleoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All other taxa	0%	<1%	0%	<1%	<1%	<1%	2%	<1%	1%	<1%

Table 4.3-3. 2010 to 2019 Lower Churchill River at the Little Churchill River nearshore benthic invertebrate relative abundance.

0% <1% to 15% >15% to 25% >25% to 50% >50%

Invertebrate Taxa	2010	2011	2012	2013	2014	2015	2016	2017 (n=0)	2018 (n=0)	2019 (n=0)
Oligochaeta	2%	<1%	15%	2%	1%	7%	3%	-	-	-
Amphipoda	<1%	<1%	4%	12%	53%	16%	39%	-	-	-
Bivalvia	<1%	6%	3%	10%	<1%	48%	6%	-	-	-
Gastropoda	<1%	7%	17%	15%	2%	7%	3%	-	-	-
Ceratopogonidae	<1%	0%	<1%	0%	1%	<1%	1%	-	-	-
Chironomidae	1%	4%	15%	5%	9%	5%	2%	-	-	-
Other Diptera	2%	<1%	<1%	<1%	<1%	<1%	0%	-	-	-
Ephemeroptera	4%	10%	37%	25%	18%	8%	19%	-	-	-
Plecoptera	<1%	<1%	<1%	0%	<1%	0%	<1%	-	-	-
Trichoptera	0%	2%	3%	<1%	2%	<1%	1%	-	-	-
Corixidae	66%	65%	3%	25%	7%	4%	20%	-	-	-
Coleoptera	22%	6%	3%	5%	6%	3%	5%	-	-	-
All other taxa	<1%	<1%	<1%	<1%	<1%	2%	1%	-	-	-

Table 4.3-4. 2010 to 2019 Lower Churchill River at the Little Churchill River offshore benthic invertebrate relative abundance.

0% <1% to 15% >15% to 25% >25% to 50% >50%

Invertebrate Taxa	2010	2011 (n=4)	2012	2013	2014 (n=1)	2015	2016	2017 (n=0)	2018 (n=0)	2019 (n=0)
Oligochaeta	2%	4%	15%	6%	34%	7%	0%	-	-	-
Amphipoda	<1%	0%	0%	<1%	0%	0%	0%	-	-	-
Bivalvia	5%	44%	28%	16%	9%	3%	10%	-	-	-
Gastropoda	<1%	1%	3%	1%	0%	0%	1%	-	-	-
Ceratopogonidae	2%	3%	4%	1%	0%	1%	11%	-	-	-
Chironomidae	83%	20%	27%	50%	31%	63%	22%	-	-	-
Other Diptera	0%	1%	1%	<1%	22%	1%	3%	-	-	-
Ephemeroptera	7%	26%	4%	24%	0%	22%	51%	-	-	-
Plecoptera	0%	0%	7%	0%	0%	0%	0%	-	-	-
Trichoptera	1%	2%	9%	1%	0%	2%	1%	-	-	-
Corixidae	0%	0%	0%	<1%	0%	0%	0%	-	-	-
Coleoptera	0%	0%	0%	<1%	0%	0%	0%	-	-	-
All other taxa	0%	0%	2%	1%	3%	<1%	1%	-	-	-

Table 4.3-5. 2010 to 2019 Partridge Breast Lake nearshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2012	2015	2018
Oligochaeta	32%	21%	4%
Amphipoda	14%	28%	14%
Bivalvia	2%	3%	0%
Gastropoda	6%	4%	18%
Ceratopogonidae	3%	6%	<1%
Chironomidae	8%	9%	14%
Other Diptera	0%	<1%	<1%
Ephemeroptera	26%	18%	14%
Plecoptera	0%	0%	0%
Trichoptera	<1%	<1%	3%
Corixidae	7%	8%	27%
Coleoptera	1%	1%	4%
All other taxa	2%	1%	1%

Table 4.3-6. 2010 to 2019 Partridge Breast Lake offshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2012	2015	2018
Oligochaeta	1%	<1%	3%
Amphipoda	15%	69%	14%
Bivalvia	18%	9%	1%
Gastropoda	<1%	1%	1%
Ceratopogonidae	4%	1%	2%
Chironomidae	57%	10%	30%
Other Diptera	0%	<1%	0%
Ephemeroptera	4%	9%	47%
Plecoptera	0%	0%	0%
Trichoptera	0%	<1%	2%
Corixidae	<1%	<1%	0%
Coleoptera	0%	0%	0%
All other taxa	<1%	<1%	<1%

Table 4.3-7. 2010 to 2019 Fidler Lake nearshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2011	2014	2017
Oligochaeta	29%	8%	19%
Amphipoda	1%	3%	28%
Bivalvia	2%	0%	0%
Gastropoda	31%	2%	1%
Ceratopogonidae	5%	0%	<1%
Chironomidae	8%	20%	43%
Other Diptera	9%	<1%	<1%
Ephemeroptera	<1%	7%	4%
Plecoptera	0%	0%	0%
Trichoptera	3%	<1%	<1%
Corixidae	6%	51%	1%
Coleoptera	6%	9%	3%
All other taxa	1%	<1%	1%

Table 4.3-8. 2010 to 2019 Fidler Lake offshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2011	2014	2017
Oligochaeta	7%	1%	<1%
Amphipoda	32%	11%	30%
Bivalvia	10%	10%	6%
Gastropoda	3%	4%	3%
Ceratopogonidae	11%	10%	2%
Chironomidae	26%	51%	15%
Other Diptera	0%	0%	0%
Ephemeroptera	10%	8%	41%
Plecoptera	0%	0%	0%
Trichoptera	1%	3%	1%
Corixidae	0%	0%	1%
Coleoptera	0%	0%	1%
All other taxa	0%	1%	<1%

Table 4.3-9. 2010 to 2019 Billard Lake nearshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2013	2016	2019
Oligochaeta	50%	17%	42%	38%
Amphipoda	1%	5%	4%	1%
Bivalvia	10%	2%	9%	<1%
Gastropoda	1%	5%	7%	<1%
Ceratopogonidae	2%	<1%	<1%	<1%
Chironomidae	10%	30%	18%	5%
Other Diptera	2%	<1%	<1%	<1%
Ephemeroptera	14%	26%	13%	17%
Plecoptera	0%	0%	0%	<1%
Trichoptera	<1%	5%	2%	<1%
Corixidae	2%	8%	3%	35%
Coleoptera	9%	1%	2%	2%
All other taxa	<1%	<1%	<1%	1%

Table 4.3-10. 2010 to 2019 Billard Lake offshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2013	2016	2019
Oligochaeta	7%	26%	10%	13%
Amphipoda	1%	<1%	0%	0%
Bivalvia	65%	25%	44%	60%
Gastropoda	4%	4%	3%	4%
Ceratopogonidae	1%	<1%	3%	1%
Chironomidae	22%	44%	37%	20%
Other Diptera	0%	0%	0%	0%
Ephemeroptera	<1%	<1%	1%	0%
Plecoptera	0%	0%	0%	0%
Trichoptera	<1%	<1%	2%	<1%
Corixidae	0%	0%	0%	0%
Coleoptera	0%	0%	0%	0%
All other taxa	<1%	<1%	0%	0%

Table 4.3-11. 2010 to 2019 Lower Churchill River at the Churchill Weir nearshore benthic invertebrate relative abundance.

0% <1% to 15% >15% to 25% >25% to 50% >50%

Invertebrate Taxa	2014	2017
Oligochaeta	3%	2%
Amphipoda	7%	3%
Bivalvia	2%	<1%
Gastropoda	13%	3%
Ceratopogonidae	<1%	<1%
Chironomidae	53%	42%
Other Diptera	<1%	<1%
Ephemeroptera	18%	44%
Plecoptera	0%	0%
Trichoptera	1%	2%
Corixidae	4%	2%
Coleoptera	<1%	<1%
All other taxa	<1%	<1%

Table 4.3-12. 2010 to 2019 Lower Churchill River at the Churchill Weir offshore benthic invertebrate relative abundance.

0% <1% to 15% >15% to 25% >25% to 50% >50%

Invertebrate Taxa	2014	2017
Oligochaeta	8%	4%
Amphipoda	1%	1%
Bivalvia	53%	35%
Gastropoda	9%	5%
Ceratopogonidae	2%	0%
Chironomidae	21%	37%
Other Diptera	0%	7%
Ephemeroptera	5%	3%
Plecoptera	0%	0%
Trichoptera	1%	7%
Corixidae	<1%	0%
Coleoptera	0%	0%
All other taxa	<1%	1%

Table 4.3-13. 2010 to 2019 Gauer Lake nearshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Oligochaeta	<1%	<1%	3%	2%	7%	17%	16%	35%	7%	8%
Amphipoda	3%	2%	14%	19%	3%	28%	43%	24%	4%	31%
Bivalvia	<1%	<1%	2%	1%	<1%	6%	2%	3%	<1%	2%
Gastropoda	2%	7%	4%	10%	9%	23%	18%	15%	40%	23%
Ceratopogonidae	0%	0%	0%	0%	0%	<1%	<1%	0%	0%	0%
Chironomidae	1%	1%	1%	2%	10%	9%	3%	12%	4%	6%
Other Diptera	0%	<1%	<1%	0%	<1%	0%	<1%	<1%	<1%	0%
Ephemeroptera	2%	<1%	2%	4%	4%	4%	7%	2%	9%	6%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	<1%	1%	1%	11%	5%	3%	1%	2%	5%	1%
Corixidae	90%	87%	69%	50%	40%	7%	3%	5%	4%	20%
Coleoptera	1%	<1%	<1%	1%	2%	<1%	4%	1%	1%	1%
All other taxa	<1%	1%	2%	1%	19%	2%	3%	2%	25%	2%

Table 4.3-14. 2010 to 2019 Gauer Lake offshore benthic invertebrate relative abundance.

0% | <1% to 15% | >15% to 25% | >25% to 50% | >50%

Invertebrate Taxa	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Oligochaeta	27%	30%	22%	22%	24%	29%	22%	28%	19%	18%
Amphipoda	0%	0%	<1%	<1%	<1%	1%	<1%	<1%	<1%	0%
Bivalvia	22%	14%	28%	15%	39%	30%	24%	42%	25%	31%
Gastropoda	2%	4%	2%	2%	2%	2%	1%	2%	2%	2%
Ceratopogonidae	2%	0%	1%	<1%	0%	1%	1%	1%	<1%	0%
Chironomidae	46%	49%	45%	59%	31%	36%	47%	24%	51%	48%
Other Diptera	0%	0%	0%	0%	0%	0%	0%	<1%	<1%	0%
Ephemeroptera	1%	1%	2%	1%	2%	1%	4%	3%	2%	1%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	<1%	0%	1%	<1%	0%	0%	0%	0%	0%	0%
Corixidae	0%	0%	0%	<1%	0%	0%	0%	0%	0%	0%
Coleoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All other taxa	1%	1%	2%	1%	1%	<1%	<1%	0%	<1%	1%

4.3.2 EPT INDEX

4.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

<u>**Northern Indian Lake**</u>

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from less than 1% (2010, 2018, and 2019) to 26% (2011; Figure 4.3-1). The overall mean was 10%, the overall median was 6%, and the IQR was less than 1% to 15%. Annual means were below the IQR in 2010, 2018 and 2019, and above the IQR in 2011, 2012, 2013 and 2017.

Offshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 2% (2015) to 34% (2012; Figure 4.3-2). The overall mean was 18%, the median was less than 18%, and the IQR was 6% to less than 29%. Annual means were below the IQR in 2015 and 2019, and above the IQR in 2011, 2012 and 2016.

<u>**Lower Churchill River at the Little Churchill River**</u>

Nearshore Habitat

Annual mean EPT Index over the seven years of monitoring ranged from 4% (2010) to 40% (2012; Figure 4.3-1). The overall mean was 19%, the overall median was 14%, and the IQR was 9% to 27%. Annual means were below the IQR in 2010 and above the IQR in 2012 and 2013.

Offshore Habitat

Annual mean EPT Index over the seven years of monitoring ranged from 0% (2014, n=1) to 51% (2016; Figure 4.3-2). The overall mean was 25%, the overall median was 27%, and the IQR was 10% to 34%. Annual means were below the IQR in 2010 and 2014, and above the IQR in 2016.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from less than 17% (2015) to 26% (2012; Figure 4.3-1). The overall mean was 20%, the overall median was 21%, and the IQR was 15% to 24%. Annual means were within the IQR, except in 2012 (above).

Offshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 6% (2012) to 49% (2018; Figure 4.3-2). The overall mean was 22%, the overall median was 12%, and the IQR was 6% to 42%. Annual means were within the IQR, except in 2018 (above).

Fidler Lake

Nearshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 2% (2011) to 8% (2014; Figure 4.3-1). The overall mean and median were 5%, and the IQR was 2% to 7%. Annual means were below the IQR in 2011, and above the IQR in 2014.

Offshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 12% (2014) to 38% (2017; Figure 4.3-2). The overall mean was 22%, the overall median was 16%, and the IQR was 8% to 31%. Annual means were within the IQR, except in 2017 (above).

Billard Lake

Nearshore Habitat

Annual mean EPT Index over the four years of monitoring ranged from 14% (2010) to 25% (2013; Figure 4.3-1). The overall mean was 18%, the overall median was 15%, and the IQR was 10% to 23%. Annual means were within the IQR, except in 2013 (above).

Offshore Habitat

Annual mean EPT Index over the four years of monitoring ranged from less than 1% (2010, 2013 and 2019) to more than 3% (2016; Figure 4.3-2). The overall mean was 1%, the median was less than 1%, and the IQR was less than 1% to 2%. Annual means were within the IQR, except in 2016 (above).

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean EPT Index over the two years of monitoring ranged from 18% (2014) to 44% (2017; Figure 4.3-1). The overall mean was 31%, the overall median was 29%, and the IQR was 19% to 40%. Annual means were below the IQR in 2014, and above the IQR in 2017.

Offshore Habitat

Annual mean EPT Index over the two years of monitoring ranged from 7% (2014) to 15% (2017; Figure 4.3-2). The overall mean was 11%, the overall median was 7%, and the IQR was 5% to 12%. Annual means were within the IQR, except in 2017 (above).

4.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from less than 1% (2011) to 18% (2013; Figure 4.3-1). The overall mean was 6%, the overall median was 4%, and the IQR was less than 2% to less than 9%. Annual means were below the IQR in 2011, and above the IQR in 2013, 2014 and 2018.

Offshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from less than 1% (2019) to 4% (2016; Figure 4.3-2). The overall mean was 2%, the overall median was 1%, and the IQR was less than 1% to 3%. Annual means were within the IQR, except in 2016 (above).

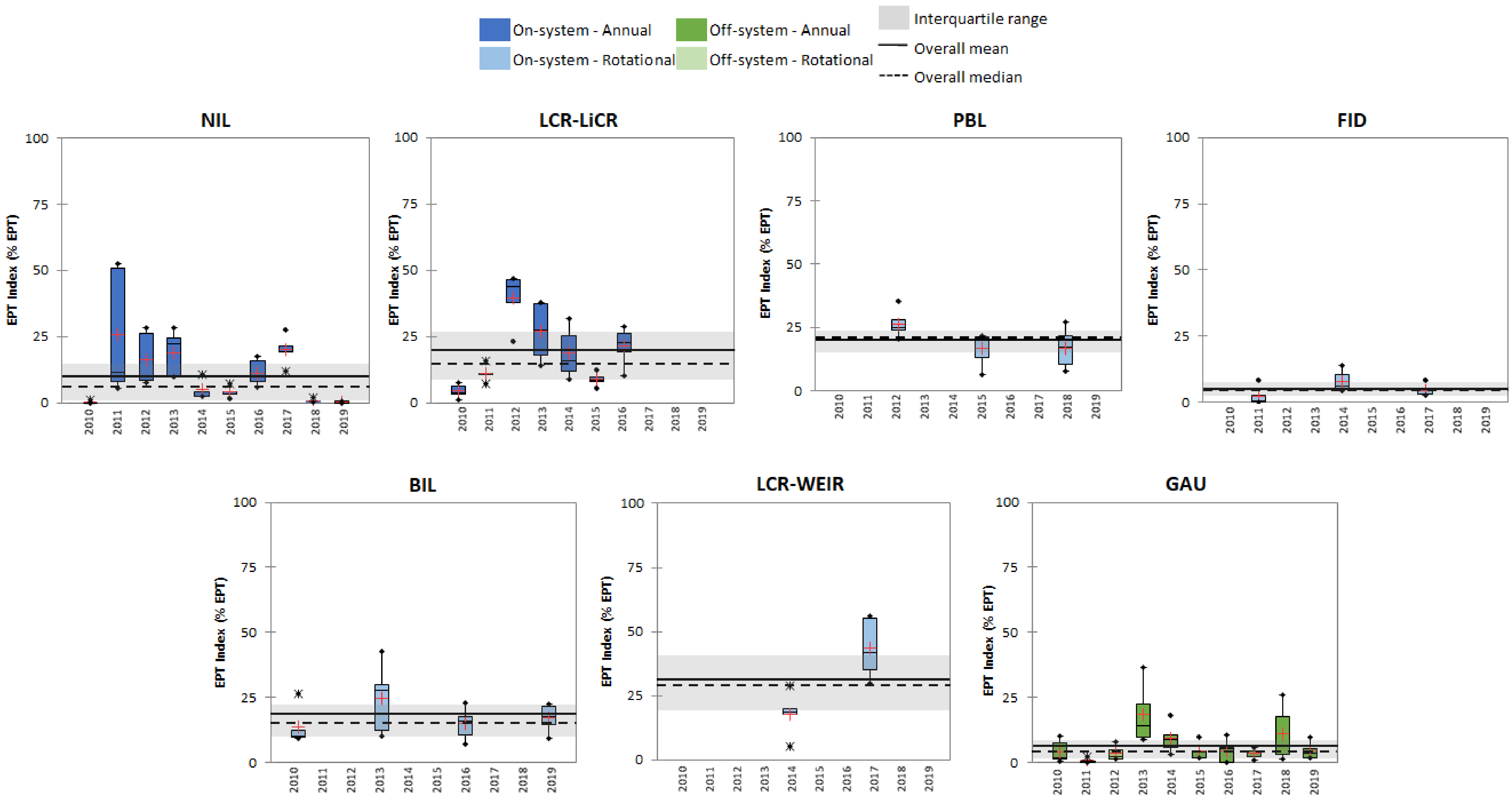


Figure 4.3-1. 2010 to 2019 Nearshore benthic invertebrate EPT Index (LCR-LiCR 2017 to 2019 n=0).

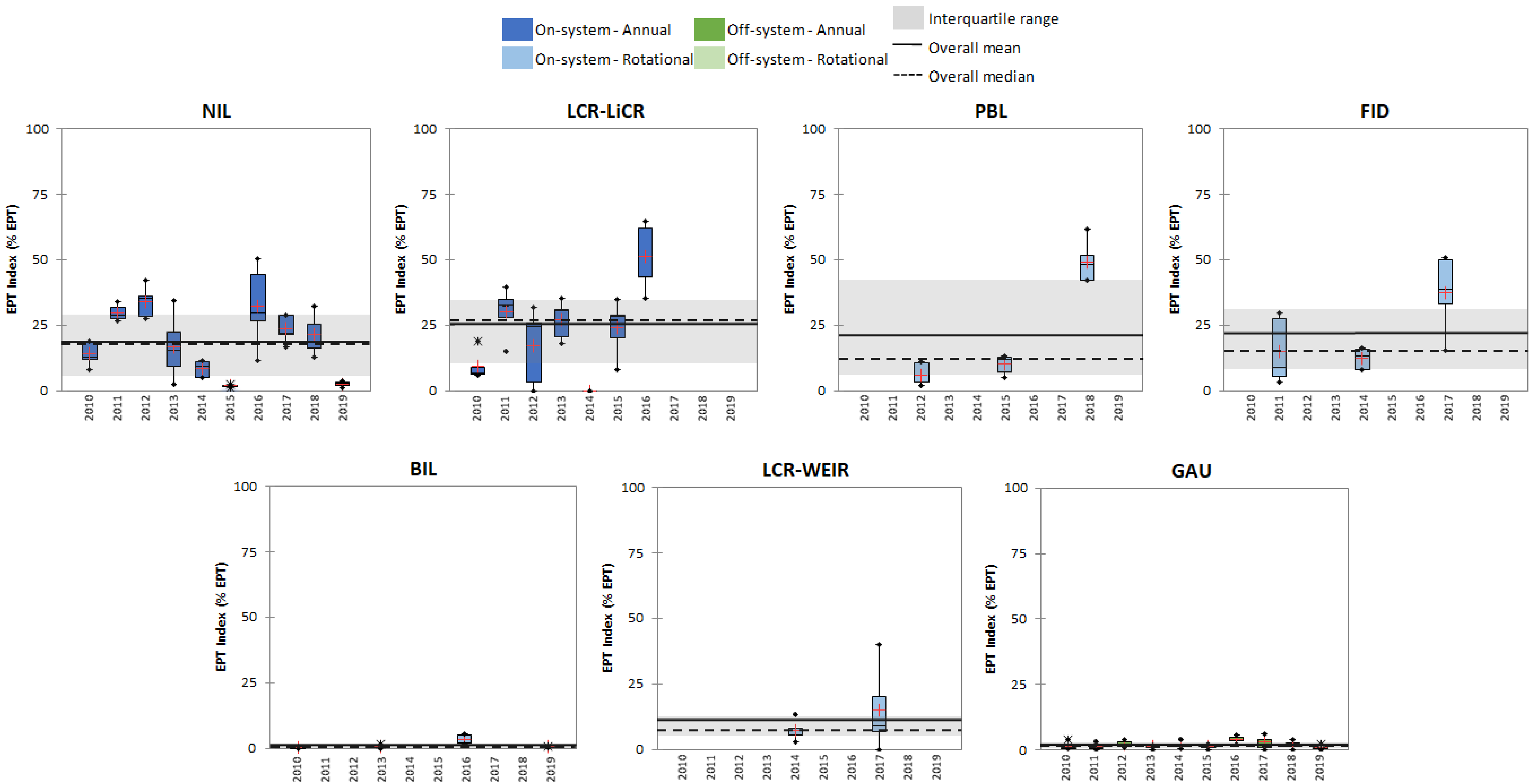


Figure 4.3-2. 2010 to 2019 Offshore benthic invertebrate EPT Index (LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

4.3.3 O+C INDEX

4.3.3.1 ON-SYSTEM SITES

ANNUAL SITES

<u>**Northern Indian Lake**</u>

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 25% (2010) to 78% (2014; Figure 4.3-3). The overall mean was 47%, the overall median was 45%, and the IQR was 30% to 60%. Annual means were below the IQR in 2010, and above the IQR in 2014.

Offshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 4% (2015) to 42% (2013; Figure 4.3-4). The overall mean was 18%, the overall median was 11%, and the IQR was 7% to 23%. Annual means were below the IQR in 2015, 2017 and 2019, and above the IQR in 2010 and 2013.

<u>**Lower Churchill River at the Little Churchill River**</u>

Nearshore Habitat

Annual mean O+C Index over the seven years of monitoring ranged from more than 3% (2010 and 2011) to 30% (2012; Figure 4.3-3). The overall mean was 10%, the overall median was 8%, and the IQR was less than 3% to 12%. Annual means were within the IQR, except in 2012 (above).

Offshore Habitat

Annual mean O+C Index over the seven years of monitoring ranged from 19% (2016) to 82% (2010; Figure 4.3-4). The overall mean was less than 50%, the overall median was 45%, and the IQR was 28% to 70%. Annual means were below the IQR in 2011 and 2016, and above the IQR in 2010 and 2015.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 18% (2018) to 39% (2012; Figure 4.3-3). The overall mean was 29%, the overall median was 28%, and the IQR was 23% to 36%. Annual means were below the IQR in 2018, and above the IQR in 2012.

Offshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 10% (2015) to 52% (2012; Figure 4.3-4). The overall mean was 32%, the overall median was 34%, and the IQR was 12% to 41%. Annual means were below the IQR in 2015, and above the IQR in 2012.

Fidler Lake

Nearshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 26% (2014) to 59% (2017; Figure 4.3-3). The overall mean was 40%, the overall median was 37%, and the IQR was 23% to 59%. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 24% (2017) to 52% (2014; Figure 4.3-4). The overall mean was 36%, the overall median was 41%, and the IQR was 19% to 49%. Annual means were within the IQR, except in 2014 (above).

Billard Lake

Nearshore Habitat

Annual mean O+C Index over the four years of monitoring ranged from 43% (2019) to 60% (2010; Figure 4.3-3). The overall mean was 53%, the overall median was 51%, and the IQR was 43% to 61%. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean O+C Index over the four years of monitoring ranged from 26% (2010) to 71% (2013; Figure 4.3-4). The overall mean and median were 44%, and the IQR was less than 25% to 57%. Annual means were within the IQR, except in 2013 (above).

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean O+C Index over the two years of monitoring ranged from 47% (2017) to 55% (2014; Figure 4.3-3). The overall mean was 51%, the overall median was 48%, and the IQR was 38% to 60%. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean O+C Index over the two years of monitoring was less than 27% (2014 and 2017; Figure 4.3-4). The overall mean was 27%, the overall median was 24%, and the IQR was 12% to 39%. Annual means for all years fell within the IQR.

4.3.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 1% (2011) to 42% (2017; Figure 4.3-3). The overall mean was 14%, the overall median was 10%, and the IQR was 2% to 26%. Annual means were below the IQR in 2010 and 2011, and above the IQR in 2016 and 2017.

Offshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 53% (2017) to 81% (2013; Figure 4.3-4). The overall mean was less than 68%, the median was 68%, and the IQR was 61% to 77%. Annual means were below the IQR in 2014 and 2017, and above the IQR in 2011 and 2013.

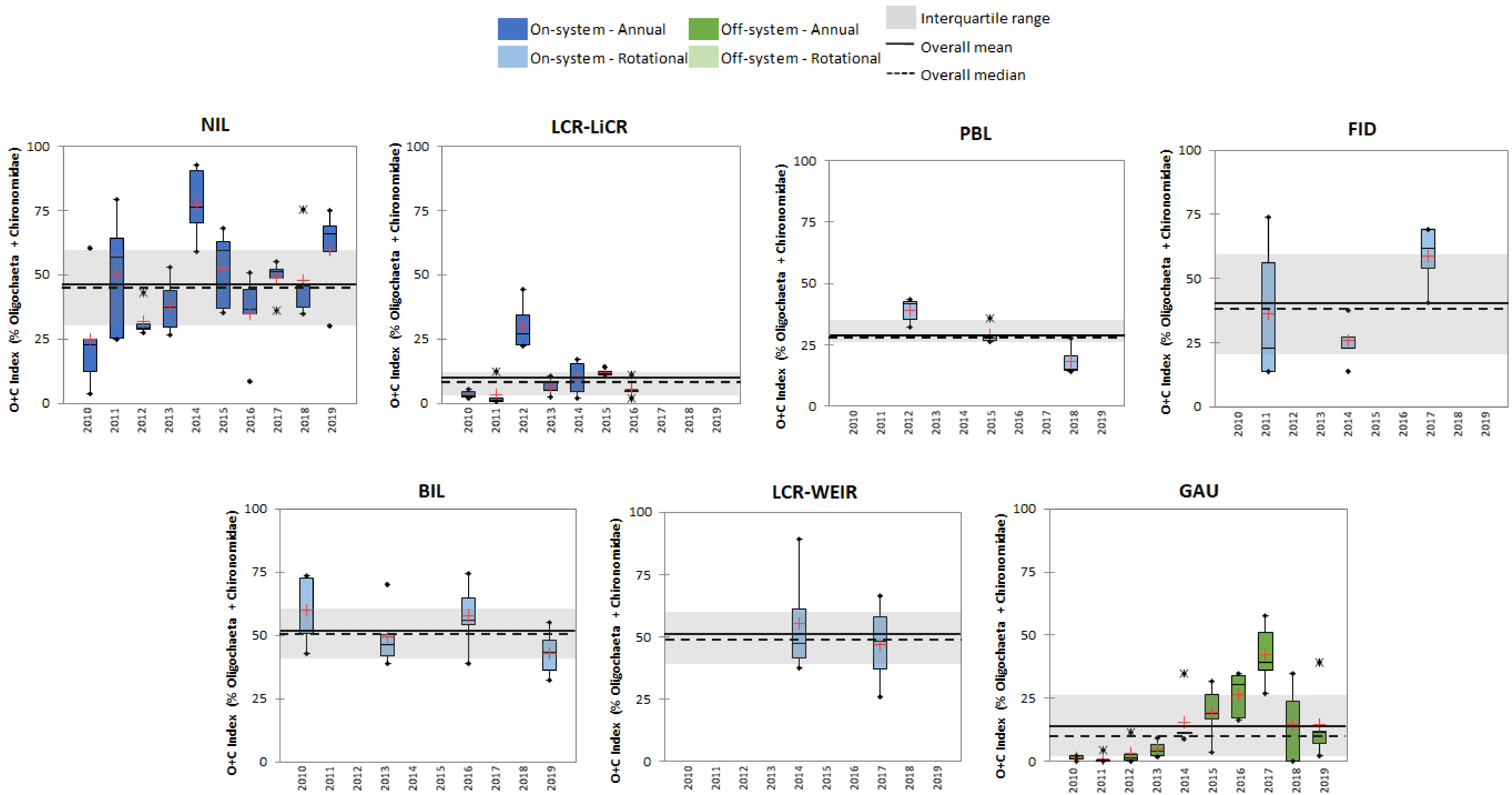


Figure 4.3-3. 2010 to 2019 Nearshore benthic invertebrate O+C Index (LCR-LiCR 2017 to 2019 n=0).

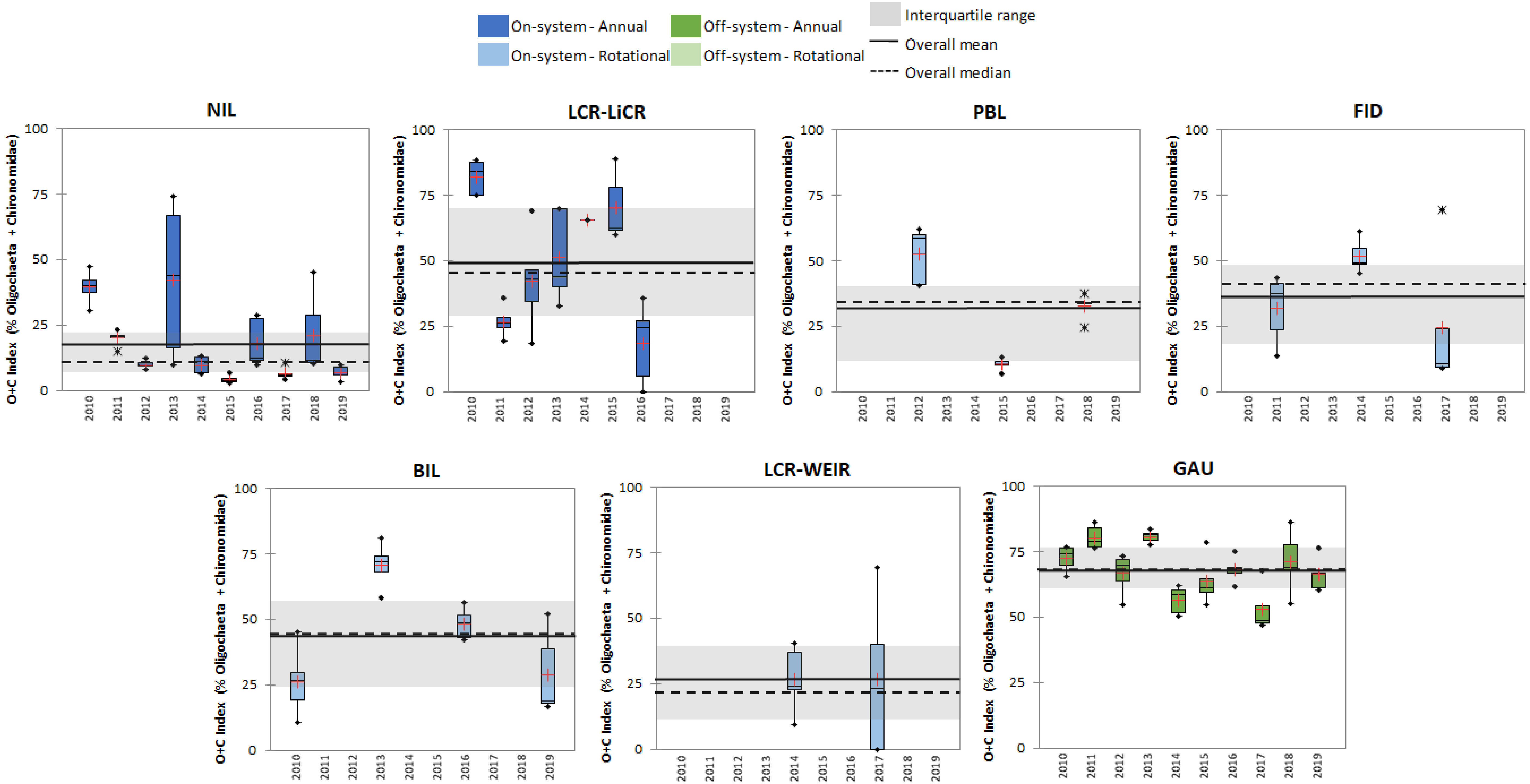


Figure 4.3-4. 2010 to 2019 Offshore benthic invertebrate O+C Index (LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

4.4 RICHNESS

4.4.1 TOTAL TAXA RICHNESS

4.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from less than 11 families (2018) to 21 families (2012; Figure 4.4-1). The overall mean and median were 16 families, and the IQR was 13 to 18 families. Annual means were below the IQR in 2018, and above the IQR in 2012, 2013 and 2015.

Offshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from less than six families (2019) to ten families (2016; Figure 4.4-2). The overall mean and median were seven families, and the IQR was 6 to 8 families. Annual means were below the IQR in 2019 and above the IQR in 2016.

Lower Churchill River at the Little Churchill River

Nearshore Habitat

Annual mean total taxa richness over the seven years of monitoring ranged from 13 families (2010) to 25 families (2012; Figure 4.4-1). The overall mean was 21 families, the overall median was 22 families, and the IQR was 20 to 24 families. Annual means were below the IQR in 2010 and 2011 and above the IQR in 2012.

Offshore Habitat

Annual mean total taxa richness over the seven years of monitoring ranged from four families (2014) to 12 families (2013; Figure 4.4-2). The overall mean was seven families, the median was less than seven families, and the IQR was 4 to 9 families. Annual means were below the IQR in 2014, and above the IQR in 2013.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from 16 families (2018) to 22 families (2015; Figure 4.4-1). The overall mean and median were 19 families, and the IQR was 17 to 21 families. Annual means were below the IQR in 2018, and above the IQR in 2015.

Offshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from less than seven families (2012) to eight families (2015; Figure 4.4-2). The overall mean was seven families, the overall median was eight families, and the IQR was 6 to 9 families. Annual means for all years fell within the IQR.

Fidler Lake

Nearshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from 13 families (2017) to 17 families (2014; Figure 4.4-1). The overall mean was less than 15 families, the overall median was 14 families, and the IQR was 13 to 18 families. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from six families (2011) to ten families (2014; Figure 4.4-2). The overall mean was less than eight families, the median was eight families, and the IQR was less than 7 to 9 families. Annual means were below the IQR in 2011, and above the IQR in 2014.

Billard Lake

Nearshore Habitat

Annual mean total taxa richness over the four years of monitoring ranged from 15 families (2019) to 19 families (2013; Figure 4.4-1). The overall mean was less than 18 families, the median was 18 families, and the IQR was 17 to less than 19 families. Annual means were below the IQR in 2019, and above the IQR in 2013 and 2016.

Offshore Habitat

Annual mean total taxa richness over the four years of monitoring ranged from six families (2013) to more than seven families (2016; Figure 4.4-2). The overall mean was less than seven families, the median was seven families, and the IQR was 6 to 7 families. Annual means were within the IQR, except in 2016 (above).

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean total taxa richness over the two years of monitoring ranged from 15 families (2014) to 21 families (2017; Figure 4.4-1). The overall mean and median were 18 families, and the IQR was 16 to 21 families. Annual means were below the IQR in 2014, and above the IQR in 2017.

Offshore Habitat

Annual mean total taxa richness over the two years of monitoring ranged from five families (2017) to 12 families (2014; Figure 4.4-2). The overall mean was less than nine families, the overall median was less than 11 families, and the IQR was less than 5 to 11 families. Annual means were within the IQR, except in 2014 (above).

4.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from seven families (2011) to 17 families (2015; Figure 4.4-1). The overall mean was 13 families, the median was less than 13 families, and the IQR was 10 to 17 families. Annual means were within the IQR, except in 2011 (below).

Offshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from five families (2014 and 2017) to more than eight families (2012 and 2013; Figure 4.4-2). The overall mean was less than seven families, the overall median was six families, and the IQR was 6 to 7 families. Annual means were below the IQR in 2014, 2016, 2017, 2018, and 2019, and above the IQR in 2010, 2012 and 2013.

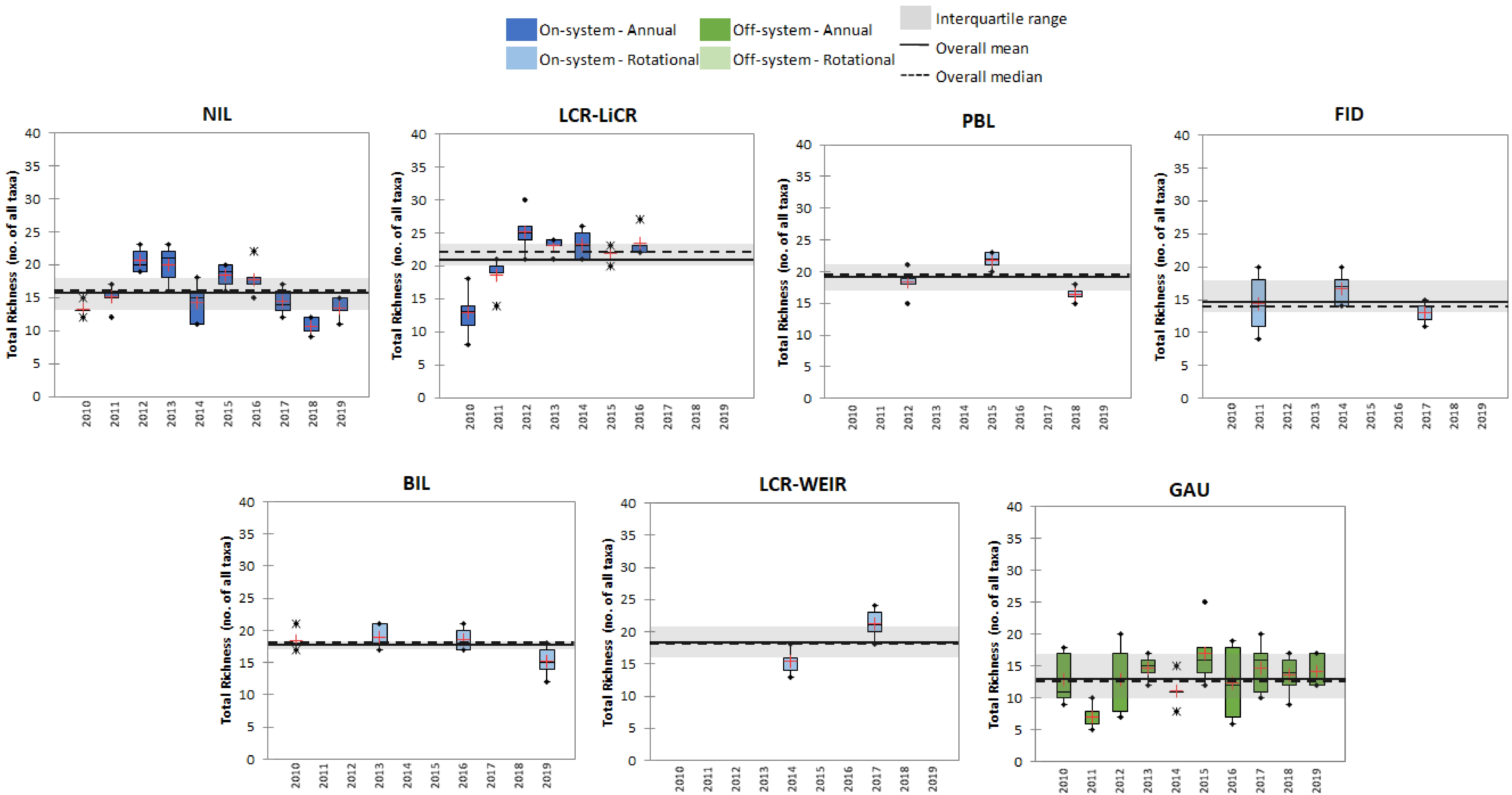


Figure 4.4-1. 2010 to 2019 Nearshore benthic invertebrate total richness (family-level; LCR-LiCR 2017 to 2019 n=0).

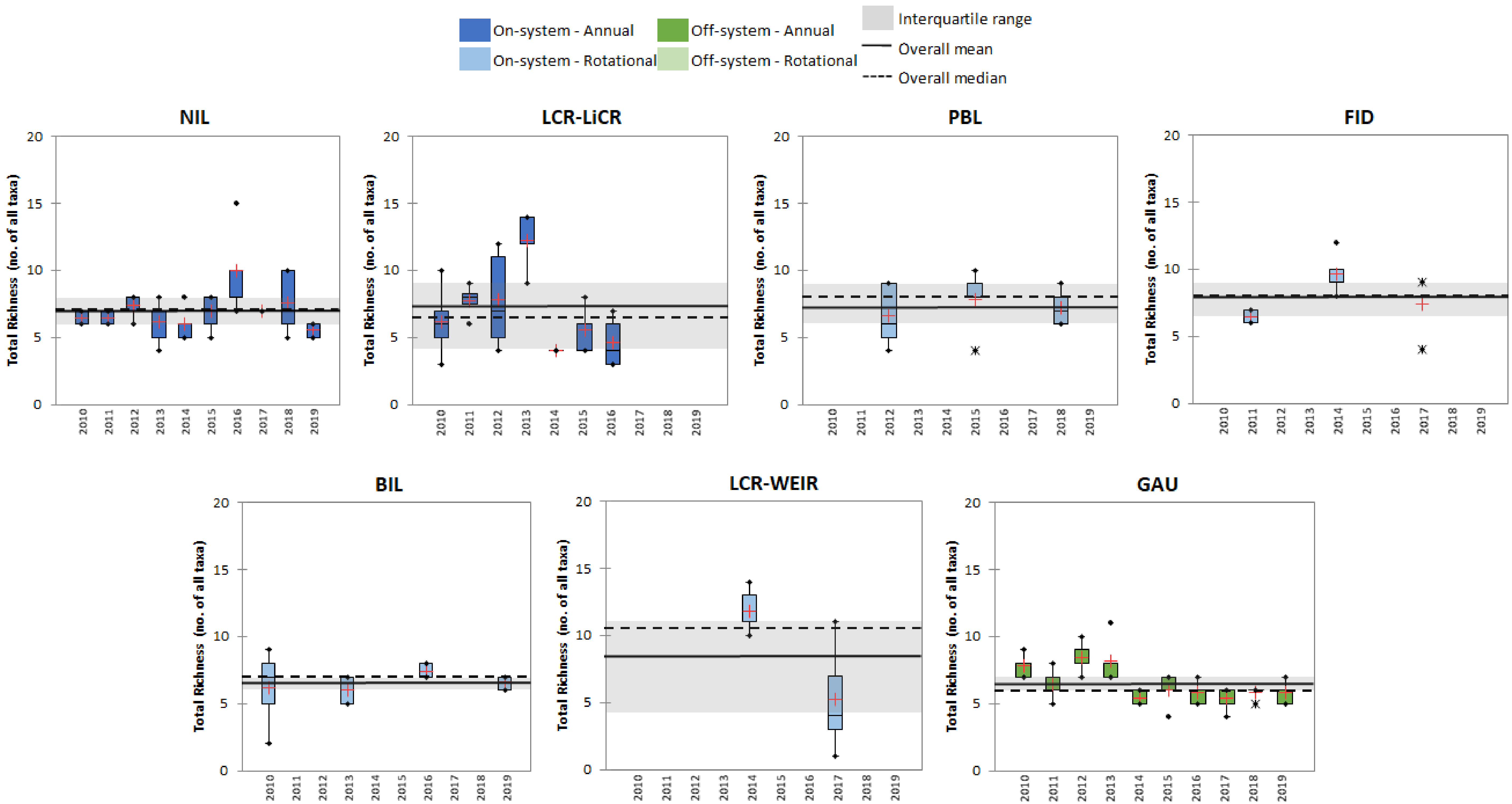


Figure 4.4-2. 2010 to 2019 Offshore benthic invertebrate total richness (family-level; LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

4.4.2 EPT TAXA RICHNESS

4.4.2.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from less than one family (2010) to eight families (2012; Figure 4.4-3). The overall mean was less than four families, the overall median was three families, and the IQR was 2 to 5 families. Annual means were below the IQR in 2010, 2018 and 2019, and above the IQR in 2012, 2013 and 2016.

Offshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from one family (2014, 2017, and 2018) to two families (2016; Figure 4.4-4). The overall mean was greater than one family, the median was one family, and the IQR was within 1 family. Annual means were above the IQR in 2010, 2011, 2012, 2013, 2015, 2016 and 2019.

Lower Churchill River at the Little Churchill River

Nearshore Habitat

Annual mean EPT taxa richness over the seven years of monitoring ranged from three families (2010) to 11 families (2012; Figure 4.4-3). The overall mean was less than eight families, the median was eight families, and the IQR was 7 to 9 families. Annual means were below the IQR in 2010, and above the IQR in 2012 and 2014.

Offshore Habitat

Annual mean EPT taxa richness over the seven years of monitoring ranged from zero families (2014) to less than five families (2013; Figure 4.4-4). The overall mean was less than three families, the overall median was two families, and the IQR was 1 to less than 4 families. Annual means were below the IQR in 2014, and above the IQR in 2013.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from four families (2018) to more than seven families (2015; Figure 4.4-3). The overall mean was less than six families, the median was six families, and the IQR was 5 to 7 families. Annual means were below the IQR in 2018, and above the IQR in 2015.

Offshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from one family (2012) to more than two families (2015 and 2018; Figure 4.4-4). The overall mean was less than two families, the overall median was one family, and the IQR was 1 to 2 families. Annual means were within the IQR, except in 2018 (above).

Fidler Lake

Nearshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from one family (2011) to five families (2014; Figure 4.4-3). The overall mean was less than three families, the median was three families, and the IQR was less than 2 to 4 families. Annual means were below the IQR in 2011, and above the IQR in 2014.

Offshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from one family (2011) to three families (2014; Figure 4.4-4). The overall mean was less than two families, the median was two families, and the IQR was 1 to less than 3 families. Annual means were within the IQR, except in 2014 (above).

Billard Lake

Nearshore Habitat

Annual mean EPT taxa richness over the four years of monitoring ranged from less than six families (2010 and 2019) to less than seven families (2013; Figure 4.4-3). The overall mean and median were six families, and the IQR was 6 to 7 families. Annual means were within the IQR, except in 2010 and 2019 (below).

Offshore Habitat

Annual mean EPT taxa richness over the four years of monitoring ranged from less than one family (2010) to two families (2016; Figure 4.4-4). The overall mean was more than one family, the median was one family, and the IQR was 1 to 2 families. Annual means were within the IQR, except in 2010 (below).

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean EPT taxa richness over the two years of monitoring ranged from six families (2014) to ten families (2017; Figure 4.4-3). The overall mean and median were eight families, and the IQR was less than 6 to less than10 families. Annual means were within the IQR, except in 2017 (above).

Offshore Habitat

Annual mean EPT taxa richness over the two years of monitoring ranged from less than two families (2017) to more than three families (2014; Figure 4.4-4). The overall mean and median were less than three families, and the IQR was 2 to 3 families. Annual means were below the IQR in 2017, and above the IQR in 2014.

4.4.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from one family (2011) to more than five families (2013 and 2015; Figure 4.4-3). The overall mean and median were three families, and the IQR was 2 to 5 families. Annual means were below the IQR in 2011, and above the IQR in 2013 and 2015.

Offshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from less than one family (2011 and 2014 to 2019) to less than two families (2012 and 2013; Figure 4.4-4). The overall mean and median were within one family, and the IQR was also within 1 family. Annual means were below the IQR in 2011, 2015, 2017, 2018, and 2019, and above the IQR in 2010, 2012 and 2013.

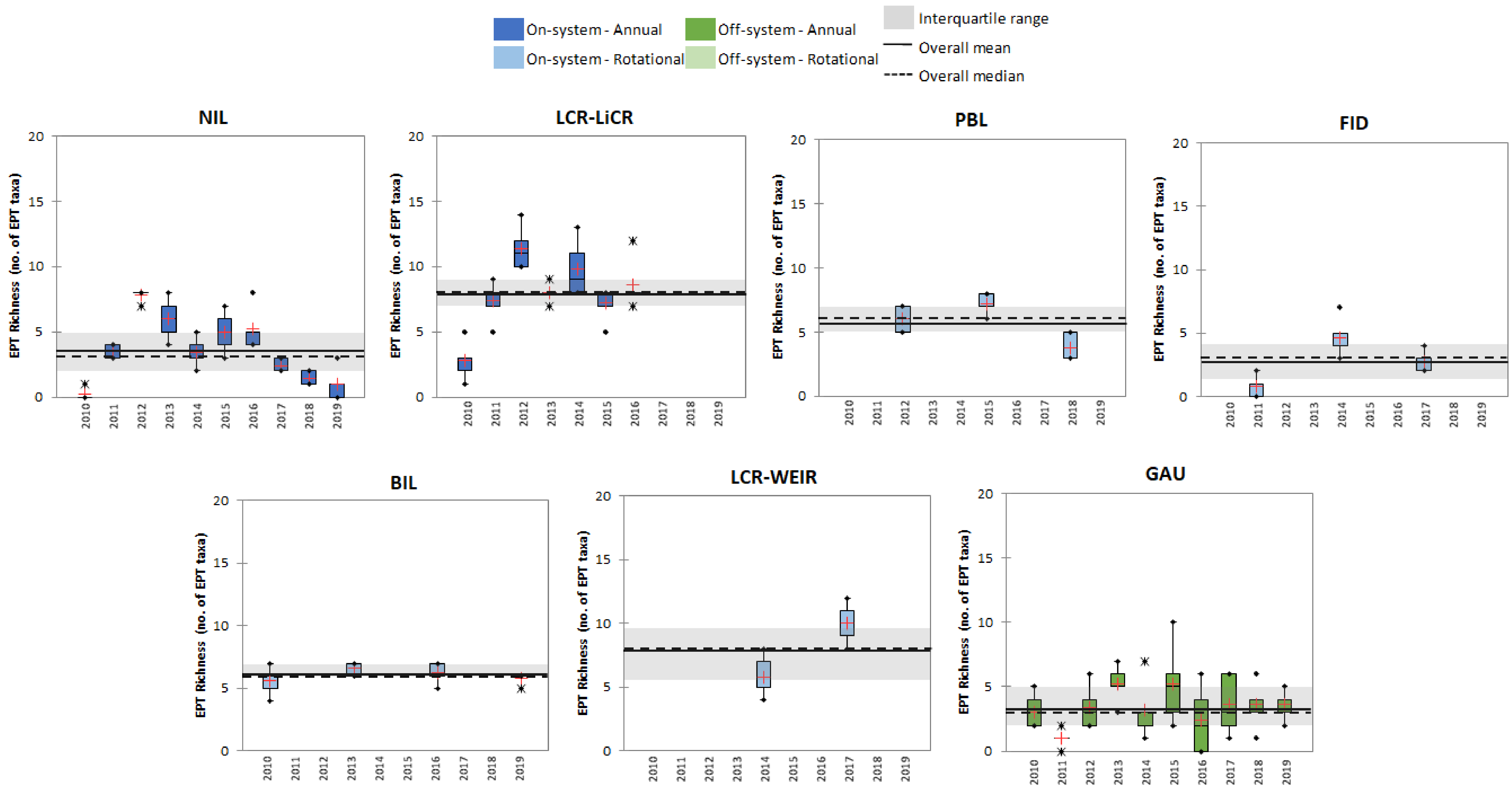


Figure 4.4-3. 2010 to 2019 Nearshore benthic invertebrate EPT richness (family-level; LCR-LiCR 2017 to 2019 n=0).

