Coordinated Aquatic Monitoring Program

CAMP Twelve Year Data Report (2008-2019)

Technical Document 8:

Lower Nelson River Region

Prepared by

Manitoba Hydro

And

North/South Consultants Inc.

2024

Report Citation

Coordinated Aquatic Monitoring Program (CAMP). 2024. CAMP Twelve Year Data Report (2008-2019). Report prepared for Manitoba/Manitoba Hydro CAMP Steering Committee by Manitoba Hydro and North/South Consultants Inc., Winnipeg, MB.

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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 Nelson River Region. The Lower Nelson River Region is composed of the reach of the Nelson River (including lakes and reservoirs) extending from the Kelsey Generating Station (GS) downstream to the river's outlet at Hudson Bay, the Burntwood River from First Rapids to Split Lake, an off-system river (Hayes River) and an off-system lake (Assean Lake; Figure 1-1). Waterbodies and sites monitored in this region over this period included six on-system and two off-system waterbodies or river reaches as follows:

- the Burntwood River;
- Split Lake;
- Stephens Lake - South;
- Stephens Lake – North;
- the lower Nelson River in the Limestone GS Forebay;
- the lower Nelson River downstream of the Limestone GS;
- the Hayes River (off-system); and
- Assean Lake (off-system).

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 Nelson River Region presented in this report include the physical environment (water regime and sedimentation), water quality, benthic invertebrates, 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, ACRONYMS, AND UNITS

ANN	Annual
CAMP	Coordinated Aquatic Monitoring Program
CCME	Canadian Council of Ministers of the Environment
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
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
GS(s)	Generating station(s)
h	hour
IC	Ice-cover season
IQR	Interquartile range
KF	Fulton's Condition Factor
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
no.	Number
ND	No data

n_S	Number of sites
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
SP	Spring
SN	Small mesh index gillnet gang
SU	Summer
spp.	species
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
ASSN	Assean Lake
BURNT	Burntwood River
HAYES	Hayes River
KETT GS	Kettle Generating Station
LMFB	Limestone Forebay
LNR	Lower Nelson River downstream of the Limestone Generating Station
STL-S	Stephens Lake - South
STL-N	Stephens Lake - North
SPLIT	Split Lake

FISH SPECIES LIST

Abbreviation	Common Species Name	Species Name
BRTR	Brook Trout	*Salvelinus fontinalis*
BURB	Burbot	*Lota lota*
CARP	Common Carp	*Cyprinus carpio*
CISC	Cisco	*Coregonus artedi*
EMSH	Emerald Shiner	*Notropis atherinoides*
FRDR	Freshwater Drum	*Aplodinotus grunniens*
JHDR	Johnny Darter	*Etheostoma nigrum*
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*
MOON	Mooneye	*Hiodon tergisus*
MTSC	Mottled Sculpin	*Cottus bairdii*
NRPK	Northern Pike	*Esox lucius*
RNSM	Rainbow Smelt	*Osmerus mordax*
SAUG	Sauger	*Sander canadensis*
SHRD	Shorthead Redhorse	*Moxostoma macrolepidotum*
SLLM	Silver Lamprey	*Ichthyomyzon unicuspis*
SLRD	Silver Redhorse	*Moxostoma anisurum*
SLSC	Slimy Sculpin	*Cottus cognatus*
SPSC	Spoonhead Sculpin	*Bottus 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 Nelson River Region. The Lower Nelson River Region is composed of the reach of the Nelson River (including lakes and reservoirs) extending from the Kelsey Generating Station (GS) downstream to the river's outlet at Hudson Bay, the Burntwood River from First Rapids to Split Lake, an off-system river (Hayes River) and an off-system lake (Assean Lake; Figure 1-1). Waterbodies and sites monitored in this region over this period included six on-system and two off-system waterbodies or river reaches as follows:

- the Burntwood River;
- Split Lake;
- Stephens Lake - South;
- Stephens Lake – North;
- the Limestone Forebay;
- the lower Nelson River downstream of the Limestone GS;
- the Hayes River (off-system); and
- Assean Lake (off-system).

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 Nelson River Region presented in this report include the physical environment (water regime and sedimentation), water quality, benthic invertebrates, 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 Nelson 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
Burntwood River	BURNT	●		CONT		ANN	ROT	ROT	
Split Lake	SPLIT	●		CONT		ANN	ANN	ANN	ROT
Lower Nelson River downstream of the Limestone GS	LNR	●				ANN	ANN	ANN	ROT
Stephens Lake - South	STL-S	●		CONT		ROT	ROT	ROT	ROT
Stephens Lake - North	STL-N	●		CONT		ROT	ROT	ROT	
Kettle GS	KETT GS	●		CONT					
Limestone Forebay	LMFB	●		CONT	CONT	ROT	ROT	ROT	ROT
Hayes River	HAYES		●	CONT		ANN	ANN	ANN	ROT
Assean Lake	ASSN		●	CONT		ANN	ANN	ANN	ROT

Notes:

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

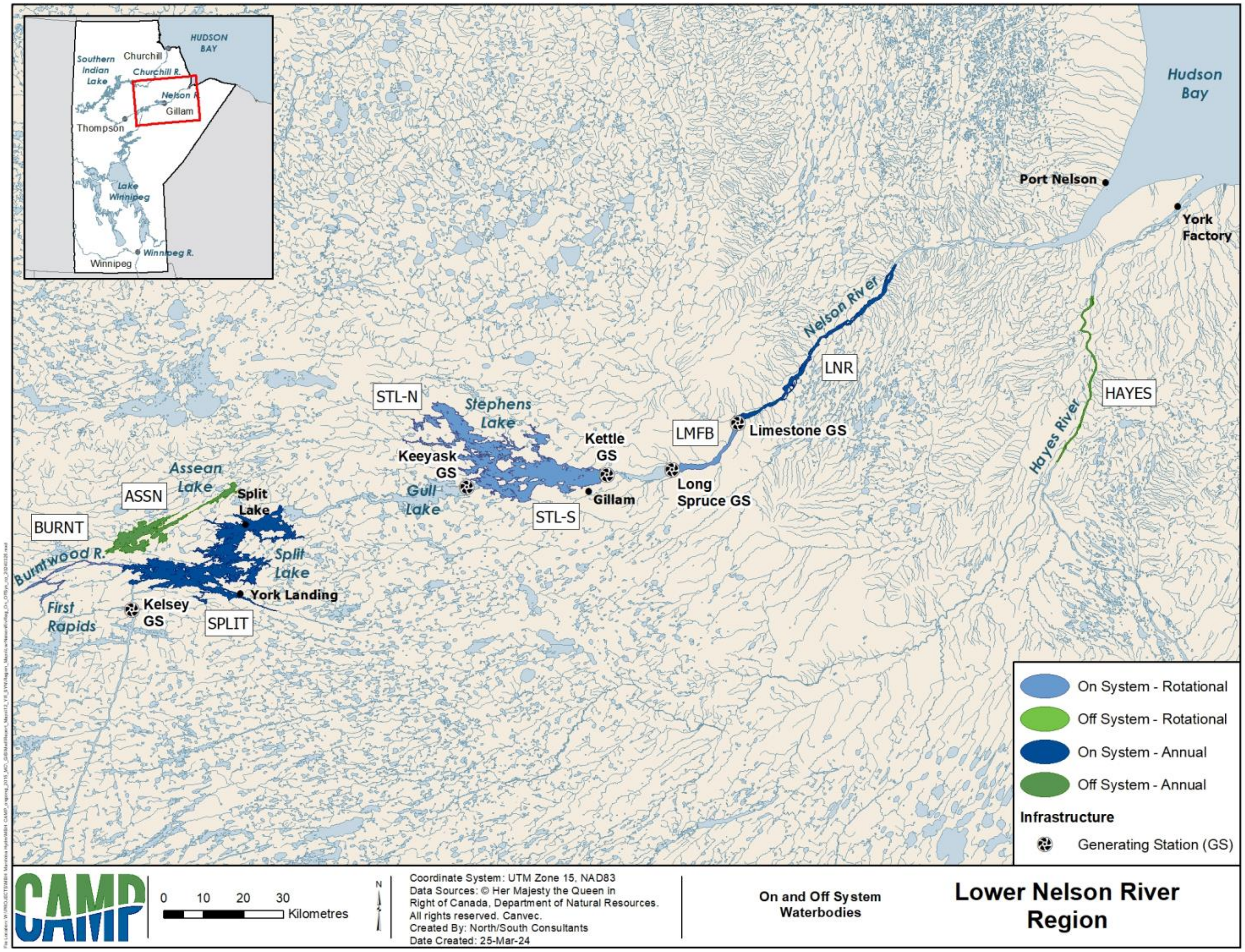


Figure 1-1. On-system and off-system waterbodies and river reaches sampled under CAMP in the Lower Nelson River Region: 2008-2019.


Photograph 1. Burntwood River and First Rapids.


Photograph 2. Split Lake and the Community of Split Lake.

Photograph 3. Stephens Lake – North (left) and Stephens Lake – South (right).

Photograph 4. Limestone GS, forebay, and the lower Nelson River.

Photograph 5. The lower Nelson River downstream of the Limestone GS.

Photograph 6. The Hayes River.

Photograph 7. Assean 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 Nelson River Region. Six waterbodies were monitored in the Lower Nelson River Region: four on-system sites (Split Lake, Stephens Lake [Kettle GS forebay], the Limestone forebay, and the Nelson River downstream from the Limestone GS); and two off-system sites (Assean Lake and the Hayes River). In addition, a continuous water quality monitoring station is located at the Limestone GS. 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 Nelson River Region, meteorological conditions from ECCC's Gillam 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 in 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 ECCC climate normals to provide a summary of the Gillam 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 Gillam station is used herein to illustrate climate conditions in the Lower Nelson 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: 5061001). 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 Gillam 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 ºC) 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, 2010 recorded considerably warmer temperatures from January to April.

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 +/- 1ºC 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, September, and December 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 most years in the monitoring period experienced near normal temperatures, with the exception of 2010 to 2012 and 2016 which were above normal; 2010 had the warmest annual average temperature at -0.5ºC, while 2013 had the coolest annual average temperature at -4.6ºC. The maximum and minimum monthly average air temperatures during the monitoring period were 18.3ºC (July 2012) and -28.6ºC (December 2013), respectively.

Table 2.2-1. Gillam 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	-22.3	-25.8	-19.1	-4.8	2.7	11.8	15.5	17.2	6.6	2.4	-8.8	-27.2	-4.3
2009	-22.9	-21.0	-17.1	-3.7	-1.4	10.0	13.9	12.4	11.3	-0.1	-6.0	-22.2	-3.9
2010	-18.7	-16.6	-5.6	2.3	3.9	12.4	18.0	14.0	7.3	2.7	-8.6	-17.0	-0.5
2011	-24.7	-21.2	-16.7	-5.0	3.3	13.4	16.7	15.3	11.3	3.0	-9.4	-18.5	-2.7
2012	-22.7	-16.8	-11.6	-3.1	4.8	11.2	18.3	14.7	9.8	-0.4	-14.0	-21.7	-2.6
2013	-26.8	-21.3	-15.0	-8.7	5.0	13.9	16.6	14.3	11.0	-0.1	-15.2	-28.6	-4.6
2014	-25.4	-23.2	-19.6	-8.8	4.7	12.1	15.7	14.5	7.3	1.6	-16.2	-17.3	-4.5
2015	-24.9	-26.7	-15.0	-4.3	3.9	12.4	16.6	13.4	9.2	0.9	-8.3	-13.6	-3.0
2016	-20.6	-23.2	-13.5	-7.2	5.8	13.1	16.0	14.9	10.2	0.2	-3.4	-21.9	-2.5
2017	-17.9	-19.4	-14.9	-6.5	4.0	12.0	17.3	15.6	9.7	1.5	-14.8	-21.9	-2.9
2018	-24.7	-23.2	-11.8	-6.2	5.8	12.9	15.9	13.9	4.9	-2.2	-14.5	-17.7	-3.9
2019	-26.1	-23.9	-12.0	-3.5	3.1	12.9	16.9	13.6	9.5	1.5	-12.3	-20.4	-3.4
2020	-19.1	-20.9	-15.4	-7.3	2.7	11.0	17.9	15.4	7.7	-2.0	-13.7	-18.4	-3.5
1981-2010 Normal	-24.4	-21.7	-14.6	-4.4	3.9	11.6	15.8	14.4	7.9	0.0	-11.6	-21.4	-3.7

Below Normal **Near Normal** **Above Normal**

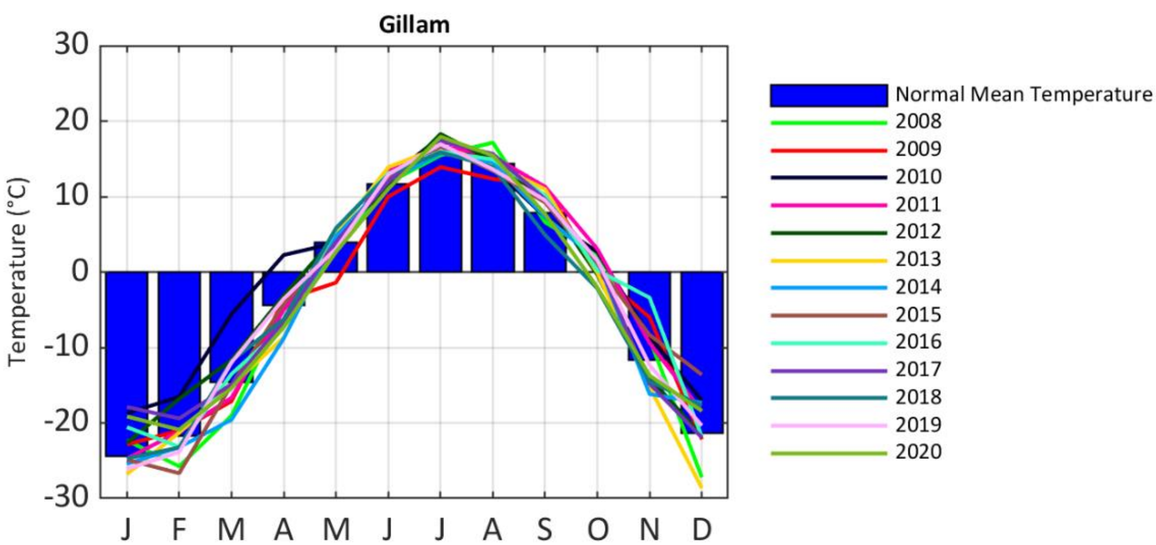


Figure 2.2-1. Gillam mean monthly air temperature (in ºC) compared to 1981-2010 normal.

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 Gillam follows a noticeable seasonal pattern, where generally the highest amounts of precipitation fall during the summer months (July and August) and the lowest amounts fall during the winter months (January and February). 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, August, and September 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, June, July, August, and October generally experienced more than normal precipitation (≥ 7 out of 13 months above normal), while February, March, May, November, and December generally experienced less than normal precipitation (≥ 7 out of 13 months below normal). On an annual basis, no distinct patterns in the data were identified as most of the years experienced near normal conditions. However, there were more years with above normal precipitation than below normal in the monitoring period; 2020 had the highest annual total precipitation (701.6 mm), while 2013 had the lowest annual total precipitation (429.0 mm). The maximum and minimum monthly total precipitation recorded during the monitoring period were 190.3 mm (August 2019) and 0.2 mm (March 2017), respectively.

Table 2.2-2. Gillam 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	37.9	20.9	38.0	2.6	33.4	55.6	92.8	72.4	62.0	26.4	32.3	12.0	486.3
2009	17.4	5.6	33.1	27.1	32.0	83.2	94.0	38.1	42.0	46.4	22.3	10.3	451.5
2010	22.4	7.4	9.5	29.6	11.8	15.0	111.2	174.0	101.0	70.6	28.8	30.8	612.1
2011	9.0	16.9	11.0	15.4	45.9	30.0	104.2	125.4	47.4	64.2	39.6	32.0	541.0
2012	20.8	5.0	38.2	25.0	21.0	108.6	60.4	93.6	55.4	75.0	15.0	48.0	566.0
2013	20.0	10.2	10.6	23.2	10.2	4.4	48.4	75.8	89.4	67.6	61.2	8.0	429.0
2014	23.2	26.5	6.5	15.4	31.6	62.0	45.5	120.7	31.2	84.0	23.6	18.8	489.0
2015	11.4	7.1	14.7	22.0	55.3	76.3	113.1	65.5	121.8	37.8	29.1	22.7	576.8
2016	20.0	11.7	26.9	7.6	56.9	37.3	99.8	46.0	75.0	100.9	18.8	0.6	501.4
2017	1.7	0.4	0.2	4.8	52.6	85.4	43.1	47.7	48.2	83.0	32.1	44.4	443.6
2018	29.2	5.9	13.7	10.2	9.0	73.8	105.6	110.8	81.0	21.0	34.6	15.3	510.1
2019	18.0	10.0	5.2	19.8	6.4	32.6	61.6	190.3	35.1	57.4	32.6	14.6	483.6
2020	17.3	25.4	20.4	40.0	46.5	151.0	127.8	87.4	55.3	41.2	69.8	19.6	701.6
1981-2010 Normal	19.6	19.0	22.7	21.7	42.6	55.8	78.6	76.1	56.8	42.2	38.0	23.3	496.4

Below Normal	Near Normal	Above Normal

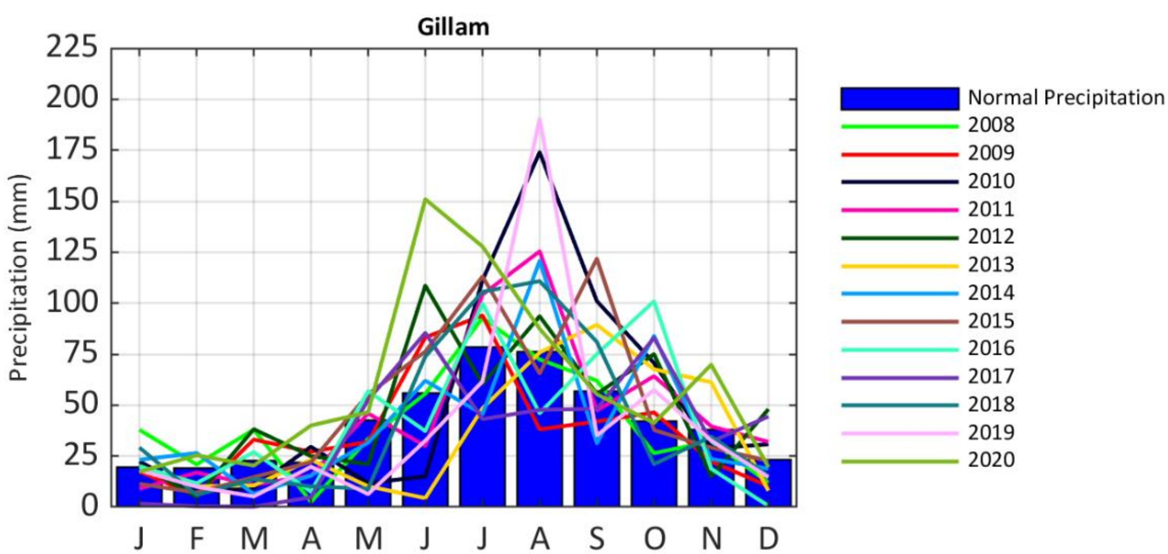


Figure 2.2-2. Gillam total monthly precipitation (in mm) compared to 1981-2010 normal.

2.3 WATER REGIME

The Nelson River drainage basin covers an area greater than one million square kilometers. Lower Nelson River flows are influenced by regulation of Lake Winnipeg outflows and the Churchill River Diversion (CRD), which diverts the majority of the Churchill River flow into the Nelson River through the Rat-Burntwood River system. Additional information on the lower Nelson River water regime 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 along the lower Nelson River occurred on Split Lake, Stephens Lake (Kettle forebay), in the Limestone forebay, and in the Nelson River downstream from the Limestone GS (Figure 2.3-1). Relative water levels for the lower Nelson River downstream from the Limestone GS can be inferred from lower Nelson River flows, which are reported at the Kettle GS. CAMP monitoring also occurs in the Burntwood River upstream from its confluence with Split Lake where it enters the Nelson River and begins to mix with water from the upper Nelson River. Relative water levels for the Burntwood River upstream from Split Lake can be inferred from the Burntwood River flow reported at the Thompson gauge.

Continuous water temperature is measured at the Limestone GS continuous water quality monitoring site (Figure 2.3-1). Monitoring started in 2017 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 Assean Lake and the Hayes River as the off-system waterbodies for this region (Figure 2.3-1). Assean Lake flows into the Nelson River at Clark Lake via the Assean River and is unaffected by Manitoba Hydro’s system. A water level gauge was established on Assean Lake in September 2009 as part of CAMP.

The Hayes River, which flows to Hudson Bay, is an off-system waterbody sampled annually under CAMP.

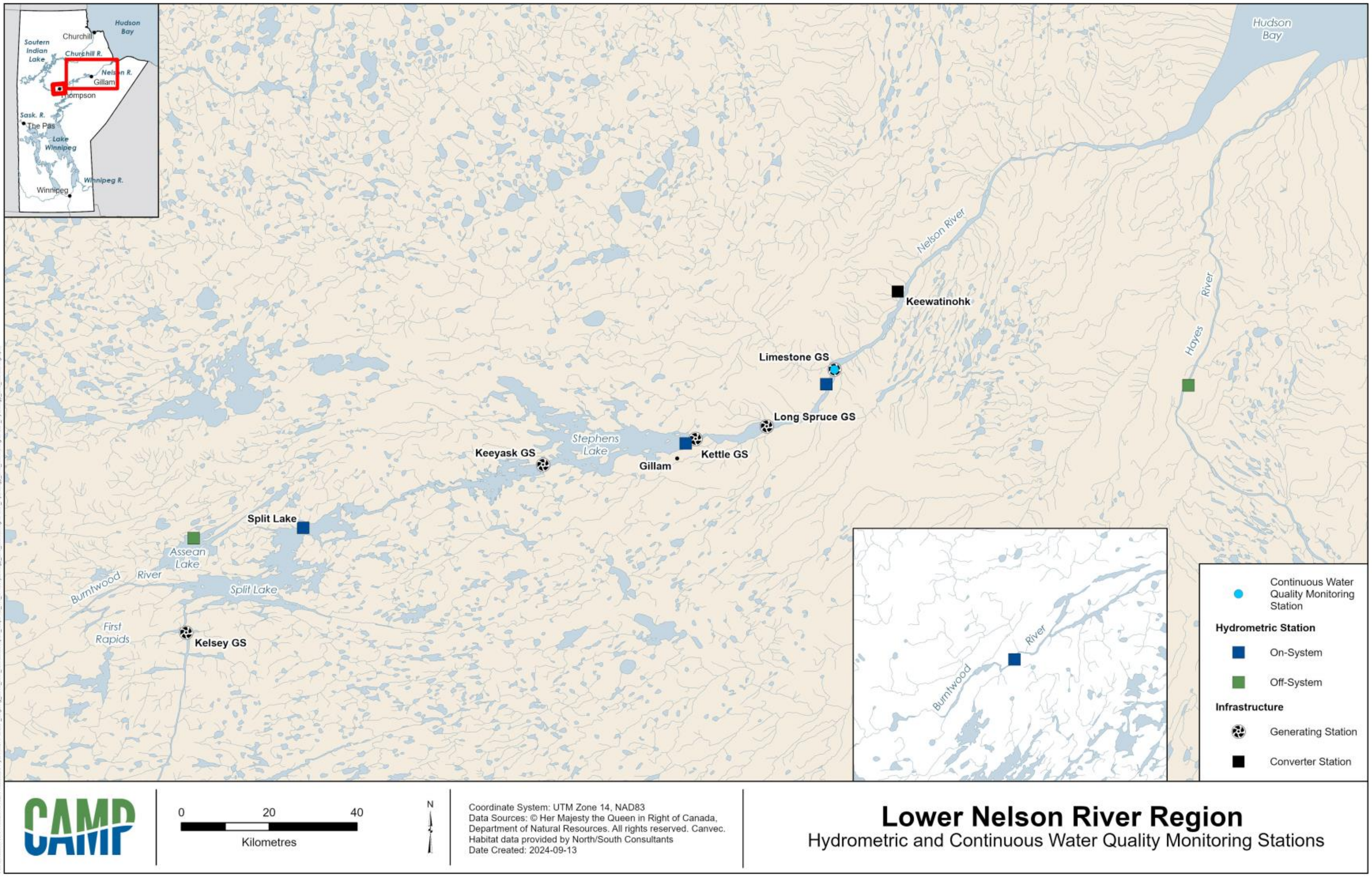


Figure 2.3-1. Hydrometric and continuous water quality monitoring stations in the Lower Nelson River Region.

2.3.1 FLOW

2.3.1.1 ON-SYSTEM SITES

Kettle GS

From 2008 to 2020, flow conditions on the lower Nelson River ranged from dry to very wet and were more frequently above average than below average compared to the reference period from 1981 to 2010 (Table 2.3-1 and Figure 2.3-2). Monthly mean flow ranged from 2,598 to 6,498 cms with the overall mean from 2008 to 2020 at 4,086 cms. Very dry flow conditions, defined as lower than 10th percentile, did not occur in any months during the 12 years of CAMP monitoring (Table 2.3-1). Flow conditions were very wet, defined as above the 90th percentile, in parts of nine years during CAMP, during the following months; August to September 2008, June to September 2009, August to November 2010, February and June to October 2011, August 2013, June to October 2014, August 2016, January to August 2017, and May to August 2020 (Table 2.3-1).

ROTATIONAL SITES

Burntwood River

The Burntwood River site is located in the lower reach of the Burntwood River, upstream of its confluence with Split Lake. Water levels are not measured at this location but would vary up and down with flow in the Burntwood River measured at Thompson.

From 2008 to 2020, flow conditions on the Burntwood River at Thompson ranged from very dry to very wet and were more frequently above average than below average, compared to the reference period from 1981 to 2010 (Table 2.3-2 and Figure 2.3-3). Monthly mean flow ranged from 536 to 1,209 cms with the overall mean from 2008 to 2020 at 941 cms. Very dry flow conditions, defined as lower than 10th percentile, occurred in parts of 2 years during the 12 years of CAMP monitoring during the following months: June to July 2011, and August to September 2014 (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; April to May 2008, April 2011, June to July 2012, May and October 2013, May 2014, March 2015, May 2017, May and July 2018, and May to June 2019 (Table 2.3-2).

2.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

From 2008 to 2020, flow conditions on the Hayes River ranged from very dry to very wet and were more frequently above average than below average compared to the reference period from 1981 to 2010 (Table 2.3-3 and Figure 2.3-4). Monthly mean flow ranged from 113 to 2,209 cms with the overall mean from 2008 to 2020 at 618 cms. Very dry flow conditions, defined as lower than 10th percentile, occurred in parts of 4 years during the 12 years of CAMP monitoring during the following months: March 2013, January to April 2014, February to April 2018, and February to March 2019 (Table 2.3-3). Flow conditions were very wet, defined as above the 90th percentile, in parts of nine years during CAMP, during the following months; August to October 2008, July 2009, September to November 2010, May 2011, May 2012, May 2015, October to November 2016, May to June 2017, and May to September 2020 (Table 2.3-3).

Table 2.3-1. Lower Nelson River monthly average flow (cms).

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	4081	3998	3983	3744	3788	3491	3337	4313	5246	4665	4331	4276	3787
2009	4420	3771	3776	3638	3686	4364	5329	5646	5519	5211	4416	3981	3659
2010	4182	3854	3777	3607	3356	2598	3358	4035	4938	5567	5666	5146	4267
2011	4912	4215	4536	4430	4123	4641	5432	5927	6311	6144	5207	4134	3816
2012	3500	4011	3586	3211	2834	3072	3234	3886	3993	3708	3203	3619	3624
2013	3924	3806	3713	3795	3538	3639	3718	4464	4863	3907	3943	3856	3810
2014	4524	3632	3542	3568	3622	4120	5027	5579	5759	5628	5411	4239	4080
2015	3828	4119	3883	3874	3761	3780	3658	3700	3802	3790	4017	3775	3771
2016	4075	3776	3960	4026	3739	3741	3609	4042	4748	4424	4419	4393	4010
2017	4642	4506	4568	4534	4704	6498	5941	5631	5183	3929	3101	3217	3853
2018	3222	3382	3510	3556	3178	3301	3000	3490	3201	2802	2663	3117	3464
2019	3375	3321	3190	3348	3139	3417	3322	3269	3331	3487	2885	3613	4167
2020	4462	4274	4327	4256	3925	5024	5350	5608	5488	4338	3612	3398	3904

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

Notes:

1. Percentiles calculated using 1981-2010 as the reference period.

Table 2.3-2. Burntwood River at Thompson monthly average flow (cms).

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	995	1032	1003	988	1116	1179	1071	837	687	928	1054	1033	1017
2009	898	1002	1010	1034	1063	859	755	767	696	621	883	1033	1060
2010	940	1031	1029	1040	1056	1002	916	816	651	870	899	967	1008
2011	803	1001	999	1008	1109	709	548	538	640	624	663	904	914
2012	1023	944	969	1001	1023	899	1125	1093	1034	1039	1045	1055	1050
2013	984	1050	1050	1037	1033	1090	924	771	729	937	1132	1078	989
2014	874	962	999	1026	1041	1209	865	670	573	536	652	911	1054
2015	917	1040	1037	1093	1027	883	799	779	859	834	791	881	991
2016	864	1038	1067	936	745	614	618	652	935	976	912	893	995
2017	919	994	989	967	964	1188	752	648	638	929	1003	991	965
2018	1026	959	956	969	983	1083	1076	1111	1059	1048	1024	1025	1018
2019	1028	995	1031	1000	1024	1083	1085	1049	1011	1039	1020	1007	994
2020	958	976	959	915	910	975	925	931	825	993	1068	1039	981

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 1981-2010 as the reference period.

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

Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	631	371	310	276	268				1890	1202	1142	749	480
2009	492	372	336	313	303			1519		806	635	479	360
2010	850					513	347	307	748	1567	1301	1116	721
2011	749	523	386	263	258	1701	977	718	869	930	1015	770	541
2012	588	418	371	415	605	1270			675	822	941	562	420
2013	373	332	265	208	244	582	752	498	419	424	478	295	229
2014	514	170	122	113	131	731	784	561	559	838	943	728	507
2015	563	370	257	227	465	1546	842	629	542	836	785	562	422
2016	613	362	320	297	462					444	1440	1353	
2017	562	429	333	324	365	1160	1342	799	526	384	450	337	279
2018	404	231	192	173	170	570	403	549	486	762	520	369	299
2019	548	242	202	181	365	653	433	354	616	979	1044	966	528
2020	891	322	248	230	282	1385	2035	2209	1330	1168	1097	364	241

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 1981-2010 as the reference period.

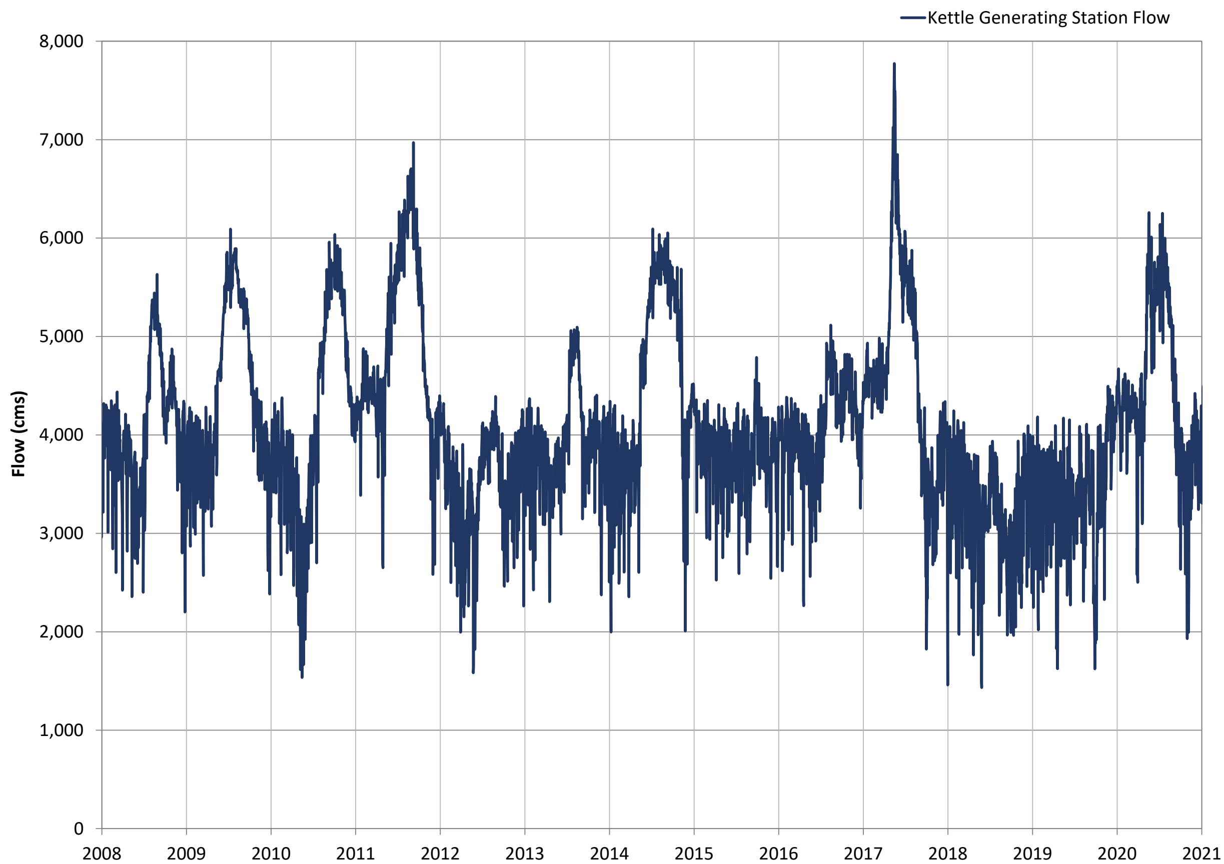


Figure 2.3-2. 2008-2020 Lower Nelson River daily mean flow.

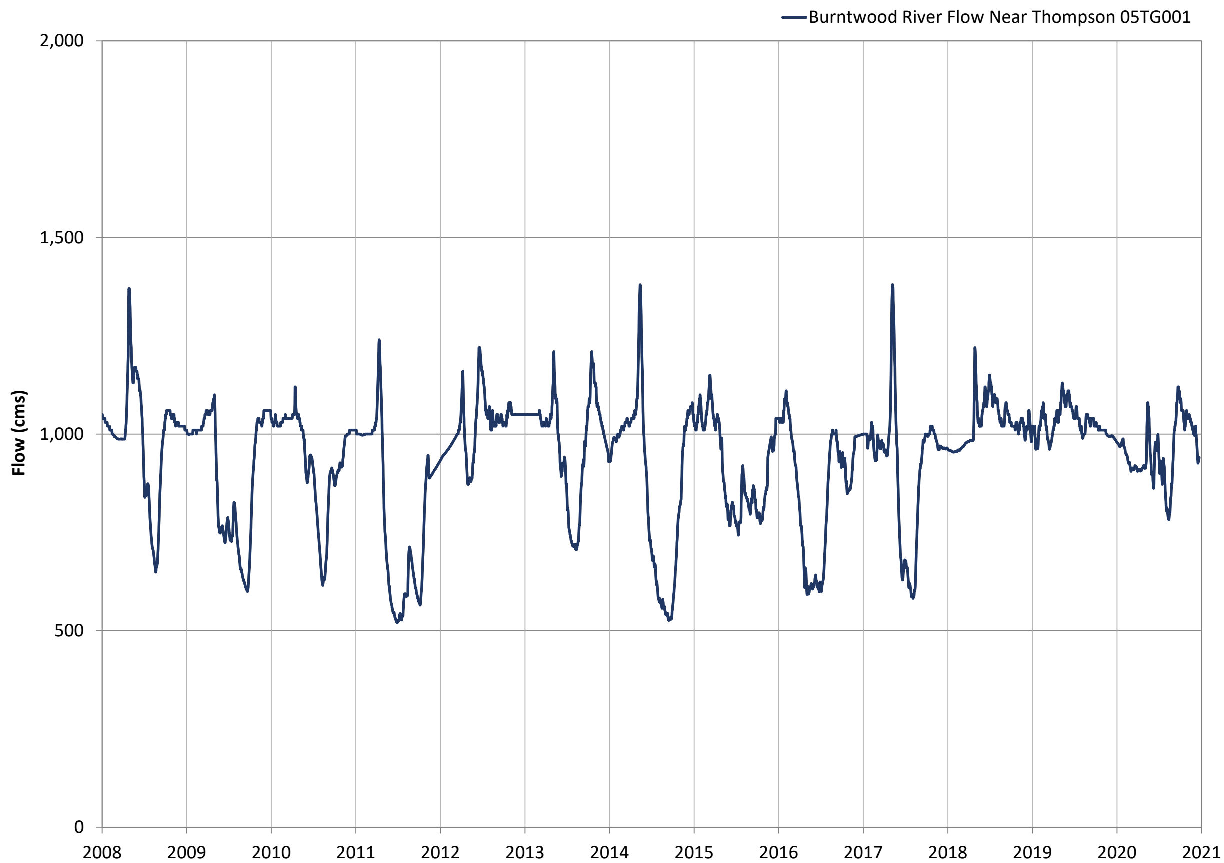


Figure 2.3-3. 2008-2020 Burntwood River daily mean flow.

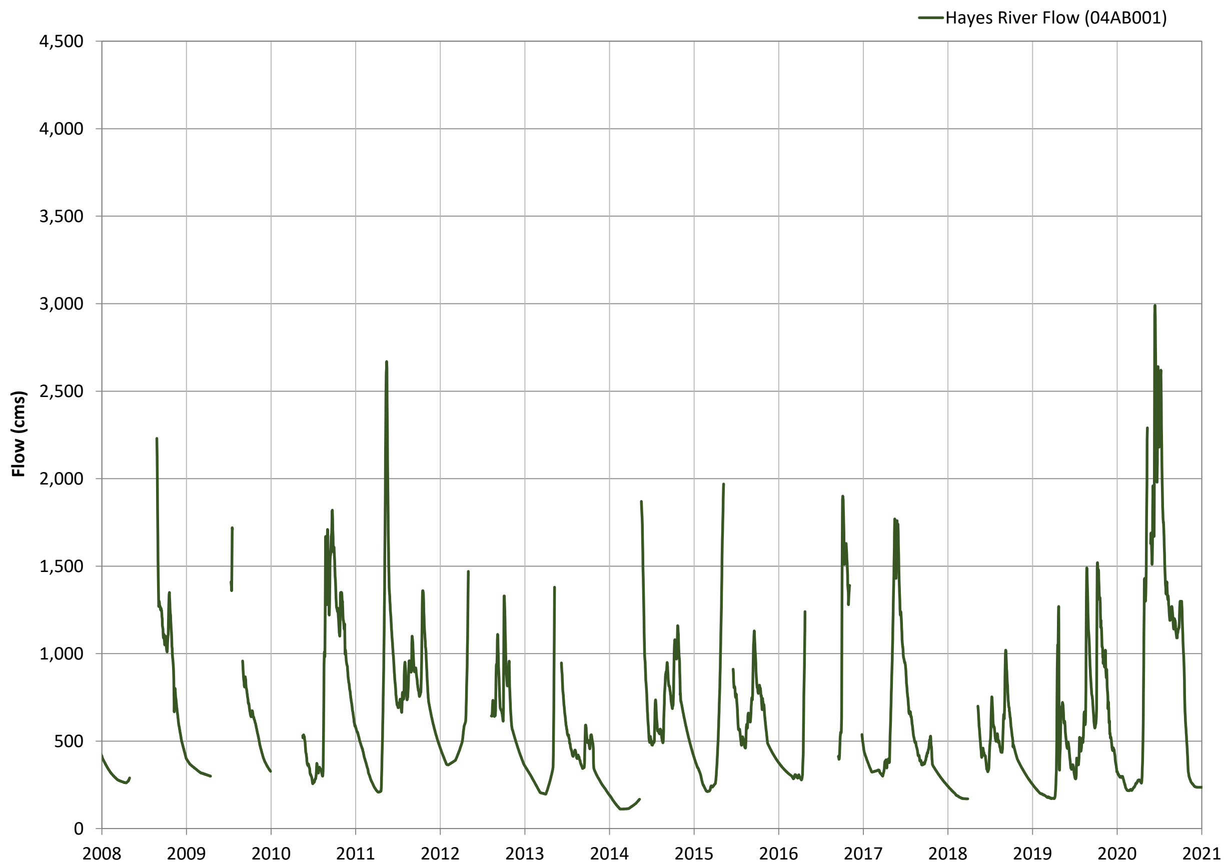


Figure 2.3-4. 2008-2020 Hayes River daily mean flow.

2.3.2 WATER LEVEL AND VARIABILITY

2.3.2.1 ON-SYSTEM SITES

Split Lake

Water levels on Split Lake follow the same pattern as lower Nelson River flow (Figure 2.3-5). During the period from 2008-2020, Split Lake water levels were more than 0.5 m above the 2008-2020 average in 28 months and lower than 0.5 m below the 2008-2020 average in 28 months (Table 2.3-4). Split Lake monthly water level variability was lower (below 0.25 m) in 51 months, moderate (between 0.25 and 0.75 m) in 91 months, and higher (above 0.75 m) in 10 months (Table 2.3-5).

Lower Nelson River Downstream of the Limestone GS

This CAMP measurement area is located about 30 km downstream from the Limestone GS (Figure 2.3-1). The general pattern of water levels on the Nelson River downstream from the Limestone GS would follow the pattern of lower Nelson River flow reported at the Kettle GS (Table 2.3-1 and Figure 2.3-2). This daily and monthly averaged data does not capture the water level variations created by the daily cycling operations that frequently occur at the lower Nelson River generating stations (the Kettle, Long Spruce, and Limestone GSs). More information about these cycling effects is available in the Physical Environment Part IV section of the Regional Cumulative Effects Assessment – Phase II Report (RCEA 2015).

ROTATIONAL SITES

Stephens Lake

Stephens Lake acts as the reservoir for the Kettle Generating Station and its outflow is regulated for power production (Figure 2.3-6). During the period from 2008-2020, Stephens Lake monthly average water levels were more than 0.5 m above the 2008-2020 average in 5 months and lower than 0.5 m below the 2008-2020 average in 11 months (Table 2.3-6). Stephens Lake monthly water level variability was lower (below 0.25 m) in 34 months, moderate (between 0.25 and 0.75 m) in 44 months, and higher (above 0.75 m) in 78 months (Table 2.3-7).

Limestone GS Forebay

Despite the changing flow conditions on the lower Nelson River, the water level in the Limestone forebay remained relatively stable as the flow through the generating station is regulated to maintain stable upstream water levels. Limestone forebay water level typically remains within a narrow range between 84.5 m and 85.2 m (Figure 2.3-7). During the period from 2008-2020, Limestone forebay monthly average water levels were never more than 0.5 m above the 2008-2020 average or lower than 0.5 m below the 2008-2020 average (Table 2.3-8). Limestone forebay monthly water level variability was lower (below 0.25 m) in 29 months, moderate (between 0.25 and 0.75 m) in 126 months, and higher (above 0.75 m) in 1 month (Table 2.3-9).

2.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Water levels on Assean Lake vary with precipitation in the drainage basin (Figure 2.3-8). During the period from September 2009 to 2020, Assean Lake monthly average water levels were more than 0.5 m above the 2008-2020 average in 16 months and were never lower than 0.5 m below the 2008-2020 average (Table 2.3-10). Assean Lake monthly water level variability was lower (below 0.25 m) in 107 months, moderate (between 0.25 and 0.75 m) in 25 months, and higher (above 0.75 m) in 4 months (Table 2.3-11).

ROTATIONAL SITES

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

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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	168.13	167.90	167.81	167.53	167.20	167.08	167.87	168.35	168.00	167.80	167.90	167.86
2009	168.02	167.80	167.55	167.41	167.93	168.41	168.61	168.54	168.35	167.84	167.67	167.85
2010	168.13	167.91	167.43	167.13	166.63	167.03	167.73	168.16	168.56	168.62	168.46	168.18
2011	168.29	168.61	168.22	167.70	168.06	168.52	168.78	169.02	168.93	168.36	167.74	168.09
2012	168.26	168.01	167.44	166.92	166.90	167.10	167.56	167.61	167.31	167.05	167.50	167.90
2013	167.99	167.97	167.75	167.34	167.39	167.27	167.99	168.09	167.52	167.51	167.58	167.83
2014	168.03				168.03	168.23	168.58	168.69	168.60	168.46	167.85	168.03
2015	168.14	168.10	167.86	167.44	167.38	167.40	167.38	167.42	167.53	167.57	167.50	167.89
2016	168.07	168.09	167.87	167.56	167.33	167.23	167.74	168.08	167.84	167.86	167.82	168.02
2017	168.36	168.47	168.40	168.20	169.08	168.75	168.62	168.31	167.38	167.04	167.44	167.84
2018	167.76	167.93	167.80		167.00	166.97	167.20	167.10	166.63	166.65	167.25	167.64
2019	167.61	167.66	167.49	167.16	167.14	167.15	167.13	167.12	167.06	166.95	167.56	168.14
2020	168.39	168.28	168.01	167.77	168.22	168.40	168.57	168.54	167.81	167.28	167.50	168.03

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 2.3-5. Split Lake monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.19	0.18	0.39	0.17	0.45	0.43	0.90	0.11	0.60	0.25	0.32	0.31
2009	0.22	0.52	0.09	0.30	0.52	0.52	0.22	0.30	0.33	0.40	0.39	0.35
2010	0.29	0.50	0.29	0.46	0.23	0.80	0.70	0.36	0.18	0.09	0.68	0.52
2011	0.40	0.14	0.72	0.17	0.73	0.27	0.25	0.27	0.38	0.81	0.38	0.71
2012	0.26	0.47	0.62	0.30	0.24	0.48	0.06	0.09	0.61	0.34	0.51	0.38
2013	0.11	0.26	0.60	0.13	0.24	0.65	0.33	0.36	0.39	0.14	0.25	0.34
2014	0.12				0.33	0.54	0.20	0.09	0.18	0.25	0.85	0.72
2015	0.39	0.19	0.52	0.22	0.18	0.27	0.26	0.24	0.49	0.28	0.21	0.51
2016	0.23	0.27	0.34	0.16	0.31	0.27	0.57	0.09	0.34	0.31	0.24	0.49
2017	0.30	0.35	0.42	0.36	0.90	0.54	0.14	0.59	0.83	0.06	0.89	0.38
2018	0.23	0.24	0.29		0.28	0.17	0.25	0.31	0.16	0.36	0.72	0.41
2019	0.25	0.15	0.36	0.33	0.06	0.11	0.10	0.18	0.47	0.69	0.50	0.38
2020	0.16	0.26	0.31	0.15	0.99	0.30	0.21	0.31	1.00	0.18	0.79	0.16

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. Stephens Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	140.63	140.02	139.66	140.10	140.27	140.09	140.42	141.10	141.09	141.08	140.89	140.42
2009	140.66	140.65	140.11	139.73	140.71	141.10	141.10	141.10	141.10	141.05	140.92	140.14
2010	140.62	140.55	140.52	140.63	140.69	139.99	140.04	141.08	141.09	141.09	141.06	140.41
2011	140.82	140.98	140.96	140.17	140.92	141.02	141.00	141.04	141.04	141.04	140.77	140.54
2012	140.59	140.41	140.65	140.35	140.09	140.53	140.42	141.03	140.92	140.45	140.18	140.30
2013	140.48	140.36	140.11	139.60	140.45	139.98	140.58	141.09	141.02	141.04	140.60	140.59
2014	140.51	140.50	140.36	140.31	140.49	141.08	141.08	141.07	141.05	141.09	140.28	140.46
2015	140.63	140.58	140.68	140.33	140.38	140.33	140.50	140.37	140.42	141.01	140.68	140.14
2016	140.26	140.23	140.38	140.40	140.68	140.33	139.95	141.04	141.02	140.99	141.05	140.34
2017	140.96	140.94	141.03	141.09	141.09	141.07	141.08	140.99	140.58	140.36	140.45	140.67
2018	140.38	140.40	140.33	140.15	140.21	140.66	140.69	140.55	140.66	140.37	140.31	140.60
2019	140.44	140.39	140.35	139.71	140.46	140.36	140.57	140.40	139.63	140.33	140.48	140.48
2020	140.40	140.24	140.13	140.58	141.00	140.93	140.97	140.99	140.99	140.70	140.48	140.73

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. Stephens Lake monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.82	0.93	1.04	0.85	0.91	0.92	1.43	0.03	0.09	0.09	0.65	0.97
2009	0.73	0.56	0.77	0.45	1.29	0.02	0.01	0.01	0.01	0.20	0.48	1.43
2010	0.57	0.86	0.57	0.79	0.48	1.38	1.81	0.11	0.02	0.01	0.19	1.19
2011	0.58	0.35	0.27	1.64	0.63	0.20	0.08	0.04	0.12	0.07	0.96	1.25
2012	1.12	1.07	0.83	1.11	1.50	0.69	0.73	0.27	0.68	0.37	1.03	0.95
2013	0.97	0.96	0.97	1.02	1.18	1.69	1.90	0.04	0.21	0.23	1.05	0.77
2014	0.98	1.01	0.94	1.23	1.69	0.03	0.05	0.05	0.09	0.04	1.64	1.01
2015	0.44	0.50	0.59	0.65	1.53	0.94	1.07	0.76	1.32	0.27	1.10	0.63
2016	1.31	1.07	0.63	1.04	0.93	1.01	1.75	0.16	0.26	0.45	0.15	1.35
2017	0.38	0.48	0.27	0.08	0.05	0.09	0.05	0.27	1.82	1.92	0.87	0.88
2018	1.36	0.93	0.73	0.68	0.65	0.94	0.55	0.66	0.57	0.74	0.99	0.82
2019	0.62	0.81	0.66	2.68	0.74	1.00	0.43	0.92	2.00	2.49	0.93	0.81
2020	0.90	1.00	0.89	1.71	0.24	0.32	0.26	0.19	0.20	0.78	0.90	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.

Table 2.3-8. Limestone Forebay monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	84.92	84.88	84.91	84.99	84.90	84.85	84.93	85.10	84.95	84.97	84.95	84.94
2009	84.93	84.95	85.01	84.96	85.00	85.07	85.06	85.07	85.03	84.96	84.91	84.95
2010	84.97	84.95	84.96	84.91	84.88	84.85	84.89	85.03	85.08	85.04	85.01	84.88
2011	84.83	84.87	84.90	84.92	85.03	85.05	85.05	85.09	85.08	85.06	84.89	84.90
2012	84.93	84.94	84.94	84.93	84.92	84.90	84.91	84.98	84.98	84.86	84.88	84.96
2013	84.91	84.91	84.88	84.90	84.90	84.93	85.03	85.06	84.94	84.99	84.95	84.92
2014	84.92	84.94	84.93	84.91	84.99	85.05	85.07	85.05	85.06	85.07	85.00	84.90
2015	84.91	84.99	84.90	84.87	84.93	84.91	84.90	84.87	84.90	85.04	84.90	84.89
2016	84.91	84.90	84.88	85.03	85.00	84.90	84.90	85.03	84.97	85.04	85.03	84.93
2017	84.94	85.04	85.06	85.16	85.15	85.15	85.16	85.08	84.91	84.97	85.03	84.97
2018	85.02	85.03	85.02	84.99	84.99	85.01	85.04	85.04	85.06	85.04	85.04	85.00
2019	85.04	85.03	85.00	84.96	84.96	84.94	84.94	84.94	84.82	84.90	84.92	84.91
2020	84.90	84.94	84.95	85.01	85.07	85.08	85.09	85.14	85.11	84.95	85.00	84.99

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 2.3-9. Limestone Forebay monthly water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	0.25	0.38	0.46	0.46	0.32	0.77	0.40	0.33	0.63	0.55	0.34	0.23
2009	0.39	0.29	0.29	0.41	0.33	0.20	0.12	0.15	0.56	0.54	0.31	0.36
2010	0.25	0.27	0.34	0.40	0.33	0.54	0.36	0.35	0.11	0.18	0.38	0.40
2011	0.41	0.52	0.43	0.48	0.32	0.12	0.15	0.08	0.12	0.24	0.43	0.47
2012	0.38	0.36	0.40	0.26	0.36	0.28	0.28	0.46	0.38	0.44	0.39	0.32
2013	0.39	0.39	0.34	0.37	0.43	0.38	0.29	0.34	0.35	0.34	0.34	0.30
2014	0.31	0.25	0.31	0.32	0.40	0.18	0.14	0.18	0.27	0.13	0.30	0.25
2015	0.25	0.22	0.35	0.49	0.31	0.27	0.28	0.23	0.51	0.33	0.40	0.29
2016	0.37	0.29	0.33	0.42	0.43	0.29	0.36	0.44	0.41	0.41	0.40	0.29
2017	0.47	0.38	0.37	0.18	0.37	0.18	0.09	0.39	0.56	0.40	0.35	0.41
2018	0.39	0.34	0.35	0.38	0.33	0.35	0.27	0.25	0.28	0.24	0.21	0.28
2019	0.25	0.31	0.39	0.41	0.39	0.45	0.30	0.28	0.53	0.37	0.38	0.34
2020	0.40	0.30	0.60	0.42	0.34	0.43	0.19	0.17	0.29	0.41	0.36	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 2.3-10. Assean Lake monthly average water level (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008												
2009									177.32	177.03	176.90	176.77
2010	176.67	176.60	176.53	176.55	176.69	176.69	176.56	176.71	177.64	177.71	177.42	177.09
2011	176.83	176.70	176.63	176.55	176.74	176.88	176.90	177.28	177.49	177.26	177.11	176.91
2012	176.76	176.67	176.62	176.58	177.02	177.31	177.48	177.16	177.19	177.18	177.09	176.91
2013	176.75	176.66	176.56	176.48	176.70	176.95	176.76	176.60	176.57	176.87	177.13	176.99
2014	176.82	176.67	176.57	176.49	176.91	177.50	177.47	177.24	177.07	176.98	177.01	176.88
2015	176.74	176.67	176.62	176.62	176.98	177.18	177.18	177.66	177.62	177.61	177.34	177.02
2016	176.80	176.71	176.66	176.60	176.78	176.99	176.90	176.89	176.82	177.12	177.20	177.03
2017	176.83	176.70	176.65	176.60	177.23	178.76	177.98	177.22	176.84	176.77	176.85	176.80
2018	176.73	176.67	176.61	176.56	177.01	177.13	177.20	177.29	177.10	176.96	176.84	176.74
2019	176.70	176.67	176.62	176.57	176.71	176.66	176.57	176.60	176.92	176.97	176.94	176.83
2020	176.75	176.68	176.64	176.63	176.89	177.73	178.36	178.05	177.77	177.52	177.27	177.05

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 2.3-11. Assean Lake monthly average water level range (m).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008												
2009									0.30	0.19	0.13	0.12
2010	0.07	0.06	0.08	0.18	0.05	0.14	0.06	0.67	0.52	0.23	0.31	0.30
2011	0.18	0.08	0.06	0.06	0.32	0.06	0.28	0.40	0.17	0.15	0.19	0.18
2012	0.10	0.07	0.06	0.10	0.51	0.25	0.22	0.25	0.14	0.08	0.16	0.17
2013	0.12	0.08	0.09	0.06	0.54	0.15	0.19	0.06	0.08	0.45	0.06	0.19
2014	0.16	0.11	0.09	0.08	0.90	0.21	0.14	0.17	0.20	0.08	0.07	0.15
2015	0.10	0.05	0.07	0.22	0.32	0.18	0.21	0.36	0.19	0.24	0.34	0.27
2016	0.13	0.06	0.05	0.08	0.29	0.09	0.16	0.06	0.10	0.34	0.10	0.21
2017	0.15	0.10	0.06	0.07	2.15	0.54	0.90	0.54	0.24	0.10	0.01	0.08
2018	0.05	0.05	0.08	0.14	0.43	0.06	0.21	0.21	0.10	0.14	0.10	0.09
2019	0.01	0.04	0.08	0.11	0.08	0.09	0.08	0.23	0.18	0.03	0.10	0.10
2020	0.07	0.06	0.04	0.05	0.81	0.64	0.32	0.51	0.23	0.23	0.22	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.

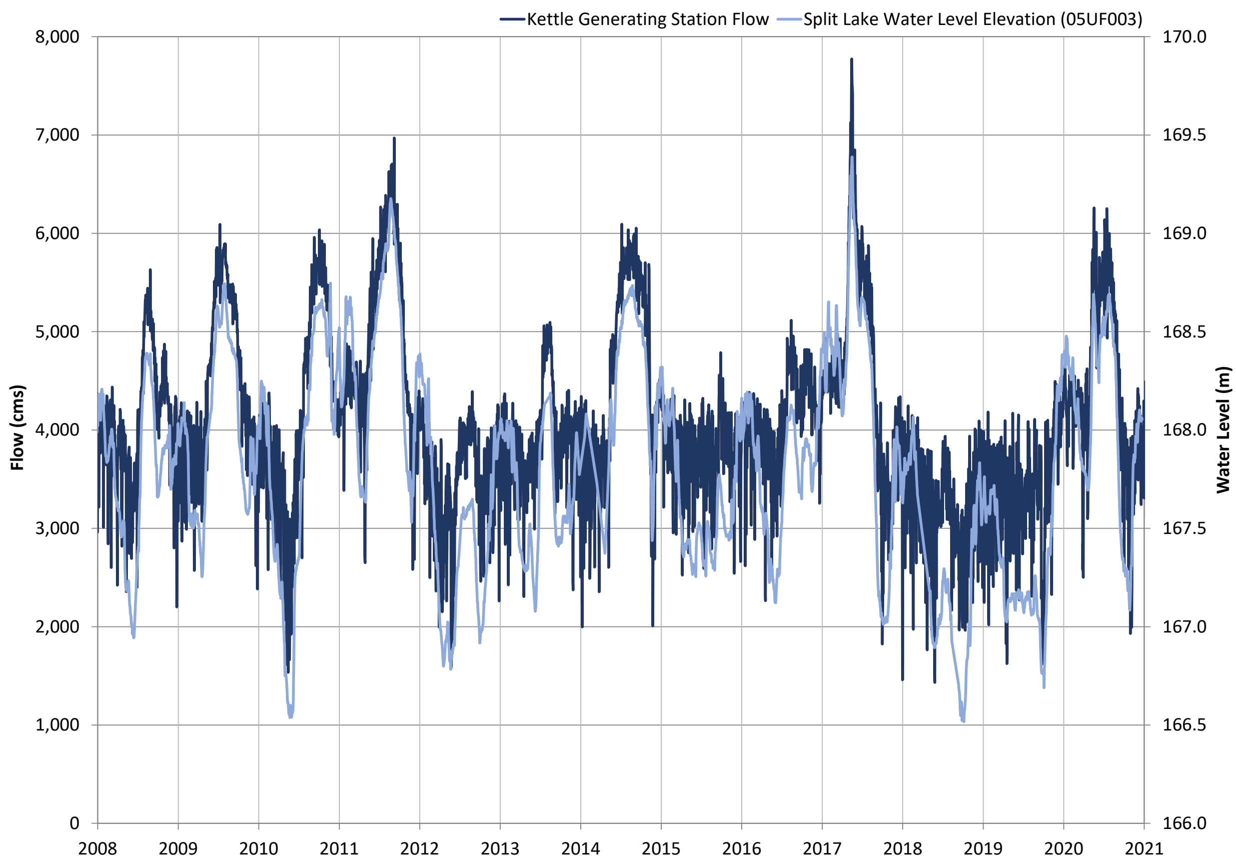


Figure 2.3-5. 2008-2020 Lower Nelson River daily mean flow and Split Lake daily mean water level.

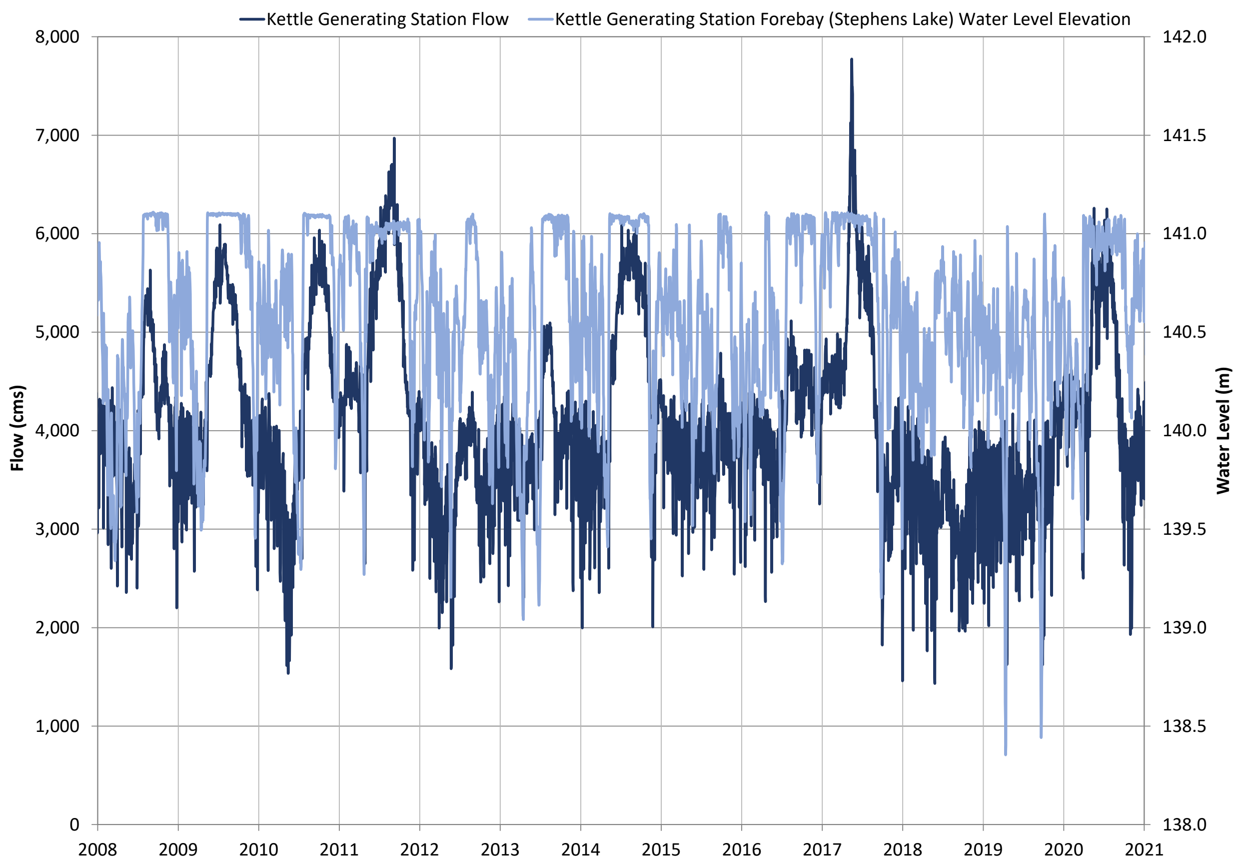


Figure 2.3-6. 2008-2020 Lower Nelson River daily mean flow and Stephens Lake daily mean water level.

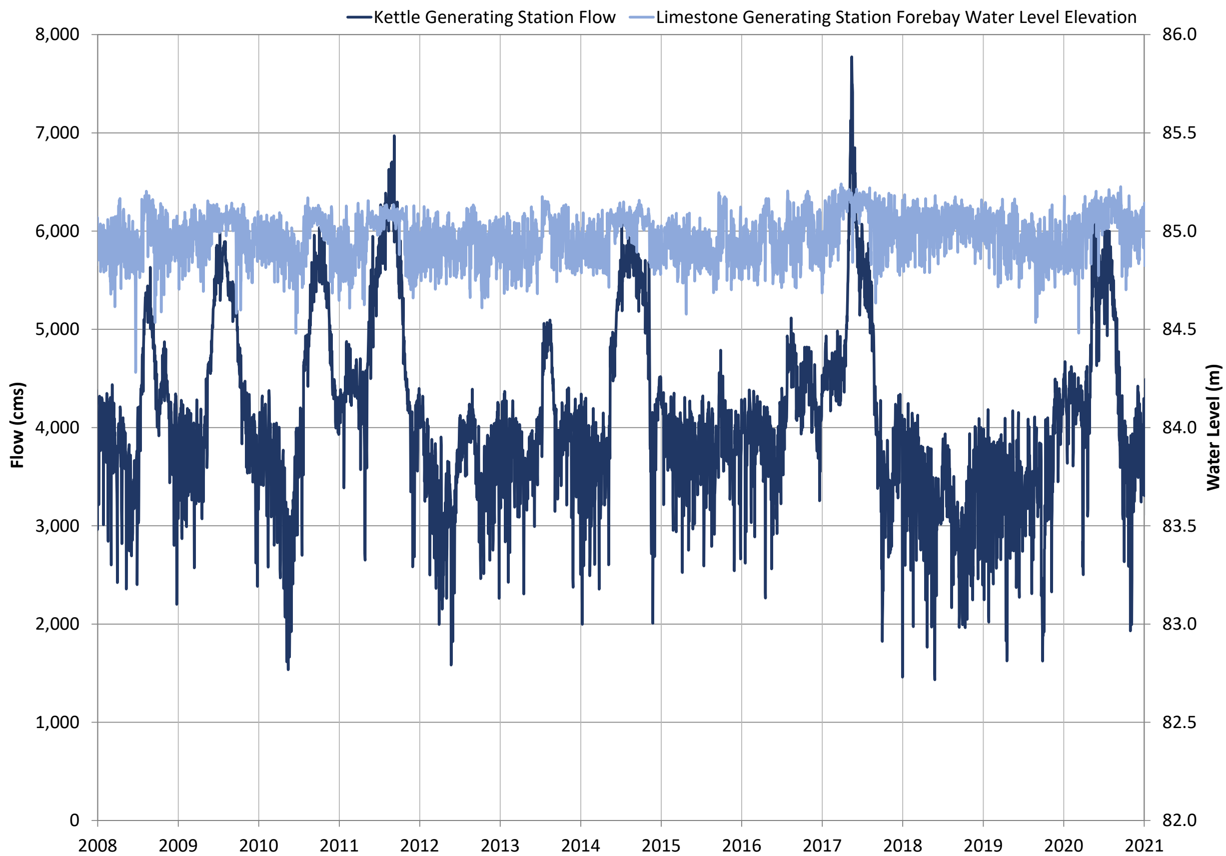


Figure 2.3-7. 2008-2020 Lower Nelson River daily mean flow and Limestone Forebay daily mean water level.

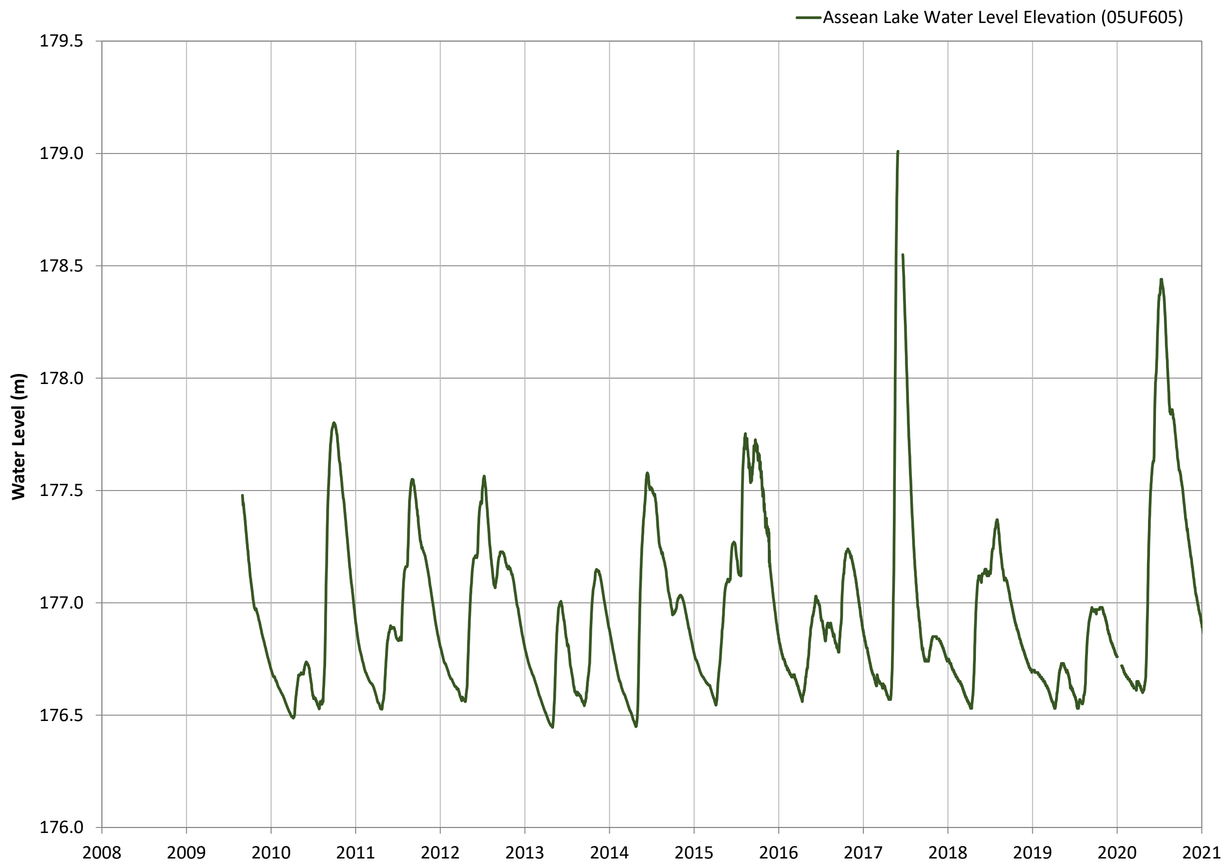


Figure 2.3-8. 2008-2020 Assean Lake daily mean water level.

2.3.3 WATER TEMPERATURE

2.3.3.1 ON-SYSTEM SITES

Limestone Generating Station

Water temperature in the Lower Nelson River Region is monitored at the continuous water quality monitoring station located at the Limestone GS (Figure 2.3-1). Water temperatures during the open-water season increase steadily before peaking in July/August and decreasing steadily back to near freezing (Figure 2.3-9). Temperatures peaked near 21°C in August 2017 and near 20°C in July 2018 and 2019 since monitoring has started. During the one winter with complete data, water temperatures hit near 0°C in early November and began to increase in May.

The duration, in days, that water temperature is within different temperature ranges is used as a metric (Table 2.3-12). 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 201 days the one winter there is data. In summer, the there were 17 days above 20°C in 2017 and no days the other two years. In 2017 there was a total of 70 days above 15°C, compared to 74 in 2018 and 67 in 2019.

2.3.3.2 OFF-SYSTEM SITES

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

Table 2.3-12. 2017-19 Limestone GS 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				47	53	17
2018			25	33	74	0
2019	201	16	34	49	67	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.

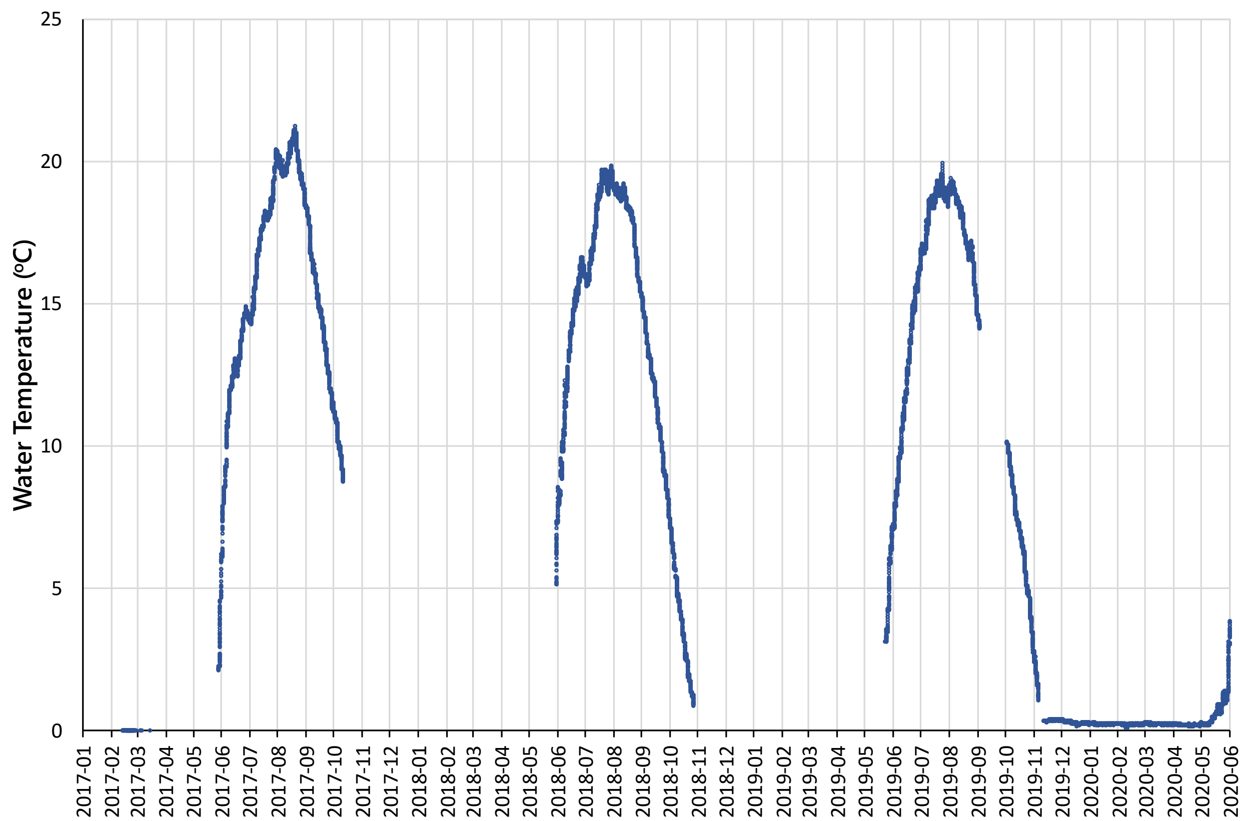


Figure 2.3-9. 2017-2019 Limestone GS continuous water temperature.

2.4 SEDIMENTATION

The following presents the results of sedimentation monitoring conducted in the Lower Nelson River Region. Monitoring occurred on-system at the continuous water quality monitoring site located at the Limestone GS (Figure 2.3-1). Monitoring started in 2017 (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
Limestone GS										●	●	●

Table 2.4-2. Sedimentation indicators and metrics.

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

2.4.1 CONTINUOUS TURBIDITY

2.4.1.1 ON-SYSTEM SITES

Limestone Generating Station

Turbidity in the Lower Nelson River Region is monitored at the continuous water quality monitoring station located at the Limestone GS (Figure 2.3-1). The average monthly turbidity ranged from 8.4 to 29.7 FNU (Table 2.4-3 and Figure 2.4-1) with the hourly turbidity ranging from 7 to 35 FNU (Figure 2.4-2) over the entire monitoring period.

Turbidity in January through April showed less variability than the other months. Turbidity reached the annual minimum levels in April each year before starting to increase, peaking in November/December. Turbidity is seen increasing and decreasing throughout the year and there are considerable differences in yearly monthly averages, particularly during the period of May to December.

2.4.1.2 OFF-SYSTEM SITES

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

Table 2.4-3. 2017-2019 Limestone GS average monthly turbidity.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017		11.7	10.2	8.6	14.6	17.6	22.2	17.2	20.7			
2018				8.5	9.9	11.2	14.5	15.5	17.1	20.0	23.6	29.7
2019	13.7	12.1	10.2	8.7	9.0	10.6	13.5	14.4	14.1	16.9	26.6	23.0
2020	12.7	9.4	9.0	8.4								

Notes:

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

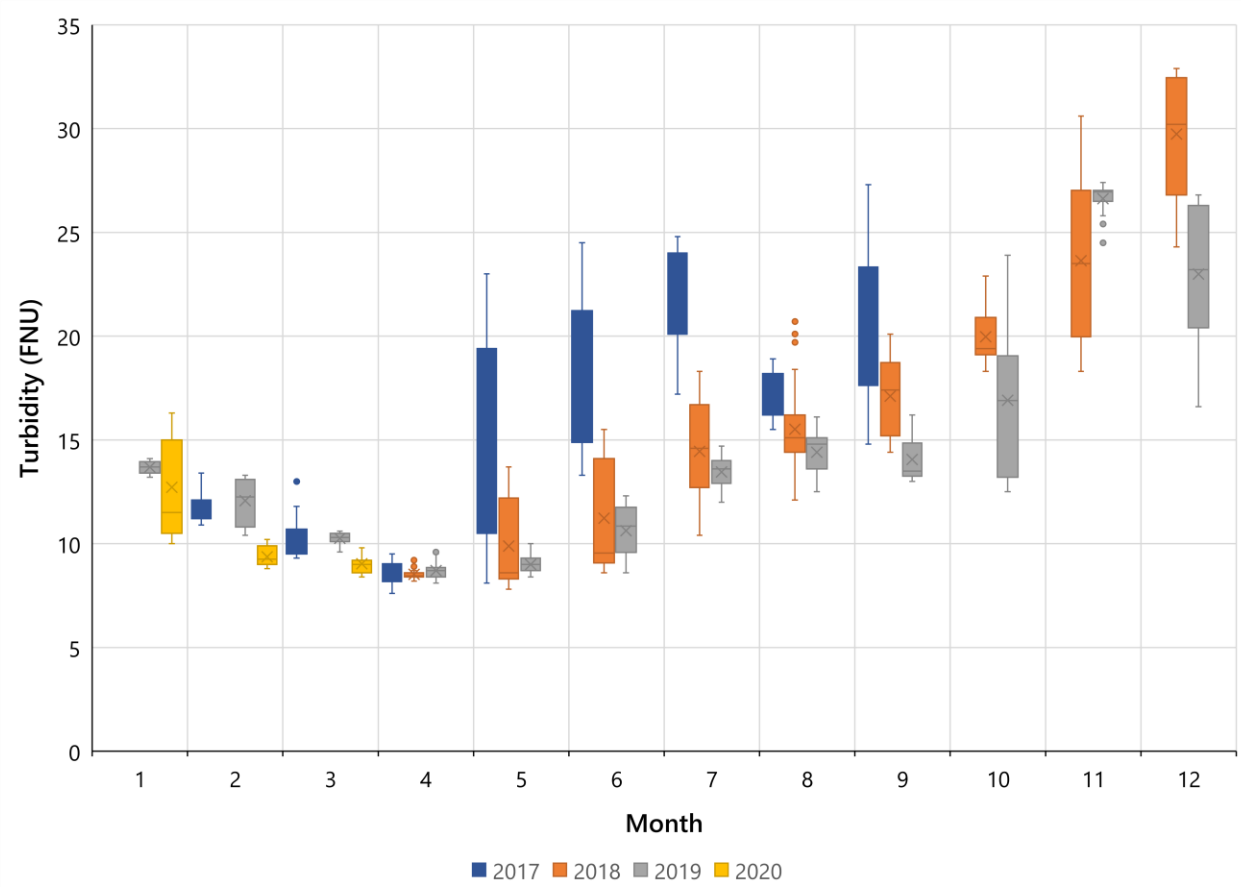


Figure 2.4-1. 2017-2019 Limestone GS monthly turbidity.

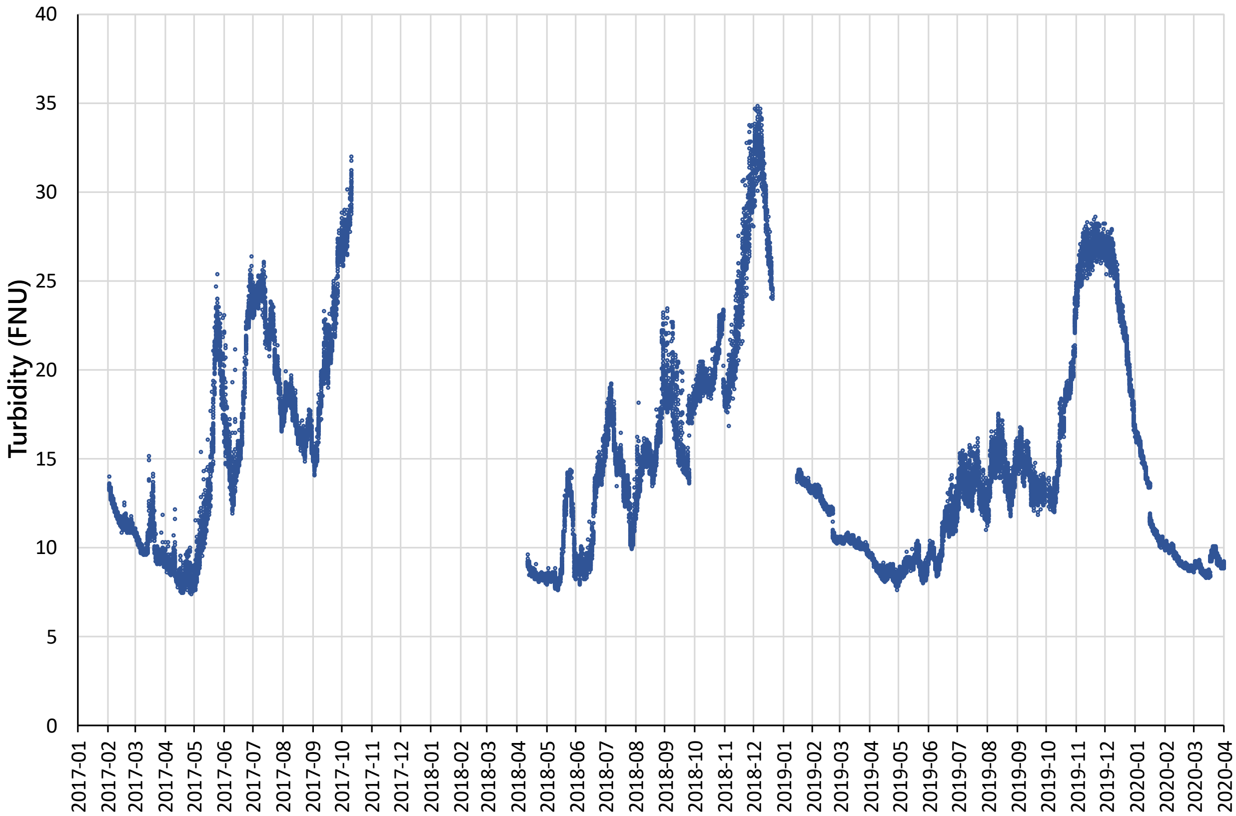


Figure 2.4-2. 2017-2019 Limestone GS continuous turbidity.

2.4.2 SUSPENDED SEDIMENT LOAD

2.4.2.1 ON-SYSTEM SITES

Limestone Generating Station

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 665 to 7829 T/day (Table 2.4-4, Figure 2.4-3) with the peak daily load reaching over 9000 T/day.

The lowest sediment load generally appeared in the February to May time period with the average load at or below 1000 T/day. There is no clear trend in the timing of the peak sediment load, in 2017 it occurred in July and in 2018 and 2019 it occurred in December (Figure 2.4-4).

2.4.2.2 OFF-SYSTEM SITES

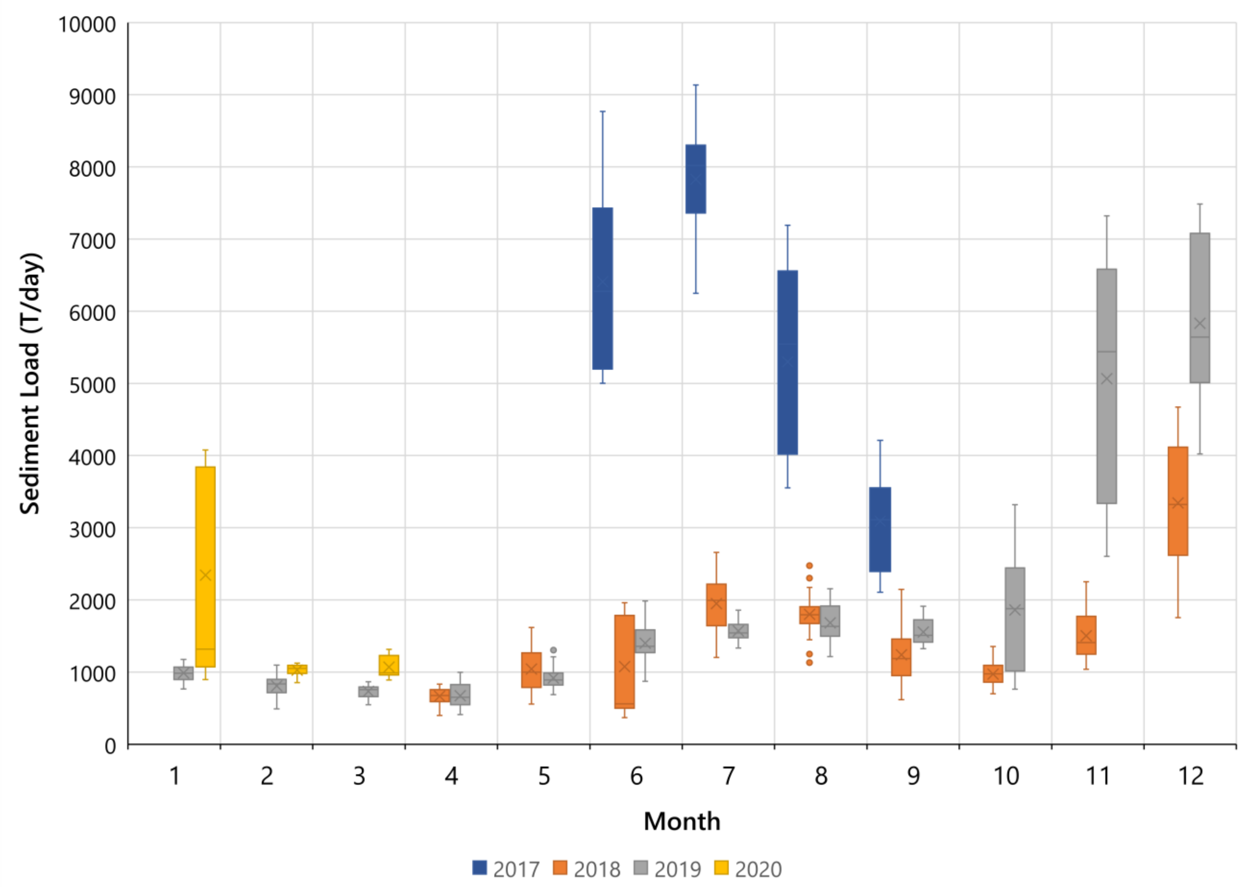
There are no continuous monitoring off-system sites in this region.

Table 2.4-4. 2017-19 Limestone GS average monthly sediment load.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017						6409	7829	5300	3092			
2018				665	1041	1074	1950	1801	1238	973	1503	3343
2019	987	809	731	672	916	1401	1569	1682	1555	1860	5066	5833
2020	2343	1025	1073	989								

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 Limestone GS monthly sediment load.

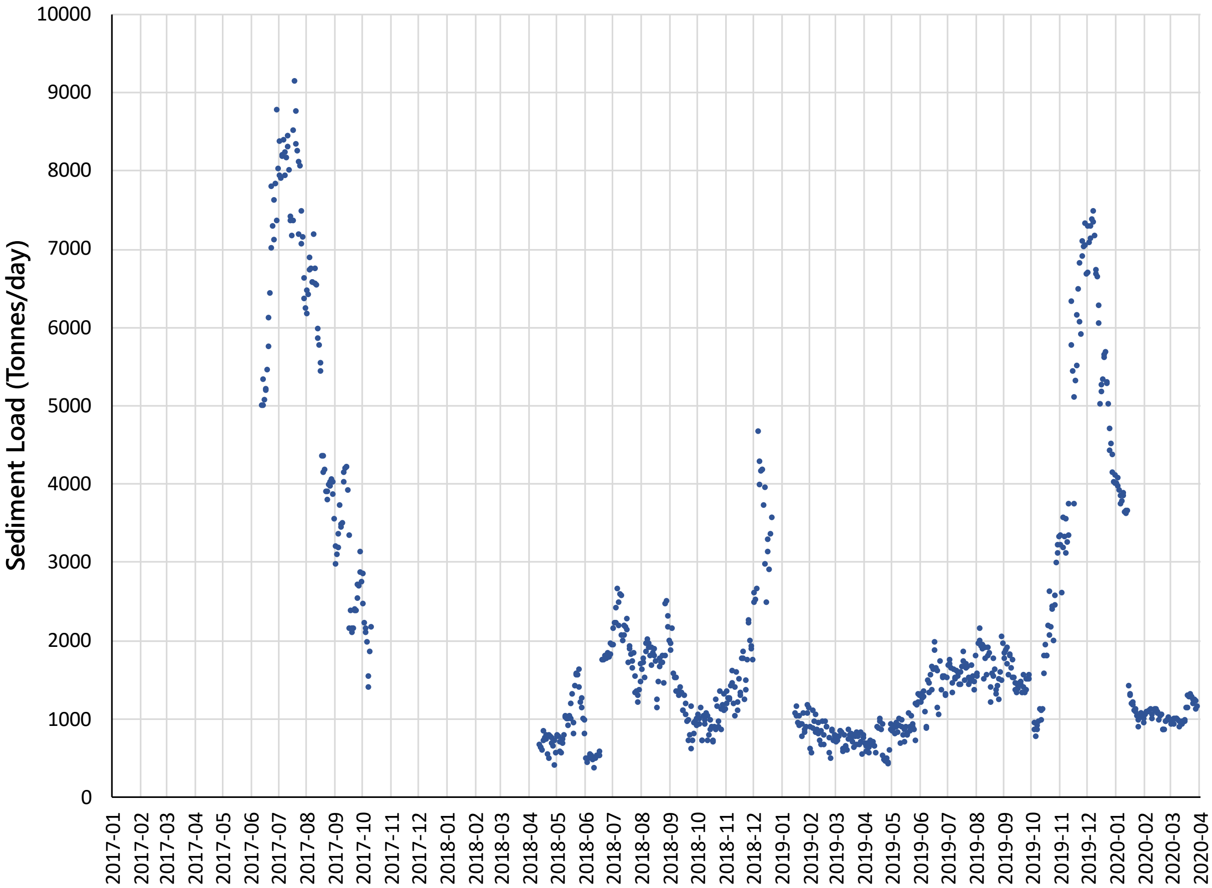


Figure 2.4-4. 2017-2019 Limestone GS daily sediment load.