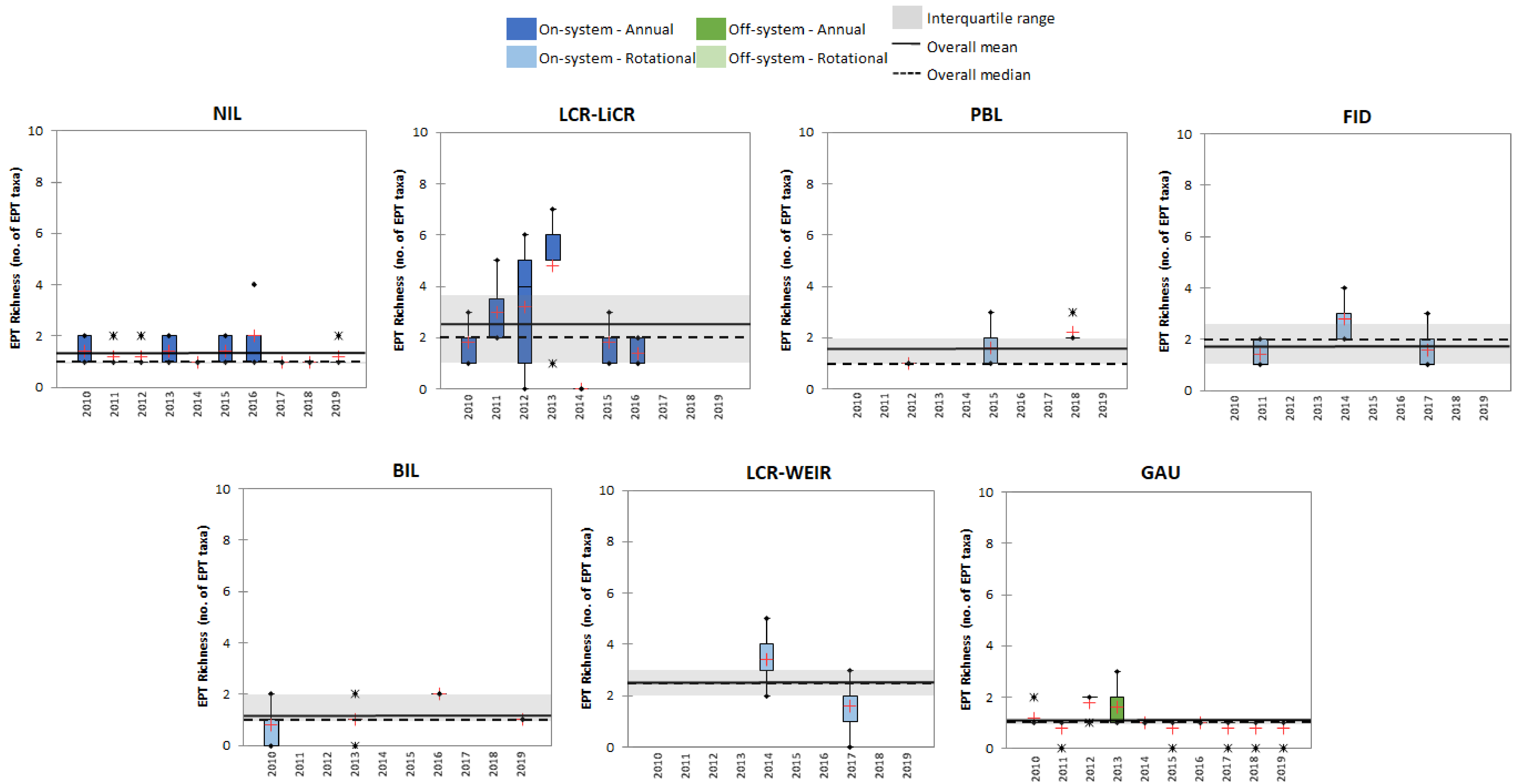


Figure 4.4-4. 2010 to 2019 Offshore benthic invertebrate EPT richness (family-level; LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

4.5 DIVERSITY

4.5.1 HILL'S EFFECTIVE RICHNESS

4.5.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Nearshore Habitat

Annual mean Hill's effective richness (Hill's index) over the ten years of monitoring ranged from four (2014) to nine (2013; Figure 4.5-1). The overall mean was less than six, the overall median was more than five, and the IQR was 4 to less than 7. Annual means were below the IQR in 2014, and above the IQR in 2013 and 2016.

Offshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from two (2015 and 2019) to four (2010 to 2013 and 2016 to 2018; Figure 4.5-2). The overall mean was more than three, the overall median was less than four, and the IQR was less than 3 to less than 4. Annual means were below the IQR in 2015 and 2019 and above the IQR in 2011, 2016 and 2018.

Lower Churchill River at the Little Churchill River

Nearshore Habitat

Annual mean Hill's index over the seven years of monitoring ranged from three (2010) to ten (2012 and 2013; Figure 4.5-1). The overall mean was less than seven, the overall median was six, and the IQR was 4 to 10. Annual means were below the IQR in 2010 and 2011, and above the IQR in 2012 and 2013.

Offshore Habitat

Annual mean Hill's index over the seven years of monitoring ranged from two (2010) to five (2012; Figure 4.5-2). The overall mean was less than four, the overall median was three, and the IQR was less than 3 to more than 4. Annual means were below the IQR in 2010, and above the IQR in 2012.

ROTATIONAL SITES

Partridge Breast Lake

Nearshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from seven (2012) to eight (2015 and 2018; Figure 4.5-1). The overall mean and median were less than eight and the IQR was 7 to less than 9. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from three (2015) to four (2012 and 2018; Figure 4.5-2). The overall mean and median were three, and the IQR was more than 3 to less than 4. Annual means were below the IQR in 2015, and above the IQR in 2018.

Fidler Lake

Nearshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from four (2017) to less than seven (2011; Figure 4.5-1). The overall mean was five. the median was less than five, and the IQR was 4 to 5. Annual means were within the IQR, except in 2011 (above).

Offshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from four (2017) to five (2011 and 2014; Figure 4.5-2). The overall mean was less than five, the median was five, and the IQR was 4 to 5. Annual means were within the IQR, except in 2017 (below).

Billard Lake

Nearshore Habitat

Annual mean Hill's index over the four years of monitoring ranged from less than five (2019) to less than eight (2013; Figure 4.5-1). The overall mean was six, the median was less than six, and the IQR was less than 5 to less than 8. Annual means were below the IQR in 2019, and above the IQR in 2013.

Offshore Habitat

Annual mean Hill's index over the four years of monitoring ranged from three (2010, 2013 and 2019) to four (2016; Figure 4.5-2). The overall mean and median were three, and the IQR was 3 to less than 4. Annual means were below the IQR in 2010 and 2019, and above the IQR in 2016.

Lower Churchill River at the Churchill Weir

Nearshore Habitat

Annual mean Hill's index over the two years of monitoring was five (2014 and 2017; Figure 4.5-1). The overall mean was less than five, the median was five, and the IQR was less than 5 to less than 6. Annual means for all years fell within the IQR.

Offshore Habitat

Annual mean Hill's index over the two years of monitoring ranged from three (2017) to four (2014; Figure 4.5-2). The overall mean and median were less than four, and the IQR was 3 to less than 5. Annual means for all years fell within the IQR.

4.5.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Nearshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from less than two (2011) to eight (2018; Figure 4.5-1). The overall mean was five, the overall median was less than six, and the IQR was less than 3 to 7. Annual means were below the IQR in 2010 and 2011, and above the IQR in 2018.

Offshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from three (2011, 2013 and 2017 to 2019) to four (2010, 2012 and 2014 to 2016; Figure 4.5-2). The overall mean and median were more than three, and the IQR was 3 to less than 4. Annual means were below the IQR in 2013 and 2019, and above the IQR in 2012.

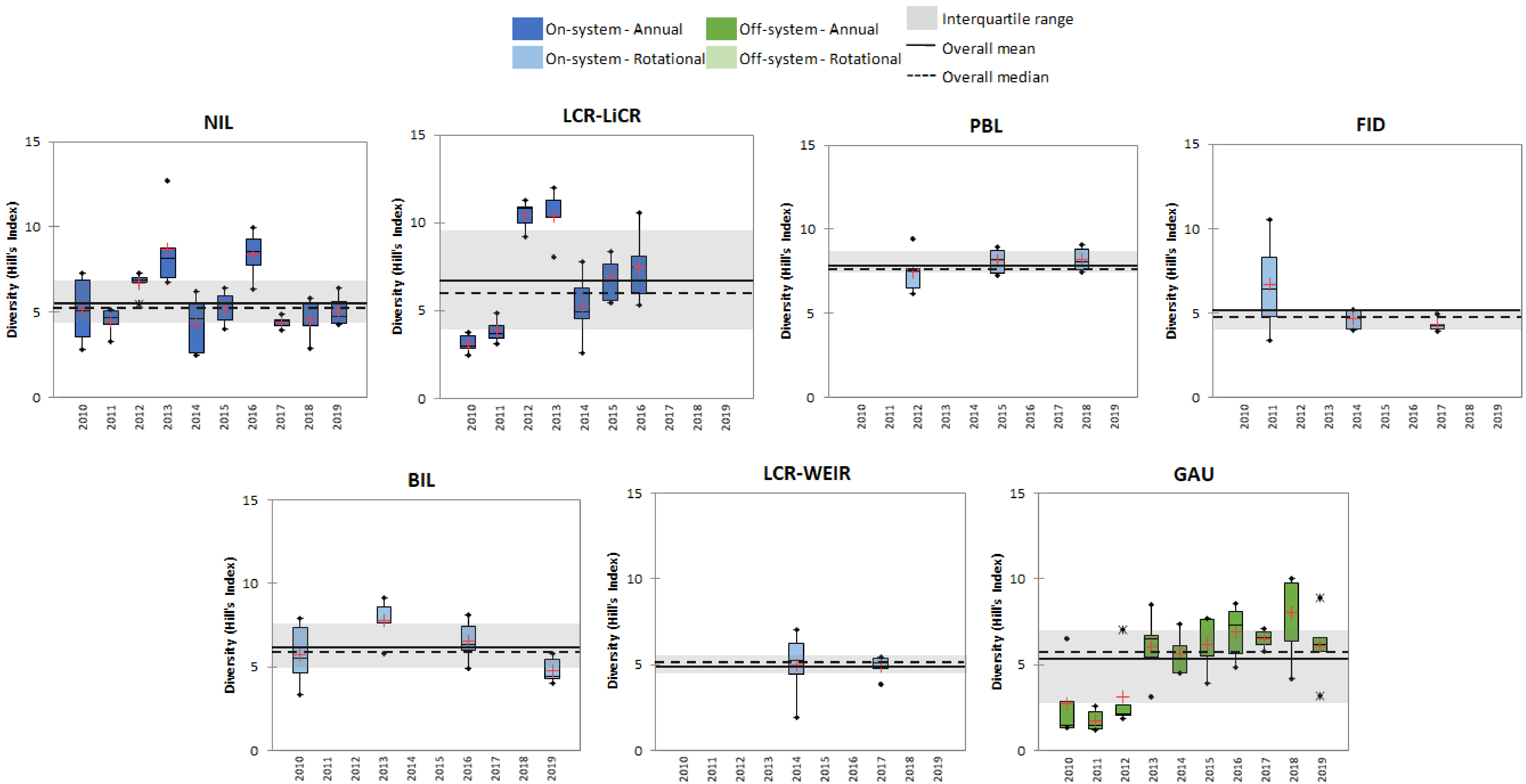


Figure 4.5-1. 2010 to 2019 Nearshore benthic invertebrate diversity (family-level; LCR-LiCR 2017 to 2019 n=0).

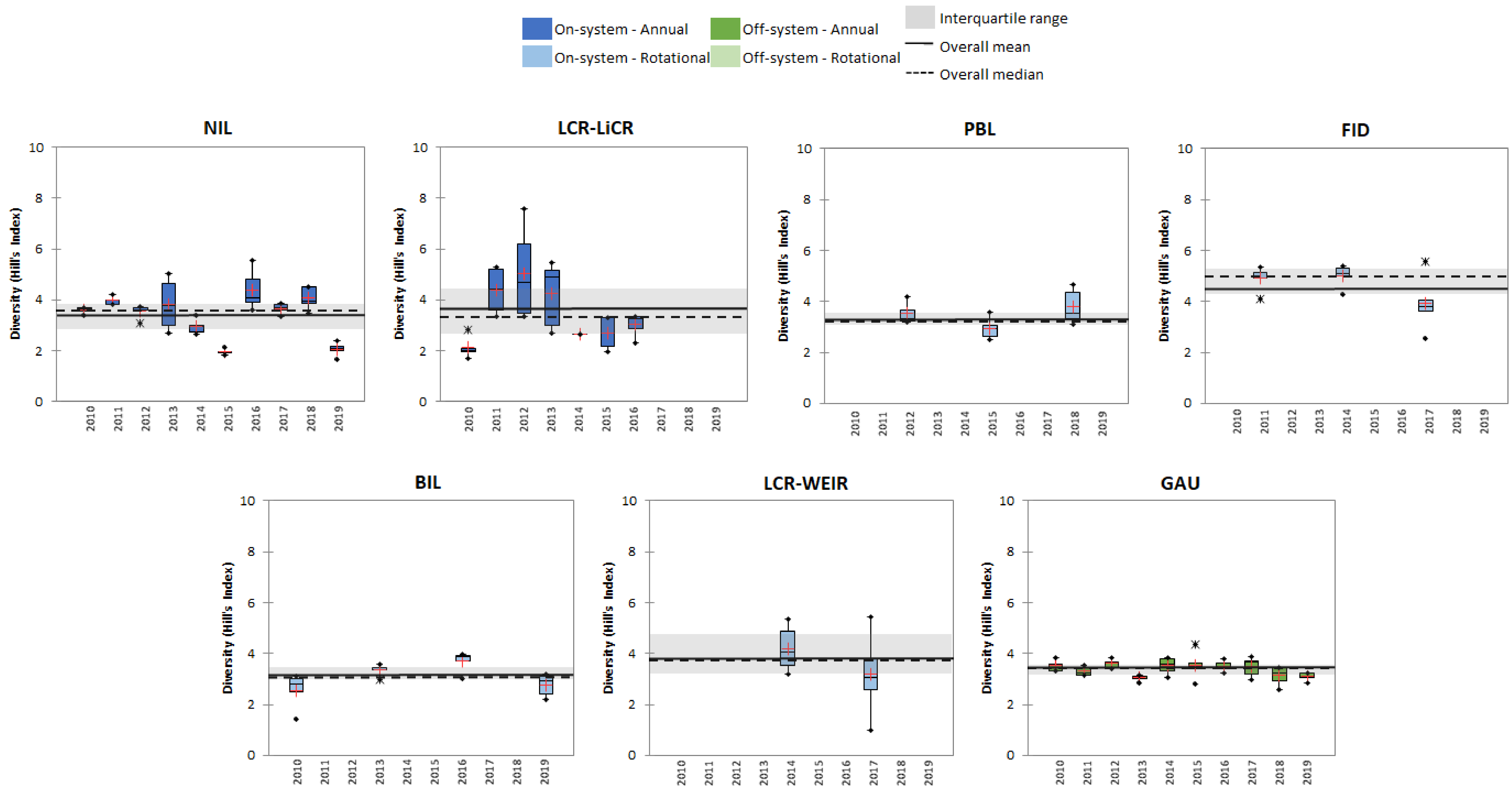


Figure 4.5-2. 2010 to 2019 Offshore benthic invertebrate diversity (family-level; LCR-LiCR 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

APPENDIX 4-1. BENTHIC INVERTEBRATE NEARSHORE AND OFFSHORE SAMPLING SITES: 2008-2019

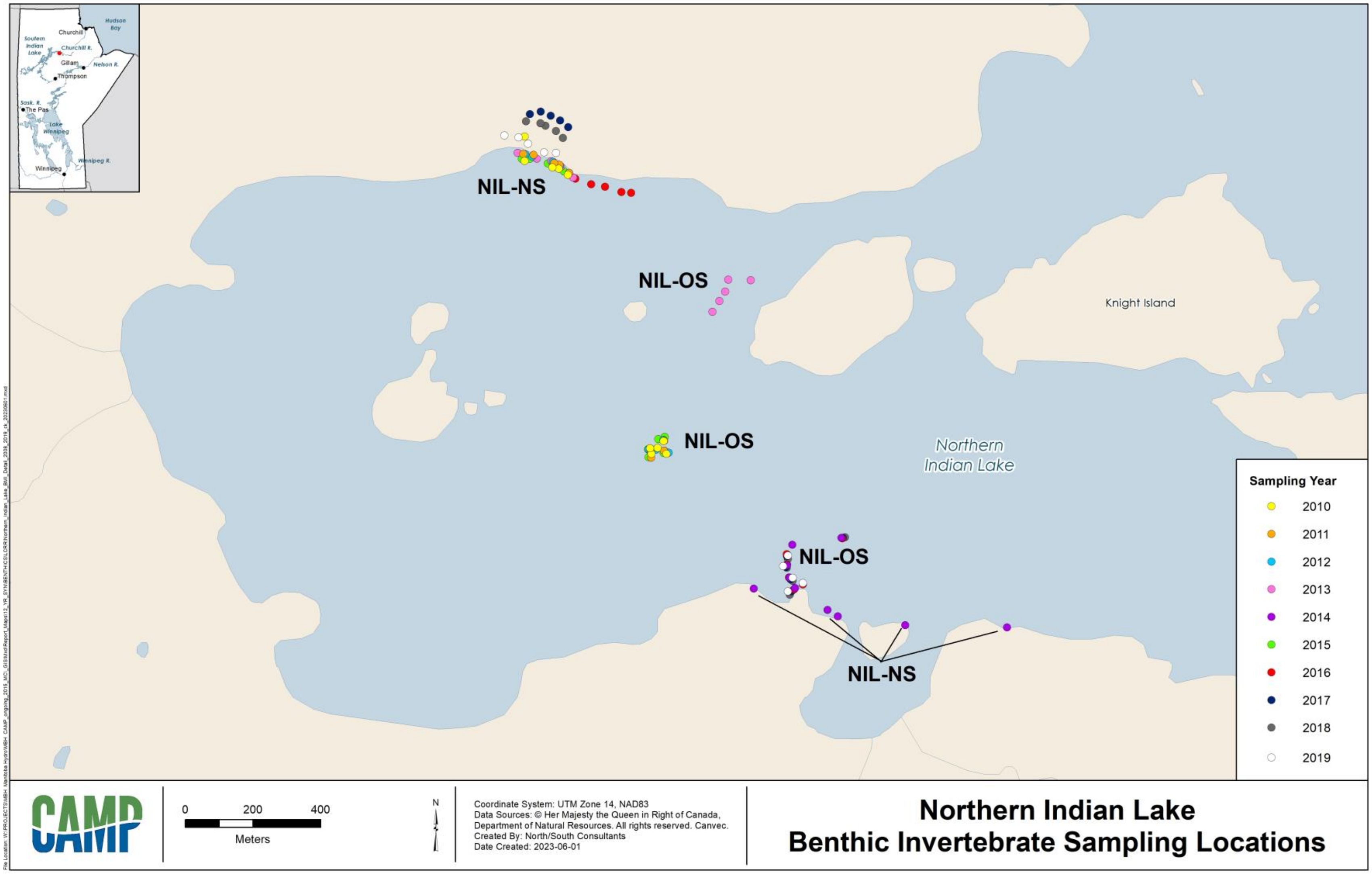


Figure A4-1-1. 2010 to 2019 Northern Indian Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

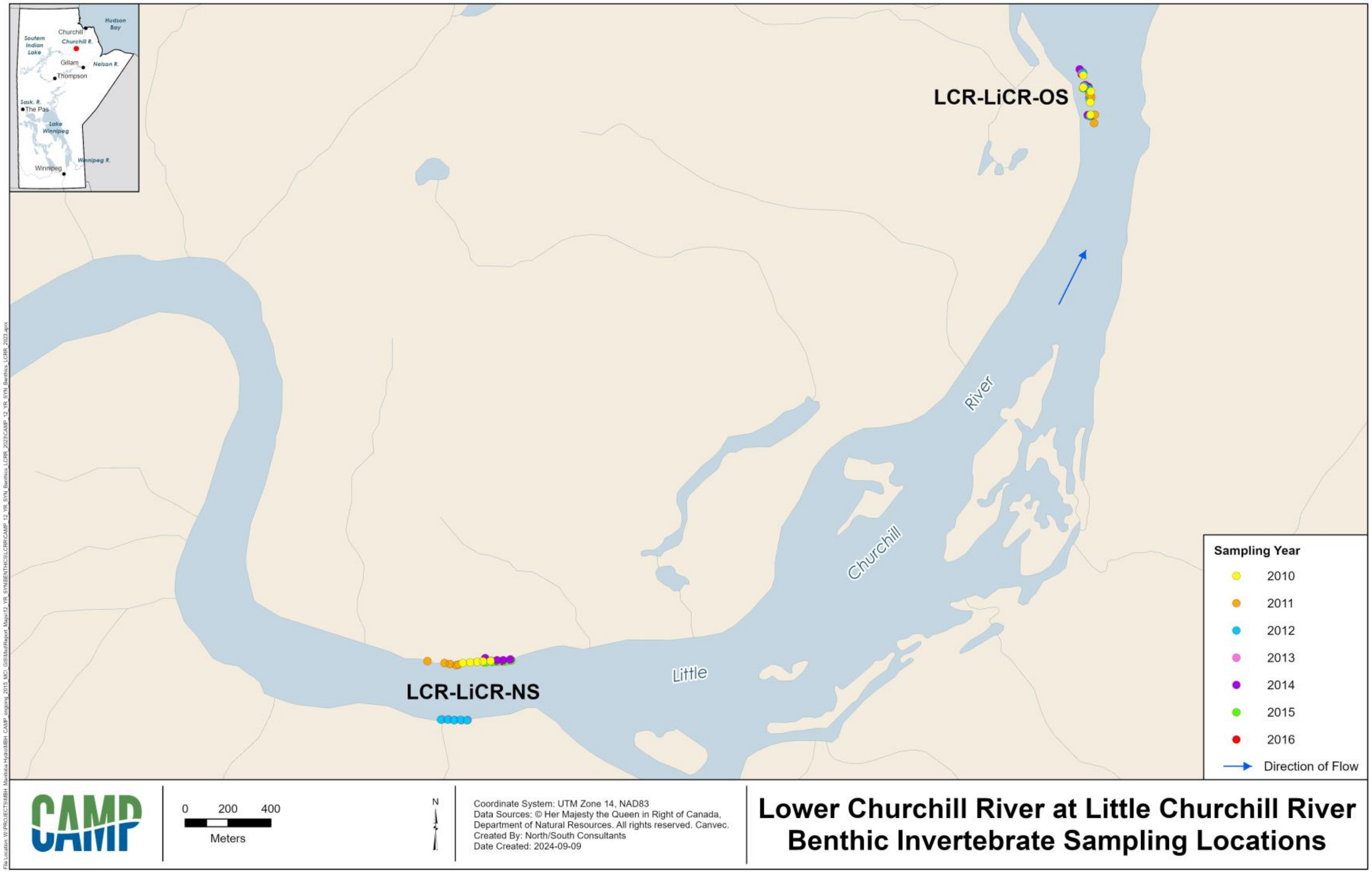


Figure A4-1-2. 2010 to 2019 Lower Churchill River at the Little Churchill River nearshore (NS) and offshore (OS) benthic invertebrate sampling sites (LCR-LiCR OS 2011 n=4, 2014 n=1, and 2017 to 2019 n=0).

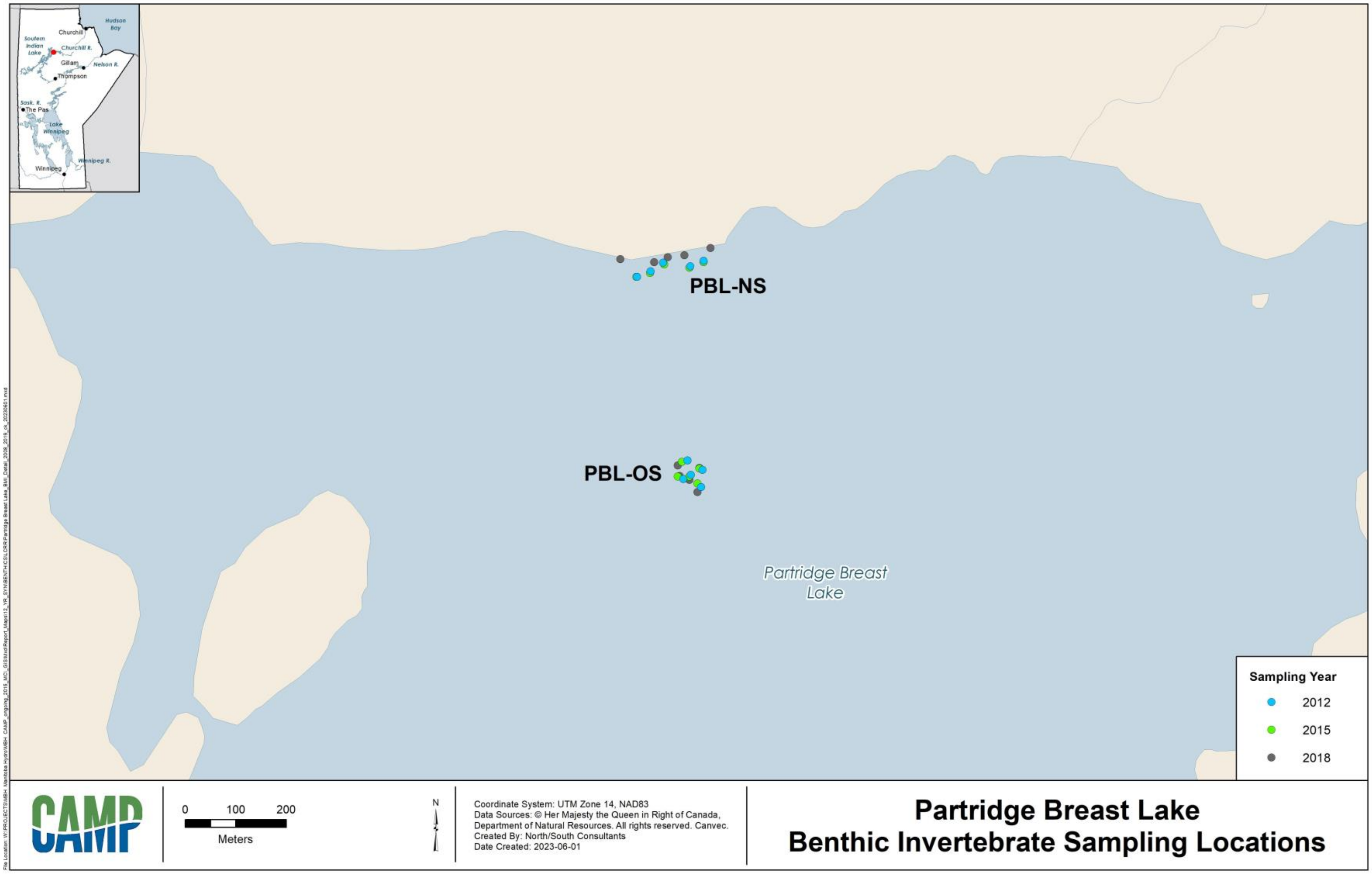


Figure A4-1-3. 2010 to 2019 Partridge Breast Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

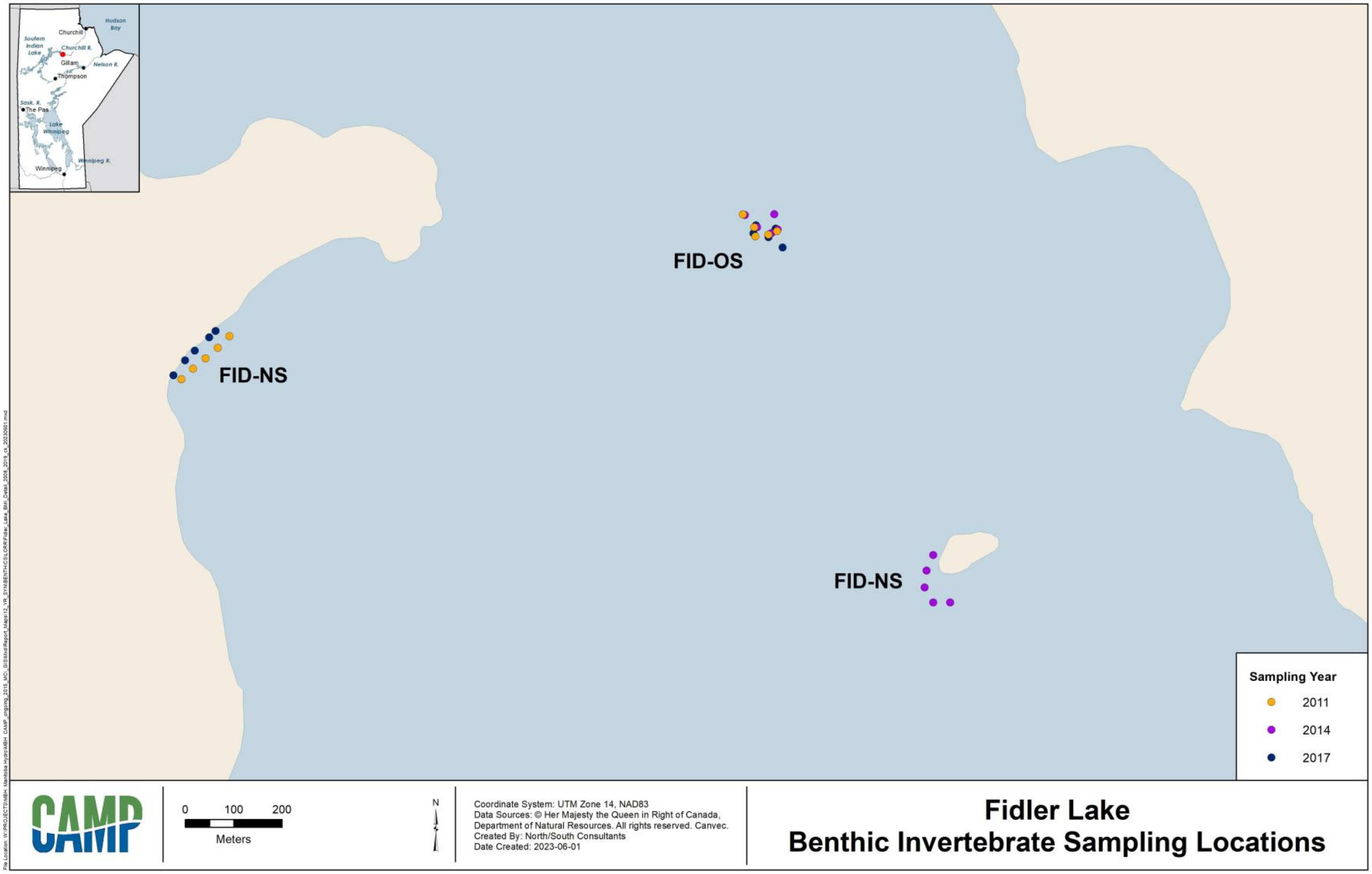


Figure A4-1-4. 2010 to 2019 Fidler Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

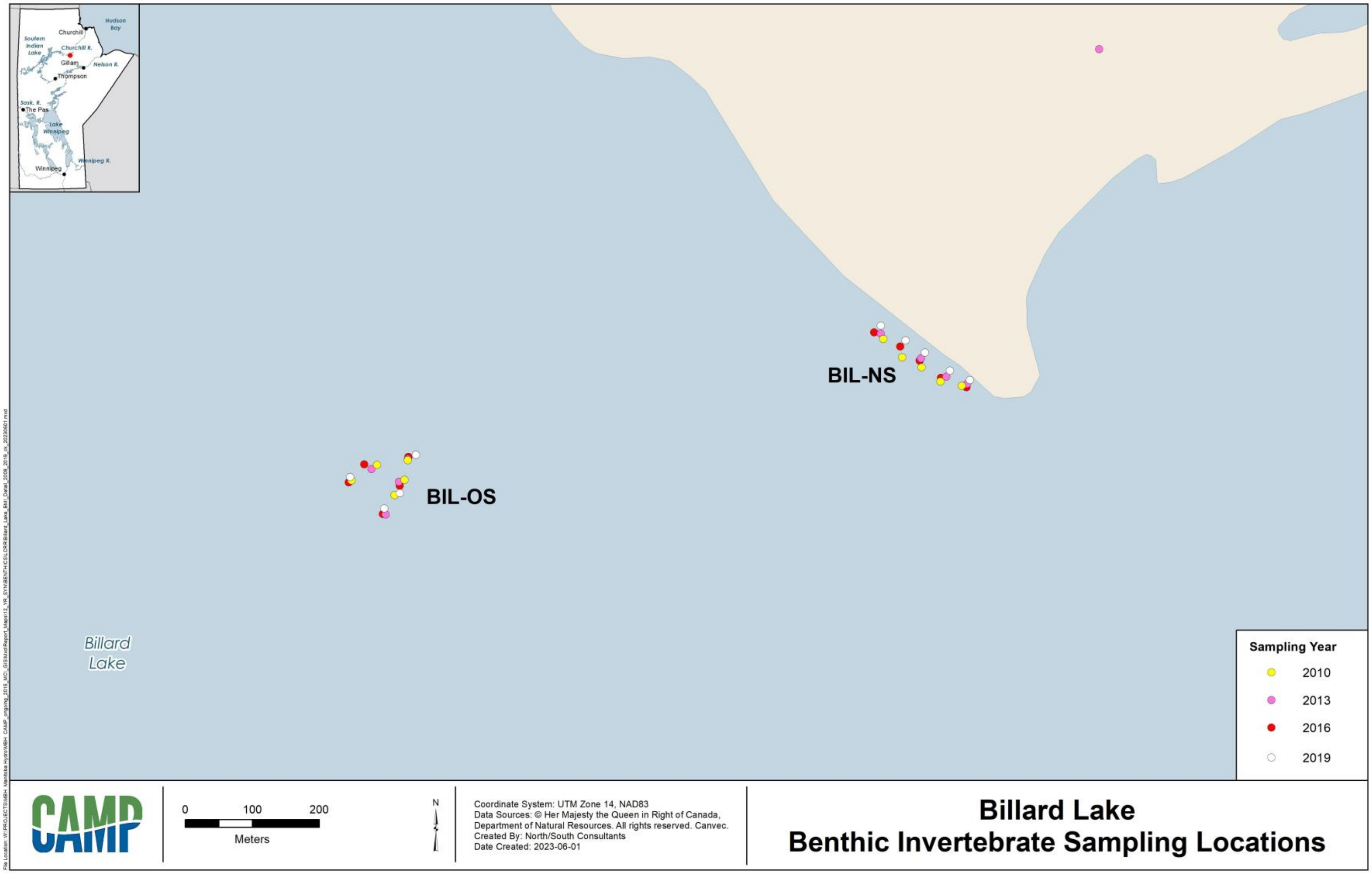


Figure A4-1-5. 2010 to 2019 Billard Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

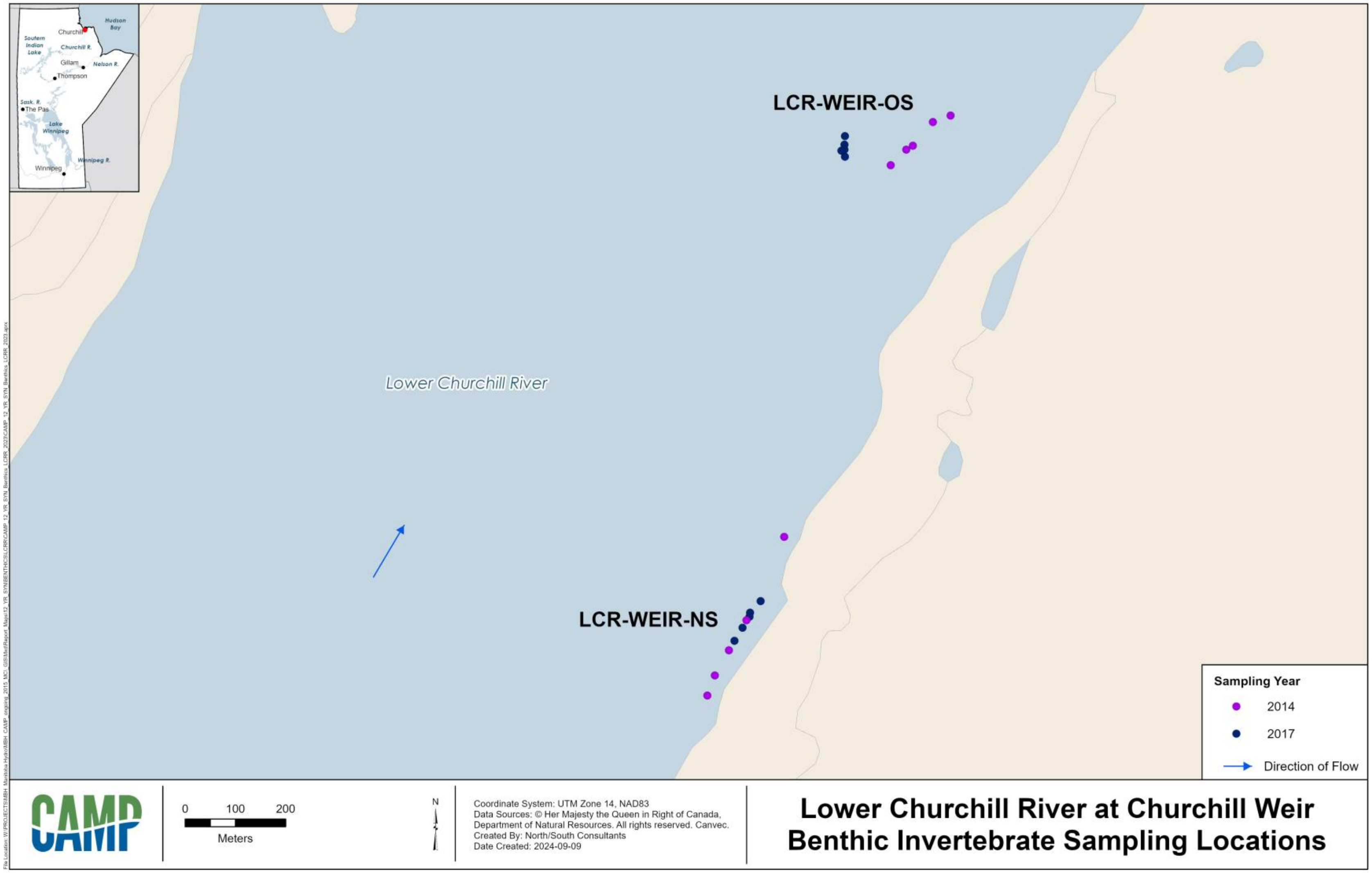


Figure A4-1-6. 2010 to 2019 Lower Churchill River at the Churchill Weir nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

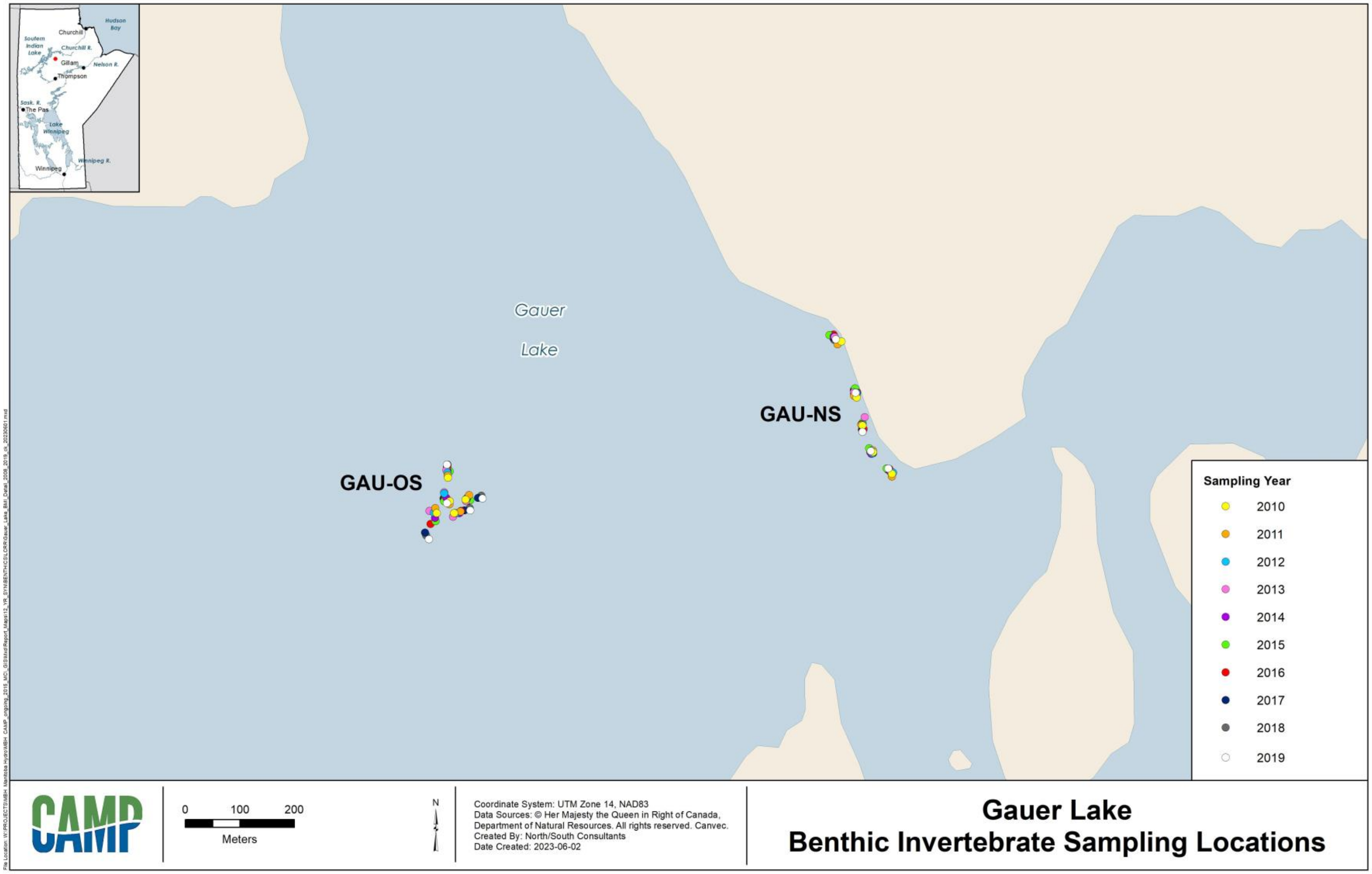


Figure A4-1-7. 2010 to 2019 Gauer Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

APPENDIX 4-2. BENTHIC INVERTEBRATE NEARSHORE AND OFFSHORE SUPPORTING SUBSTRATE DATA BY YEAR

Table A4-2-1. 2010 to 2019 Northern Indian Lake nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	fines and organics	0.2	16.4	51.2	32.4	1.0	Silty clay loam
2011	fines and coarse	1.0	63.2	24.1	12.8	0.9	Loamy sand
2012	fines and organics	0.4	51.8	34.6	13.6	0.8	Loam
2013	fines	0.3	35.9	39.8	24.3	0.6	Silty clay/loam
2014	hard and coarse	no sample	-	-	-	-	-
2015	fines and coarse	0.2	29.2	46.4	24.3	1.0	Silt loam
2016	fines	0.3	80.8	13.8	5.5	0.6	Sand
2017	organic material	0.1	84.7	12.8	7.1	0.4	Sandy loam
2018	fines and flooded terrestrial	0.1	45.0	40.8	17.6	1.3	Silt loam / Silty clay loam
2019	fines, organics, and coarse	0.1	8.6	57.7	33.7	2.3	Silty clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-2. 2010 to 2019 Northern Indian Lake offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	fines	3.5	28.5	50.8	20.7	2.6	Silt loam
2011	fines	5.0	24.9	51.5	23.5	1.8	Silt loam
2012	fines	4.0	23.2	63.2	13.6	1.8	Silt loam
2013	fines	8.3	1.5	67.1	31.4	2.9	Silty clay loam
2014	fines	6.2	9.9	66.4	23.7	2.4	Silty clay loam
2015	fines	3.5	18.8	65.2	15.9	2.1	Silt loam
2016	fines	5.2	4.2	76.1	19.7	2.6	Silt
2017	fines	7.4	8.5	65.2	26.3	2.4	Silt loam / Silty clay loam
2018	fines and organics	6.3	11.6	61.7	26.7	2.4	Silt loam
2019	fines	6.4	40.8	44.8	14.5	1.7	Silty clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-3. 2010 to 2019 Lower Churchill River at the Little Churchill River nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	flooded terrestrial and hard	no sample	-	-	-	-	-
2011	hard and fines	1.0	81.3	12.5	6.2	0.7	Loamy sand
2012	fines and coarse	0.5	84.9	13.4	1.7	0.7	Loamy sand
2013	fines	0.4	95.5	3.9	0.7	0.4	Sand
2014	fines	1.0	29.1	57.6	13.3	3.0	Silt loam
2015	fines and coarse	1.0	69.5	24.1	6.4	1.1	Sandy loam
2016	hard and fines	0.5	67.1	26.3	6.6	2.5	Sandy loam
2017 (n=0)	-	-	-	-	-	-	-
2018 (n=0)	-	-	-	-	-	-	-
2019 (n=0)	-	-	-	-	-	-	-

Notes:

1. TOC = Total organic carbon.

Table A4-2-4. 2010 to 2019 Lower Churchill River at the Little Churchill River offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	fines	6.2	87.4	7.7	4.9	0.8	Sandy loam
2011 (n=4)	fines and coarse	6.3	89.8	6.8	3.4	0.5	Loamy sand
2012	fines and coarse	5.4	97.5	1.8	0.7	0.3	Sand
2013	fines and coarse	5.0	96.1	2.0	1.9	0.3	Sand
2014 (n=1)	fines and coarse	5.9	97.3	1.9	0.8	0.6	Sand
2015	fines and coarse	5.0	96.3	3.0	0.7	0.2	Sand
2016	fines	5.3	91.2	6.7	2.1	1.2	Loamy sand
2017 (n=0)	-	-	-	-	-	-	-
2018 (n=0)	-	-	-	-	-	-	-
2019 (n=0)	-	-	-	-	-	-	-

Notes:

1. TOC = Total organic carbon.

Table A4-2-5. 2010 to 2019 Partridge Breast Lake nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2012	fines and coarse	1.0	91.1	5.1	3.9	0.3	Sand
2015	fines, coarse, and hard	0.5	89.8	7.4	2.8	0.3	Sand
2018	flooded terrestrial, coarse, and hard	no sample	-	-	-	-	-

Notes:
1. TOC = Total organic carbon.

Table A4-2-6. 2010 to 2019 Partridge Breast Lake offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2012	fines and coarse	5.9	71.4	15.1	13.5	0.8	Sandy loam
2015	fines and coarse	5.4	69.6	19.3	11.1	0.6	Sandy loam
2018	fines and coarse	8.4	79.1	16.2	4.7	0.6	Loamy sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-7. 2010 to 2019 Fidler Lake nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2011	organics	no sample	-	-	-	-	-
2014	coarse and fines	0.3	58.7	30.3	11.0	1.7	Sandy loam
2017	organics	0.2	99.0	1.5	-	0.5	Sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-8. 2010 to 2019 Fidler Lake offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2011	fines	8.8	48.3	29.0	22.8	0.9	Sandy loam/Sandy clay loam
2014	fines and organics	8.4	40.2	44.6	15.2	1.3	Sandy loam
2017	fines and coarse	11.1	56.5	32.4	11.1	0.8	Loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-9. 2010 to 2019 Billard Lake nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	coarse and fines	0.2	96.9	2.7	0.4	0.3	Sand
2013	fines	0.3	98.4	1.1	0.5	0.2	Sand
2016	coarse and fines	0.3	98.4	1.4	-	0.5	Sand
2019	coarse and fines	0.4	96.7	2.4	1.4	0.6	Sand

Notes:

1. TOC = Total organic carbon.

Table A4-2-10. 2010 to 2019 Billard Lake offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	fines and organics	8.2	2.7	58.4	38.8	2.9	Silty clay
2013	fines	9.2	3.4	70.2	26.4	2.7	Silty clay loam
2016	fines	8.7	2.5	64.3	33.2	2.8	Silty clay loam
2019	fines and organics	10.1	5.9	58.9	34.0	2.6	Silty clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-11. 2010 to 2019 Lower Churchill River at the Churchill Weir nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2014	fines and hard	0.6	85.0	13.4	1.6	1.4	Sand
2017	fines and coarse	0.5	77.3	20.5	2.7	2.1	Sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-12. 2010 to 2019 Lower Churchill River at the Churchill Weir offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2014	fines	2.3	83.4	14.9	1.8	0.5	Sand
2017	fines and coarse	3.1	81.5	16.0	3.4	1.2	Loamy sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-13. 2010 to 2019 Gauer Lake nearshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	hard	no sample	-	-	-	-	-
2011	coarse and hard	no sample	-	-	-	-	-
2012	hard and coarse	no sample	-	-	-	-	-
2013	hard	no sample	-	-	-	-	-
2014	hard and coarse	no sample	-	-	-	-	-
2015	hard, coarse, and fines	no sample	-	-	-	-	-
2016	hard	no sample	-	-	-	-	-
2017	hard	no sample	-	-	-	-	-
2018	hard and coarse	no sample	-	-	-	-	-
2019	hard and coarse	no sample	-	-	-	-	-

Notes:

1. TOC = Total organic carbon.

Table A4-2-14. 2010 to 2019 Gauer Lake offshore supporting benthic substrate data.

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Mean Particle Size (%)			Mean TOC (%)	Texture
			Sand	Silt	Clay		
2010	fines	6.2	0.5	62.4	37.0	8.0	Silty clay loam
2011	fines	6.8	1.5	57.7	40.8	7.9	Silty clay loam
2012	fines	6.5	2.1	74.5	23.3	7.9	Silt loam
2013	fines	6.4	2.4	57.1	40.5	7.5	Silty clay
2014	fines	7.0	0.6	51.8	47.6	7.7	Silty clay
2015	fines	1.0	0.1	51.7	48.2	7.4	Silty clay
2016	fines	7.1	1.1	66.9	32.1	7.5	Silty clay loam
2017	fines	6.8	1.7	51.8	47.0	7.4	Silty clay
2018	fines	6.6	-	55.5	44.2	7.3	Silty clay
2019	fines	6.6	-	69.3	30.1	7.9	Silt Clay loam / Silty clay

Notes:

1. TOC = Total organic carbon.

5.0 FISH COMMUNITY

5.1 INTRODUCTION

The following presents the results of fish community monitoring conducted from 2008 to 2019 in the lower Churchill River Region. Seven waterbodies were monitored in the Lower Churchill River Region: two on-system annual sites (Northern Indian Lake and the lower Churchill River at the Little Churchill River); four on-system rotational sites (Partridge Breast Lake, Fidler Lake, Billard Lake, and the lower Churchill River at the Churchill Weir); and one off-system annual site (Gauer Lake; Table 5.1-1 and Figure 5.1-1). Annual sites are sampled each year, whereas rotational sites are sampled once every three years on a rotational basis and are therefore limited to three or four years of data for the 12-year period.

There was one departure from the planned field sampling during the 12-year period. The lower Churchill River at the Little Churchill River was not sampled in 2019 due to community concerns.

Monitoring targets both small-bodied fish species (i.e., forage fish) and large-bodied fish species (e.g., fish targeted in subsistence, commercial, and/or recreational fisheries). Within a given waterbody, sampling was conducted at approximately the same time of year during each year of monitoring. Standard gang index gill nets (GN; 51, 76, 95, 108, and 127 mm stretched mesh panels) were set at each site and a small mesh index gillnet gang (SN; 16, 20, and 25 mm bar measure panels) was attached to the end of the standard gang at approximately every third site (Appendix 5-1). Gill nets were set for approximately 24 hours (h). All fish captured at each site were counted by mesh size and species. Individual metrics (e.g., length, weight, deformities, erosion, lesions, and tumours [DELTs], sex and maturity, age) were collected for species of management interest (i.e., "target" species). These include: Lake Whitefish (*Coregonus clupeaformis*), Walleye (*Sander vitreus*), Northern Pike (*Esox lucius*) from all waterbodies in all years; Sauger (*S. canadensis*) from all waterbodies starting in 2017; and White Sucker (*Catostomus commersonii*) from all waterbodies starting in 2010. All other species were bulk weighed.

Five fish community indicators (abundance, condition, growth, recruitment, and community diversity) were selected for detailed reporting (Table 5.1-2). Metrics for these indicators that are presented herein include: catch-per-unit-effort (CPUE); Fulton's condition factor (KF); relative weight (Wr); fork length-at-age (FLA); relative year-class strength (RYCS); Hill's effective species richness (Hill's index); and relative species abundance (RSA; Table 5.1-2).

A detailed description of the program design and sampling methods is provided in Technical Document 1, Section 2.5.

Table 5.1-1. 2008-2019 Inventory of fish community sampling.

Waterbody/Area	Sampling Year											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NIL	●	●	●	●	●	●	●	●	●	●	●	●
LCR-LiCR	●	●	●	●	●	●	●	●	●	●	●	[1]
PBL		●			●			●			●	
FID				●			●			●		
BIL			●			●			●			●
LCR-WEIR							●			●		
GAU	●	●	●	●	●	●	●	●	●	●	●	●

Notes:

1. Sampling not conducted due to a pause in monitoring as sampling methods are reviewed.

Table 5.1-2. Fish community indicators and metrics.