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

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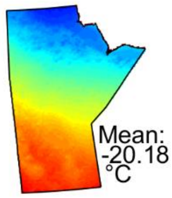
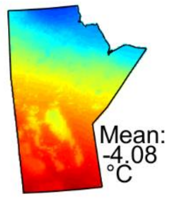
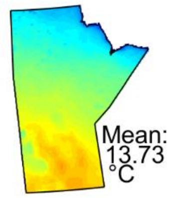
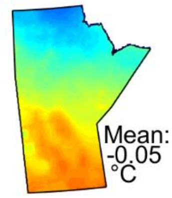
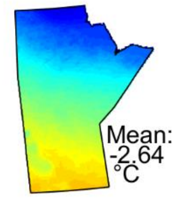
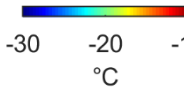
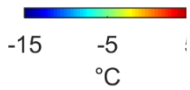
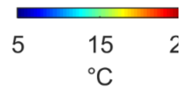
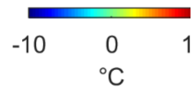
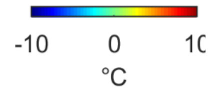
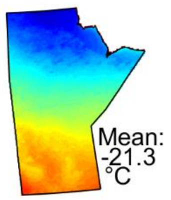
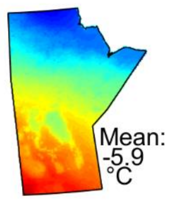
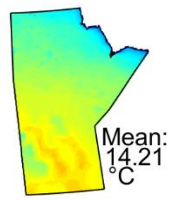
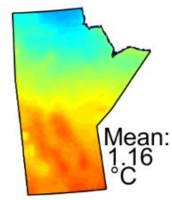
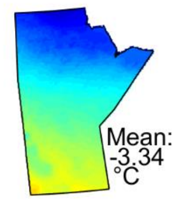
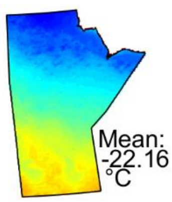
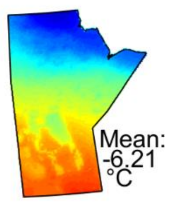
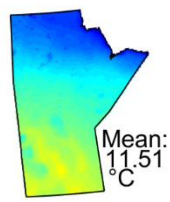
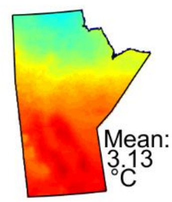
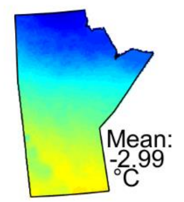
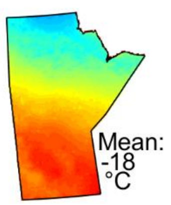
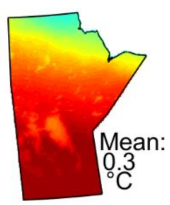
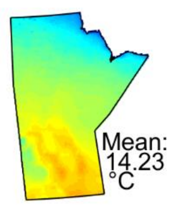
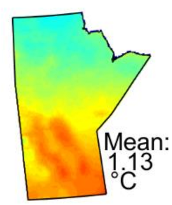
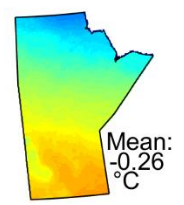
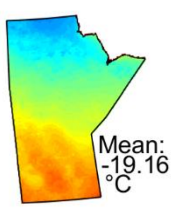
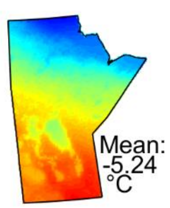
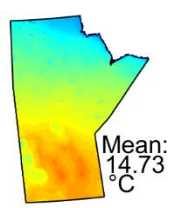
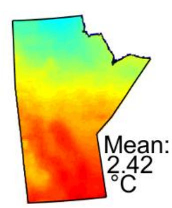
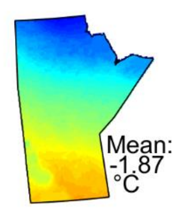
Normals (1981-2010)					
					
2008					
2009					
2010					
2011					

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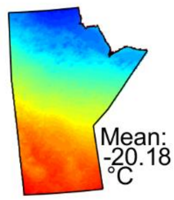
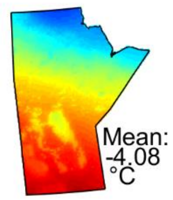
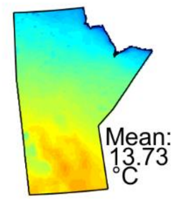
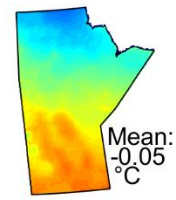
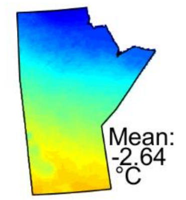
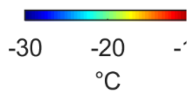
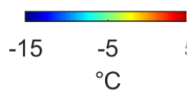
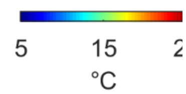
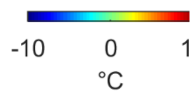
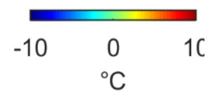
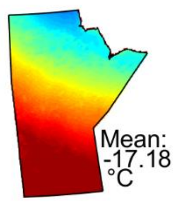
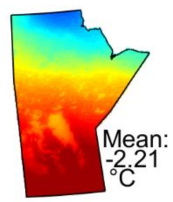
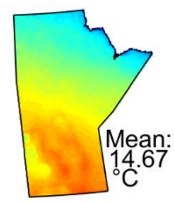
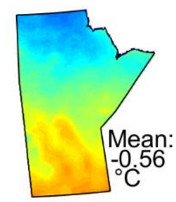
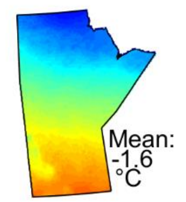
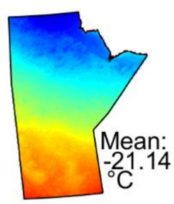
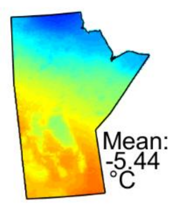
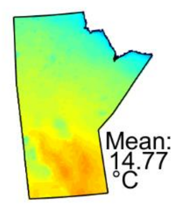
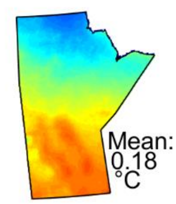
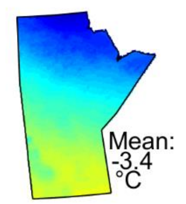
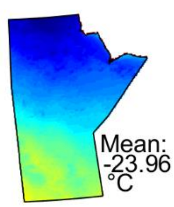
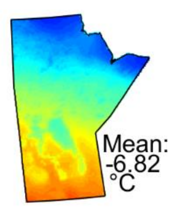
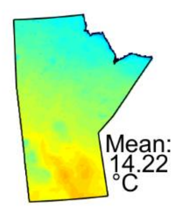
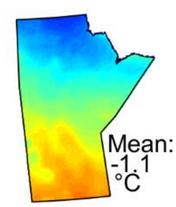
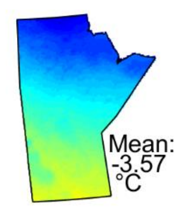
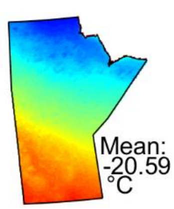
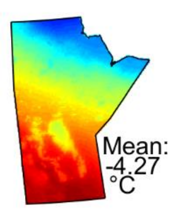
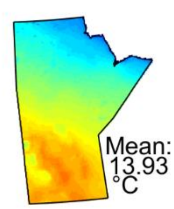
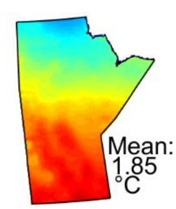
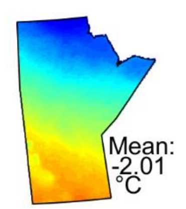
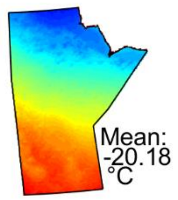
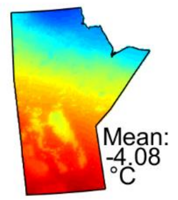
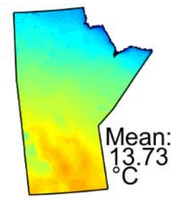
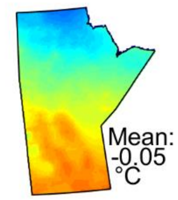
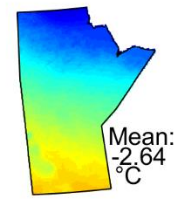
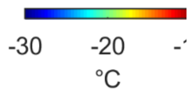
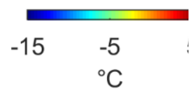
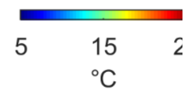
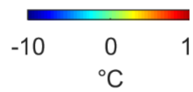
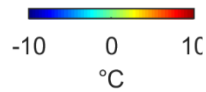
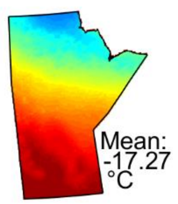
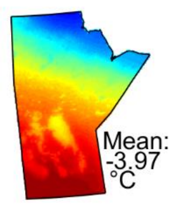
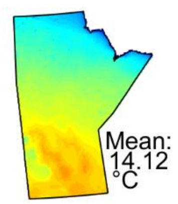
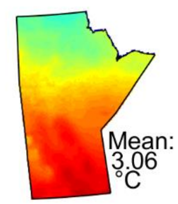
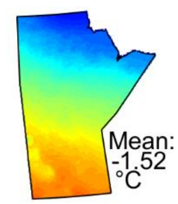
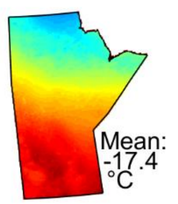
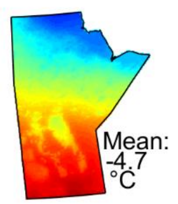
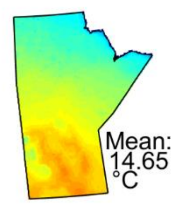
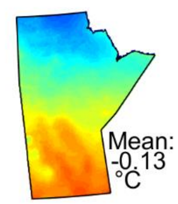
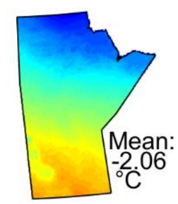
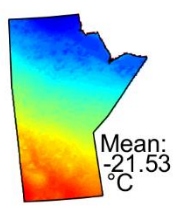
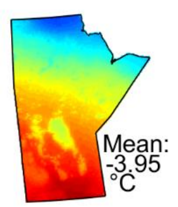
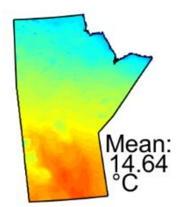
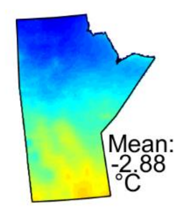
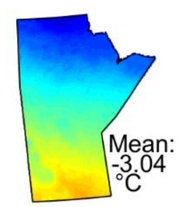
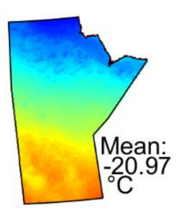
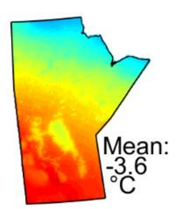
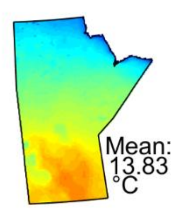
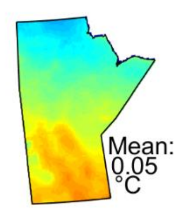
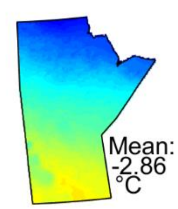
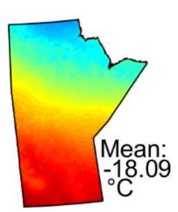
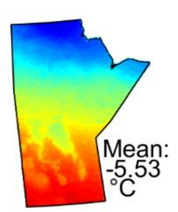
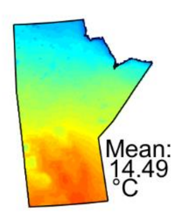
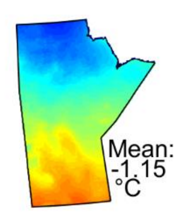
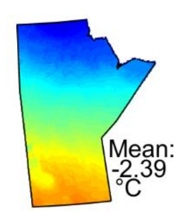
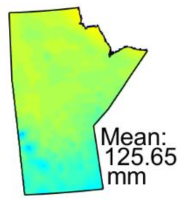
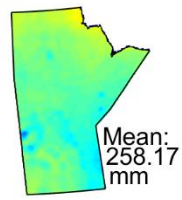
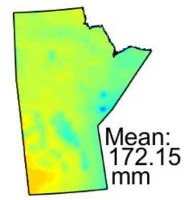
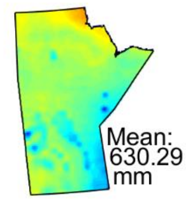
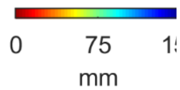
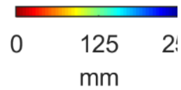
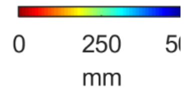
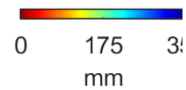
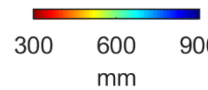
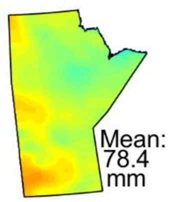
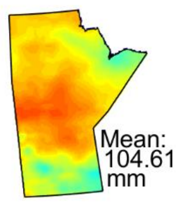
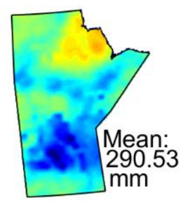
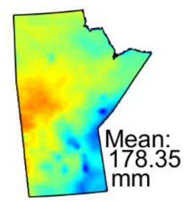
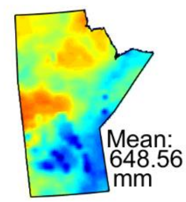
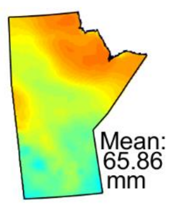
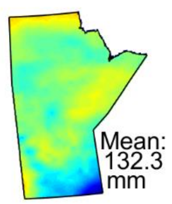
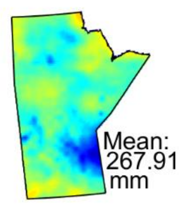
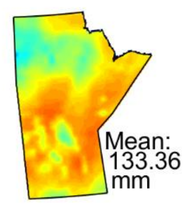
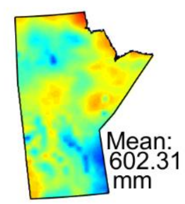
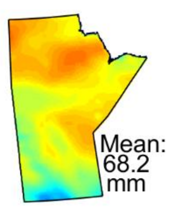
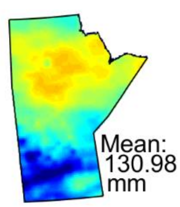
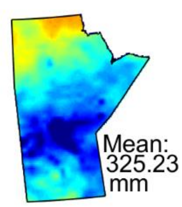
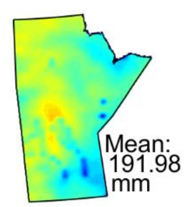
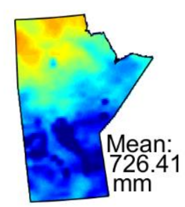
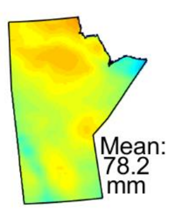
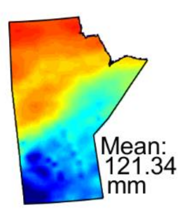
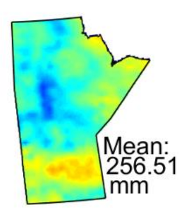
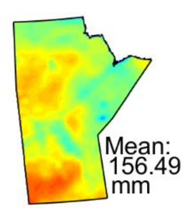
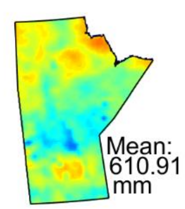
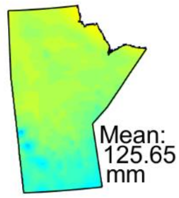
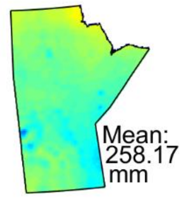
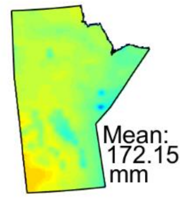
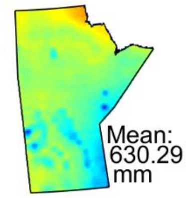
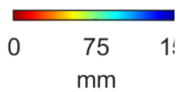
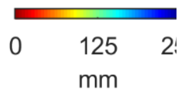
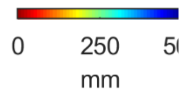
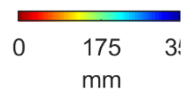
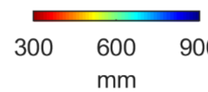
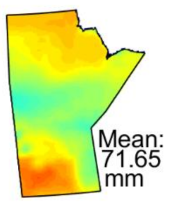
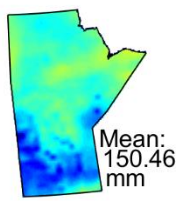
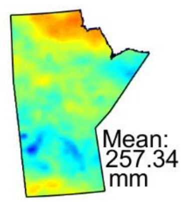
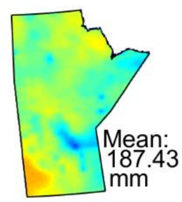
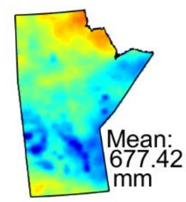
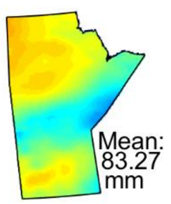
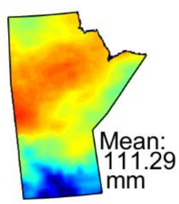
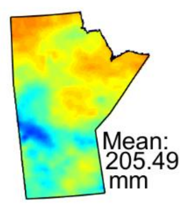
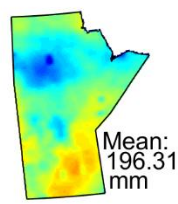
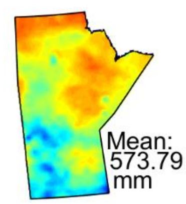
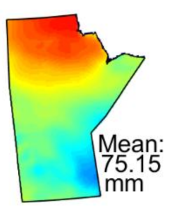
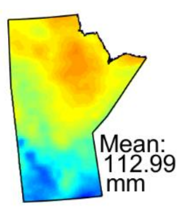
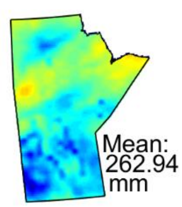
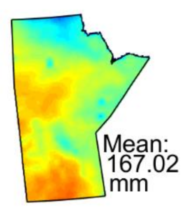
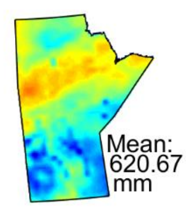
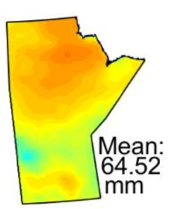
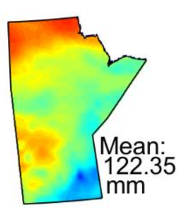
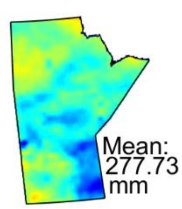
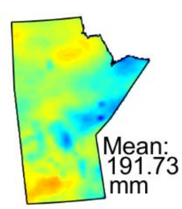
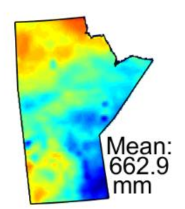
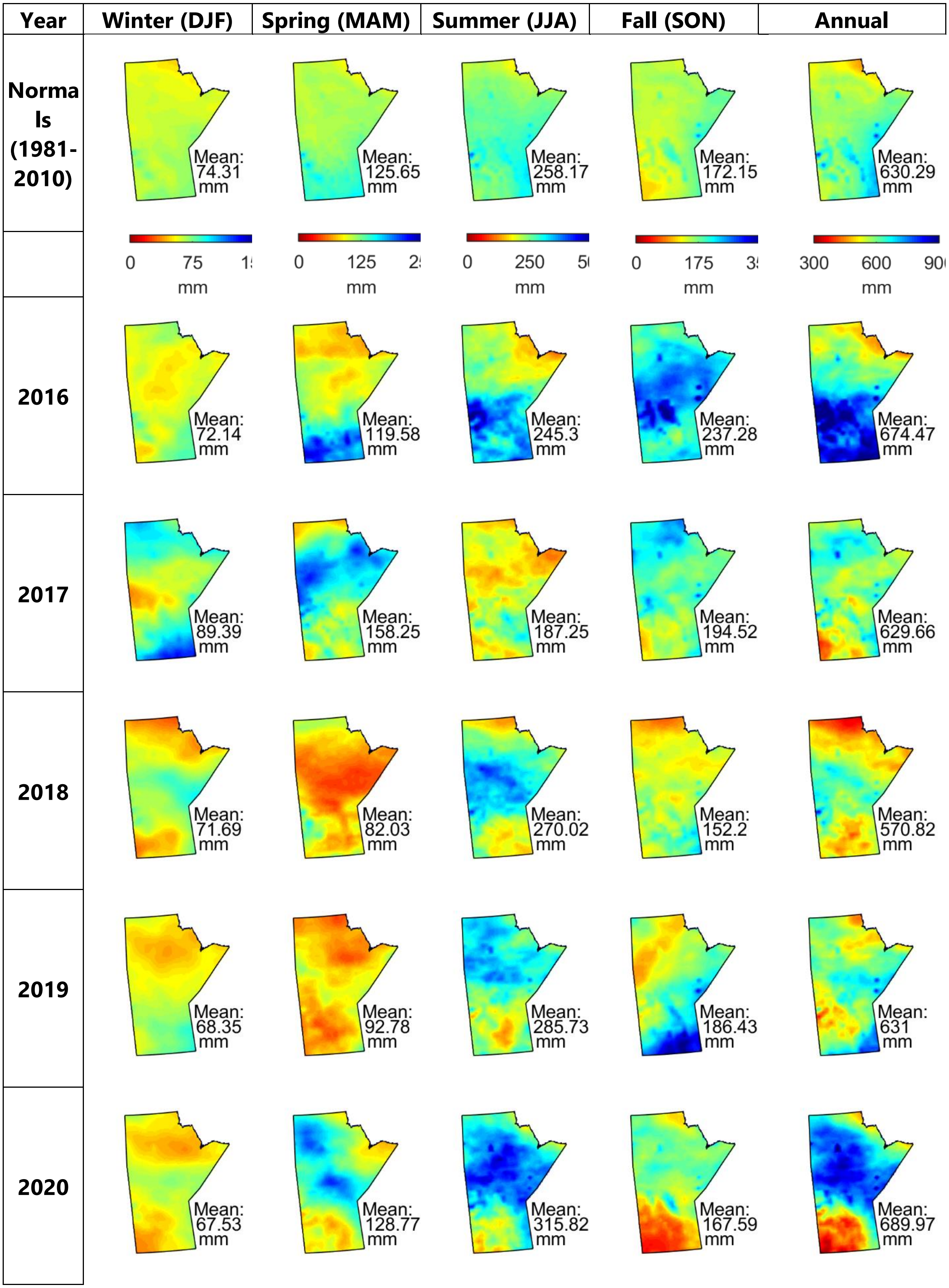
Normals (1981-2010)					
					
2012					
2013					
2014					
2015					

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)
Mean: 74.31 mm
Mean: 125.65 mm
Mean: 258.17 mm
Mean: 172.15 mm
Mean: 630.29 mm
0 75 mm
0 125 mm
0 250 mm
0 175 mm
300 600 mm
2016
Mean: 72.14 mm
Mean: 119.58 mm
Mean: 245.3 mm
Mean: 237.28 mm
Mean: 674.47 mm
2017
Mean: 89.39 mm
Mean: 158.25 mm
Mean: 187.25 mm
Mean: 194.52 mm
Mean: 629.66 mm
2018
Mean: 71.69 mm
Mean: 82.03 mm
Mean: 270.02 mm
Mean: 152.2 mm
Mean: 570.82 mm
2019
Mean: 68.35 mm
Mean: 92.78 mm
Mean: 285.73 mm
Mean: 186.43 mm
Mean: 631 mm
2020
Mean: 67.53 mm
Mean: 128.77 mm
Mean: 315.82 mm
Mean: 167.59 mm
Mean: 689.97 mm

3.0 WATER QUALITY

3.1 INTRODUCTION

The following presents the results of water quality monitoring conducted from 2008 to 2019 in the Lower Nelson River Region. Eight waterbodies were monitored in the Lower Nelson River Region: three on-system annual sites (Burntwood River near the inflow to Split Lake, Split Lake, and Lower Nelson River downstream of Limestone GS); three on-system rotational sites (Stephens Lake - South, Stephens Lake - North, and the Limestone Forebay); and two off-system annual sites (Hayes River and Assean 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 six exceptions (Table 3.1-1; Appendix 3-1):

- sampling was initiated in the Burntwood River, Split Lake, and Assean Lake in 2009, therefore there are only 11 years of monitoring for these sites over the 12-year period (i.e., n=44);
- due to ice conditions, sampling in winter cannot be completed safely in the Lower Nelson River downstream of the Limestone GS therefore no winter samples were collected for this site over the 12-year period (i.e., n=34);
- instead, sampling in winter was completed annually in the Limestone Forebay such that 12 winter samples were collected over the 12-year period for this rotational site (i.e., n= 24); and
- sampling could not be completed on the Hayes River due to frazil ice in the winters of 2008 and 2016 therefore only ten winter samples were collected for this site over the 12-year period (i.e., n=46).

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. Inventory of water quality sampling completed in the Lower Nelson River Region: 2008-2019.

Waterbody/ Area	Sampling Year [1]											
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BURNT[2]		●	●	●	●	●	●	●	●	●	●	●
SPLIT		●	●	●	●	●	●	●	●	●	●	●
LNR[3]	●	●	●	●	●	●	●	●	●	●	●	●
STL-S		●			●			●			●	
STL-N		●			●			●			●	
LMFB[3]			●			●			●			●
HAYES	●[4]	●	●	●	●	●	●	●	●[4]	●	●	●
ASSN		●	●	●	●	●	●	●	●	●	●	●

Notes:
1. Sampling year is from April-March.
2. Site sampled annually for water quality and rotationally for other components.
3. Due to unsafe ice conditions on the Lower Nelson River downstream of the Limestone GS, sampling in winter is conducted annually in the Limestone forebay.
4. No winter sample collected due to unsafe ice conditions.

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

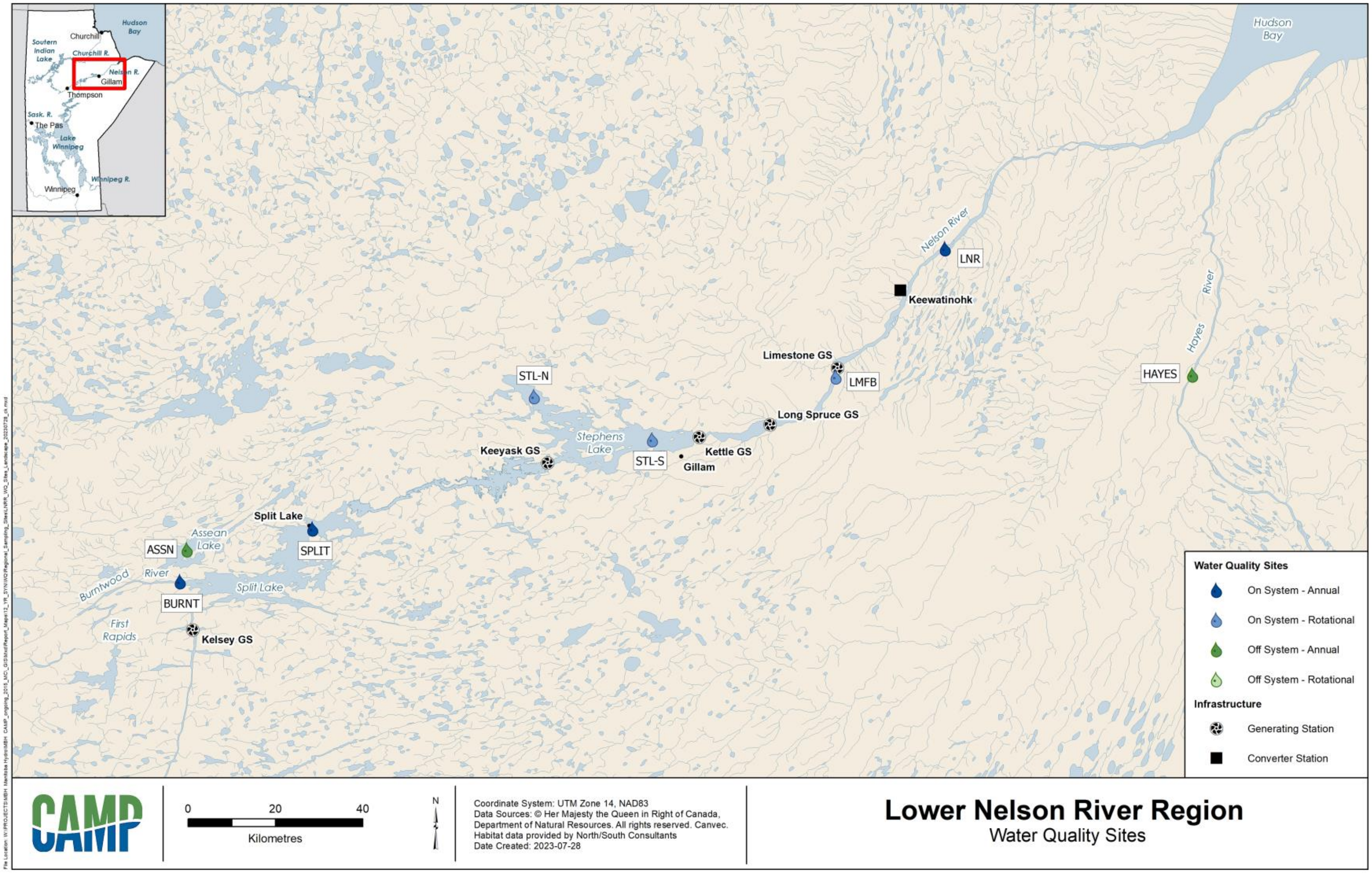


Figure 3.1-1. 2008-2019 Lower Nelson River Region water quality sites.

3.2 DISSOLVED OXYGEN

3.2.1 DISSOLVED OXYGEN

3.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

Burntwood River

The Burntwood River near the inlet to Split Lake was well-oxygenated year-round and DO concentrations at the surface 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). Only surface data are available for this site.

DO concentrations at the surface ranged from 8.73 to 12.52 mg/L during the open-water season, and from 15.09 to 16.94 mg/L during the ice-cover season (Table 3.2-2 and Figure 3.2-1). 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 3.2-2).

DO saturation was near 100% at the surface during each season sampled (Figure 3.2-3). During the open-water season, surface DO saturation ranged from 93.0 to 123.7% with a mean of 105.0% and a median of 104.8% over the 11 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 96.7 to 113.4% and were within or near the interquartile range (IQR) of 100.2 to 107.4% (Table 3.2-2 and Figure 3.2-4).

During the ice-cover season, DO saturation at the surface ranged from 105.7 to 120.2% with a mean of 113.3% and a median of 111.9%. The IQR was 110.7 to 118.0% (Table 3.2-2 and Figure 3.2-5).

Split Lake

Split 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).

Split Lake was isothermal (i.e., thermal stratification was not observed) and DO concentrations were similar across the water column during each sampling period (Figures 3.2-6 and 3.2-7). During the open-water season, DO concentrations ranged from 8.40 to 10.68 mg/L at the surface and 7.92 to 11.00 mg/L near the bottom (maximum site water depth = 22.0 m). During the ice-cover season, DO concentrations ranged from 14.32 to 16.42 mg/L at the surface and 14.37 to 16.51 mg/L near the bottom (Table 3.2-2 and Figure 3.2-8).

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 3.2-2).

DO saturation was near 100% at the surface and near the bottom during each season sampled (Figure 3.2-3). During the open-water season, surface DO saturation ranged from 92.8 to 112.8% over the 11 years of monitoring, with a mean of 98.8% and a median of 98.0%. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 94.7 to 102.2% and were within or near the IQR of 95.1 to 100.4%. Bottom DO saturation during the open-water season ranged from 86.3 to 108.8% with a mean of 97.9% and a median of 98.2% over the 11 years of monitoring. Mean bottom DO saturation levels in the open-water season were similar from year to year ranging from 90.9 to 101.4% and were within or near the IQR of 94.8 to 100.4% (Table 3.2-2 and Figure 3.2-4).

During the ice-cover season, DO saturation at the surface ranged from 100.6 to 120.3% with a mean of 108.9% and a median of 107.3%. The IQR was 103.9 to 113.1%. Bottom DO saturation during the ice-cover season ranged from 101.0 to 121.0% with a mean of 109.5% and a median of 108.6%. The IQR was 103.3 to 114.4% (Table 3.2-2 and Figure 3.2-5).

Lower Nelson River

The lower Nelson River downstream of the Limestone GS was well-oxygenated and DO concentrations near the surface consistently met the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water season (Table 3.2-1). No data are available for the ice-cover season and only surface data are available for this site.

During the open-water season, surface DO concentrations ranged from 8.76 to 12.39 mg/L over the 12 years of monitoring (Table 3.2-2 and Figure 3.2-9).

DO concentrations varied between seasons with seasonal mean DO concentrations being higher in spring and fall when the water was cooler, and lower in the summer when the water was warmer (Figure 3.2-2).

DO saturation was near 100% at the surface during each season sampled (Figure 3.2-3). During the open-water season, surface DO saturation ranged from 93.5 to 122.2% with a mean of 104.4% and a median of 102.8% over the 12 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 95.2 to 114.3% and were within or near the IQR of 98.0 to 109.3% (Table 3.2-2 and Figure 3.2-4).

ROTATIONAL SITES

Stephens Lake – South

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

Stephens Lake - South was isothermal and DO concentrations were similar throughout the water column during each sampling period (Table 3.2-1, and Figures 3.2-6 and 3.2-7). During the open-water season, DO concentrations ranged from 8.25 to 11.55 mg/L at the surface and 8.02 to 11.49 mg/L near the bottom (maximum site water depth = 20.1 m). During the ice-cover season, the surface DO concentration was 16.18 mg/L in 2012 and 14.72 mg/L in 2018 and near the bottom it was 14.71 mg/L in 2018 and 16.40 mg/L in 2012 (Table 3.2-2 and Figure 3.2-10).

DO saturation at Stephens Lake - South was near 100% at both the surface and near the bottom of the water column during each season sampled. During the open-water season, surface DO saturation ranged from 86.5 to 111.6% with a mean of 96.8% and a median of 98.1% over the four years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 90.3 to 100.4% and were within or near the IQR of 92.0 to 100.0%. Bottom DO saturation during the open-water season ranged from 85.1 to 110.8% with a mean of 94.5 and median of 95.4% over the four years of monitoring. Mean bottom DO saturation levels in the open-water season were similar from year to year ranging from 88.9 to 98.3% and were within or near the IQR of 88.1 to 97.9% (Table 3.2-2 and Figure 3.2-11).

During the ice-cover season, DO saturation at the surface was 103.6% in 2018 and 119.7% in 2012 with a mean of 111.6%. Bottom DO saturation during the ice-cover season was 121.3% in 2012 and 103.6% in 2018 with a mean of 112.5% (Table 3.2-2 and Figure 3.2-12).

Stephens Lake – North

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

Stephens Lake - North was isothermal and DO concentrations were similar throughout the water column during each sampling period (Table 3.2-2, and Figures 3.2-6 and 3.2-7). During the open-water season, DO concentrations ranged from 8.61 to 13.07 mg/L at the surface and 8.46 to 13.36 mg/L near the bottom (maximum site water depth = 10.6 m). During the ice-cover season, the surface DO concentration was 14.17 mg/L in 2018 and 16.25 mg/L in 2012, and near the bottom it was 13.75 mg/L in 2018 and 14.55 mg/L in 2012 (Table 3.2-2 and Figure 3.2-13).

DO saturation at Stephens Lake - North was near 100% at both the surface and near the bottom of the water column during each season sampled. During the open-water season, surface DO saturation ranged from 87.5 to 117.2% with a mean of 97.8% and a median of 98.8% over the four years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 94.0 to 100.0% and were within or near the IQR of 91.7 to 99.8%. Bottom DO saturation during the open-water season ranged from 84.6 to 119.3% with a mean of 96.1% and median of 96.6% over the four years of monitoring. Mean bottom DO saturation levels in the open-water season were similar from year to year ranging from 91.2 to 98.6% and were within or near the IQR of 89.4 to 98.5% (Table 3.2-2 and Figure 3.2-11).

During the ice-cover season, DO saturation at the surface was 99.5% in 2018 and 120.2% in 2012 with a mean of 109.8%. Bottom DO saturation during the ice-cover season was 97.7% in 2018 and 109.1% in 2012 with a mean of 103.4% (Table 3.2-2 and Figure 3.2-12).

Limestone Forebay

The Limestone Forebay was well-oxygenated year-round and DO concentrations throughout the water column consistently complied with 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 Limestone Forebay was isothermal and DO concentrations were similar throughout the water column during each sampling period (Table 3.2-1, and Figures 3.2-6 and 3.2-7). During the open-water season, DO concentrations ranged from 8.86 to 11.63 mg/L at the surface and 8.51 to 11.67 mg/L near the bottom over the four years of monitoring (maximum site water depth = 27.3 m). During the ice-cover season, the DO concentration ranged from 14.69 mg/L to 16.81 mg/L at the surface and from 14.65 mg/L to 16.74 mg/L near the bottom over the 12 years of monitoring (Table 3.2-2 and Figure 3.2-14).

DO saturation in the Limestone Forebay was near 100% at both the surface and near the bottom of the water column during each season sampled. During the open-water season, surface DO saturation ranged from 96.3 to 123.2% with a mean of 104.0% and a median of 102.6% over the four years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 99.2 to 109.9% and were within or near the IQR of 99.2 to 107.2%. Bottom DO saturation during the open-water season ranged from 93.6 to 123.3% with a mean of 102.1 and a median of 100.4% over the four years of monitoring. Mean bottom DO saturation levels in the open-water season were similar from year to year ranging from 96.7 to 108.5% and were within or near the IQR of 97.3 to 103.5% (Table 3.2-2 and Figure 3.2-11).

During the ice-cover season, surface DO saturation ranged from 100.9 to 119.4%. The mean was 109.6%, the median was 108.7%, and the IQR was 106.1 to 112.9% over the 12 years of monitoring. Bottom DO saturation during the ice-cover season ranged from 100.7 to 121.5%. The mean was 109.6%, the median was 109.3%, and the IQR was 106.0 to 111.8% (Table 3.2-2 and Figure 3.2-12).

3.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

The Hayes 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 3.2-3). Only surface data are available for this site.

DO concentrations at the surface ranged from 8.59 to 12.38 mg/L during the open-water season and from 10.42 and 14.30 mg/L during the ice-cover season (Table 3.2-4 and Figure 3.2-15).

DO concentrations varied between seasons with seasonal mean DO concentrations being higher in winter when the water was colder, and lower during the open-water season when the water was warmer (Figure 3.2-16). Mean DO saturation was near 100% at the surface during the spring, summer, and fall (99.3, 98.5, and 99.0%, respectively); however, mean DO saturation was lower in winter (82.6%; Figure 3.2-17).

During the open-water season, surface DO saturation ranged from 92.7 to 112.9% with a mean of 98.9% and a median of 98.0% over the 12 years of monitoring. Mean surface DO saturation levels in the open-water season were similar from year to year ranging from 93.9 to 106.9% and were within or near the IQR of 95.5 to 100.1% (Table 3.2-4 and Figure 3.2-18).

During the ice-cover season, surface DO saturation ranged from 73.0 to 103.1% with a mean of 82.6% and a median of 73.4%. The IQR for the ice-cover season was 73.0 to 90.5%. (Table 3.2-4 and Figure 3.2-19).

Assean Lake

Assean Lake was well-oxygenated year-round and DO concentrations across the water column consistently complied with the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life during the open-water and ice-cover seasons (Table 3.2-3).

Assean Lake was typically isothermal. However, there were two occurrences of thermal stratification near the surface (thermocline at 0-1 m) during the open-water season (spring 2012 and summer 2017). Thermal stratification was also observed during one winter sampling event (2011; Table 3.2-3 and Figure 3.2-6).

DO concentrations were typically similar throughout the water column; however, DO decreased with water depth during one summer sampling event (2017) and during one winter sampling event (2012). DO concentrations near the bottom remained above the MWQSOGs instantaneous minimum objectives for cool- and cold-water aquatic life on both of these occasions (Figures 3.2-7 and 3.2-20).

During the open-water season, DO concentrations ranged from 8.56 to 12.62 mg/L at the surface and from 7.50 to 12.00 mg/L near the bottom (maximum site water depth = 4.7 m). During the ice-cover season, DO concentrations ranged from 12.12 to 16.62 mg/L at the surface and from 10.90 to 15.90 mg/L near the bottom (Table 3.2-4 and Figure 3.2-20).

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

DO saturation in Assean Lake was near 100% at the surface and near the bottom of the water column during each season sampled (Figure 3.2-17). During the open-water season, surface DO saturation ranged from 89.6 to 122.8% with a mean of 99.9% and a median of 98.5% over the 11 years of monitoring. Mean surface DO saturation levels in the open-water season ranged from 93.3 to 106.3% and were within or near the IQR of 95.6 to 103.3%. Bottom DO saturation during the open-water season ranged from 81.3 to 116.7% with a mean of 98.1 and median of 96.9% over the 11 years of monitoring. Mean bottom DO saturation levels in the open-water season ranged from 89.7 to 105.0% and were within or near the IQR of 95.2 to 100.6% (Table 3.2-6 and Figure 3.2-18).

During the ice-cover season, DO saturation at the surface ranged from 88.3 to 124.6% with a mean of 103.7% and a median of 102.2%. The IQR was 93.4 to 112.0%. Bottom DO saturation during the ice-cover season ranged from 82.1 to 120.5% with a mean of 96.8% and a median of 96.1%. The IQR was 89.5 to 100.1% (Table 3.2-4 and Figure 3.2-19).

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

Metric	Sampling Year	Surface or Bottom	BURNT				SPLIT				LNR			
			Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover
			SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI
Thermal Stratification	2008		No Data								No Data			
	2009						No	No	No	No				
	2010						No	No	No	No				
	2011						No	No	No	No				
	2012						No	No	No	No				
	2013						No	No	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	Yes	Yes	
		Bottom												
	2009	Surface	ND	ND	ND	ND	ND	ND	ND	ND	ND	Yes	Yes	
		Bottom					ND	ND	ND	ND				
	2010	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				
	2011	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	ND				
	2012	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				
	2013	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	ND				
	2014	Surface	Yes	Yes	Yes	ND	Yes	Yes	ND	ND	Yes	Yes	Yes	
		Bottom					ND	Yes	Yes	ND				
	2015	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	ND				
	2016	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				
	2017	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				
	2018	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				
	2019	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		Bottom					Yes	Yes	Yes	Yes				

Table 3.2-1. continued.

Metric	Sampling Year	Surface or Bottom	STL-S				STL-N				LMFB			
			Open-Water			Ice-Cover	Open-Water			Ice-Cover	Open-Water			Ice-Cover
			SP	SU	FA	WI	SP	SU	FA	WI	SP	SU	FA	WI
Thermal Stratification	2008													No
	2009		No	No	No	No	No	No	No	No				No
	2010										No	No	No	No
	2011													No
	2012		No	No	No	No	No	No	No	No				No
	2013										No	No	No	No
	2014													No
	2015		No	No	No	No	No	No	No	No				No
	2016										No	No	No	No
	2017													No
	2018		No	No	No	No	No	No	No	No				No
	2019										No	No	No	No
DO met MWQSOGs PAL objectives	2008	Surface												Yes
		Bottom												Yes
	2009	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND				ND
		Bottom	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND				ND
	2010	Surface									Yes	Yes	Yes	Yes
		Bottom									Yes	Yes	Yes	Yes
	2011	Surface												ND
		Bottom												ND
	2012	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes
		Bottom	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes
	2013	Surface									Yes	Yes	Yes	ND
		Bottom									Yes	Yes	Yes	ND
	2014	Surface												ND
		Bottom												ND
	2015	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND				ND
		Bottom	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND				ND
	2016	Surface									Yes	Yes	Yes	Yes
		Bottom									Yes	Yes	Yes	Yes
	2017	Surface												Yes
		Bottom												Yes
	2018	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes
		Bottom	Yes	Yes	Yes	Yes	Yes	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
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., BURNT and LNR), 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
BURNT	Mean	10.27	16.09	-	-	105.0	113.3	-	-	7.7	2.3	0.58
	Median	10.39	16.26	-	-	104.8	111.9	-	-	9.2	2.3	0.57
	Minimum	8.73	15.09	-	-	93.0	105.7	-	-	1.6	1.2	0.46
	Maximum	12.52	16.94	-	-	123.7	120.2	-	-	11.9	4.5	0.66
	SD	0.977	0.705	-	-	6.65	5.85	-	-	3.3	0.8	0.08
	SE	0.178	0.315	-	-	1.21	2.62	-	-	0.6	0.3	0.02
	25th Percentile	9.30	15.73	-	-	100.2	110.7	-	-	4.75	2.00	0.5
	75th Percentile	10.78	16.42	-	-	107.4	118.0	-	-	10.3	2.40	0.7
	n	30	5	-	-	30	5	-	-	32	11	11
	% Detections	100	100	-	-	100	100	-	-	-	-	-
SPLIT	Mean	9.58	15.33	9.58	15.42	98.8	108.9	97.9	109.5	14.7	15.1	0.74
	Median	9.73	15.26	9.69	15.22	98.0	107.3	98.2	108.6	16.2	16.3	0.79
	Minimum	8.40	14.32	7.92	14.37	92.8	100.6	86.3	101.0	4.2	7.1	0.28
	Maximum	10.68	16.42	11.00	16.51	112.8	120.3	108.8	121.0	22.0	17.4	0.96
	SD	0.654	0.762	0.744	0.916	4.67	7.41	4.95	8.05	4.4	3.5	0.20
	SE	0.124	0.311	0.136	0.374	0.882	3.03	0.904	3.29	0.8	1.1	0.06
	25th Percentile	9.06	14.89	9.06	14.78	95.1	103.9	94.8	103.3	14.0	15.9	0.6
	75th Percentile	10.06	15.79	10.05	16.25	100.4	113.1	100.4	114.4	16.9	17.2	0.9
	n	28	6	30	6	28	6	30	6	30	11	11
	% Detections	100	100	100	100	100	100	100	100	-	-	-
LNR	Mean	10.39	-	-	-	104.4	-	-	-	5.5	-	-
	Median	10.27	-	-	-	102.8	-	-	-	5.4	-	-
	Minimum	8.76	-	-	-	93.5	-	-	-	1.1	-	-
	Maximum	12.39	-	-	-	122.2	-	-	-	11.2	-	-
	SD	0.982	-	-	-	8.01	-	-	-	2.3	-	-
	SE	0.166	-	-	-	1.35	-	-	-	0.4	-	-
	25th Percentile	9.78	-	-	-	98.0	-	-	-	4.65	-	-
	75th Percentile	11.16	-	-	-	109.3	-	-	-	6.28	-	-
	n	35	-	-	-	35	-	-	-	26	-	-
	% Detections	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
STL-S	Mean	9.63	15.45	9.45	15.56	96.8	111.6	94.5	112.5	12.6	10.2	1.08
	Median	9.44	-	9.26	-	98.1	-	95.4	-	11.9	-	-
	Minimum	8.25	14.72	8.02	14.71	86.5	103.6	85.1	103.6	9.1	9.1	0.90
	Maximum	11.55	16.18	11.49	16.40	111.6	119.7	110.8	121.3	20.1	10.8	1.20
	SD	0.962	-	1.04	-	6.88	-	7.19	-	3.2	0.8	0.13
	SE	0.278	-	0.300	-	1.99	-	2.08	-	0.9	0.4	0.06
	25th Percentile	8.99	-	8.68	-	92.0	-	88.1	-	11.0	-	-
	75th Percentile	10.31	-	10.27	-	100.0	-	97.9	-	12.6	-	-
	n	12	2	12	2	12	2	12	2	12	4	4
	% Detections	100	100	100	100	100	100	100	100	-	-	-
STL-N	Mean	10.10	15.21	9.99	14.15	97.8	109.8	96.1	103.4	8.2	6.2	1.04
	Median	9.78	-	9.56	-	98.8	-	96.6	-	8.8	-	-
	Minimum	8.61	14.17	8.46	13.75	87.5	99.5	84.6	97.7	4.3	4.8	0.96
	Maximum	13.07	16.25	13.36	14.55	117.2	120.2	119.3	109.1	10.6	7.4	1.16
	SD	1.36	-	1.47	-	7.87	-	9.08	-	2.1	1.1	0.09
	SE	0.394	-	0.425	-	2.27	-	2.62	-	0.6	0.5	0.05
	25th Percentile	9.06	-	8.91	-	91.7	-	89.4	-	6.65	-	-
	75th Percentile	11.06	-	10.94	-	99.8	-	98.5	-	10.1	-	-
	n	12	2	12	2	12	2	12	2	12	4	4
	% Detections	100	100	100	100	100	100	100	100	-	-	-
LMFB	Mean	10.39	15.67	10.25	15.68	104.0	109.6	102.1	109.6	25.0	25.2	0.89
	Median	10.82	15.61	10.48	15.64	102.6	108.7	100.4	109.3	24.9	25.6	0.88
	Minimum	8.86	14.69	8.51	14.65	96.3	100.9	93.6	100.7	24.0	23.6	0.72
	Maximum	11.63	16.81	11.67	16.74	123.2	119.4	123.3	121.5	27.3	27.0	1.20
	SD	0.970	0.798	1.07	0.791	7.25	6.20	8.57	6.59	0.8	1.0	0.13
	SE	0.280	0.302	0.309	0.299	2.09	2.34	2.47	2.49	0.2	0.3	0.04
	25th Percentile	9.65	15.04	9.57	15.06	99.2	106.1	97.3	106.0	24.8	24.7	0.8
	75th Percentile	11.02	16.26	11.01	16.30	107.2	112.9	103.5	111.8	25.2	25.7	0.9
	n	12	7	12	7	12	7	12	7	12	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