Indicator	Metric	Units
Abundance	• Catch-Per-Unit-Effort (CPUE)	# fish/30 m/24 hour (h) # fish/100 m/24 h
Condition	• Fulton's Condition Factor (KF)	-
	• Relative Weight (Wr)	-
Growth	• Fork Length-At-Age (FLA)	mm
Recruitment	• Relative Year-Class Strength (RYCS)	-
Diversity	• Hill's Effective Species Richness	species
	• Relative Species Abundance (RSA)[1]	%

Notes:

1. Supporting metric.

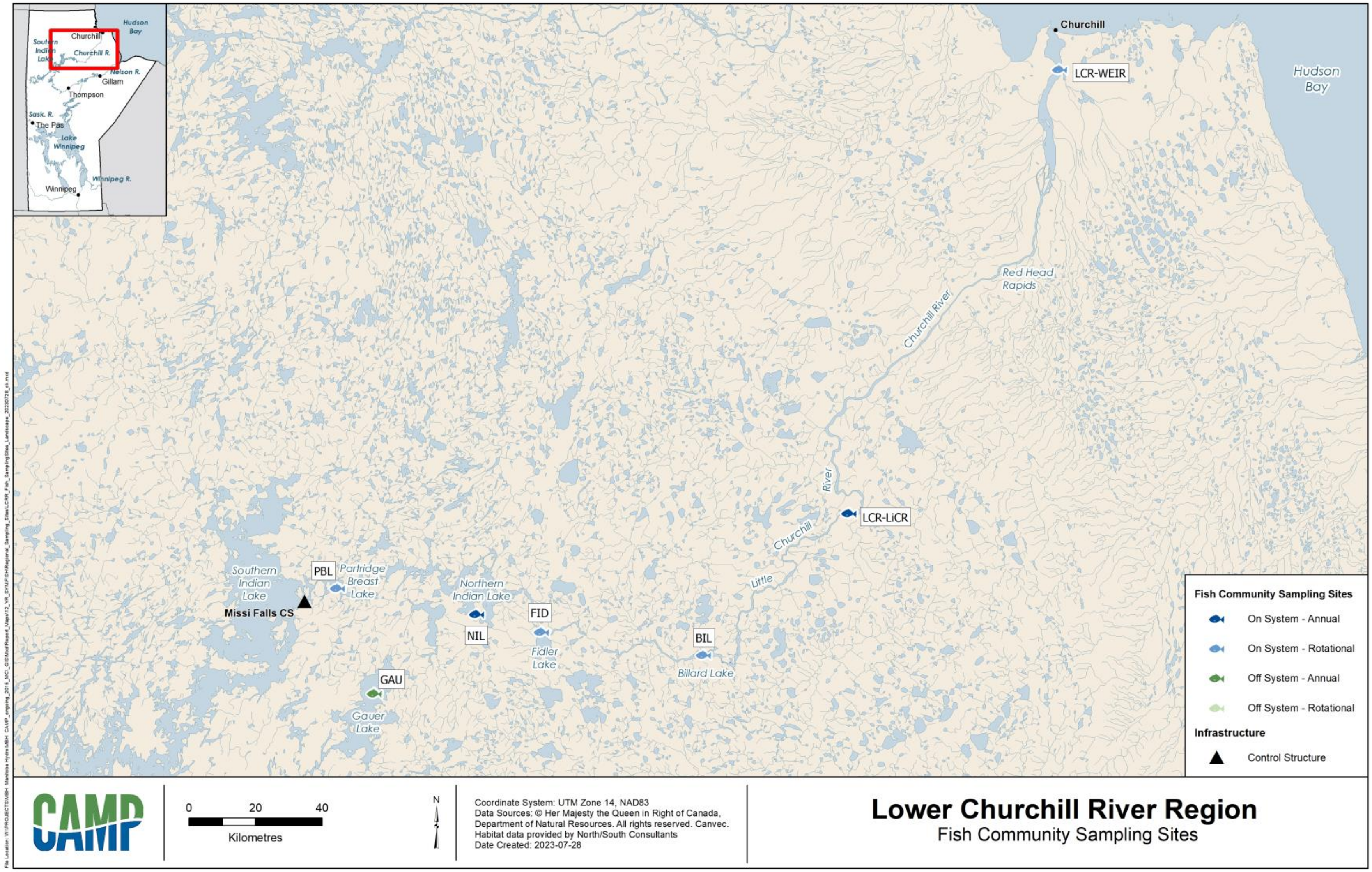


Figure 5.1-1. 2008-2019 Fish community sampling sites.

5.2 ABUNDANCE

5.2.1 CATCH-PER-UNIT-EFFORT

5.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the 12 years of monitoring was variable from year-to-year, with the mean ranging from a low of 50.5 in 2018 to a maximum of 77.7 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 62.2, the median was 60.5, and the IQR was 57.9-65.8 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in 2008, 2013, and 2018 when it was below the IQR and in 2010, 2012, and 2015 when it was above the IQR.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the 10 years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 36.8 in 2008 to a high of 242.8 fish/30 m/24 h in 2016 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 145.2, the median was 139.7, and the IQR was 107.4-182.1 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2008, 2009, and 2018 when it was below the IQR and in 2010, 2016, and 2017 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish in Northern Indian Lake varied almost five-fold over the 12 years of monitoring, with the annual mean CPUE ranging from a low of 4.6 in 2013 to a high of 19.3 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 10.5, the median was 9.2, and the IQR was 6.9-12.3 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2013, 2018, and 2019 when it was below the IQR and in 2010, 2015, and 2017 when it was above the IQR.

Northern Pike

Catches of Northern Pike were relatively average in Northern Indian Lake over the 12 years of monitoring, with the annual mean CPUE ranging from a low of 3.8 in 2008 to a high of 10.9 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 7.8, the median was 7.6, and the IQR was 6.6-9.4 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2008, 2018, and 2019 when it was below the IQR and in 2009, 2010, and 2015 when it was above the IQR.

Sauger

Two individual Sauger were caught in Northern Indian Lake in 2019. The annual mean CPUE in 2019 was 1.0 fish/100 m/24 h (Table 5.2-1; Figure 5.2-5).

Walleye

The annual mean CPUE over the 12 years of monitoring varied by up to about two-fold from year-to-year, ranging from a low of 14.7 in 2011 to a high of 30.2 fish/100 m/24 h in 2019 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 21.2, the median was 20.9, and the IQR was 19.6-22.7 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2010, 2011, and 2017 when it was below the IQR and in 2013, 2018, and 2019 when it was above the IQR.

White Sucker

The annual mean CPUE over the 12 years of monitoring was variable from year-to-year, ranging from a low of 11.0 in 2013 to a high of 25.1 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 17.2, the median was 15.5, and the IQR was 13.5-21.5 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2008, 2013, and 2019 when it was below the IQR and in 2011, 2014, and 2015 when it was above the IQR.

Lower Churchill River at the Little Churchill River

Standard Gang Index Gill Nets

The annual mean CPUE over the 11 years of monitoring varied up to about three-fold from year-to-year, with the mean ranging from a low of 18.8 in 2017 to a high of 59.2 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 40.2, the median was 37.6, and the IQR was 26.3-56.2 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in 2009, 2014, and 2017 when it was below the IQR and in 2010, 2013, and 2015 when it was above the IQR.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the 11 years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 27.4 in 2014 to a high of 166.0 fish/30 m/24 h in 2010 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 110.2, the median was 120.9, and the IQR was 74.7-145.4 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2009, 2014, and 2017 when it was below the IQR and in 2010, 2015, and in 2018 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were relatively low in the lower Churchill River at the Little Churchill River over the 11 years of monitoring, with the annual mean ranging from 5.3 in 2012 to a high of 12.7 fish/100 m/24 in 2008 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 7.9, the median was 7.1, and the IQR was 6.6-7.9 fish/100 m/24 (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2011, 2012, and 2014 when it below the IQR and 2008, 2010, and 2016 when it was above the IQR.

Northern Pike

The annual mean CPUE over the 11 years of monitoring varied up to about three-fold from year-to-year, with the annual mean ranging from a low of 2.6 in 2018 to a high of 6.6 fish/100 m/24 in 2008 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 4.8, the median was 4.9, and the IQR was 4.3-5.5 fish/100 m/24 (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2011, 2017, and 2018 when it was below the IQR and in 2008, 2009, and 2013 when it was above the IQR.

Sauger

Sauger were not captured in the lower Churchill River at the Little Churchill River over the 11 years of monitoring (Table 5.2-1).

Walleye

The annual mean CPUE over the 12 years of monitoring varied up to about four-fold from year-to-year, with the mean ranging from a low of 4.5 in 2017 to a high of 22.8 fish/100 m/24 h in 2013 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 11.2, the median was 9.2, and the IQR was 7.4-13.7 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2009, 2016, and 2017 when it was below the IQR and in 2012, 2013, and 2015 when it was above the IQR.

White Sucker

The annual mean CPUE over the 12 years of monitoring varied up to about three-fold from year-to-year, with the mean ranging from a low of 2.0 in 2009 to a high of 6.7 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 3.8, the median was 3.3, and the IQR was 2.8-4.5 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2009 when it was below the IQR and in 2010, 2012, and 2013 when it was above the IQR.

ROTATIONAL SITES

Partridge Breast Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the four years of monitoring varied very little from year-to-year, with the mean ranging from a low of 56.5 in 2015 to a high of 73.0 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 62.7, the median was 60.7, and the IQR was 57.6-65.9 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was below the IQR in 2015 and was above the IQR in 2012.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the four years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 83.2 in 2018 to a high of 148.9 fish/30 m/24 h in 2015 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 109.3, the median was 102.4, and the IQR was 95.4-116.3 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2018 and was above the IQR in 2015.

Lake Whitefish

Catches of Lake Whitefish were relatively low in Partridge Breast Lake over the four years of monitoring, with the annual mean ranging from a low of 7.6 in 2009 to a high of 19.4 fish/100 m/24 in 2012 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 11.4, the median was 9.3, and the IQR was 7.9-12.8 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was below the IQR in 2009 and above the IQR in 2012.

Northern Pike

The annual mean CPUE over the four years of monitoring varied very little from year-to-year, with the annual mean ranging from a low of 12.8 in 2018 to a high of 16.7 fish/100 m/24 in 2009 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 14.6, the median was 14.4, and the IQR was 13.8-15.3 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was below the IQR in 2018 and above the IQR in 2009.

Sauger

Only one individual Sauger was caught in Partridge Breast Lake in 2018. The annual mean CPUE in 2018 was 0.9 fish/100 m/24 h (Table 5.2-1; Figure 5.2-5).

Walleye

The annual mean CPUE over the four years of monitoring varied by almost five-fold, with the mean ranging from a low of 5.3 in 2012 to a high of 24.0 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 14.5, the median was 14.3, and the IQR was 10.7-18.2 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was below the IQR in 2012 and above the IQR in 2018.

White Sucker

The annual mean CPUE over the four years of monitoring varied by up to about two-fold, with the mean ranging from a low of 10.5 in 2018 to a high of 26.8 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 17.4, the median was 16.2, and the IQR was 14.1-19.5 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was below the IQR in 2018 and was above the IQR in 2012.

Fidler Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the three years of monitoring varied from year-to-year, with the mean ranging from a low of 37.6 in 2017 to a high of 56.9 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-1).

The overall mean and median were 47.2, and the IQR was 42.4-52.0 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was below the IQR in 2017 and was above the IQR in 2014.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the three years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 79.2 in 2011 to a high of 128.2 fish/30 m/24 h in 2017 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 102.1, the median was 98.8, and the IQR was 89.0-113.5 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2011 and was above the IQR in 2017.

Lake Whitefish

Catches of Lake Whitefish were relatively high in Fidler Lake over the three years of monitoring, with the annual mean ranging from 21.3 in 2011 to a high of 22.5 fish/100 m/24 in 2017 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 22.1, the median was 22.4, and the IQR was 21.8-22.4 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was below the IQR in 2011 and above the IQR in 2017.

Northern Pike

The annual mean CPUE over the three years of monitoring varied up to about three-fold from year-to-year, with the annual mean ranging from a low of 5.3 in 2017 to a high of 17.5 fish/100 m/24 in 2011 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 10.9, the median was 9.9, and the IQR was 7.6-13.7 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was below the IQR in 2017 and above the IQR in 2011.

Sauger

Sauger were not captured in Fidler Lake over the three years of monitoring (Table 5.2-1).

Walleye

The annual mean CPUE over the three years of monitoring varied up to about four-fold, ranging from a low of 4.0 in 2017 to a high of 18.0 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 9.2, the median was 5.7, and the IQR was 4.8-11.8 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was below the IQR in 2017 and above the IQR in 2014.

White Sucker

The annual mean CPUE over the three years of monitoring varied by about three-fold, with the mean ranging from a low of 2.5 in 2011 to a high of 7.4 fish/100 m/24 h in 2017 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 5.3, the median was 6.0, and the IQR was 4.3-6.7 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was below the IQR in 2011 and was above the IQR in 2017.

Billard Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the four years of monitoring was generally similar among years ranging from a low of 47.2 in 2019 to a high of 56.1 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 50.5, the median was 49.4, and the IQR was 48.5-51.4 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was below the IQR in 2019 and above the IQR in 2010.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the four years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 44.4 in 2019 to a high of 108.1 fish/30 m/24 h in 2013 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 81.0, the median was 85.8, and the IQR was 69.1-97.8 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2019 and was above the IQR in 2013.

Lake Whitefish

Catches of Lake Whitefish were moderate in Billard Lake over the four years of monitoring, with the annual mean ranging from 11.5 in 2013 to a high of 26.4 fish/100 m/24 in 2010 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 18.5, the median was 18.0, and the IQR was 12.0-24.4 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was below the IQR in 2013 and above the IQR in 2010.

Northern Pike

The annual mean CPUE over the four years of monitoring varied up to almost two-fold from year-to-year, with the annual mean ranging from a low of 6.2 in 2019 to a high of 11.5 fish/100 m/24 in 2010 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE were 8.9, and the IQR was 6.8-10.9 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was below the IQR in 2019 and above the IQR in 2010.

Sauger

Sauger were not captured in Billard Lake over the four years of monitoring (Table 5.2-1).

Walleye

Catches of Walleye were relatively low in Billard Lake over the four years of monitoring, with the mean ranging from a low of 12.6 in 2010 to a high of 26.1 fish/100 m/24 h in 2019 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 18.5, the median was 17.6, and the IQR was 13.7-22.4 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was below the IQR in 2010 and was above the IQR in 2019.

White Sucker

The annual mean CPUE over the four years of monitoring varied by up to about two-fold among years, ranging from a low of 3.2 in 2019 to a high of 7.1 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-7).

The overall mean and median CPUE were 5.1, and the IQR was 4.1-6.0 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was below the IQR in 2019 and was above the IQR in 2010.

Lower Churchill River at the Churchill Weir

Standard Gang Index Gill Nets

The annual mean CPUE over the two years of monitoring varied up to about three-fold among years ranging from a low of 7.7 in 2017 to a high of 24.1 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-1).

The overall mean and median CPUE were 15.9, and the IQR was 11.8-20.0 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was below the IQR in 2017 and above the IQR in 2014.

Small Mesh Index Gill Nets

The annual mean CPUE over the two years of monitoring was generally similar among years ranging from a low of 20.2 in 2014 to a high of 23.0 fish/100 m/24 h in 2017 (Table 5.2-1; Figure 5.2-1).

The overall mean and median CPUE were 21.6, and the IQR was 20.9-22.3 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was slightly below the IQR in 2014.

Lake Whitefish

Catches of Lake Whitefish varied considerably in the lower Churchill River at the Churchill Weir over the two years of monitoring, with the annual mean ranging from 5.6 in 2017 to a high of 19.5 fish/100 m/24 in 2014 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 12.6, and the IQR was 9.1-16.0 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was below the IQR in 2017 and above the IQR in 2014.

Northern Pike

Catches of Northern Pike were relatively low and similar in the lower Churchill River at the Churchill Weir over the two years of monitoring, with the annual mean ranging from a low of 2.1 in 2017 to a high of 3.1 in 2014 fish/100 m/24 in 2011 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE was 2.6, and the IQR was 2.4-2.8 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was slightly below the IQR in 2017 and slightly above the IQR in 2014.

Sauger

Sauger were not captured in the lower Churchill River at the Churchill Weir over the 2 years of monitoring (Table 5.2-1).

Walleye

The annual mean CPUE over the two years of monitoring was generally low and similar among years, ranging from a low of 1.1 in 2017 to a high of 1.2 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-6).

The overall mean and median CPUE were 1.2, and the IQR was 1.2-1.2 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was slightly below the IQR in 2017.

White Sucker

The annual mean CPUE over the two years of monitoring varied by up to about three-fold from year-to-year, with the mean ranging from a low of 1.7 in 2017 to a high of 3.7 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-7).

The overall mean and median CPUE were 2.7, and the IQR was 2.2-3.2 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was below the IQR in 2017 and above the IQR in 2014.

5.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the 12 years of monitoring varied by up to almost two-fold from year-to-year, with the mean ranging from a low of 59.8 in 2009 to a high of 100.8 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 86.1, the median was 87.3, and the IQR was 84.3-96.3 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in in 2008-2010 when it was below the IQR and in 2012, 2013, and 2018 when it was above the IQR.

Small Mesh Index Gill Nets

The annual mean CPUE in the small mesh gangs over the 12 years of monitoring was more variable than in the standard gangs, with the mean ranging from a low of 67.1 in 2018 to a high of 252.6 fish/30 m/24 h in 2014 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 130.0, the median was 130.3, and the IQR was 95.4-116.3 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2009, 2013, and 2018 when it was below the IQR and in 2008, 2011, and 2014 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were relatively high in Gauer Lake over the 12 years of monitoring, with the annual mean CPUE ranging from a low of 10.5 in 2017 to a high of 27.4 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 18.7, the median was 19.4, and the IQR was 15.1-21.1 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2009 and 2017 when it was below the IQR and in 2012 and 2018 when it was above the IQR.

Northern Pike

Catches of Northern Pike were relatively consistent in Gauer Lake over the 12 years of monitoring, with the annual mean CPUE ranging from a low of 8.3 in 2009 to a high of 17.9 fish/100 m/24 h in 2017 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 12.3, the median was 11.3, and the IQR was 10.8-13.3 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2009 when it was below the IQR and in 2014, 2017, and 2009 when it was above the IQR.

Sauger

Sauger were not captured in Gauer Lake over the 12 years of monitoring (Table 5.2-1).

Walleye

The annual mean CPUE over the 12 years of monitoring was relatively high, with the mean ranging from a low of 12.5 in 2008 to a high of 34.0 fish/100 m/24 h in 2013 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 23.6, the median was 22.5, and the IQR was 17.7-31.0 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2008-2010 when it was below the IQR and in 2013 and 2019 when it was above the IQR.

White Sucker

The annual mean CPUE over the 12 years of monitoring varied by up to almost two-fold, with the mean ranging from a low of 16.8 in 2010 to a high of 28.6 fish/100 m/24 h in 2013 (Table 5.2-1; Figure 5.2-7).

The overall mean and median CPUE were 21.8, and the IQR was 19.7-22.8 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except 2010, 2017, and 2019 when it was below the IQR, and 2008, 2012, and 2013 when it was above the IQR.

Table 5.2-1. 2008-2019 Catch-per-unit-effort.

Waterbody	Year	Small Mesh Catch[1]				Total Catch[2]				LKWH			NRPK			SAUG			WALL			WHSC		
		n_S[3]	n_F[4]	Mean	SE[5]	n_S	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE
NIL	2008	2	113	36.8	1.4	8	503	50.8	0.8	79	7.1	0.6	41	3.8	0.3	-	-	-	203	20.9	0.7	108	11.1	0.7
	2009	4	497	105.6	3.6	12	817	58.5	0.5	117	9.2	0.8	135	9.7	0.6	-	-	-	293	20.9	0.5	219	15.6	0.6
	2010	4	558	184.5	4.8	12	670	75.7	0.9	169	19.3	1.8	87	9.6	0.7	-	-	-	140	15.8	1.0	171	20.8	0.9
	2011	4	730	173.7	1.9	12	712	61.8	0.5	123	11.0	0.6	78	6.9	0.4	-	-	-	166	14.7	0.6	264	22.4	0.5
	2012	4	553	139.8	1.0	12	834	70.0	0.7	141	11.9	0.5	91	7.8	0.4	-	-	-	270	22.5	0.8	253	21.2	0.7
	2013	4	556	135.8	1.2	12	678	56.3	0.5	51	4.6	0.4	111	9.3	0.4	-	-	-	327	27.3	0.7	134	11.0	0.7
	2014	4	593	181.2	1.8	12	702	64.3	0.8	97	8.8	0.5	80	7.2	0.3	-	-	-	229	21.0	0.7	250	23.1	0.6
	2015	4	522	139.7	3.6	12	858	77.7	0.7	150	13.6	0.5	120	10.9	0.5	-	-	-	223	20.4	0.7	281	25.1	0.9
	2016	4	896	242.8	4.4	12	693	59.5	0.3	107	9.1	0.5	104	8.8	0.5	-	-	-	237	20.6	0.6	169	14.5	0.6
	2017	4	899	199.7	4.4	12	782	61.5	0.7	229	18.5	0.8	77	7.3	0.4	0	-	-	227	17.4	0.7	198	15.4	0.5
	2018	4	447	94.5	2.1	12	666	50.5	0.5	75	6.2	1.0	71	5.9	0.3	0	-	-	308	23.2	0.7	176	13.6	0.6
	2019	4	426	108.1	3.5	12	711	59.4	0.9	69	6.2	0.4	65	6.0	0.3	2	1.0	-	360	30.2	0.9	160	13.2	0.6
LCR-LiCR	2008	3	232	84.7	4.0	9	314	37.6	1.2	88	12.7	1.6	57	6.6	0.7	-	-	-	76	9.2	1.0	17	2.3	0.4
	2009	3	146	47.0	3.9	9	205	21.2	1.0	62	7.2	0.7	36	5.6	0.5	-	-	-	51	6.0	0.7	17	2.0	0.3
	2010	3	580	166.0	5.9	9	603	59.2	1.1	78	8.4	0.9	51	4.9	0.4	-	-	-	137	13.5	0.6	68	6.7	0.6
	2011	3	282	120.9	1.8	9	194	28.1	1.3	30	5.6	1.0	28	4.1	0.4	-	-	-	59	8.5	0.7	13	2.9	0.4
	2012	3	367	140.6	7.3	9	402	55.2	0.9	34	5.3	0.8	29	4.4	0.5	-	-	-	121	16.6	0.7	49	6.6	0.7
	2013	3	236	106.6	7.3	9	391	57.3	1.5	42	6.9	1.0	40	5.8	0.6	-	-	-	156	22.8	1.8	28	4.6	0.5
	2014	3	68	27.4	4.6	9	174	24.5	1.2	36	6.4	1.2	21	5.3	0.7	-	-	-	53	7.5	0.5	27	3.7	0.7
	2015	3	384	163.8	9.2	9	418	58.5	2.1	50	7.1	0.8	32	4.5	0.5	-	-	-	99	13.9	0.8	20	2.8	0.3
	2016	3	319	141.8	7.4	9	331	48.1	0.5	88	12.7	0.8	25	5.4	0.8	-	-	-	44	7.2	0.6	27	4.4	0.3
	2017	3	192	64.8	7.8	9	128	18.8	1.3	24	7.1	1.3	18	3.0	0.5	-	-	-	26	4.5	0.8	22	3.3	0.5
	2018	3	369	149.0	10.2	9	237	33.1	1.3	42	7.4	0.9	14	2.6	0.3	-	-	-	94	13.4	0.9	11	2.8	0.6
PBL	2009	3	369	105.5	4.2	9	608	57.9	0.6	79	7.6	0.6	175	16.7	0.4	-	-	-	170	16.2	0.7	162	15.3	0.9
	2012	3	265	99.4	4.7	9	623	73.0	0.6	162	19.4	1.1	127	14.8	0.4	-	-	-	39	5.3	0.7	233	26.8	1.1
	2015	3	375	148.9	6.9	9	454	56.5	0.7	63	8.0	0.7	114	14.1	0.5	-	-	-	100	12.5	1.0	136	17.1	1.1
	2018	3	264	83.2	2.9	9	604	63.5	0.9	97	10.7	1.1	122	12.8	0.5	1	0.9	-	231	24.0	1.1	103	10.5	0.7
FID	2011	3	275	79.2	2.7	6	325	47.2	0.5	147	21.3	0.5	120	17.5	0.6	-	-	-	33	5.7	0.6	17	2.5	0.5
	2014	3	223	98.8	2.4	6	262	56.9	1.4	103	22.4	1.7	45	9.9	0.6	-	-	-	83	18.0	0.9	28	6.0	0.6
	2017	3	365	128.2	6.9	6	222	37.6	1.4	133	22.5	1.1	26	5.3	0.5	-	-	-	24	4.0	0.4	36	7.4	1.1
BIL	2010	3	231	77.3	1.3	9	508	56.1	0.7	241	26.4	0.7	104	11.5	0.4	-	-	-	112	12.6	1.0	50	7.1	0.5
	2013	3	363	108.1	4.6	9	378	49.8	1.0	89	11.5	0.8	81	10.8	0.5	-	-	-	158	21.1	0.7	29	4.5	0.6
	2016	3	274	94.4	4.1	9	420	49.0	1.1	203	23.8	1.2	62	6.9	0.5	-	-	-	121	14.1	0.6	25	5.7	1.0
	2019	3	145	44.4	3.4	9	440	47.2	1.1	105	12.2	0.8	57	6.2	0.2	-	-	-	242	26.1	1.1	29	3.2	0.4
LCR-WEIR	2014	3	65	20.2	1.5	9	240	24.1	1.7	173	19.5	1.8	27	3.1	0.3	-	-	-	4	1.2	0.3	24	3.7	0.7
	2017	3	76	23.0	1.4	9	76	7.7	1.0	43	5.6	1.4	16	2.1	0.3	-	-	-	5	1.1	0.2	9	1.7	0.1

Table 5.2-1. continued.

Waterbody	Year	Small Mesh Catch				Total Catch				LKWH			NRPK			SAUG			WALL			WHSC		
		n_S	n_F	Mean	SE	n_S	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE
GAU	2008	3	522	142.8	3.7	9	887	79.7	0.9	212	20.1	0.8	126	10.8	0.6	-	-	-	129	12.5	0.7	255	26.0	0.8
	2009	3	272	80.7	4.5	9	565	59.8	1.1	105	11.4	0.6	80	8.3	0.4	-	-	-	131	15.7	1.0	171	20.3	0.7
	2010	3	297	98.5	4.4	9	716	61.0	0.6	172	15.1	0.7	122	10.2	0.7	-	-	-	187	15.3	0.3	178	16.8	0.6
	2011	3	630	180.3	9.7	9	805	87.0	1.3	197	21.1	0.9	121	13.3	0.6	-	-	-	183	19.4	0.8	182	22.5	1.0
	2012	3	355	105.5	1.5	9	944	96.7	0.6	270	27.4	0.6	108	10.9	0.5	-	-	-	211	21.5	1.0	228	23.7	0.8
	2013	3	267	93.0	3.0	9	793	97.5	1.0	129	15.1	1.1	93	11.4	0.5	-	-	-	268	34.0	1.4	233	28.6	0.7
	2014	3	875	252.6	8.2	9	832	85.8	1.0	177	18.7	0.8	168	17.1	0.6	-	-	-	176	18.3	1.0	190	21.7	0.7
	2015	3	446	137.1	2.7	9	919	96.2	1.0	194	20.4	1.3	129	13.3	0.6	-	-	-	221	23.4	1.0	215	21.8	0.9
	2016	3	350	136.6	7.1	9	649	87.6	1.8	120	16.0	1.8	76	11.3	0.8	-	-	-	227	31.0	1.4	129	19.8	1.0
	2017	3	408	141.8	3.6	9	828	85.9	1.0	98	10.5	0.6	176	17.9	0.3	-	-	-	271	26.8	0.9	182	19.6	0.8
	2018	3	216	67.1	1.6	9	995	100.8	0.8	263	27.0	0.9	113	11.3	0.5	-	-	-	307	31.0	0.9	196	22.5	0.6
	2019	3	371	123.9	5.0	9	848	94.7	1.4	193	21.0	0.8	104	11.5	0.7	-	-	-	297	33.9	1.6	152	18.9	0.9

Notes:

1. fish/30 m/24 h.
2. fish/100 m/24 h.
3. nS = number of sites fished (excludes sets > 36 h).
4. nF = number of fish caught.
5. SE = standard error.

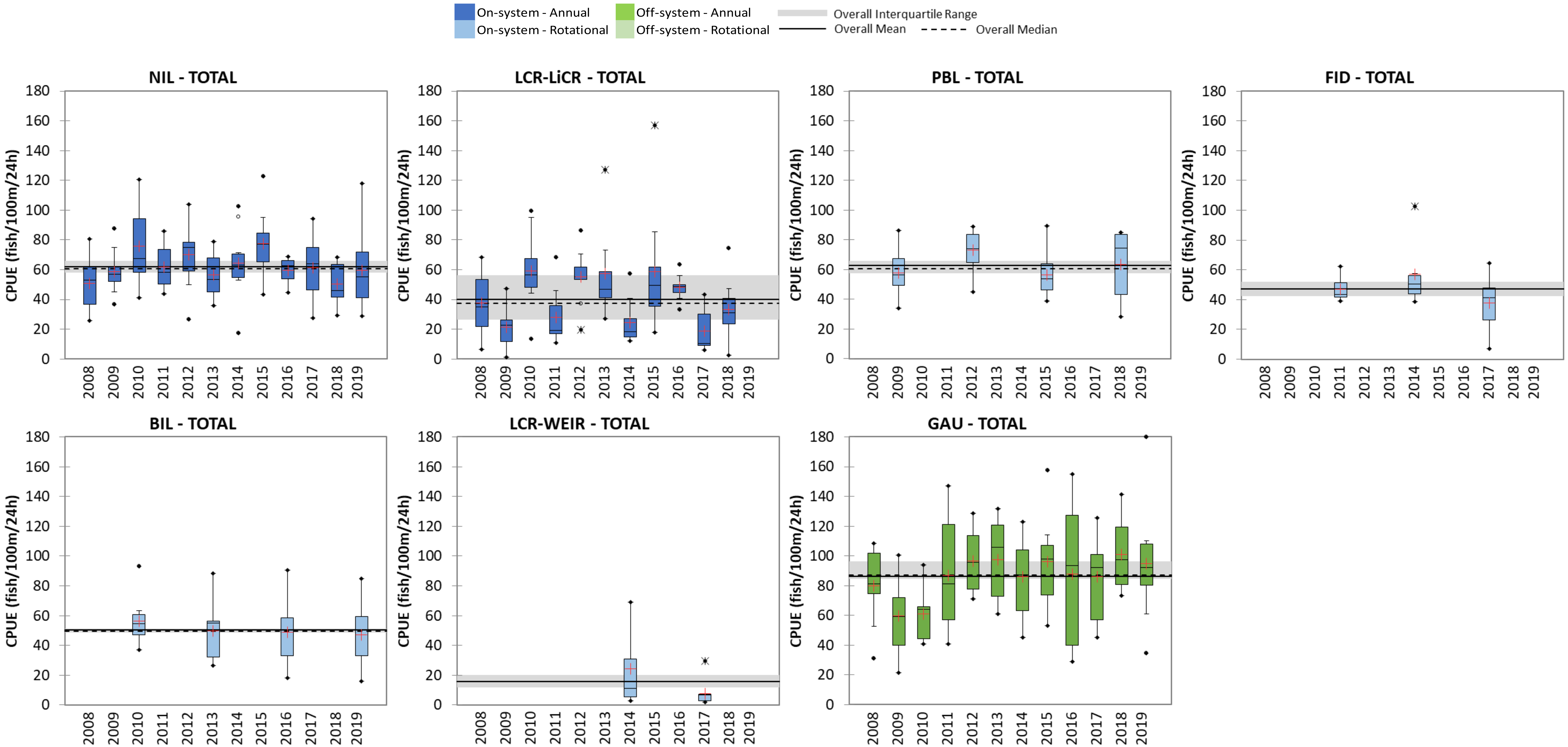


Figure 5.2-1. 2008-2019 Catch-per-unit-effort (CPUE) of standard gang index gill nets.

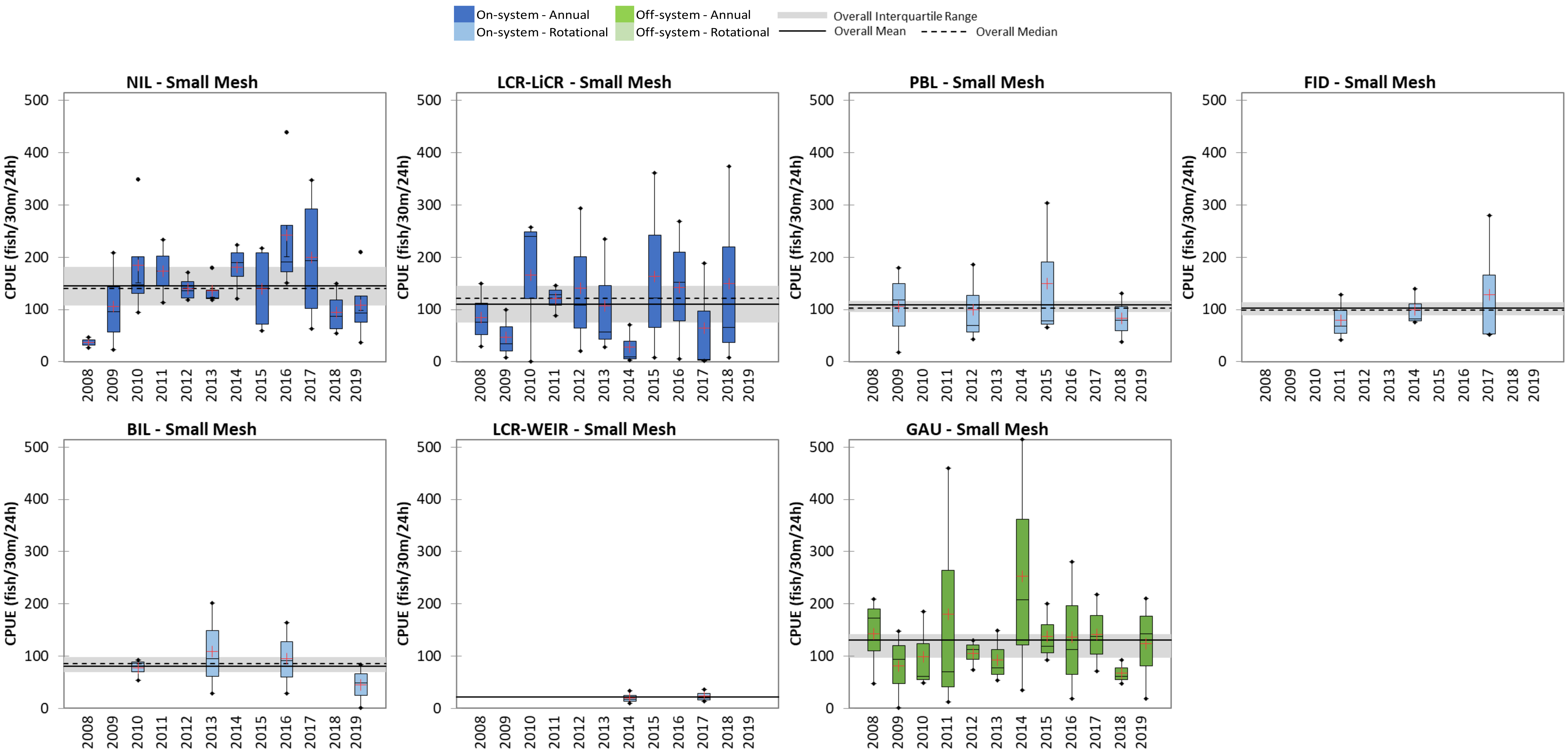


Figure 5.2-2. 2008-2019 Catch-per-unit-effort (CPUE) of small mesh index gill nets.

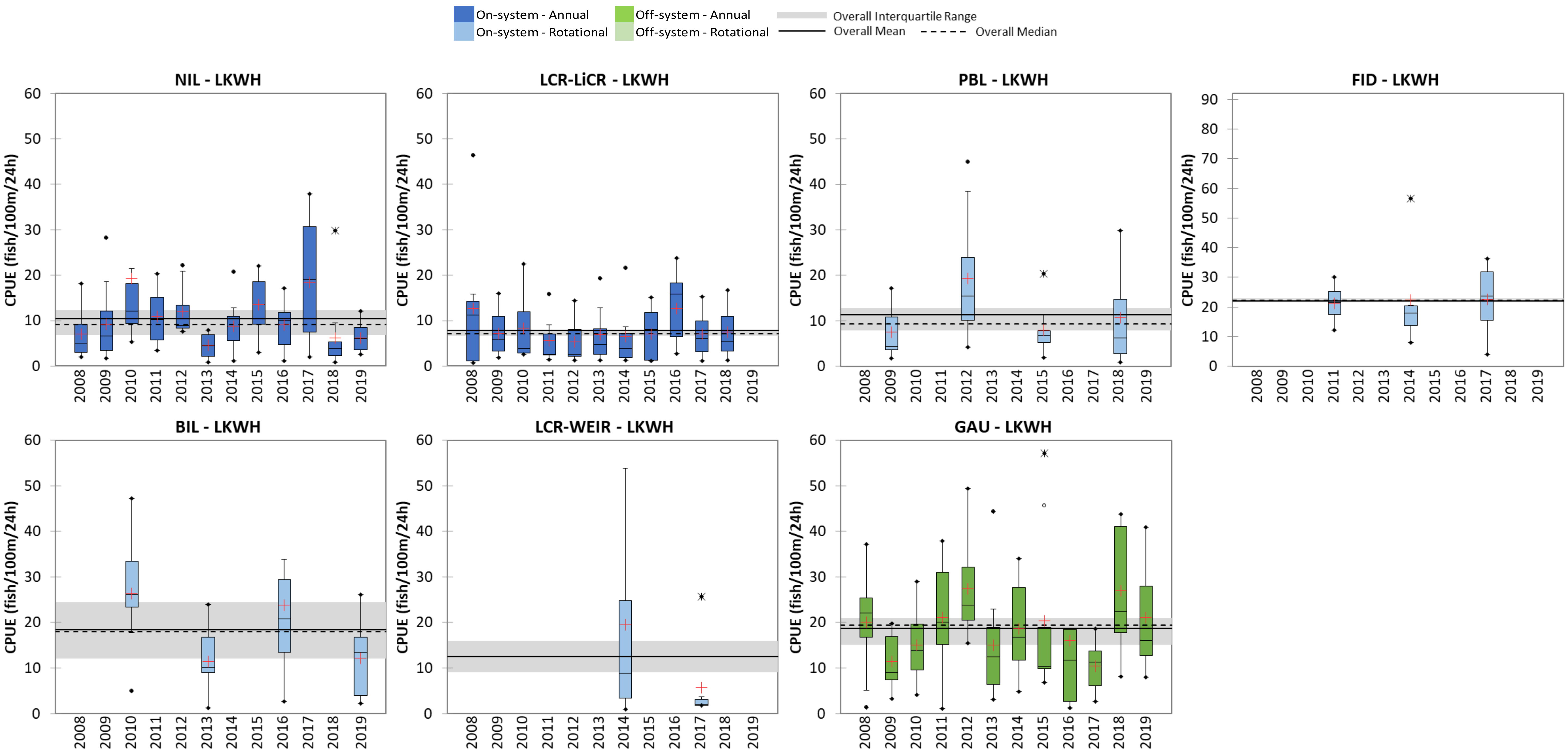


Figure 5.2-3. 2008-2019 Catch-per-unit-effort (CPUE) of Lake Whitefish.

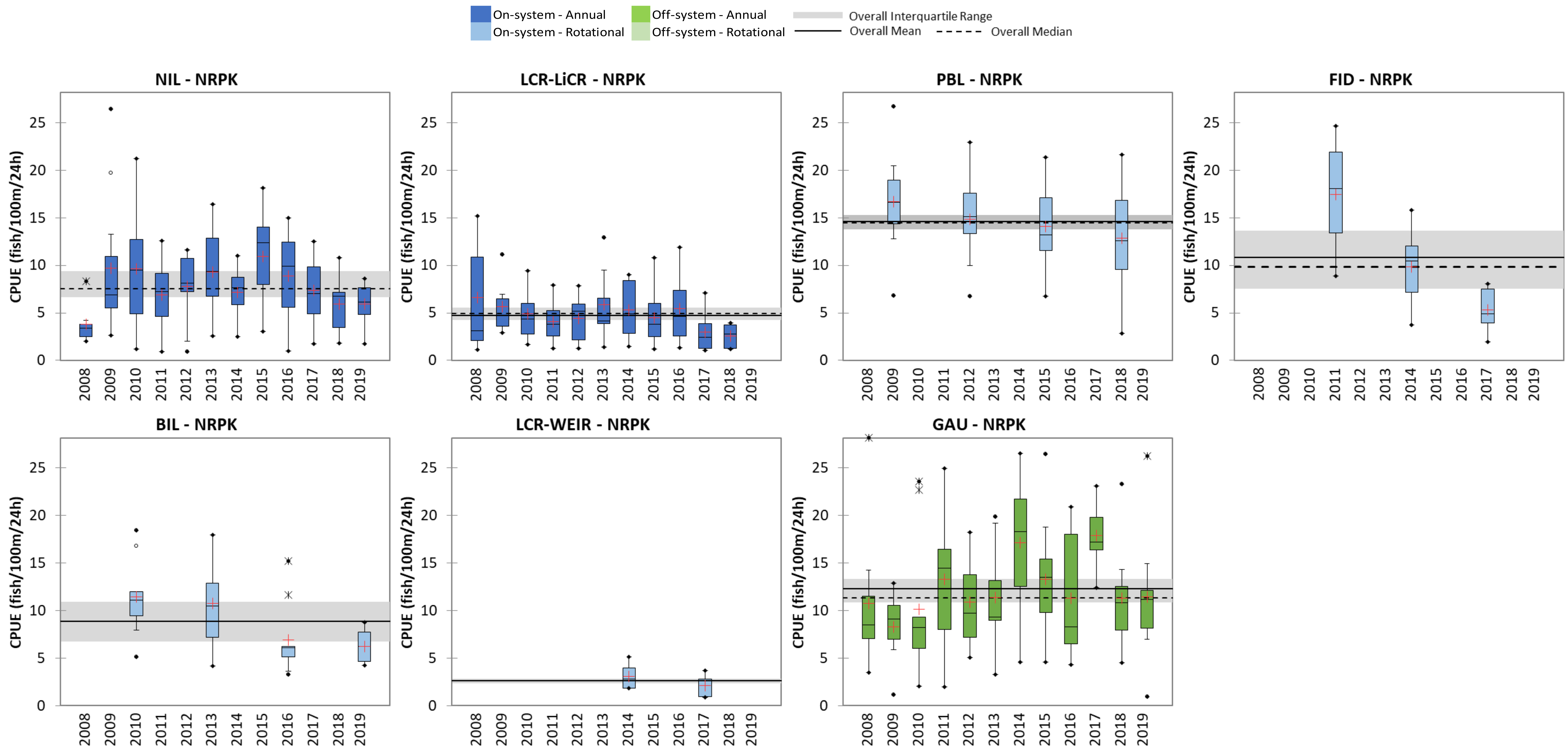


Figure 5.2-4. 2008-2019 Catch-per-unit-effort (CPUE) of Northern Pike.

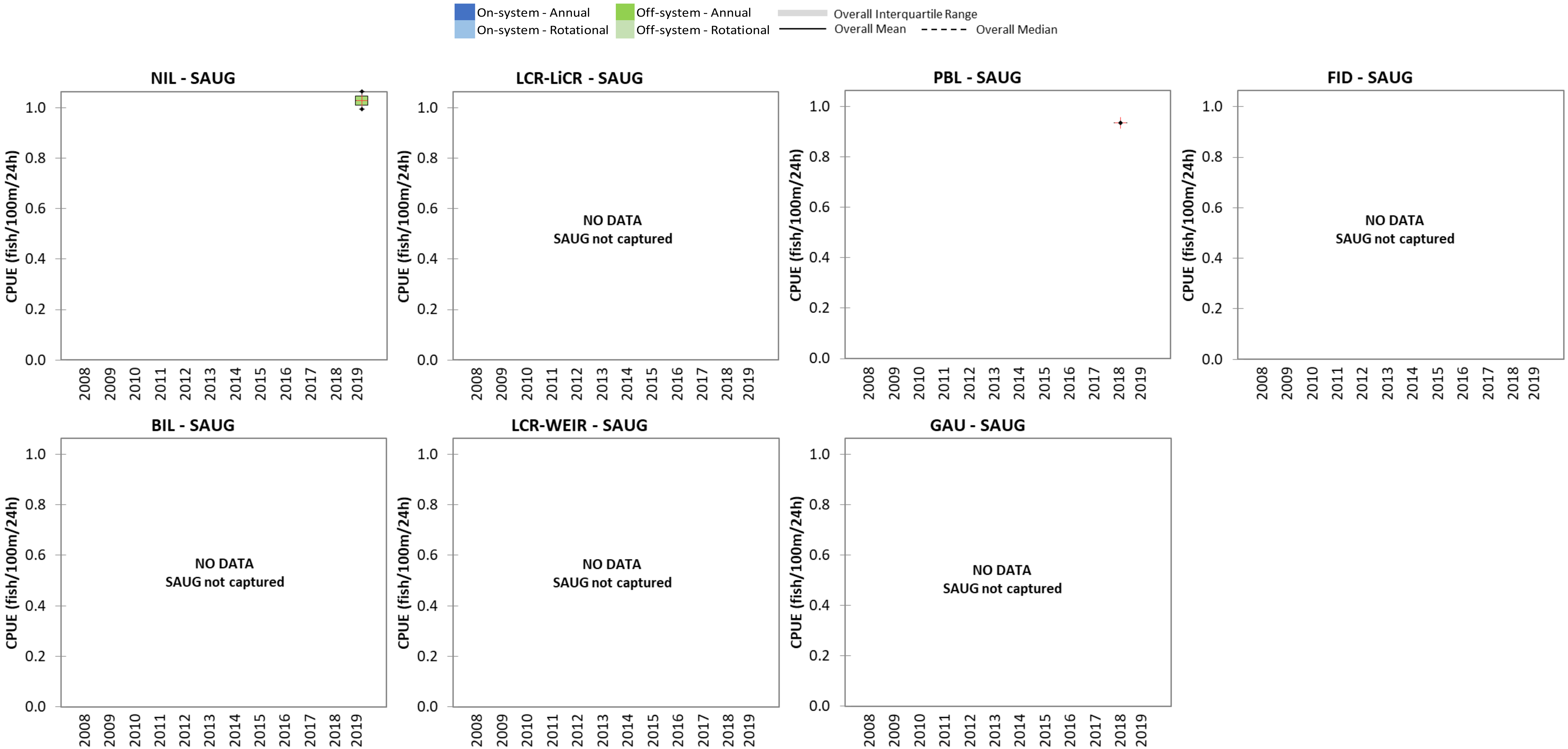


Figure 5.2-5 2008-2019 Catch-per-unit-effort (CPUE) of Sauger.

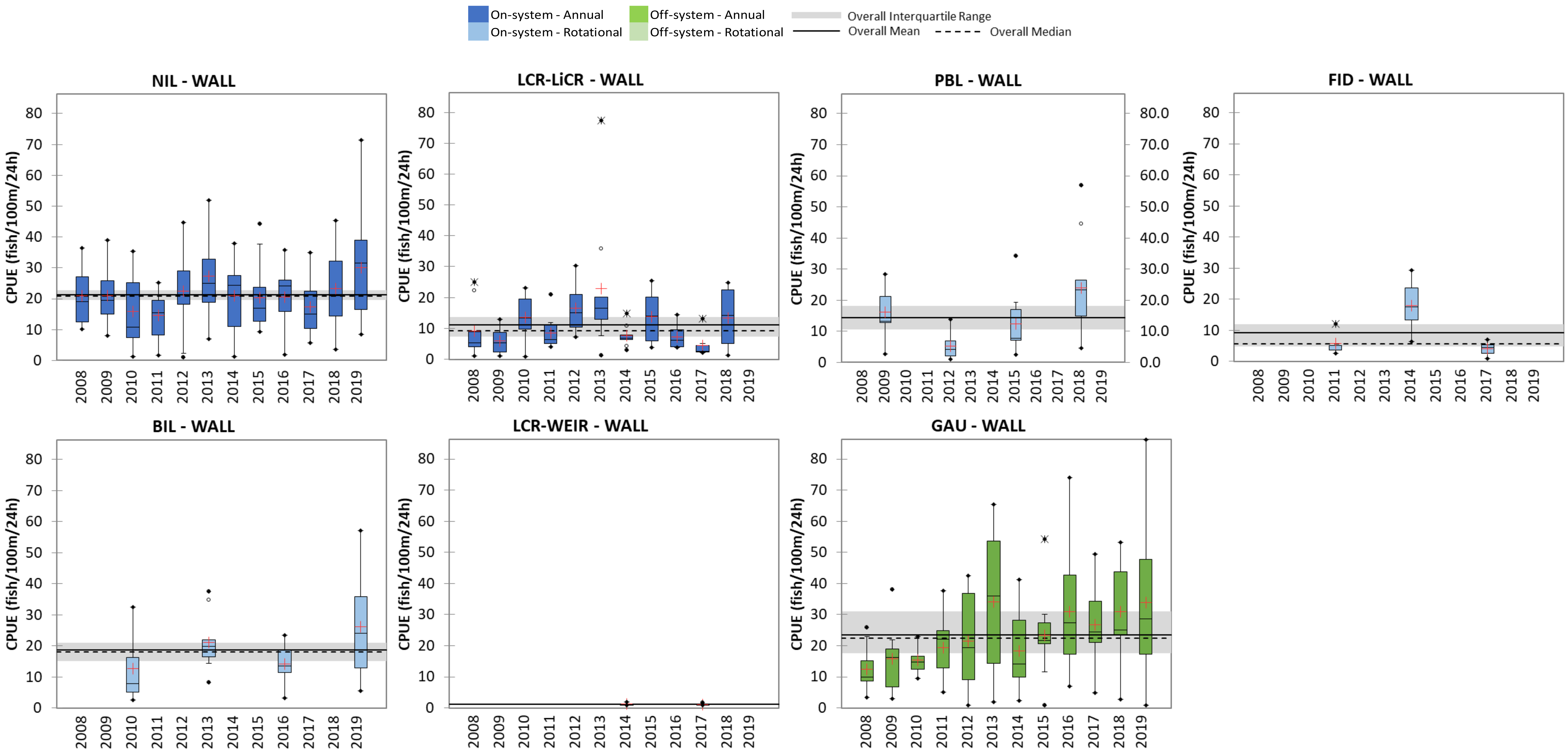


Figure 5.2-6. 2008-2019 Catch-per-unit-effort (CPUE) of Walleye.

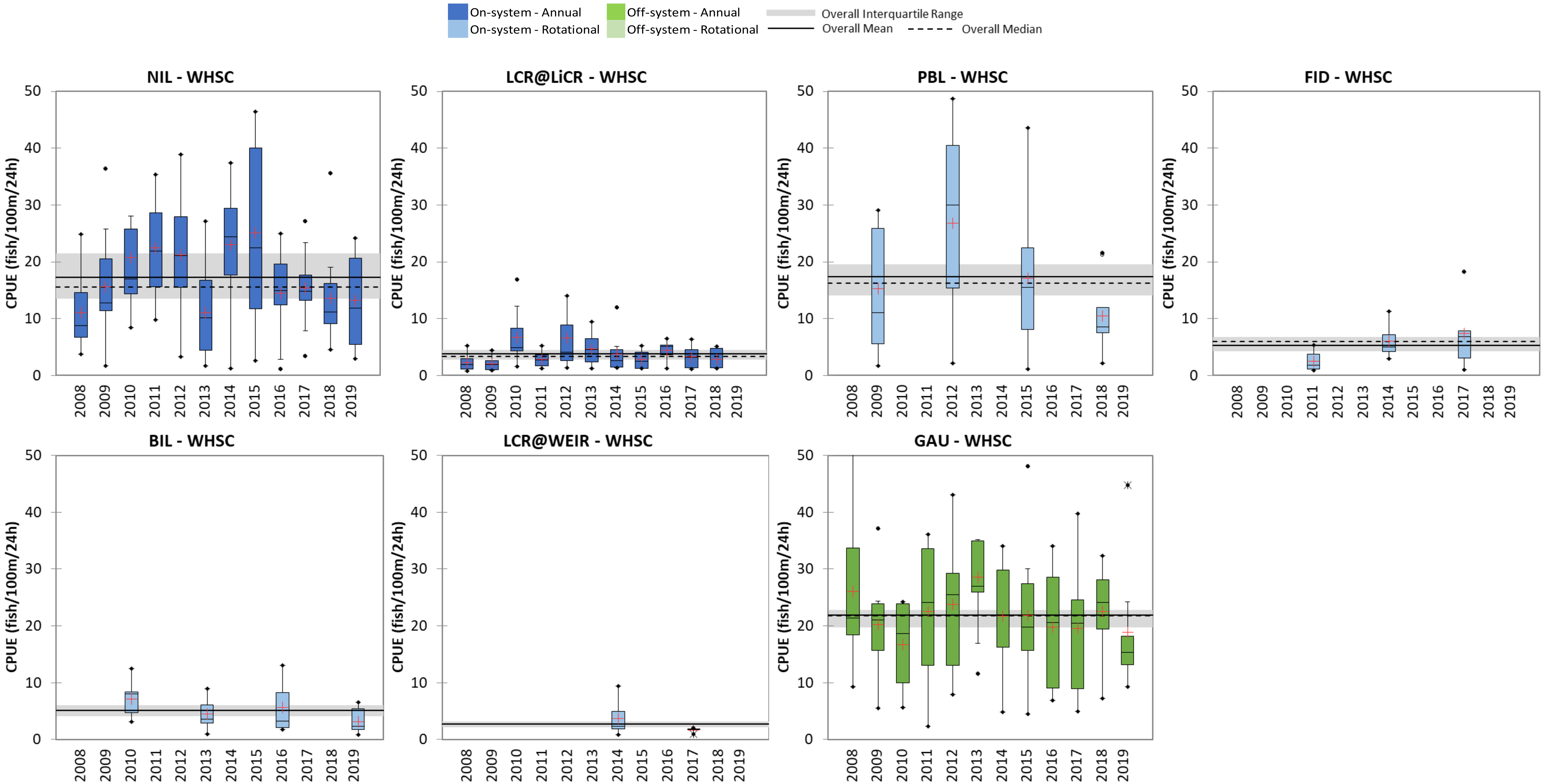


Figure 5.2-7. 2008-2019 Catch-per-unit-effort (CPUE) of White Sucker.