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

Metric	Sampling Year	Surface or Bottom	HAYES				ASSN			
			Open-Water			Ice-Cover	Open-Water			Ice-Cover
			SP	SU	FA	WI	SP	SU	FA	WI
Thermal Stratification	2008									
	2009						No	No	No	No
	2010						No	No	No	No
	2011						No	No	No	2011
	2012						2012	No	No	No
	2013		No Data				No	No	No	No
	2014						No	No	No	No
	2015						No	No	No	No
	2016						No	No	No	No
	2017						No	2017	No	No
	2018						No	No	No	No
	2019						No	No	No	No
DO met MWQSOGs PAL objectives	2008	Surface	Yes	Yes	Yes	ND				
		Bottom								
	2009	Surface	ND	ND	ND	ND	ND	ND	ND	ND
		Bottom					ND	ND	ND	ND
	2010	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2011	Surface	ND	ND	ND	ND	Yes	Yes	Yes	ND
		Bottom					Yes	Yes	Yes	ND
	2012	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2013	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND
		Bottom					Yes	Yes	Yes	ND
	2014	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	ND
		Bottom					Yes	Yes	Yes	ND
	2015	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2016	Surface	Yes	Yes	Yes	ND	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2017	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2018	Surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Bottom					Yes	Yes	Yes	Yes
	2019	Surface	Yes	Yes	Yes	Yes	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. As only surface data are available for riverine sites (i.e., HAYES), assessment of thermal stratification and bottom dissolved oxygen concentrations are not provided for these locations.
6.. [ ] = 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
HAYES	Mean	9.95	11.75	-	-	98.9	82.6	-	-	2.6	2.1	0.79
	Median	10.06	10.75	-	-	98.0	73.4	-	-	2.3	1.6	0.75
	Minimum	8.59	10.42	-	-	92.7	73.0	-	-	1.4	0.8	0.43
	Maximum	12.38	14.30	-	-	112.9	103.1	-	-	4.8	5.2	1.40
	SD	0.945	1.65	-	-	4.64	13.7	-	-	0.8	1.4	0.26
	SE	0.165	0.740	-	-	0.808	6.14	-	-	0.1	0.5	0.08
	25th Percentile	9.11	10.73	-	-	95.5	73.0	-	-	2.10	1.25	0.7
	75th Percentile	10.54	12.55	-	-	100.1	90.5	-	-	3.00	2.45	0.9
	n	33	5	-	-	33	5	-	-	34	10	10
	% Detections	100	100	-	-	100	100	-	-	-	-	-
ASSN	Mean	9.85	14.11	9.75	12.83	99.9	103.7	98.1	96.8	3.3	2.3	0.89
	Median	9.74	14.04	9.80	12.71	98.5	102.2	96.9	96.1	3.3	2.5	0.85
	Minimum	8.56	12.12	7.50	10.90	89.6	88.3	81.3	82.1	2.2	0.9	0.72
	Maximum	12.62	16.62	12.00	15.90	122.8	124.6	116.7	120.5	4.7	3.2	1.57
	SD	0.947	1.64	0.976	1.66	6.85	13.6	6.96	12.4	0.6	0.6	0.24
	SE	0.173	0.620	0.178	0.626	1.25	5.14	1.27	4.70	0.1	0.2	0.07
	25th Percentile	9.05	12.93	8.94	11.79	95.6	93.4	95.2	89.5	3.00	2.05	0.8
	75th Percentile	10.37	15.07	10.31	13.38	103.3	112.0	100.6	100.1	3.60	2.75	0.9
	n	30	7	30	7	30	7	30	7	33	11	11
	% 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

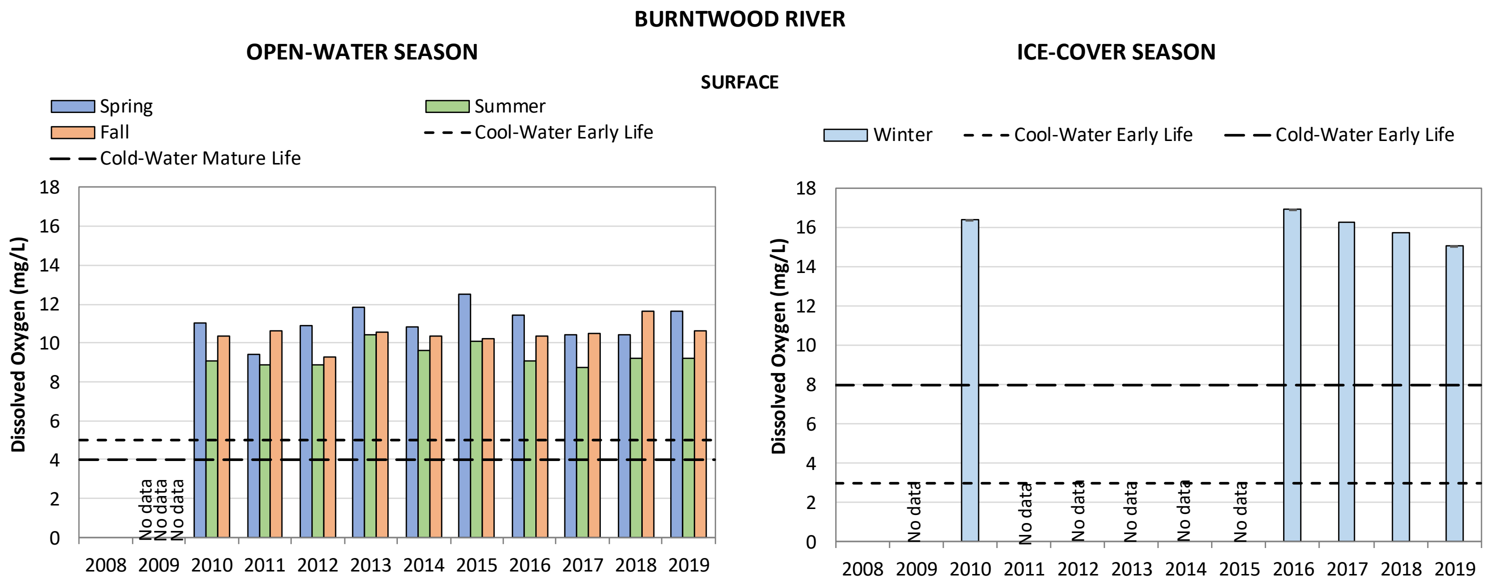


Figure 3.2-1. 2008-2019 Burntwood River surface dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

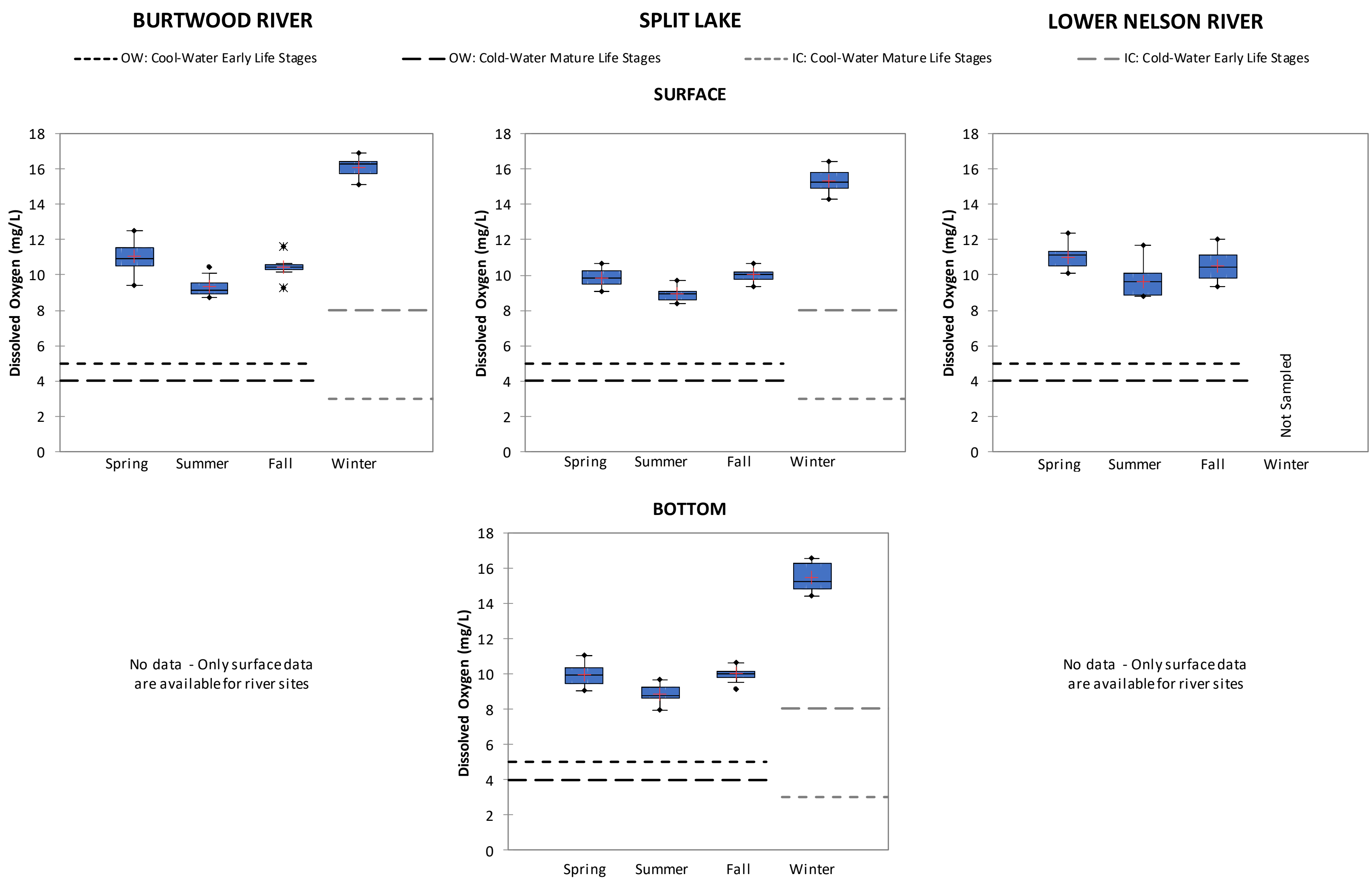


Figure 3.2-2. 2008-2019 On-system seasonal surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

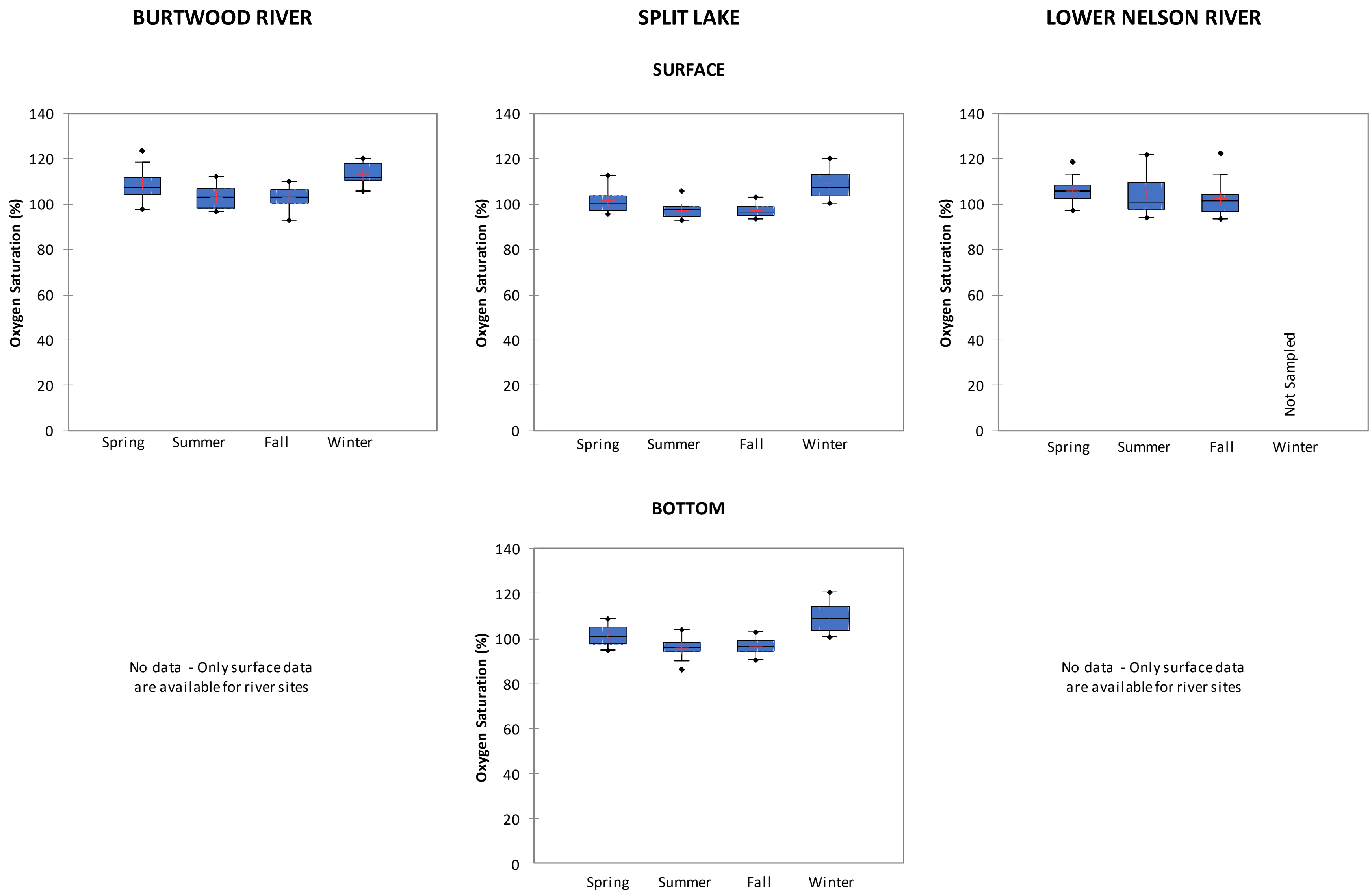


Figure 3.2-3. 2008-2019 On-system seasonal surface and bottom dissolved oxygen saturation.

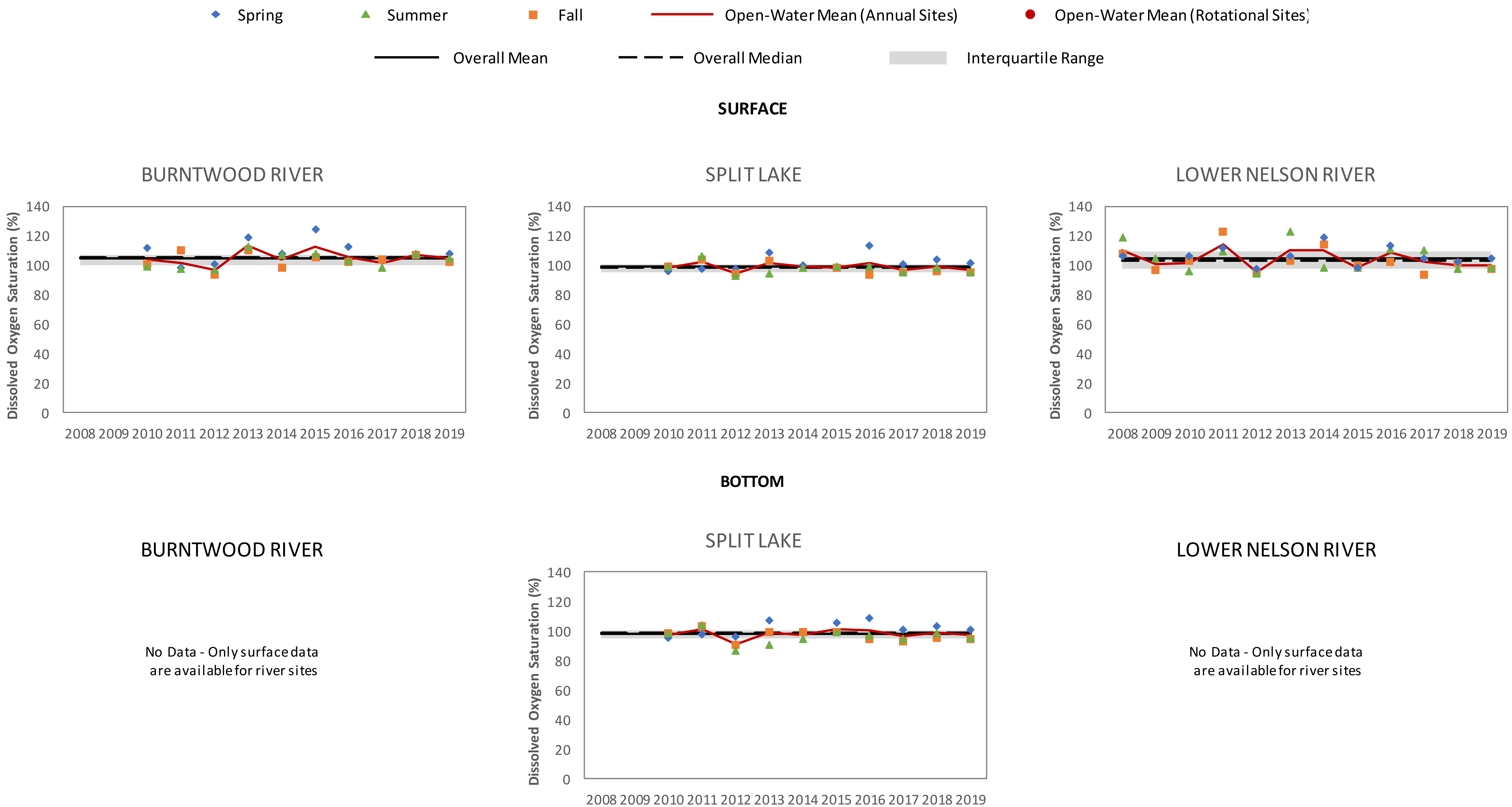


Figure 3.2-4. 2008-2019 On-system annual sites open-water season surface and bottom dissolved oxygen saturation.

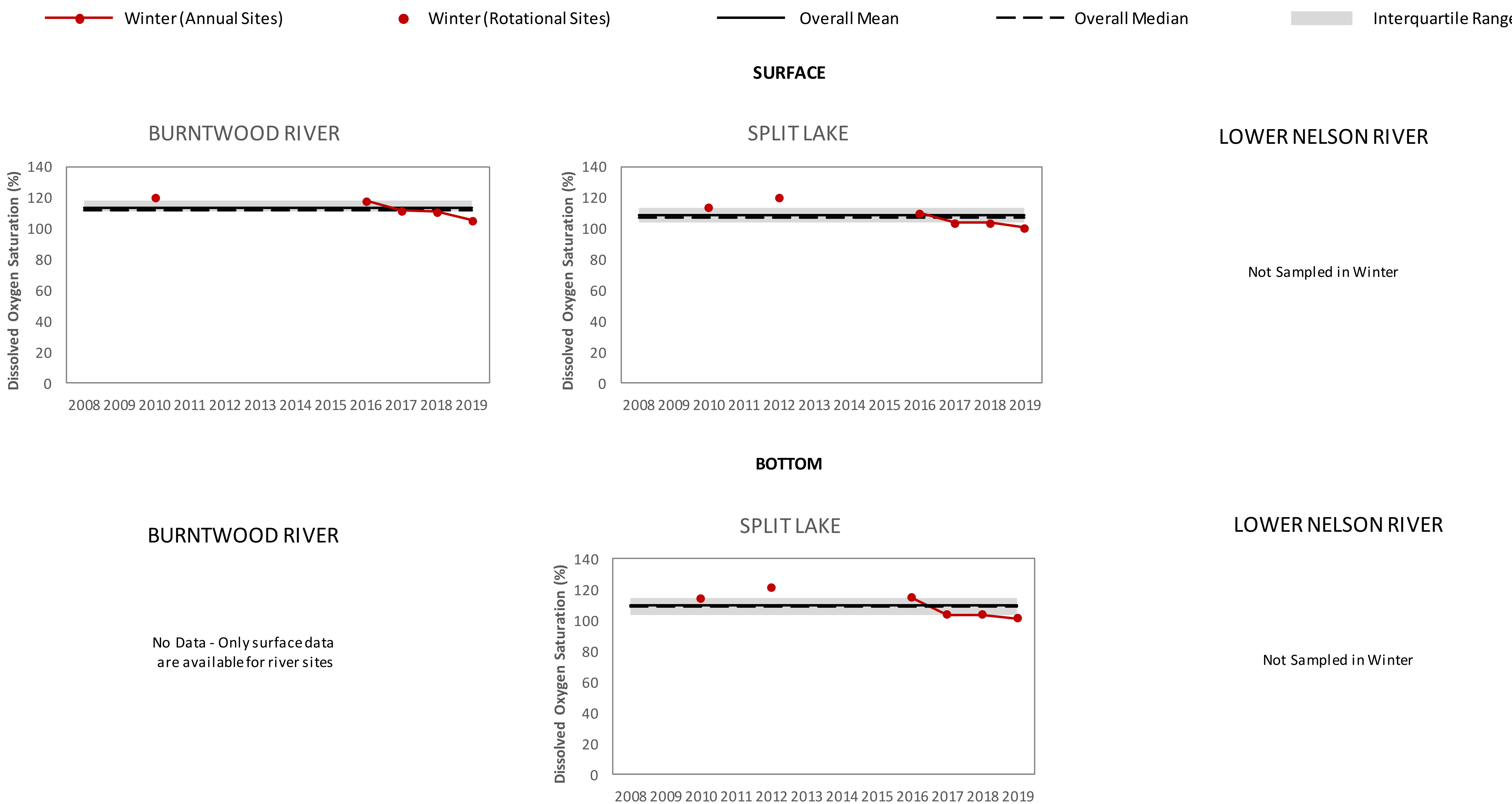


Figure 3.2-5. 2008-2019 On-system annual sites ice-cover season surface and bottom dissolved oxygen saturation.

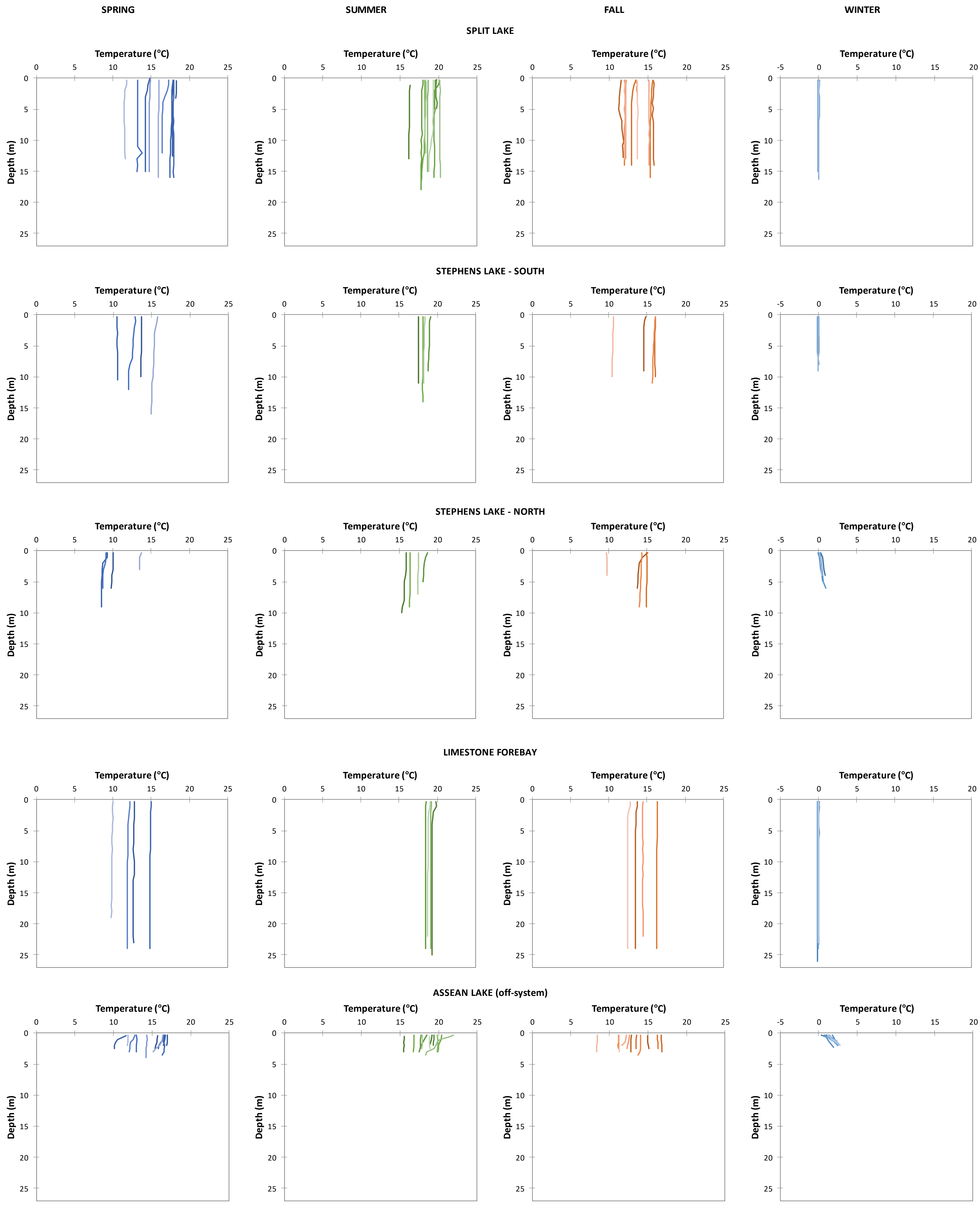


Figure 3.2-6. 2008-2019 On-system and off-system water temperature depth profiles.

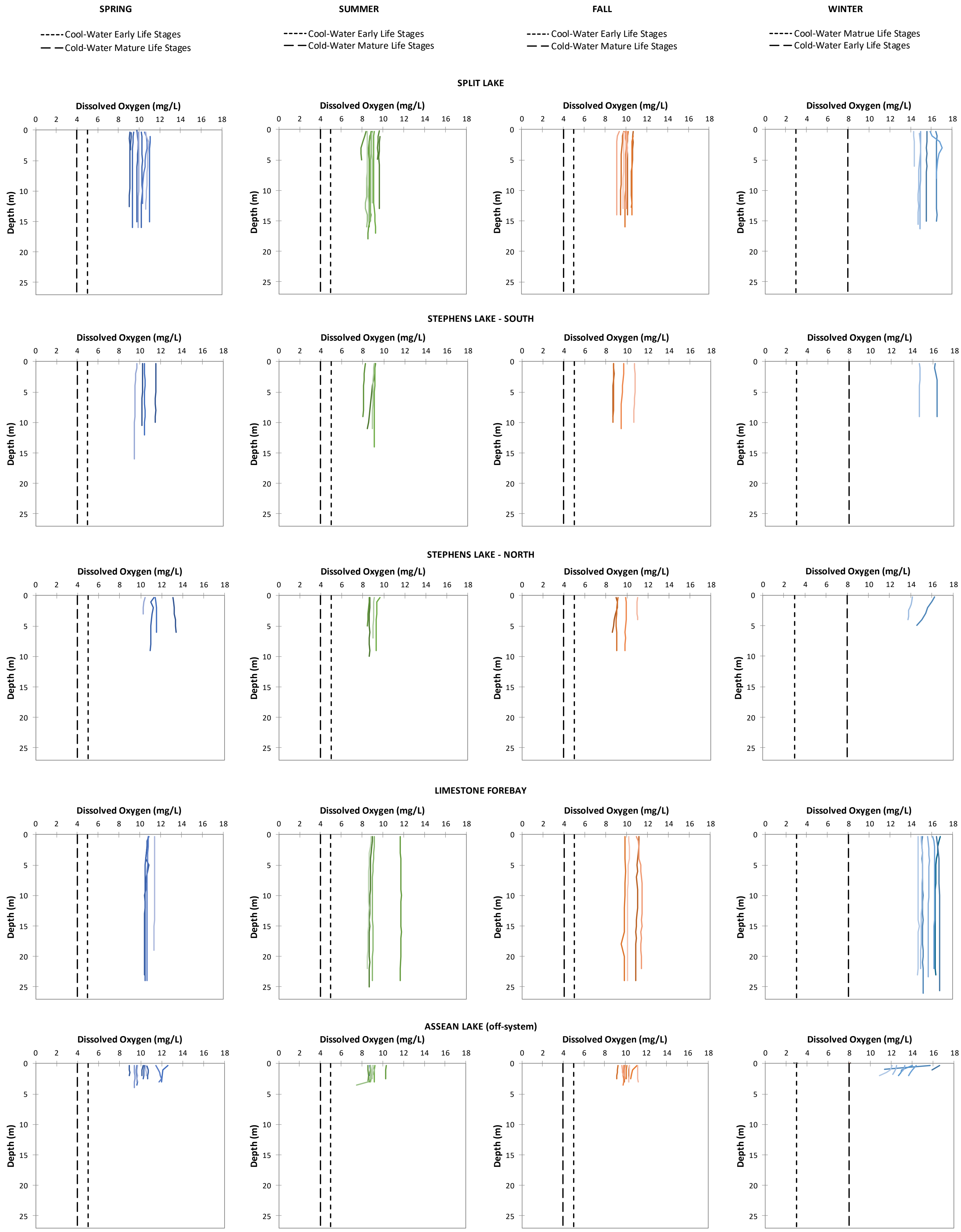


Figure 3.2-7. 2008-2019 On-system and off-system dissolved oxygen depth profiles and comparison to instantaneous minimum objectives for the protection of aquatic life.

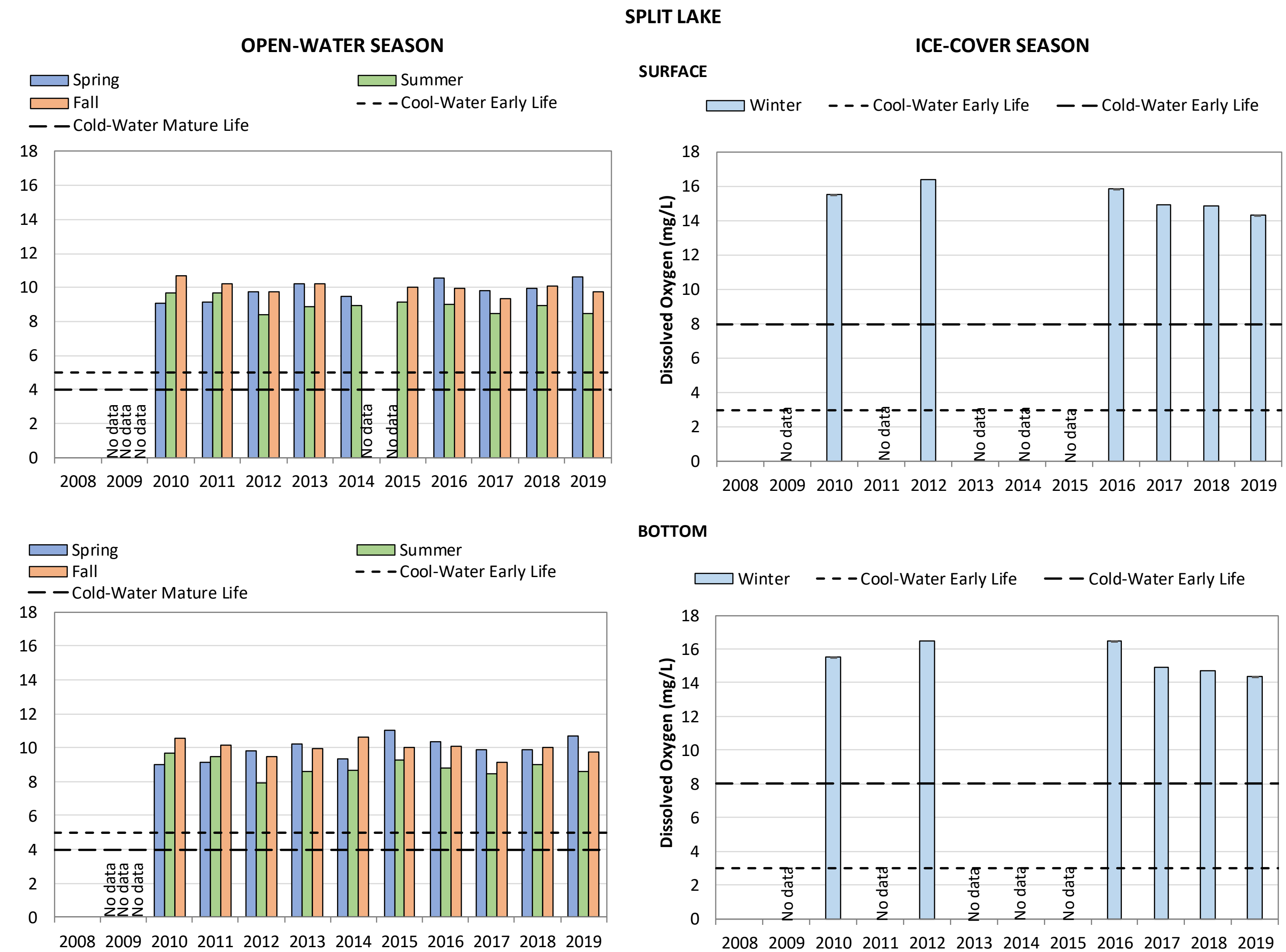


Figure 3.2-8. 2008-2019 Split Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

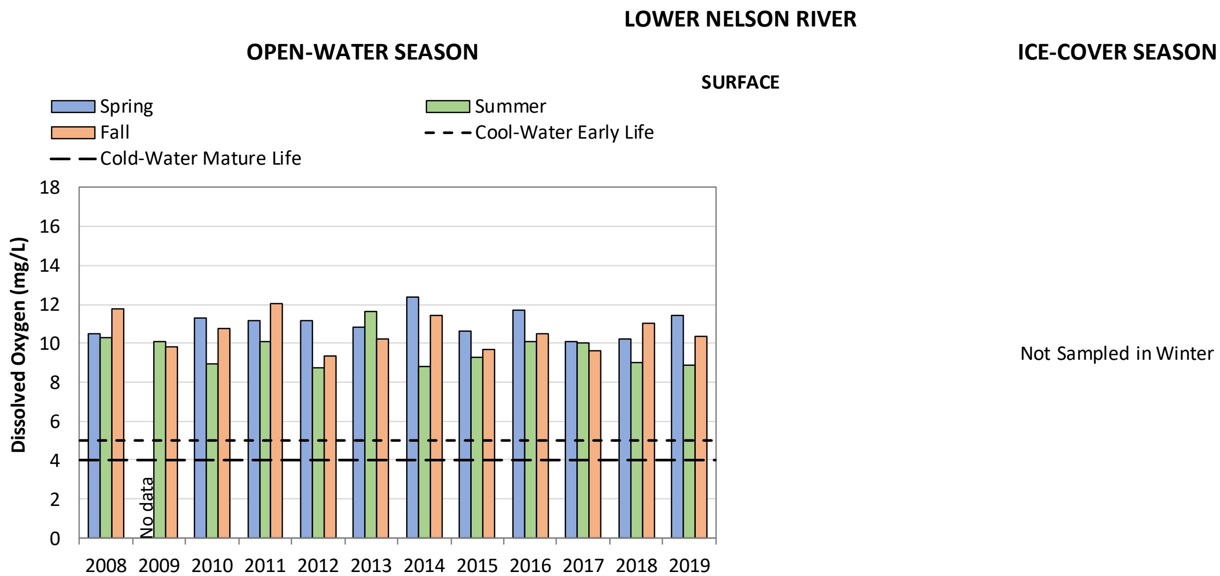


Figure 3.2-9. 2008-2019 Lower Nelson River surface dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

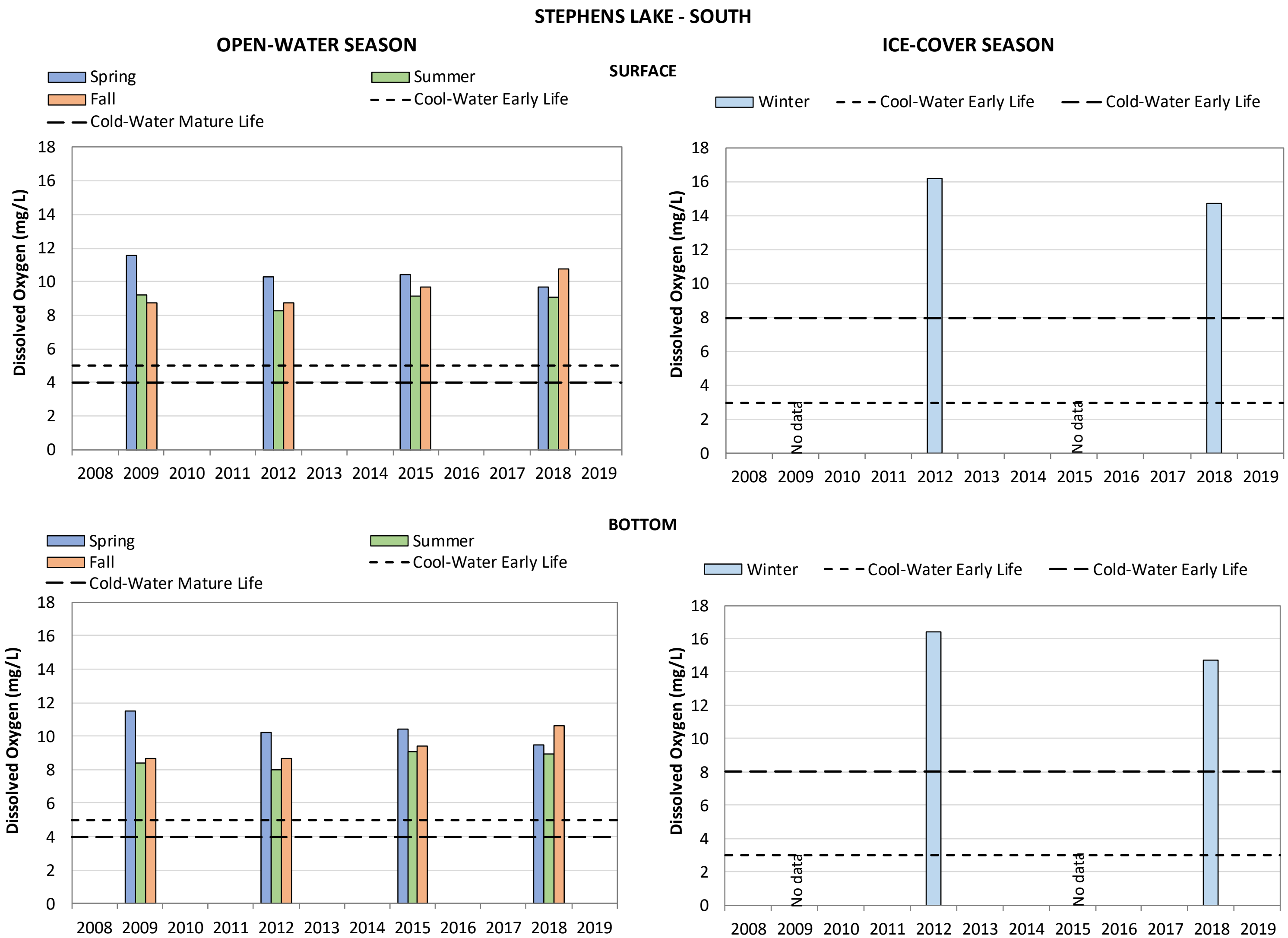


Figure 3.2-10. 2008-2019 Stephens Lake – South surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

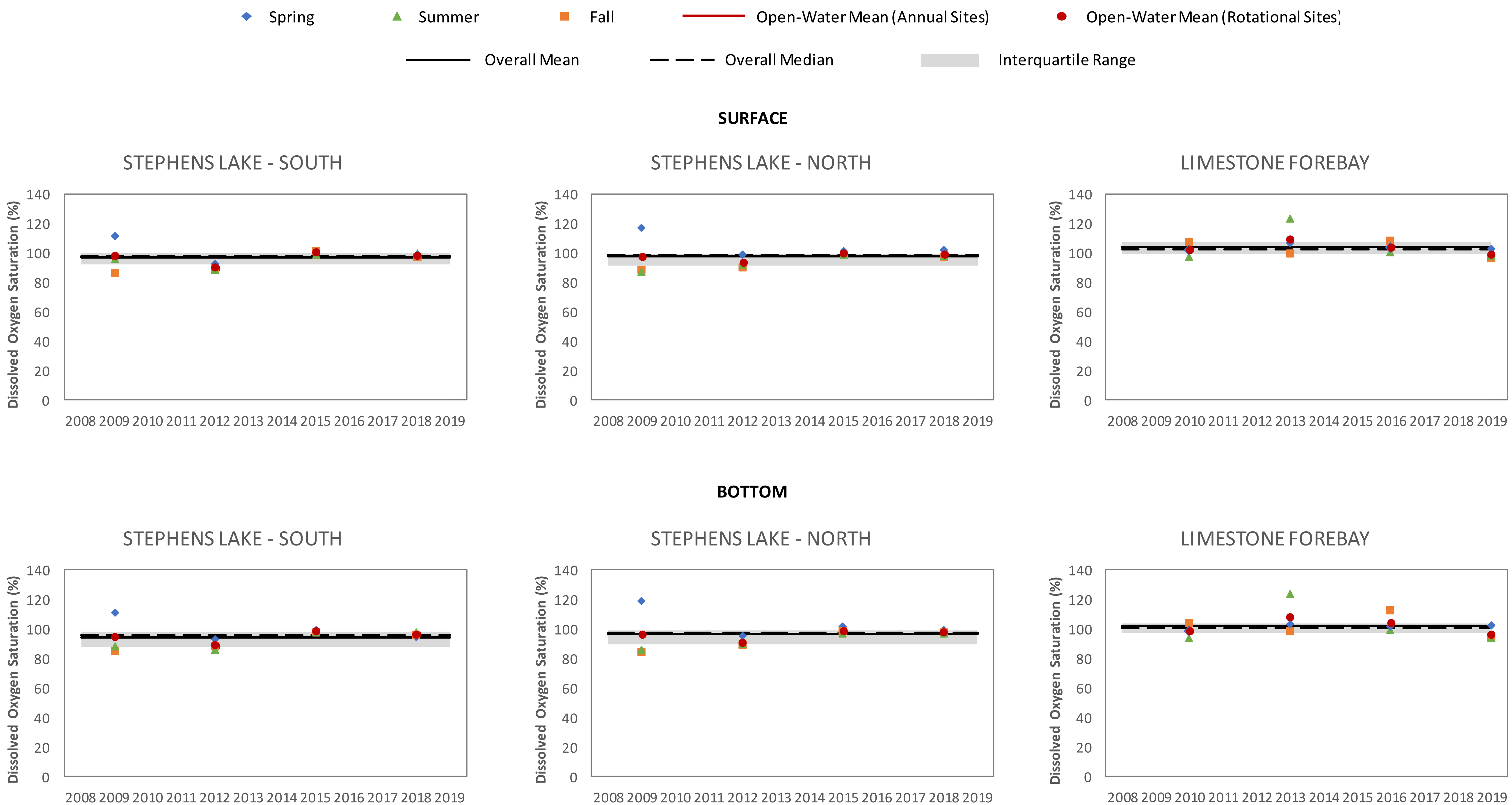


Figure 3.2-11. 2008-2019 On-system rotational sites open-water season surface and bottom dissolved oxygen saturation.

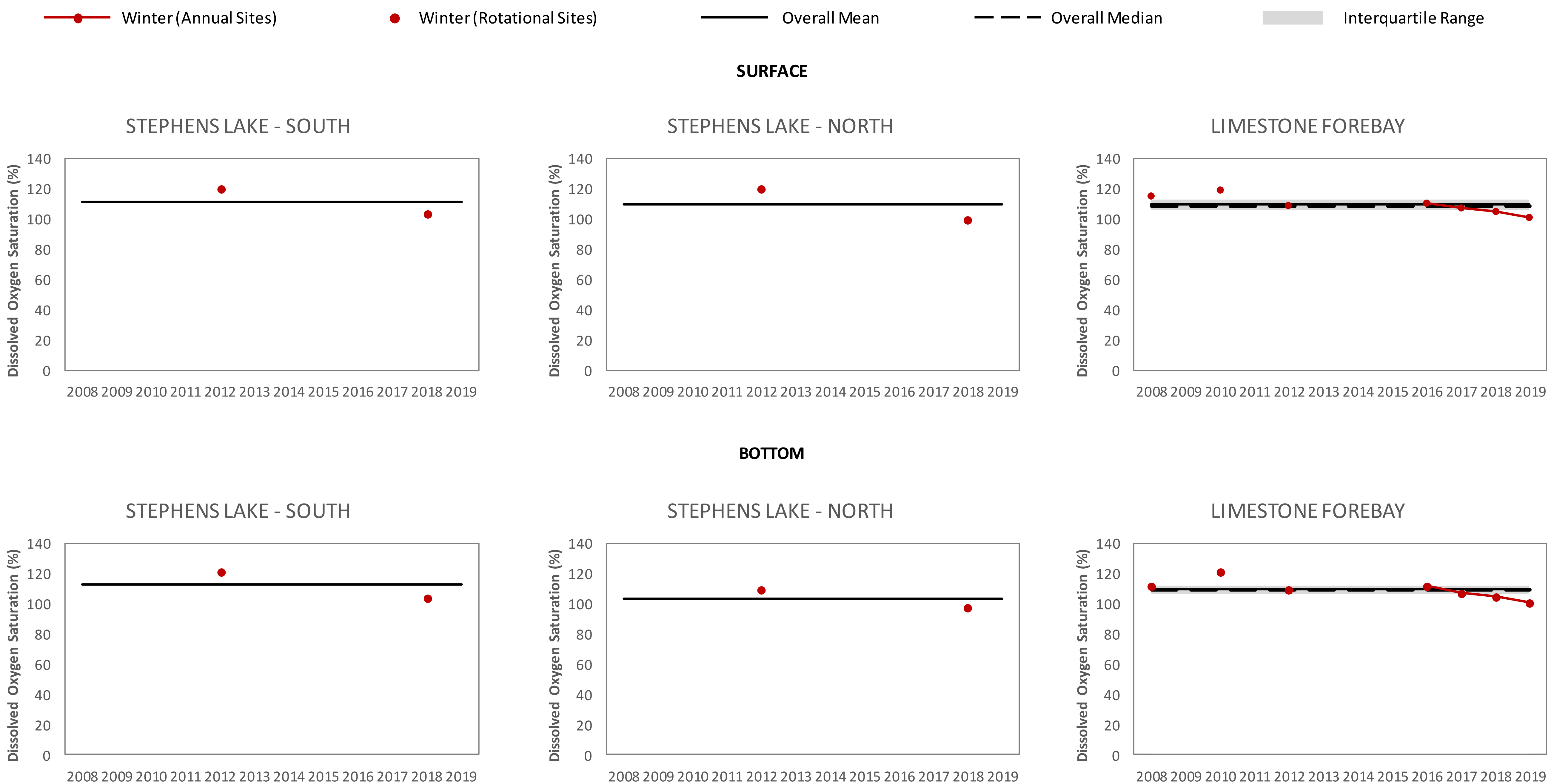


Figure 3.2-12. 2008-2019 On-system rotational sites ice-cover season surface and bottom dissolved oxygen saturation.