5.3 CONDITION

5.3.1 FULTON'S CONDITION FACTOR

5.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the 12 years of monitoring ranged from a low of 1.37 in 2010 to a high of 1.59 in 2014 (Table 5.3-1; Figure 5.3-1).

The overall mean and median KF were 1.46 and the IQR was 1.40-1.50 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2008, 2010, and 2011 when it was below the IQR and in 2014, 2017, and 2019 when it was above the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the 12 years of monitoring varied very little, ranging from a low of 0.61 in 2013 and 2016 to a high of 0.65 in 2015 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF was 0.63, and the IQR was 0.63-0.64 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2013 and 2016 when it was below the IQR, and 2012 and 2015 when it was above the IQR.

Sauger

Sauger was not a target species in Northern Indian Lake until 2017; and was not captured in Northern Indian Lake until 2019 when one individual Sauger between 200 and 349 mm in fork length was caught. The KF of the one Sauger between 200 and 349 mm in fork length caught in 2019 was 1.14 (Table 5.3-1; Figure 5.3-3).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the 12 years of monitoring ranged from a low of 1.06 in 2015 to a high of 1.15 in 2018 (Table 5.3-1; Figure 5.3-4).

The overall mean and median KF were 1.11 and the IQR was 1.09-1.14 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2010, 2015 and 2016 when it was below the IQR and in 2018 and 2019 when it was above the IQR.

White Sucker

White Sucker was not a target species in Northern Indian Lake until 2010; the annual mean KF of White Sucker between 300 and 499 mm in fork length over the 10 years of monitoring ranged from a low of 1.42 in 2011 to a high of 1.57 in 2014 (Table 5.3-1; Figure 5.3-5).

The overall mean and median KF was 1.49, and the IQR was 1.46-1.51 (Figure 5.3-5). The annual mean KF fell within the overall IQR except in 2010 and 2011 when it was below the IQR, and in 2014 and 2019 when it was above the IQR.

Lower Churchill River at the Little Churchill River

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the 11 years of monitoring ranged from a low of 1.36 in 2008 to a high of 1.60 in 2009 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.46, the median was 1.47, and the IQR was 1.42-1.50 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2008 and 2017 when it was below the IQR, and 2009 and 2014 when it was above the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the 11 years of monitoring ranged from a low of 0.66 in 2017 to a high of 0.73 in 2012 (Table 5.3-1; Figure 5.3-2).

The overall mean KF was 0.69, the median was 0.70, and the IQR was 0.68-0.70 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2009 and 2017 when it was below the IQR, and 2010-2012 when it was above the IQR.

Sauger

Sauger was not a target species in the lower Churchill River at the Little Churchill River until 2017. Sauger was not captured in the lower Churchill River at the Little Churchill River over the 2 years of monitoring (Table 5.2-1).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the 11 years of monitoring ranged from a low of 1.08 in 2008 to a high of 1.20 in 2011 and 2012 (Table 5.3-1; Figure 5.3-4).

The overall mean and median KF were 1.17, and the IQR was 1.13-1.19 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2008, 2009, and 2016 when it was below the IQR and in 2011 and 2012 when it was above the IQR.

White Sucker

White Sucker was not a target species in lower Churchill River at the Little Churchill River until 2010; the annual mean KF of White Sucker between 300 and 499 mm in fork length over the nine years of monitoring ranged from a low of 1.47 in 2017 to a high of 1.56 in 2012 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.52, the median was 1.50, and the IQR was 1.50-1.54 (Figure 5.3-5). The annual mean KF in 2015 and 2017 was below the overall IQR, and in 2012 was above the IQR.

ROTATIONAL SITES

Partridge Breast Lake

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the four years of monitoring ranged from a low of 1.41 in 2012 to a high of 1.50 in 2009 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.44, the median was 1.45, and the IQR was 1.42-1.48 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2012 when it was below the IQR, and in 2009 when it was above the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the four years of monitoring it was a target species ranged from a low of 0.64 in 2009 to a high of 0.67 in 2012 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.65, and the IQR was 0.65-0.66 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2009 when it was below the IQR and 2012 when it was above the IQR.

Sauger

Over the four years of monitoring, Sauger was only a target species in Partridge Breast Lake in 2018. In this year, no Sauger between 200 and 349 mm in fork length were captured (Table 5.3-1; Figure 5.3-3).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the four years of monitoring ranged from a low of 1.08 in 2015 to a high of 1.14 in 2012 (Table 5.3-1; Figure 5.3-4).

The overall mean and median KF was 1.10, and the IQR was 1.09-1.12 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2015 when it was below the IQR and 2012 when it was above the IQR.

White Sucker

White Sucker was not a target species in Partridge Breast Lake until 2010; the annual mean KF of White Sucker between 300 and 499 mm in fork length over the three years of monitoring ranged from a low of 1.50 in 2012 to a high of 1.56 in 2018 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.52, the median was 1.54, and the IQR was 1.52-1.55 (Figure 5.3-5). The annual mean KF was equal to or fell within the overall IQR except in 2012 when it was below the IQR and 2018 when it was above the IQR.

Fidler Lake

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the three years of monitoring ranged from a low of 1.44 in 2011 to a high of 1.63 in 2014 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.54, the median was 1.62, and the IQR was 1.53-1.63 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2011 when it was below the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the three years of monitoring ranged from a low of 0.66 in 2017 to a high of 0.67 in 2011 and 2014 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.67, and the IQR were 0.67 (Figure 5.3-2). The annual mean KF was equal to the overall IQR except in 2017 when it was below the IQR.

Sauger

Over the three years of monitoring, Sauger was only a target species in Fidler Lake in 2017. In this year, no Sauger were captured (Table 5.3-1; Figure 5.3-3).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the three years of monitoring ranged from a low of 1.16 in 2017 to a high of 1.22 in 2011 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.19, the median was 1.18, and the IQR was 1.17-1.20 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2017 when in was below the IQR and in 2011 when it was above the IQR.

White Sucker

The annual mean KF of White Sucker between 300 and 499 mm in fork length over the three years of monitoring ranged from a low of 1.44 in 2011 to a high of 1.53 in 2014 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.49, the median was 1.48, and the IQR was 1.46-1.50 (Figure 5.3-5). The annual mean KF fell within or was equal to the overall IQR except in 2011 when in was below the IQR, and in 2014 when it was above the IQR.

Billard Lake

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the four years of monitoring ranged from a low of 1.37 in 2010 to a high of 1.53 in 2019 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.44, the median was 1.46, and the IQR was 1.44-1.48 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2010 when it was below the IQR, and 2019 when it was above the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the four years of monitoring ranged from a low of 0.64 in 2010 to a high of 0.68 in 2019 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.65, and the IQR was 0.65-0.66 (Figure 5.3-2). The annual mean KF was equal to or fell within the overall IQR except in 2010 when it was below the IQR and 2019 when it was above the IQR.

Sauger

Over four years of monitoring, Sauger was only a target species in Billard Lake in 2019. In this year, no Sauger were captured (Table 5.3-1; Figure 5.3-3).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the four years of monitoring ranged from a low of 1.06 in 2010 to a high of 1.17 in 2019 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.12, the median was 1.09, and the IQR was 1.08-1.11 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2010 when it was below the IQR, and 2019 when it was above the IQR.

White Sucker

The annual mean KF of White Sucker between 300 and 499 mm in fork length over the four years of monitoring ranged from a low of 1.41 in 2016 to a high of 1.60 in 2019 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.46, the median was 1.45, and the IQR was 1.43-1.49 (Figure 5.3-5). The annual mean KF was equal to or fell within the overall IQR except in 2016 when it was below the IQR, and 2019 when it was above the IQR.

Lower Churchill River at the Churchill Weir

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the two years of monitoring ranged from a low of 1.35 in 2017 to a high of 1.49 in 2014 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.47, the median was 1.42, and the IQR was 1.39-1.45 (Figure 5.3-1). The annual mean KF was above the overall IQR in 2014 and below the overall IQR in 2017.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the two years of monitoring ranged from a low of 0.68 in 2017 to a high of 0.73 in 2014 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.71 and the IQR was 0.69-0.72 (Figure 5.3-2). The annual mean KF was below the overall IQR in 2017 and above the overall IQR in 2014.

Sauger

Over two years of monitoring, Sauger was only a target species in the lower Churchill River in 2017. In this year, no Sauger were captured (Table 5.3-1; Figure 5.3-3).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the two years of monitoring ranged from a low of 1.20 in 2017 to a high of 1.34 in 2014 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.23, the median was 1.27, and the IQR was 1.23-1.31 (Figure 5.3-4). The annual mean KF was below the overall IQR in 2017, and above the overall IQR in 2014.

White Sucker

Over the two years of monitoring, White Sucker were only caught in the lower Churchill River at the Churchill Weir in 2014. The annual mean KF of White Sucker between 300 and 499 mm in fork length in 2014 was 1.56 (Table 5.3-1; Figure 5.3-5).

5.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the 12 years of monitoring ranged from a low of 1.42 in 2010 to a high of 1.58 in 2019 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.52, the median was 1.53, and the IQR was 1.49-1.55 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2008, 2010, and 2017 when it was below the IQR and in 2014 and 2019 when it was above the IQR.

Northern Pike

The annual mean KF of Northern Pike between 400 and 699 mm in fork length over the 12 years of monitoring ranged from a low of 0.63 in 2017 and 2018 to a high of 0.69 in 2008 (Table 5.3-1; Figure 5.3-2).

The overall mean KF was 0.65, the median was 0.66, and the IQR was 0.65-0.66 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2016-2018 when it was below the IQR and in 2008 and 2012 when it was above the IQR.

Sauger

Sauger was not a target species in Gauer Lake until 2012. Sauger were not captured in Gauer Lake over the 12 years of monitoring (Table 5.2-1).

Walleye

The annual mean KF of Walleye between 300 and 499 mm in fork length over the 12 years of monitoring ranged from a low of 1.09 in 2016 to a high of 1.16 in 2013 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.2, the median was 1.11, and the IQR was 1.10-1.13 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2016 and 2019 when it was below the IQR and in 2011-2013 when it was above the IQR.

White Sucker

White Sucker was not a target species in Gauer Lake until 2010; the annual mean KF of White Sucker between 300 and 499 mm in fork length over the 10 years of monitoring ranged from a low of 1.50 in 2016 to a high of 1.58 in 2014 when only one individual fish between 300 and 499 mm in fork length was caught and 2019 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.55, the median was 1.56, and the IQR was 1.52-1.57 (Figure 5.3-5). The annual mean KF was within the overall IQR in all years except in 2010 and 2016, when the annual mean was lower than the IQR, and 2014 and 2019, when the annual mean was higher than the IQR.

Table 5.3-1. 2008-2019 Fulton's condition factor of target species.

Waterbody	Year	LKWH			NRPK			SAUG			WALL			WHSC		
		n_F[1]	Mean	SE[2]	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE
NIL	2008	56	1.38	0.02	38	0.63	0.01				168	1.11	0.01			
	2009	78	1.47	0.02	123	0.63	0.01				267	1.11	0.004			
	2010	124	1.37	0.01	73	0.63	0.01				142	1.07	0.01	148	1.45	0.01
	2011	80	1.38	0.01	59	0.63	0.01				137	1.12	0.01	245	1.42	0.01
	2012	108	1.43	0.01	85	0.65	0.01				224	1.14	0.01	215	1.46	0.01
	2013	32	1.40	0.02	99	0.62	0.01				271	1.10	0.01	113	1.50	0.01
	2014	73	1.59	0.02	62	0.64	0.01				184	1.14	0.01	215	1.57	0.01
	2015	118	1.49	0.01	100	0.65	0.01				164	1.06	0.01	223	1.52	0.01
	2016	82	1.44	0.01	85	0.61	0.01				197	1.07	0.01	141	1.51	0.01
	2017	159	1.51	0.01	73	0.63	0.01				166	1.09	0.01	167	1.49	0.01
	2018	59	1.48	0.02	55	0.64	0.01				226	1.15	0.01	154	1.48	0.01
	2019	51	1.52	0.03	69	0.64	0.01	1	1.14	-	313	1.15	0.01	135	1.57	0.01
LCR-LiCR	2008	67	1.36	0.02	33	0.68	0.02				46	1.08	0.02			
	2009	60	1.60	0.02	22	0.67	0.01				37	1.12	0.01			
	2010	75	1.42	0.01	23	0.71	0.01				91	1.19	0.01	56	1.54	0.02
	2011	26	1.48	0.04	21	0.71	0.02				39	1.20	0.02	10	1.53	0.03
	2012	29	1.50	0.03	23	0.73	0.03				65	1.20	0.01	43	1.56	0.02
	2013	43	1.50	0.02	21	0.70	0.02				100	1.19	0.01	22	1.50	0.03
	2014	36	1.51	0.02	14	0.70	0.02				32	1.14	0.01	16	1.54	0.03
	2015	45	1.44	0.01	26	0.70	0.01				53	1.17	0.01	16	1.49	0.03
	2016	83	1.47	0.01	14	0.68	0.02				18	1.09	0.03	24	1.50	0.03
	2017	22	1.38	0.03	12	0.66	0.02	-	-	-	10	1.14	0.03	19	1.47	0.04
	2018	39	1.42	0.02	12	0.70	0.02	-	-	-	71	1.18	0.02	6	1.50	0.06
PBL	2009	61	1.51	0.01	168	0.64	0.005				154	1.10	0.01			
	2012	148	1.41	0.01	108	0.67	0.01				28	1.14	0.01	209	1.50	0.01
	2015	56	1.43	0.02	106	0.65	0.01				86	1.08	0.01	117	1.54	0.01
	2018	78	1.47	0.01	114	0.65	0.01	-	-	-	181	1.11	0.01	97	1.56	0.01
FID	2011	116	1.44	0.01	101	0.67	0.01				28	1.22	0.02	15	1.39	0.03
	2014	71	1.63	0.02	36	0.67	0.01				55	1.18	0.02	13	1.53	0.02
	2017	60	1.62	0.02	15	0.66	0.02	-	-	-	6	1.16	0.03	20	1.48	0.04
BIL	2010	220	1.37	0.01	94	0.64	0.01				67	1.05	0.01	32	1.45	0.02
	2013	79	1.46	0.01	68	0.65	0.01				71	1.09	0.01	23	1.44	0.02
	2016	150	1.46	0.01	53	0.65	0.01				72	1.08	0.01	13	1.41	0.02
	2019	77	1.53	0.02	47	0.68	0.01	-	-	-	194	1.17	0.01	12	1.60	0.03
LCR-Weir	2014	121	1.49	0.02	22	0.73	0.02				1	1.34	-	8	1.56	0.04
	2017	14	1.35	0.04	11	0.68	0.02	-	-	-	3	1.20	0.03	0	-	-
GAU	2008	163	1.48	0.01	105	0.69	0.01				119	1.11	0.01			
	2009	82	1.53	0.01	68	0.66	0.01				117	1.11	0.01			
	2010	119	1.42	0.01	109	0.66	0.01				173	1.11	0.01	155	1.51	0.01
	2011	139	1.50	0.01	101	0.66	0.01				149	1.14	0.01	147	1.53	0.01
	2012	194	1.54	0.01	84	0.67	0.01				192	1.16	0.01	209	1.57	0.01
	2013	90	1.54	0.01	81	0.66	0.01				249	1.16	0.01	206	1.56	0.01
	2014	164	1.56	0.01	146	0.66	0.01				171	1.12	0.01	163	1.58	0.01
	2015	184	1.55	0.01	107	0.65	0.01				191	1.11	0.01	190	1.56	0.01
	2016	102	1.49	0.02	63	0.64	0.01				194	1.09	0.01	111	1.53	0.01
	2017	83	1.47	0.01	130	0.63	0.01	-	-	-	242	1.10	0.01	147	1.52	0.01
	2018	200	1.53	0.01	99	0.63	0.01	-	-	-	226	1.10	0.01	168	1.56	0.01
	2019	179	1.58	0.01	84	0.65	0.01	-	-	-	249	1.09	0.005	140	1.58	0.01

Notes:

1. nF = number of fish measured for length and weight.
2. SE = standard error.
3. Grey shading indicates a species was not a target species in that year.

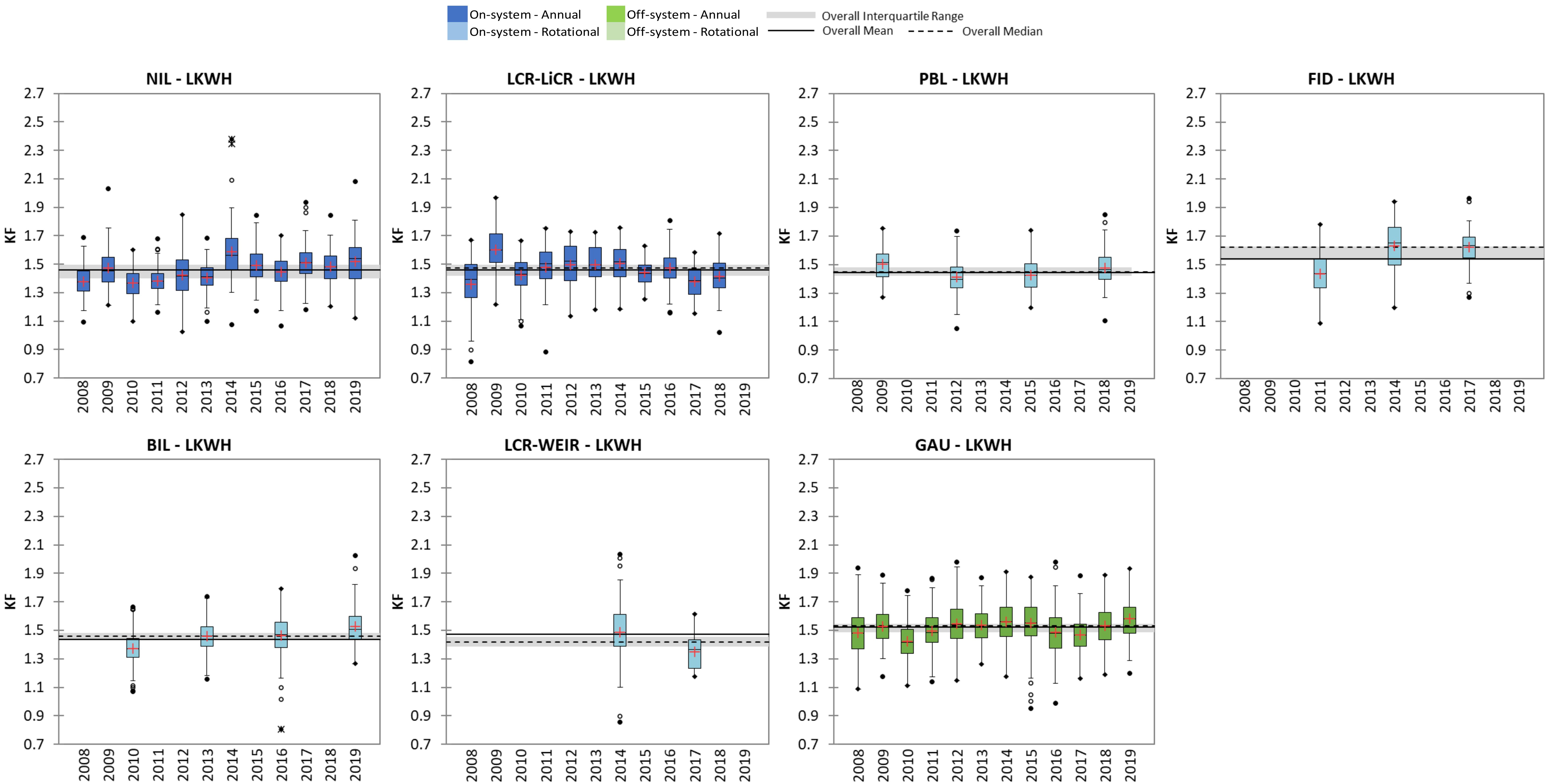


Figure 5.3-1. 2008-2019 Fulton's condition factor (KF) of Lake Whitefish.

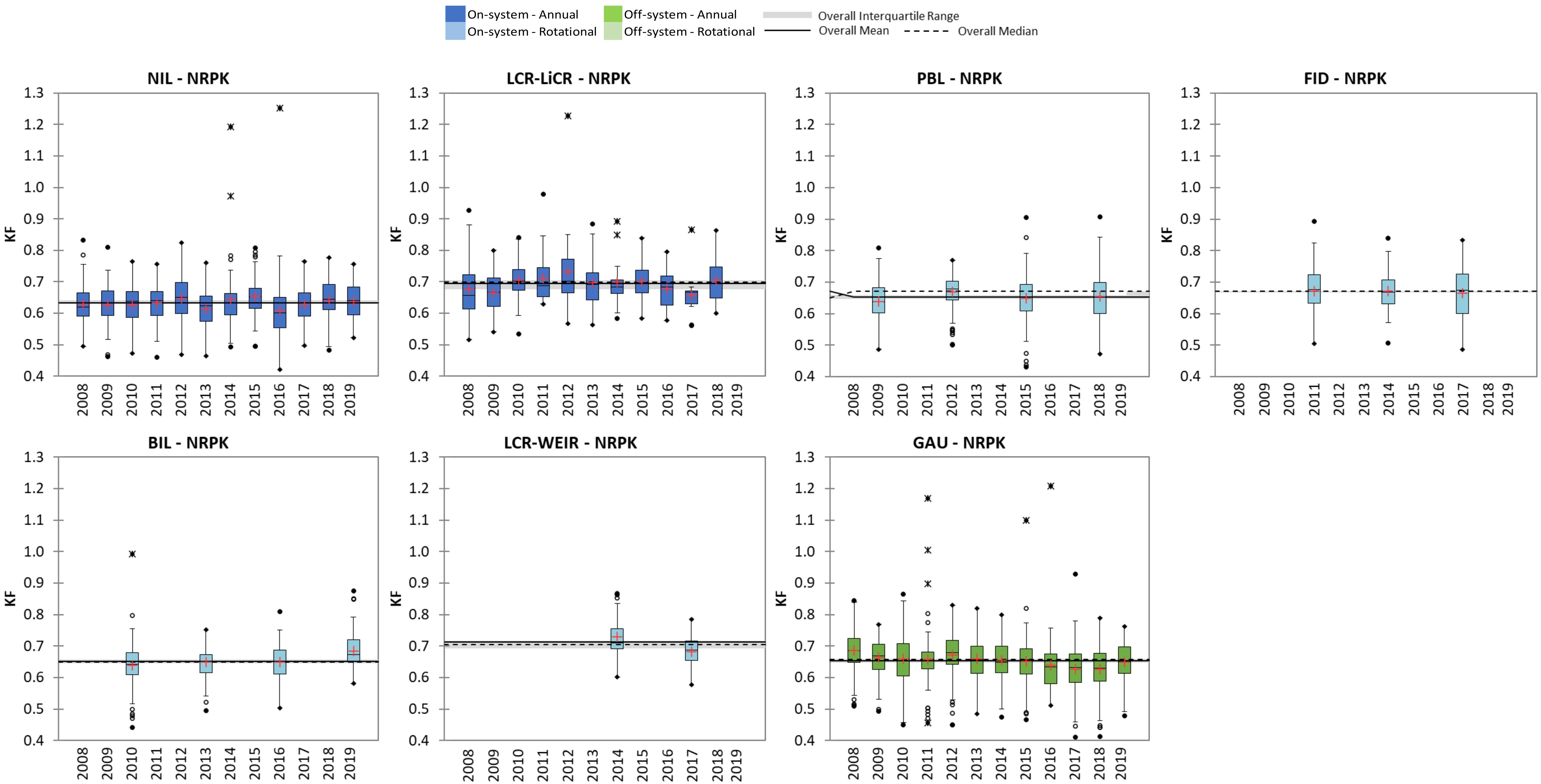


Figure 5.3-2. 2008-2019 Fulton's condition factor (KF) of Northern Pike.

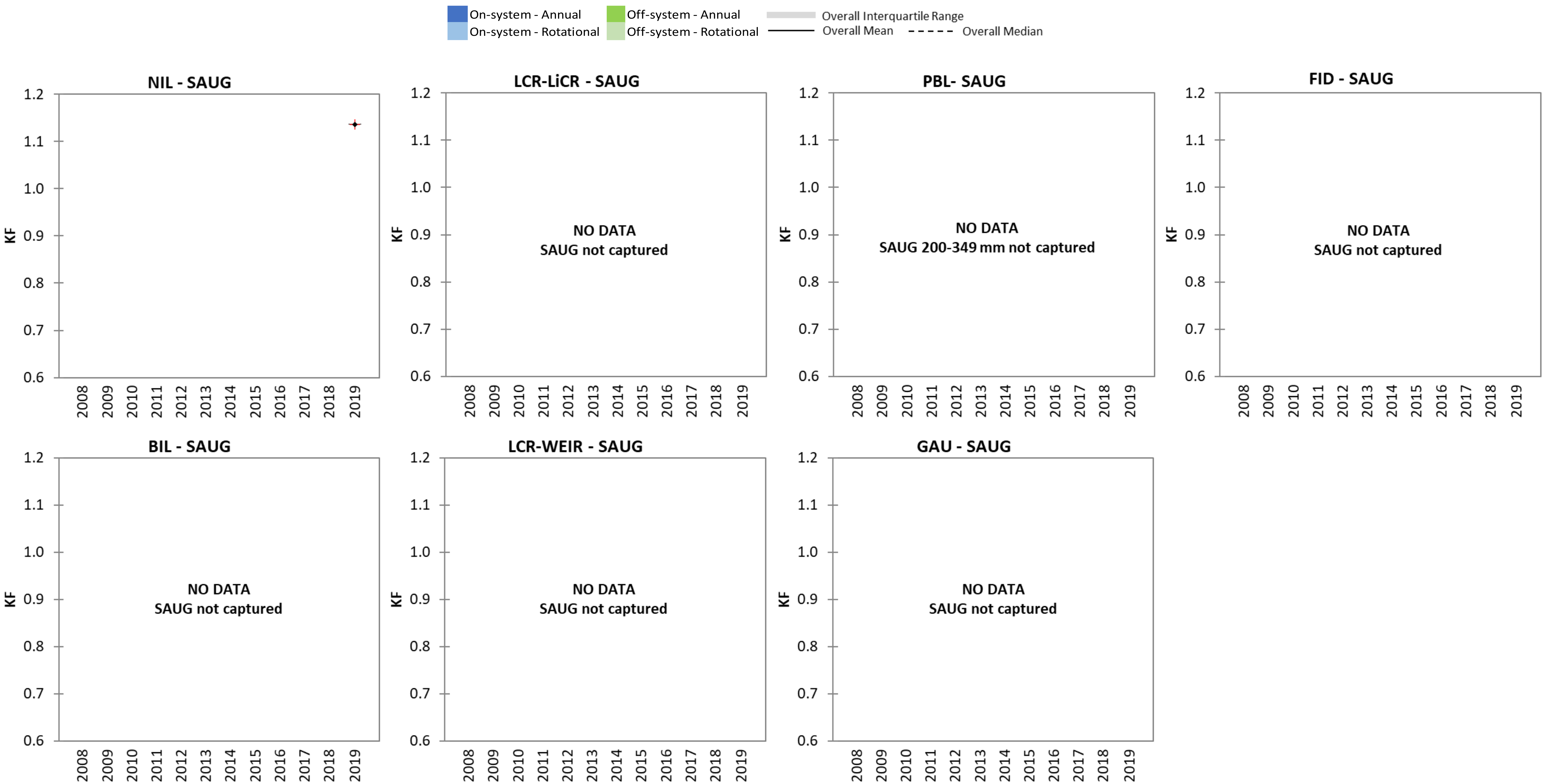


Figure 5.3-3. 2008-2019 Fulton's condition factor (KF) of Sauger.

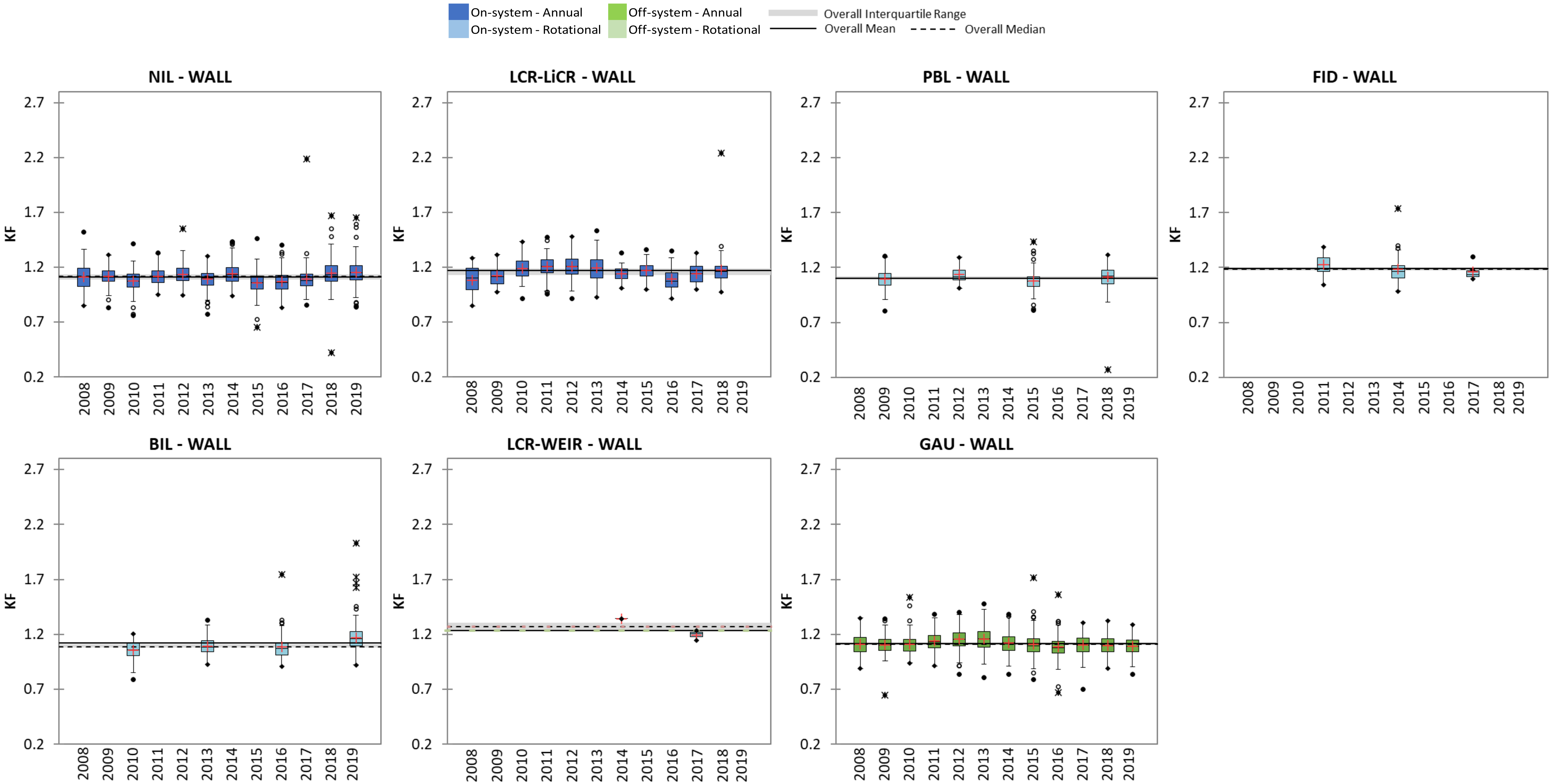


Figure 5.3-4. 2008-2019 Fulton's condition factor (KF) of Walleye.

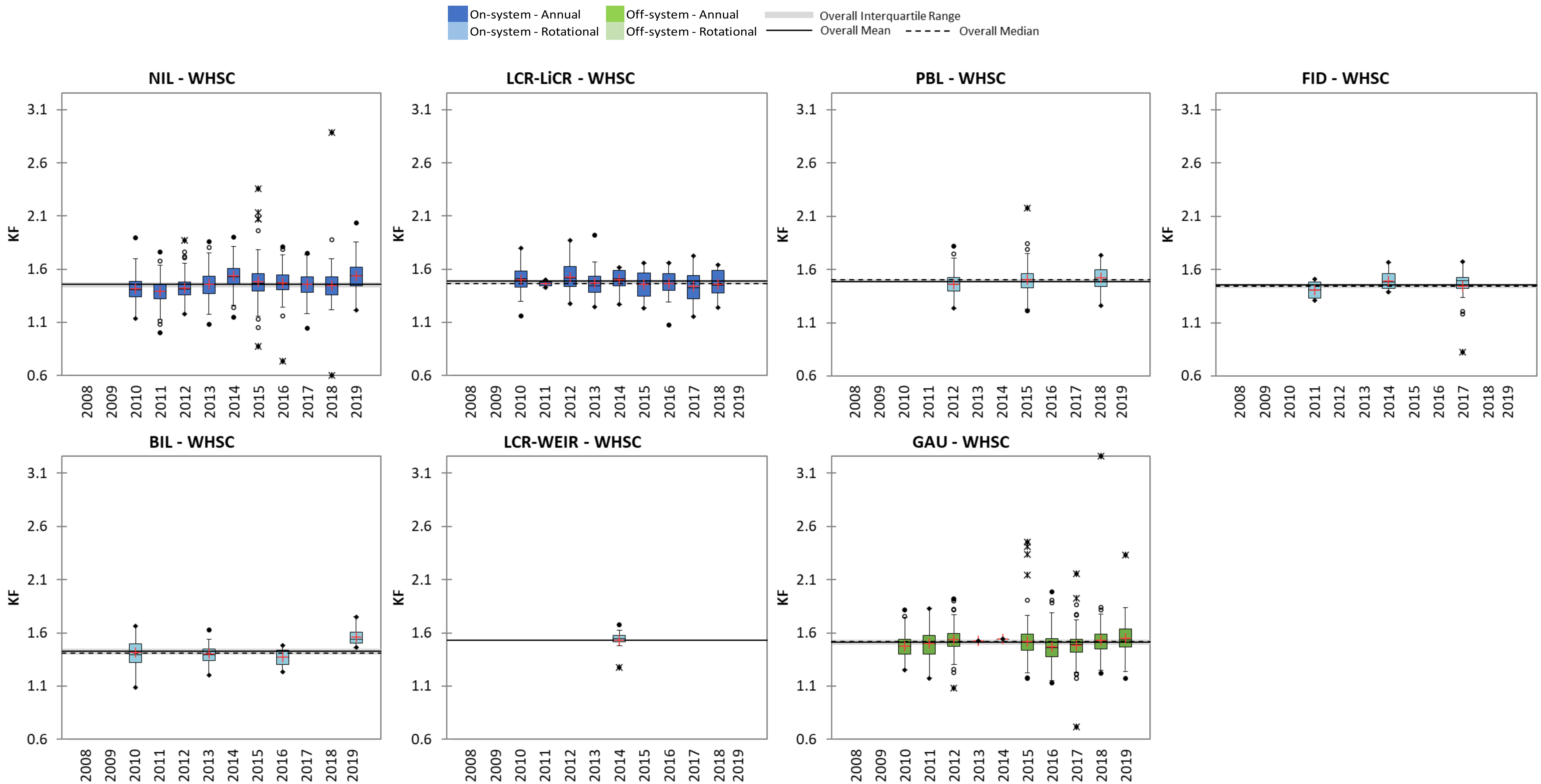


Figure 5.3-5. 2008-2019 Fulton's condition factor (KF) of White Sucker.

5.3.2 RELATIVE WEIGHT

5.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the 12 years of monitoring ranged from a low of 95 in 2008 and 2013 to a high of 111 in 2014 (Table 5.3-2; Figure 5.3-6).

The overall mean and median Wr were 101, and the IQR was 96-104 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2008, 2011, and 2013 when it was below the IQR and in 2015 and 2019 when it was above the IQR.

Northern Pike

The annual mean of Wr of Northern Pike greater than 99 mm in total length over the 12 years of monitoring ranged from a low of 76 in 2013 to a high of 81 in 2012 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 78, and the IQR was 77-79 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2013 when it was below the IQR, and in 2012 and 2015 when it was above the IQR.

Sauger

Sauger was not a target species in Northern Indian Lake until 2017 and were only captured in 2019. The annual mean Wr of the two individual Sauger greater than 69 mm in total length captured in 2019 was 106 (Table 5.3-2; Figure 5.3-8).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the 12 years of monitoring ranged from a low of 84 in 2015 to a high of 91 in 2019 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr was 87, and the IQR was 85-88 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2015 when it was below the IQR and in 2009, 2018, and 2019 when it was above the IQR.

White Sucker

White Sucker was not a target species in Northern Indian Lake until 2010; the annual mean Wr of White Sucker greater than 99 mm in total length over the 10 years of monitoring ranged from a low of 91 in 2011 and 2012 to a high of 100 in 2014 and 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean and median Wr were 95, and the IQR was 93-97 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2011 and 2012 when it was below the IQR and 2014 and 2019 when it was above the IQR.

Lower Churchill River at the Little Churchill River

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 and 701 mm in total length over the 11 years of monitoring ranged from a low of 94 in 2008 to a high of 112 in 2009 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 101, the median was 102, and the IQR was 99-103 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2008 and 2017 when it was below the IQR and in 2009 and 2014 when it was above the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the 11 years of monitoring ranged from a low of 82 in 2017 to a high of 93 in 2012 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 87, and the IQR was 85-88 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2017 when it was below the IQR and in 2010-2012 when it was above the IQR.

Sauger

Sauger was not a target species in the lower Churchill River at the Little Churchill River until 2017. Sauger were not captured in the little Churchill River at the Little Churchill River over the two years of monitoring (Table 5.3-2; Figure 5.3-7).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the 11 years of monitoring ranged from a low of 83 in 2013 to a high of 94 in 2011 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 88, and the IQR was 86-91 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2012 and 2013 when it was below the IQR and in 2010, 2011, and 2015 when it was above the IQR.

White Sucker

White Sucker was not a target species in the lower Churchill River at the Little Churchill River until 2010; the annual mean Wr of White Sucker greater than 99 mm in total length over the nine years of monitoring ranged from a low of 91 in 2018 to a high of 97 in 2010 and 2014 (Table 5.3-2; Figure 5.3-10).

The overall mean and median Wr were 95 and the IQR was 94-96 (Figure 5.3-10). The annual mean KF fell within the overall IQR except in 2017 and 2018 when it was below the IQR and in 2010 and 2014 when it was above the IQR.

ROTATIONAL SITES

Partridge Breast Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the four years of monitoring ranged from a low of 97 in 2012 to a high of 102 in 2009 and 2018 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 100, the median was 101, and the IQR was 100-102 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2012 when it was below the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the four years of monitoring ranged from a low of 79 in 2009 to a high of 83 in 2012 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr as 80, the median was 81, and the IQR was 80-81 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2009 when it was below the IQR and in 2012 when it was above the IQR.

Sauger

Over four years of monitoring, Sauger was only a target species in Partridge Breast Lake in 2018. In this year, one Sauger greater than 69 mm in total length was captured and had a Wr of 81 (Table 5.3-2; Figure 5.3-8).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the four years of monitoring ranged from a low of 86 in 2015 to a high of 89 in 2012 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 87 and the IQR was 87-88 (Figure 5.3-9). The annual mean Wr was equal to or fell within the overall IQR except in 2015 when it was below the IQR and 2012 when it was above the IQR.

White Sucker

White Sucker was not a target species in Partridge Breast Lake until 2010; the annual mean Wr of White Sucker greater than 99 mm in total length over the three years of monitoring ranged from a low of 95 in 2012 to a high of 100 in 2018 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 97, the median was 99, and the IQR was 97-100 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2012 when it was below the IQR.

Fidler Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the three years of monitoring ranged from a low of 98 in 2011 to a high of 112 in 2017 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 103, the median was 100, and the IQR was 99-106 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2011 when it was below the IQR and 2017 when it was above the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the three years of monitoring ranged from a low of 82 in 2011 to a high of 112 in 2017 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 89, the median was 84, and the IQR was 83-98 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2011 when it was below the IQR and 2017 when it was above the IQR.

Sauger

Over three years of monitoring, Sauger was only a target species in Fidler Lake in 2017. Sauger were not captured in Fidler Lake in 2017 (Table 5.3-2; Figure 5.3-7).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the three years of monitoring ranged from a low of 93 in 2014 to a high of 96 in 2011 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 94, the median was 95, and the IQR was 94-96 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2014 when it was below the IQR.

White Sucker

The annual mean Wr of White Sucker greater than 99 mm in total length over the three years of monitoring ranged from a low of 93 in 2011 to a high of 107 in 2017 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 103, the median was 96, and the IQR was 95-101 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2011 when it was below the IQR and 2017 when it was above the IQR.

Billard Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the four years of monitoring ranged from a low of 96 in 2010 to a high of 106 in 2019 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 100, the median was 101, and the IQR was 99-103 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2010 when it was below the IQR and 2019 when it was above the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the four years of monitoring ranged from a low of 79 in 2010 to a high of 85 in 2019 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 81, and the IQR was 81-82 (Figure 5.3-7). The annual mean Wr was equal to or fell within the overall IQR except in 2010 when it was below the IQR and in 2019 when it was above the IQR.

Sauger

Over three years of monitoring, Sauger was only a target species in Billard Lake in 2019. Sauger were not captured in Fidler Lake in 2019 (Table 5.3-2; Figure 5.3-7).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the four years of monitoring ranged from a low of 82 in 2010 to a high of 93 in 2019 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 89, the median was 87, and the IQR was 85-89 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2010 when it was below the IQR and 2019 when it was above the IQR.

White Sucker

The annual mean Wr of White Sucker greater than 99 mm in total length over the four years of monitoring ranged from a low of 87 in 2016 to a high of 92 in 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean and median Wr were 90 and the IQR was 89-91 (Figure 5.3-10). The annual mean Wr was equal to or fell within the overall IQR except in 2016 when it was below the IQR and 2019 when it was above the IQR.

Lower Churchill River at the Churchill Weir

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the two years of monitoring ranged from a low of 100 in 2017 to a high of 101 in 2014 (Table 5.3-2; Figure 5.3-6).

The overall mean and median Wr were 101 and the IQR was 100-101 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2017 when it was below the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the two years of monitoring ranged from a low of 82 in 2017 to a high of 91 in 2014 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 87, the median was 86, and the IQR was 84-89 (Figure 5.3-7). The annual mean Wr was below the overall IQR in 2017 and above the overall IQR in 2014.

Sauger

Over two years of monitoring, Sauger was only a target species in the lower Churchill River in 2017. In this year, no Sauger were captured (Table 5.3-2; Figure 5.3-8).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the two years of monitoring ranged from a low of 85 in 2014 to a high of 88 in 2017 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 87 and the IQR was 86-88 (Figure 5.3-9). The annual mean Wr was equal to or fell within the overall IQR in 2017 and below the overall IQR in 2014.

White Sucker

The annual mean Wr of White Sucker greater than 99 mm in total length over the two years of monitoring ranged from a low of 80 in 2017 to a high of 99 in 2014 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 98, the median was 90, and the IQR was 85-94 (Figure 5.3-10). The annual mean Wr was below the overall IQR in 2017 and above the overall IQR in 2014.

5.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the 12 years of monitoring ranged from a low of 99 in 2010 to a high of 110 in 2019 (Table 5.3-2; Figure 5.3-6).

The overall mean and median Wr were 106 and the IQR was 103-109 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2010 and 2017 when it was below the IQR and in 2019 when it was above the IQR.

Northern Pike

The annual mean Wr of Northern Pike greater than 99 mm in total length over the 12 years of monitoring it was a target species ranged from a low of 78 in 2018 to a high of 85 in 2008 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 81 and the IQR was 80-82 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2016-2018 when it was below the IQR and in 2008, 2019, and 2012 when it was above the IQR.

Sauger

Sauger was not a target species in Gauer Lake until 2017. Sauger were not captured in Gauer Lake over the three years of monitoring (Table 5.3-2; Figure 5.3-7).

Walleye

The annual mean Wr of Walleye greater than 29 mm in total length over the 12 years of monitoring ranged from a low of 86 in 2019 to a high of 92 in 2012 and 2013 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 88 and the IQR was 87-89 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2019 when it was below the IQR and in 2011-2013 when it was above the IQR.

White Sucker

White Sucker was not a target species in Gauer Lake until 2010; the annual mean Wr of White Sucker greater than 99 mm in total length over the 10 years of monitoring ranged from a low of 98 in 2010, 2011, 2016, and 2017 to a high of 102 in 2012 and 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 100, the median was 101, and the IQR was 98-101 (Figure 5.3-10). The annual mean Wr was within the overall IQR in all years except in 2012 and 2019, when the annual mean was above the IQR.

Table 5.3-2. 2008-2019 Relative weight of target species.

Waterbody	Year	LKWH			NRPK			SAUG			WALL			WHSC		
		n_F[1]	Mean	SE[2]	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE
NIL	2008	88	95	1.0	47	78	1.2				214	88	0.7			
	2009	121	100	0.8	159	78	0.6				348	89	0.3			
	2010	181	96	0.6	94	78	0.9				187	86	0.5	170	93	0.6
	2011	123	95	0.7	78	79	0.8				166	88	0.5	264	91	0.5
	2012	166	97	0.9	111	81	0.9				334	87	0.4	262	91	0.6
	2013	51	95	1.2	125	77	0.8				350	86	0.4	134	94	1.0
	2014	101	111	1.3	91	79	1.3				382	87	0.7	253	100	0.6
	2015	150	105	0.9	127	81	0.7				238	84	0.6	255	97	0.7
	2016	110	101	1.0	109	77	1.2				269	85	0.4	170	96	0.7
	2017	241	104	0.7	104	77	0.8	-	-	-	366	85	0.7	200	95	0.6
	2018	75	102	1.0	79	80	1.0	-	-	-	370	89	0.5	177	95	1.3
	2019	70	107	1.8	81	79	0.8	2	106	0.8	419	91	0.5	160	100	0.8
LCR-LiCR	2008	88	94	1.5	57	85	1.4				76	87	0.9			
	2009	64	112	1.3	37	88	2.3				56	86	1.0			
	2010	78	99	1.1	41	90	1.5				138	93	0.7	68	97	1.2
	2011	30	103	2.5	28	89	1.8				59	94	1.0	13	96	2.2
	2012	38	103	1.6	30	93	3.7				236	85	0.9	58	94	2.0
	2013	53	103	1.5	42	87	1.5				266	83	1.0	29	94	2.2
	2014	37	105	1.5	27	85	1.9				64	90	1.2	28	97	2.1
	2015	51	101	1.1	35	87	1.4				102	92	0.7	20	95	2.0
	2016	95	102	1.0	25	85	1.5				45	90	2.1	27	96	1.6
	2017	25	97	2.2	19	82	2.1	-	-	-	43	87	1.2	22	93	2.1
	2018	44	99	1.6	16	87	2.0	-	-	-	165	88	1.1	11	91	3.2
PBL	2009	83	102	1.0	185	79	0.6				176	87	0.5			
	2012	174	97	0.6	144	83	0.6				41	89	0.9	236	95	0.6
	2015	63	100	1.1	118	80	0.9				101	86	0.8	136	99	0.9
	2018	100	102	1.2	134	81	0.8	1	81	-	238	88	0.5	104	100	0.8
FID	2011	147	98	0.9	120	82	0.9				33	96	1.2	15	89	1.8
	2014	146	100	2.1	55	84	1.8				88	93	1.1	35	96	2.7
	2017	141	112	0.9	43	112	6.9	-	-	-	32	95	2.6	71	107	2.8
BIL	2010	255	95	0.5	109	79	0.9				124	82	0.6	48	89	1.7
	2013	92	100	0.8	84	81	0.8				160	86	0.6	29	90	1.4
	2016	204	102	1.0	63	81	1.7				135	88	1.1	25	87	1.6
	2019	108	106	0.9	63	85	1.1	-	-	-	273	93	0.9	31	92	2.3
LCR-WEIR	2014	171	101	1.5	26	91	1.9				4	85	14.9	-	-	-
	2017	23	100	5.4	15	82	2.1	-	-	-	6	90	6.0	7	80	8.4
GAU	2008	212	103	0.8	126	85	0.8				129	89	0.7			
	2009	105	105	0.8	80	83	0.9				131	88	0.6			
	2010	172	99	0.6	130	82	0.8				190	89	0.5	178	98	0.6
	2011	193	104	0.7	119	81	1.0				181	90	0.5	181	98	0.8
	2012	310	108	0.6	120	84	0.9				262	92	0.5	228	102	0.5
	2013	133	107	0.8	101	82	1.0				293	92	0.4	233	101	0.5
	2014	184	109	0.8	193	81	0.6				221	88	0.7	196	100	0.8
	2015	205	109	0.8	137	80	1.0				259	87	0.6	215	101	0.8
	2016	120	104	0.9	76	79	1.3				227	87	0.6	129	99	0.8
	2017	105	101	0.9	182	79	0.8	-	-	-	323	87	0.4	184	98	0.7
	2018	273	109	1.0	123	78	0.9	-	-	-	334	88	0.4	189	101	0.8
	2019	197	110	0.7	108	81	0.9	-	-	-	322	88	1.6	153	102	0.7

Notes:

1. nF = number of fish measured for length and weight.
2. SE = standard error.
3. Grey shading indicates a species was not a target species in that year.

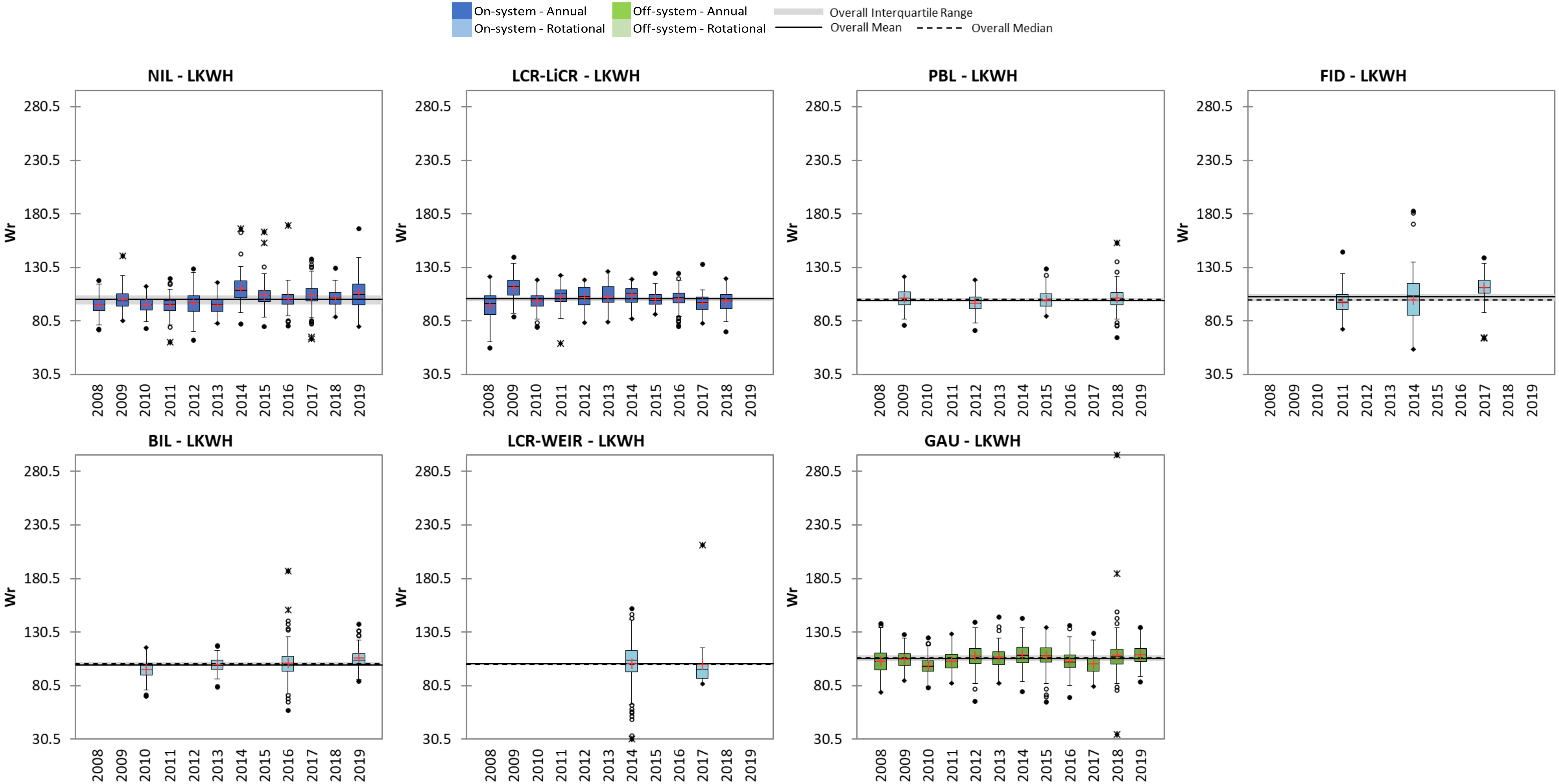


Figure 5.3-6. 2008-2019 Relative weight (Wr) of Lake Whitefish.