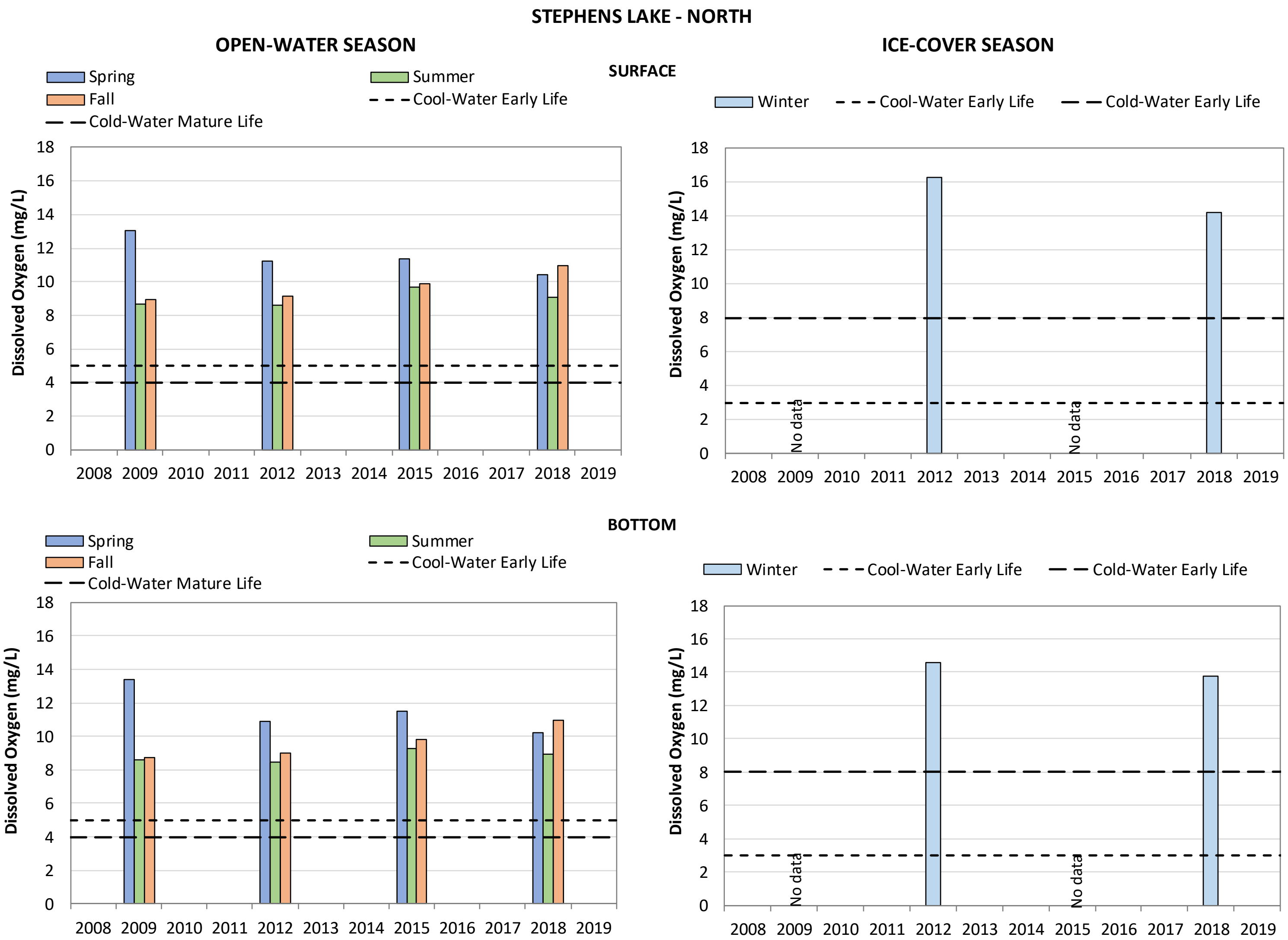


Figure 3.2-13. 2008-2019 Stephens Lake – North surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

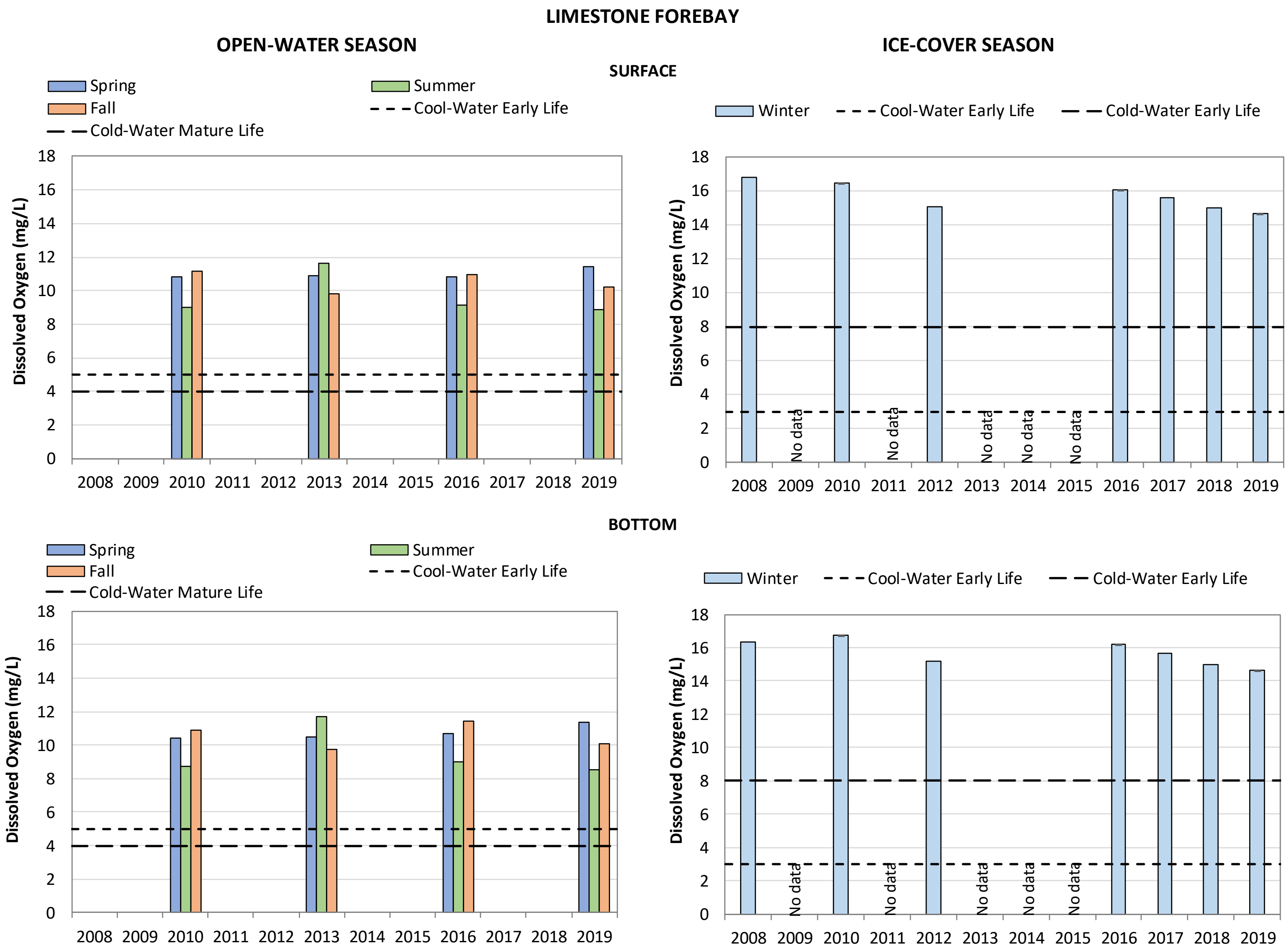


Figure 3.2-14. 2008-2019 Limestone Forebay surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

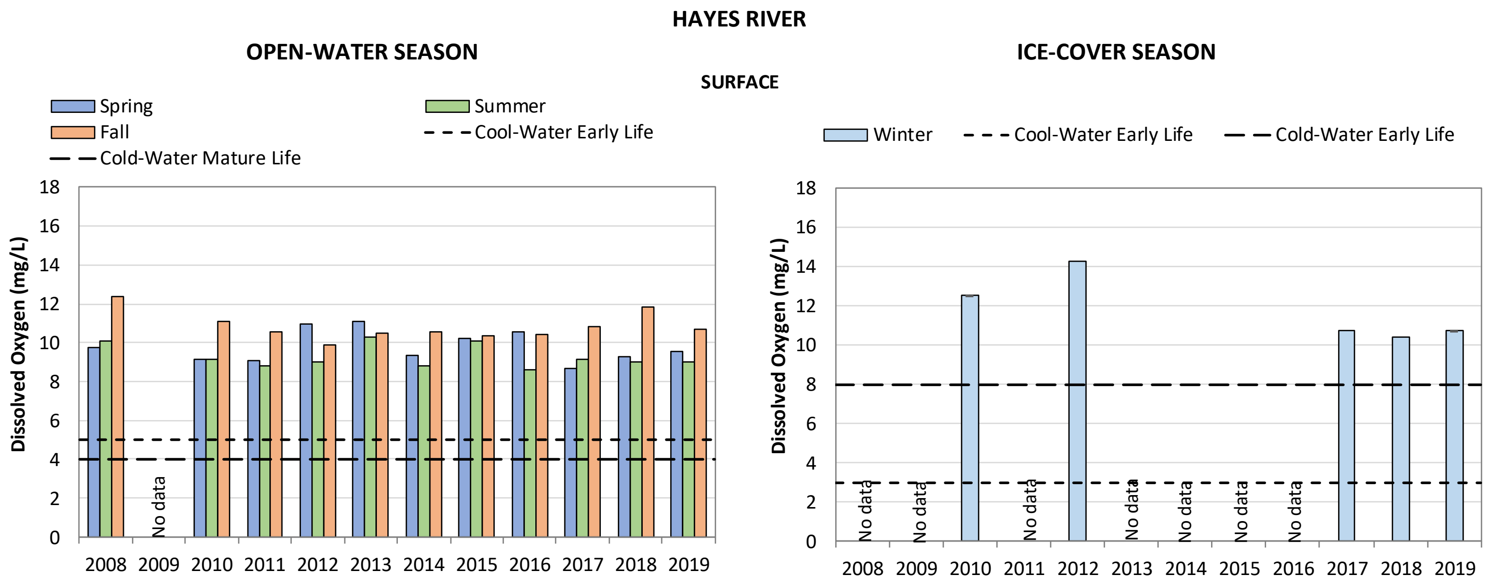


Figure 3.2-15. 2008-2019 Hayes River surface dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

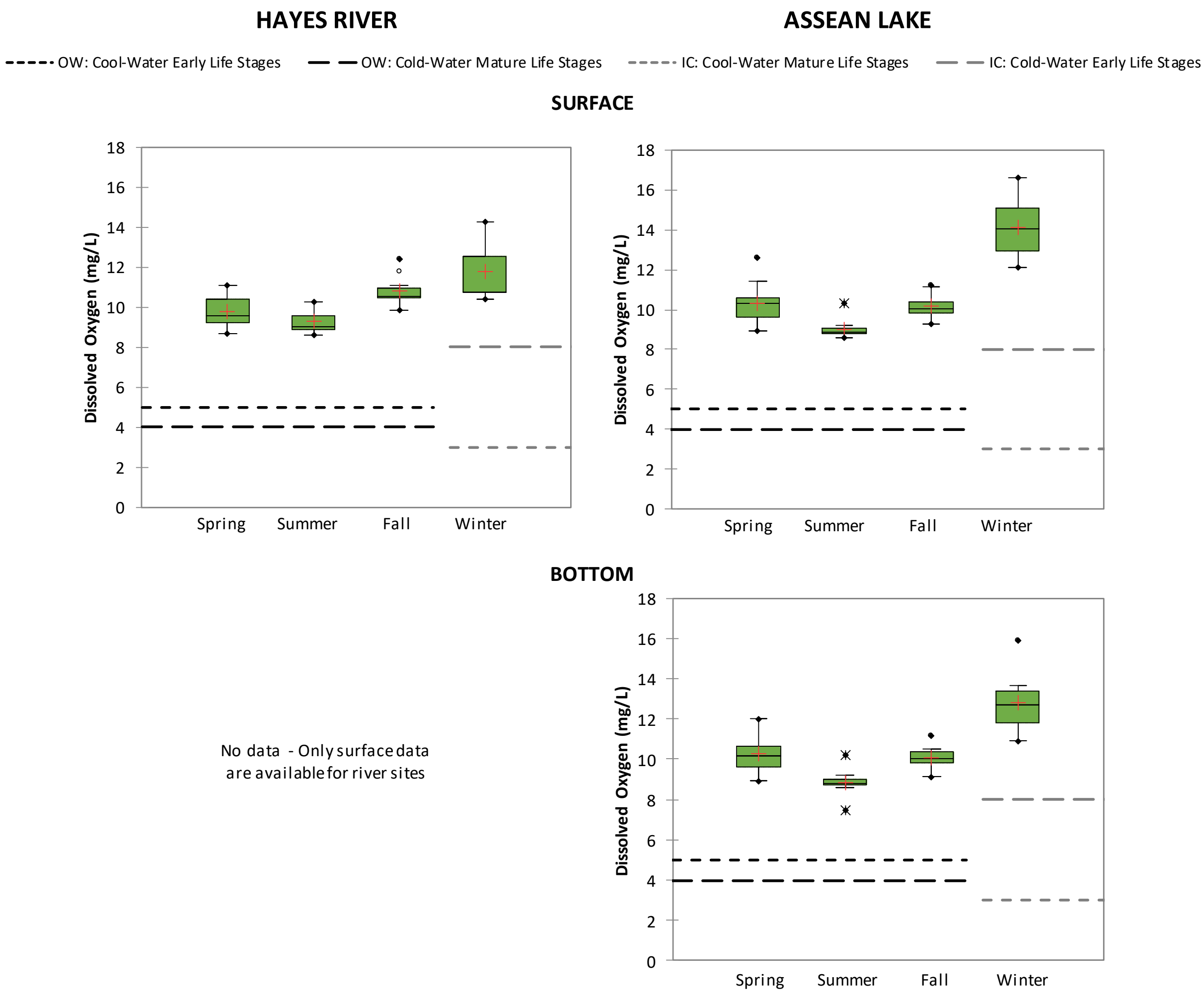


Figure 3.2-16. 2008-2019 Off-system seasonal surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

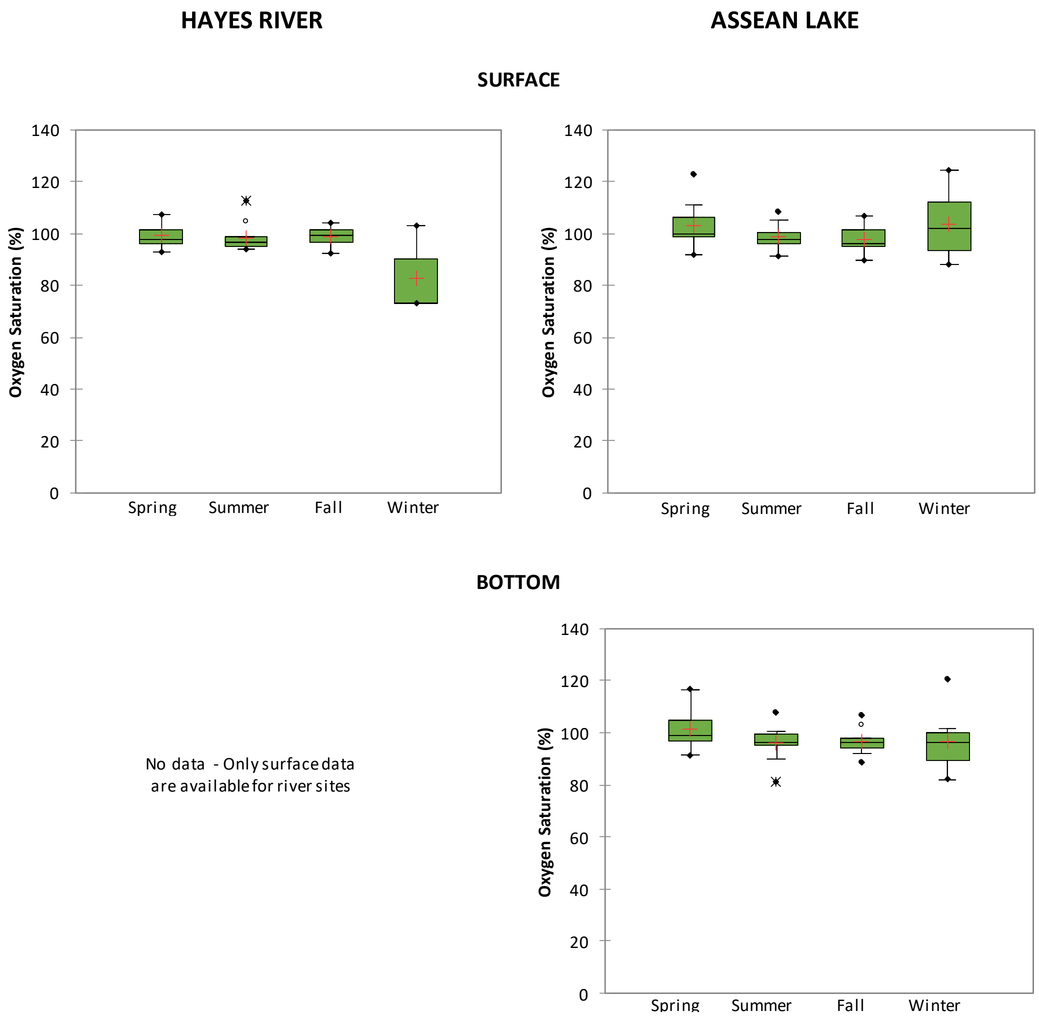


Figure 3.2-17. 2008-2019 Off-system seasonal surface and bottom dissolved oxygen saturation.

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

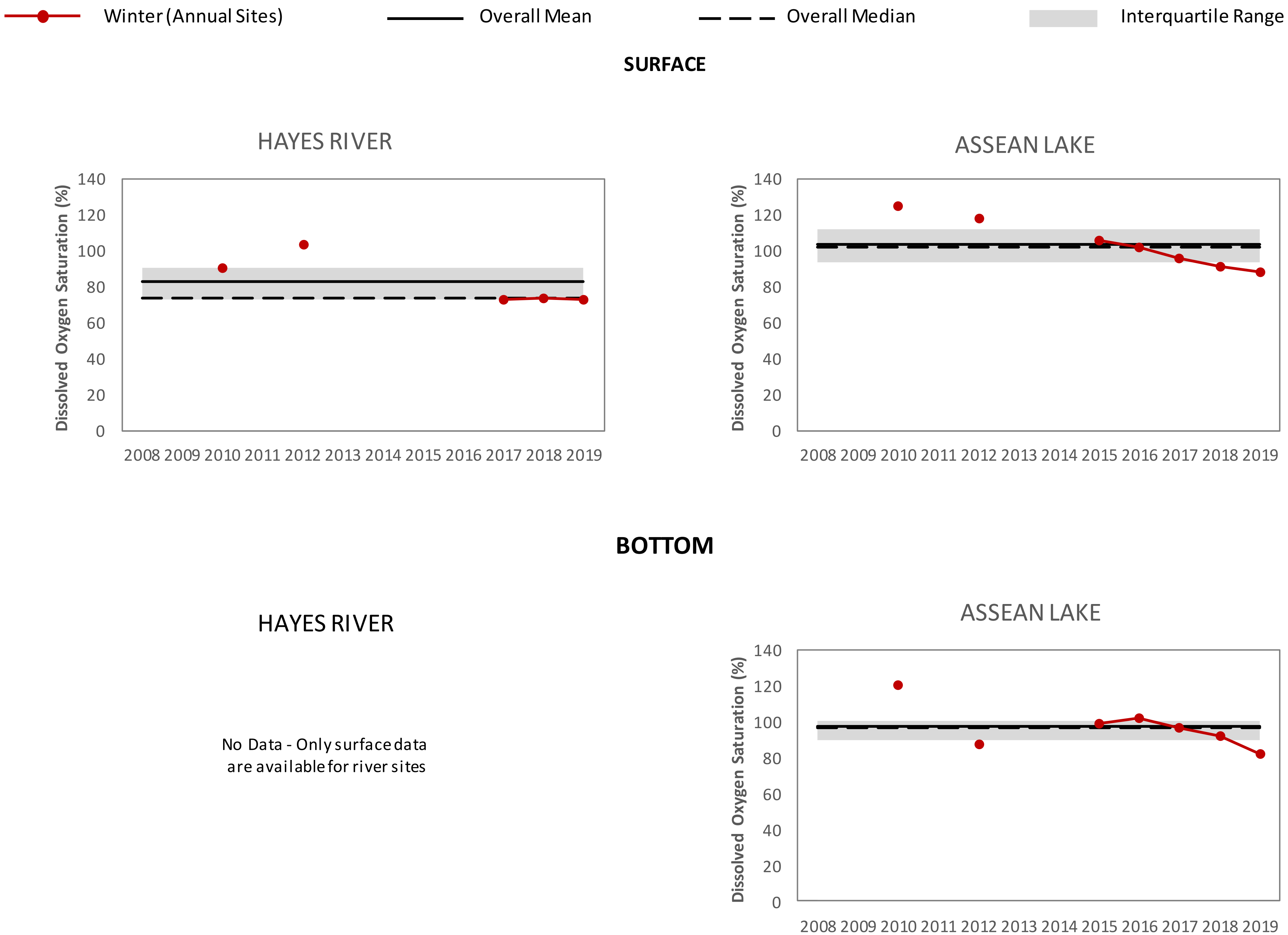


Figure 3.2-19. 2008-2019 Off-system ice-cover season surface and bottom dissolved oxygen saturation.

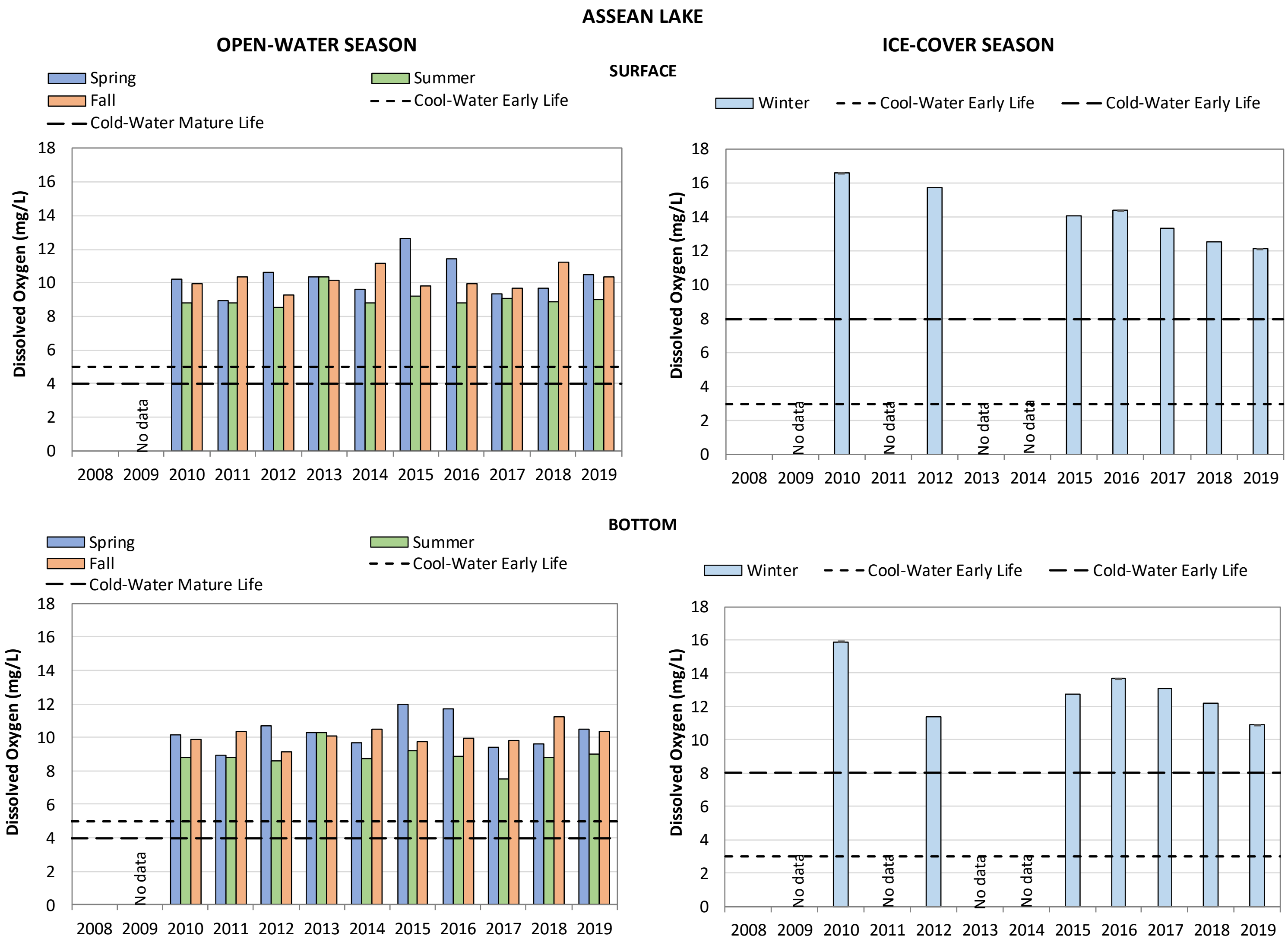


Figure 3.2-20. 2008-2019 Assean Lake surface and bottom dissolved oxygen concentrations with comparison to instantaneous minimum objectives for the protection of aquatic life.

3.3 WATER CLARITY

3.3.1 SECCHI DISK DEPTH

3.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Burntwood River

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

Split Lake

Secchi disk depth in Split Lake ranged from 0.15 to 0.80 m during the open-water season. The mean and median measurements for the ten years of monitoring (Secchi disk depths were not measured at this site in 2009) were 0.42 and 0.40 m, respectively. Mean annual Secchi disk depths ranged from 0.32 to 0.56 m and were within the IQR (0.32 to 0.46 m) in seven of the ten years. Mean Secchi disk depths were above the IQR in 2013, 2015, and 2019 (Table 3.3-1 and Figure 3.3-1).

Secchi disk depths in Split Lake were similar throughout the open-water season with no clear differences between seasons. Seasonal mean Secchi disk depths ranged from 0.41 m in spring to 0.43 m in fall over the ten years of monitoring (Figure 3.3-2).

Lower Nelson River

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

ROTATIONAL SITES

Stephens Lake – South

Secchi disk depths in Stephens Lake - South ranged from 0.35 to 0.59 m during the open-water season. The mean was 0.48 m, the median was 0.50 m, and the IQR was 0.44 to 0.55 m for the four years of monitoring. Mean annual Secchi disk depths ranged from 0.43 to 0.52 m and were within the IQR except in 2009 when it was below the IQR (Table 3.3-1 and Figure 3.3-1).

Stephens Lake – North

Secchi disk depths in Stephens Lake - North ranged from 0.25 to 1.40 m during the open-water season. The mean was 0.82 m, the median was 0.78 m, and the IQR was 0.59 to 1.06 m for the four years of monitoring. Mean annual Secchi disk depths ranged from 0.62 to 1.09 m and were within the IQR except in 2009 when it was above the IQR (Table 3.3-1 and Figure 3.3-1).

Limestone Forebay

Secchi disk depths in the Limestone Forebay ranged from 0.35 to 0.95 m during the open-water season. The mean was 0.54 m, the median was 0.49 m, and the IQR was 0.46 to 0.60 m for the four years of monitoring. Mean annual Secchi disk depths ranged from 0.43 to 0.72 m and were within the IQR in 2013 and 2016 but were below the IQR in 2010 and above the IQR in 2019 (Table 3.3-1 and Figure 3.3-1).

3.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

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

Assean Lake

Secchi disk depths in Assean Lake ranged from 0.26 to 1.80 m during the open-water season. The mean and median for the 11 years of monitoring were 0.99 and 1.00 m, respectively. Mean annual Secchi disk depths ranged from 0.61 to 1.35 m and were within the IQR (0.65 to 1.30 m) in nine of the 11 years. Mean Secchi disk depths were below the IQR in 2012 and above the IQR in 2016 (Table 3.3-2 and Figure 3.3-3).

No clear seasonality was observed for Secchi disk depth in Assean Lake over the 11 years of monitoring. However, the smallest mean Secchi disk depth occurred in summer (0.88 m) and the largest in spring (1.15 m; Figure 3.3-4).

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

Site	Statistic	Secchi Disk Depth (m)		Turbidity (NTU)		TSS (mg/L)	
		OW	IC	OW	IC	OW	IC
BURNT	Mean	-	-	35.5	22.3	22.8	13.5
	Median	-	-	34.9	22.3	18.1	12.0
	Minimum	-	-	16.4	17.6	7.8	7.3
	Maximum	-	-	60.0	27.5	179	25.3
	SD	-	-	9.21	2.62	28.8	5.80
	SE	-	-	1.60	0.789	5.01	1.75
	25th Percentile	-	-	29.9	21.1	13.6	9.2
	75th Percentile	-	-	37.2	23.5	22.0	15.8
	n	-	-	33	11	33	11
	% Detections	-	-	100	100	100	100
SPLIT	Mean	0.42	-	22.6	11.0	13.4	4.6
	Median	0.40	-	21.7	10.8	12.4	3.6
	Minimum	0.15	-	14.8	7.83	<5	2.4
	Maximum	0.80	-	38.8	15.0	30.4	8.6
	SD	0.147	-	5.90	1.97	5.53	1.93
	SE	0.027	-	1.03	0.594	0.962	0.583
	25th Percentile	0.32	-	16.9	10.4	10.4	3.3
	75th Percentile	0.46	-	26.3	11.9	15.6	5.8
	n	29	-	33	11	33	11
	% Detections	100	-	100	100	97	100
LNR	Mean	-	-	21.2	-	13.2	-
	Median	-	-	21.0	-	12.8	-
	Minimum	-	-	12.5	-	3.7	-
	Maximum	-	-	32.0	-	28.0	-
	SD	-	-	5.17	-	6.10	-
	SE	-	-	0.862	-	1.02	-
	25th Percentile	-	-	17.5	-	8.8	-
	75th Percentile	-	-	25.9	-	16.0	-
	n	-	-	36	-	36	-
	% Detections	-	-	100	-	100	-

Table 3.3.1. continued.

Site	Statistic	Secchi Disk Depth (m)		Turbidity (NTU)		TSS (mg/L)	
		OW	IC	OW	IC	OW	IC
STL-S	Mean	0.48	-	21.2	13.3	8.4	6.4
	Median	0.50	-	22.0	-	7.6	-
	Minimum	0.35	-	13.8	6.03	3.8	<2.0
	Maximum	0.59	-	29.7	21.0	15.2	14.8
	SD	0.074	-	4.31	6.26	3.41	6.68
	SE	0.021	-	1.24	3.13	0.985	3.34
	25th Percentile	0.44	-	18.1	-	5.9	-
	75th Percentile	0.55	-	23.5	-	10.5	-
	n	12	-	12	4	12	4
	% Detections	100	-	100	100	100	50
STL-N	Mean	0.82	-	11.5	9.53	5.2	2.9
	Median	0.78	-	11.0	-	5.2	-
	Minimum	0.25	-	5.50	3.56	<2.0	<2.0
	Maximum	1.40	-	19.4	13.6	9.0	4.0
	SD	0.331	-	4.63	4.40	2.73	1.37
	SE	0.096	-	1.34	2.20	0.79	0.69
	25th Percentile	0.59	-	7.31	-	3.5	-
	75th Percentile	1.06	-	14.2	-	7.5	-
	n	12	-	12	4	12	4
	% Detections	100	-	100	100	83	75
LMFB	Mean	0.54	-	16.5	14.4	9.1	7.2
	Median	0.49	-	15.3	12.8	10.2	6.0
	Minimum	0.35	-	11.3	9.72	4.0	3.1
	Maximum	0.95	-	26.2	22.1	14.0	16.0
	SD	0.159	-	4.11	4.12	3.66	4.18
	SE	0.046	-	1.19	1.19	1.06	1.21
	25th Percentile	0.46	-	14.3	11.4	5.6	4.0
	75th Percentile	0.60	-	18.5	17.6	12.6	9.5
	n	12	-	12	12	12	12
	% Detections	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 3.3-2. 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
HAYES	Mean	-	-	7.73	1.13	14.2	<2.0
	Median	-	-	5.99	1.08	9.0	<2.0
	Minimum	-	-	1.80	0.91	2.6	<2.0
	Maximum	-	-	41.4	1.38	81.7	2.9
	SD	-	-	7.62	0.152	14.9	-
	SE	-	-	1.27	0.048	2.49	-
	25th Percentile	-	-	3.87	1.03	7.1	<2.0
	75th Percentile	-	-	7.93	1.26	13.8	<2.0
	n	-	-	36	10	36	10
	% Detections	-	-	100	100	100	20
ASSN	Mean	0.99	-	8.53	1.04	7.7	<2.0
	Median	1.00	-	7.00	0.92	6.4	<2.0
	Minimum	0.26	-	2.45	0.38	<2.0	<2.0
	Maximum	1.80	-	21.7	2.19	32.0	<2.0
	SD	0.434	-	4.93	0.597	5.89	-
	SE	0.075	-	0.857	0.180	1.02	-
	25th Percentile	0.65	-	4.50	0.59	4.0	<2.0
	75th Percentile	1.30	-	12.1	1.33	10.0	<2.0
	n	33	-	33	11	33	11
	% Detections	100	-	100	100	97	0

Notes:

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

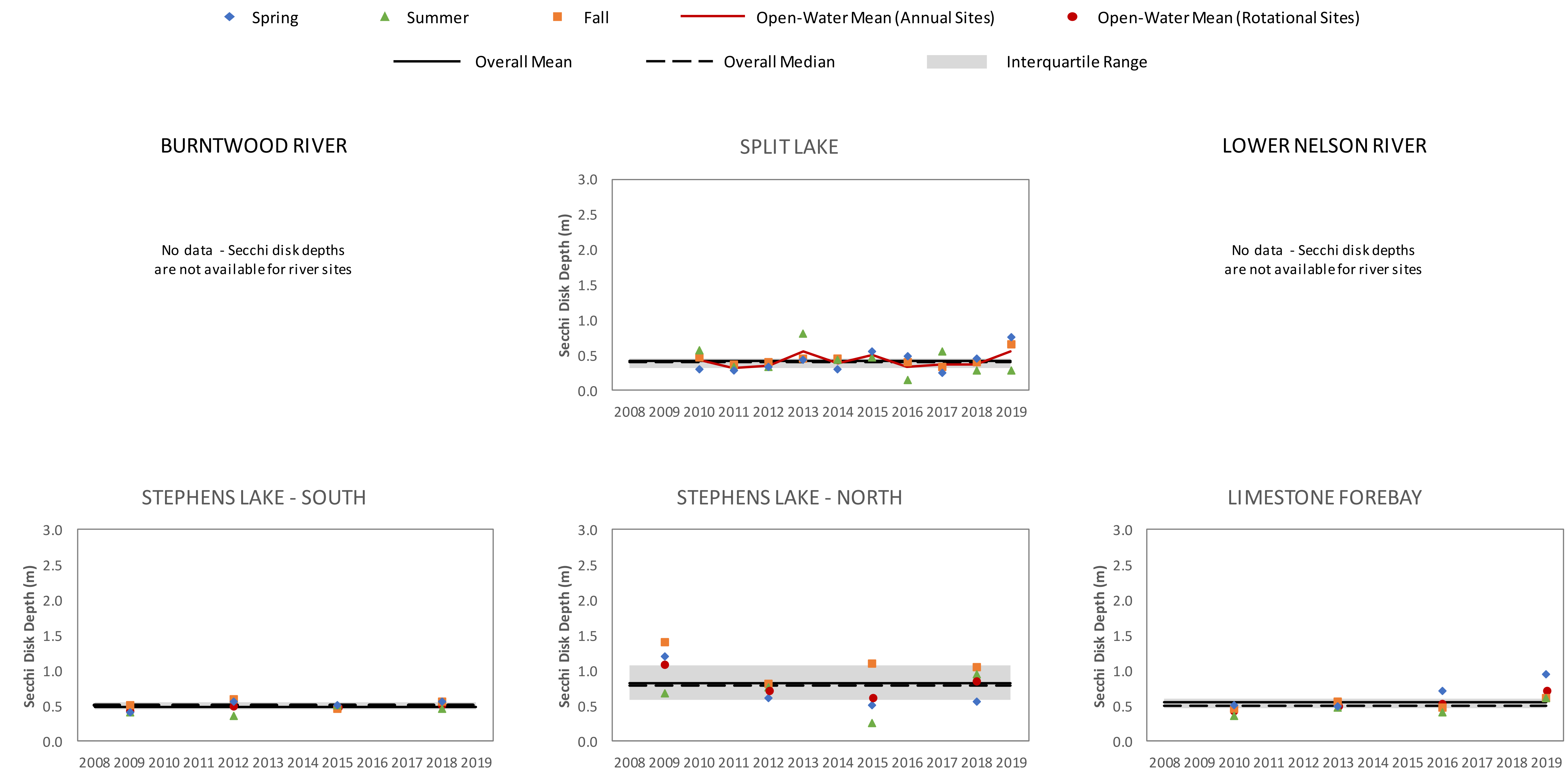


Figure 3.3-1. 2008-2019 On-system open-water season Secchi disk depths.

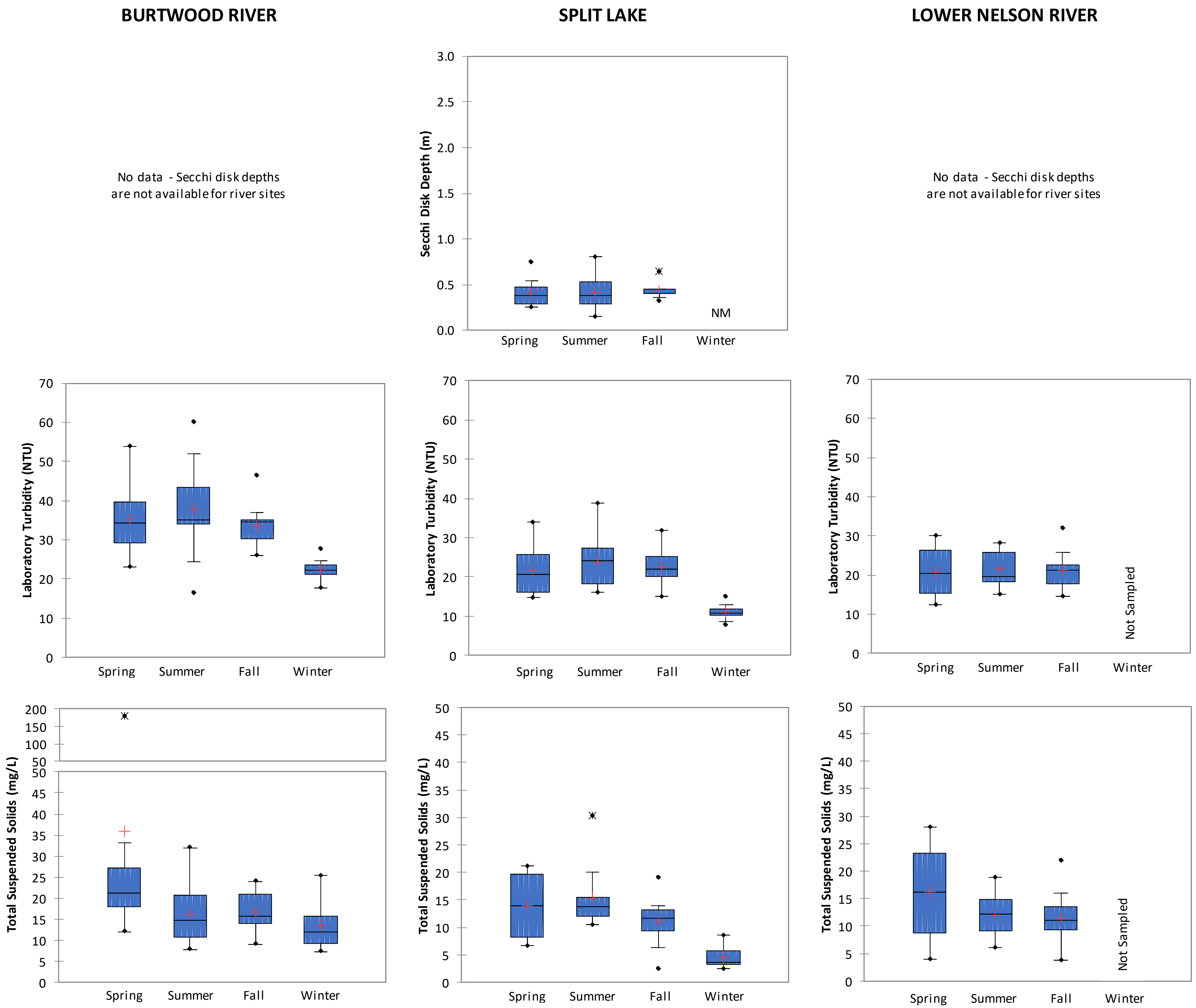


Figure 3.3-2. 2008-2019 On-system seasonal Secchi disk depth, turbidity, and TSS concentrations.

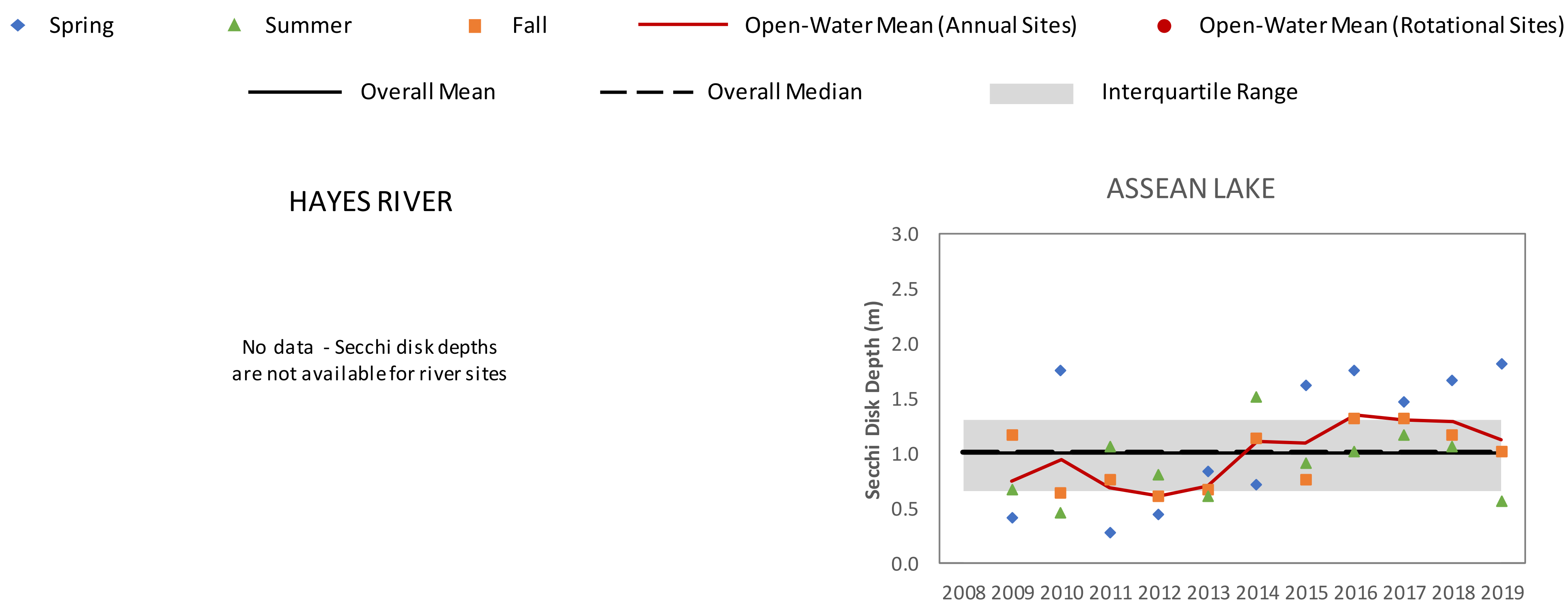


Figure 3.3-3. 2008-2019 Off-system open-water season Secchi disk depths.

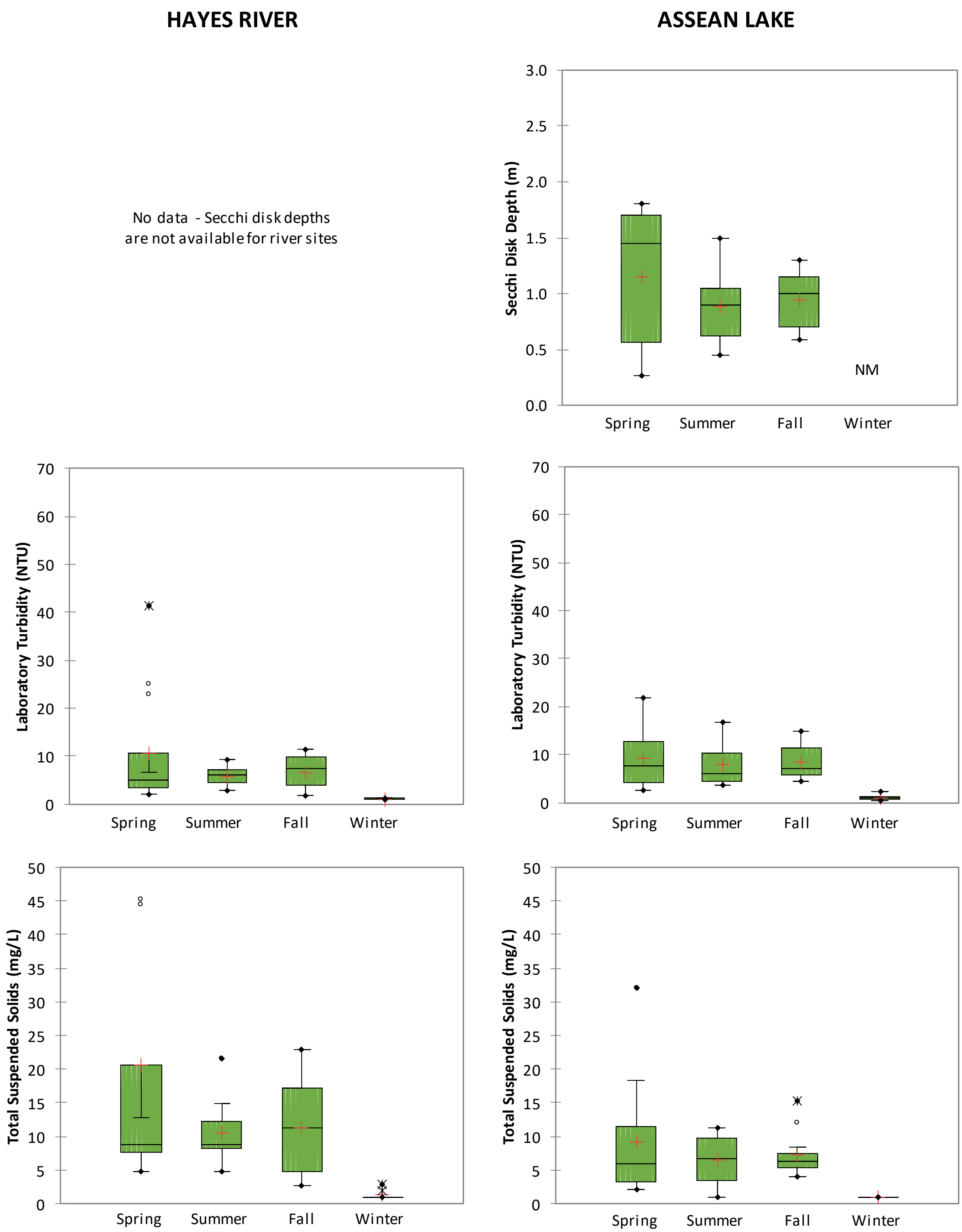


Figure 3.3-4. 2008-2019 Off-system seasonal Secchi disk depth, turbidity, and TSS concentrations.

3.3.2 TURBIDITY

3.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

Burntwood River

Turbidity in the Burntwood River near the inlet to Split Lake ranged from 16.4 to 60.0 NTU during the open-water season. The mean and median turbidity for the 11 years of monitoring was 35.5 and 34.9 NTU, respectively. Open-water season mean annual turbidity ranged from 24.9 to 46.7 NTU and was within the IQR (29.9 to 37.2 NTU) in four of the 11 years of monitoring. Mean turbidity was below the IQR in 2010 and 2011 and above the IQR in 2009, 2012, 2014, 2015, and 2016 (Table 3.3-1 and Figure 3.3-5).

Turbidity in the ice-cover season ranged from 17.6 to 27.5 NTU, with a mean and median of 22.3 NTU for the 11 years of monitoring. The IQR was 21.1 to 23.5 NTU (Table 3.3-1 and Figure 3.3-6).

Turbidity in the Burntwood River was lower in winter (mean = 22.3 NTU) than in the open-water season over the 11 years of monitoring. No clear seasonality was observed for turbidity in the open-water season; however, the lowest mean turbidity occurred in fall (33.5 NTU) and the highest in summer (37.7 NTU; Figure 3.3-2).

Split Lake

Turbidity in Split Lake ranged from 14.8 to 38.8 NTU during the open-water season. The mean and median turbidity for the 11 years of monitoring were 22.6 and 21.7 NTU, respectively. Open-water season mean annual turbidity ranged from 17.0 to 29.3 NTU and was within the IQR (16.9 to 26.3 NTU) in 10 of the 11 years of monitoring. Mean turbidity was above the IQR in 2012 (Table 3.3-1 and Figure 3.3-5).