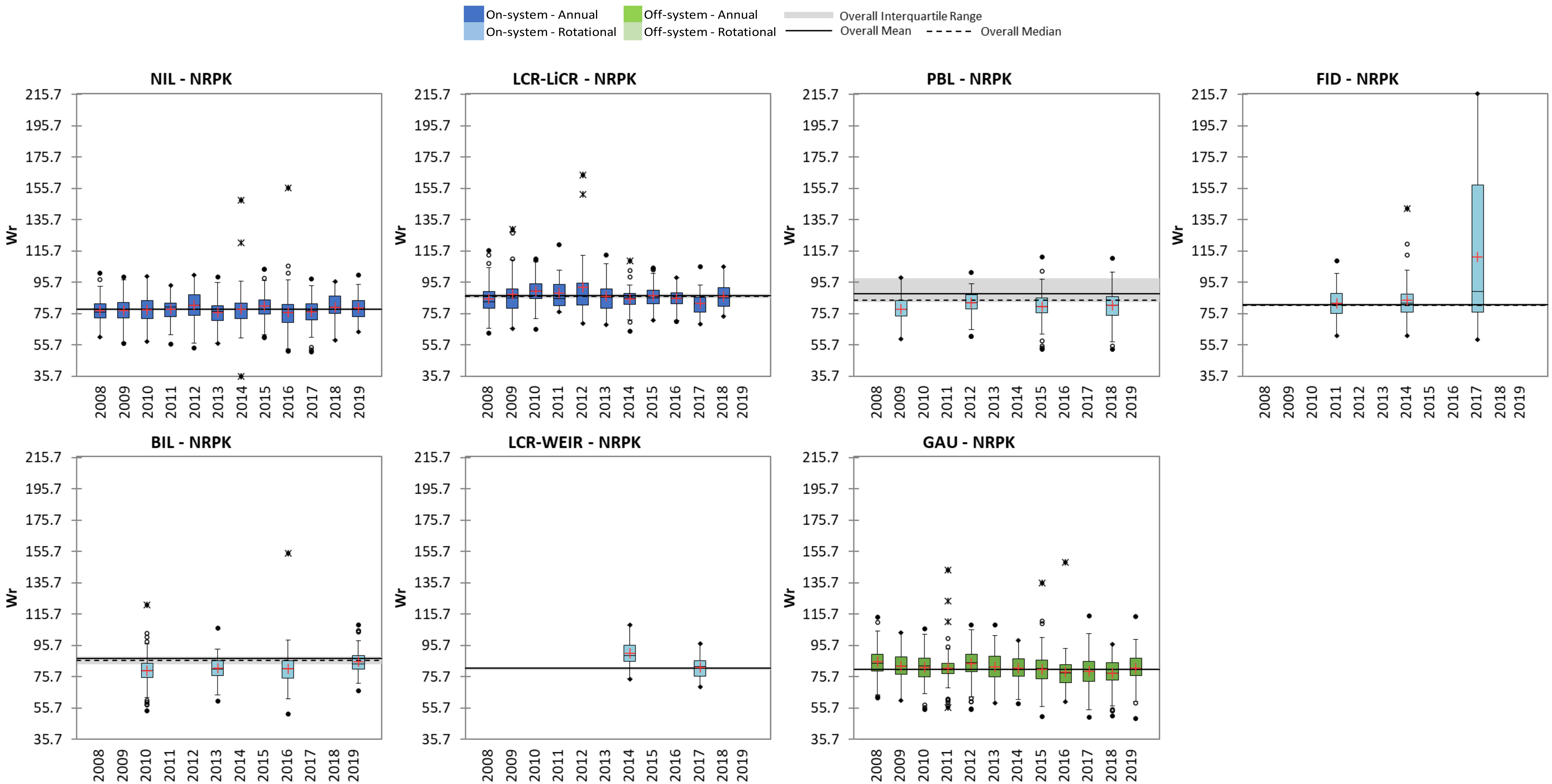


Figure 5.3-7. 2008-2019 Relative weight (Wr) of Northern Pike.

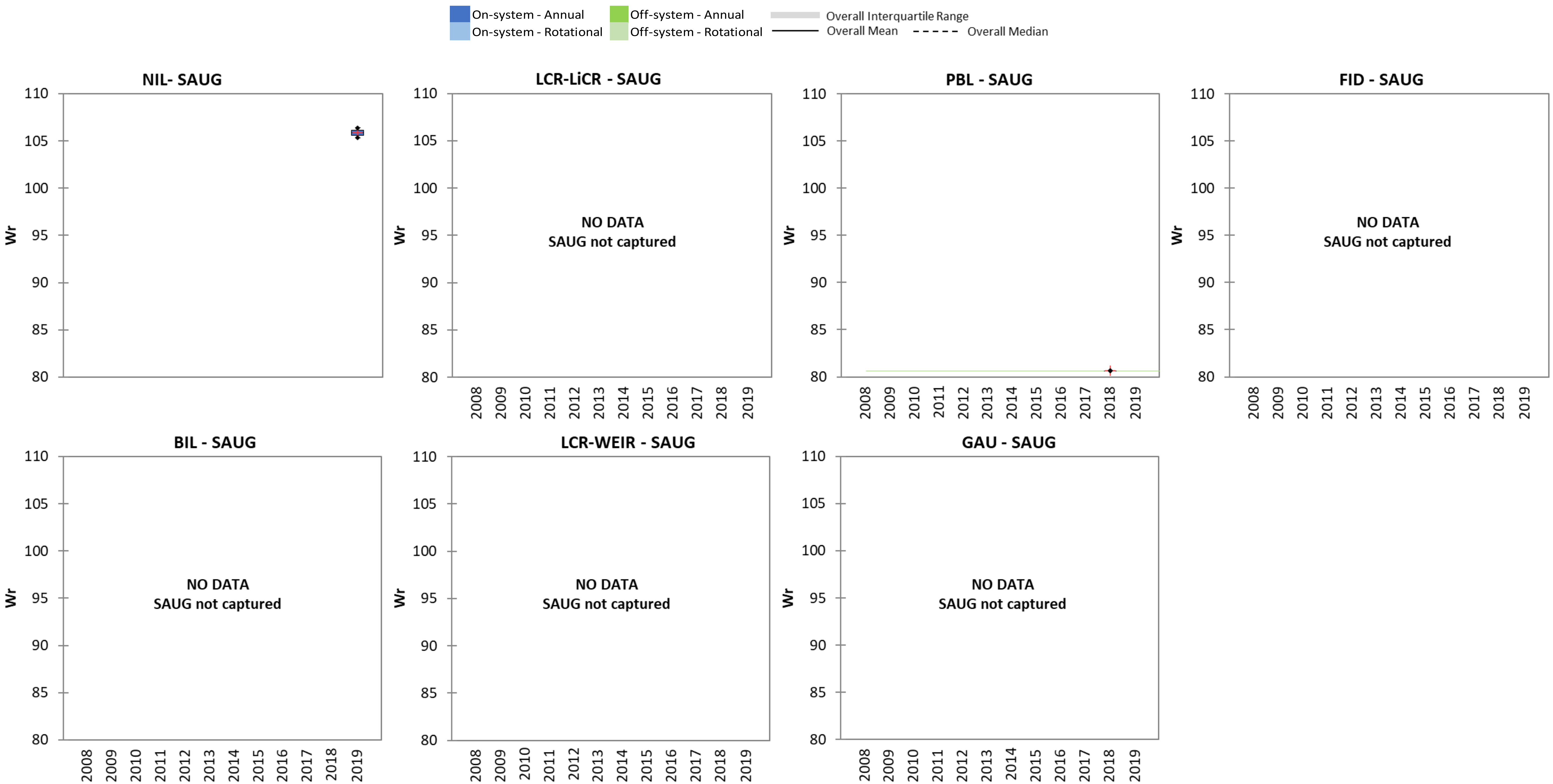


Figure 5.3-8. 2008-2019 Relative weight (Wr) of Sauger.

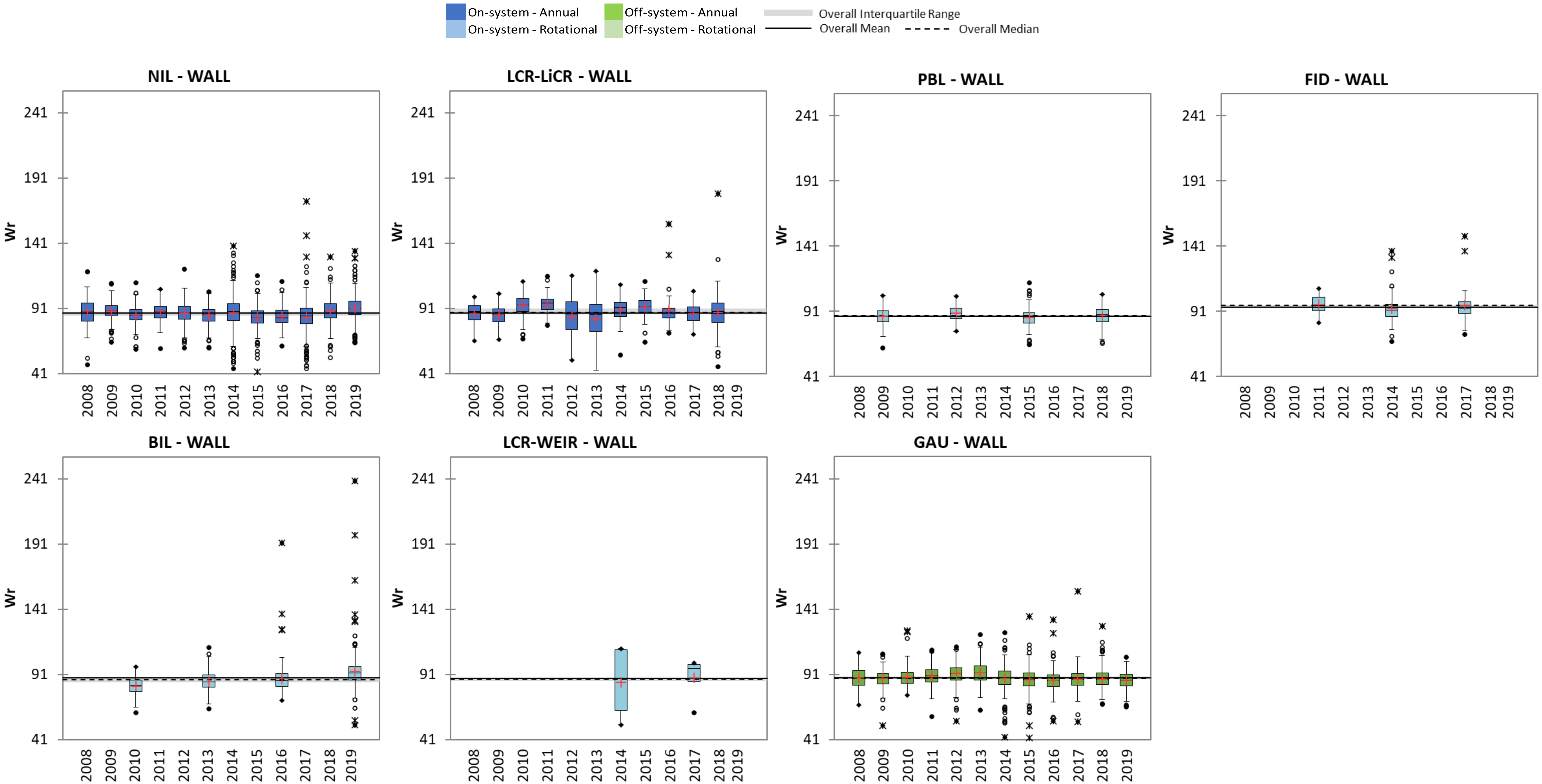


Figure 5.3-9. 2008-2019 Relative weight (Wr) of Walleye.

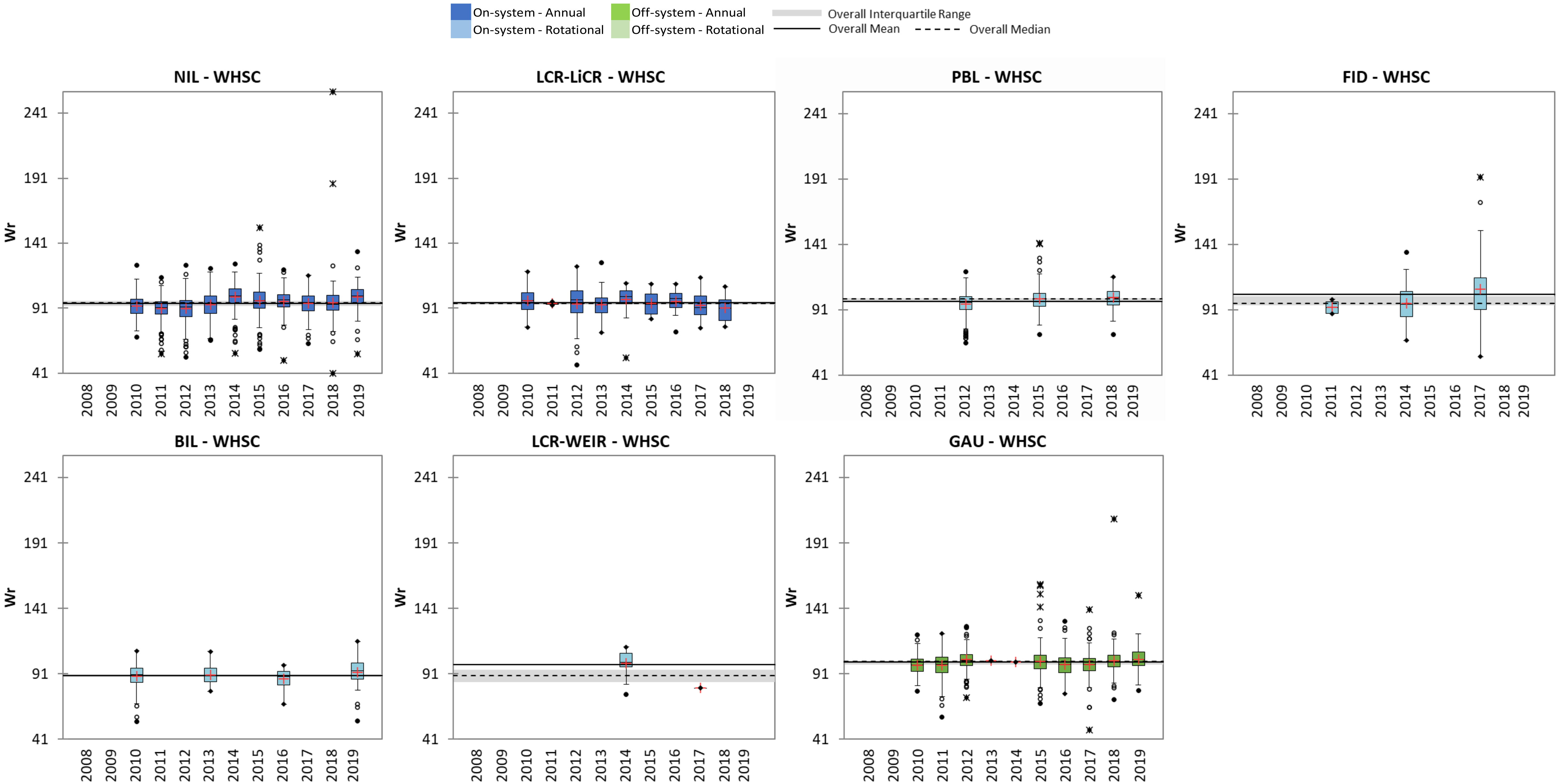


Figure 5.3-10. 2008-2019 Relative weight (Wr) of White Sucker.

5.4 GROWTH

5.4.1 LENGTH-AT-AGE

5.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the 12 years of monitoring ranged from a low of 216 in 2013 to a high of 292 mm in 2017 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 235, the median was 266 and the IQR was 243-283 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2011-2013 when it was below the IQR and in 2016-2018 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the 12 years of monitoring ranged from a low of 406 in 2010 to a high of 537 mm in 2019 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 478, the median was 466, and the IQR was 444-473 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2010, 2011, and 2014 when it was below the IQR and in 2012, 2017, and 2019 when it was above the IQR.

Sauger

Sauger was not a target species in Northern Indian Lake until 2017; no 3-year-old Sauger were captured in Northern Indian Lake over the three years of monitoring (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the 12 years of monitoring ranged from a low of 203 in 2017 to a high of 262 mm in 2012 (Table 5.4-1; Figure 5.4-4). No 3-year-old Walleye were captured in Northern Indian Lake in 2009 and 2018, and only one individual Walleye was captured in 2008, 2010, and 2012.

The overall mean FLA was 222, the median was 225, and the IQR was 212-237 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2016, 2017, and 2019 when it was below the IQR and in 2012-2014 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

Lower Churchill River at the Little Churchill River

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the 11 years of monitoring ranged from a low of 265 in 2010 to a high of 395 mm in 2013 (Table 5.4-1; Figure 5.4-1). No 4-year-old Lake Whitefish were captured in the lower Churchill River at the Little Churchill River in 2019, and only one individual Lake Whitefish was captured in 2012 and 2013.

The overall mean FLA was 330, the median was 339 and the IQR was 306-362 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2010, 2011, and 2018 when it was below the IQR and in 2013, 2015, and 2016 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the 11 years of monitoring ranged from a low of 368 in 2014 to a high of 527 mm in 2008 (Table 5.4-1; Figure 5.4-2). No 4-year-old Northern Pike were captured in the lower Churchill River at the Little Churchill River in 2009, 2011, and 2019, and only one individual Lake Whitefish was captured in 2010, 2012 and 2013.

The overall mean FLA was 490, the median was 486, and the IQR was 464-521 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2014 and 2015 when it was below the IQR and in 2008 and 2013 when it was above the IQR.

Sauger

Sauger was not a target species in the lower Churchill River at the Little Churchill River until 2017; no 3-year-old Sauger were captured in Northern Indian Lake over the two years of monitoring (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the 11 years of monitoring ranged from a low of 254 in 2019 to a high of 337 mm in 2014 (Table 5.4-1; Figure 5.4-4). No 3-year-old Walleye were captured in the lower Churchill River at the Little Churchill River in 2008, 2011, 2017, and 2019, and only one individual Lake Whitefish was captured in 2009 and 2010.

The overall mean FLA was 270, the median was 241, and the IQR was 228-277 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2010 and 2018 when it was below the IQR and in 2013 and 2014 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

Partridge Breast Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the four years of monitoring ranged from a low of 275 in 2009 to a high of 311 mm in 2015 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 297, the median was 304, and the IQR was 296-307 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2009 when it was below the IQR and in 2015 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the four years of monitoring ranged from a low of 442 in 2009 to a high of 514 mm in 2018 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 495, the median was 479, and the IQR was 468-489 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009 when it was below the IQR and in 2018 when it was above the IQR.

Sauger

Over four years of monitoring, Sauger was only a target species in Partridge Breast Lake in 2018; no 3-year-old Sauger were captured in Partridge Breast Lake in 2018 (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the four years of monitoring ranged from a low of 228 in 2018 to a high of 358 mm in 2009 (Table 5.4-1; Figure 5.4-4). Only one individual three-year old was caught in 2009 and 2012.

The overall mean and median FLA were 246 and the IQR was 238-277 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2018 when it was below the IQR and in 2009 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

Fidler Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the three years of monitoring ranged from a low of 275 in 2011 to a high of 306 mm in 2017 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 299, the median was 303, and the IQR was 289-304 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2011 when it was below the IQR and in 2017 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the three years of monitoring ranged from a low of 478 in 2014 to a high of 503 mm in 2017 (Table 5.4-1; Figure 5.4-1). No 4-year-old Northern Pike were captured in Fidler Lake in 2011.

The overall mean FLA was 494, the median was 490, and the IQR was 484-497 mm (Figure 5.4-1). The annual mean FLA was below the overall IQR in 2014 and above the overall IQR in 2017.

Sauger

Over three years of monitoring, Sauger was only a target species in Fidler Lake in 2017; no Sauger were captured in Fidler Lake in 2017 (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the four years of monitoring ranged from a low of 219 in 2014 to a high of 238 mm in 2017 (Table 5.4-1; Figure 5.4-4). No 3-year-old Walleye were captured in Fidler Lake in 2011.

The overall mean FLA was 230, the median was 229, and the IQR was 224-233 mm (Figure 5.4-4). The annual mean FLA fell below the overall IQR in 2019 and above the overall IQR in 2017.

White Sucker

White Sucker was not aged as part of CAMP.

Billard Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the four years of monitoring ranged from a low of 274 in 2019 to a high of 320 mm in 2010 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 307, the median was 300, and the IQR was 292-306 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2019 when it was below the IQR and in 2010 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the four years of monitoring ranged from a low of 470 in 2010 to a high of 538 mm in 2016 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 510, the median was 493, and the IQR was 479-513 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2010 when it was below the IQR and in 2016 when it was above the IQR.

Sauger

Over four years of monitoring, Sauger was only a target species in Billard Lake in 2019; no Sauger were captured in 2019 (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the four years of monitoring ranged from a low of 222 in 2019 to a high of 278 mm in 2013 (Table 5.4-1; Figure 5.4-4). No 3-year-old Walleye were captured in Billard Lake in 2010.

The overall mean FLA was 262, the median was 236, and the IQR was 229-257 mm (Figure 5.4-4). The annual mean FLA was below the overall IQR in 2019 and above the overall IQR in 2013.

White Sucker

White Sucker was not aged as part of CAMP.

Lower Churchill River at the Churchill Weir

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the two years of monitoring ranged from a low of 330 in 2017 to a high of 348 mm in 2014 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 347, the median was 339, and the IQR was 335-344 mm (Figure 5.4-1). The annual mean FLA was below the overall IQR in 2017 and above the overall IQR in 2014.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the two years of monitoring ranged from a low of 512 in 2014 to a high of 517 mm in 2017 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 514, the median was 515, and the IQR was 513-516 mm (Figure 5.4-2). The annual mean FLA fell below the overall IQR in 2014 and above the overall IQR in 2017.

Sauger

Over two years of monitoring, Sauger was only a target species in the lower Churchill River at the Churchill Weir in 2017; no Sauger were captured in 2017 (Table 5.4-1; Figure 5.4-3).

Walleye

Over the two years of monitoring, 3-year-old Walleye were not caught in the lower Churchill River at the Churchill Weir (Table 5.4-1; Figure 5.4-4).

White Sucker

White Sucker was not aged as part of CAMP.

5.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the 12 years of monitoring ranged from a low of 262 in 2012 to a high of 310 mm in 2016 (Table 5.4-1; Figure 5.4-1).

The overall mean FLA was 280, the median was 281, and the IQR was 268-290 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2008, 2011, and 2012 when it was below the IQR and in 205, 2016, and 2019 when it was above the IQR.

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the 12 years of monitoring ranged from a low of 390 in 2012 to a high of 558 mm in 2016 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 474, the median was 475, and the IQR was 447-485 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009, 2011, and 2012 when it was below the IQR and in 2016, 2017, and 2019 when it was above the IQR.

Sauger

Sauger was not a target species in Gauer Lake until 2017; no Sauger were captured in Gauer Lake over the three years of monitoring (Table 5.4-1; Figure 5.4-3).

Walleye

The annual mean FLA of 3-year-old Walleye over the 12 years of monitoring ranged from a low of 210 in 2011 to a high of 248 mm in 2016 (Table 5.4-1; Figure 5.4-4). No 3-year-old Walleye were captured in Gauer Lake in 2010.

The overall mean FLA was 226, the median was 227, and the IQR was 215-232 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2011 and 2018 when it was below the IQR and in 2013, 2014, and 2016 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

Table 5.4-1. 2008-2019 Fork length-at-age of target species.

Waterbody	Year	LKWH			NRPK			SAUG			WALL		
		n_F[1]	Mean	SE[2]	n_F	Mean	SE	n_F	Mean	SE	n_F	Mean	SE
NIL	2008	11	237	8	3	468	5				1	234	-
	2009	14	245	5	16	448	13				-	-	-
	2010	11	246	18	4	406	18				1	227	-
	2011	13	235	8	3	411	41				3	223	4
	2012	9	240	12	10	481	9				1	262	-
	2013	4	216	4	9	465	10				9	238	8
	2014	10	266	9	12	434	16				27	239	5
	2015	18	278	4	24	456	11				11	224	4
	2016	7	288	6	14	469	11				3	208	7
	2017	17	292	8	19	511	14	-	-	-	32	203	3
	2018	6	289	11	9	471	11	-	-	-	-	-	-
	2019	9	276	9	28	537	13	-	-	-	4	206	9
LCR-LiCR	2008	6	351	16	8	527	14				-	-	-
	2009	6	330	15	-	-	-				1	229	-
	2010	2	265	40	1	465	-				1	209	-
	2011	2	276	7	-	-	-				-	-	-
	2012	1	315	-	1	486	-				2	240	16
	2013	1	395	-	2	523	18				21	278	6
	2014	11	333	6	1	368	-				4	299	10
	2015	5	373	11	5	436	15				9	276	9
	2016	9	381	17	4	521	29				3	242	13
	2017	2	318	34	3	464	62	-	-	-	-	-	-
	2018	5	298	6	3	492	100	-	-	-	2	223	8
PBL	2009	10	275	17	9	442	22				1	358	-
	2012	11	306	10	6	477	10				1	250	-
	2015	4	311	19	28	480	11				3	241	8
	2018	10	303	10	53	514	8	-	-	-	6	228	11
FID	2011	4	275	46	-	-	-				-	-	-
	2014	12	303	11	3	478	46				5	219	28
	2017	10	306	9	5	503	22	-	-	-	7	238	4
BIL	2010	24	320	8	8	470	21				-	-	-
	2013	6	302	16	5	483	16				15	278	8
	2016	12	298	17	19	538	14				6	236	3
	2019	6	274	11	12	504	16	-	-	-	2	222	4
LCR-WEIR	2014	42	348	5	5	512	14				-	-	-
	2017	3	330	3	3	517	27	-	-	-	-	-	-
GAU	2008	21	266	10	15	484	15				1	215	-
	2009	6	287	12	6	419	24				2	228	8
	2010	15	278	7	9	456	12				-	-	-
	2011	22	262	4	2	405	13				2	210	13
	2012	32	262	6	20	390	11				2	216	11
	2013	12	275	8	12	471	10				6	235	10
	2014	9	284	7	23	478	10				3	241	7
	2015	13	299	9	13	468	10				15	227	3
	2016	25	310	5	6	558	12				5	248	7
	2017	10	269	9	28	486	8	-	-	-	11	229	11
	2018	22	290	7	16	485	11	-	-	-	10	210	5
	2019	10	291	11	27	515	11	-	-	-	2	215	25

Notes:

1. nF = number of fish measured for length and weight.
2. SE = standard error.
3. Grey shading indicates that a species was not a target species in that year.

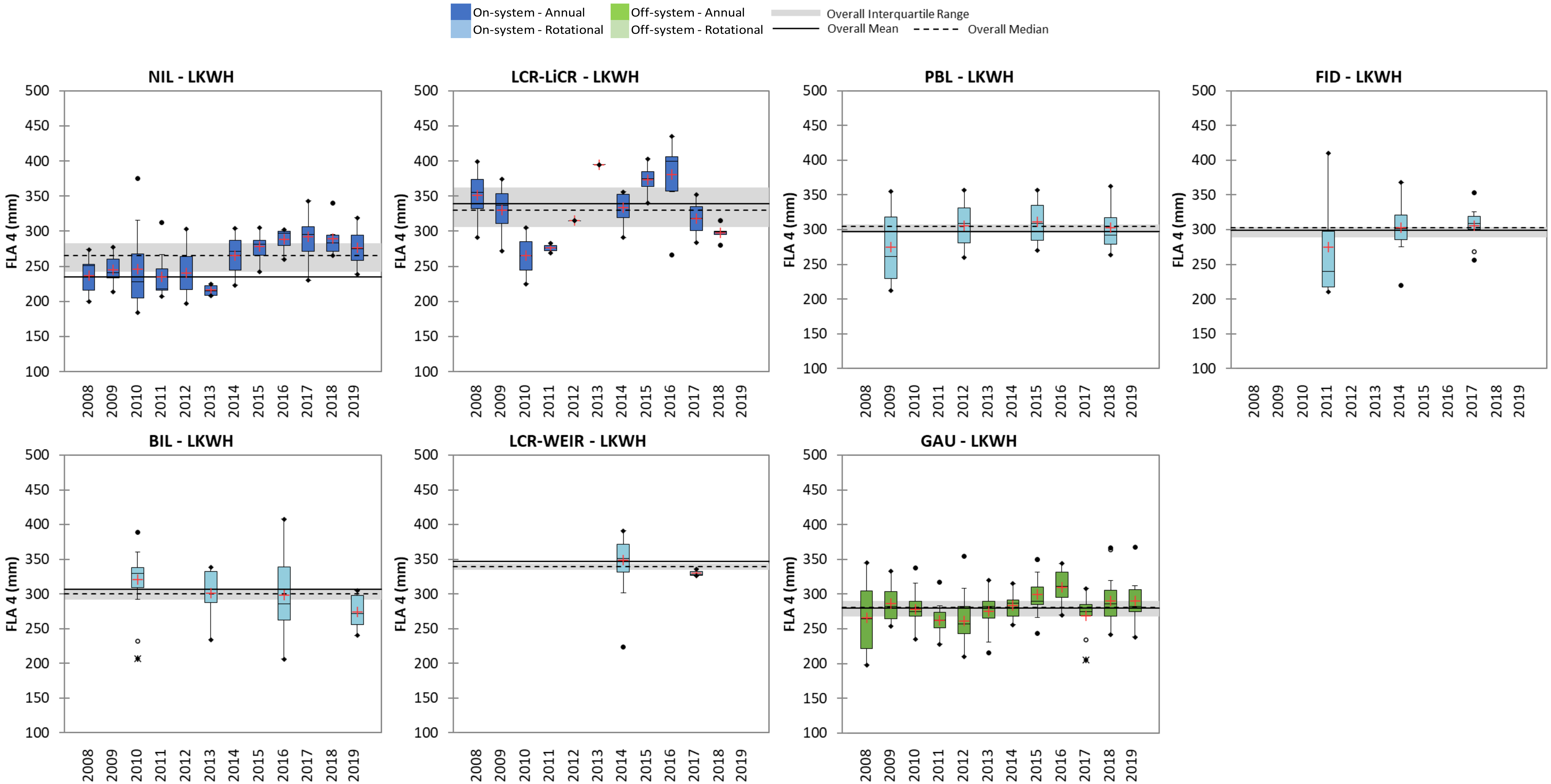


Figure 5.4-1. 2008-2019 Fork length-at-age (FLA) 4 of Lake Whitefish.

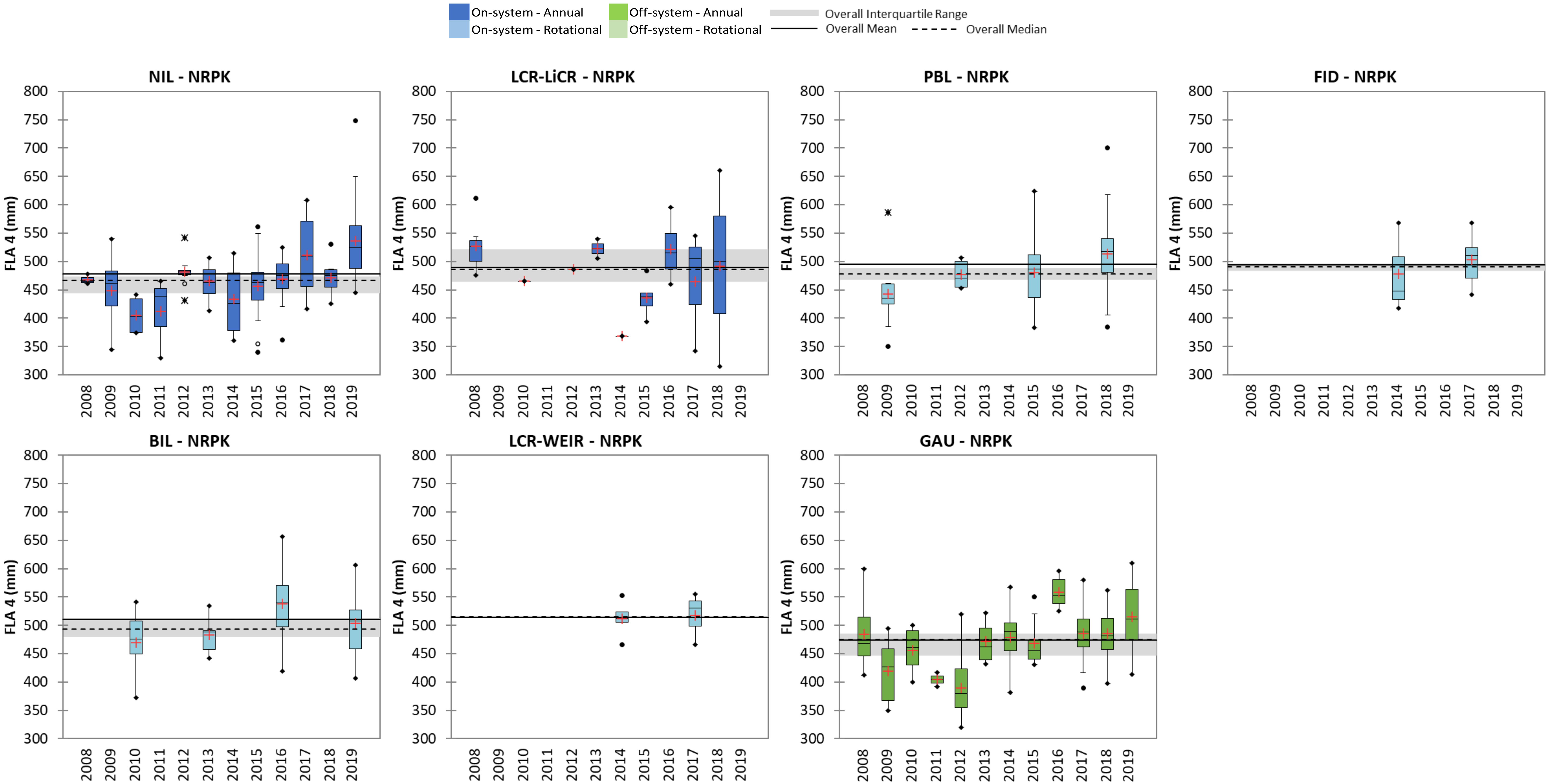


Figure 5.4-2. 2008-2019 Fork length-at-age (FLA) 4 of Northern Pike.

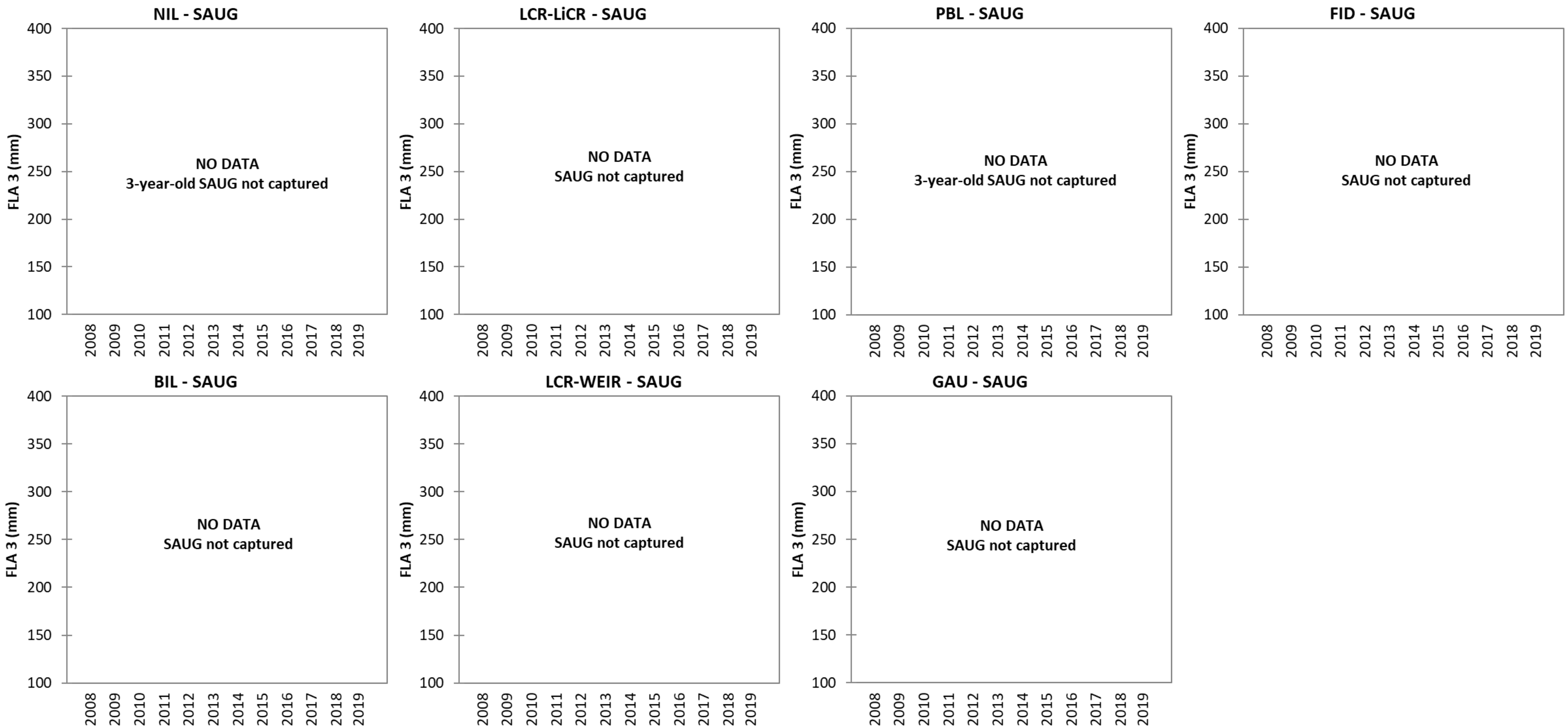


Figure 5.4-3. 2008-2019 Fork length-at-age (FLA) 3 of Sauger.

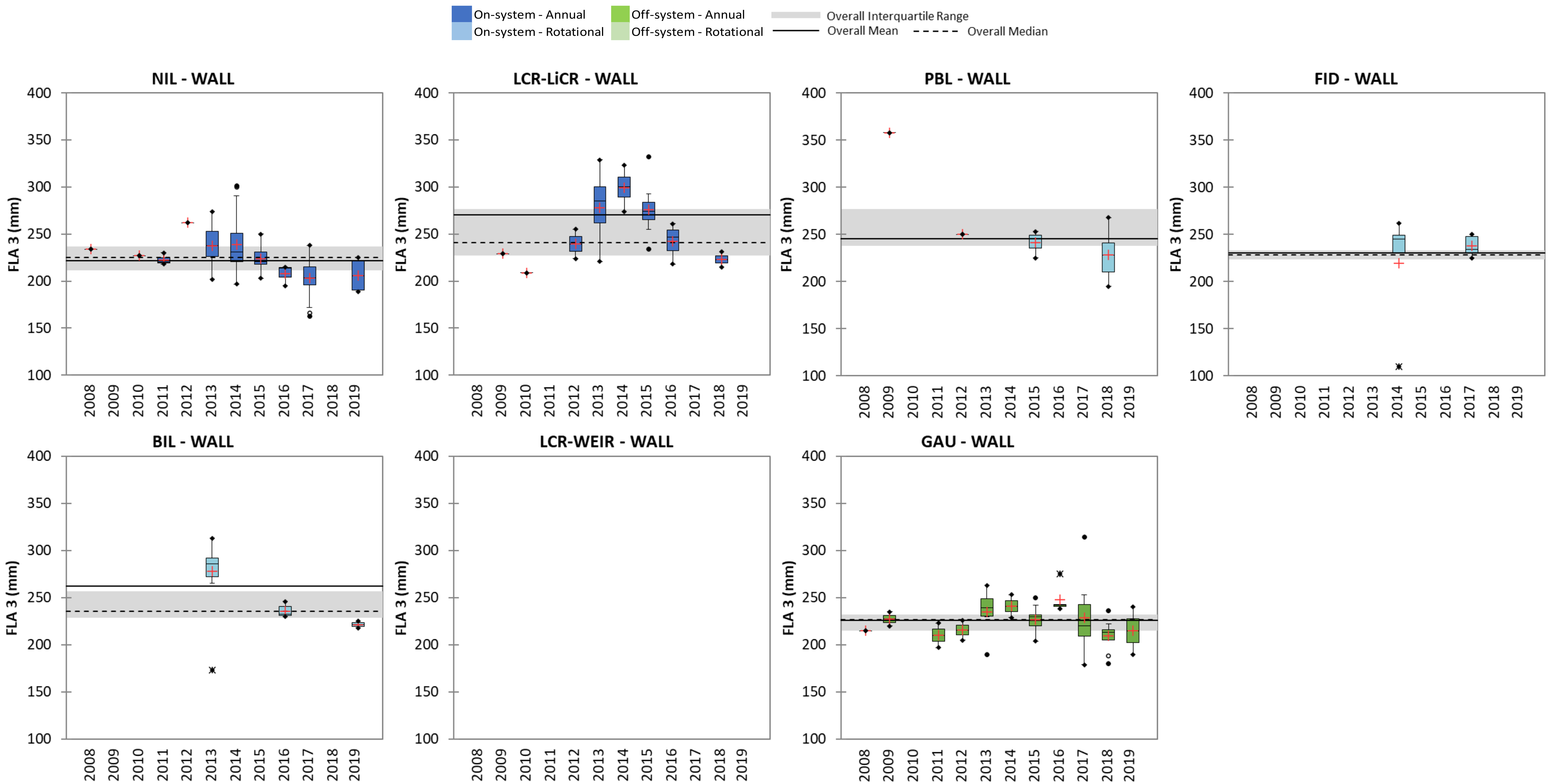


Figure 5.4-4. 2008-2019 Fork length-at-age (FLA) 3 of Walleye.

5.5 RECRUITMENT

5.5.1 RELATIVE YEAR-CLASS STRENGTH

5.5.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

Lake Whitefish

The RYCS of Lake Whitefish over the 12 years of monitoring ranged from a low of 61 for the 1997 cohort to a high of 204 for the 2014 cohort (Figure 5.5-2). There were no missing cohorts from 1996-2014. Strong cohorts (>100) were produced in over one-third of the years, from 1998, 2001, 2003-2006, 2010, and 2014. No cohort was particularly weak (<50).

Northern Pike

The RYCS of Northern Pike over the 12 years of monitoring ranged from a low of 4 for the 1997 cohort to a high of 31 for the 1996 cohort (Figure 5.5-2). There were no missing cohorts from 1996-2014. No strong cohorts (>100) were produced, rather, particularly weak cohorts (<50) were produced in all years.

Sauger

Age data for Sauger were insufficient to allow year-class strength determination.

Walleye

The RYCS of Walleye over the 12 years of monitoring ranged from a low of 22 for the 2009 cohort to a high of 252 for the 2014 cohort (Figure 5.5-2). There were no missing cohorts from 1996-2014. Strong cohorts (>100) were produced in over half of the years, from 1996, 2000-2003, 2008, and 2010-2014. A particularly weak cohort (<50) occurred in 2005-2007 and 2009.

White Sucker

White Sucker was not aged as part of CAMP.

Lower Churchill River at the Little Churchill River

Lake Whitefish

The RYCS of Lake Whitefish over the 11 years of monitoring ranged from a low of 16 for the 1997 cohort to a high of 204 for the 2014 cohort (Figure 5.5-2). There was one missing cohort (1996) from 1996-2014. Strong cohorts (>100) were produced in just under one-third of the years, from 1998, 2000, 2004, 2005, 2010, and 2011. Particularly weak cohorts (<50) were produced in 1996, 1997, 2008, and 2014.

Northern Pike

The RYCS of Northern Pike over the 11 years of monitoring ranged from a low of 23 for the 1997 cohort to a high of 172 for the 1996 cohort (Figure 5.5-3). There were no missing cohorts from 1996-2014. A particularly strong cohort (>100) was produced in 1996, and particularly weak cohorts (<50) were produced in 1997, 2000, and 2003-2011.

Sauger

Age data for Sauger were insufficient to allow year-class strength determination.

Walleye

The RYCS of Walleye over the 12 years of monitoring ranged from a low of 23 for the 2008 cohort to a high of 245 for the 2010 cohort (Figure 5.5-2). There was one missing cohort (2014) from 1996-2014. Strong cohorts (>100) were produced in over half of the years, from 1996-1999, 2003, 2004, and again from 2010-2013. Particularly weak cohorts (<50) were produced in 2000, 2006-2009, and again in 2014.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

RYCS analysis requires data be collected in at least three consecutive years and therefore cannot be conducted for rotational waterbodies.

5.5.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

Lake Whitefish

The RYCS of Lake Whitefish over the 12 years of monitoring ranged from a low of 54 for the 1996 cohort to a high of 159 for the 2006 cohort (Figure 5.5-3). There were no missing cohorts from 1996-2014. Strong cohorts (>100) were produced in just under one half of the years, from 1997, 1999, 2000, 2002, 2006, 2007, 2010, and 2013.

Northern Pike

The RYCS of Northern Pike over the 12 years of monitoring ranged from a low of 2 for the 1998 cohort to a high of 44 for the 2014 cohort (Figure 5.5-3). There was one missing cohort (1996) from 1996-2014. No strong cohorts (>100) were produced, rather, particularly weak cohorts were produced in all years.

Sauger

Age data for Sauger were insufficient to allow year-class strength determination.

Walleye

The RYCS of Walleye over the 12 years of monitoring ranged from a low of 44 for the 2005 cohort to a high of 188 for the 1996 cohort (Figure 5.5-2). There were no missing cohorts from 1996-2014. Strong cohorts (>100) were produced in over half of the years, from 1996-2002, 2007, 2008, and 2012-2014. A particularly weak cohort (<50) occurred in 2004 and 2005.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

RYCS analysis requires data be collected in at least three consecutive years and therefore cannot be conducted for rotational waterbodies.

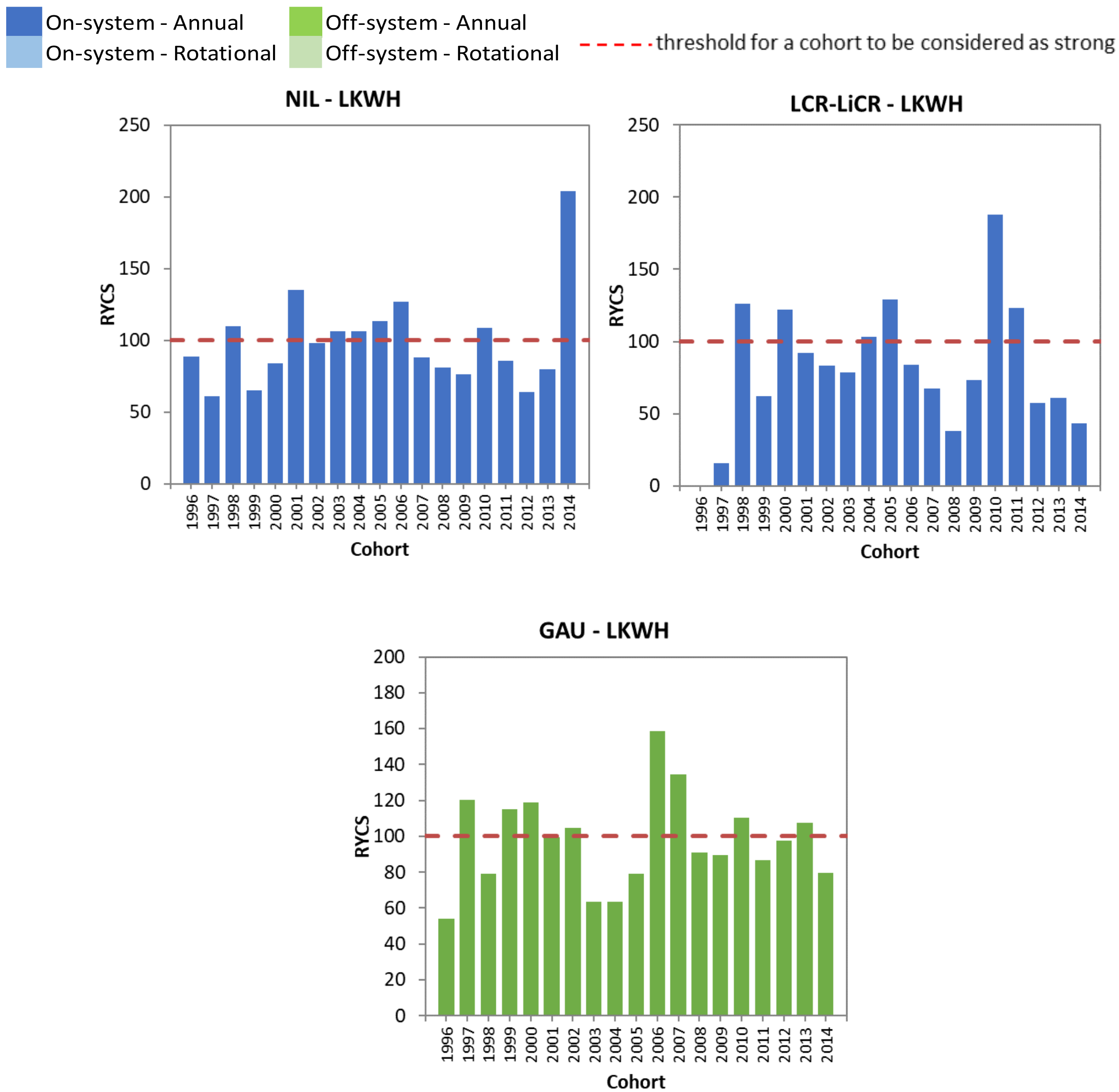


Figure 5.5-1. Relative year-class strength (RYCS) of Lake Whitefish.

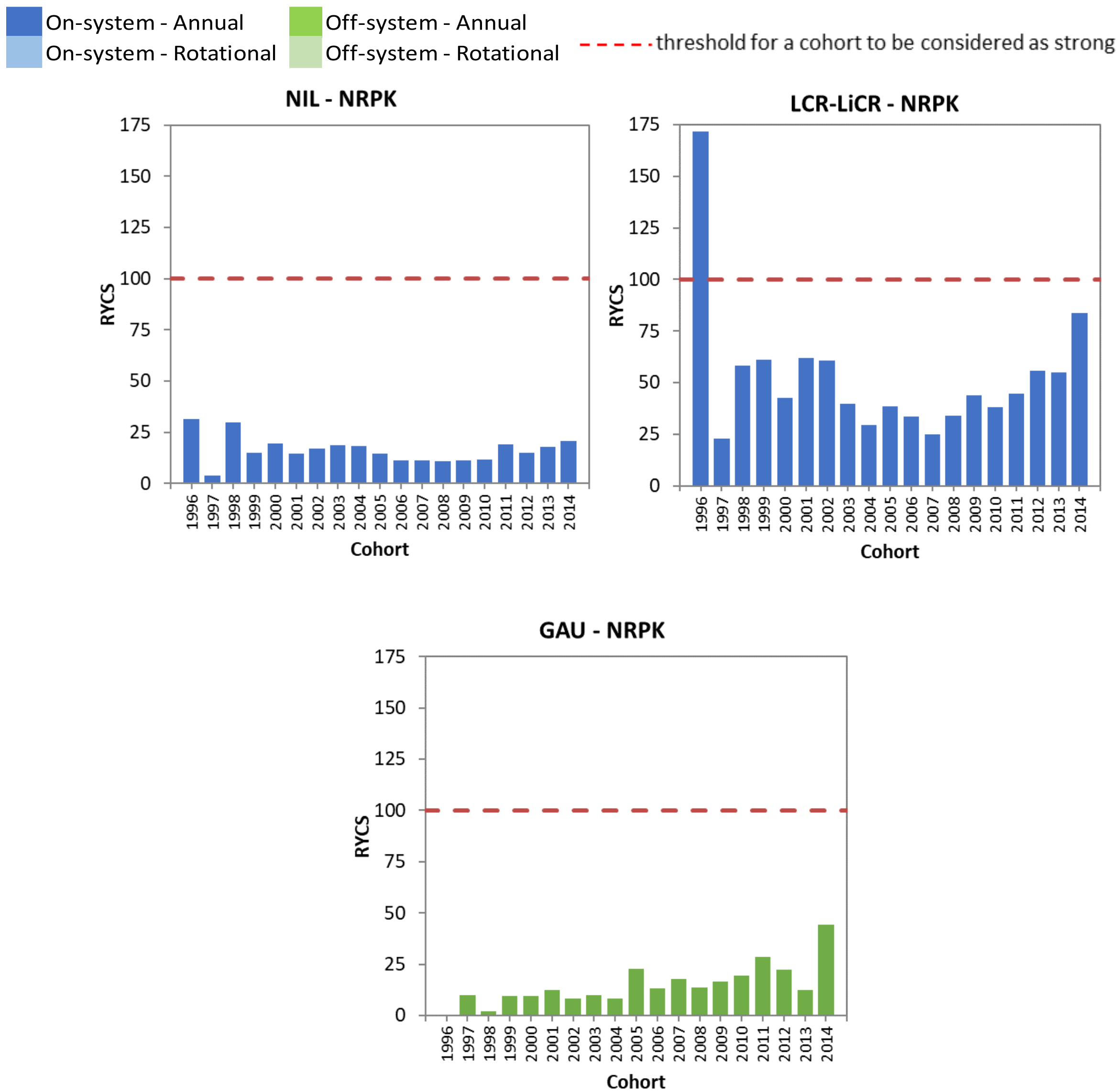


Figure 5.5-2. Relative year-class strength (RYCS) of Northern Pike.

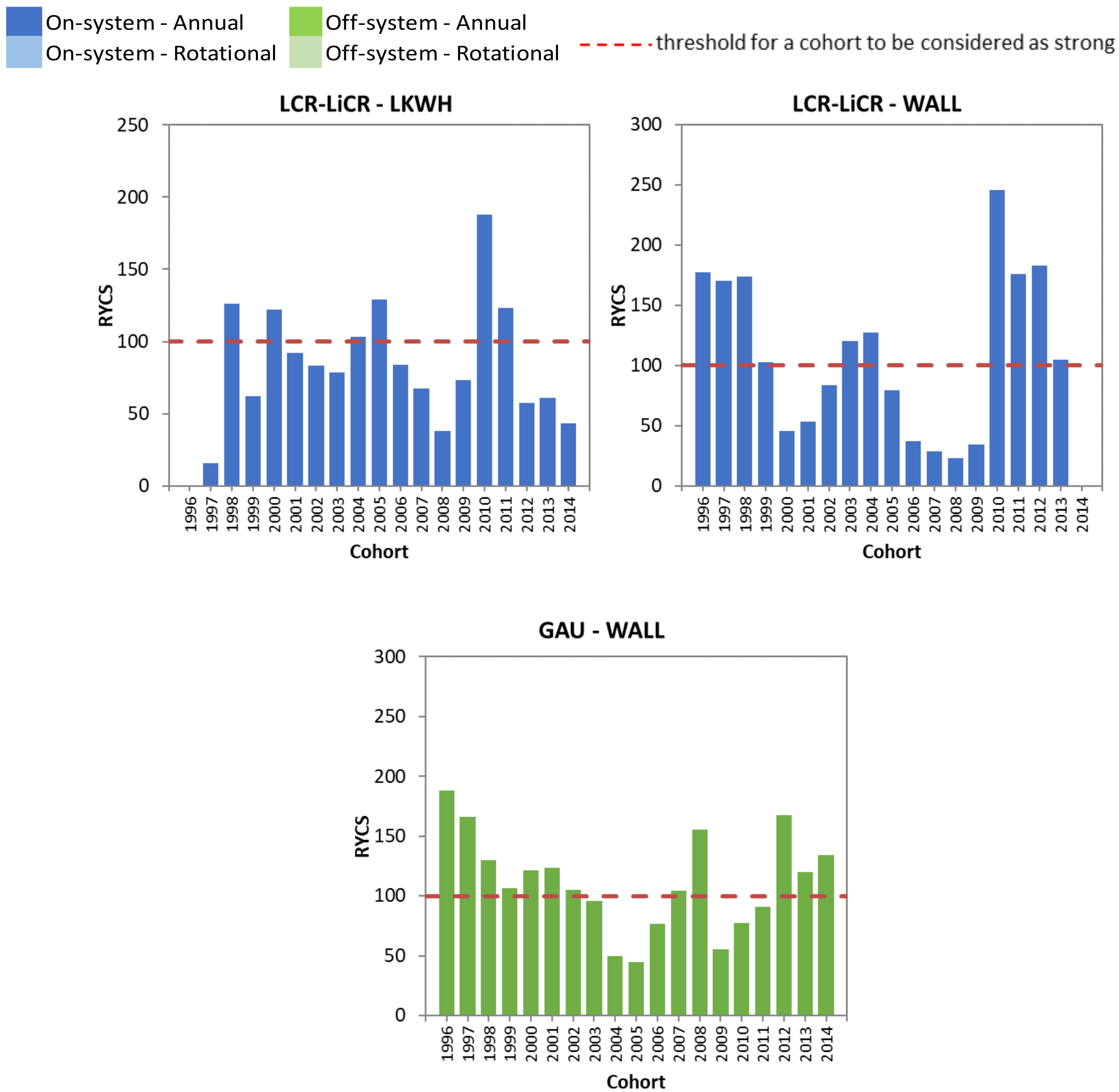


Figure 5.5-3. Relative year-class strength (RYCS) of Walleye.

5.6 DIVERSITY

5.6.1 RELATIVE SPECIES ABUNDANCE

5.6.1.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

A total of 16 fish species were captured in the combined standard and small mesh gangs in Northern Indian Lake over 12 years of monitoring (Table 5.6-1) with the number of species caught each year ranging from 11-14 (Tables 5.6-2 and 5.6-3).

Standard Gang Index Gill Nets

Walleye was the most frequently captured species at Northern Indian Lake over 12 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-2). The annual RSA for Walleye ranged from a low of 21% in 2010 to a high of 51% in 2019. Two species accounted for >25% of the catch in some years, Lake Whitefish in 2010 and 2017, and White Sucker in 2009-2012, 2014, 2015, 2017, and 2018.

Small Mesh Index Gill Nets

Spottail Shiner (*Notropis hudsonius*) was the most frequently captured species at Northern Indian Lake over 12 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-2). The annual RSA for Spottail Shiner ranged from a low of 15% in 2013 to a high of 39% in 2009. Three species accounted for >25% of the catch in some years, Emerald Shiner (Notropis *atherinoides*) in 2013, 2015, 2016, and 2019, Walleye in 2014, and Yellow Perch in 2011 and 2012.

Lower Churchill River at the Little Churchill River

A total of 19 fish species were captured in the combined standard and small mesh gangs at lower Churchill River at the Little Churchill River over 11 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 10-14 (Tables 5.6-4 and 5.6-5).

Standard Gang Index Gill Nets

Lake Sturgeon was the most frequently captured species at the lower Churchill River at the Little Churchill River over 11 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-4). The annual RSA for Lake Sturgeon (*Acipenser fulvescens*) ranged from a low of 16% in 2014 to a high of 49% in 2015. Two species accounted for >25% of the catch in some years, Lake Whitefish in 2008, 2009, and 2016, and Walleye in 2011-2014 and 2018.

Small Mesh Index Gill Nets

The most common species captured in the lower Churchill River at the Little Churchill River over 11 years of monitoring was Trout-perch (*Percopsis omiscomaycus*), accounting for an average of >25% of the catch (Table 5.6-5). The annual RSA for Trout-perch ranged from a low of 3% in 2010 to a high of 83% in 2015. Three species accounted for >25% of the catch in some years, Walleye in 2008, and 2010-2013, Lake Chub (*Couesius plumbeus*) in 2008 and 2016, and Spottail Shiner in 2016.

ROTATIONAL SITES

Partridge Breast Lake

A total of 14 fish species were captured in the combined standard and small mesh gangs at Partridge Breast Lake over four years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 10-13 (Tables 5.6-6 and 5.6-7).

Standard Gang Index Gill Nets

White Sucker was the most frequently captured species at Partridge Breast Lake over four years of monitoring, accounting for an average of >25% of the catch (Table 5.6-6). The annual RSA for White Sucker ranged from a low of 17% in 2018 to a high of 37% in 2012. Three species accounted for >25% of the catch in some years, Lake Whitefish in 2012, Northern Pike in 2009 and 2015, and Walleye in 2009 and 2018.

Small Mesh Index Gill Nets

The most common species captured at Partridge Breast Lake over four years of monitoring was Spottail Shiner, which accounted for an average of >25% of the catch (Table 5.6-7). The annual RSA for Spottail Shiner ranged from a low of 8% in 2018 to a high of 48% in 2015. Four species accounted for >25% of the catch in some years, Emerald Shiner in 2015, Cisco (*Coregonus artedi*) in 2018, Trout-perch in 2018, and Yellow Perch (*Perca flavescens*) in 2012.

Fidler Lake

A total of 12 fish species were captured in the combined standard and small mesh gangs at Fidler Lake over three years of monitoring (Table 5.6-1), with 10 species caught each year (Tables 5.6-8 and 5.6-9).

Standard Gang Index Gill Nets

Lake Whitefish was the most frequently captured species at Fidler Lake over three years of monitoring, accounting for an average of >25% of the catch (Table 5.6-8). The annual RSA of Lake Whitefish ranged from a low of 39% in 2014 to a high of 60% in 2017. Two species accounted for >25% of the catch in some years, Northern Pike in 2011 and Walleye in 2014.

Small Mesh Index Gill Nets

The most common species captured in Fidler Lake over three years of monitoring was Trout-perch, which accounted for an average of >25% of the catch (Table 5.6-9). The annual RSA for Trout-perch ranged from a low of 11% in 2011 to a high of 57% in 2017. Three species accounted for >25% of the catch in some years, Lake Whitefish in 2014, Spottail Shiner in 2011, and Longnose Sucker (*Catostomus catostomus*) in 2011.

Billard Lake

A total of 13 fish species were captured in the combined standard and small mesh gangs at Billard Lake over four years of monitoring (Table 5.6-1), with 9-11 species caught each year (Tables 5.6-10 and 5.6-11).

Standard Gang Index Gill Nets

Walleye and Lake Whitefish were the most frequently captured species at Billard Lake over four years of monitoring, accounting for an average of >25% of the catch (Table 5.6-10). The annual RSA of Walleye ranged from a low of 22% in 2010 to a high of 55% in 2019. The annual RSA of Lake Whitefish ranged from a low of 24% in 2013 and 2019 to a high of 48% in 2016.

Small Mesh Index Gill Nets

The most common species captured in Billard Lake over four years of monitoring was Spottail Shiner, accounting for an average of >25% of the catch (Table 5.6-11). The annual RSA for Spottail Shiner ranged from a low of 11% in 2010 to a high of 60% in 2013. Three other species accounted for >25% of the catch in some years, Lake Whitefish in 2010, Emerald Shiner in 2016, and Trout-perch in 2010.

Lower Churchill River at the Churchill Weir

A total of 11 fish species were captured in the combined standard and small mesh gangs in the lower Churchill River at the Churchill Weir over two years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 9-11 (Tables 5.6-12 and 5.6-3).

Standard Gang Index Gill Nets

Lake Whitefish was the most frequently captured species in the lower Churchill River at the Churchill Weir over two years of monitoring, accounting for an average of >25% of the catch (Table 5.6-12). The annual RSA for Lake Whitefish ranged from a low of 57% in 2017 to a high of 72% in 2014.

Small Mesh Index Gill Nets

The most common species captured in lower Churchill River over two years of monitoring were Trout-perch and Lake Whitefish, which each accounted for an average of >25% of the catch (Table 5.6-13). The annual RSA for Trout-perch ranged from a low of 28% in 2017 to a high of 32% in 2014. The annual RSA for Lake Whitefish ranged from a low of 22% in 2017 to a high of 35% in 2014.

5.6.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

A total of 16 fish species were captured in the combined standard and small mesh gangs at Gauer Lake over 12 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 10-13 (Tables 5.6-14 and 5.6-15).

Standard Gang Index Gill Nets

Walleye was the most frequently captured species at Gauer Lake over 12 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-14). The annual RSA for Walleye ranged from a low of 15% in 2008 to a high of 35% in 2016 and 2019. Two species accounted for >25% of the catch in some years, Lake Whitefish in 2012 and 2018 and White Sucker in 2008, 2009, and 2013.

Small Mesh Index Gill Nets

The most common species captured in Gauer Lake over 12 years of monitoring was Spottail Shiner, which accounted for an average of >25% of the catch (Table 5.6-15). The annual RSA for Spottail Shiner ranged from a low of 18% in 2010 to a high of 69% in 2014. Two other species accounted for >25% of the catch in some years, Emerald Shiner in 2010, 2013, and 2019, and Yellow Perch in 2011.

Table 5.6-1. 2008-2019 Inventory of fish species.

Family	Species	Abbreviation	Status[1]	Target	NIL	LCR-LiCR	PBL	FID	BIL	LCR-WEIR	GAU
Acipenseridae	Lake Sturgeon[2]	LKST	Native			●			●	●	
Cyprinidae	Lake Chub	LKCH	Native		●	●	●		●	●	●
	Northern Pearl Dace	NPDC	Native		●	●					●
	Emerald Shiner	EMSH	Native		●	●	●	●	●		●
	Spottail Shiner	SPSH	Native		●	●	●	●	●	●	●
	Blacknose Shiner	BLSH	Native		●						
	Northern Redbelly Dace	NRDC	Native			●					
	Longnose Dace	LNDC	Native			●					
Catostomidae	Longnose Sucker	LNSC	Native		●	●	●	●	●	●	●
	White Sucker	WHSC	Native	●	●	●	●	●	●	●	●
Esocidae	Northern Pike	NRPK	Native	●	●	●	●	●	●	●	●
Salmonidae	Cisco	CISC	Native		●	●	●	●	●	●	●
	Lake Whitefish	LKWH	Native	●	●	●	●	●	●	●	●
	Arctic Grayling	ARGR	Native			●					
Percopsidae	Trout-perch	TRPR	Native		●	●	●	●	●	●	●
Gadidae	Burbot	BURB	Native		●	●	●	●			●
Cottidae	Slimy Sculpin	SLSC	Native		●	●	●			●	●
	Spoonhead Sculpin	SPSC	Native		●						
Percidae	Yellow Perch	YLPR	Native		●	●	●	●	●		●
	Logperch	LGPR	Native			●					●
	Sauger	SAUG	Native	●			●	●	●		●
	Walleye	WALL	Native	●	●	●	●	●	●	●	●

Notes:

1. Assigned from Stewart and Watkinson (2004).
2. Status under review by Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Table 5.6-2. 2008-2019 Relative species abundance in standard gang index gill nets in Northern Indian Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	16%	14%	25%	17%	17%	8%	14%	17%	15%	29%	11%	10%	16%
	NRPK	8%	17%	13%	11%	11%	16%	11%	14%	15%	10%	11%	9%	12%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0%
	WALL	40%	36%	21%	23%	32%	48%	33%	26%	34%	29%	46%	51%	35%
	WHSC	21%	27%	26%	37%	30%	20%	36%	33%	24%	25%	26%	23%	27%
Sturgeons	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0%	1%	1%	3%	0.4%	1%	0.3%	0.5%	0.3%	1%	0%	0.4%	1%
Coregonids	CISC	13%	6%	13%	7%	6%	5%	3%	3%	7%	5%	3%	6%	6%
	ARGR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cod-like fishes	BURB	0.2%	0.4%	0.4%	0.1%	0%	1%	0%	1%	0.3%	0.1%	0.5%	0.3%	0%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Perch	YLPR	1%	0%	1%	1%	4%	1%	3%	6%	3%	1%	2%	1%	2%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-3. 2008-2019 Relative species abundance in small mesh index gill nets in Northern Indian Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	9%	2%	3%	2%	5%	0.2%	4%	1%	2%	1%	0%	0.2%	2%
	NRPK	5%	5%	1%	2%	4%	3%	2%	3%	1%	3%	2%	4%	3%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	14%	18%	9%	8%	13%	15%	26%	9%	4%	16%	14%	14%	13%
	WHSC	1%	2%	4%	7%	2%	0.2%	1%	2%	2%	1%	0.2%	0.2%	2%
Sturgeons	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	0%	1%	1%	0.4%	1%	0.2%	1%	0%	0.2%	0.1%	1%	0%	0.5%
	NPDC	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.5%
	EMSH	18%	11%	12%	16%	4%	43%	7%	34%	54%	9%	22%	31%	22%
	SPSH	30%	39%	33%	16%	29%	15%	19%	30%	27%	30%	19%	35%	27%
Suckers	BLSH	0%	0%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0.01%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coregonids	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0.2%	0.4%	0%	0%	0%	0%	0%	0%	0.2%	0%	0.1%
Coregonids	CISC	6%	0.4%	16%	8%	1%	1%	4%	4%	3%	3%	15%	4%	5%
	ARGR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	2%	15%	11%	11%	3%	9%	19%	6%	5%	14%	20%	8%	10%
Cod-like fishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%	0%	0%	0.01%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0.2%	0%	0.1%	1%	0%	0.1%
	SPSC	0%	0%	0%	1%	0.2%	0%	0%	0%	0%	0%	0%	0%	0.06%
Perch	YLPR	14%	6%	9%	28%	38%	13%	19%	11%	2%	21%	6%	4%	14%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-4. 2008-2019 Relative species abundance in standard gang index gill nets in the lower Churchill River at the Little Churchill River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean
Target	LKWH	28%	30%	13%	15%	8%	11%	21%	12%	27%	19%	18%	18%
	NRPK	18%	18%	8%	14%	7%	10%	12%	8%	8%	14%	6%	11%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	24%	25%	23%	30%	30%	40%	30%	24%	13%	20%	40%	27%
	WHSC	5%	8%	11%	7%	12%	7%	16%	5%	8%	17%	5%	9%
Sturgeons	LKST	21%	17%	42%	29%	39%	29%	16%	49%	37%	28%	31%	31%
Minnows	LKCH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	2%	1%	1%	1%	0.2%	1%	3%	1%	1%	2%	1%	1%
Coregonids	CISC	2%	1%	1%	2%	3%	2%	2%	2%	6%	0%	0%	2%
	ARGR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cod-like fishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0%	0%	0.03%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.00%
Perch	YLPR	0%	0%	0%	1%	0%	0.3%	0%	0.2%	0%	0%	0%	0.1%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-5. 2008-2019 Relative species abundance in small mesh index gill nets in the lower Churchill River at the Little Churchill River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Mean
Target	LKWH	1%	5%	3%	1%	1%	5%	3%	0.3%	2%	4%	5%	3%
	NRPK	0.4%	1%	0%	1%	0.3%	1%	12%	1%	0.3%	1%	1%	2%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.00%
	WALL	40%	3%	60%	36%	54%	47%	16%	1%	2%	11%	19%	26%
	WHSC	2%	3%	1%	0%	2%	0.4%	1%	0%	0%	0%	0%	1%
Sturgeons	LKST	2%	0%	0%	0.4%	0.3%	0%	0%	0%	0%	0%	0%	0.2%
Minnows	LKCH	27%	0%	6%	0%	5%	3%	12%	5%	28%	6%	9%	9%
	NPDC	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.2%
	EMSH	0.4%	1%	1%	9%	5%	3%	7%	9%	4%	0%	2%	4%
	SPSH	22%	14%	15%	6%	18%	23%	22%	0%	34%	5%	6%	15%
	BLSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0.05%
	LNDC	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Suckers	LNSC	1%	1%	0.3%	17%	0%	0%	0%	0%	0%	0%	0.3%	2%
Coregonids	CISC	0.4%	0%	3%	0%	1%	0%	3%	1%	1%	7%	0%	1%
	ARGR	0%	0%	0.2%	0%	0%	0%	0%	0%	0%	0%	0%	0.02%
Trout-perch	TRPR	4%	70%	3%	29%	13%	18%	24%	83%	28%	65%	58%	36%
Cod-like fishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0%	0%	0.03%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.00%
Perch	YLPR	0%	0%	0%	0.4%	0.3%	0%	0%	0%	0%	0%	0%	0.1%
	LGPR	0.4%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%

Table 5.6-6. 2008-2019 Relative species abundance in standard gang index gill nets in Partridge Breast Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2009	2012	2015	2018	Mean
Target	LKWH	13%	26%	14%	16%	17%
	NRPK	29%	20%	25%	20%	24%
	SAUG	0%	0%	0%	0.2%	0.04%
	WALL	28%	6%	22%	38%	24%
	WHSC	27%	37%	30%	17%	28%
Sturgeons	LKST	0%	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	0.5%	3%	0.4%	0.2%	1%
Coregonids	CISC	2%	5%	6%	7%	5%
	ARGR	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0.2%	0.04%
Cod-like fishes	BURB	0.3%	0%	0%	0%	0.1%
Sculpins	SLSC	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%
Perch	YLPR	0.3%	1%	3%	1%	1%
	LGPR	0%	0%	0%	0%	0%

Table 5.6-7. 2008-2019 Relative species abundance in small mesh index gill nets in Partridge Breast Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2009	2012	2015	2018	Mean
Target	LKWH	5%	5%	4%	1%	4%
	NRPK	3%	6%	3%	5%	4%
	SAUG	0%	0%	0%	0%	0%
	WALL	4%	1%	2%	3%	2%
	WHSC	1%	2%	1%	0.4%	1%
Sturgeons	LKST	0%	0%	0%	0%	0%
Minnows	LKCH	1%	1%	3%	0%	1%
	NPDC	0%	0%	0%	0%	0%
	EMSH	14%	3%	34%	19%	17%
	SPSH	47%	41%	48%	8%	36%
	BLSH	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0.4%	0%	0%	0.1%
Coregonids	CISC	0.3%	0%	3%	29%	8%
	ARGR	0%	0%	0%	0%	0%
Trout-perch	TRPR	8%	16%	0%	31%	14%
Cod-like fishes	BURB	0%	0%	0%	0%	0%
Sculpins	SLSC	0%	0%	0%	0.4%	0.1%
	SPSC	0%	0%	0%	0%	0%
Perch	YLPR	17%	26%	3%	3%	13%
	LGPR	0%	0%	0%	0%	0%

Table 5.6-8. 2008-2019 Relative species abundance in standard gang index gill nets in Fidler Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2011	2014	2017	Mean
Target	LKWH	45%	39%	60%	48%
	NRPK	37%	17%	12%	22%
	SAUG	0%	0%	0%	0%
	WALL	10%	32%	11%	18%
	WHSC	5%	11%	16%	11%
Sturgeons	LKST	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%
Suckers	LNSC	2%	1%	0.5%	1%
Coregonids	CISC	1%	0%	0.5%	0.4%
	ARGR	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%
Cod-like fishes	BURB	0%	0%	0.5%	0.2%
Sculpins	SLSC	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%
Perch	YLPR	0%	0.4%	0%	0.1%
	LGPR	0%	0%	0%	0%

Table 5.6-9. 2008-2019 Relative species abundance in small mesh index gill nets in Fidler Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2011	2014	2017	Mean
Target	LKWH	13%	33%	2%	16%
	NRPK	11%	4%	5%	7%
	SAUG	0%	0%	0%	0%
	WALL	0.4%	2%	2%	2%
	WHSC	0.4%	6%	11%	6%
Sturgeons	LKST	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%
	EMSH	7%	6%	0%	4%
	SPSH	28%	21%	6%	18%
	BLSH	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%
Suckers	LNSC	29%	0%	0%	10%
Coregonids	CISC	0%	7%	17%	8%
	ARGR	0%	0%	0%	0%
Trout-perch	TRPR	11%	21%	57%	30%
Cod-like fishes	BURB	0%	0%	0.3%	0.1%
Sculpins	SLSC	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%
Perch	YLPR	1%	1%	0.3%	1%
	LGPR	0.0%	0.0%	0.0%	0%

Table 5.6-10. 2008-2019 Relative species abundance in standard gang index gill nets in Billard Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2010	2013	2016	2019	Mean
Target	LKWH	47%	24%	48%	24%	36%
	NRPK	20%	21%	15%	13%	17%
	SAUG	0%	0%	0%	0%	0%
	WALL	22%	42%	29%	55%	37%
	WHSC	10%	8%	6%	7%	8%
Sturgeons	LKST	0.2%	0%	0%	0%	0.05%
Minnows	LKCH	0%	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	0%	1%	0.2%	1%	0.5%
Coregonids	CISC	0%	5%	1%	0.2%	2%
	ARGR	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%
Cod-like fishes	BURB	0%	0%	0%	0%	0%
Sculpins	SLSC	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%
Perch	YLPR	0%	0.3%	0.5%	0.2%	0.2%
	LGPR	0%	0%	0%	0%	0%

Table 5.6-11. 2008-2019 Relative species abundance in small mesh index gill nets in Billard Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2010	2013	2016	2019	Mean
Target	LKWH	37%	12%	7%	5%	15%
	NRPK	2%	1%	0.4%	4%	2%
	SAUG	0%	0%	0%	0%	0%
	WALL	5%	7%	6%	21%	10%
	WHSC	6%	1%	5%	3%	4%
Sturgeons	LKST	0%	0%	0%	0%	0%
Minnows	LKCH	0.4%	1%	0.4%	1%	1%
	NPDC	0%	0%	0%	0%	0%
	EMSH	0%	4%	34%	14%	13%
	SPSH	11%	60%	36%	34%	35%
	BLSH	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	1%	0%	0%	0%	0.2%
Coregonids	CISC	0%	2%	0%	1%	1%
	ARGR	0%	0%	0%	0%	0%
Trout-perch	TRPR	38%	11%	11%	17%	19%
Cod-like fishes	BURB	0%	0%	0%	0%	0%
Sculpins	SLSC	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%
Perch	YLPR	0%	1%	0%	0%	0.2%
	LGPR	0.0%	0.0%	0.0%	0.0%	0%

Table 5.6-12. 2008-2019 Relative species abundance in standard gang index gill nets in the lower Churchill River at the Churchill Weir.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2014	2017	Mean
Target	LKWH	72%	57%	64%
	NRPK	11%	21%	16%
	SAUG	0%	0%	0%
	WALL	2%	7%	4%
	WHSC	10%	12%	11%
Sturgeons	LKST	0%	1%	1%
Minnows	LKCH	0%	0%	0%
	NPDC	0%	0%	0%
	EMSH	0%	0%	0%
	SPSH	0%	0%	0%
	BLSH	0%	0%	0%
	NRDC	0%	0%	0%
	LNDC	0%	0%	0%
Suckers	LNSC	0.4%	3%	2%
Coregonids	CISC	5%	0%	2%
	ARGR	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%
Cod-like fishes	BURB	0%	0%	0%
Sculpins	SLSC	0%	0%	0%
	SPSC	0%	0%	0%
Perch	YLPR	0%	0%	0%
	LGPR	0%	0%	0%

Table 5.6-13. 2008-2019 Relative species abundance in small mesh index gill nets in the lower Churchill River at the Churchill Weir.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2014	2017	Mean
Target	LKWH	35%	22%	29%
	NRPK	6%	20%	13%
	SAUG	0%	0%	0%
	WALL	3%	14%	9%
	WHSC	5%	4%	4%
Sturgeons	LKST	0%	1%	1%
Minnows	LKCH	2%	3%	2%
	NPDC	0%	0%	0%
	EMSH	0%	0%	0%
	SPSH	15%	0%	8%
	BLSH	0%	0%	0%
	NRDC	0%	0%	0%
	LNDC	0%	0%	0%
Suckers	LNSC	0%	5%	3%
Coregonids	CISC	0%	3%	1%
	ARGR	0%	0%	0%
Trout-perch	TRPR	32%	28%	30%
Cod-like fishes	BURB	0%	0%	0%
Sculpins	SLSC	2%	0%	1%
	SPSC	0%	0%	0%
Perch	YLPR	0%	0%	0%
	LGPR	0.0%	0.0%	0%

Table 5.6-14. 2008-2019 Relative species abundance in standard gang index gill nets in Gauer Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	24%	19%	24%	24%	29%	16%	21%	21%	18%	12%	26%	23%	21%
	NRPK	14%	14%	17%	15%	11%	12%	20%	14%	12%	21%	11%	12%	15%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	15%	23%	26%	23%	22%	34%	21%	24%	35%	33%	31%	35%	27%
	WHSC	29%	30%	25%	23%	24%	29%	23%	23%	20%	22%	20%	18%	24%
Sturgeons	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NPDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	EMSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	BLSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	2.1%	2.8%	2.2%	1.9%	1.4%	0.9%	1.9%	2.6%	1.5%	0.4%	0.8%	0.8%	1.6%
Coregonids	CISC	7%	2%	2%	8%	6%	4%	3%	1%	4%	6%	1%	4%	4%
	ARGR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cod-like fishes	BURB	4%	1%	0.4%	1%	0.3%	0%	1%	0%	0.5%	0%	0%	2%	1%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Perch	YLPR	5%	7%	4%	4%	5%	4%	9%	14%	9%	6%	9%	5%	7%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-15. 2008-2019 Relative species abundance in small mesh index gill nets in Gauer Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	2%	1%	4%	3%	11%	1%	1%	2%	4%	2%	5%	1%	3%
	NRPK	2%	7%	3%	1%	3%	3%	3%	2%	0.3%	1%	5%	1%	3%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	4%	12%	9%	5%	14%	9%	5%	9%	5%	13%	13%	7%	9%
	WHSC	2%	0.4%	0%	0%	2%	1%	2%	0%	0%	1%	2%	1%	1%
Sturgeons	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	2%	0.4%	2%	0%	0%	0%	0%	0%	0%	0.2%	0%	0%	0.4%
	NPDC	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0.5%	0%	0.5%
	EMSH	3%	0%	42%	0%	5%	28%	11%	23%	21%	12%	4%	30%	15%
	SPSH	64%	53%	18%	42%	41%	37%	69%	44%	62%	41%	51%	42%	47%
	BLSH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	NRDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0.0%	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Coregonids	CISC	1%	0%	0%	0%	1%	1%	2%	0%	0%	2%	1%	1%	1%
	ARGR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	13%	18%	20%	21%	10%	5%	4%	15%	6%	24%	16%	17%	14%
Cod-like fishes	BURB	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%
Sculpins	SLSC	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0.05%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Perch	YLPR	7%	8%	2%	29%	8%	13%	4%	5%	2%	5%	4%	1%	7%
	LGPR	0.2%	0%	0%	0%	0.3%	0.4%	0%	0%	0%	0%	0%	0%	0.1%

5.6.2 HILL'S EFFECTIVE RICHNESS

5.6.2.1 ON-SYSTEM SITES

ANNUAL SITES

Northern Indian Lake

The Hill's effective species richness over the 12 years of monitoring ranged from a low of 6.2 in 2008 to a high of 8.9 species in 2011 (Table 5.6-16; Figure 5.6-1).

The overall mean Hill's index value was 7.5, the median was 7.3, and the IQR was 7.1-8.1 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2008 and 2019 when it was below the IQR and in 2010, 2011, and 2017 when it was above the IQR.

Lower Churchill River at the Little Churchill River

The Hill's effective species richness over the 11 years of monitoring ranged from a low of 5.6 in 2015 to a high of 8.6 species in 2016 (Table 5.6-16; Figure 5.6-1).

The overall mean Hill's index value was 6.7, the median was 6.6, and the IQR was 6.1-7.1 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2013, 2015 and 2018 when it was below the IQR and in 2014 and 2016 when it was above the IQR.

ROTATIONAL SITES

Partridge Breast Lake

The Hill's effective species richness over the four years of monitoring ranged from a low of 7.3 in 2012 to a high of 7.6 species in 2009 (Table 5.6-16; Figure 5.6-1).

The overall mean and median Hill's index values were 7.4, and the IQR was 7.3-7.5 species (Figure 5.6-1). The annual mean Hill's index value was above the IQR in 2009.

Fidler Lake

The Hill's effective species richness over the three years of monitoring ranged from a low of 5.6 in 2017 to a high of 6.3 species in 2014 (Table 5.6-16; Figure 5.6-1).

The overall mean Hill's index value was 6.0, the median was 6.1, and the IQR was 5.9-6.2 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2017 when it was below the IQR and in 2014 when it was above the IQR.

Billard Lake

The Hill's effective species richness over the four years of monitoring ranged from a low of 4.7 in 2010 to a high of 6.2 species in 2016 (Table 5.6-16; Figure 5.6-1).

The overall mean Hill's index value was 5.5, the median was 5.6, and the IQR was 5.0-6.2 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2010 when it was below the IQR

Lower Churchill River at the Churchill Weir

The Hill's effective species richness over the three years of monitoring ranged from a low of 3.6 in 2014 to a high of 5.5 species in 2017 (Table 5.6-16; Figure 5.6-1).

The overall mean and median Hill's index values were 4.5, and the IQR was 4.1-5.0 species (Figure 5.6-1). The annual mean Hill's index value was below the overall IQR in 2014 and above the IQR in 2017.

5.6.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Gauer Lake

The Hill's effective species richness over the 12 years of monitoring ranged from a low of 6.6 in 2018 to a high of 8.3 species in 2008 (Table 5.6-16; Figure 5.6-1).

The overall mean Hill's index value was 7.6, the median was 7.7, and the IQR was 7.4-8.0 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2013, 2014, and 2018 when it was below the IQR and in 2008 and 2015 when it was above the IQR.

Table 5.6-16. 2008-2019 Hill's effective species richness.

Waterbody	Year	n_F[1]	n_{spp}[2]	Value
NIL	2008	616	11	6.2
	2009	1314	12	7.3
	2010	1228	12	8.7
	2011	1442	14	8.9
	2012	1387	12	7.1
	2013	1234	12	7.1
	2014	1295	11	7.3
	2015	1380	12	7.9
	2016	1589	12	7.1
	2017	1681	14	8.6
	2018	1113	13	7.6
	2019	1137	12	6.7
LCR-LiCR	2008	546	12	7.1
	2009	351	11	6.7
	2010	1183	14	6.3
	2011	476	11	7.1
	2012	769	12	6.1
	2013	627	12	6.0
	2014	242	11	8.3
	2015	773	11	5.6
	2016	650	14	8.6
	2017	320	11	6.6
	2018	606	10	5.7
PBL	2009	977	12	7.6
	2012	888	11	7.3
	2015	829	10	7.4
	2018	868	13	7.4
FID	2011	600	10	6.1
	2014	485	10	6.3
	2017	587	10	5.6
BIL	2010	739	9	4.7
	2013	741	11	6.1
	2016	694	11	6.2
	2019	585	11	5.0
LCR-WEIR	2014	305	10	3.6
	2017	152	9	5.5

Table 5.6-16. continued.

Waterbody	Year	n_F[1]	n_{spp}[2]	Value
GAU	2008	1409	13	8.3
	2009	837	11	7.5
	2010	1013	12	7.9
	2011	1435	10	8.0
	2012	1299	13	7.6
	2013	1060	11	7.1
	2014	1707	11	7.0
	2015	1365	10	8.1
	2016	999	12	7.6
	2017	1236	12	7.8
	2018	1211	11	6.6
	2019	1219	11	8.0

Notes:

1. n_F = number of fish caught in standard and small mesh gill nets.
2. n_{spp} = number of species caught in standard and small mesh gill nets.

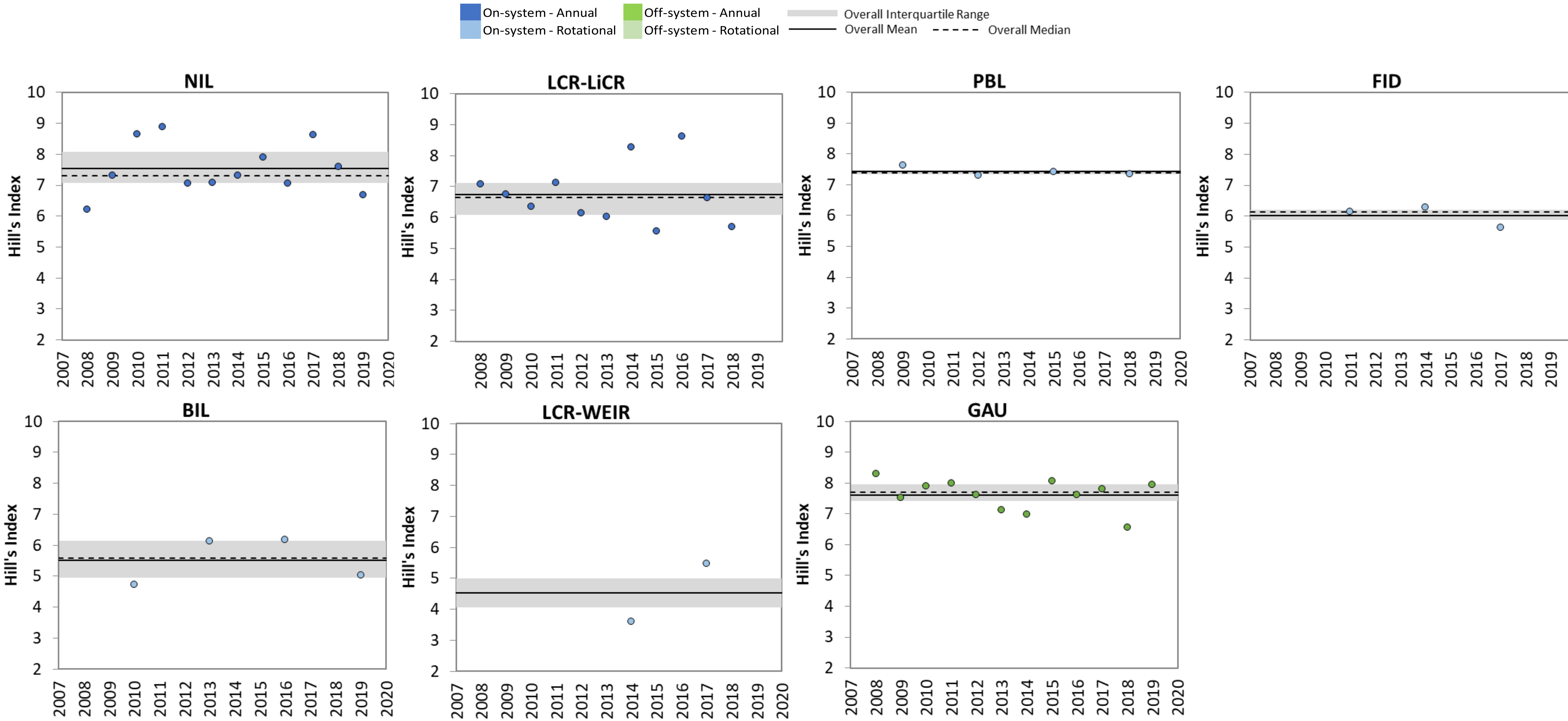


Figure 5.6-1. 2008-2019 Hill's effective species richness.

APPENDIX 5-1. GILLNETTING SITE INFORMATION AND LOCATIONS

The following is a summary of modifications and deviations in sampling locations over the 12 years of monitoring in the lower Churchill River Region:

Northern Indian Lake

- Gill nets were set at the target locations in all 12 years with the following exceptions:
  - GN-01, GN-02, GN-03, GN-04, GN-05, GN-06, and GN-07 were not selected as target locations until 2009, after which they were sampled every year.
  - GN-13 and GN-15 were only sampled in 2008, and GN-14 was only sampled in 2008 and 2009, after which they were both discontinued.
  - A net was set very close to the GN-11 target location in 2009 but was named GN-14.
  - SN-08 was only sampled in 2008.
  - SN-03, SN-05, and SN-12 were not selected as target locations until 2009, after which they were sampled every year.

Lower Churchill River at the Little Churchill River

- Gill nets were set at the target locations in all 11 years with a few modifications:
  - SN-03 was set in 2008 rather than SN-05, SN-03 was set in 2009 and 2011 rather than SN-06 and SN-03 was not set again after 2011.
  - SN-05 was not selected as a target location until 2009, after which it was sampled every year.
  - SN-06 was not selected as a target location until 2012, after which it was sampled every year.
  - Nets were set at the GN-07 target location, but were named GN-09 in 2008-2009, 2011-2012, and 2015.
  - Nets were set at the GN-09 target location, but were named GN-07 in 2008-2009, 2011-2012, and 2015.

Partridge Breast Lake

- Gill nets were set at the target locations in all four years.

Fidler Lake

- Gill nets were set at the target locations in all three years.

Billard Lake

- Gill nets were set at the target locations in all four years.

Lower Churchill River at the Churchill Weir

- Gill nets were set at the target locations in the two years of monitoring.

Gauer Lake

- Gill nets were set at the target locations in all 12 years.

Table A5-1-1. 2008-2019 Set information for gillnetting sites.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	GN-08	26-Aug-08	14	606399	6360026	44.4	5.5	5.9	17
	GN-09	25-Aug-08	14	605915	6366619	25.3	6.8	18.3	15
	GN-10	24-Aug-08	14	606419	6363940	15.1	-	-	16
	GN-11	25-Aug-08	14	607490	6361881	20.5	11.9	0.8	16
	GN-12	24-Aug-08	14	607463	6363269	16.7	-	-	16
	GN-13	26-Aug-08	14	607568	6360660	49.6	12.5	0.9	16
	GN-14	26-Aug-08	14	607325	6360996	47.5	11.7	1.1	17
	GN-15	25-Aug-08	14	608116	6362758	22.8	-	-	16
	SN-08	26-Aug-08	14	606413	6360060	44.4	0.9	5.5	17
	SN-09	25-Aug-08	14	605890	6366588	25.3	-	-	15
	GN-01	11-Aug-09	14	598933	6350622	23.7	7.1	5.1	14
	GN-02	11-Aug-09	14	603566	6349855	23.8	12.4	12.7	14
	GN-03	12-Aug-09	14	606601	6350708	23.8	5.5	2.6	14
	GN-04	12-Aug-09	14	600409	6350971	24.4	7.2	2.3	14
	GN-05	13-Aug-09	14	605422	6356585	25.3	7.9	8	15
	GN-06	13-Aug-09	14	608465	6353026	24.3	9.5	8.7	15
	GN-07	14-Aug-09	14	606166	6359022	24.5	9.7	10	15
	GN-08	14-Aug-09	14	606364	6360040	24.5	8	8	15
	GN-09	15-Aug-09	14	605373	6366523	24.8	7.7	7.8	14
	GN-10	15-Aug-09	14	606314	6363941	24.8	8.8	9	14
	GN-12	16-Aug-09	14	607605	6363273	24.8	10.4	12.5	15
	GN-14	16-Aug-09	14	607330	6361062	24.1	-	-	15
	SN-03	12-Aug-09	14	606566	6350700	23.8	6	5.5	14
	SN-05	13-Aug-09	14	605376	6356614	25.3	3.5	7.9	15
	SN-09	15-Aug-09	14	605398	6366554	24.8	6.5	7.7	14
	SN-12	16-Aug-09	14	607572	6363292	24.8	8	10.4	15

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	GN-01	07-Aug-10	14	599033	6350500	15.8	2.5	3	19
	GN-02	07-Aug-10	14	604258	6349713	14.6	15.2	21	19
	GN-03	08-Aug-10	14	606790	6350687	17.3	7	10	20
	GN-04	07-Aug-10	14	600354	6350843	15.9	2.5	2.5	19
	GN-05	08-Aug-10	14	605333	6356405	17.5	3.8	4.1	20
	GN-06	08-Aug-10	14	608420	6352936	17.3	9.1	8.2	20
	GN-07	09-Aug-10	14	606154	6359037	14.8	5.9	6	21
	GN-08	09-Aug-10	14	606325	6359927	15	4	4	19
	GN-09	09-Aug-10	14	605405	6366506	14.8	3	6	19
	GN-10	06-Aug-10	14	606417	6363839	14.3	5.5	4	19
	GN-11	06-Aug-10	14	607544	6361982	14.8	9.7	9	19
	GN-12	06-Aug-10	14	607611	6363297	15.7	2.5	9	19
	SN-03	08-Aug-10	14	606769	6350705	17.3	7	7	20
	SN-05	08-Aug-10	14	605353	6356379	17.5	3.8	3.8	20
	SN-09	09-Aug-10	14	605412	6366555	14.8	3	3	19
	SN-12	06-Aug-10	14	607597	6363321	15.7	2.5	2.5	19
	GN-01	09-Aug-11	14	599033	6350500	21	3.7	3.5	19
	GN-02	10-Aug-11	14	604258	6349713	23	19.2	8.3	19
	GN-03	09-Aug-11	14	606769	6350705	24.6	10	7.5	19
	GN-04	09-Aug-11	14	600373	6350966	21.7	3.7	3.2	19
	GN-05	10-Aug-11	14	605821	6356514	19.7	5	5.1	18
	GN-06	10-Aug-11	14	608543	6352962	18.8	9.3	7.6	19
	GN-07	11-Aug-11	14	606154	6359037	15.8	5.1	6.5	19
	GN-08	11-Aug-11	14	606381	6360035	16.5	5.3	8.7	19
	GN-09	12-Aug-11	14	605393	6366589	20.7	4.4	5.5	18
	GN-10	12-Aug-11	14	606417	6363839	22.5	6.1	9.1	18
	GN-11	11-Aug-11	14	607513	6361887	17.1	10.3	10.5	19
	GN-12	12-Aug-11	14	607611	6363297	25.3	10.1	10.4	18

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	SN-03	09-Aug-11	14	606846	6350624	24.6	10.2	10	19
	SN-05	10-Aug-11	14	605333	6356405	19.7	5.2	5	18
	SN-09	12-Aug-11	14	605290	6366486	20.7	4.7	4.4	18
	SN-12	12-Aug-11	14	607597	6363321	25.3	6.7	10.1	18
	GN-01	17-Aug-12	14	599170	6350431	19.8	3.7	3.4	16.5
	GN-02	16-Aug-12	14	604214	6349714	23.5	14.9	19.6	14.5
	GN-03	16-Aug-12	14	606810	6350709	22.5	10.5	12.4	14.5
	GN-04	17-Aug-12	14	600350	6350897	21	3.1	3.4	16.5
	GN-05	15-Aug-12	14	605232	6356410	19.3	5.3	5.3	17.5
	GN-06	16-Aug-12	14	608396	6353035	19.5	4.3	10.3	14.5
	GN-07	14-Aug-12	14	606173	6359144	19.8	6.9	6.6	18
	GN-08	14-Aug-12	14	606417	6360012	21	8.4	11.4	18
	GN-09	14-Aug-12	14	605313	6366528	19	2.7	2.4	18
	GN-10	13-Aug-12	14	606394	6363853	21.5	9.3	5.7	16.5
	GN-11	13-Aug-12	14	607489	6361928	19	8	10.4	16.5
	GN-12	13-Aug-12	14	607619	6363160	23	10.1	6.2	16.5
	SN-03	16-Aug-12	14	606778	6350739	22.5	5.7	5.7	14.5
	SN-05	15-Aug-12	14	605248	6356382	19.3	5.2	5.2	17.5
	SN-09	14-Aug-12	14	605354	6366544	18.5	3.7	3.7	18
	SN-12	13-Aug-12	14	607613	6363128	23	10	10	16.5
	GN-01	23-Aug-13	14	599089	6350437	21	3.1	3.6	16
	GN-02	22-Aug-13	14	604250	6349718	24.6	16.5	20	16
	GN-03	23-Aug-13	14	606759	6350671	25.3	12	6.5	16
	GN-04	23-Aug-13	14	600382	6350848	21.7	2.8	3.5	16
	GN-05	22-Aug-13	14	605144	6356540	22.8	5.4	5.3	16
	GN-06	22-Aug-13	14	608367	6352930	23.3	8	13	16
	GN-07	21-Aug-13	14	606164	6359052	18.6	6.5	6.5	16
	GN-08	21-Aug-13	14	606405	6359925	17.8	9.9	8	16

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	GN-09	21-Aug-13	14	605430	6366487	17	8	8	16
	GN-10	20-Aug-13	14	606427	6363882	23	8.3	5.6	17
	GN-11	20-Aug-13	14	607633	6362015	19.1	10	10	17
	GN-12	20-Aug-13	14	607681	6363229	21	10	10	17
	SN-03	23-Aug-13	14	606758	6350716	25.3	8.4	12	16
	SN-05	22-Aug-13	14	605135	6356510	22.8	5.6	5.4	16
	SN-09	21-Aug-13	14	605467	6366503	17	8.4	8	16
	SN-12	20-Aug-13	14	607663	6363265	21	8.5	10	17
	GN-01	18-Aug-14	14	599024	6350494	24.3	5.1	5.1	17
	GN-02	19-Aug-14	14	604213	6349732	16.8	19.9	21.4	17
	GN-03	19-Aug-14	14	606807	6350724	17.1	6.1	-	17
	GN-04	18-Aug-14	14	600373	6350852	24.8	4.6	5	17
	GN-05	20-Aug-14	14	605145	6356410	19.5	6.9	6.2	16
	GN-06	19-Aug-14	14	608535	6352944	18.5	9.2	6	17
	GN-07	17-Aug-14	14	606135	6359228	19.3	8.3	8.1	17
	GN-08	17-Aug-14	14	606364	6360015	19.9	8	9.2	17
	GN-09	16-Aug-14	14	605299	6366396	16.5	8.1	6.9	17
	GN-10	16-Aug-14	14	606468	6363903	17.3	9.1	6.7	17
	GN-11	20-Aug-14	14	607538	6361988	18.6	11.6	10.7	16
	GN-12	20-Aug-14	14	607621	6363255	16.4	8.5	10.8	16
	SN-03	19-Aug-14	14	606795	6350681	17.1	13.6	6.1	17
	SN-05	20-Aug-14	14	605145	6356410	19.5	6.9	6.9	16
	SN-09	16-Aug-14	14	605364	6366400	16.5	8.1	8.1	17
	SN-12	20-Aug-14	14	607619	6363275	16.4	8.5	8.5	16
	GN-01	12-Aug-15	14	599050	6350387	18.1	3.5	5.1	18
	GN-02	13-Aug-15	14	604213	6349732	24.3	19.6	20.1	18
	GN-03	12-Aug-15	14	606862	6350764	20.8	2	11	18
	GN-04	12-Aug-15	14	600660	6350845	18.9	4.6	1.2	18

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	GN-05	13-Aug-15	14	605327	6356460	22.8	4.4	4.4	18
	GN-06	13-Aug-15	14	608535	6352944	21.1	9.8	5.6	19
	GN-07	14-Aug-15	14	606199	6359006	17.8	8.3	6.1	18
	GN-08	14-Aug-15	14	606221	6359954	18.5	3.5	5.7	18
	GN-09	14-Aug-15	14	605415	6366396	19.4	3.7	4.6	18
	GN-10	11-Aug-15	14	606502	6363979	19	4.6	6.9	18
	GN-11	11-Aug-15	14	607557	6361944	16.7	10.2	9.9	18
	GN-12	11-Aug-15	14	607722	6363278	17.7	6.6	8.6	18
	SN-03	12-Aug-15	14	606954	6350747	20.8	1.6	2	18
	SN-05	13-Aug-15	14	605325	6356480	22.8	4.5	4.4	18
	SN-09	14-Aug-15	14	605441	6366419	19.4	6.6	3.7	18
	SN-12	11-Aug-15	14	607712	6363315	17.7	6.6	6.6	18
	GN-01	21-Aug-16	14	599037	6350498	21.6	3	3.4	16
	GN-02	22-Aug-16	14	604265	6349708	20.7	14.8	19.6	17
	GN-03	21-Aug-16	14	606894	6350633	20.1	11.5	11.6	17
	GN-04	21-Aug-16	14	600349	6350836	21	2.6	3.1	17
	GN-05	22-Aug-16	14	605255	6356458	21.4	4.6	4.6	18
	GN-06	22-Aug-16	14	608425	6352958	21.2	7.9	8	17.5
	GN-07	23-Aug-16	14	606117	6359073	21.1	6.3	2.2	17
	GN-08	23-Aug-16	14	606356	6359999	21.4	5.5	5.4	17
	GN-09	20-Aug-16	14	605366	6366443	17.1	5.2	3.3	18
	GN-10	20-Aug-16	14	606451	6363847	18.2	4.6	5.8	18
	GN-11	20-Aug-16	14	607513	6361943	19.3	8.9	9.3	18
	GN-12	23-Aug-16	14	607688	6363179	22.1	9.4	9.4	17
	SN-03	21-Aug-16	14	606866	6350663	20.1	10.3	11.5	17
	SN-05	22-Aug-16	14	605258	6356421	21.4	4.5	4.6	18
	SN-09	20-Aug-16	14	605366	6366397	17.1	6.4	5.2	18
	SN-12	23-Aug-16	14	607676	6363232	22.1	9.2	9.4	17

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	GN-01	16-Aug-17	14	599049	6350455	21.8	6.8	6.7	20
	GN-02	17-Aug-17	14	604255	6349711	24.6	19.5	22.4	20
	GN-03	16-Aug-17	14	606813	6350673	21.1	14	12.1	20
	GN-04	16-Aug-17	14	600363	6350863	22.5	5.8	6.6	20
	GN-05	15-Aug-17	14	605347	6356420	19.3	7.5	5.9	20
	GN-06	17-Aug-17	14	608426	6352922	24.3	15.3	7.8	20
	GN-07	15-Aug-17	14	606152	6359037	18.8	9.4	9.7	20
	GN-08	15-Aug-17	14	606346	6359939	18.6	6.1	14.3	20
	GN-09	18-Aug-17	14	605408	6366511	24	8.1	9.3	20
	GN-10	18-Aug-17	14	606418	6363853	24.7	12.6	8.7	19
	GN-11	18-Aug-17	14	607521	6361973	23.3	13.4	9.3	21
	GN-12	17-Aug-17	14	607628	6363301	25.2	7.4	12.3	21
	SN-03	16-Aug-17	14	606772	6350699	21.1	14.2	14	20
	SN-05	15-Aug-17	14	605349	6356388	19.3	7.9	7.5	20
	SN-09	18-Aug-17	14	605416	6366538	24	7.8	8.1	20
	SN-12	17-Aug-17	14	607604	6363316	25.2	3.8	7.4	21
	GN-01	17-Aug-18	14	599038	6350536	19.4	5	5.1	17.5
	GN-02	18-Aug-18	14	604267	6349733	23.2	19.4	21.1	17
	GN-03	17-Aug-18	14	606938	6350500	22.1	12.9	12.2	17.5
	GN-04	17-Aug-18	14	600413	6350953	19.8	4.3	5.1	17.5
	GN-05	18-Aug-18	14	605294	6356469	27.5	6.2	2.8	17
	GN-06	18-Aug-18	14	608520	6352961	23.5	10	11.3	17.5
	GN-07	19-Aug-18	14	606160	6359030	21.8	7.8	8.1	17
	GN-08	19-Aug-18	14	606333	6359929	23.6	5.7	5.7	16.5
	GN-09	19-Aug-18	14	605358	6366394	24.2	7.8	6.9	16
	GN-10	20-Aug-18	14	606410	6363847	24.7	11.1	7	16.5
	GN-11	20-Aug-18	14	607431	6362002	23.1	11.6	8.8	17
	GN-12	20-Aug-18	14	607670	6363224	24	-	-	16