Turbidity in the ice-cover season ranged from 7.83 to 15.0 NTU, with a mean of 11.0 NTU and a median of 10.8 NTU for the 11 years of monitoring. The IQR was 10.4 to 11.9 NTU (Table 3.3-1 and Figure 3.3-6).

Turbidity in Split Lake was lower in winter (mean = 11.0 NTU) than in the open-water season over the 11 years of monitoring. No clear seasonality was observed for turbidity in the open-water season; however, the lowest mean turbidity occurred in spring (21.7 NTU) and the highest in summer (23.7 NTU; Figure 3.3-2).

Lower Nelson River

Turbidity in the lower Nelson River downstream of the Limestone GS ranged from 12.5 to 32.0 NTU during the open-water season. The mean and median turbidity for the 12 years of monitoring was 21.2 and 21.0 NTU, respectively. Open-water season mean annual turbidity ranged from 15.0 to 26.3 NTU and was within the IQR (17.5 to 25.9 NTU) in eight of the 12 years of monitoring. Mean turbidity was below the IQR in 2013 and 2019 and above the IQR in 2008 and 2011 (Table 3.3-1 and Figure 3.3-5).

No data are available for the ice-cover season as this site is not sampled in winter.

No clear seasonality was observed for turbidity in the Lower Nelson River over the 12-year period. However, the lowest mean turbidity occurred in spring (20.8 NTU) and the highest in summer (21.6 NTU; Figure 3.3-2).

ROTATIONAL SITES

Stephens Lake – South

Turbidity in Stephens Lake - South ranged from 13.8 to 29.7 NTU during the open-water season. The mean and median were 21.2 and 22.0 NTU, respectively. The IQR was 18.1 to 23.5 NTU for the four years of monitoring. Mean annual turbidity in the open-water season ranged from 19.4 to 23.0 NTU and was within the IQR in all four years of monitoring (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged from 6.03 to 21.0 NTU with a mean of 13.3 NTU for the four years of monitoring (Table 3.3-1 and Figure 3.3-6).

Stephens Lake – North

Turbidity in Stephens Lake - North ranged from 5.50 to 19.4 NTU during the open-water season. The mean and median were 11.5 and 11.0 NTU, respectively. The IQR was 7.31 to 14.2 NTU for the four years of monitoring. Mean annual turbidity in the open-water season ranged from 7.93 to 17.1 NTU and was within the IQR in 2009, 2012, and 2018 but was above the IQR in 2015 (Table 3.3-1 and Figure 3.3-5).

During the ice-cover season, turbidity ranged from 3.56 to 13.6 NTU with a mean of 9.53 NTU for the four years of monitoring (Table 3.3-1 and Figure 3.3-6).

Limestone Forebay

Turbidity in the Limestone Forebay ranged from 11.3 to 26.2 NTU during the open-water season. The mean was 16.5 NTU, the median was 15.3 NTU, and the IQR was 14.3 to 18.5 NTU for the four years of monitoring. Mean annual turbidity in the open-water season ranged from 13.9 to 19.2 NTU and was within the IQR in 2010 and 2013 but was below the IQR in 2019 and above the IQR in 2016 (Table 3.3-1 and Figure 3.3-5).

Turbidity in the ice-cover season ranged from 9.72 to 22.1 NTU, with a mean of 14.4 NTU and a median of 12.8 NTU for the 12 years of monitoring. The IQR was 11.4 to 17.6 NTU (Table 3.3-1 and Figure 3.3-6).

3.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

Turbidity in the Hayes River ranged from 1.80 to 41.4 NTU during the open-water season. The mean was 7.73 NTU and the median was 5.99 NTU for the 12 years of monitoring. Open-water season mean annual turbidity ranged from 4.17 to 18.6 NTU and was within the IQR (3.87 to 7.93 NTU) in seven of the 12 years of monitoring. Mean turbidity was above the IQR in 2008, 2009, 2012, 2014, and 2015 (Table 3.3-2 and Figure 3.3-7).

Turbidity in the ice-cover season ranged from 0.91 to 1.38 NTU, with a mean of 1.13 NTU and a median of 1.08 NTU for the 10 years of monitoring. The IQR was 1.03 to 1.26 NTU (Table 3.3-2 and Figure 3.3-7).

Turbidity in the Hayes River was lower in winter (mean = 1.13 NTU) than in the open-water season over the 12-year period. No clear seasonality was observed for turbidity in the open-water season; however, the lowest mean turbidity occurred in summer (5.8 NTU) and the highest in spring (10.6 NTU; Figure 3.3-4).

Assean Lake

Turbidity in Assean Lake ranged from 2.45 to 21.7 NTU during the open-water season. The mean was 8.53 NTU and the median was 7.00 NTU for the 11 years of monitoring. Open-water season mean annual turbidity ranged from 3.93 to 14.4 NTU and was within the IQR (4.50 to 12.1 NTU) in eight of the 11 years of monitoring. Mean turbidity was below the IQR in 2016 above the IQR in 2009 and 2011 (Table 3.3-2 and Figure 3.3-7).

Turbidity in the ice-cover season ranged from 0.38 to 2.19 NTU, with a mean of 1.04 NTU and a median of 0.92 NTU for the 11 years of monitoring. The IQR was 0.59 to 1.33 NTU (Table 3.3-2 and Figure 3.3-7).

Turbidity in Assean Lake was lower in winter (mean = 1.04 NTU) than in the open-water season over the 11 years of monitoring. No clear seasonality was observed for turbidity in the open-water season; however, the lowest mean turbidity occurred in summer (7.85 NTU) and the highest in spring (9.20 NTU; Figure 3.3-4).

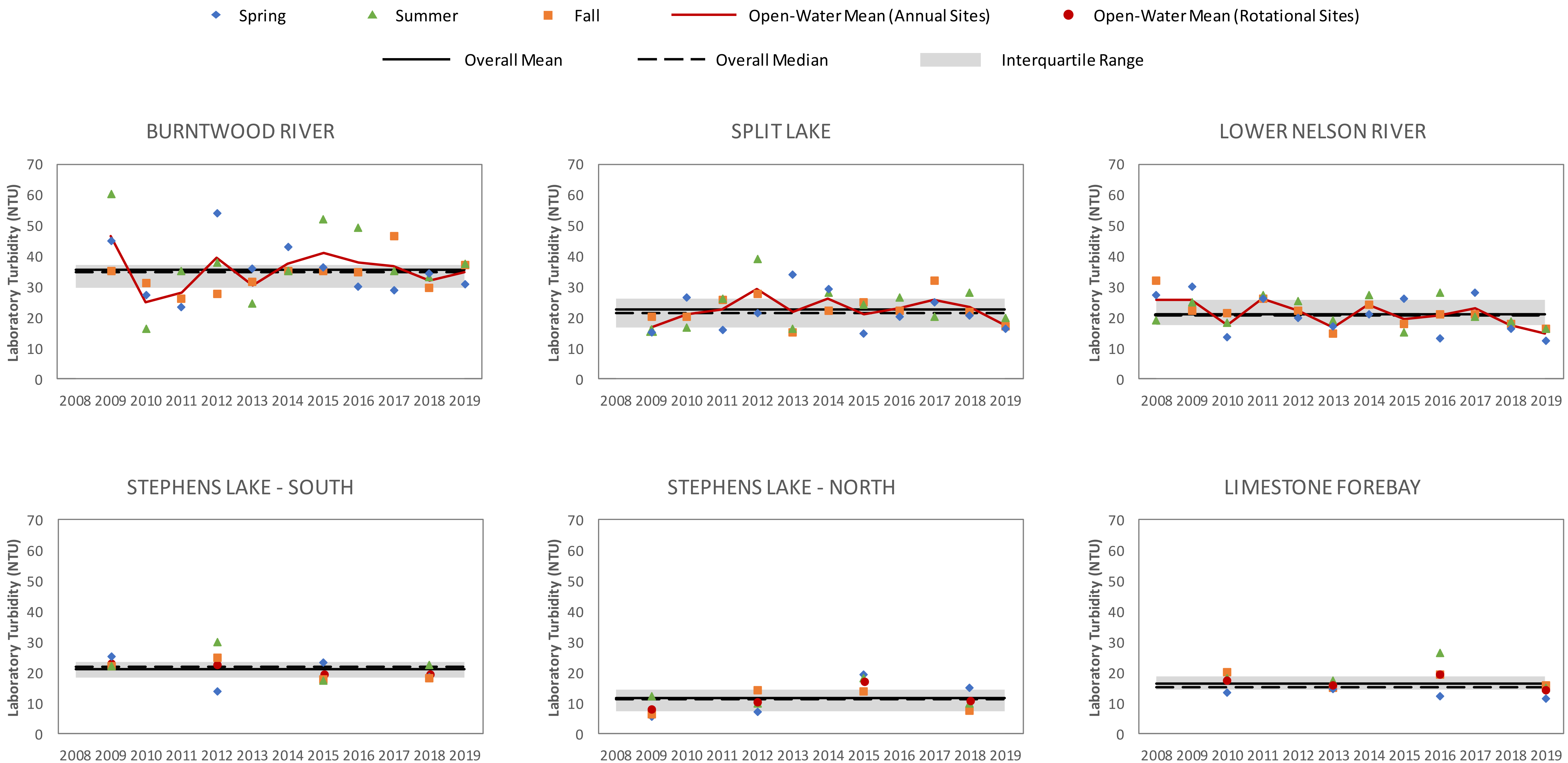


Figure 3.3-5. 2008-2019 On-system open-water season turbidity levels.

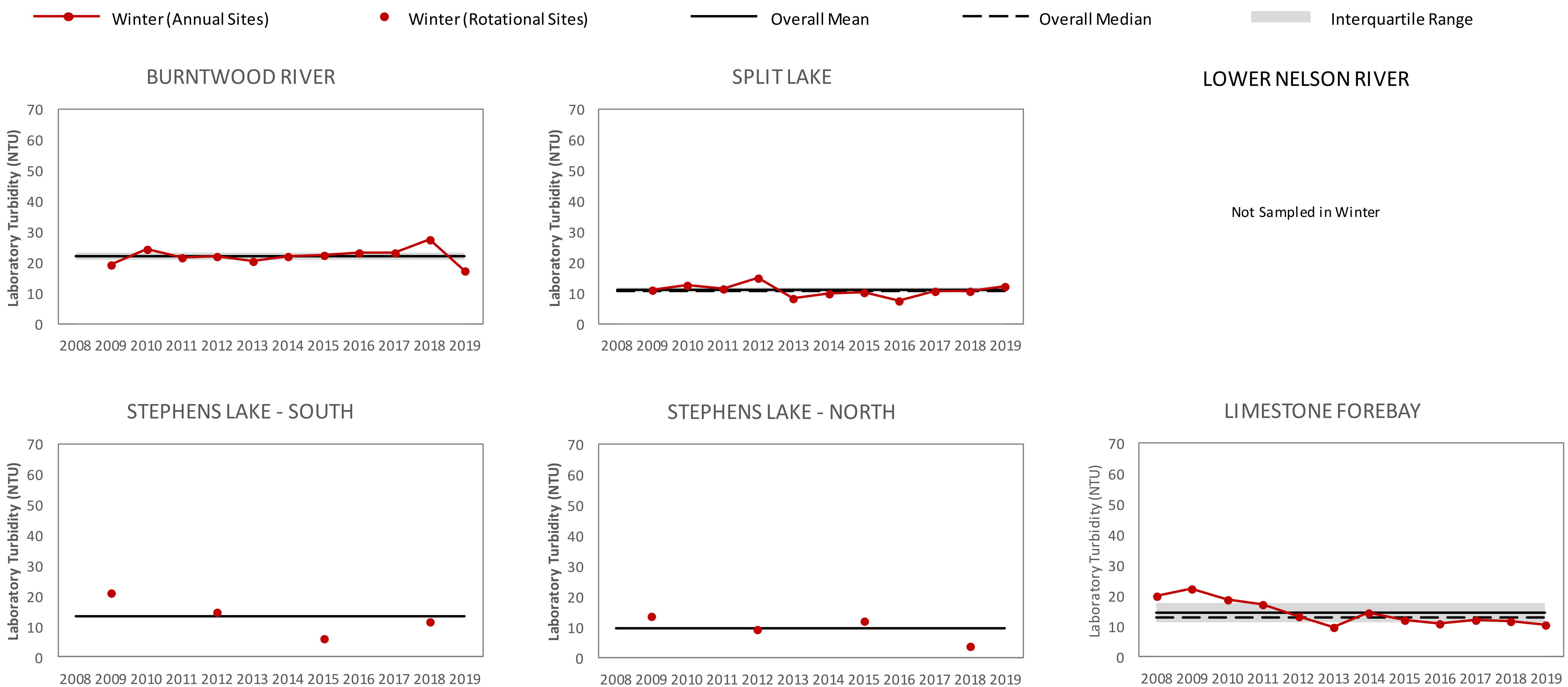


Figure 3.3-6. 2008-2019 On-system ice-cover season turbidity levels.

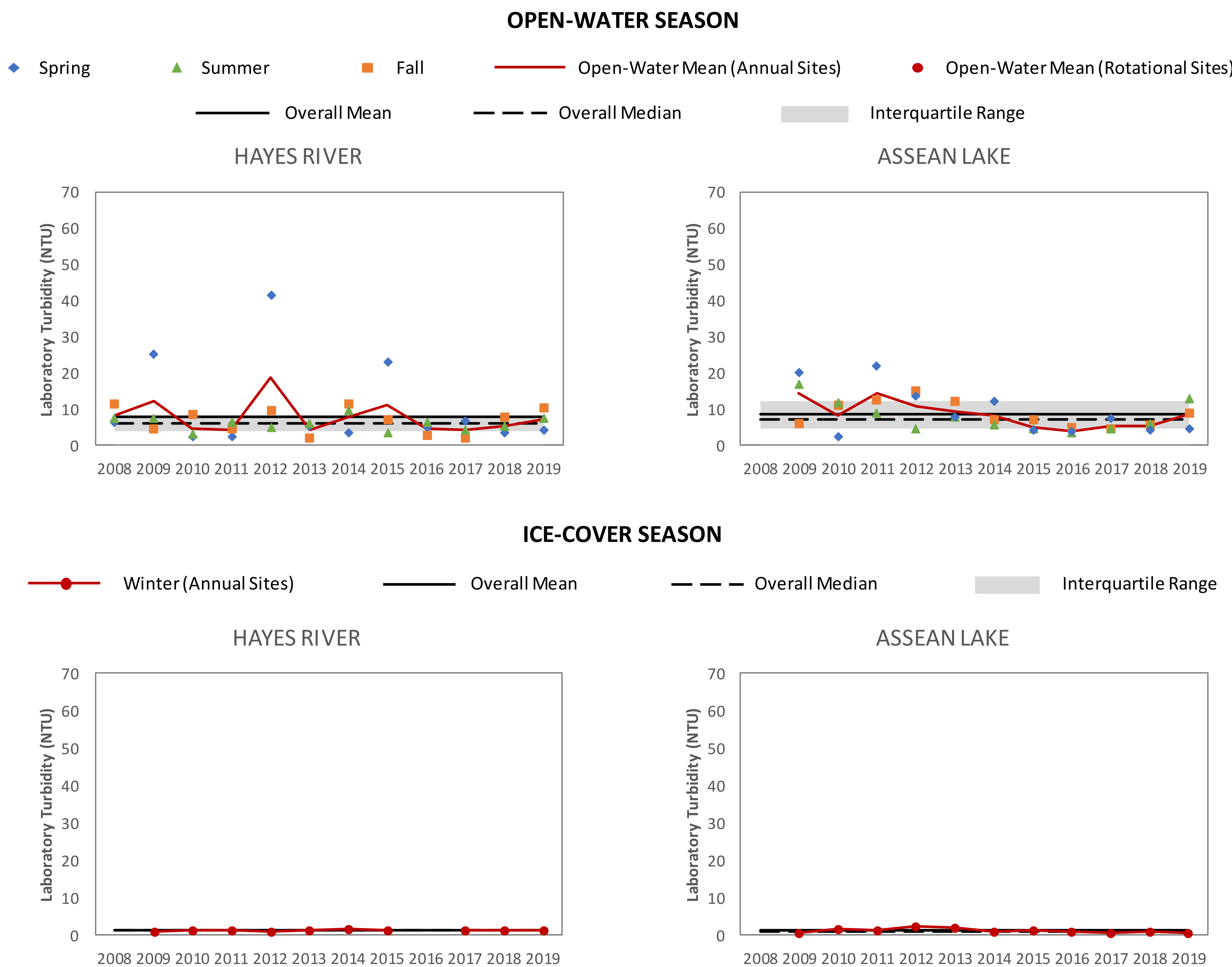


Figure 3.3-7. 2008-2019 Off-system open-water and ice-cover season turbidity levels.

3.3.3 TOTAL SUSPENDED SOLIDS

3.3.3.1 ON-SYSTEM SITES

ANNUAL SITES

Burntwood River

TSS concentrations in the Burntwood River near the inlet to Split Lake ranged from 7.8 to 179 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were 22.8 and 18.1 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from 12.9 to 74.9 mg/L and were within the IQR (13.6 to 22.0 mg/L) in eight of the 11 years of monitoring. Mean TSS concentrations were below the IQR in 2015 and above the IQR in 2009 and 2012. TSS concentrations were consistently above the detection limit (DL; 2.0 mg/L) during the open-water season (percent detections = 100; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season ranged from 7.3 to 25.3 mg/L. The mean and median were 13.5 and 12.0 mg/L, respectively, and the IQR was 9.2 to 15.8 mg/L for the 11 years of monitoring. TSS concentrations were consistently above the DL (2.0 mg/L) during the ice-cover season (percent detections = 100; Table 3.3-1 and Figure 3.3-9).

No clear seasonality was observed for TSS concentrations in the Burntwood River over the 11 years of monitoring. However, the lowest mean TSS concentration occurred in winter (13.5 mg/L) and the highest in spring (35.7 mg/L; Figure 3.3-2).

Split Lake

TSS concentrations in Split Lake ranged from <5 to 30.4 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were 13.4 and 12.4 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from 8.1 to 18.4 mg/L and were within the IQR (10.4 to 15.6 mg/L) in four of the 11 years of monitoring. Mean TSS concentrations were below the IQR in 2009, 2018, and 2019 and above the IQR in 2010, 2012, 2014, and 2017. TSS concentrations were typically above the DL (2.0-5 mg/L) during the open-water season (percent detections = 97; Table 3.3-1 and Figure 3.3-8).

TSS concentrations in the ice-cover season ranged from 2.4 to 8.6 mg/L. The mean was 4.6 mg/L, the median was 3.6 mg/L, and the IQR was 3.3 to 5.8 mg/L for the 11 years of monitoring. TSS concentrations were consistently above the DL (2.0 mg/L) during the ice-cover season (percent detections = 100; Table 3.3-1 and Figure 3.3-9).

TSS concentrations in Split Lake were lower in winter (mean = 4.6 mg/L) than during the open-water season. No clear seasonality was observed for TSS concentrations in the open-water season over the 11 years of monitoring; however, the lowest mean TSS concentration occurred in fall (11.0 mg/L) and the highest in summer (15.2 mg/L; Figure 3.3-2).

Lower Nelson River

TSS concentrations in the lower Nelson River downstream of the Limestone GS ranged from 3.7 to 28.0 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 13.2 and 12.8 mg/L, respectively. Open-water season mean annual TSS concentrations ranged from 4.6 to 18.8 mg/L and were within the IQR (8.8 to 16.0 mg/L) in seven of the 12 years of monitoring. Mean TSS concentrations were below the IQR in 2018 and 2019 and above the IQR in 2008, 2009, and 2011. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (percent detections = 100; Table 3.3-1 and Figure 3.3-8).

No data are available for the ice-cover season as this site is not sampled in winter.

No clear seasonality was observed for TSS concentrations in the open-water season over the 12-year period; however, mean TSS concentrations were lowest in summer and fall (11.9 and 11.4 mg/L, respectively) and highest in spring (16.3 mg/L; Figure 3.3-2).

ROTATIONAL SITES

Stephens Lake – South

TSS concentrations in Stephens Lake - South ranged from 3.8 to 15.2 mg/L during the open-water season. The mean was 8.4 mg/L, the median was 7.6 mg/L, and the IQR was 5.9 to 10.5 mg/L for the four years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 5.1 to 12.4 mg/L and were within the IQR in two of the four years of monitoring. Mean TSS concentrations were below the IQR in 2018 and above the IQR in 2009. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (percent detections = 100; Table 3.3-1 and Figure 3.3-8).

During the ice-cover season, TSS concentrations ranged from <2.0 to 14.8 mg/L, with a mean of 6.4 mg/L. TSS concentrations were below the DL (2.0 mg/L) in two of four samples collected in winter (percent detections = 50; Table 3.3-1 and Figure 3.3-9).

Stephens Lake – North

TSS concentrations in Stephens Lake – North ranged from <2.0 to 9.0 mg/L during the open-water season. Both the mean and the median were 5.2 mg/L and the IQR was 3.5 to 7.5 mg/L for the four years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 2.8 to 7.3 mg/L and were within the IQR three of the four years of monitoring. The mean TSS concentration was below the IQR in 2018. TSS concentrations were typically above the DL (2.0 mg/L) during the open-water season (percent detection = 83; Table 3.3-1 and Figure 3.3-8).

During the ice-cover season, TSS concentrations ranged from <2.0 to 4.0 mg/L, with a mean of 2.9 mg/LL. TSS concentrations were below the DL (2.0 mg/L) in one of four samples collected in winter (percent detections = 75; Table 3.3-1 and Figure 3.3-9).

Limestone Forebay

TSS concentrations in the Limestone Forebay ranged from 4.0 to 14.0 mg/L during the open-water season. The mean was 9.1 mg/L, median was 10.2 mg/L, and the IQR was 5.6 to 12.6 mg/L for the four years of monitoring. Mean annual TSS concentrations in the open-water season ranged from 4.6 to 12.0 mg/L and were within the IQR in three of the four years of monitoring. The mean TSS concentration was below the IQR in 2019. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (percent detections = 100; Table 3.3-1 and Figure 3.3-8).

During the ice-cover season, TSS concentrations ranged from 3.1 to 16.0 mg/L, the mean was 7.2 mg/L, the median was 6.0 mg/L, and the IQR was 4.0 to 9.5 mg/L for the 12 years of monitoring. TSS concentrations were consistently above the DL (2.0 mg/L) during the ice-cover season (percent detections = 100; Table 3.3-1 and Figure 3.3-9).

3.3.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

TSS concentrations in Hayes River ranged from 2.6 to 81.7 mg/L during the open-water season. The mean and median were 14.2 and 9.0 mg/L, respectively, for the 12 years of monitoring. Open-water season mean annual TSS concentrations ranged from 6.9 to 35.6 mg/L and were within the IQR (7.1 to 13.8 mg/L) in six of the 12 years of monitoring. Mean TSS concentrations were below the IQR in 2010 and 2013 and above the IQR in 2009, 2011, 2012, and 2015. TSS concentrations were consistently above the DL (2.0 mg/L) during the open-water season (percent detections = 100; Table 3.3-2 and Figure 3.3-10).

TSS concentrations in the ice-cover season ranged from <2.0 to 2.9 mg/L, with both a mean and median of <2.0 mg/L for the 10 years of monitoring. The IQR was below the analytical DL of 2.0 mg/L. TSS concentrations were typically below the DL (2.0 mg/L) during the ice-cover season (percent detections = 20; Table 3.3-2 and Figure 3.3-10).

TSS concentrations in the Hayes River were lower in winter (mean = <2.0 mg/L), often below the DL, than during the open-water season. No clear seasonality was observed for TSS concentrations in the open-water season over the 12-year period; however, the lowest mean TSS concentration occurred in summer (10.6 mg/L) and the highest in spring (20.6 mg/L; Figure 3.3-4).

Assean Lake

TSS concentrations in Assean Lake ranged from <2.0 to 32.0 mg/L during the open-water season. The mean and median were 7.7 and 6.4 mg/L, respectively, for the 11 years of monitoring. Open-water season mean annual TSS concentrations ranged from 3.7 to 16.8 mg/L and were within the IQR (4.0 to 10.0 mg/L) in seven of the 11 years of monitoring. Mean TSS concentrations were below the IQR in 2018 and above the IQR in 2009, 2011, and 2012. TSS concentrations were typically above the DL (2.0 mg/L) during the open-water season (percent detections = 97; 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 11 years of monitoring (Table 3.3-2 and Figure 3.3-10).

TSS concentrations in Assean 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 over the 11 years of monitoring; however, mean TSS concentrations were lowest in summer (6.6 mg/L) and highest in spring (9.2 mg/L; Figure 3.3-4).

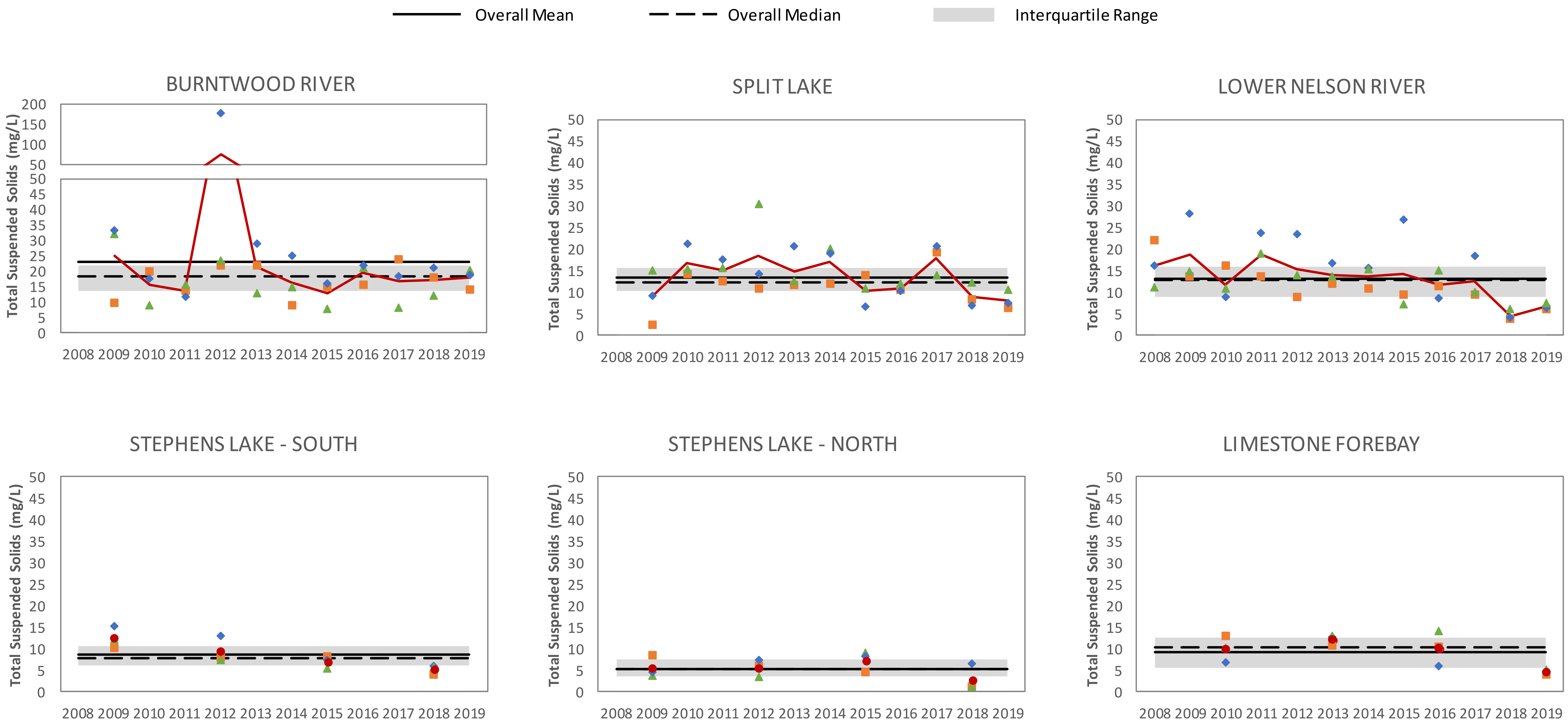


Figure 3.3-8. 2008-2019 On-system open-water season TSS concentrations.

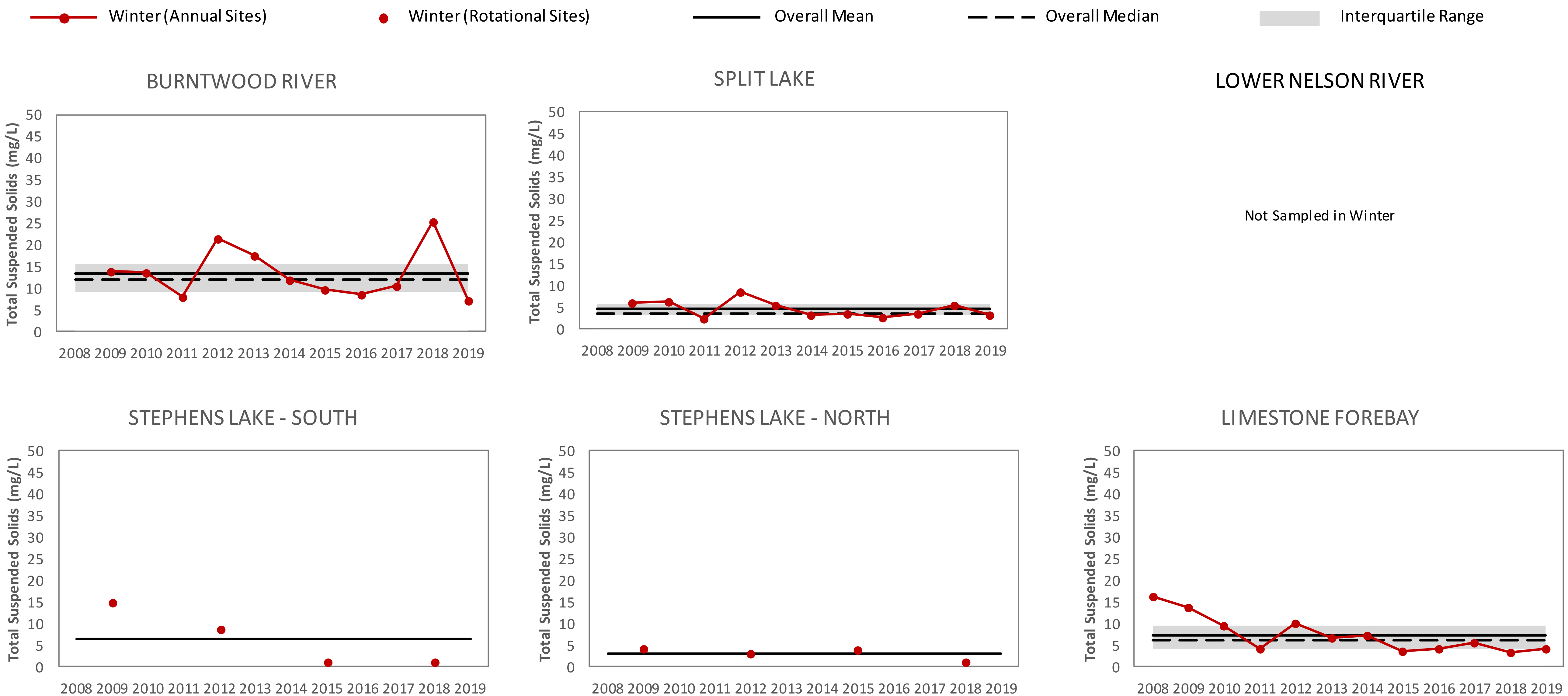


Figure 3.3-9. 2008-2019 On-system ice-cover season TSS concentrations.

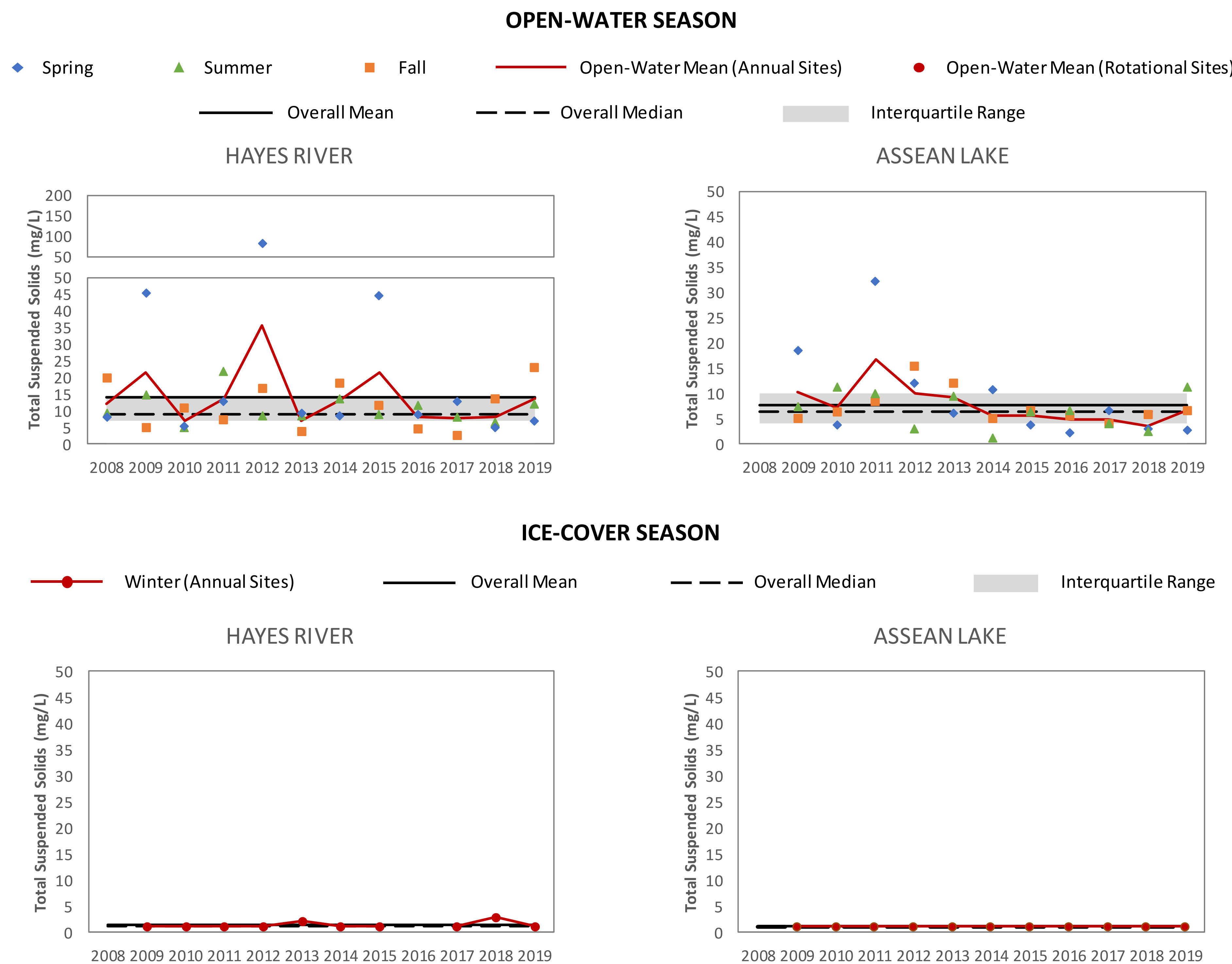


Figure 3.3-10. 2008-2019 Off-system open-water and ice-cover season TSS concentrations.

3.4 NUTRIENTS AND TROPHIC STATUS

3.4.1 TOTAL PHOSPHORUS

3.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Burntwood River

TP concentrations in the Burntwood River near the inlet to Split Lake ranged from 0.021 to 0.059 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were both 0.039 mg/L. Open-water season mean annual TP concentrations ranged from 0.031 to 0.049 mg/L and were within the IQR (0.032 to 0.045 mg/L) in eight of the 11 years of monitoring. Mean TP concentrations were below the IQR in 2011 and 2013 and above the IQR in 2016 (Table 3.4-1 and Figure 3.4-1).

TP concentrations in the ice-cover season ranged from 0.026 to 0.041 mg/L, with a mean of 0.034 mg/L and a median of 0.035 mg/L for the 11 years of monitoring. The IQR was 0.032 to 0.036 mg/L (Table 3.4-1 and Figure 3.4-2).

No clear seasonality was observed for TP in the Burntwood River over the 11 years of monitoring. However, the lowest mean TP concentration occurred in winter (0.034 mg/L) and the highest in summer (0.041 mg/L; Figure 3.4-3).

The Burntwood River near the inlet to Split Lake was eutrophic (0.035 to 0.100 mg/L based on the 2009-2019 mean open-water season TP concentration (0.039 mg/L). Mean annual TP concentrations (0.031 to 0.049 mg/L) in the open-water season were within the eutrophic range (0.035 to 0.100 mg/L) seven of the 11 years of monitoring. Mean annual TP concentrations were within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2010, 2011, 2013, and 2019 (Table 3.4-2).

Split Lake

TP concentrations in Split Lake ranged from 0.018 to 0.053 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were both 0.039 mg/L. Open-water season mean annual TP concentrations ranged from 0.031 to 0.046 mg/L and were within the IQR (0.035 to 0.044 mg/L) in seven of the 11 years of monitoring. Mean TP concentrations were below the IQR in 2015 and 2019 and above the IQR in 2010 and 2011 (Table 3.4-1 and Figure 3.4-1).

TP concentrations in the ice-cover season ranged from 0.020 to 0.044 mg/L, with a mean of 0.032 mg/L and a median of 0.031 mg/L for the 11 years of monitoring. The IQR was 0.028 to 0.036 mg/L (Table 3.4-1 and Figure 3.4-2).

No clear seasonality was observed for TP over the 11 years of monitoring. However, mean TP concentrations were lowest in winter (0.032 mg/L) and highest in summer (0.043 mg/L; Figure 3.4-2).

Split Lake was eutrophic (0.035 to 0.100 mg/L) based on the 2009-2019 mean open-water season TP concentration (0.039 mg/L). Mean annual TP concentrations (0.031 to 0.046 mg/L) in the open-water season were within the eutrophic range (0.035 to 0.100 mg/L) in nine of the 11 years of monitoring. Mean annual TP concentrations were within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2015 and 2019 (Table 3.4-3).

Lower Nelson River

TP concentrations in the lower Nelson River downstream of the Limestone GS ranged from 0.019 to 0.056 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.037 mg/L and 0.038 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.030 to 0.045 mg/L and were within the IQR (0.032 to 0.043 mg/L) in nine of the 12 years of monitoring. Mean TP concentrations were below the IQR in 2013 and 2019 and above the IQR in 2010 (Table 3.4-1 and Figure 3.4-1).

No data are available for the ice-cover season as this site is not sampled in winter.

No clear seasonality was observed for TP concentrations in the lower Nelson River downstream of the Limestone GS. However, mean TP concentrations were lowest in spring (0.031 mg/L) and highest in fall (0.041 mg/L; Figure 3.4-3).

The lower Nelson River downstream of the Limestone GS was eutrophic (0.035 to 0.100 mg/L) based on the 2008-2019 mean open-water season TP concentration (0.037 mg/L). Mean annual TP concentrations (0.030 to 0.045 mg/L) in the open-water season were within the eutrophic range in eight of the 12 years of monitoring. Mean annual TP concentrations were within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2013, 2015, 2018, and 2019 (Table 3.4-2).

ROTATIONAL SITES

Stephens Lake – South

TP concentrations in Stephens Lake - South ranged from 0.024 to 0.065 mg/L during the open-water season. The mean was 0.038 mg/L, the median was 0.035 mg/L, and the IQR was 0.030 to 0.042 mg/L for the four years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.027 to 0.050 mg/L and were within the IQR in 2009 and 2018 but were below the IQR in 2015 and above the IQR in 2012 (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.023 to 0.050 mg/L, with a mean of 0.032 mg/L (Table 3.4-1 and Figure 3.4-2).

Stephens Lake - South was eutrophic (0.035 to 0.100 mg/L) based on the mean of the open-water season TP concentrations for the four years of monitoring (0.038 mg/L). Open-water season mean annual TP concentrations (0.027 to 0.050 mg/L) were also within the eutrophic range in three of the four years sampled. The exception was 2015 when the mean (0.027 mg/L) was within the meso-eutrophic range (0.020-0.035 mg/L; Table 3.4-3).

Stephens Lake – North

TP concentrations in Stephens Lake – North ranged from 0.009 to 0.051 mg/L during the open-water season. The mean was 0.021 mg/L, the median was 0.018 mg/L, and the IQR was 0.017 to 0.021 mg/L for the four years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.015 to 0.031 mg/L and were below the IQR in 2009 and 2018 and above the IQR in 2012 and 2015 (Table 3.4-1 and Figure 3.4-1).

During the ice-cover season, TP concentrations ranged from 0.013 and 0.048 mg/L, with a mean of 0.031 mg/L (Table 3.4-1 and Figure 3.4-2).

Stephens Lake – North was meso-eutrophic (0.020 to 0.035 mg/L) based on the mean of the open-water season TP concentrations for the four years of monitoring (0.021 mg/L). Open-water season mean annual TP concentrations (0.015 to 0.031 mg/L) were also within the meso-eutrophic range in 2012 and 2015; however, they were within the mesotrophic range (0.010-0.020 mg/L) in 2009 and 2018 (Table 3.4-3).

Limestone Forebay

TP concentrations in the Limestone Forebay ranged from 0.015 to 0.051 mg/L during the open-water season. The mean was 0.035 mg/L, the median was 0.034 mg/L, and the IQR was 0.030 to 0.039 mg/L for the four years of monitoring. Mean annual TP concentrations in the open-water season ranged from 0.027 to 0.044 mg/L and were within the IQR in 2013 and 2016 but below the IQR in 2019 and above the IQR in 2010 (Table 3.4-1 and Figure 3.4-1).

TP concentrations in the ice-cover season ranged from 0.025 to 0.051 mg/L, with a mean of 0.037 mg/L and a median of 0.034 mg/L for the 12 years of monitoring. The IQR was 0.033 to 0.042 mg/L (Table 3.4-1 and Figure 3.4-2).

The Limestone Forebay was meso-eutrophic (0.020 to 0.035 mg/L) based on the mean of the open-water season TP concentrations for the four years of monitoring (0.035 mg/L). Open-water season mean annual TP concentrations (0.027 to 0.044 mg/L) were within the meso-eutrophic range in 2013 and 2019, and within the eutrophic range (0.035 – 0.100 mg/L) in 2010 and 2016 (Table 3.4-3).

3.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

TP concentrations in the Hayes River ranged from 0.009 to 0.044 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.018 mg/L and 0.016 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.013 to 0.026 mg/L and were within the IQR (0.014 to 0.020 mg/L) in seven of the 12 years of monitoring. Mean TP concentrations were below the IQR in 2013 and above the IQR in 2009, 2011, 2014, and 2015 (Table 3.4-4 and Figure 3.4-4).

TP concentrations in the ice-cover season ranged from 0.006 to 0.015 mg/L, with a mean of 0.010 mg/L and a median of 0.009 mg/L for the 10 years of monitoring. The IQR was 0.009 to 0.010 mg/L (Table 3.4-4 and Figure 3.4-4).

On average, TP concentrations were lower in winter (mean = 0.010 mg/L) than during the open-water season over the 12-year period. No clear seasonality was observed for TP concentrations during the open-water season; however, mean TP was lowest in fall (0.015 mg/L) and highest in spring (0.022 mg/L; Figure 3.4-5).

The Hayes River was mesotrophic (0.010 to 0.020 mg/L) based on the 2008-2019 mean open-water season TP concentration (0.018 mg/L). Mean annual TP concentrations (0.013 to 0.026 mg/L) in the open-water season were also within the mesotrophic range (0.010 to 0.020 mg/L) in eight of the 12 years of monitoring; however, they were within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2009, 2011, 2014, and 2015 (Table 3.4-5).

Assean Lake

TP concentrations in Assean Lake ranged from 0.006 to 0.051 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were 0.020 mg/L and 0.018 mg/L, respectively. Open-water season mean annual TP concentrations ranged from 0.014 to 0.028 mg/L and were within the IQR (0.015 to 0.023 mg/L) in nine of the 11 years of monitoring. Mean TP concentrations were below the IQR in 2015 and above the IQR in 2011 (Table 3.4-4 and Figure 3.4-4).

TP concentrations in the ice-cover season ranged from 0.011 to 0.019 mg/L, with a mean of 0.014 mg/L and a median of 0.013 mg/L for the 11 years of monitoring. The IQR was 0.011 to 0.016 mg/L (Table 3.4-4 and Figure 3.4-4).

No clear seasonality was observed for TP concentrations in Assean Lake over the 11 years of monitoring. However, mean TP concentrations were lowest in winter (0.014 mg/L) and highest in summer (0.021 mg/L; Figure 3.4-5).

Assean Lake was mesotrophic (0.010 to 0.020 mg/L) based on the 2009-2019 mean open-water season TP concentration (0.020 mg/L). Mean annual TP concentrations (0.014 to 0.028 mg/L) in the open-water season were also within the mesotrophic range (0.010 to 0.020 mg/L) in seven of the 11 years of monitoring; however, they were within the meso-eutrophic range (0.020 to 0.035 mg/L) in 2011, 2012, 2018, and 2019 (Table 3.4-6).

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
BURNT	Mean	0.039	0.034	0.40	0.47	2.97	<0.60
	Median	0.039	0.035	0.40	0.42	3.05	<0.60
	Minimum	0.021	0.026	<0.20	0.33	0.84	<0.60
	Maximum	0.059	0.041	1.03	1.03	5.03	0.95
	SD	0.0097	0.0045	0.158	0.192	1.08	-
	SE	0.0017	0.0013	0.027	0.058	0.190	-
	25th Percentile	0.032	0.032	0.30	0.39	2.34	<0.60
	75th Percentile	0.045	0.036	0.44	0.46	3.83	<0.60
	n	33	11	33	11	32	11
	% Detections	100	100	100	100	100	36
SPLIT	Mean	0.039	0.032	0.44	0.51	4.96	<0.60
	Median	0.039	0.031	0.46	0.50	5.02	<0.60
	Minimum	0.018	0.020	0.27	0.37	<0.60	<0.60
	Maximum	0.053	0.044	0.62	0.67	9.74	1.72
	SD	0.0078	0.0074	0.091	0.091	1.86	0.469
	SE	0.0014	0.0022	0.016	0.027	0.324	0.141
	25th Percentile	0.035	0.028	0.36	0.44	3.47	<0.60
	75th Percentile	0.044	0.036	0.51	0.57	6.11	0.71
	n	33	11	33	11	33	11
	% Detections	100	100	100	100	100	45
LNR	Mean	0.037	-	0.46	-	4.64	-
	Median	0.038	-	0.46	-	4.20	-
	Minimum	0.019	-	0.24	-	1.72	-
	Maximum	0.056	-	1.20	-	9.00	-
	SD	0.0089	-	0.156	-	1.72	-
	SE	0.0015	-	0.026	-	0.291	-
	25th Percentile	0.032	-	0.37	-	3.52	-
	75th Percentile	0.043	-	0.52	-	5.66	-
	n	36	-	36	-	35	-
	% Detections	100	-	100	-	100	-

Table 3.4.1. continued.