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
NIL	SN-03	17-Aug-18	14	606890	6350599	22.1	13.2	12.9	17.5
	SN-05	18-Aug-18	14	605294	6356469	27.5	6.2	6.2	17
	SN-09	19-Aug-18	14	605347	6366366	24.2	6.2	7.8	16
	SN-12	20-Aug-18	14	607654	6363253	24	10	10.8	16
	GN-01	21-Aug-19	14	598946	6350507	22.3	4.3	5	13
	GN-02	22-Aug-19	14	604274	6349700	21.1	16.5	20.3	13.5
	GN-03	22-Aug-19	14	606331	6350518	23.8	13	11.6	13
	GN-04	21-Aug-19	14	600337	6350981	22.4	4.1	4.3	13
	GN-05	21-Aug-19	14	605276	6356522	20.2	6	5.9	13
	GN-06	22-Aug-19	14	608527	6352930	19.7	8.2	10.4	13.5
	GN-07	23-Aug-19	14	606124	6359037	20.5	7.3	7.6	13
	GN-08	24-Aug-19	14	606321	6360052	21	5	6.6	13
	GN-09	20-Aug-19	14	605339	6366370	20.8	6.7	5.3	13
	GN-10	20-Aug-19	14	606380	6363875	21.8	9.3	6.3	13
	GN-11	23-Aug-19	14	607562	6361967	19.3	11	12.6	13.5
	GN-12	23-Aug-19	14	607737	6363178	19.5	10.5	11.2	13
	SN-03	22-Aug-19	14	606886	6350616	23.8	12.2	13	13
	SN-05	21-Aug-19	14	605240	6356422	20.2	6.3	6	13
	SN-09	20-Aug-19	14	605343	6366341	20.8	3	6.7	13
	SN-12	23-Aug-19	14	607729	6363208	19.5	11.3	10.5	13
LCR-LiCR	GN-01	12-Aug-08	15	357186	6376811	26.9	0.5	3	21
	GN-02	12-Aug-08	15	360480	6379199	21.3	0.5	5.8	21
	GN-03	13-Aug-08	15	358509	6376564	20.2	3.3	0.5	22
	GN-04	13-Aug-08	15	360650	6382061	23.5	0.5	3.2	22
	GN-05	14-Aug-08	15	359665	6382897	16.3	4.5	0.5	21
	GN-06	15-Aug-08	15	360873	6380606	17.4	4	2.4	22
	GN-07	15-Aug-08	15	359599	6377858	15.9	0.5	2.2	22
	GN-08	16-Aug-08	15	355845	6382569	17.8	4.5	5.8	20

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-LiCR	GN-09	16-Aug-08	15	361161	6381301	19	3.9	0.5	20
	SN-03	13-Aug-08	15	358509	6376564	20.2	3.3	0.5	22
	SN-06	15-Aug-08	15	360873	6380606	17.4	4.7	4	22
	SN-08	16-Aug-08	15	355845	6382569	17.8	0.5	4.5	20
	GN-01	12-Aug-09	15	357320	6376786	19.8	3.3	2.7	14.1
	GN-02	12-Aug-09	15	360494	6379373	20.9	9	6.4	15
	GN-03	13-Aug-09	15	358501	6376515	22.6	1.8	1.9	14.7
	GN-04	13-Aug-09	15	360667	6382230	24.8	4.1	5	14.7
	GN-05	15-Aug-09	15	359708	6382934	21.8	9.5	1.5	14.4
	GN-06	15-Aug-09	15	361087	6380670	21.8	4.4	5.5	14.4
	GN-07	16-Aug-09	15	359640	6377733	19.2	4	2.9	14.4
	GN-08	14-Aug-09	15	355645	6383872	21.1	2.5	2.3	14.4
	GN-09	14-Aug-09	15	360637	6381661	25.2	2.1	8.7	14.4
	SN-03	13-Aug-09	15	358501	6376515	22.6	1.7	1.8	14.7
	SN-05	15-Aug-09	15	359708	6382934	21.8	9.5	1.5	14.4
	SN-08	14-Aug-09	15	355645	6383872	21.1	2.5	2.3	14.4
	GN-01	11-Aug-10	15	357387	6376685	22.2	3.1	0.2	19
	GN-02	12-Aug-10	15	360445	6379491	26	0.8	3	19
	GN-03	11-Aug-10	15	358464	6376582	22.8	-	-	19
	GN-04	12-Aug-10	15	360673	6381916	23.6	3.5	1	19
	GN-05	13-Aug-10	15	359608	6383044	24.2	3.7	4	20
	GN-06	13-Aug-10	15	360876	6380553	26.5	-	-	20
	GN-07	15-Aug-10	15	360947	6381612	20.9	2.3	2.6	15
	GN-08	14-Aug-10	15	355372	6383711	24.6	-	-	19
	GN-09	15-Aug-10	15	359343	6377258	25.2	-	-	15
	SN-05	13-Aug-10	15	359564	6383007	24.2	2.3	3.7	20
	SN-06	11-Aug-10	15	360876	6380553	23	-	-	19
	SN-08	14-Aug-10	15	355407	6383707	24.6	3	4.3	19

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-LiCR	GN-01	15-Aug-11	15	357413	6376755	17.1	2	3.9	19.5
	GN-02	14-Aug-11	15	360480	6379378	16	4.2	4.8	19
	GN-03	15-Aug-11	15	358525	6376607	16	4.1	3	19.5
	GN-04	16-Aug-11	15	360545	6382228	16.3	2.9	3	19
	GN-05	12-Aug-11	15	359702	6382979	15.9	5	5.9	19
	GN-06	13-Aug-11	15	361060	6380647	16.2	2.2	2	19
	GN-07	14-Aug-11	15	359654	6377758	16.5	3.9	1.9	19
	GN-08	12-Aug-11	15	355520	6383689	15.4	3.5	6.2	19
	GN-09	13-Aug-11	15	360634	6381751	15.8	6.3	6.5	19
	SN-03	15-Aug-11	15	358534	6376580	16.8	3.3	4.1	19.5
	SN-05	12-Aug-11	15	359722	6382946	16.4	5.3	5	19
	SN-08	12-Aug-11	15	355553	6383706	15.8	2.6	3.5	19
	GN-01	15-Aug-12	15	357387	6376680	16.7	4.3	4.1	16
	GN-02	17-Aug-12	15	360444	6379478	17.9	4.5	4.7	15
	GN-03	15-Aug-12	15	358467	6376589	15.2	5.1	2.6	16
	GN-04	16-Aug-12	15	360694	6381953	16.5	3.7	5	16
	GN-05	17-Aug-12	15	359619	6383039	16.7	8	6.7	15
	GN-06	17-Aug-12	15	361006	6380624	19.6	2.9	4.1	15
	GN-07	18-Aug-12	15	359632	6377745	16	2.1	4.5	17.5
	GN-08	16-Aug-12	15	355328	6383721	16	5.1	4.4	16
	GN-09	16-Aug-12	15	360923	6381555	17.5	3.9	2.8	16
	SN-05	17-Aug-12	15	359584	6383011	17.6	4.3	4.1	15
	SN-06	17-Aug-12	15	360958	6380613	20.4	2.7	2.5	15
	SN-08	16-Aug-12	15	355303	6383687	16.4	4.7	5.1	16
	GN-01	17-Aug-13	15	357384	6376665	16.4	4.5	2.2	14
	GN-02	16-Aug-13	15	360445	6379498	15.5	3.8	3.7	15
	GN-03	17-Aug-13	15	358443	6376582	16	2.3	4.5	14
	GN-04	15-Aug-13	15	360634	6382028	16.3	3.9	3	14

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-LiCR	GN-05	15-Aug-13	15	359613	6383053	15.3	5.6	4.9	14
	GN-06	16-Aug-13	15	360901	6380588	16.3	1.8	1.6	15
	GN-07	14-Aug-13	15	360945	6381608	16.3	3.2	3	15
	GN-08	14-Aug-13	15	355390	6383764	15.7	3.8	5.3	15
	GN-09	17-Aug-13	15	359374	6377257	15.3	4.2	4.2	14
	SN-05	15-Aug-13	15	359575	6383016	15.3	4.2	5.6	14
	SN-06	16-Aug-13	15	360878	6380552	16.3	2.8	1.8	15
	SN-08	14-Aug-13	15	355407	6383729	15.7	3.6	3.8	15
	GN-01	14-Aug-14	15	357448	6376686	14.3	3.9	2.8	15
	GN-02	16-Aug-14	15	360428	6379518	17	3.7	4.3	17
	GN-03	14-Aug-14	15	358506	6376656	14.5	5.8	5.1	15
	GN-04	15-Aug-14	15	360685	6381688	18.3	5.9	6.6	15
	GN-05	15-Aug-14	15	359636	6382997	17.5	6.7	5.9	15
	GN-06	16-Aug-14	15	360805	6380586	16.3	2.1	4.7	17
	GN-07	16-Aug-14	15	361080	6381400	15.5	2	2.6	17
	GN-08	15-Aug-14	15	355338	6383622	16.2	5.4	4.5	15
	GN-09	14-Aug-14	15	359365	6377246	14.8	5.7	5.7	15
	SN-05	15-Aug-14	15	359611	6382970	17.5	3.3	6.7	15
	SN-06	16-Aug-14	15	360777	6380571	16.3	2.3	2.1	17
	SN-08	15-Aug-14	15	355378	6383589	16.2	6	5.4	15
	GN-01	14-Aug-15	15	357329	6376764	18.1	5.1	2.9	17
	GN-02	11-Aug-15	15	360441	6379501	16.6	2.7	3.7	16
	GN-03	14-Aug-15	15	358438	6376596	16.6	3.6	4.2	17
	GN-04	12-Aug-15	15	360764	6381989	15.9	2.5	4.3	17
	GN-05	12-Aug-15	15	359608	6383049	16.7	6	5	17
	GN-06	11-Aug-15	15	360928	6380596	15.6	2.1	5.2	16
	GN-07	11-Aug-15	15	359398	6377272	17.5	5.1	2.9	16
	GN-08	13-Aug-15	15	355399	6383697	15.3	4.1	4.9	17

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-LiCR	GN-09	13-Aug-15	15	360677	6381695	17.5	4.8	6.7	17
	SN-05	12-Aug-15	15	359577	6383024	16.7	3	6	17
	SN-06	11-Aug-15	15	360919	6380557	15.6	2.9	2.1	16
	SN-08	13-Aug-15	15	355420	6383687	15.3	3.7	4.1	17
	GN-01	31-Jul-16	15	357510	6376698	16.4	1.8	1.8	16
	GN-02	03-Aug-16	15	360449	6379473	16.3	3	3.7	18
	GN-03	31-Jul-16	15	358645	6376554	16.8	1.8	4.2	16
	GN-04	01-Aug-16	15	360630	6382007	16.1	4.3	0.5	17
	GN-05	02-Aug-16	15	359641	6382989	15.5	5	4.8	17
	GN-06	31-Jul-16	15	360931	6380584	15.8	2.5	5	16
	GN-07	02-Aug-16	15	360929	6381602	15.9	3.2	3	17
	GN-08	01-Aug-16	15	355376	6383718	16.3	5.2	4.6	17
	GN-09	03-Aug-16	15	359344	6377230	15	4.2	4.7	18
	SN-05	02-Aug-16	15	359612	6382973	15.5	0.5	5	17
	SN-06	31-Jul-16	15	360938	6380551	15.8	0.5	2.5	16
	SN-08	01-Aug-16	15	355387	6383692	16.3	5.6	5.2	17
	GN-01	17-Aug-17	15	357578	6376732	15.8	4.9	4.9	19
	GN-02	16-Aug-17	15	360419	6379504	16.5	3.5	5	19
	GN-03	17-Aug-17	15	358641	6376537	15.9	1.9	2.6	19
	GN-04	14-Aug-17	15	360628	6382041	17.3	6.7	6.1	19.5
	GN-05	15-Aug-17	15	359640	6382997	20.8	8	7.2	19
	GN-06	16-Aug-17	15	360987	6380603	17.1	4.9	4.8	19
	GN-07	14-Aug-17	15	360933	6381570	17.1	4.8	5.5	19.5
	GN-08	15-Aug-17	15	355384	6383781	19.4	5.7	6.9	19
	GN-09	17-Aug-17	15	359394	6377323	15.5	5.7	5.3	19
	SN-05	15-Aug-17	15	359607	6382987	20.8	8	5.8	19
	SN-06	16-Aug-17	15	360966	6380571	17.1	4.9	4.1	19
	SN-08	15-Aug-17	15	355384	6383781	19.4	5.7	6.8	19

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-LiCR	GN-01	14-Aug-18	15	357349	6376774	16.3	4.1	2.7	17
	GN-02	17-Aug-18	15	360450	6379500	16.5	4.3	4.7	16
	GN-03	14-Aug-18	15	358507	6376570	17.5	2.7	5.9	17
	GN-04	16-Aug-18	15	360733	6382017	16.8	5.2	3	16
	GN-05	15-Aug-18	15	359752	6383054	17.5	7.2	6.1	17
	GN-06	17-Aug-18	15	361017	6380594	16.3	3.7	3.2	16
	GN-07	16-Aug-18	15	360726	6381675	15.9	3.7	6.6	16
	GN-08	15-Aug-18	15	355421	6383827	16	5.1	5.1	17
	GN-09	14-Aug-18	15	359640	6377667	15.2	3.7	2.3	17
	SN-05	15-Aug-18	15	359640	6382974	17.5	7.2	7.2	17
	SN-06	17-Aug-18	15	360997	6380566	16.3	1.5	3.7	16
	SN-08	15-Aug-18	15	355443	6383794	16	4.9	5.1	17
PBL	GN-01	26-Aug-09	14	567957	6354808	24.3	7.8	5.9	12
	GN-02	26-Aug-09	14	567227	6356363	24.6	5.7	7.2	12
	GN-03	26-Aug-09	14	564465	6355790	24.6	6.3	9.5	12
	GN-04	27-Aug-09	14	560608	6357661	25.2	7.3	8.2	11
	GN-05	27-Aug-09	14	560996	6358412	26.9	7.1	5.1	11.5
	GN-06	27-Aug-09	14	561944	6357266	24.3	4.9	10.9	11
	GN-07	28-Aug-09	14	562352	6359394	23.3	6.5	6.3	12
	GN-08	28-Aug-09	14	560438	6359033	23	11	10.8	12
	GN-09	28-Aug-09	14	559841	6359379	22.8	7.5	10	12
	SN-01	26-Aug-09	14	567847	6354855	24.3	8	7.8	12
	SN-04	27-Aug-09	14	560586	6357650	25.2	5.4	7.3	11
	SN-07	28-Aug-09	14	562382	6359375	23.3	7.4	6.5	12
	GN-01	19-Aug-12	14	567990	6354948	18	4.3	5.6	19
	GN-02	19-Aug-12	14	567244	6356106	19.1	3.7	3.9	19
	GN-03	19-Aug-12	14	564613	6355774	20.4	4.2	8	19
	GN-04	20-Aug-12	14	560644	6357673	21.8	4.3	6.2	17

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
PBL	GN-05	20-Aug-12	14	561123	6358264	20.2	4.1	3.4	17
	GN-06	20-Aug-12	14	561928	6357291	18.9	6.1	6	17
	GN-07	21-Aug-12	14	561485	6358944	19.7	3.4	3.3	18.5
	GN-08	21-Aug-12	14	560442	6359033	20.8	6.9	7.2	18.5
	GN-09	21-Aug-12	14	560045	6359336	21	4.3	6.5	18.5
	SN-01	19-Aug-12	14	568026	6354957	17.5	4.4	4.3	19
	SN-04	20-Aug-12	14	560599	6357679	21.8	3.8	4.3	17
	SN-07	21-Aug-12	14	561516	6358912	19.7	2.8	3.4	18.5
	GN-01	18-Aug-15	14	567900	6354890	18.4	4.3	4.1	17
	GN-02	18-Aug-15	14	567228	6356293	18.7	3.6	3.1	17
	GN-03	18-Aug-15	14	564515	6355833	20.3	4.2	8	17
	GN-04	17-Aug-15	14	560604	6357624	21.7	1.7	4.2	15
	GN-05	17-Aug-15	14	560989	6358447	21.4	1.4	4.7	15
	GN-06	17-Aug-15	14	561947	6357301	22.3	6.8	7.4	17
	GN-07	16-Aug-15	14	562370	6359342	16.4	2.2	3.4	18
	GN-08	16-Aug-15	14	560399	6358992	15.9	6.9	7.2	18
	GN-09	16-Aug-15	14	559889	6359331	15.5	6.8	6.1	18
	SN-01	18-Aug-15	14	567878	6354881	18.4	4.4	4.3	17
	SN-04	17-Aug-15	14	560617	6357588	21.7	0.8	1.7	15
	SN-07	16-Aug-15	14	562377	6359326	16.4	2.2	2.2	18
	GN-01	13-Aug-18	14	567965	6354785	19.7	7.2	8.6	19
	GN-02	13-Aug-18	14	567232	6356355	20.3	4.4	6.2	19
	GN-03	13-Aug-18	14	564448	6355794	22.3	6.2	8.6	17
	GN-04	14-Aug-18	14	560592	6357681	23.5	6	7.6	17
	GN-05	15-Aug-18	14	561006	6358399	23.7	4.1	6	16
	GN-06	15-Aug-18	14	561940	6357268	23.3	4.7	9.9	16.5
	GN-07	15-Aug-18	14	562369	6359404	22.8	7.3	5.8	17
	GN-08	14-Aug-18	14	560431	6358994	22.4	9.9	9.8	17

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
PBL	GN-09	14-Aug-18	14	559835	6359379	21.9	8.7	3.6	17
	SN-01	13-Aug-18	14	567927	6354806	19.7	6.9	7.2	19
	SN-04	14-Aug-18	14	560709	6357642	23.5	8.3	7.6	17
	SN-07	15-Aug-18	14	562345	6359377	22.8	5.3	7.3	17
FID	GN-01	08-Aug-11	14	624362	6343157	23.8	7.4	7.1	18
	GN-02	08-Aug-11	14	624519	6342649	25.1	2.8	3.8	18
	GN-03	09-Aug-11	14	623384	6343541	24.4	5.8	6.2	18
	GN-04	09-Aug-11	14	623777	6342642	24.6	2.8	3.8	18
	GN-05	10-Aug-11	14	622558	6345518	23.6	6.9	9.3	18
	GN-06	10-Aug-11	14	623063	6345336	22.6	2.4	3.7	18
	SN-01	08-Aug-11	14	624391	6343173	24.1	6.7	7.4	18
	SN-04	09-Aug-11	14	623751	6342677	25.5	2.7	2.8	18
	SN-05	10-Aug-11	14	622537	6345540	23.9	6.5	6.9	18
	GN-01	13-Aug-14	14	624283	6343045	14.5	11.4	3.2	17
	GN-02	13-Aug-14	14	624498	6342765	17.2	-	7.5	17
	GN-03	14-Aug-14	14	623379	6343534	15.7	8.4	6.2	17
	GN-04	13-Aug-14	14	623750	6342716	15.9	5	8.3	17
	GN-05	14-Aug-14	14	622522	6345498	16.7	8.4	11.6	17
	GN-06	14-Aug-14	14	623095	6345302	16.3	7.1	5.3	17
	SN-01	13-Aug-14	14	624289	6343049	14.5	11.4	11.4	17
	SN-04	13-Aug-14	14	623732	6342695	15.9	5	5	17
	SN-05	14-Aug-14	14	622522	6345492	16.7	8.4	8.4	17
	GN-01	13-Aug-17	14	624363	6343155	21.3	13.5	6.1	19
	GN-02	13-Aug-17	14	624515	6342642	20.8	8.4	8.5	19
	GN-03	12-Aug-17	14	623405	6343537	21.4	10.2	9.3	19
	GN-04	13-Aug-17	14	623776	6342693	19.5	8.9	11.3	19
	GN-05	12-Aug-17	14	622579	6345519	20.6	13.4	13.8	19
	GN-06	12-Aug-17	14	623085	6345330	21.2	9.4	7.2	19

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
FID	SN-01	13-Aug-17	14	624358	6343127	21.3	15.1	13.5	19
	SN-04	13-Aug-17	14	623780	6342662	19.5	9.2	8.9	19
	SN-05	12-Aug-17	14	622540	6345533	20.6	11.8	13.4	19
BIL	GN-01	23-Jul-10	14	671175	6336533	20	9	7.8	18.5
	GN-02	23-Jul-10	14	671650	6336560	20	2.2	3.3	18.5
	GN-03	24-Jul-10	14	673959	6337121	18.5	5	3	20
	GN-04	24-Jul-10	14	672390	6337817	20.8	8.5	7.8	20
	GN-05	25-Jul-10	14	671572	6337385	19.3	2.5	5.2	22
	GN-06	25-Jul-10	14	673130	6337293	24.5	6.7	8	20
	GN-07	26-Jul-10	14	670542	6337415	23.8	3.2	3	23
	GN-08	26-Jul-10	14	675310	6337324	23.3	3	3.8	23
	GN-09	26-Jul-10	14	676095	6337262	21	1	3.4	22
	SN-03	24-Jul-10	14	673905	6337135	18.5	5	3	20
	SN-06	25-Jul-10	14	673159	6337269	24.5	6.7	8	20
	SN-09	26-Jul-10	14	676134	6337261	21	1	3.4	22
	GN-01	27-Aug-13	14	671209	6336593	18	14	9.5	14
	GN-02	27-Aug-13	14	671671	6336682	17.4	10	9.3	14
	GN-03	26-Aug-13	14	673911	6337112	24.9	5.9	3.3	17
	GN-04	25-Aug-13	14	672471	6337829	16.3	9.8	8	18
	GN-05	25-Aug-13	14	671820	6337489	17.9	4.3	5.3	18
	GN-06	25-Aug-13	14	673173	6337309	22.8	8.5	8.8	18
	GN-07	27-Aug-13	14	670566	6337444	16.5	4.6	5	14
	GN-08	26-Aug-13	14	675285	6337237	14	3.5	3.7	16
	GN-09	26-Aug-13	14	676204	6337231	15	1.1	2.3	16
	SN-03	26-Aug-13	14	673894	6337135	24.9	5.8	5.9	17
	SN-06	25-Aug-13	14	673186	6337278	22.8	8.8	8.5	18
	SN-09	26-Aug-13	14	676229	6337244	15	1	1.1	16
	GN-01	17-Aug-16	14	671171	6336537	20.3	12.1	8.9	19

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
BIL	GN-02	17-Aug-16	14	671655	6336570	20.6	5.3	1.1	19
	GN-03	16-Aug-16	14	674059	6337085	19.2	2.6	8.1	19
	GN-04	16-Aug-16	14	672390	6337837	16.1	8.9	6.9	19
	GN-05	16-Aug-16	14	671583	6337384	17.2	3.3	1.4	19
	GN-06	17-Aug-16	14	673121	6337309	20.4	5.3	8.1	19
	GN-07	18-Aug-16	14	670568	6337441	23.4	3.5	4.9	19
	GN-08	18-Aug-16	14	675316	6337319	22.1	1.4	3.5	19
	GN-09	18-Aug-16	14	675963	6337230	23	3.8	3.9	19
	SN-03	16-Aug-16	14	674081	6337050	19.2	2.4	2.6	19
	SN-06	17-Aug-16	14	673119	6337240	20.4	4.8	5.3	19
	SN-09	18-Aug-16	14	675989	6337206	23	3.6	3.8	19
	GN-01	17-Aug-19	14	671317	6336634	18.2	12.9	9.4	15
	GN-02	17-Aug-19	14	671621	6336592	15.5	10.1	7	15
	GN-03	15-Aug-19	14	673988	6337084	22.5	-	4.2	17
	GN-04	15-Aug-19	14	672377	6337830	23.9	10.8	9.1	17
	GN-05	15-Aug-19	14	671583	6337389	24.4	4.7	5.1	17
	GN-06	16-Aug-19	14	673075	6337190	23.5	-	8.4	15
	GN-07	16-Aug-19	14	670672	6337457	23.7	5.6	5.4	15
	GN-08	14-Aug-19	14	675321	6337326	19.6	2.1	3.4	17
	GN-09	14-Aug-19	14	676227	6337262	19.2	2.3	2.9	17
	SN-03	15-Aug-19	14	673988	6337084	22.5	9.2	-	17
	SN-06	16-Aug-19	14	673051	6337167	23.5	3.9	-	15
	SN-09	14-Aug-19	14	676275	6337255	19.2	2.2	2.3	17
LCR-WEIR	GN-04	12-Sep-14	15	428810	6500477	22.3	3.4	3.4	9
	GN-05	12-Sep-14	15	428196	6499424	22.7	3.4	4.8	9
	GN-07	10-Sep-14	15	431605	6503165	24.5	2.3	2.4	9
	GN-08	11-Sep-14	15	430936	6503273	22.9	3.7	3.7	9
	GN-09	12-Sep-14	15	429518	6500742	22.7	1.6	1.4	9

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
LCR-WEIR	GN-10	11-Sep-14	15	430480	6503565	22.3	3.5	3.6	9
	GN-16	10-Sep-14	15	431217	6504201	22.5	4	1.2	9
	GN-17	10-Sep-14	15	432127	6503976	22.7	2.2	2.8	9
	GN-18	11-Sep-14	15	430191	6502193	22.3	3.9	4.5	9
	SN-05	12-Sep-14	15	428155	6499398	22.7	3.4	3.4	9
	SN-10	11-Sep-14	15	430468	6503547	22.3	3.5	3.5	9
	SN-17	10-Sep-14	15	432128	6503968	22.7	2.2	2.2	9
	GN-04	16-Sep-17	15	428892	6500630	23.1	2.4	2.6	9
	GN-05	17-Sep-17	15	428195	6499470	23.2	3	3.3	9
	GN-07	15-Sep-17	15	431720	6502938	22.6	1.5	0.9	9
	GN-08	13-Sep-17	15	431002	6503372	22.8	3.4	3.4	9
	GN-09	16-Sep-17	15	429510	6500758	23	1.4	1.4	9
	GN-10	13-Sep-17	15	430603	6503533	23.1	3.3	2.8	9
	GN-16	14-Sep-17	15	431208	6504340	23.5	3.5	3.4	9
	GN-17	14-Sep-17	15	432086	6503991	22.8	1.6	1.8	9
	GN-18	15-Sep-17	15	430201	6502174	21.6	3.7	4.1	9
	SN-05	17-Sep-17	15	428190	6499439	23.2	3	3	9
	SN-10	13-Sep-17	15	430543	6503524	23.1	3.6	3.3	9
	SN-17	14-Sep-17	15	432091	6503963	22.8	1.4	1.6	9
GAU	GN-01	25-Jul-08	14	570993	6307763	22.6	1.8	5.6	17
	GN-02	25-Jul-08	14	567110	6308585	45.7	6.4	7.2	17
	GN-03	25-Jul-08	14	564457	6312455	26.8	1.6	1.5	17
	GN-04	26-Jul-08	14	568015	6310555	26.5	1	4.7	17.5
	GN-05	27-Jul-08	14	571365	6314613	23.9	21.5	22.8	22
	GN-06	27-Jul-08	14	568168	6314278	17.8	5.1	3.8	22
	GN-07	28-Jul-08	14	568602	6311778	47.9	9.1	5.1	18.5
	GN-08	28-Jul-08	14	566588	6317104	23.7	2.6	2.3	19
	GN-09	29-Jul-08	14	562503	6310057	24.7	3.2	2.8	19

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
GAU	SN-03	25-Jul-08	14	564476	6312494	26.9	1.3	1.6	17
	SN-05	27-Jul-08	14	571365	6314613	23.8	18	21.5	22
	SN-09	29-Jul-08	14	562544	6310065	26.2	3.2	3.2	19
	GN-01	24-Jul-09	14	570865	6307811	23.3	6.6	2.3	16
	GN-02	24-Jul-09	14	567193	6308674	24	3	8.9	16
	GN-03	25-Jul-09	14	564412	6312314	22	1.4	2.7	17
	GN-04	23-Jul-09	14	567909	6310496	16.9	5.9	1.7	14
	GN-05	27-Jul-09	14	571301	6314698	18.6	23.6	24.4	16
	GN-06	26-Jul-09	14	568145	6314312	28.5	3.3	5.9	17
	GN-07	25-Jul-09	14	568509	6311651	23	15.1	8.4	15
	GN-08	27-Jul-09	14	566554	6316951	19.8	3.5	2.4	16
	GN-09	26-Jul-09	14	562528	6309951	26.1	1.7	24.4	19
	SN-03	25-Jul-09	14	564412	6312314	22	1.4	2.7	17
	SN-05	27-Jul-09	14	571301	6314698	18.6	23.6	24.4	16
	SN-09	26-Jul-09	14	562528	6309951	26.1	1.7	24.4	19
	GN-01	14-Jul-10	14	570828	6307756	45.1	1	6.5	18.5
	GN-02	14-Jul-10	14	567206	6308669	24.2	6	7	18
	GN-03	17-Jul-10	14	564469	6312317	22.3	2	1	18
	GN-04	14-Jul-10	14	567874	6310483	46.2	2	6	17.5
	GN-05	16-Jul-10	14	571226	6314682	20.3	25	24	18
	GN-06	16-Jul-10	14	568189	6314213	22.9	5.5	4.5	18
	GN-07	14-Jul-10	14	568537	6311638	45.5	3.5	13.5	18
	GN-08	16-Jul-10	14	566594	6317087	20.3	3	1	18
	GN-09	17-Jul-10	14	562378	6309862	21	1	3.5	18
	SN-03	17-Jul-10	14	564469	6312317	22.3	2	2	18
	SN-05	16-Jul-10	14	571226	6314682	20.3	25	25	18
	SN-09	17-Jul-10	14	562378	6309862	21	1	1	18
	GN-01	12-Jul-11	14	570931	6307734	18.9	2	5.9	18

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
GAU	GN-02	14-Jul-11	14	567189	6308662	18.3	8.7	8.2	21
	GN-03	15-Jul-11	14	564395	6312277	24.4	2	1.5	21
	GN-04	14-Jul-11	14	567926	6310387	17.8	5.2	2.3	21
	GN-05	13-Jul-11	14	571279	6314687	21	22.6	17.7	17
	GN-06	13-Jul-11	14	568146	6314321	22.7	4.8	3.6	17
	GN-07	12-Jul-11	14	568423	6311646	16.6	13.8	2.3	18
	GN-08	13-Jul-11	14	566523	6316998	23.6	2.9	3	17
	GN-09	15-Jul-11	14	562589	6310114	25.1	3.9	3.2	21
	SN-03	15-Jul-11	14	564445	6312392	24.4	2.2	1.5	21
	SN-05	13-Jul-11	14	571310	6314648	21.1	23.7	22.6	17
	SN-09	15-Jul-11	14	562516	6309987	25.2	2.9	3.2	21
	GN-01	26-Jul-12	14	570903	6307823	20.8	6.2	3	20
	GN-02	26-Jul-12	14	567153	6308689	20.5	6.1	7.3	20
	GN-03	24-Jul-12	14	564400	6312358	24.2	1.9	1.5	20
	GN-04	25-Jul-12	14	567919	6310379	23.1	3.1	5.3	19.5
	GN-05	23-Jul-12	14	571505	6314571	22.7	6.4	14.4	19
	GN-06	23-Jul-12	14	568152	6314317	24.1	2.8	4.7	19
	GN-07	24-Jul-12	14	568509	6311661	23.9	15.5	8.6	20
	GN-08	23-Jul-12	14	566504	6316972	23.7	2.6	2.5	19
	GN-09	25-Jul-12	14	562582	6310079	22.8	3.6	1.1	19.5
	SN-03	24-Jul-12	14	564402	6312319	24.9	1.6	1.9	20
	SN-05	23-Jul-12	14	571527	6314602	23.5	5.2	6.4	19
	SN-09	25-Jul-12	14	562588	6310125	22.4	3.6	3.6	19.5
	GN-01	19-Jul-13	14	570915	6307827	13.5	2.4	5.7	16.5
	GN-02	16-Jul-13	14	567166	6308740	19.6	4	6.4	18
	GN-03	18-Jul-13	14	564434	6312412	24.7	1.7	1.9	17.5
	GN-04	19-Jul-13	14	567951	6310444	13.7	3.8	5.5	16.5
	GN-05	17-Jul-13	14	571406	6314635	21.8	5.7	17.6	18

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
GAU	GN-06	17-Jul-13	14	568230	6314263	21	5.9	4.2	17.5
	GN-07	18-Jul-13	14	568433	6311600	25.4	4.2	14.2	17
	GN-08	17-Jul-13	14	566516	6317003	21.9	2.7	2.5	17.5
	GN-09	16-Jul-13	14	562402	6310065	17.5	3	3	18
	SN-03	18-Jul-13	14	564439	6312445	24.7	1.8	1.7	17.5
	SN-05	17-Jul-13	14	571367	6314640	21.8	23.4	5.7	18
	SN-09	16-Jul-13	14	562389	6310098	17.5	3	3	18
	GN-01	24-Jul-14	14	570864	6307813	23.8	2	6	18
	GN-02	24-Jul-14	14	567266	6308662	23.5	7.6	6.6	18
	GN-03	22-Jul-14	14	564445	6312383	24	2.5	1.9	16
	GN-04	23-Jul-14	14	567844	6310478	21.2	3	5.8	17
	GN-05	21-Jul-14	14	571361	6314659	18.4	23.2	22	16
	GN-06	21-Jul-14	14	568274	6314224	17.8	7.3	5.5	16
	GN-07	22-Jul-14	14	568482	6311644	26.1	4.8	8.8	16
	GN-08	22-Jul-14	14	566629	6316997	23.7	3	3	16
	GN-09	23-Jul-14	14	562557	6310097	25.6	3.7	1.4	17
	SN-03	22-Jul-14	14	564457	6312408	24	2.3	2.5	16
	SN-05	21-Jul-14	14	571411	6314657	18.4	21	23.2	16
	SN-09	23-Jul-14	14	562568	6310131	25.6	3.7	3.7	17
	GN-01	24-Jul-15	14	570988	6307655	23.3	5.5	1.9	18
	GN-02	24-Jul-15	14	567254	6308684	23.5	5.5	7.7	18
	GN-03	22-Jul-15	14	564404	6312268	23.5	2	1.3	17.5
	GN-04	23-Jul-15	14	567867	6310474	26.1	5.3	2.7	17
	GN-05	21-Jul-15	14	571365	6314667	18.2	22.3	6.3	18.5
	GN-06	22-Jul-15	14	568176	6314319	24.5	4.7	6	17.5
	GN-07	22-Jul-15	14	568536	6311652	25.6	16	2.8	17.5
	GN-08	21-Jul-15	14	566527	6317087	17.4	2.8	2.4	18.5
	GN-09	23-Jul-15	14	562518	6309982	24.4	3.1	2.2	17

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
GAU	SN-03	22-Jul-15	14	564442	6312414	23.5	1.9	2	17.5
	SN-05	21-Jul-15	14	571328	6314668	18.2	23.9	22.3	18.5
	SN-09	23-Jul-15	14	562569	6310084	24.4	3.1	3.1	17
	GN-01	20-Jul-16	14	570878	6307805	18.4	2	5	17
	GN-02	21-Jul-16	14	567201	6308684	14.5	6	6.9	17
	GN-03	20-Jul-16	14	564439	6312478	18.2	2	2	17
	GN-04	21-Jul-16	14	567868	6310482	14.7	5.5	3	17
	GN-05	19-Jul-16	14	571379	6314621	17.2	21	6.3	17
	GN-06	19-Jul-16	14	568139	6314264	18.9	4.5	6.3	17
	GN-07	21-Jul-16	14	568809	6311800	15.8	15	3	17
	GN-08	19-Jul-16	14	566559	6317042	18.1	2.2	2.4	17
	GN-09	20-Jul-16	14	562477	6309935	17.8	2	3	17
	SN-03	20-Jul-16	14	564442	6312489	18.2	2	2	17
	SN-05	19-Jul-16	14	571410	6314606	17.2	21	21	17
	SN-09	20-Jul-16	14	562470	6309915	17.8	2	2	17
	GN-01	19-Jul-17	14	570871	6307801	24.5	3.5	6.1	16
	GN-02	21-Jul-17	14	567284	6308656	23.1	7.1	7.8	16
	GN-03	20-Jul-17	14	564436	6312464	17.4	2.3	2.5	16
	GN-04	20-Jul-17	14	567830	6310464	19.5	3.5	5.5	16
	GN-05	18-Jul-17	14	571446	6314682	20.5	6.8	6.5	16
	GN-06	19-Jul-17	14	568187	6314383	30.6	3.9	3.3	16
	GN-07	19-Jul-17	14	568397	6311652	33.8	6	16.1	16
	GN-08	18-Jul-17	14	566517	6317128	18	4.1	3.5	16
	GN-09	21-Jul-17	14	562555	6310066	24.2	3.8	2.3	16
	SN-03	20-Jul-17	14	564462	6312492	17.4	1.8	2.3	16
	SN-05	18-Jul-17	14	571409	6314669	20.5	21	6.8	16
	SN-09	21-Jul-17	14	562575	6310115	24.2	3.9	3.8	16
	GN-01	22-Jul-18	14	570987	6307738	21.1	4.7	5.9	18

Table A5-1-1. continued.

Waterbody	Site	Set Date	UTM Coordinates			Duration (dec. hrs)[1]	Water Depth (m)		Set Water Temperature (°C)
			Zone	Easting	Northing		Start	End	
GAU	GN-02	22-Jul-18	14	567242	6308636	21.4	5.3	6.5	18
	GN-03	25-Jul-18	14	564427	6312462	23.4	1.8	1.8	18
	GN-04	22-Jul-18	14	567971	6310461	22.1	4.2	5.5	18
	GN-05	23-Jul-18	14	571321	6314629	23.8	10.1	22	18
	GN-06	25-Jul-18	14	568195	6314273	23.4	5.6	4	18
	GN-07	25-Jul-18	14	568392	6311718	23.3	13.6	16	18
	GN-08	23-Jul-18	14	566647	6317009	28.5	2.9	2.8	18
	GN-09	24-Jul-18	14	562514	6310028	21.3	3	3.3	18
	SN-03	25-Jul-18	14	564436	6312526	23.4	1.5	1.8	18
	SN-05	23-Jul-18	14	571444	6314617	23.8	8.2	10.1	18
	SN-09	24-Jul-18	14	562502	6309994	21.3	2.8	3	18
	GN-01	19-Jul-19	14	570804	6307746	20.9	1.6	5.6	19
	GN-02	16-Jul-19	14	567255	6308672	19	6.7	7.2	19
	GN-03	17-Jul-19	14	564424	6312379	22.6	1.9	2.1	19
	GN-04	17-Jul-19	14	567878	6310466	25.5	2.8	5.6	19
	GN-05	18-Jul-19	14	571322	6314671	22.3	23.8	18.5	19
	GN-06	18-Jul-19	14	568141	6314383	22.5	5.3	3.3	19
	GN-07	19-Jul-19	14	568432	6311731	18	3.7	4.2	19
	GN-08	18-Jul-19	14	566642	6317016	20.8	2.6	2.6	19
	GN-09	16-Jul-19	14	562510	6309993	19.7	3	2.9	19
	SN-03	17-Jul-19	14	564424	6312410	22.6	1.8	1.9	19
	SN-05	18-Jul-19	14	571375	6314672	22.3	22.8	23.8	19
	SN-09	16-Jul-19	14	562557	6310096	19.7	3.1	3	19

Notes:

1. Gill nets that were set for >36 h (red font) were excluded from the data analysis for abundance and diversity metrics.

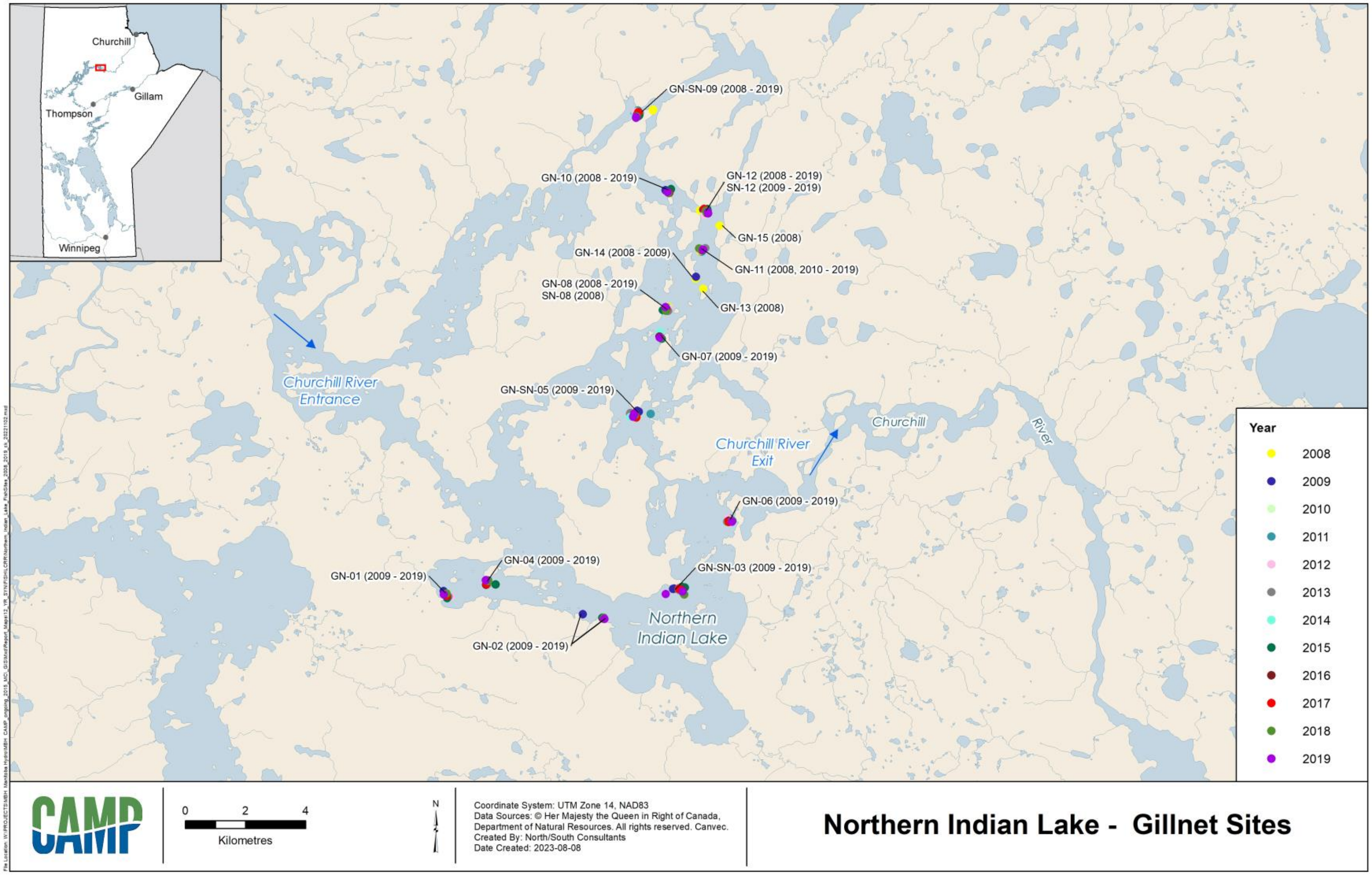


Figure A5-1-1. 2008-2019 Gillnetting sites in Northern Indian Lake.

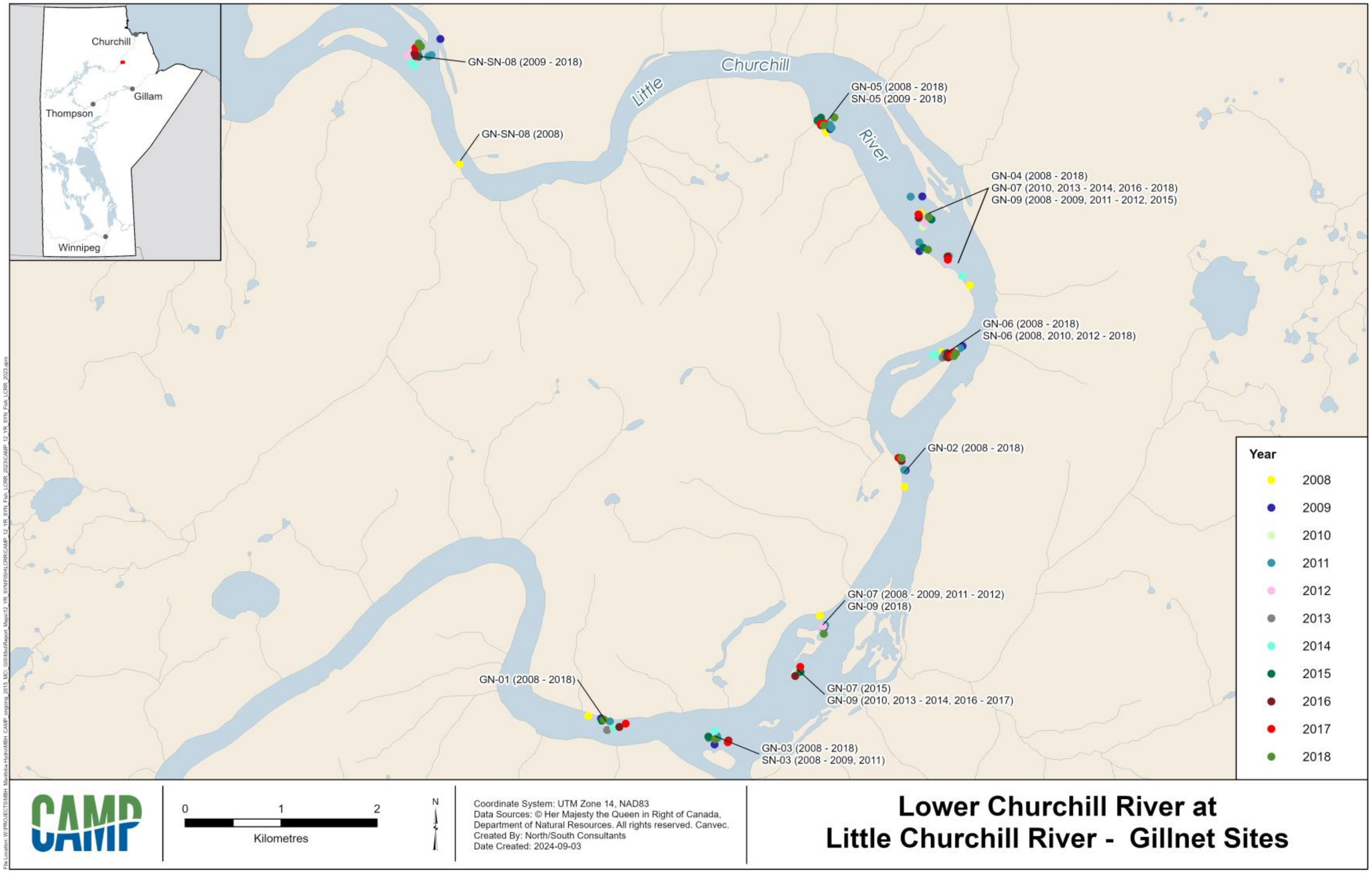


Figure A5-1-2. 2008-2018 Gillnetting sites in lower Churchill River at the Little Churchill River.

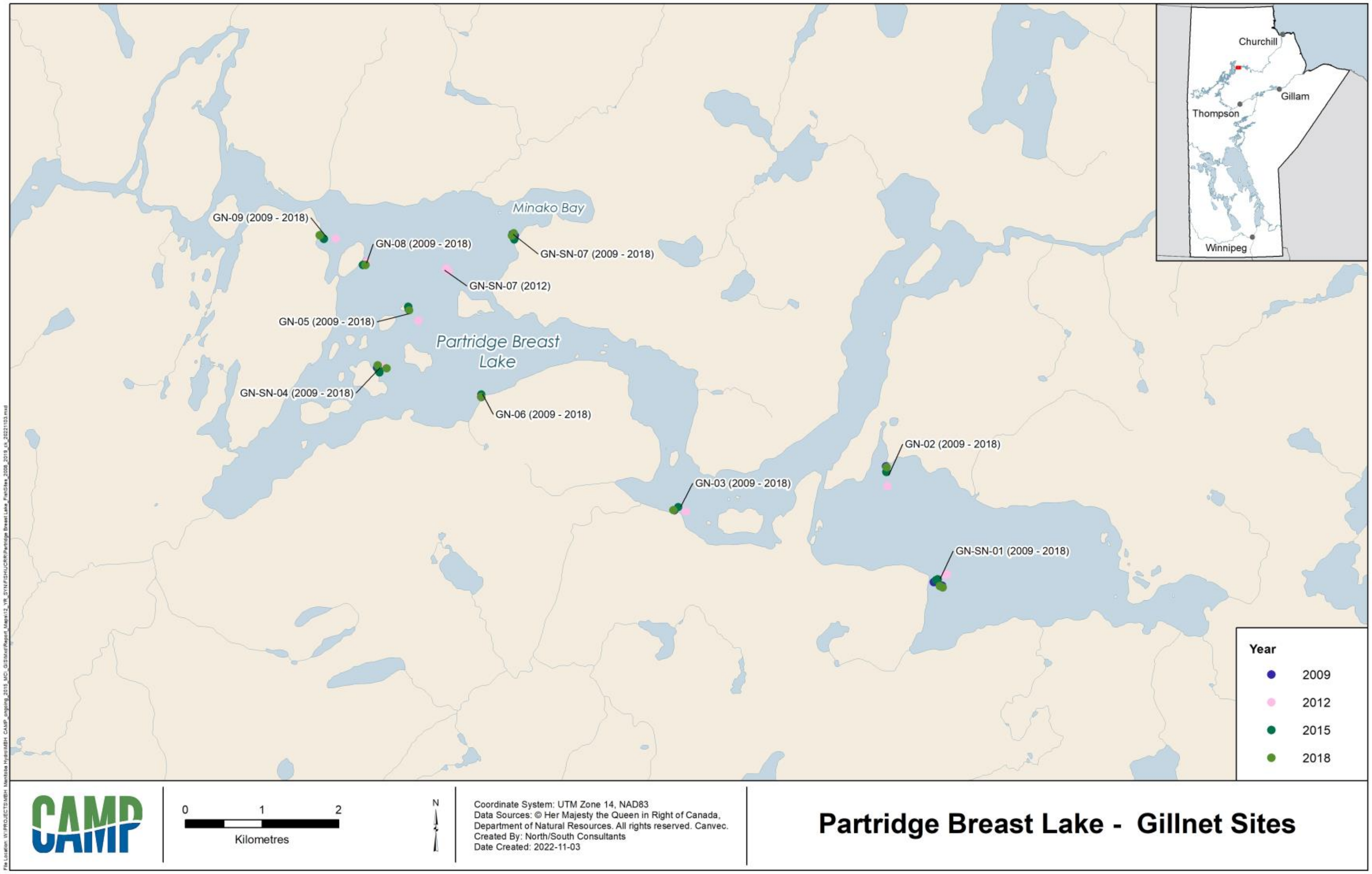


Figure A5-1-3. 2009-2018 Gillnetting sites in the Partridge Breast Lake.

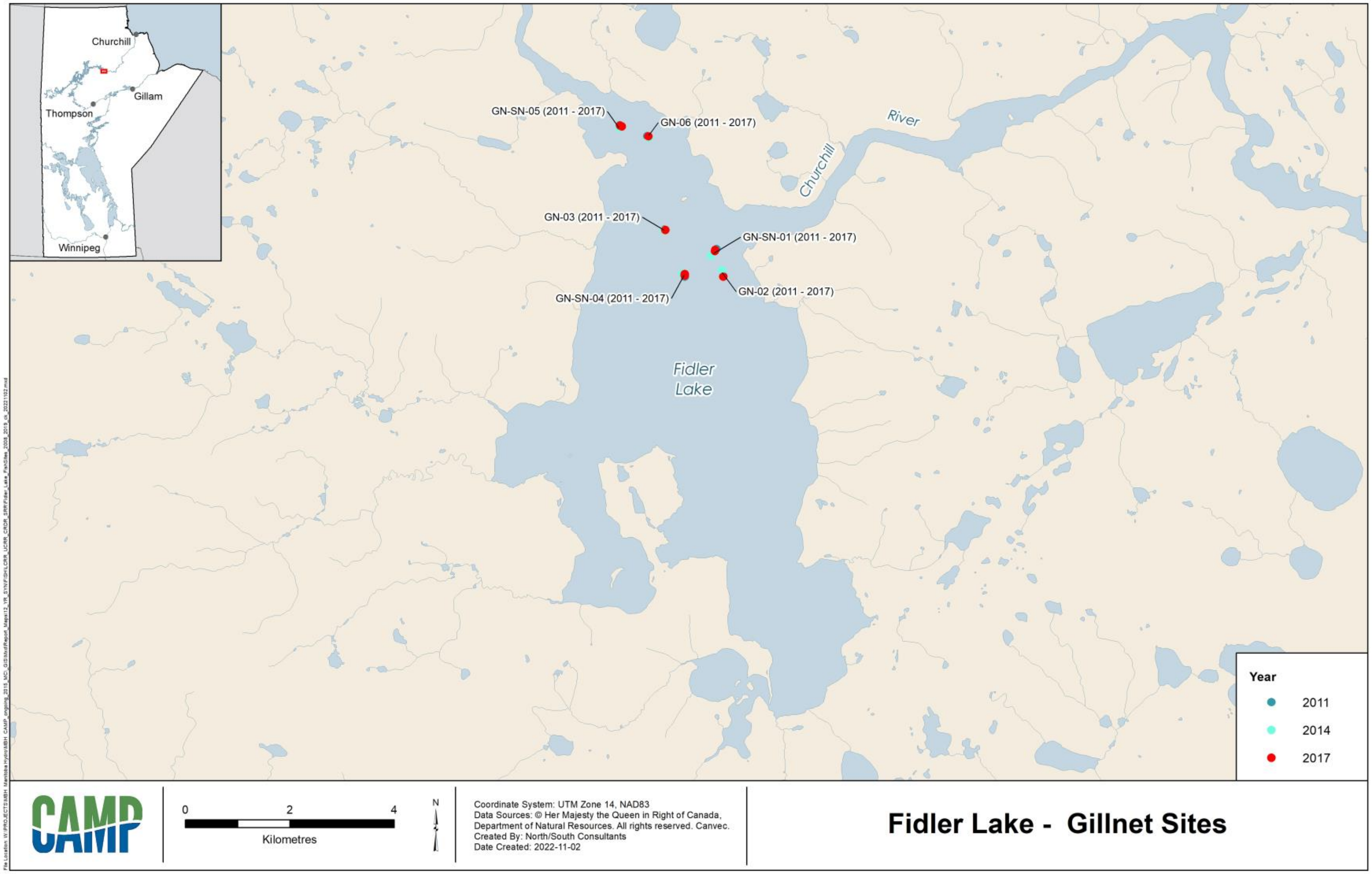


Figure A5-1-4. 2011-2017 Gillnetting sites in Fidler Lake.

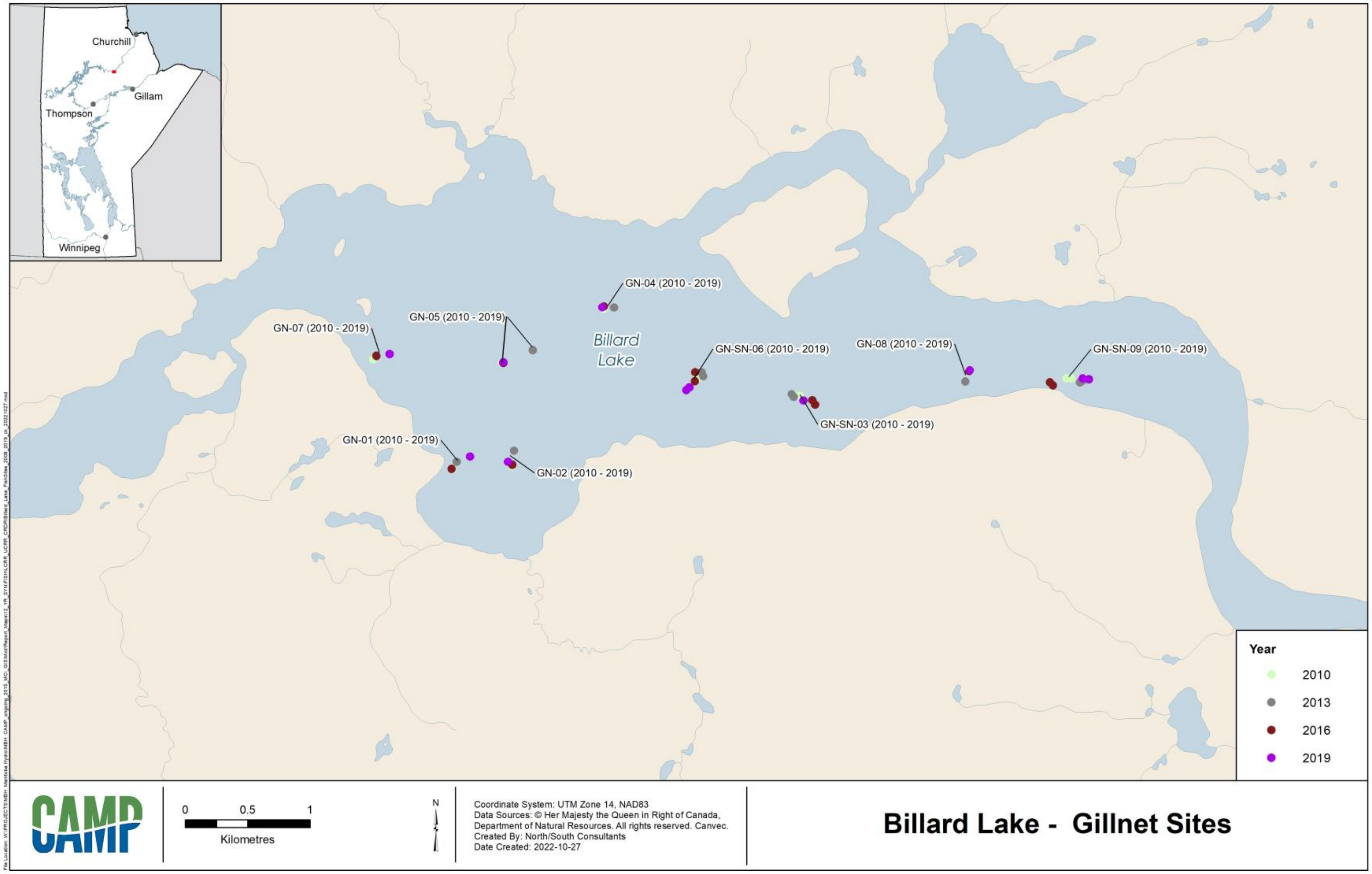


Figure A5-1-5. 2010-2019 Gillnetting sites in Billard Lake.

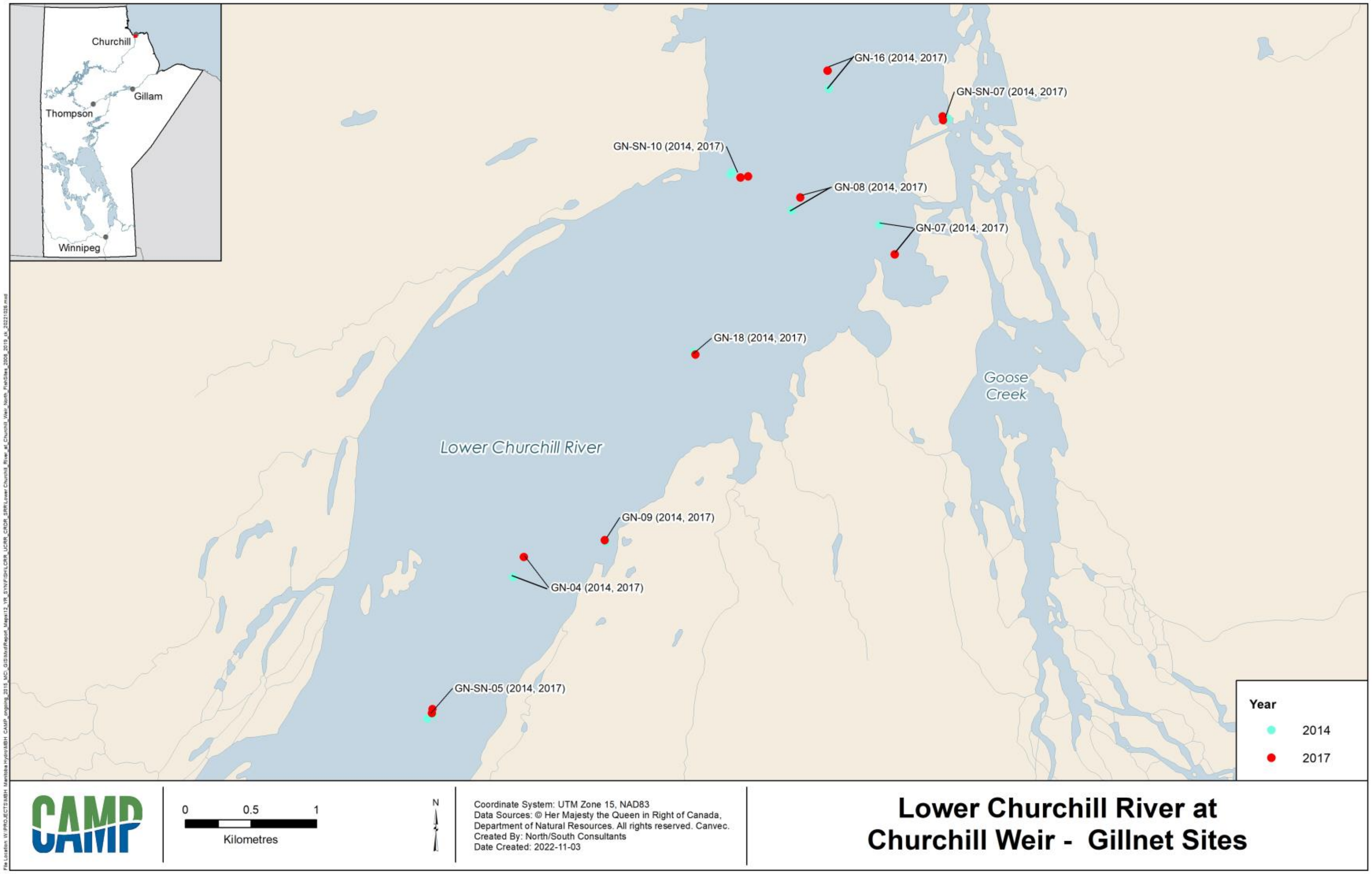


Figure A5-1-6. 2010-2019 Gillnetting sites in the lower Churchill River at the Churchill Weir.

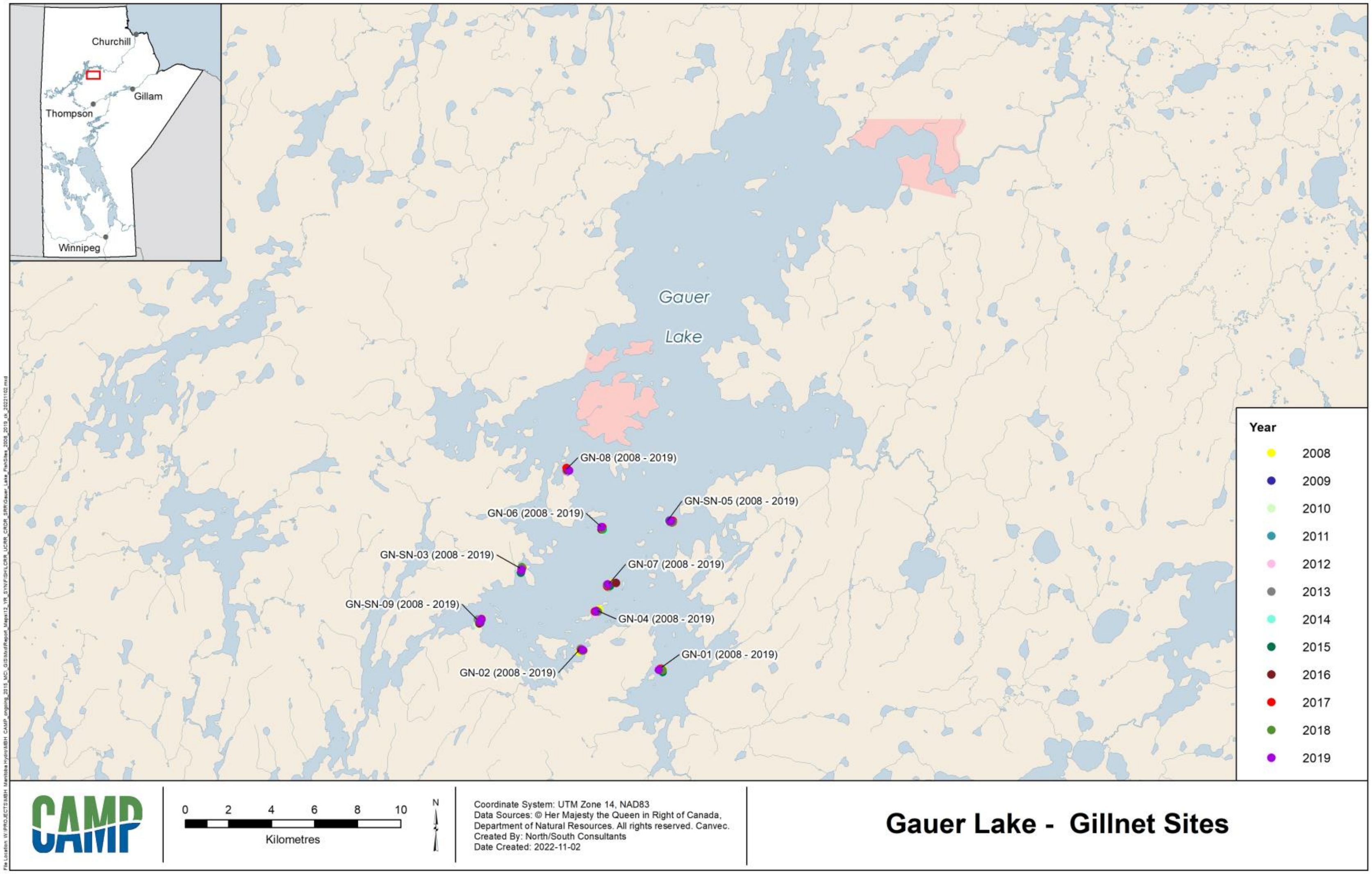


Figure A5-1-7. 2010-2019 Gillnetting sites in Gauer Lake.

6.0 MERCURY IN FISH

6.1 INTRODUCTION

The following presents the results of fish mercury monitoring conducted from 2008-2019 in the Lower Churchill River Region. Fish mercury sampling was conducted on a three-year rotation beginning in 2010 at two on-system waterbodies, Northern Indian Lake and the lower Churchill River at the Little Churchill River, and one off-system waterbody, Gauer Lake (Table 6-1.1; Figure 6.1-1). Sampling in the another on-system waterbody, the Churchill River at the Churchill Weir, started in 2017.

Mercury concentrations are measured in muscle tissue of commercially important fish species – Northern Pike, Walleye, and Lake Whitefish. Monitoring of mercury in 1-year-old Yellow Perch is also conducted as a potential early indicator of changes in mercury in the food web. Samples of fish muscle are collected during the conduct of fish community monitoring. Mercury is analysed in the trunk muscle of Northern Pike, Lake Whitefish, and Walleye selected over a range of fork lengths. Yearling Yellow Perch are analyzed for mercury as carcass with the head, pelvic and pectoral girdles, caudal fin, and digestive tract removed.

There was one departure from the planned field sampling schedule during the 12-year period:

- mercury samples were not collected from the lower Churchill River at the Little Churchill River in 2019 due to a pause in monitoring as sampling methods are reviewed.

Two metrics were selected for detailed reporting: arithmetic mean mercury concentrations; and length-standardized mean mercury concentrations (also referred to as "standard mean(s)"; Table 6.1-2). Standard lengths varied by species as follows: Lake Whitefish (350 mm); Northern Pike (550 mm); and Walleye (400 mm). As CAMP targets a specific age class of Yellow Perch, fish captured for this component are inherently of a limited size range; therefore, length-standardization for this species was not undertaken.

A detailed description of the program design and sampling methods is provided in Technical Document 1, Section 2.6.

Table 6.1-1. 2008-2019 Inventory of fish mercury sampling.

Waterbody/Area	Sampling Year											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NIL			●			●			●			●
LCR-LiCR			●			●			●			-[1]
LCR-WEIR										●		
GAU			●			●			●			●

Notes:

1. Samples not collected due to a pause in monitoring as sampling methods are reviewed.

Table 6.1-2. Mercury in fish indicators and metrics.

Key Indicator	Key Metric	Units
Mercury in Fish	• Arithmetic mean mercury concentration	Parts per million (ppm)
	• Length-standardized mean mercury concentration of large-bodied species	ppm

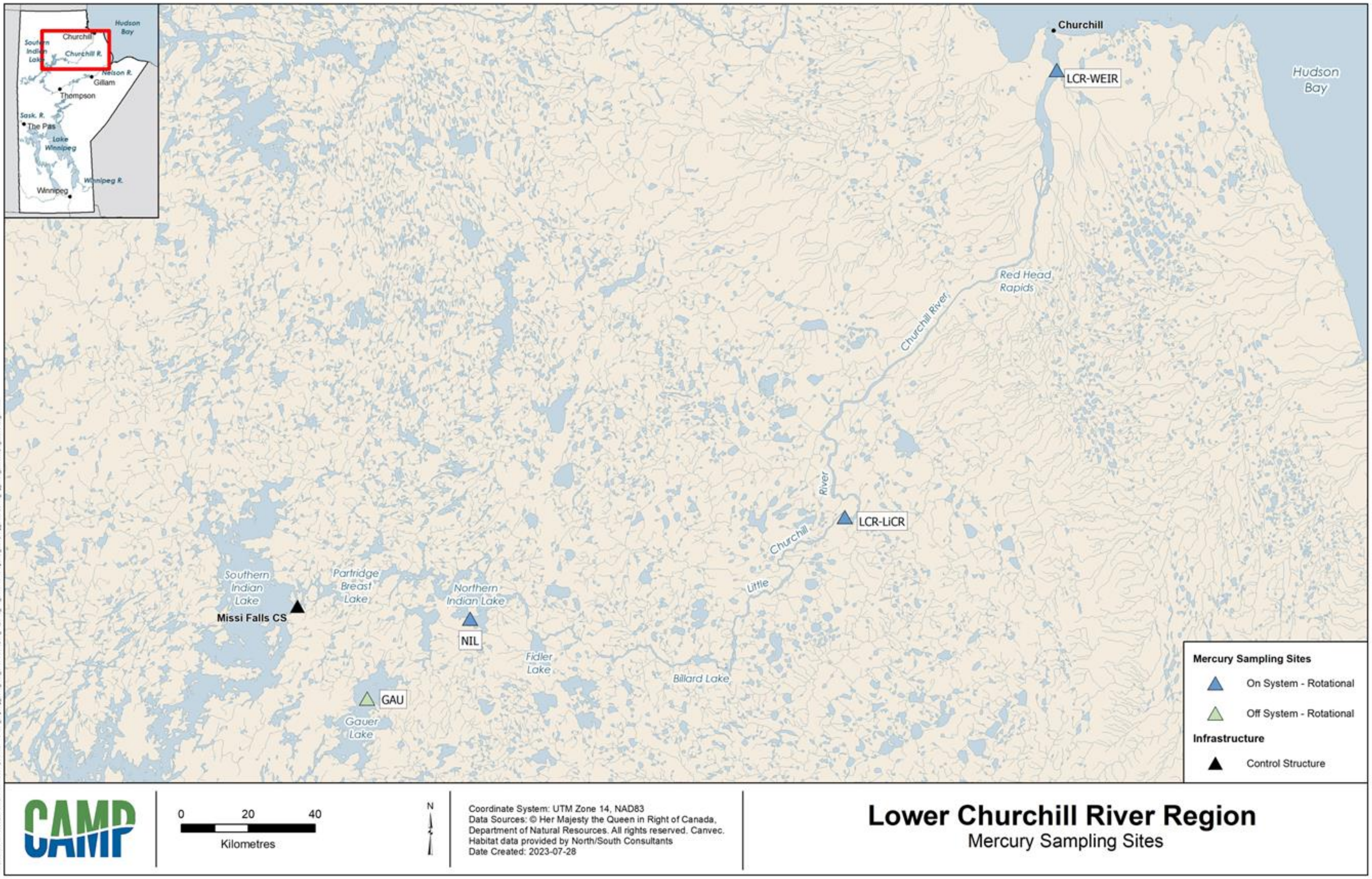


Figure 6.1-1. 2008-2019 Fish mercury sampling sites.

6.2 MERCURY IN FISH

6.2.1 ARITHMETIC MEAN MERCURY CONCENTRATION

6.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Churchill River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Northern Indian Lake

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.058 parts per million (ppm) in 2016 to a high of 0.126 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Lake Whitefish of the same length (Figure 6.2-1).

Northern Pike

The arithmetic mean mercury concentration of Northern Pike over the four years of monitoring ranged from a low of 0.488 ppm in 2019 to a high of 0.593 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Northern Pike of the same length (Figure 6.2-2).

Walleye

The arithmetic mean mercury concentration of Walleye over the four years of monitoring ranged from a low of 0.394 ppm in 2016 to a high of 0.522 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Walleye of the same length (Figure 6.2-3).

Yellow Perch

The arithmetic mean mercury concentration of 1-year-old Yellow Perch over the three years of monitoring ranged from a low of 0.028 ppm in 2019 to a high of 0.034 ppm in 2013 (Table 6.2-2; Figure 6.2-4).

Lower Churchill River at the Little Churchill River

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the three years of monitoring ranged from a low of 0.113 ppm in 2016 to a high of 0.118 ppm in 2013 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Lake Whitefish of the same length (Figure 6.2-1).

Northern Pike

The arithmetic mean mercury concentration of Northern Pike over the three years of monitoring ranged from a low of 0.332 ppm in 2013 to a high of 0.474 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Northern Pike of the same length (Figure 6.2-2).

Walleye

The arithmetic mean mercury concentration of Walleye over the three years of monitoring ranged from a low of 0.417 ppm in 2016 to a high of 0.482 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Walleye of the same length (Figure 6.2-3).

Yellow Perch

Over the three years of monitoring Yellow Perch were not submitted for mercury analysis from the lower Churchill River at the Little Churchill River (Table 6.2-2).

Lower Churchill River at the Churchill Weir

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish in the only year of monitoring was 0.109 in 2017 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Lake Whitefish of the same length (Figure 6.2-1).

Northern Pike

The arithmetic mean mercury concentration of Northern Pike in the only year of monitoring was 0.277 ppm in 2017 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Northern Pike of the same length (Figure 6.2-2).

Walleye

Walleye were not collected for mercury analysis from the lower Churchill River at the weir in the first year of monitoring in error (Table 6.2-1).

Yellow Perch

Yellow Perch were not submitted for mercury analysis from the lower Churchill River at the weir in the first year of monitoring (Table 6.2-2).

6.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Churchill River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Gauer Lake

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.028 ppm in 2016 to a high of 0.045 ppm in 2019 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Lake Whitefish of the same length (Figure 6.2-1).

Northern Pike

The arithmetic mean mercury concentration of Northern Pike over the four years of monitoring ranged from a low of 0.229 ppm in 2016 to a high of 0.272 ppm in 2013 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Northern Pike of the same length (Figure 6.2-2).

Walleye

The arithmetic mean mercury concentration of Walleye over the four years of monitoring ranged from a low of 0.182 ppm in 2019 to a high of 0.250 ppm in 2010 (Table 6.2-1). The mercury concentration typically increased with fork length, although there was variation in the mercury concentration of Walleye of the same length (Figure 6.2-3).

Yellow Perch

The arithmetic mean mercury concentration of 1-year-old Yellow Perch over the three years of monitoring was below the laboratory detection limit (<0.010) ppm in 2013 and 0.017 ppm in 2019 (Table 6.2-2; Figure 6.2-4). No Yellow Perch were submitted for mercury analysis in 2016.

Table 6.2-1. 2009-2019 Fork length, age, and mercury concentrations of Lake Whitefish, Northern Pike, and Walleye.

Species	Waterbody	Year	Fork Length (mm)					Age (years)					Mercury (ppm)						
			n[1]	Mean	Min[2]	Max[2]	SE[3]	n	Mean	Min	Max	SE	n	Mean	Min	Max	SE	Standard Mean[4]	95% CL[5]
LKWH	NIL	2010	32	353	194	475	15	32	9	4	24	1	32	0.126	0.029	0.304	0.013	0.112	0.101-0.125
		2013	17	353	201	488	19	17	9	3	24	1	17	0.094	0.027	0.298	0.017	0.078	0.060-0.103
		2016	36	343	182	468	15	35	7	1	19	1	36	0.058	0.016	0.174	0.007	0.051	0.043-0.060
		2019	36	343	188	492	15	34	7	2	16	1	36	0.107	0.023	0.236	0.008	0.103	0.091-0.118
	LCR-LiCR	2010	36	400	225	519	10	35	9	4	23	1	36	0.117	0.040	0.343	0.011	0.073	0.062-0.085
		2013	33	391	172	473	12	32	7	2	11	0	33	0.118	0.037	0.204	0.009	0.100	0.087-0.114
		2016	38	365	136	470	15	36	6	1	14	0	38	0.113	0.021	0.301	0.011	0.094	0.080-0.111
	LCR-WEIR	2017	21	337	210	481	16	21	5	2	12	0	21	0.109	0.053	0.286	0.013	not significant	
	GAU	2010	36	373	268	502	12	33	10	4	30	1	36	0.041	0.018	0.097	0.003	0.036	0.032-0.040
		2013	36	333	191	485	13	34	7	3	20	1	36	0.034	0.016	0.094	0.003	0.034	0.030-0.038
		2016	36	358	261	481	11	36	7	3	15	1	36	0.028	0.016	0.062	0.002	0.026	0.023-0.029
		2019	36	379	238	503	12	36	9	3	17	1	36	0.045	0.018	0.113	0.004	0.037	0.033-0.042
NRPK	NIL	2010	36	572	335	928	24	36	7	3	17	0	36	0.593	0.257	1.67	0.050	0.531	0.484-0.583
		2013	20	580	295	862	31	19	7	2	11	1	20	0.535	0.197	0.810	0.044	0.474	0.406-0.554
		2016	36	608	325	935	26	35	6	2	10	0	36	0.489	0.068	1.09	0.042	0.375	0.317-0.443
		2019	36	607	375	908	20	36	5	3	9	0	36	0.488	0.184	0.842	0.029	0.413	0.368-0.463
	LCR-LiCR	2010	36	668	425	1035	27	35	9	4	14	0	36	0.474	0.160	1.20	0.041	0.331	0.293-0.373
		2013	35	606	303	965	29	34	7	2	15	1	35	0.332	0.098	0.910	0.033	0.269	0.242-0.299
		2016	25	666	457	934	29	25	6	2	13	0	25	0.440	0.102	1.19	0.044	0.307	0.266-0.355
	LCR-WEIR	2017	10	542	451	681	21	10	5	3	10	1	10	0.277	0.160	0.753	0.057	0.258	0.195-0.343
	GAU	2010	36	573	353	1024	21	36	6	2	16	0	36	0.238	0.084	0.740	0.022	0.202	0.182-0.224
		2013	36	588	287	874	23	36	6	2	12	0	36	0.272	0.029	0.628	0.026	0.196	0.172-0.224
		2016	36	591	325	870	17	36	6	2	11	0	36	0.229	0.055	0.427	0.016	0.180	0.164-0.199
		2019	36	581	324	937	28	36	5	2	12	0	36	0.249	0.053	0.636	0.026	0.197	0.177-0.218
WALL	NIL	2010	36	380	254	568	14	36	11	5	26	1	36	0.522	0.191	1.22	0.042	0.528	0.471-0.592
		2013	36	408	253	562	13	36	10	3	17	1	36	0.449	0.161	0.96	0.031	0.411	0.372-0.454
		2016	36	391	195	570	19	36	10	3	20	1	36	0.394	0.099	1.21	0.041	0.366	0.325-0.412
		2019	36	374	100	607	23	36	9	1	18	1	36	0.432	0.069	0.822	0.029	0.456	0.419-0.497
	LCR-LiCR	2010	36	442	209	613	18	36	13	3	28	1	36	0.482	0.072	1.39	0.056	0.304	0.277-0.333
		2013	39	403	152	610	23	39	10	1	30	1	39	0.448	0.055	1.35	0.057	0.369	0.323-0.421
		2016	37	416	139	585	19	35	9	3	18	1	37	0.417	0.049	1.21	0.045	0.338	0.307-0.371
	LCR-WEIR	2017	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	
	GAU	2010	33	390	224	515	10	32	10	4	15	1	33	0.250	0.128	0.608	0.017	0.247	0.223-0.273
		2013	36	382	131	525	16	36	9	1	18	1	36	0.182	0.053	0.396	0.016	0.180	0.162-0.201
		2016	36	440	179	531	11	36	10	2	20	1	36	0.190	0.057	0.449	0.013	0.157	0.142-0.174
		2019	36	373	101	602	22	36	8	2	17	1	36	0.182	0.032	0.447	0.018	0.189	0.172-0.208

Notes:

1. n = sample size.
2. Min = minimum; Max = maximum.
3. SE = standard error.
4. For standard lengths of 350 mm for Lake Whitefish (LKWH), 550 mm for Northern Pike (NRPK), and 400 mm for Walleye (WALL.).
5. CL = confidence limits.

Table 6.2-2. 2013-2019 Fork length and mercury concentrations of 1-year-old Yellow Perch.

Species	Waterbody	Year	n[1]	Fork Length (mm)				Mercury (ppm)			
				Mean	Min[2]	Max[2]	SE[3]	Mean	Min	Max	SE
YLPR	NIL	2013	9	76	70	85	1	0.034	0.012	0.051	0.004
		2016	1	75	-	-	-	0.029	-	-	-
		2019	3	81	79	85	2	0.028	0.027	0.029	0.000
	LCR-LiCR	2013	0	-	-	-	-	-	-	-	-
		2016	0	-	-	-	-	-	-	-	-
		2019	0	-	-	-	-	-	-	-	-
	LCR-WEIR	2017	0	-	-	-	-	-	-	-	-
	GAU	2013	15	75	68	86	1	<0.010	<0.010	0.019	-
		2016	0	-	-	-	-	-	-	-	-
		2019	1	90	-	-	-	0.017	-	-	-

Notes:

1. n = sample size.
2. Min = minimum; Max = maximum.
3. SE = standard error.

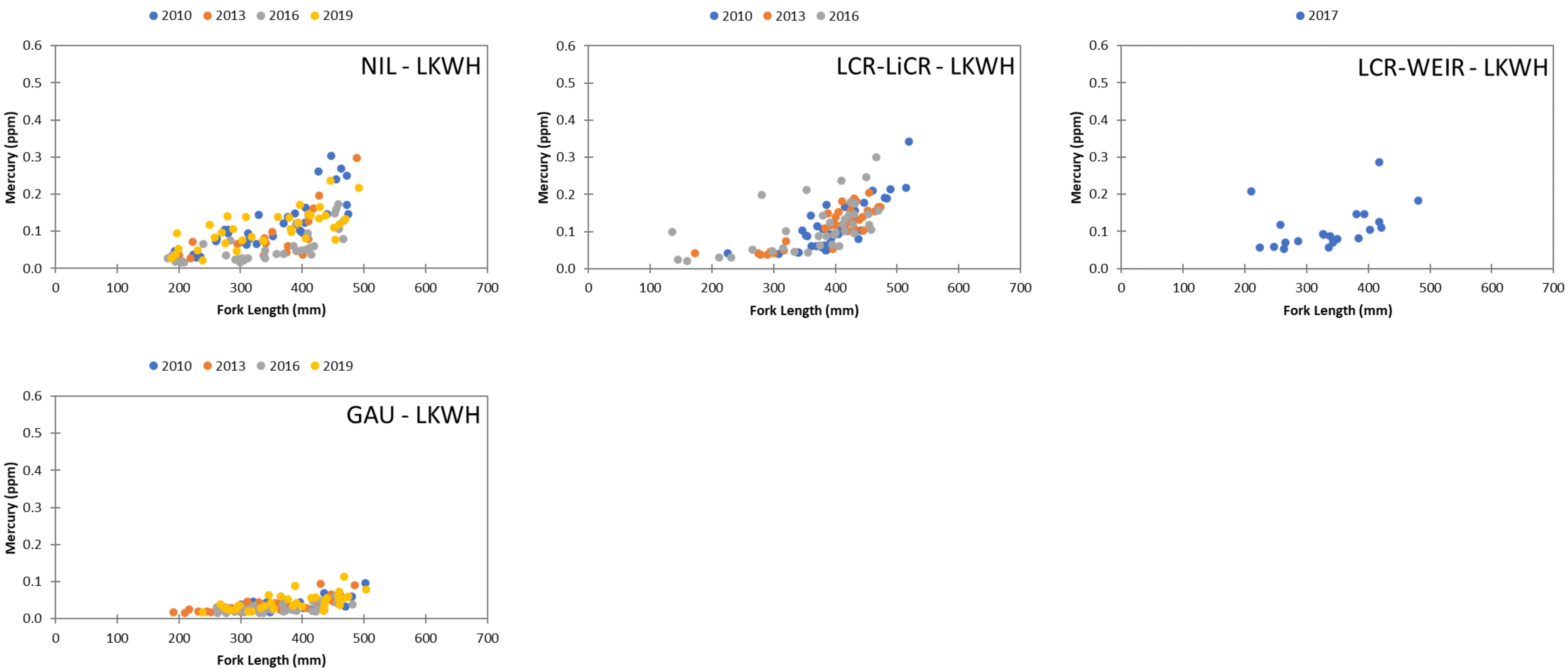


Figure 6.2-1. 2010-2019 Mercury concentration versus fork length of Lake Whitefish.

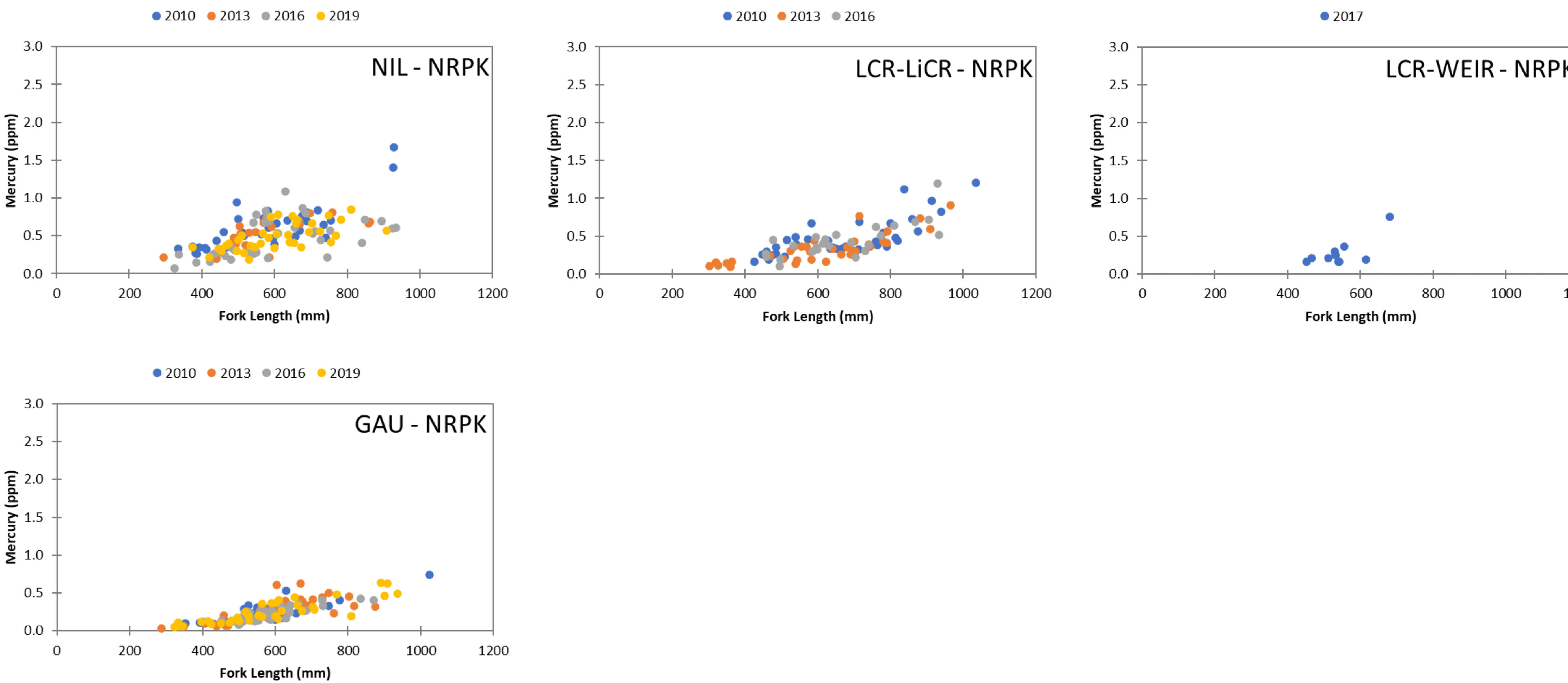


Figure 6.2-2. 2010-2019 Mercury concentration versus fork length of Northern Pike.

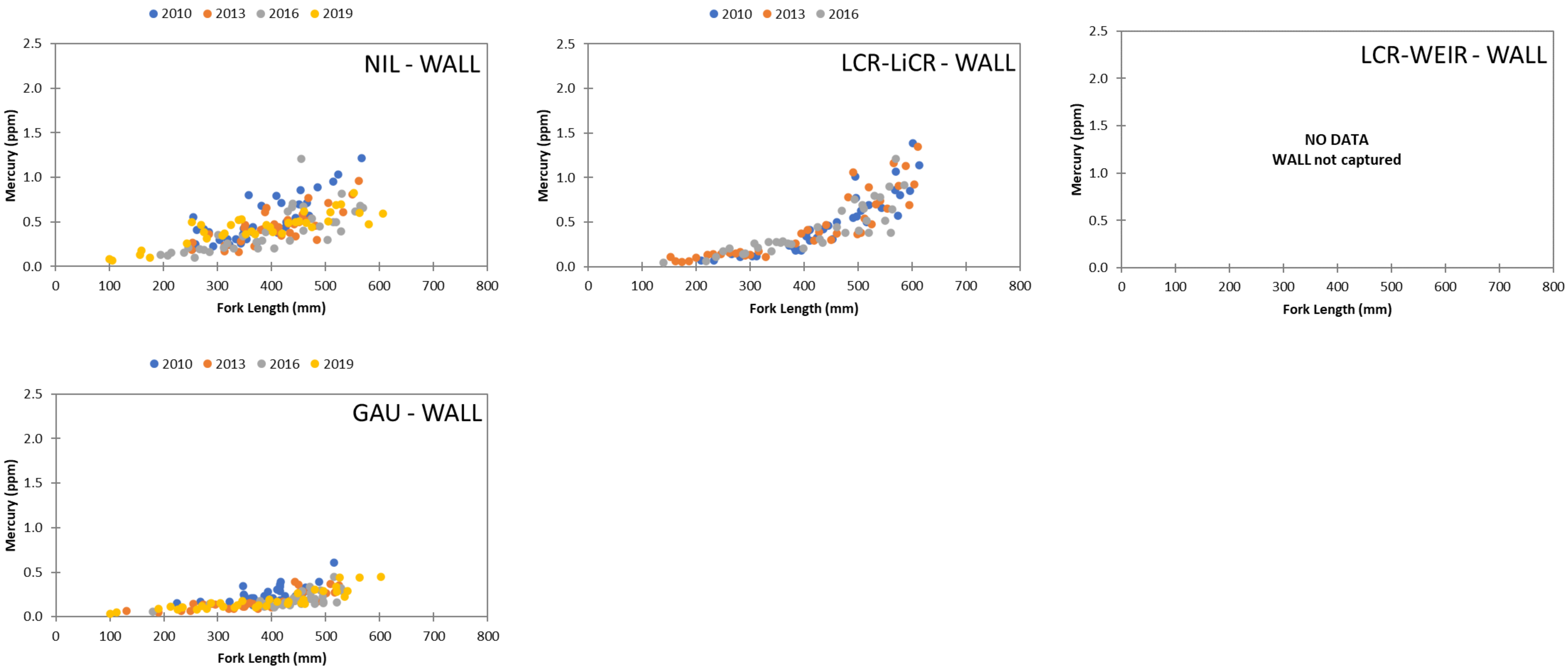


Figure 6.2-3. 2010-2019 Mercury concentration versus fork length of Walleye.

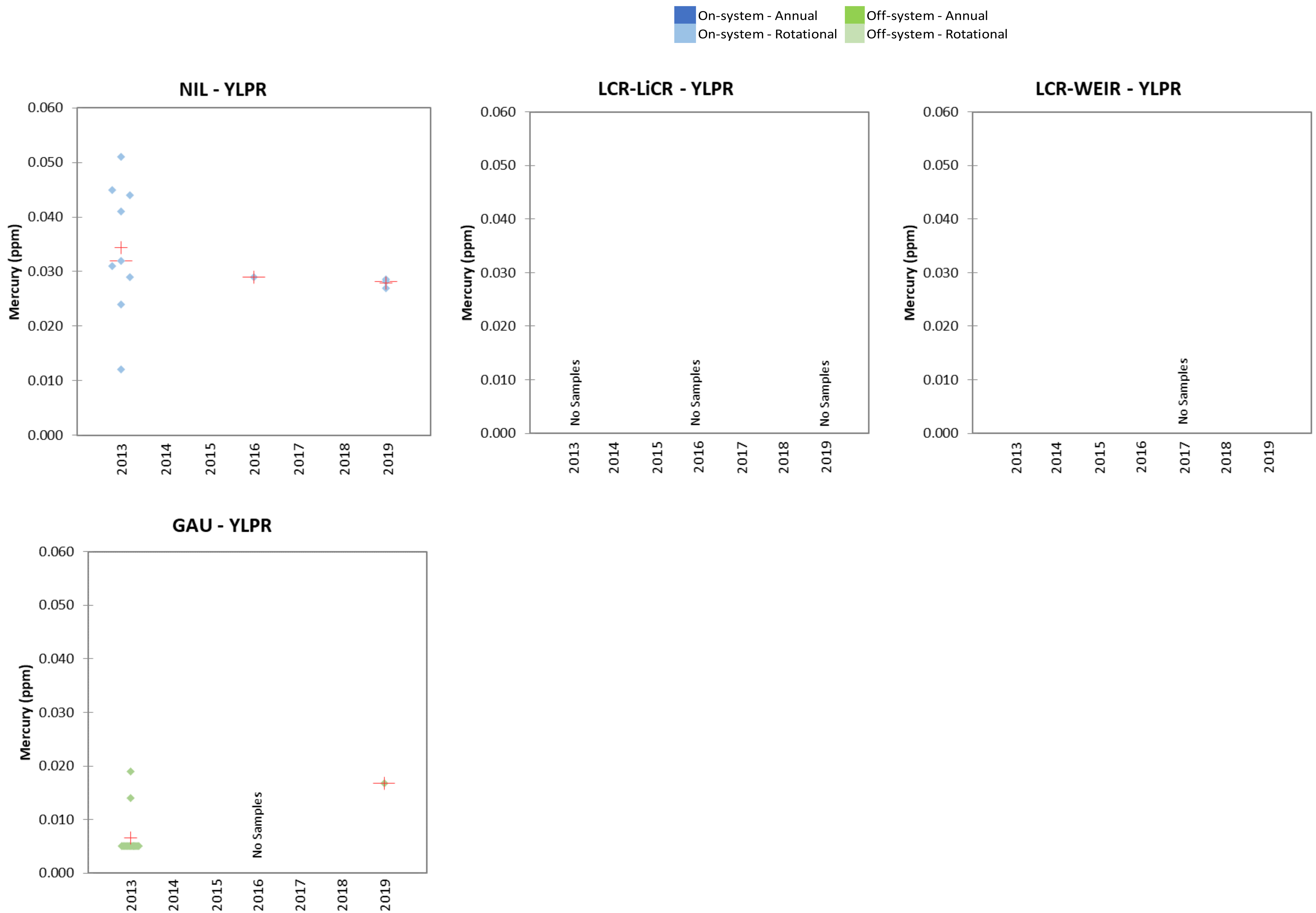


Figure 6.2-4. 2013-2019 Mercury concentrations of 1-year-old Yellow Perch.

6.2.2 LENGTH-STANDARDIZED MEAN CONCENTRATION

6.2.2.1 ON-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Churchill River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Northern Indian Lake

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the four years of monitoring ranged from 0.051 in 2016 to a high of 0.112 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.086 ppm, the median concentration was 0.091 ppm, and the IQR was 0.072–0.106 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2010 when it was above the IQR.

Northern Pike

The length-standardized mean mercury concentration of a 550 mm Northern Pike over the four years of monitoring ranged from a low of 0.375 ppm in 2016 to a high of 0.531 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.448 ppm, the median concentration was 0.444 ppm, and the IQR was 0.403–0.488 ppm (Figure 6.2-6). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2010 when it was above the IQR.

Walleye

The length-standardized mean mercury concentration of a 400 mm Walleye over the four years of monitoring ranged from a low of 0.366 ppm in 2016 to a high of 0.528 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.440 ppm, the median concentration was 0.434 ppm, and the IQR was 0.400–0.474 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2010 when it was above the IQR.

Lower Churchill River at the Little Churchill River

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the three years of monitoring ranged from 0.073 in 2010 to a high of 0.100 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.089 ppm, the median concentration was 0.094 ppm, and the IQR was 0.083–0.097 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2010 when it was below the IQR and in 2013 when it was above the IQR.

Northern Pike

The length-standardized mean mercury concentration of a 550 mm Northern Pike over the three years of monitoring ranged from a low of 0.269 ppm in 2013 to a high of 0.331 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.302 ppm, the median concentration was 0.307 ppm, and the IQR was 0.288–0.319 ppm (Figure 6.2-6). The annual mean mercury concentration fell within the IQR except in 2013 when it was below the IQR and in 2010 when it was above the IQR.

Walleye

The length-standardized mean mercury concentration of a 400 mm Walleye over the three years of monitoring ranged from a low of 0.304 ppm in 2010 to a high of 0.369 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.337 ppm, the median concentration was 0.338 ppm, and the IQR was 0.321–0.353 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2010 when it was below the IQR and in 2013 when it was above the IQR.

Lower Churchill River at the Churchill Weir

Lake Whitefish

A standard mean could not be calculated for 2017 because there was not a significant relationship between mercury concentration and fork length (Table 6.2-1).

Northern Pike

The length-standardized mean mercury concentration of a 550 mm Northern Pike was 0.258 ppm in 2017 (Table 6.2-1).

Walleye

A standard mean could not be calculated for 2017 because Walleye were not submitted for mercury analysis (Table 6.2-1).

6.2.2.2 OFF-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Churchill River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Gauer Lake

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the four years of monitoring ranged from a low of 0.026 ppm in 2016 to a high of 0.037 ppm in 2019 (Table 6.2-1).

The overall mean concentration was 0.033 ppm, the median concentration was 0.035 ppm, and the IQR was 0.032–0.036 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2019 when it was above the IQR.

Northern Pike

The length-standardized mean mercury concentration of a 550 mm Northern Pike over the four years of monitoring ranged from a low of 0.180 ppm in 2016 to a high of 0.202 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.194 ppm, the median concentration was 0.197 ppm, and the IQR was 0.192–0.198 ppm (Figure 6.2-6). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2010 when it was above the IQR.

Walleye

The length-standardized mean mercury concentration of a 400 mm Walleye over the four years of monitoring ranged from a low of 0.157 ppm in 2016 to a high of 0.247 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.193 ppm, the median concentration was 0.185 ppm, and the IQR was 0.175–0.203 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2016 when it was below the IQR and in 2010 when it was above the IQR.

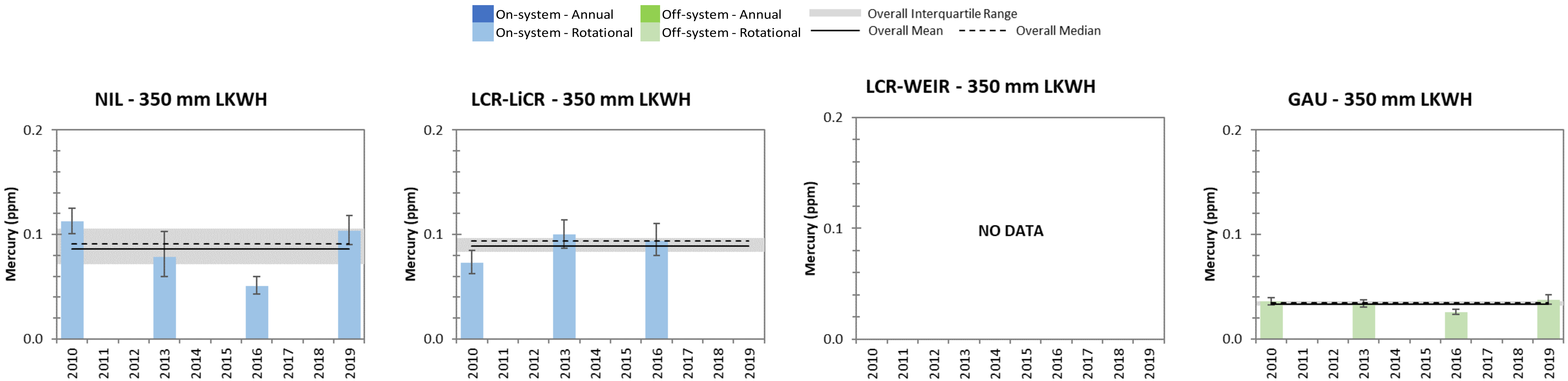


Figure 6.2-5. 2010-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Lake Whitefish.

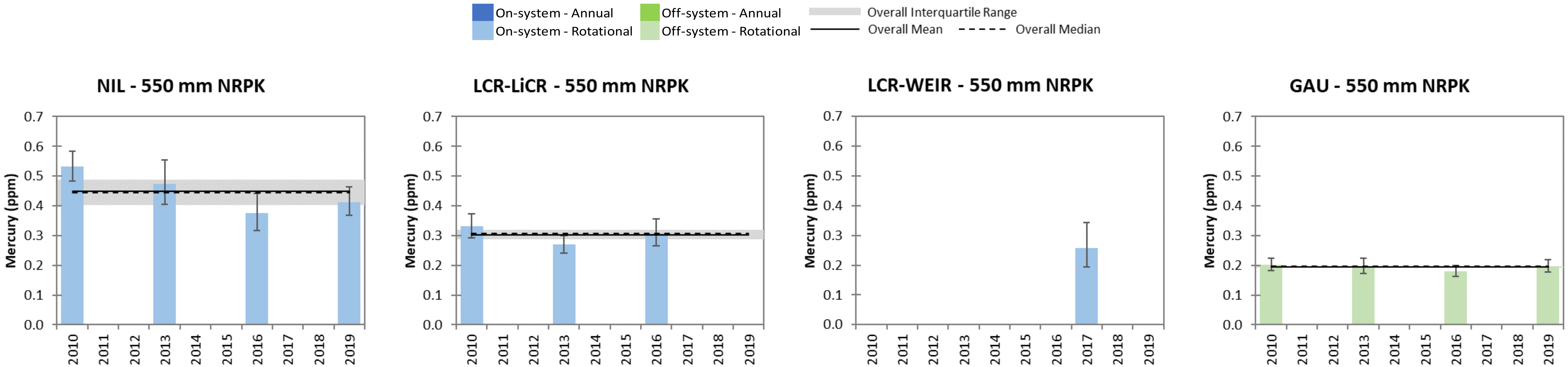


Figure 6.2-6. 2010-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Northern Pike.

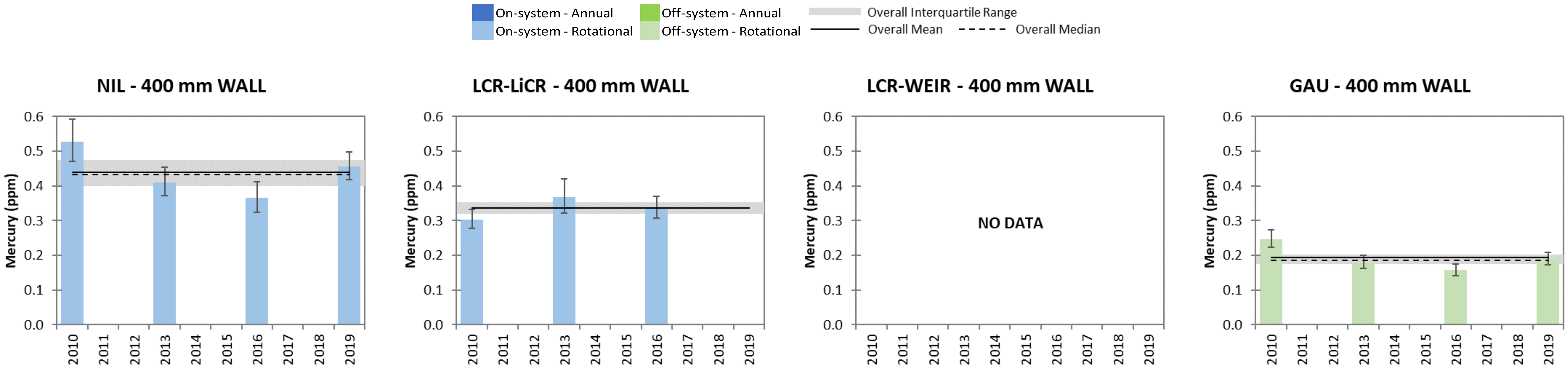


Figure 6.2-7. 2010-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Walleye.

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