Site	Statistic	TP (mg/L)		TN (mg/L)		Chlorophyll a (µg/L)	
		OW	IC	OW	IC	OW	IC
STL-S	Mean	0.038	0.032	0.43	0.47	5.61	<0.60
	Median	0.035	-	0.44	-	5.23	-
	Minimum	0.024	0.023	0.28	0.34	3.10	<0.60
	Maximum	0.065	0.050	0.58	0.61	9.89	0.76
	SD	0.0113	0.0123	0.083	0.119	1.96	0.204
	SE	0.0032	0.0061	0.024	0.060	0.567	0.102
	25th Percentile	0.030	-	0.38	-	4.26	-
	75th Percentile	0.042	-	0.48	-	5.79	-
	n	12	4	12	4	12	4
	% Detections	100	100	100	100	100	75
STL-N	Mean	0.021	0.031	0.33	0.52	2.96	0.70
	Median	0.018	-	0.36	-	1.98	-
	Minimum	0.009	0.013	<0.20	0.39	1.10	<0.60
	Maximum	0.051	0.048	0.43	0.69	7.64	1.34
	SD	0.0113	0.0173	0.093	0.142	1.99	0.545
	SE	0.0033	0.0086	0.027	0.071	0.575	0.272
	25th Percentile	0.017	-	0.30	-	1.48	-
	75th Percentile	0.021	-	0.39	-	4.15	-
	n	12	4	12	4	12	4
	% Detections	100	100	92	100	100	75
LMFB	Mean	0.035	0.037	0.39	0.51	4.32	<0.60
	Median	0.034	0.034	0.40	0.53	4.58	<0.60
	Minimum	0.015	0.025	<0.20	0.37	1.76	<0.60
	Maximum	0.051	0.051	0.60	0.66	6.68	1.95
	SD	0.0103	0.0084	0.126	0.097	1.60	0.475
	SE	0.0030	0.0024	0.036	0.028	0.463	0.137
	25th Percentile	0.030	0.033	0.37	0.43	3.24	<0.60
	75th Percentile	0.039	0.042	0.43	0.58	5.25	0.73
	n	12	12	12	12	12	12
	% Detections	100	100	92	100	100	42

Notes:

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

Table 3.4-2. 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	**BURNT**	**LNR**	**BURNT**	**LNR**	**BURNT**	**LNR**
2008	-	0.040	-	0.78	-	7.00
2009	0.044	0.038	0.62	0.48	2.40	4.20
2010	0.032	0.045	0.35	0.42	1.14	2.08
2011	0.031	0.037	0.44	0.48	2.99	4.52
2012	0.043	0.040	0.31	0.42	2.70	4.46
2013	0.031	0.031	0.31	0.39	3.63	4.84
2014	0.039	0.037	0.31	0.48	2.98	3.98
2015	0.041	0.033	0.39	0.41	2.87	5.43
2016	0.049	0.041	0.39	0.51	2.99	4.33
2017	0.042	0.043	0.49	0.47	2.55	3.12
2018	0.042	0.033	0.41	0.35	4.42	5.59
2019	0.034	0.030	0.39	0.36	3.40	5.32
Overall (2008-2019)	0.039	0.037	0.40	0.46	2.97	4.64

Notes:

1. CCME = Canadian Council of Ministers of the Environment

Table 3.4-3. 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	**SPLIT**	**STL-S**	**STL-N**	**LMFB**	**SPLIT**	**STL-S**	**STL-N**	**LMFB**	**SPLIT**	**STL-S**	**STL-N**	**LMFB**
2008	-	-	-	-	-	-	-	-	-	-	-	-
2009	0.035	0.038	0.015	-	0.41	0.50	0.36	-	5.08	4.20	1.37	-
2010	0.046	-	-	0.044	0.53	-	-	0.40	3.80	-	-	2.29
2011	0.045	-	-	-	0.41	-	-	-	4.77	-	-	-
2012	0.038	0.050	0.031	-	0.40	0.42	0.38	-	6.21	5.37	4.39	-
2013	0.041	-	-	0.031	0.32	-	-	0.33	8.15	-	-	5.24
2014	0.044	-	-	-	0.49	-	-	-	4.53	-	-	-
2015	0.033	0.027	0.022	-	0.44	0.41	0.30	-	3.54	6.42	2.50	-
2016	0.041	-	-	0.037	0.50	-	-	0.47	5.66	-	-	4.71
2017	0.039	-	-	-	0.49	-	-	-	3.24	-	-	-
2018	0.038	0.037	0.016	-	0.38	0.38	0.29	-	4.93	6.44	3.60	-
2019	0.031	-	-	0.027	0.48	-	-	0.36	4.63	-	-	5.05
Overall (2008-2019)	0.039	0.038	0.021	0.035	0.44	0.43	0.33	0.39	4.96	5.61	2.96	4.32

Notes:

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

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
HAYES	Mean	0.018	0.010	0.42	0.44	2.66	<0.60
	Median	0.016	0.009	0.43	0.42	2.86	<0.60
	Minimum	0.009	0.006	<0.20	0.35	0.76	<0.60
	Maximum	0.044	0.015	0.79	0.58	4.58	<0.60
	SD	0.0078	0.0025	0.125	0.069	0.849	-
	SE	0.0013	0.0008	0.021	0.022	0.144	-
	25th Percentile	0.014	0.009	0.31	0.40	2.00	<0.60
	75th Percentile	0.020	0.010	0.49	0.46	3.21	<0.60
	n	36	10	36	10	35	10
	% Detections	100	100	97	100	100	30
ASSN	Mean	0.020	0.014	0.37	0.45	2.70	0.90
	Median	0.018	0.013	0.37	0.46	2.67	0.95
	Minimum	0.006	0.011	<0.20	0.37	<0.60	<0.60
	Maximum	0.051	0.019	0.65	0.57	6.40	1.72
	SD	0.0080	0.0032	0.107	0.066	1.42	0.459
	SE	0.0014	0.0010	0.019	0.021	0.247	0.138
	25th Percentile	0.015	0.011	0.32	0.39	1.50	<0.60
	75th Percentile	0.023	0.016	0.42	0.49	3.82	1.15
	n	33	11	33	10	33	11
	% Detections	100	100	94	100	97	73

Notes:

1. OW = Open-water season; IC = Ice-cover season
2. SD = standard deviation; SE = standard error; n = number of samples
3. TN statistics for ASSN exclude an outlier value of 11.1 mg/L from winter 2015.

Table 3.4-5. 2008-2019 Off-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	**HAYES**	**HAYES**	**HAYES**
2008	0.018	0.61	2.33
2009	0.026	0.48	2.70
2010	0.014	0.40	1.26
2011	0.022	0.45	3.44
2012	0.018	0.38	2.77
2013	0.013	0.30	2.55
2014	0.022	0.44	3.09
2015	0.025	0.35	3.00
2016	0.017	0.43	2.35
2017	0.015	0.38	1.78
2018	0.016	0.38	3.24
2019	0.016	0.39	2.88
Overall (2008-2019)	0.018	0.42	2.66

Notes:

1. CCME = Canadian Council of Ministers of the Environment

Table 3.4-6. 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	**ASSN**	**ASSN**	**ASSN**
2008	-	-	-
2009	0.020	0.46	2.17
2010	0.020	0.39	1.47
2011	0.028	0.54	3.76
2012	0.022	0.34	2.04
2013	0.020	0.32	3.49
2014	0.017	0.25	1.61
2015	0.014	0.32	3.12
2016	0.019	0.33	1.70
2017	0.018	0.39	3.24
2018	0.021	0.33	3.18
2019	0.021	0.36	3.90
Overall (2008-2019)	0.020	0.37	2.70

Notes:

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

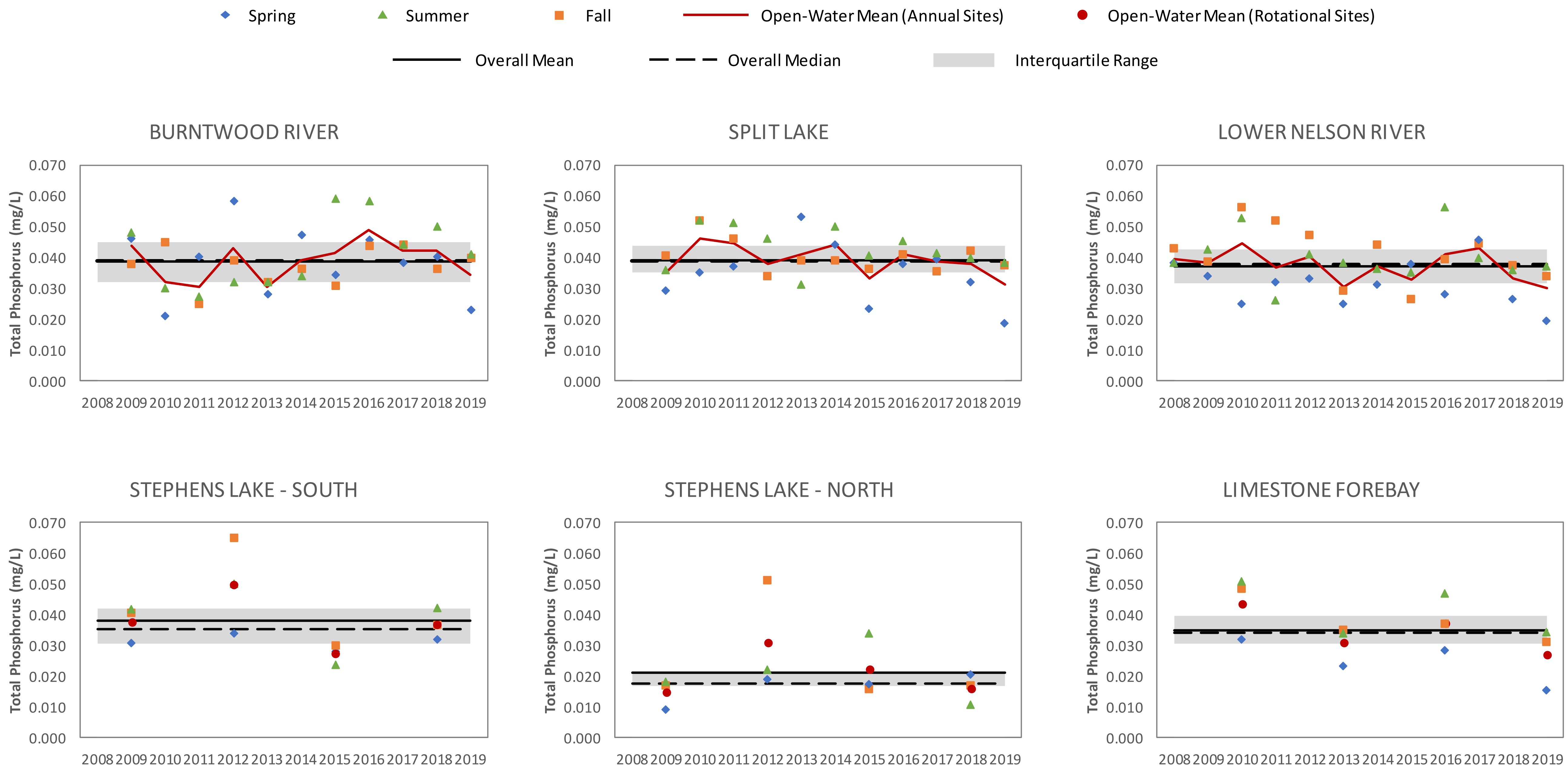


Figure 3.4-1. 2008-2019 On-system open-water season TP concentrations.

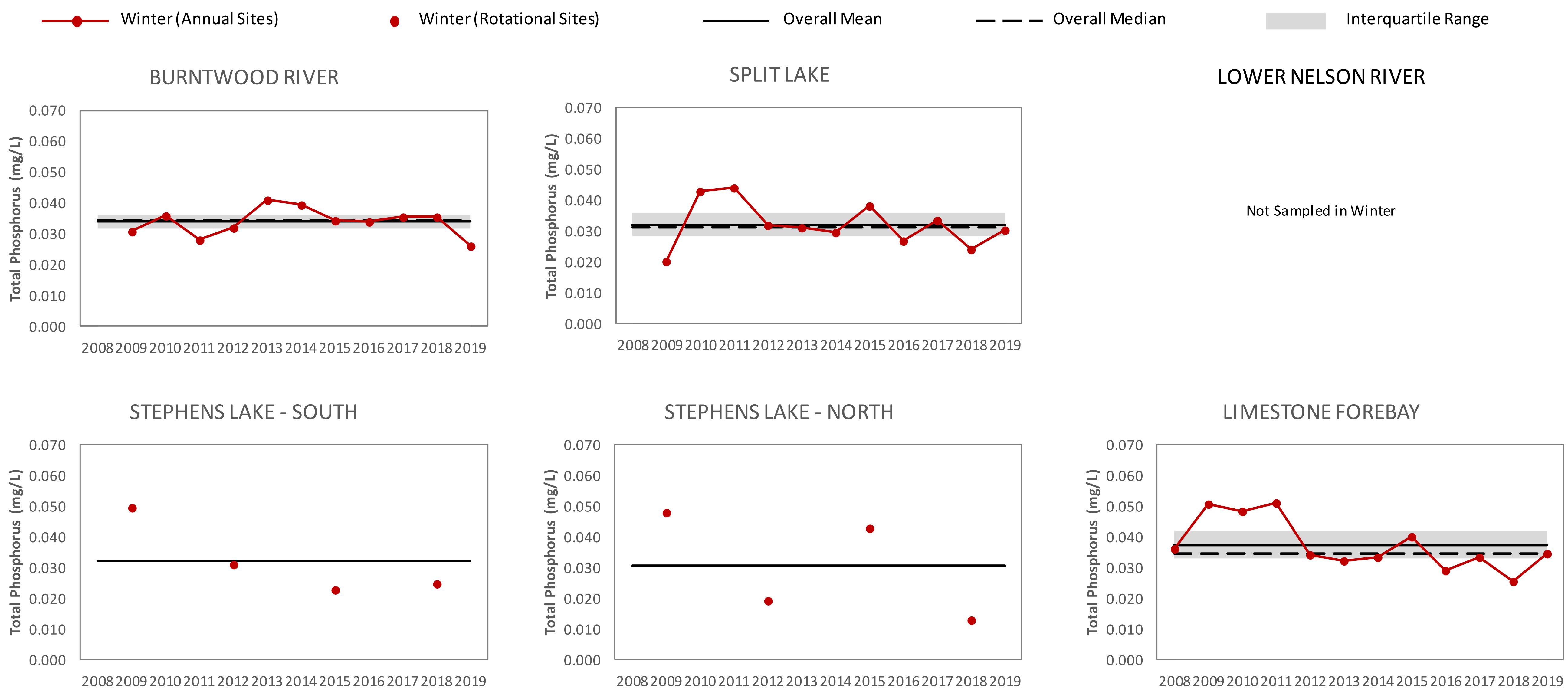


Figure 3.4-2. 2008-2019 On-system ice-cover season TP concentrations.

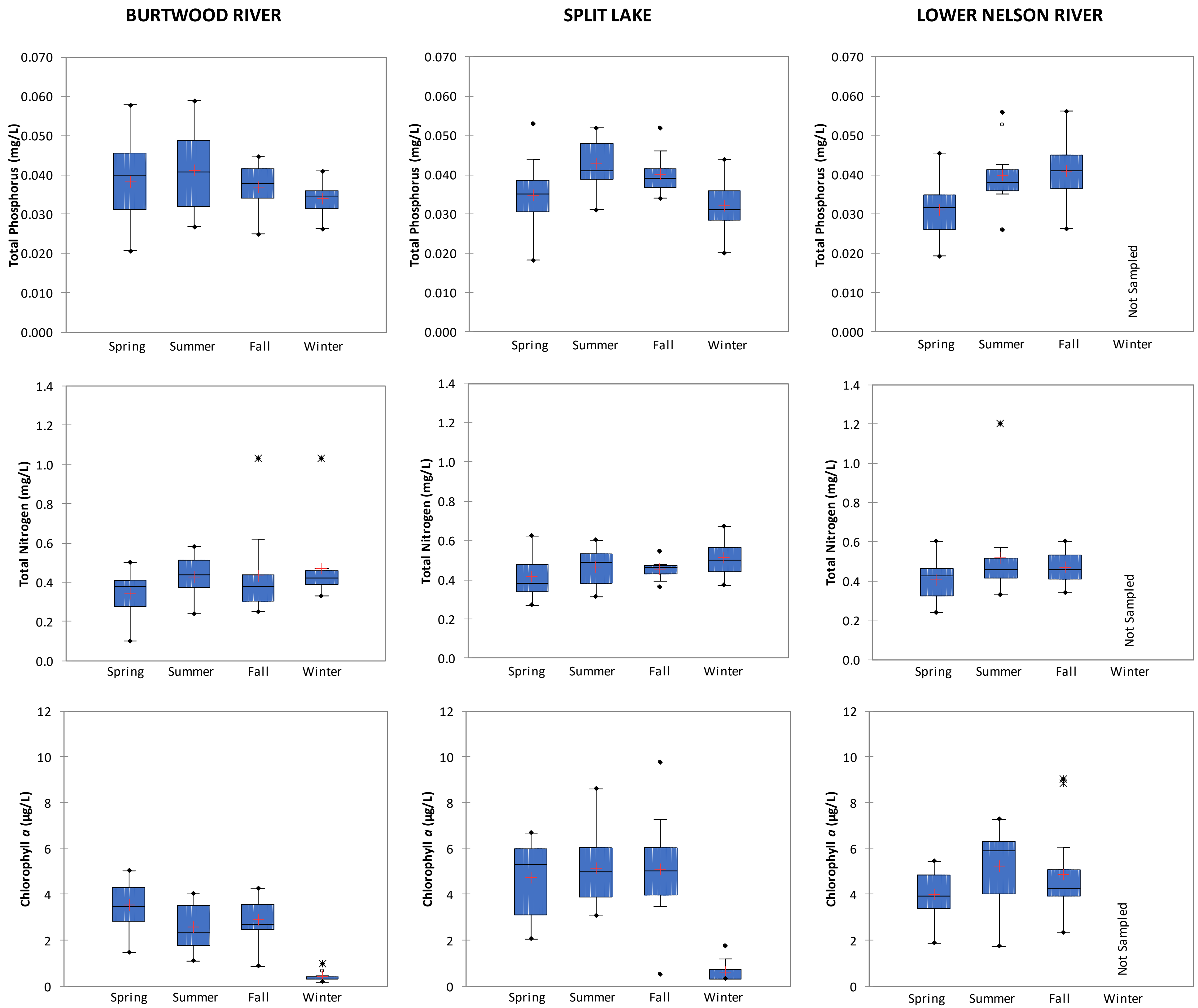


Figure 3.4-3. 2008-2019 On-system seasonal total phosphorus, total nitrogen, and chlorophyll *a* concentrations.

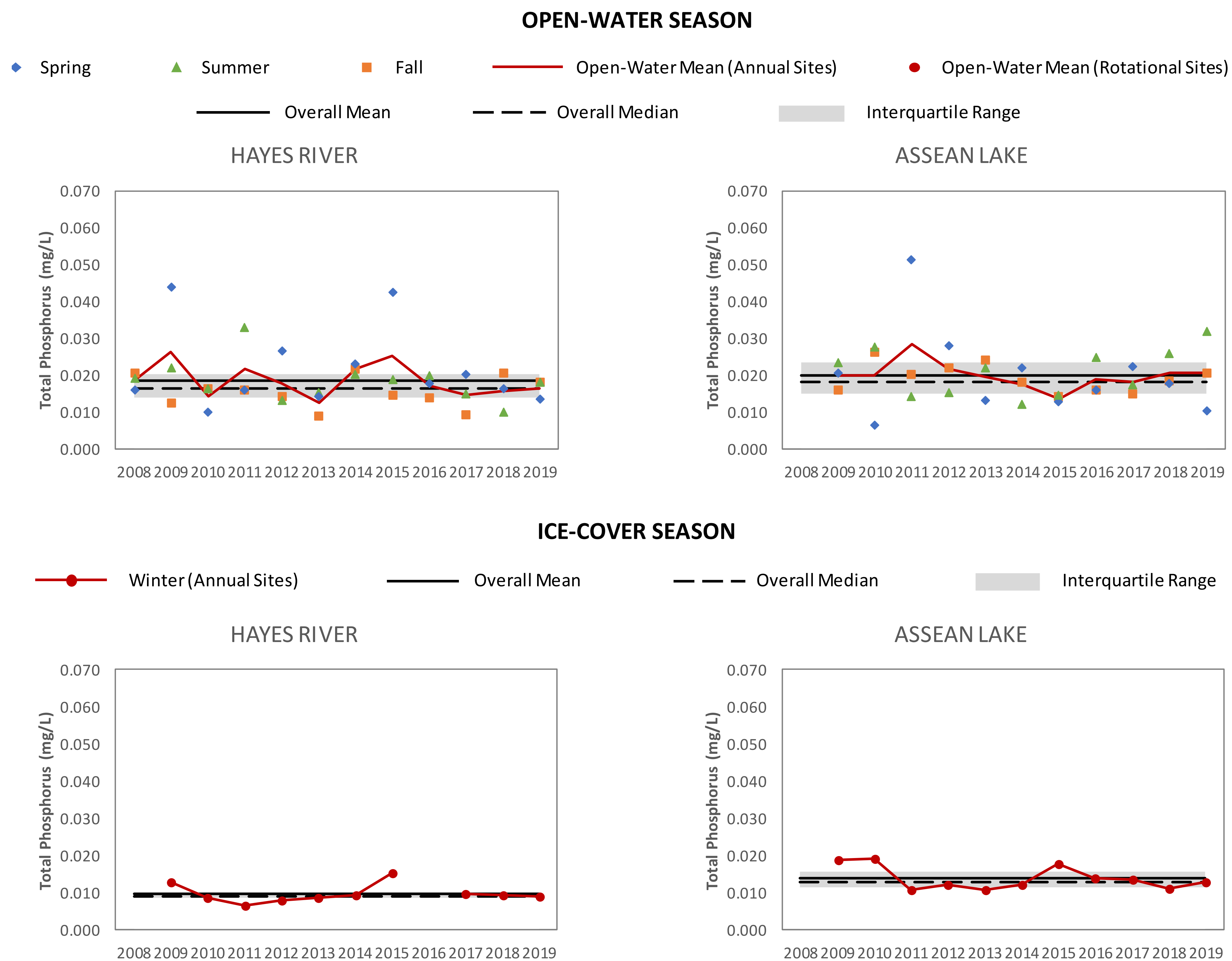
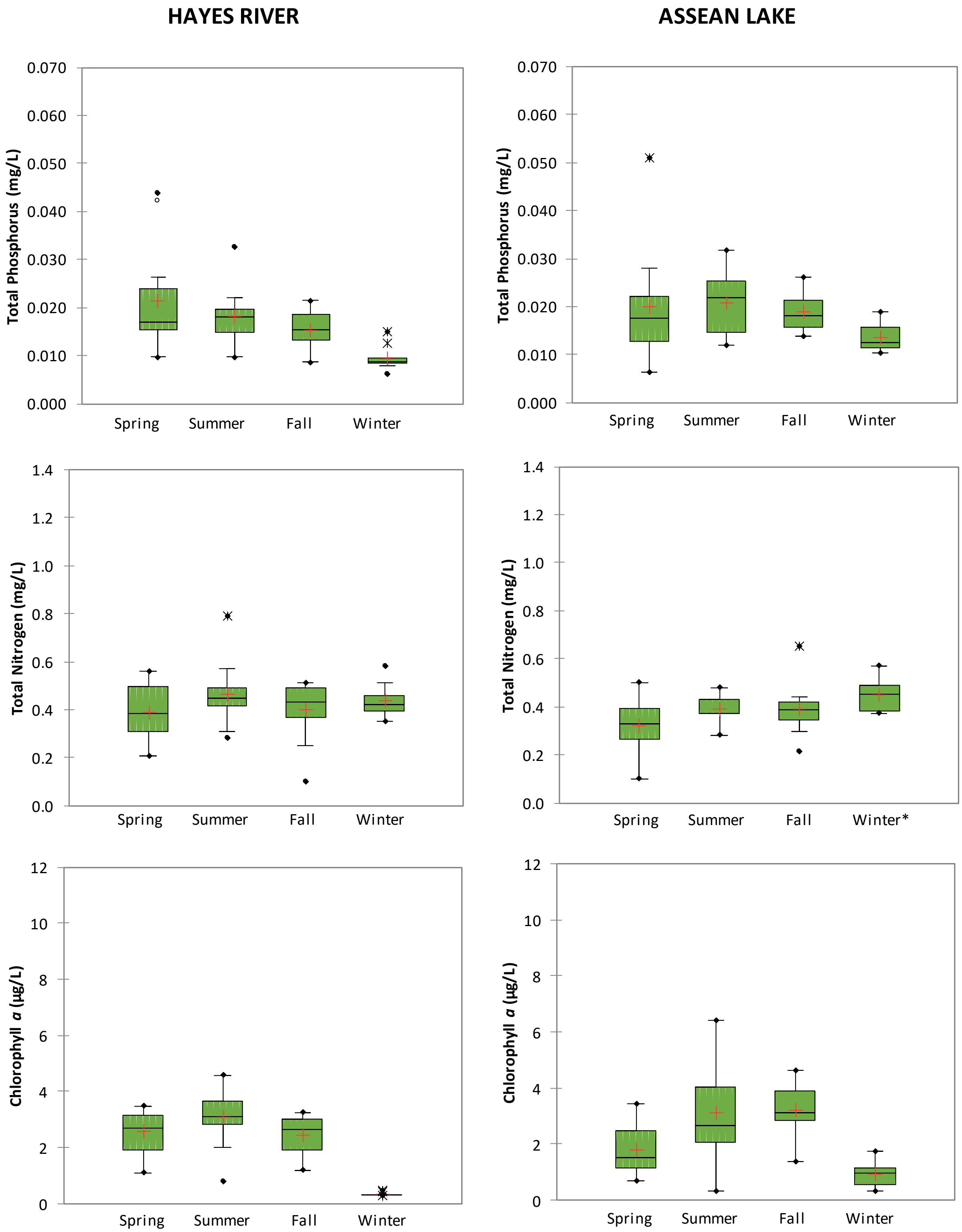


Figure 3.4-4. 2008-2019 Off-system open-water and ice-cover season TP concentrations.



*Excludes outlier TN value of 11.1 mg/L at ASSN from winter 2015.

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

Burntwood River

TN concentrations in the Burntwood River near the inlet to Split Lake ranged from <0.20 to 1.03 mg/L during the open-water season. The mean and median for the 11 years of monitoring were both 0.40 mg/L. Open-water season mean annual TN concentrations ranged from 0.31 to 0.62 mg/L and were within the IQR (0.30 to 0.44 mg/L) in nine of the 11 years of monitoring. Mean TN concentrations were above the IQR in 2009 and 2017 (Table 3.4-1 and Figure 3.4-6).

TN concentrations in the ice-cover season ranged from 0.33 to 1.03 mg/L, with a mean of 0.47 mg/L and a median of 0.42 mg/L for the 11 years of monitoring. The IQR was 0.39 to 0.46 mg/L. TN concentrations were within or near the IQR except in 2015 when it was above the IQR (Table 3.4-1 and Figure 3.4-7).

No clear seasonality was observed for TN in the Burntwood River over the 11 years of monitoring. However, the lowest mean TN concentration occurred in spring (0.34 mg/L) and the highest in winter (0.47 mg/L; Figure 3.4-3).

The Burntwood River near the inlet to Split Lake was oligotrophic (<0.7 mg/L) based on the 2009-2019 mean open-water season TN concentration (0.40 mg/L). Mean annual TN concentrations (0.31 to 0.62 mg/L) in the open-water season were within the oligotrophic range (<0.7 mg/L) in all 11 years of monitoring (Table 3.4-2).

Split Lake

TN concentrations in Split Lake ranged from 0.27 to 0.62 mg/L during the open-water season. The mean and median for the 11 years of monitoring were 0.44 mg/L and 0.46 mg/L, respectively. Open-water season mean annual TN concentrations ranged from 0.32 to 0.53 mg/L and were within the IQR (0.36 to 0.51 mg/L) in nine of the 11 years of monitoring. Mean TN concentrations were below the IQR in 2013 and above the IQR in 2010 (Table 3.4-1 and Figure 3.4-6).

TN concentrations in the ice-cover season ranged from 0.37 to 0.67 mg/L, with a mean of 0.51 mg/L and a median of 0.50 mg/L for the 11 years of monitoring. The IQR was 0.44 to 0.57 mg/L (Table 3.4-1 and Figure 3.4-7).

No clear seasonality was observed for TN in Split Lake over the 11 years of monitoring. However, the lowest mean TN concentration occurred in spring (0.41 mg/L) and the highest in winter (0.51 mg/L; Figure 3.4-3).

Split Lake was mesotrophic (0.350 to 0.650 mg/L) based on the 2009-2019 mean open-water season TN concentration (0.44 mg/L). Mean annual TN concentrations (0.32 to 0.53 mg/L) in the open-water season were within the mesotrophic range (0.350 to 0.650 mg/L) in all years except for 2013 when the mean (0.32 mg/L) was in the oligotrophic range (i.e., <0.350 mg/L; Table 3.4-3).

Lower Nelson River

TN concentrations in the lower Nelson River downstream of the Limestone GS ranged from 0.24 to 1.20 mg/L during the open-water season. The mean and median for the 12 years of monitoring were both 0.46 mg/L. Open-water season mean annual TN concentrations ranged from 0.35 to 0.78 mg/L and were within the IQR (0.37 to 0.52 mg/L) in nine of the 12 years of monitoring. Mean TN concentrations were below the IQR in 2018 and 2019 and above the IQR in 2008 (Table 3.4-1 and Figure 3.4-6).

No data are available for the ice-cover season as this site is not sampled in winter.

No clear seasonality was observed for TN in the lower Nelson River downstream of the Limestone GS over the 12 years of monitoring. However, the lowest mean TN concentration occurred in spring (0.40 mg/L) and the highest in summer (0.52 mg/L; Figure 3.4-3).

The lower Nelson River downstream of the Limestone GS was oligotrophic (i.e., <0.7 mg/L) based on the 2008-2019 mean open-water season TN concentration (0.46 mg/L). Mean annual TN concentrations (0.35 to 0.78 mg/L) in the open-water season were within the oligotrophic range (i.e., <0.7 mg/L) in all years except for 2008 when the mean TN concentration was in the mesotrophic range (0.7 to 1.5 mg/L; Table 3.4-2).

ROTATIONAL SITES

Stephens Lake – South

TN concentrations in Stephens Lake - South ranged from 0.28 to 0.58 mg/L during the open-water season. The mean was 0.43 mg/L, the median was 0.44 mg/L, and the IQR was 0.38 to 0.48 mg/L for the four years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.38 to 0.50 mg/L and were within the IQR in three of the four years of monitoring. The exception was 2009 when the mean TN concentration was above the IQR (Table 3.4-1 and Figure 3.4-6).

During the ice-cover season, TN concentrations ranged from 0.34 and 0.61 mg/L, with a mean of 0.47 mg/L (Table 3.4-1 and Figure 3.4-7).

Stephens Lake - South was mesotrophic (0.350 to 0.650 mg/L) based on the mean of the open-water season TN concentrations for the four years of monitoring (0.43 mg/L). Open-water season mean annual TN concentrations (0.38 to 0.50 mg/L) were also within the meso-eutrophic range in each year sampled (Table 3.4-3).

Stephens Lake – North

TN concentrations in Stephens Lake - North ranged from <0.20 to 0.43 mg/L during the open-water season. The mean was 0.33 mg/L, the median was 0.36 mg/L, and the IQR was 0.30 to 0.39 mg/L for the four years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.29 to 0.38 mg/L and were within the IQR in three of the four years of monitoring. The exception was 2018 when the mean TN concentrations was below the IQR (Table 3.4-1 and Figure 3.4-6).

During the ice-cover season, TN concentrations ranged from 0.39 and 0.69 mg/L, with a mean of 0.52 mg/L (Table 3.4-1 and Figure 3.4-7).

Stephens Lake - North was oligotrophic (i.e., <0.350 mg/L) based on the mean of the open-water season TN concentrations for the four years of monitoring (0.33 mg/L). Open-water season mean annual TN concentrations (0.29 to 0.38 mg/L) were also within the oligotrophic range in 2015 and 2018 but were within the mesotrophic range (0.350 to 0.650 mg/L) in 2009 and 2012 (Table 3.4-3).

Limestone Forebay

TN concentrations in the Limestone Forebay ranged from <0.20 to 0.60 mg/L during the open-water season. The mean was 0.39 mg/L, the median was 0.40 mg/L, and the IQR was 0.37 to 0.43 mg/L for the four years of monitoring. Mean annual TN concentrations in the open-water season ranged from 0.33 to 0.47 mg/L and were within the IQR in 2010 and 2019 but were below the IQR in 2013 and above the IQR in 2016 (Table 3.4-1 and Figure 3.4-6).

TN concentrations in the ice-cover season ranged from 0.37 and 0.66 mg/L, with a mean of 0.51 mg/L and a median of 0.53 mg/L over the 12 years of monitoring. The IQR was 0.43 to 0.58 mg/L (Table 3.4-1 and Figure 3.4-7).

The Limestone Forebay was mesotrophic (0.350 to 0.650 mg/L) based on the mean of the open-water season TN concentrations for the four years of monitoring (0.39 mg/L). Open-water season mean annual TN concentrations (0.33 to 0.47 mg/L) were also within the meso-eutrophic range in three of the four years of monitoring. The exception was 2013 when the mean TN concentration was within the oligotrophic range (i.e., <0.350 mg/L; Table 3.4-2).

3.4.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

TN concentrations in the Hayes River ranged from <0.20 to 0.79 mg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 0.42 mg/L and 0.43 mg/L, respectively. Open-water season mean annual TN concentrations ranged from 0.30 to 0.61 mg/L and were within the IQR (0.31 to 0.49 mg/L) in 10 of the 12 years of monitoring. Mean TN concentrations were below the IQR in 2013 and above the IQR in 2008 (Table 3.4-4 and Figure 3.4-8).

TN concentrations in the ice-cover season ranged from 0.35 to 0.58 mg/L, the mean was 0.44 mg/L, and the median was 0.42 mg/L for the 10 years of monitoring. The IQR was 0.40 to 0.46 mg/L (Table 3.4-4 and Figure 3.4-8).

No clear seasonality was observed for TN in the Hayes River over the 12-year period. However, the lowest mean TN concentration occurred in spring (0.39 mg/L) and the highest in summer (0.46 mg/L; Figure 3.4-5).

The Hayes River was oligotrophic (<0.7 mg/L) based on the 2008-2019 mean open-water season TN concentration (0.42 mg/L). Mean annual TN concentrations (0.30 to 0.61 mg/L) in the open-water season were also within the oligotrophic range in all 12 years of monitoring (Table 3.4-5).

Assean Lake

TN concentrations in Assean Lake ranged from <0.20 to 0.65 mg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were both 0.37 mg/L. Open-water season mean annual TN concentrations ranged from 0.25 to 0.54 mg/L and were within the IQR (0.32 to 0.42 mg/L) in eight of the 11 years of monitoring. Mean TN concentrations were below the IQR in 2014 and above the IQR in 2009 and 2011 (Table 3.4-4 and Figure 3.4-8).

TN concentrations in the ice-cover season ranged from 0.37 to 0.57 mg/L, and the mean was 0.45 mg/L and median was 0.46 mg/L for the 10 years of monitoring[1]. The IQR was 0.39 to 0.49 mg/L (Table 3.4-4 and Figure 3.4-8).

No clear seasonality was observed for TN in Assean Lake over the 11 years of monitoring. However, the lowest mean TN concentration occurred in spring (0.32 mg/L) and the highest in winter (0.45 mg/L; Figure 3.4-5).

Assean Lake was mesotrophic (0.350 to 0.650 mg/L) based on the 2009-2019 mean open-water season TN concentration (0.37 mg/L). Mean annual TN concentrations (0.25 to 0.54 mg/L) in the open-water season were also within the mesotrophic range in five of the 11 years of monitoring. However, the mean TN concentration was within the oligotrophic range (i.e., <0.350 mg/L) in 2012, 2013, 2014, 2015, 2016, and 2018 (Table 3.4-6).

[1] An outlier value of 11.1 mg/L from winter 2015 has been excluded from the data reported for the ice-cover season.

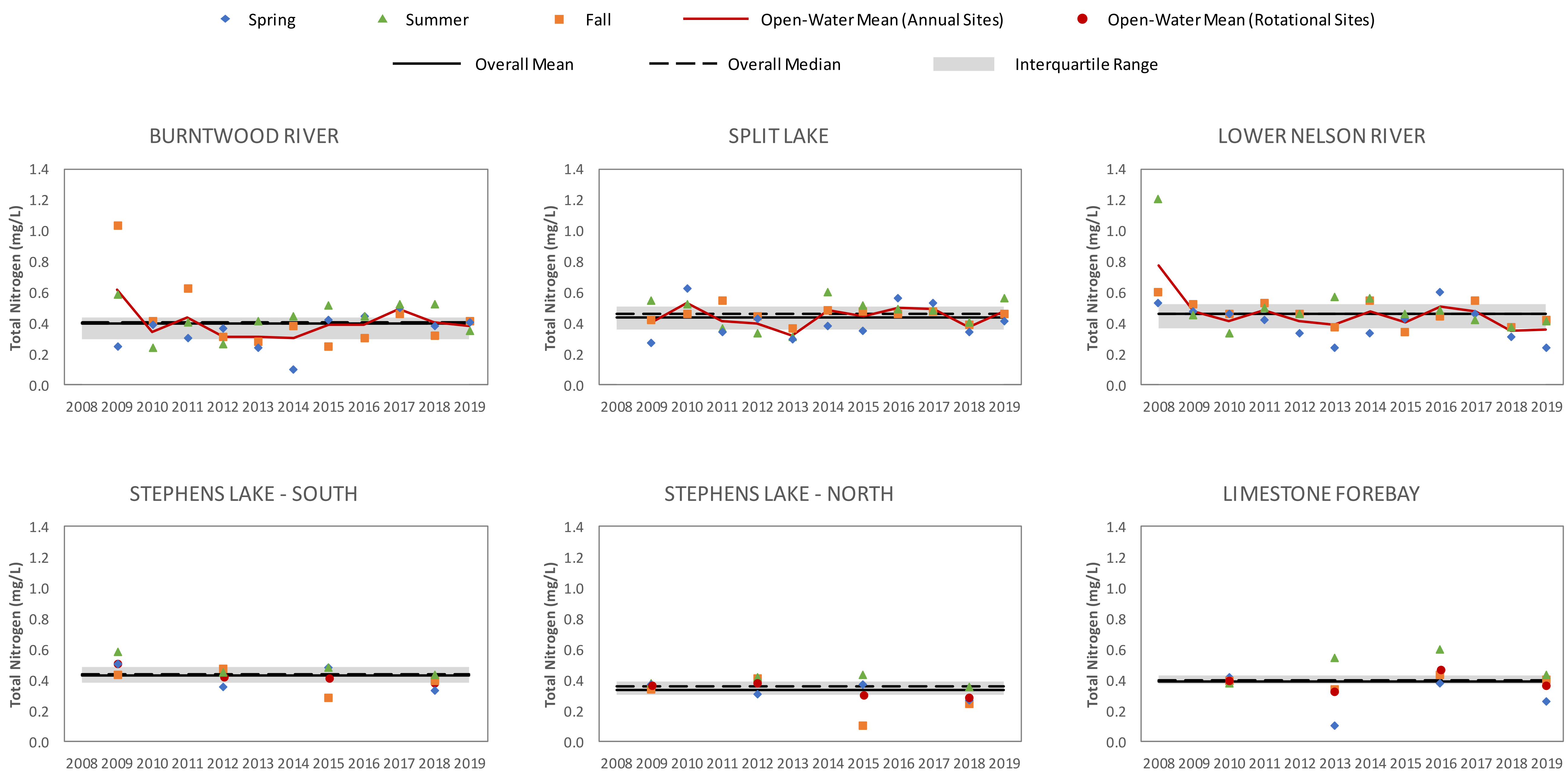


Figure 3.4-6. 2008-2019 On-system open-water season TN concentrations.

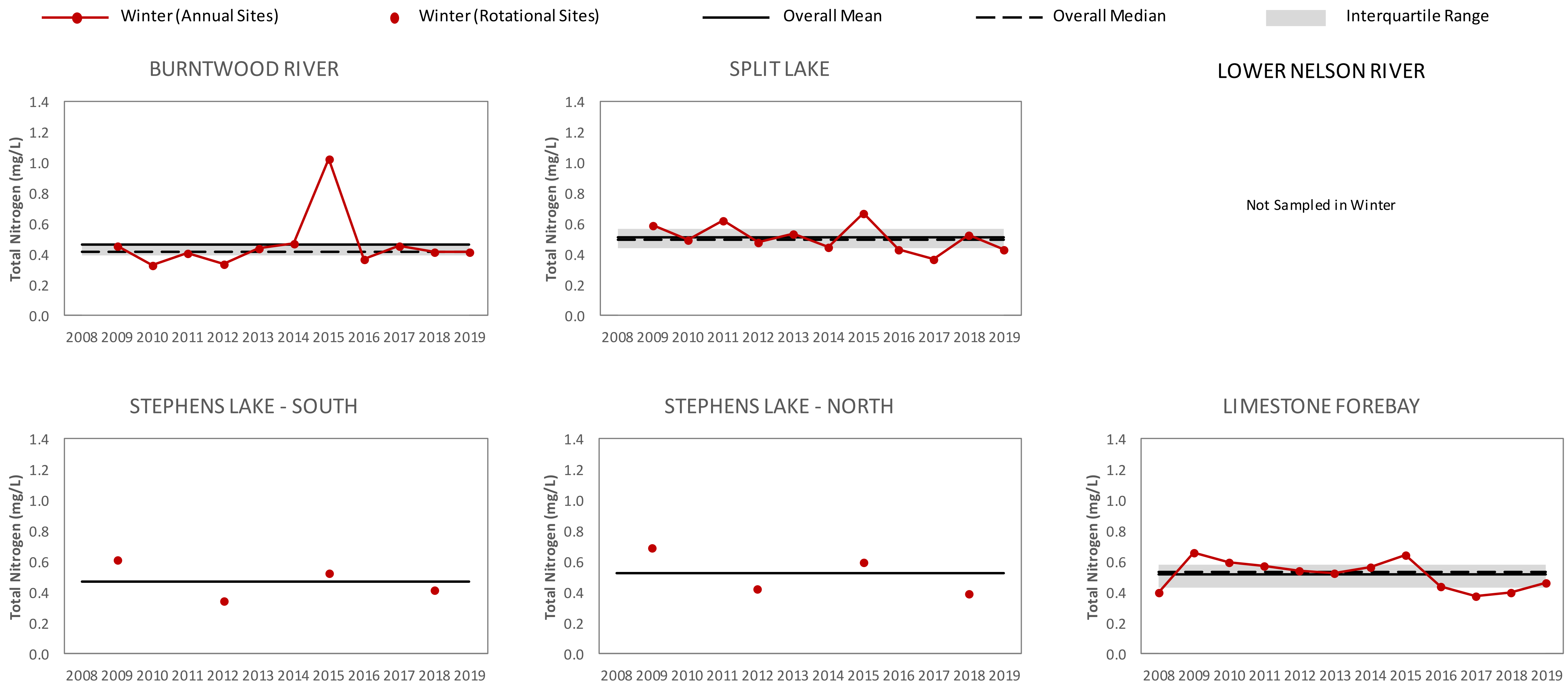
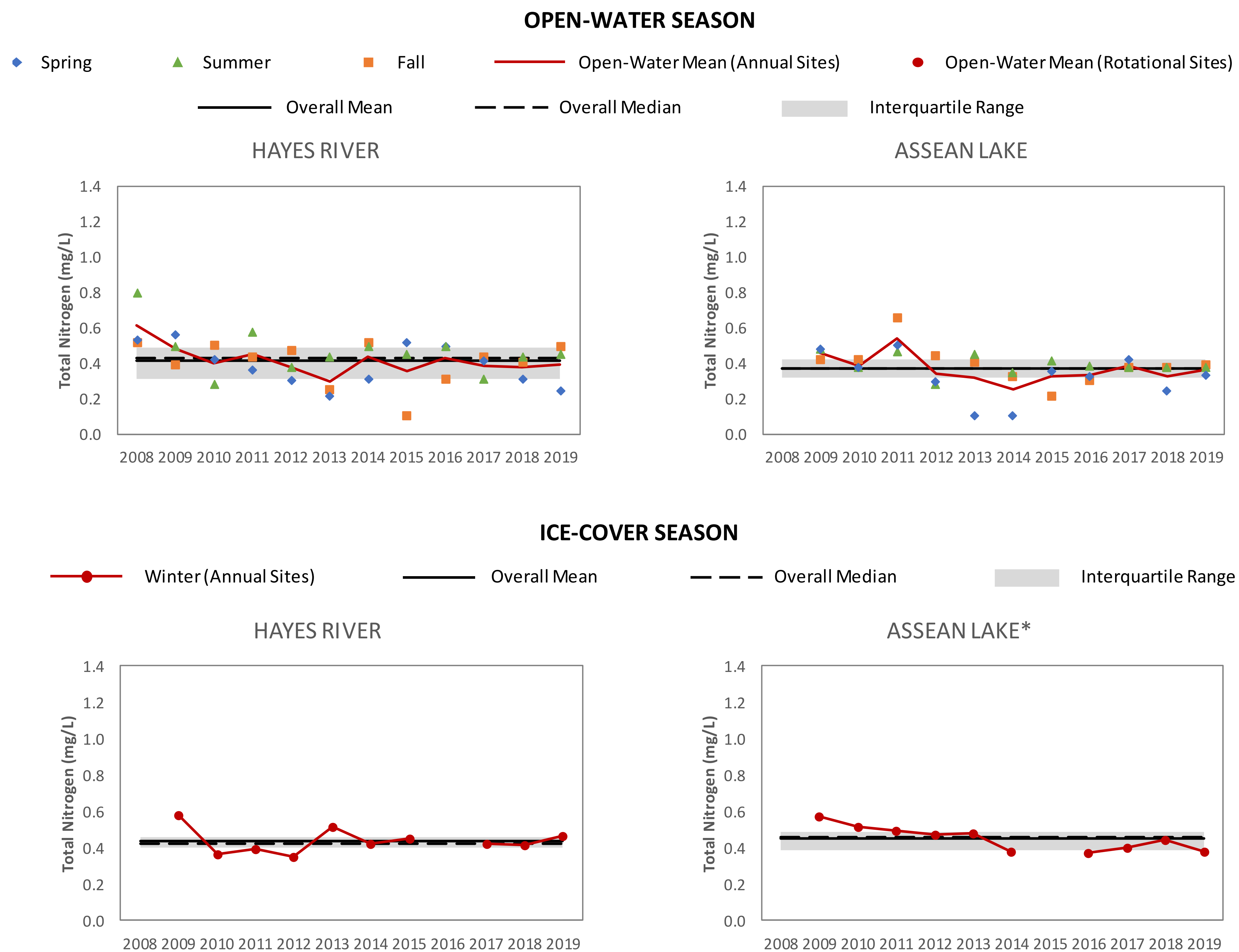


Figure 3.4-7. 2008-2019 On-system ice-cover season TN concentrations



*Excludes outlier value of 11.1 mg/L at ASSN from winter 2015

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

Burntwood River

Chlorophyll *a* concentrations in the Burntwood River near the inlet to Split Lake ranged from 0.84 to 5.03 µg/L during the open-water season. The mean and median for the 11 years of monitoring were 2.97 µg/L and 3.05 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.14 to 4.42 µg/L and were within the IQR (2.34 to 3.83 µg/L) in nine of the 11 years of monitoring. Mean chlorophyll *a* concentrations were below the IQR in 2010 and above the IQR in 2018 (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 to 0.95 µg/L, with a mean and median of <0.60 µg/L for the 11 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, often less than the DL (0.60 µg/L; percent detection = 36), compared to the open-water season (Table 3.4-1). No clear seasonality was observed for chlorophyll *a* concentrations during the open-water season; however, mean chlorophyll *a* concentrations were lowest in summer (2.54 µg/L) and highest in spring (3.49 µg/L; Figure 3.4-3).

The Burntwood River near the inlet to Split Lake was oligotrophic (<10 µg/L) based on the 2009-2019 mean open-water season chlorophyll *a* concentration (2.97 µg/L). Mean annual chlorophyll *a* concentrations (1.14 to 4.42 µg/L) in the open-water season were within the oligotrophic range (<10 µg/L) in all 11 years of monitoring (Table 3.4-2).

Split Lake

Chlorophyll *a* concentrations in Split Lake ranged from 0.49 to 9.74 µg/L during the open-water season. The mean and median for the 11 years of monitoring were 4.96 µg/L and 5.02 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 3.24 to 8.15 µg/L and were within the IQR (3.47 to 6.11 µg/L) in eight of the 11 years of monitoring. Mean chlorophyll *a* concentrations were below the IQR in 2017 and above the IQR in 2012 and 2013. Chlorophyll *a* concentrations were consistently above the DL (0.01-0.60 µg/L) in the open-water season (percent detection = 100; Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 to 1.72 µg/L, with a mean and median of <0.60 µg/L for the 11 years of monitoring. The IQR was <0.60 to 0.71 µg/L. Chlorophyll *a* concentrations were below the DL (0.05-0.60 µg/L) in approximately half the samples collected in the ice-cover season (percent detection = 45; Table 3.4-1 and Figure 3.4-10).

Chlorophyll *a* concentrations were lower in the winter (mean = <0.60 µg/L), often less than the DL, compared the open-water season. No clear seasonality was observed for chlorophyll *a* concentrations during the open-water season; however, mean chlorophyll *a* concentrations were lowest in spring (4.69 µg/L) and highest in summer (5.12 µg/L; Figure 3.4-3).

Split Lake was mesotrophic (2.5 to 8 µg/L) based on the 2009-2019 mean open-water season chlorophyll *a* concentration (4.96 µg/L). Mean annual chlorophyll *a* concentrations (3.24 to 8.15 µg/L) in the open-water season were within the mesotrophic range (2.5 to 8 µg/L) in most years except for 2013 when the mean chlorophyll *a* concentration was within the eutrophic range (8 to 25 µg/L; Table 3.4-3).

Lower Nelson River

Chlorophyll *a* concentrations in the lower Nelson River downstream of the Limestone GS ranged from 1.72 to 9.00 µg/L during the open-water season. The mean and median for the 12 years of monitoring were 4.64 µg/L and 4.20 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 2.08 to 7.00 µg/L and were within the IQR (3.52 to 5.66 µg/L) in nine of the 12 years of monitoring. Mean chlorophyll *a* concentrations were below the IQR in 2010 and 2017 and above the IQR in 2008 (Table 3.4-1 and Figure 3.4-9).

No data are available for the ice-cover season as this site is not sampled in winter.

No clear seasonality was observed for chlorophyll *a* concentrations during the open-water season over the 12 years of monitoring. However, mean chlorophyll *a* concentrations were lowest in spring (3.94 µg/L) and highest in summer (5.21 µg/L; Figure 3.4-3).

The lower Nelson River downstream of the Limestone GS was oligotrophic (<10 µg/L) based on the 2008-2019 mean open-water season chlorophyll *a* concentration (4.64 µg/L). Mean annual chlorophyll *a* concentrations (2.08 to 7.00 µg/L) in the open-water season were within the oligotrophic range (<10 µg/L) in all 12 years of monitoring (Table 3.4-2).

ROTATIONAL SITES

Stephens Lake – South

Chlorophyll *a* concentrations in Stephens Lake – South ranged from 3.10 to 9.89 µg/L during the open-water season. The mean was 5.61 µg/L, the median was 5.23 µg/L, and the IQR was 4.26 to 5.79 µg/L for the four years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 4.20 to 6.44 µg/L and were within the IQR in 2012, below the IQR in 2009, and above the IQR in 2015 and 2018 (Table 3.4-1 and Figure 3.4-9).

During the ice-cover season, chlorophyll *a* concentrations ranged from <0.60 to 0.76 µg/L, with a mean of <0.60 µg/L (Table 3.4-1 and Figure 3.4-10).

Stephens Lake – South 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 (5.61 µg/L). Open-water season mean annual chlorophyll *a* concentrations (4.20 to 6.44 µg/L) were within the mesotrophic range in each year of monitoring (Table 3.4-3).

Stephens Lake – North

Chlorophyll *a* concentrations in Stephens Lake – North ranged from 1.10 to 7.64 µg/L during the open-water season. The mean was 2.96 µg/L, the median was 1.98 µg/L, and the IQR was 1.48 to 4.15 µg/L for the four years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 1.37 to 4.39 µg/L and were within the IQR in 2015 and 2018, below the IQR in 2009, and above the IQR in 2012 (Table 3.4-1 and Figure 3.4-9).

During the ice-cover season, chlorophyll *a* concentrations ranged from <0.60 and 1.34 µg/L, with a mean of 0.70 µg/L (Table 3.4-1 and Figure 3.4-10).

Stephens Lake – North 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 (2.96 µg/L). Open-water season mean annual chlorophyll *a* concentrations (1.37 to 4.39 µg/L) were within the mesotrophic range in three of the four years of monitoring. The exception was 2009, which was within the oligotrophic range (<2.5 µg/L; Table 3.4-3).

Limestone Forebay

Chlorophyll *a* concentrations in the Limestone Forebay ranged from 1.76 to 6.68 µg/L during the open-water season. The mean was 4.32 µg/L, the median was 4.58 µg/L, and the IQR was 3.24 to 5.25 µg/L for the four years of monitoring. Mean annual chlorophyll *a* concentrations in the open-water season ranged from 2.29 to 5.24 µg/L and were within the IQR in three of the four years of monitoring. The exception was 2010, which was below the IQR (Table 3.4-1 and Figure 3.4-9).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 and 1.95 µg/L, with both a mean and median of <0.60 µg/L for the 12 years of monitoring. The IQR was <0.60 to 0.73 µg/L (Table 3.4-1 and Figure 3.4-10).

The Limestone Forebay 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 (4.32 µg/L). Open-water season mean annual chlorophyll *a* concentrations (2.29 to 5.24 µg/L) were within the mesotrophic range in three of the four years of monitoring. The exception was 2010, which was within the oligotrophic range (<2.5 µg/L; Table 3.4-3).

3.4.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Hayes River

Chlorophyll *a* concentrations in the Hayes River ranged from 0.76 to 4.58 µg/L during the open-water season. The mean and median concentrations for the 12 years of monitoring were 2.66 µg/L and 2.86 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.26 to 3.44 µg/L and were within the IQR (2.00 to 3.21 µg/L) in eight of the 12 years of monitoring. Mean chlorophyll *a* concentrations were below the IQR in 2010 and 2017 and above the IQR in 2011 and 2018 (Table 3.4-4 and Figure 3.4-11).

Chlorophyll *a* concentrations in the ice-cover season were consistently less than 0.60 µg/L over the 10 years of monitoring. As the DL varied (0.01-0.60 µg/L) chlorophyll *a* concentration were above the DL in some samples collected (percent detection = 30); however, both the mean and median were <0.60 µg/L for the 10 years of monitoring (Table 3.4-4 and Figure 3.4-11).

Chlorophyll *a* concentrations were lower in the winter (mean = <0.60 µg/L), often less than the DL, compared the open-water season (Table 3.4-4). No clear seasonality was observed for chlorophyll *a* concentrations during the open-water season; however, mean chlorophyll *a* concentrations were lowest in fall (2.40 µg/L) and highest in summer (3.03 µg/L; Figure 3.4-5).

The Hayes River was oligotrophic (<10 µg/L) based on the 2008-2019 mean open-water season chlorophyll *a* concentration (2.66 µg/L). Mean annual chlorophyll *a* concentrations (1.26 to 3.44 µg/L) in the open-water season were within the oligotrophic range in all 12 years of monitoring (Table 3.4-5).

Assean Lake

Chlorophyll *a* concentrations in Assean Lake ranged from <0.60 to 6.40 µg/L during the open-water season. The mean and median concentrations for the 11 years of monitoring were 2.70 µg/L and 2.67 µg/L, respectively. Open-water season mean annual chlorophyll *a* concentrations ranged from 1.47 to 3.90 µg/L and were within the IQR (1.50 to 3.82 µg/L) in nine of the 11 years of monitoring. Mean chlorophyll *a* concentrations were below the IQR in 2010 and above the IQR in 2019 (Table 3.4-3 and Figure 3.4-11).

Chlorophyll *a* concentrations in the ice-cover season ranged from <0.60 to 1.72 µg/L, with a mean of 0.90 µg/L and a median of 0.95 µg/L for the 11 years of monitoring. The IQR was <0.60 to 1.15 µg/L (Table 3.4-3 and Figure 3.4-11).

Chlorophyll *a* concentrations were lower under ice-cover (mean = 0.90 µg/L) than during the open-water season (mean = 2.70 µg/L). On average, chlorophyll *a* concentrations during the open-water season were lowest in spring (1.79 µg/L) and highest in fall (3.20 µg/L; Figure 3.4-5).

Assean Lake was mesotrophic (2.5 to 8 µg/L) on the basis of the 2009-2019 mean open-water season chlorophyll *a* concentration (2.70 µg/L). Mean annual chlorophyll *a* concentrations (1.47 to 3.90 µg/L) in the open-water season were also within the mesotrophic range in six of the 11 years of monitoring. However, the mean chlorophyll *a* concentration was within the oligotrophic range (<2.5 µg/L) in 2009, 2010, 2012, 2014, and 2016 (Table 3.4-6).

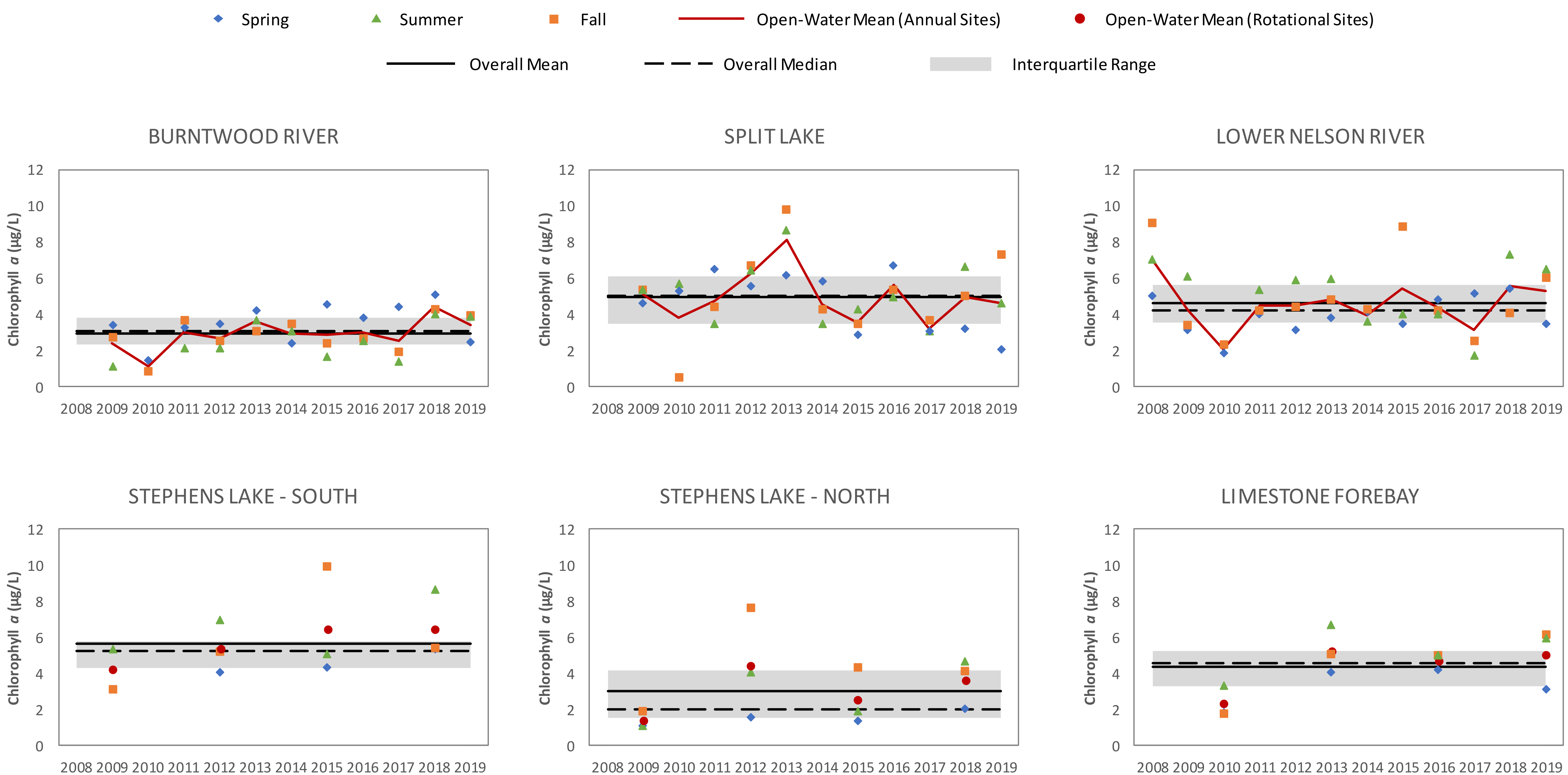


Figure 3.4-9. 2008-2019 On-system open-water season chlorophyll *a* concentrations.

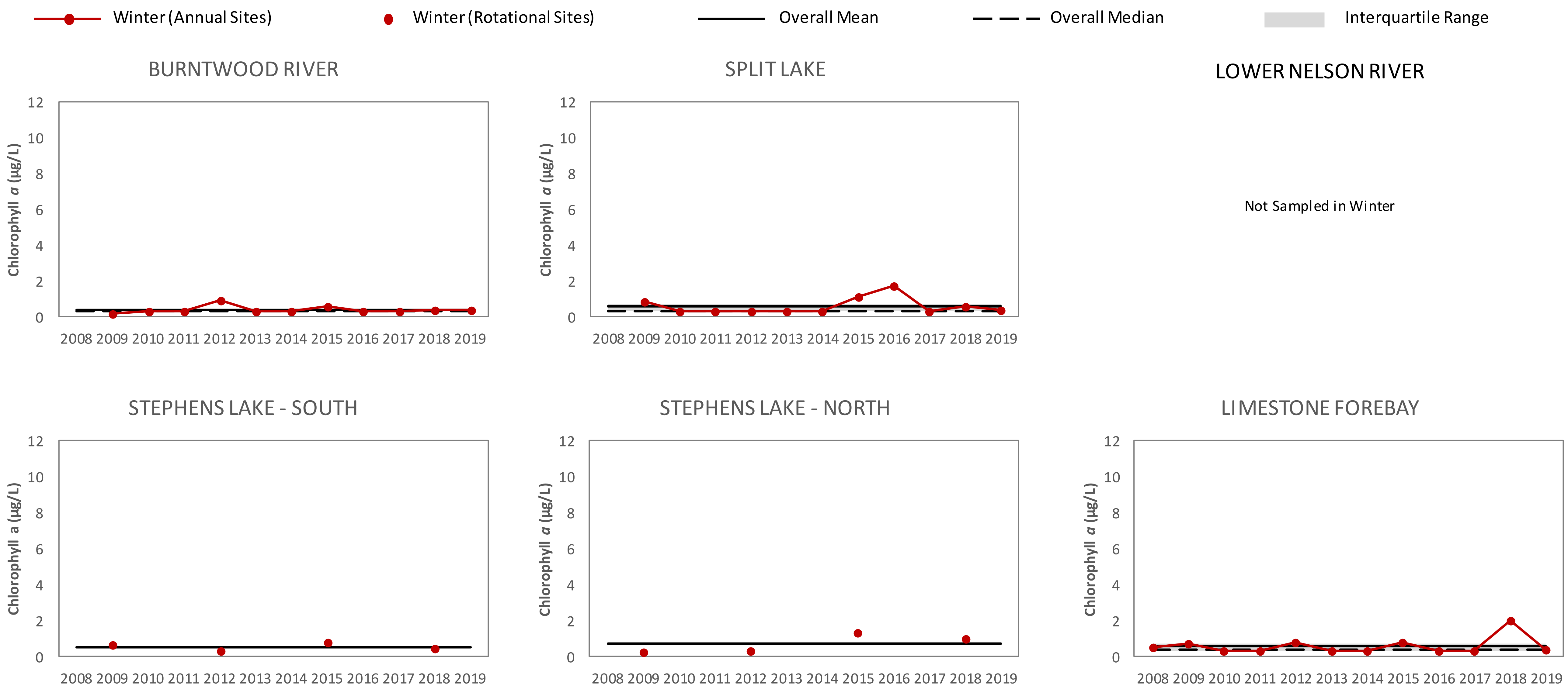


Figure 3.4-10. 2008-2019 On-system ice-cover season chlorophyll *a* concentrations.

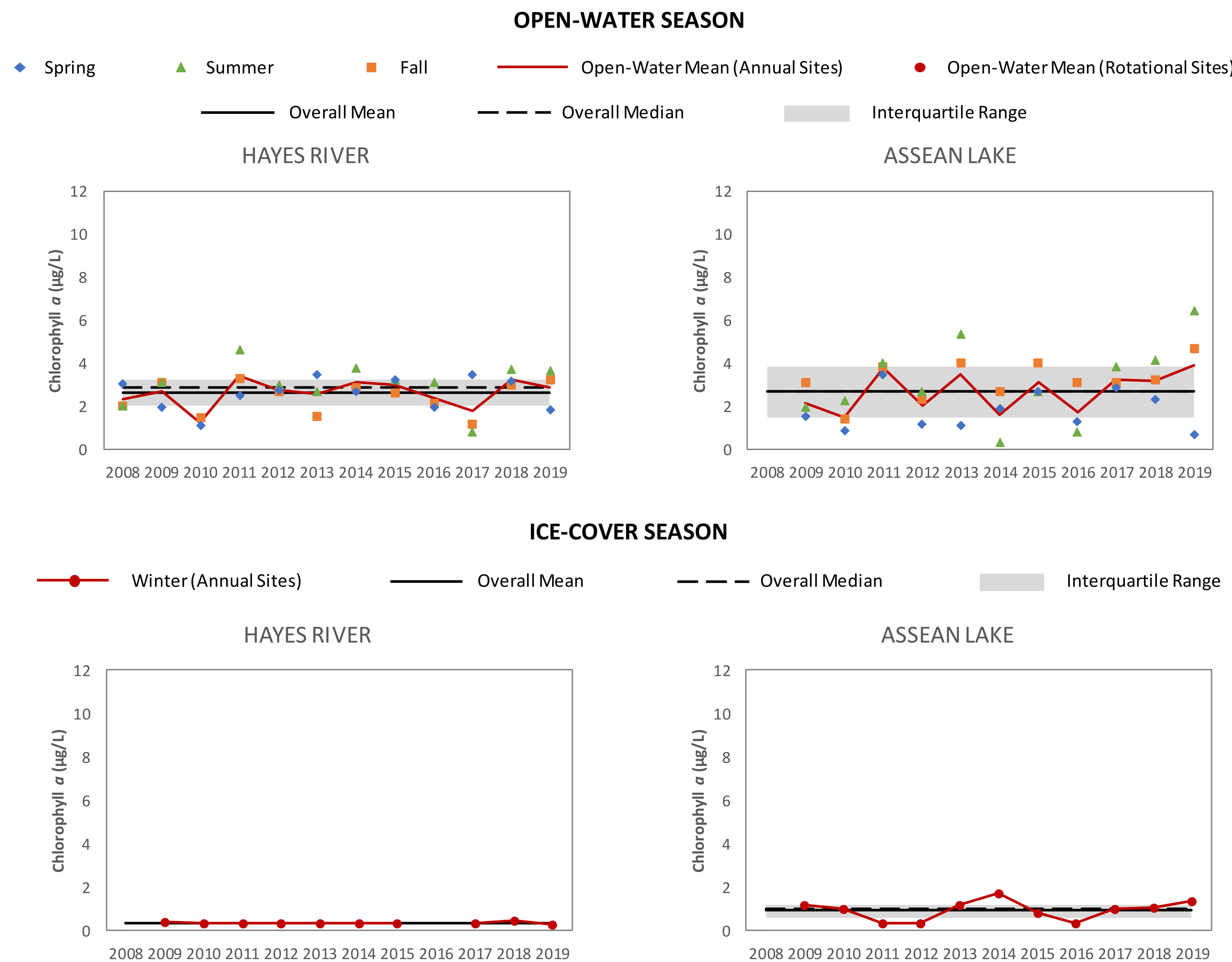


Figure 3.4-11. 2008-2019 Off-system open-water and ice-cover season chlorophyll *a* concentrations.

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

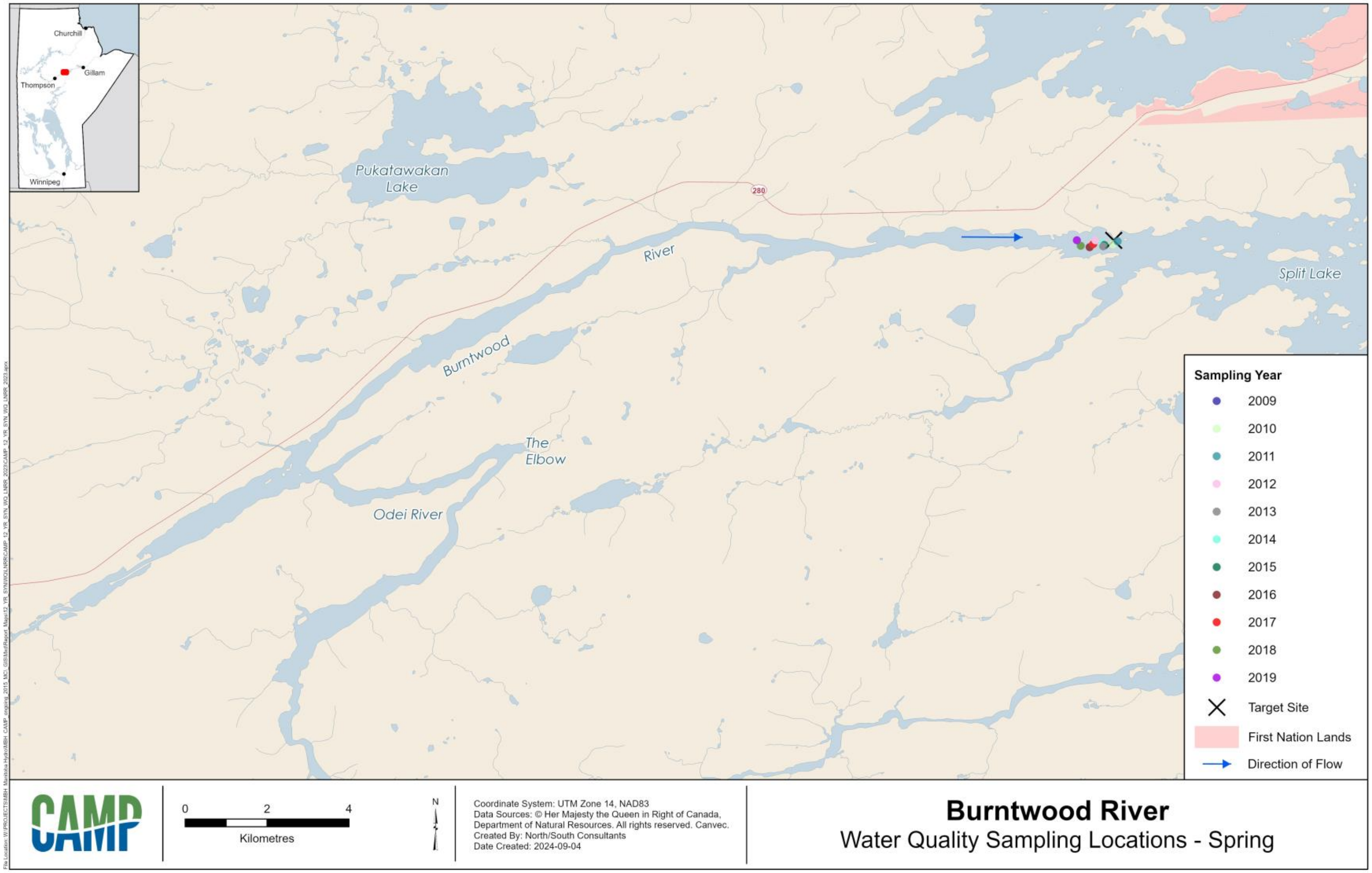


Figure A3-1-1. Spring water quality sampling locations: the Burntwood River.

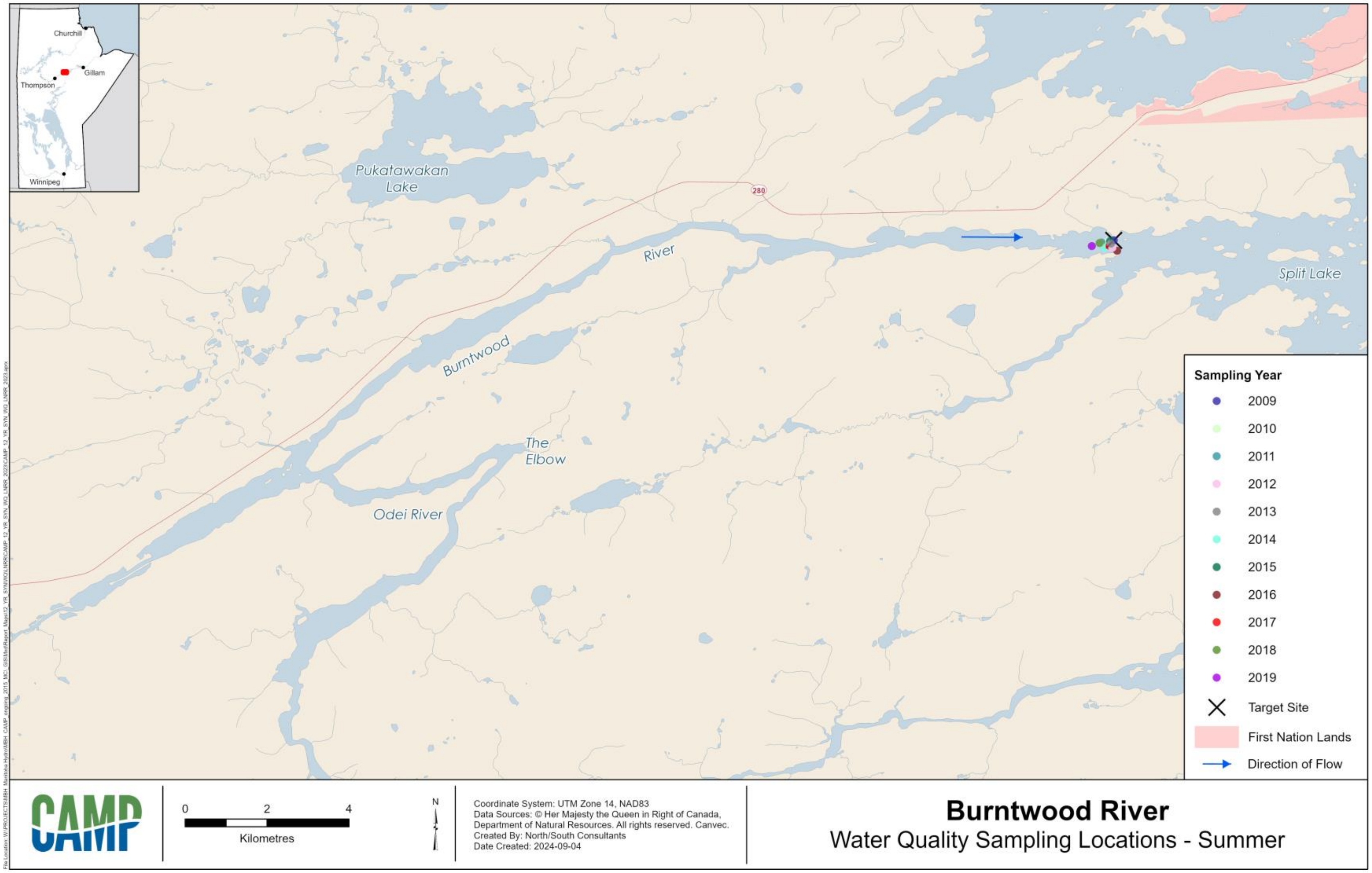


Figure A3-1-2. Summer water quality sampling locations: the Burntwood River.

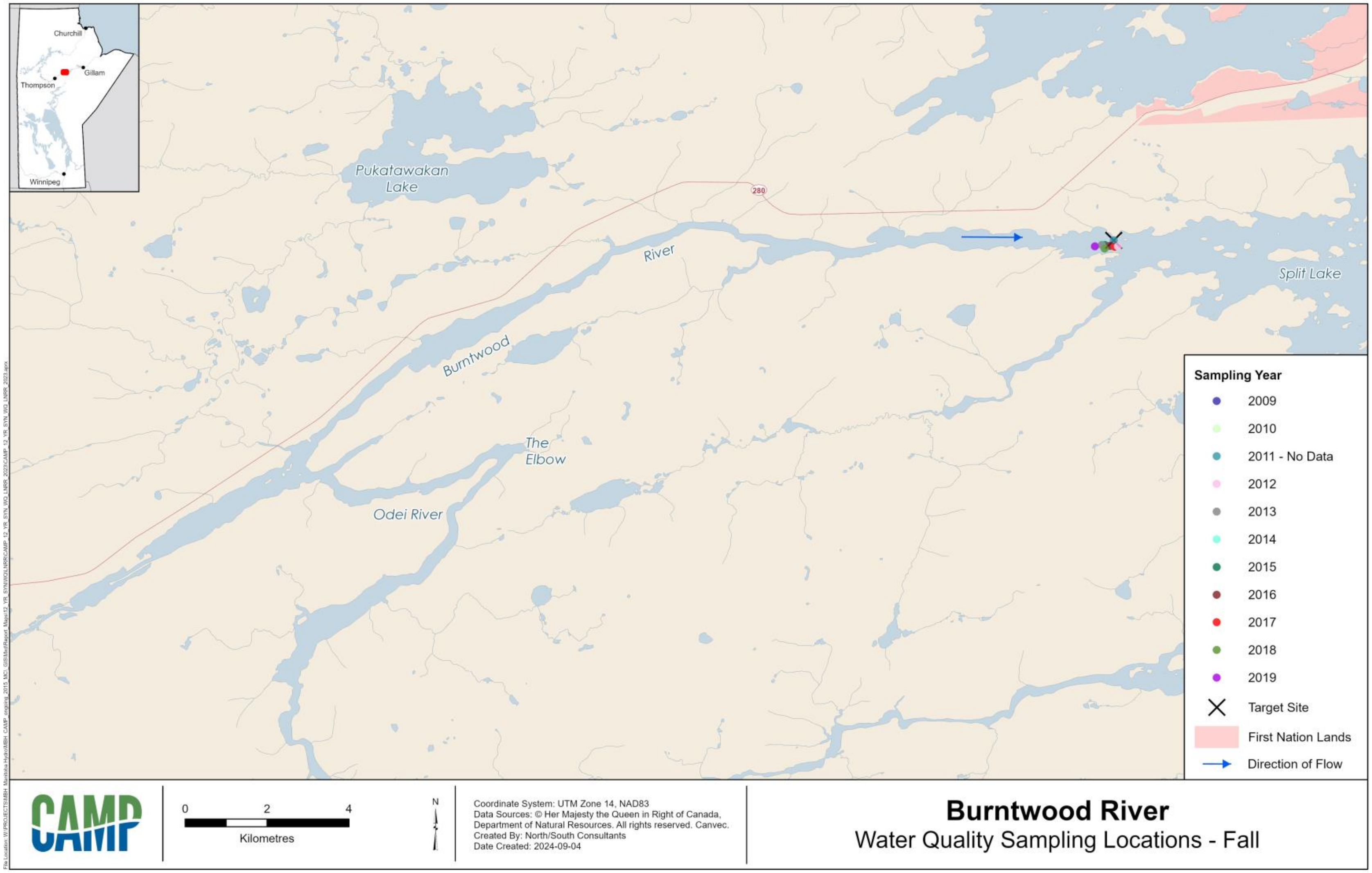


Figure A3-1-3. Fall water quality sampling locations: the Burntwood River.

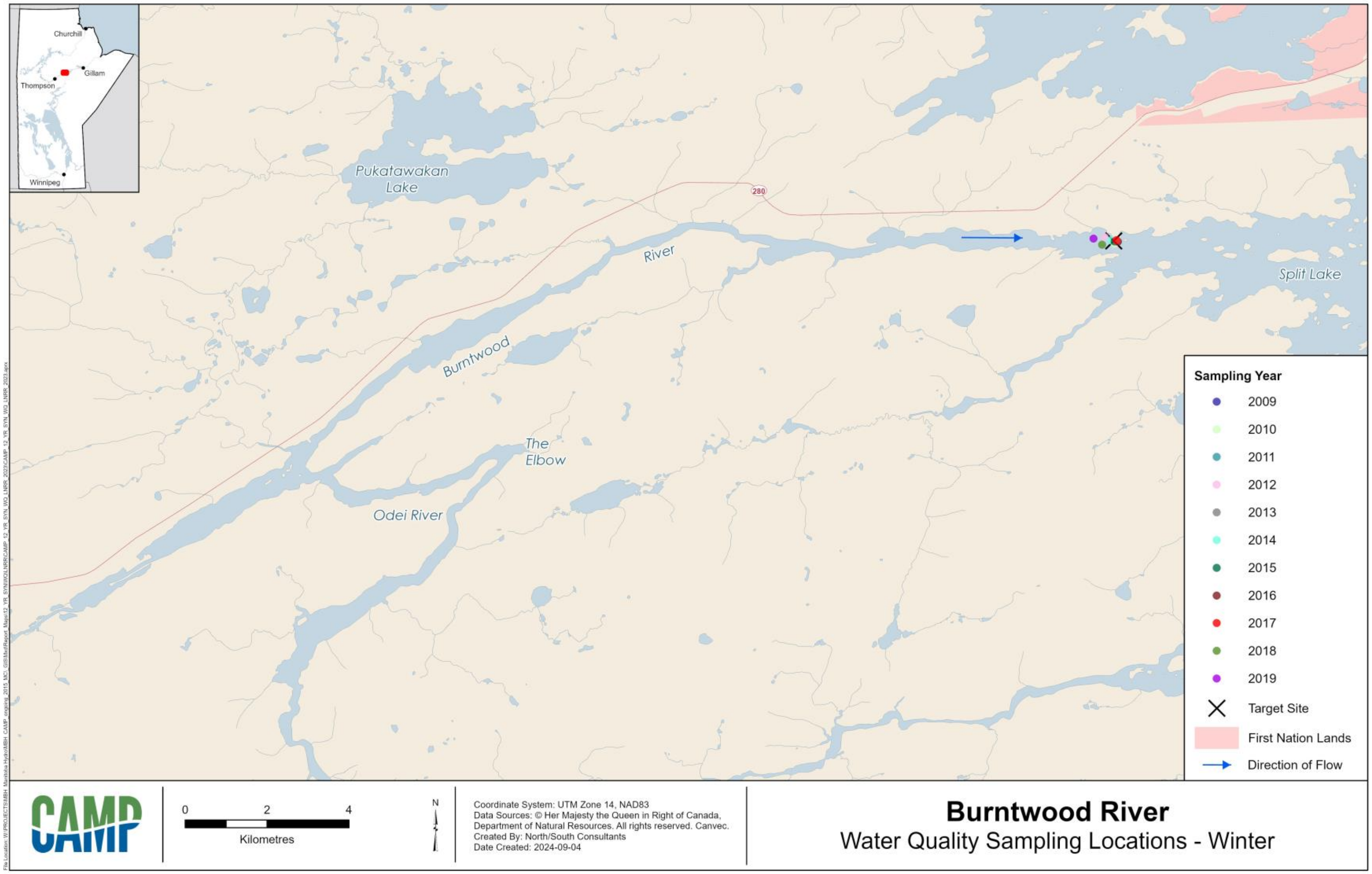


Figure A3-1-4. Winter water quality sampling locations: the Burntwood River.

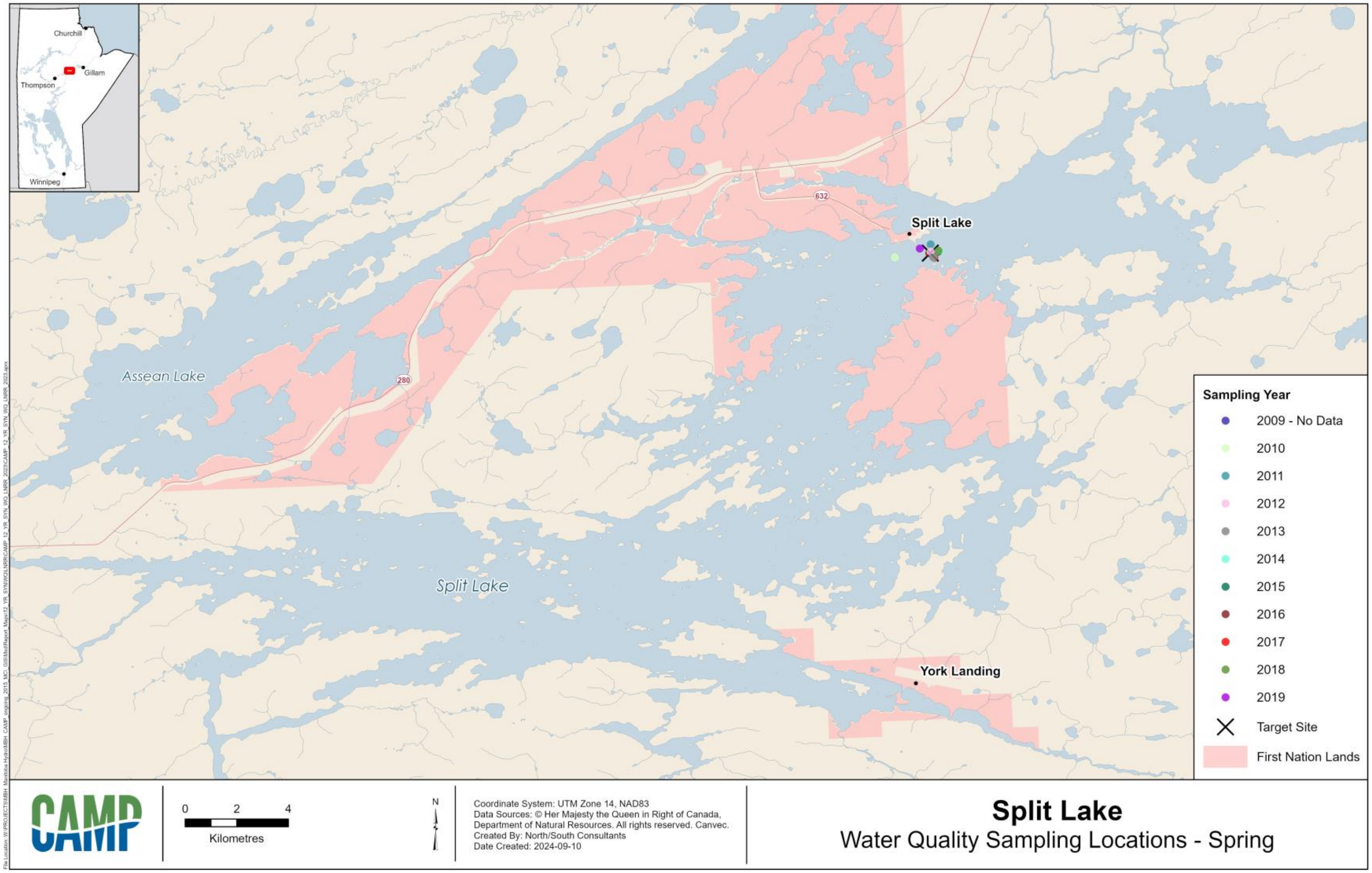


Figure A3-1-5. Spring water quality sampling locations: Split Lake.

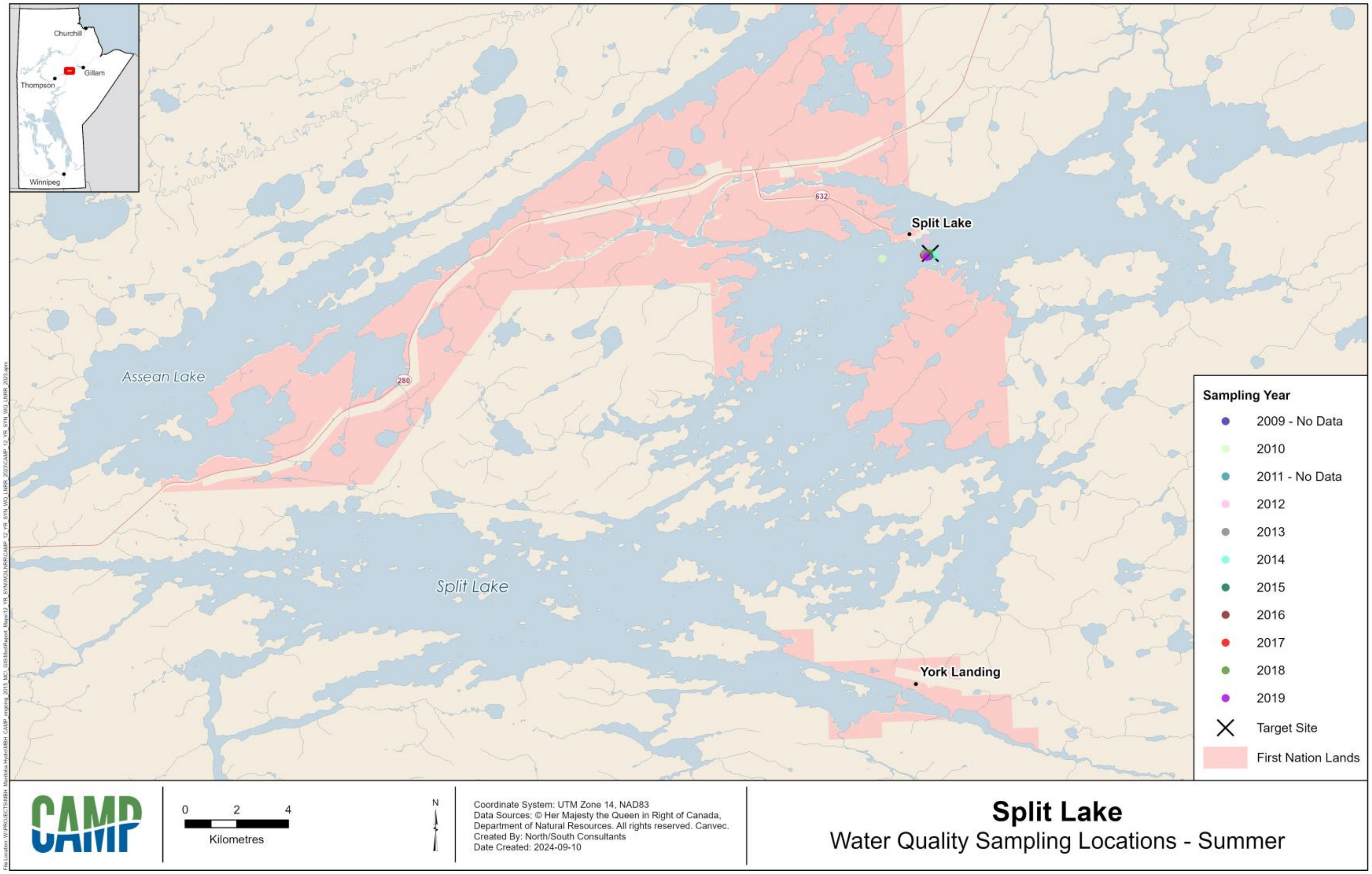


Figure A3-1-6. Summer water quality sampling locations: Split Lake.

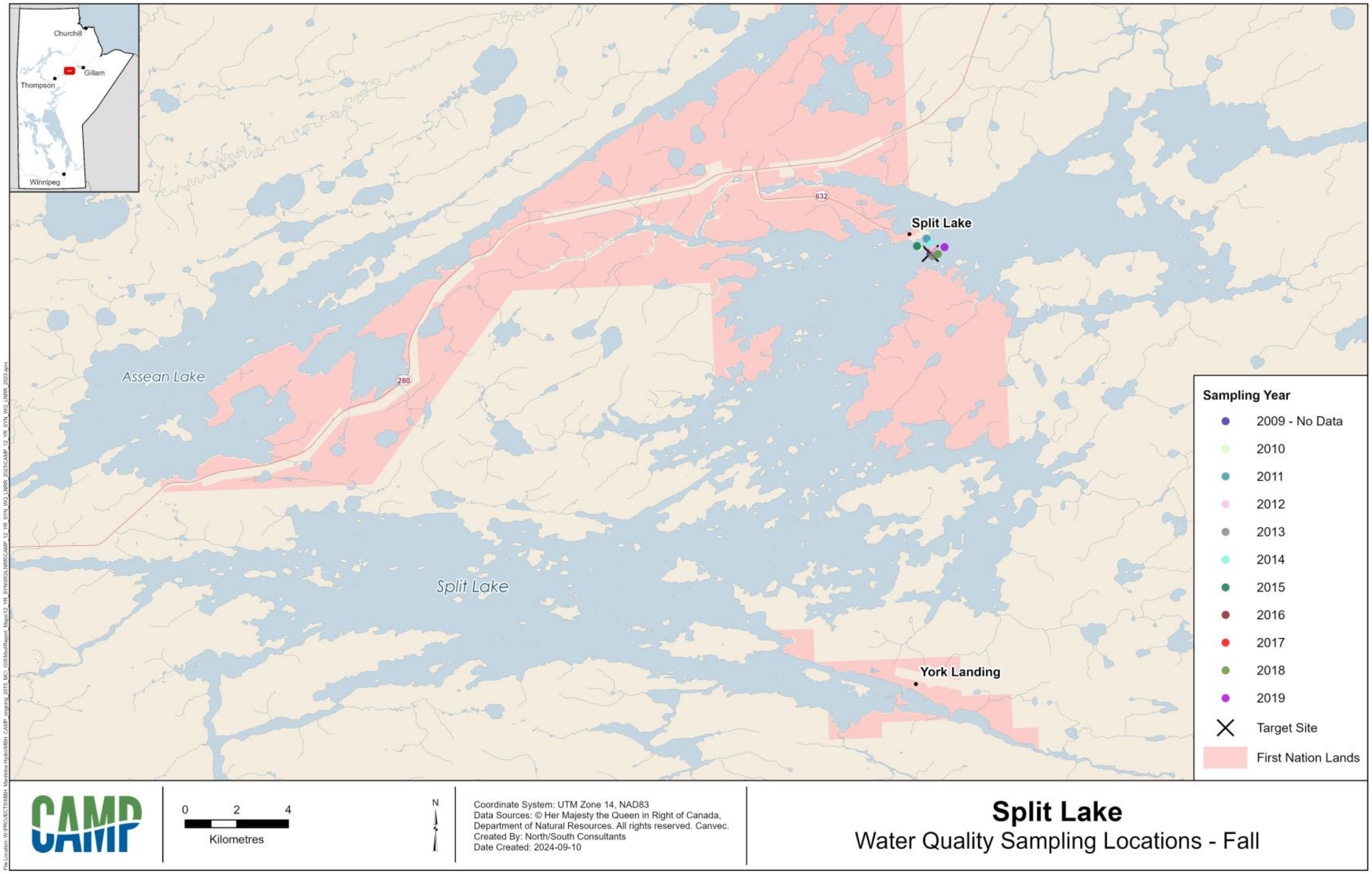


Figure A3-1-7. Fall water quality sampling locations: Split Lake.

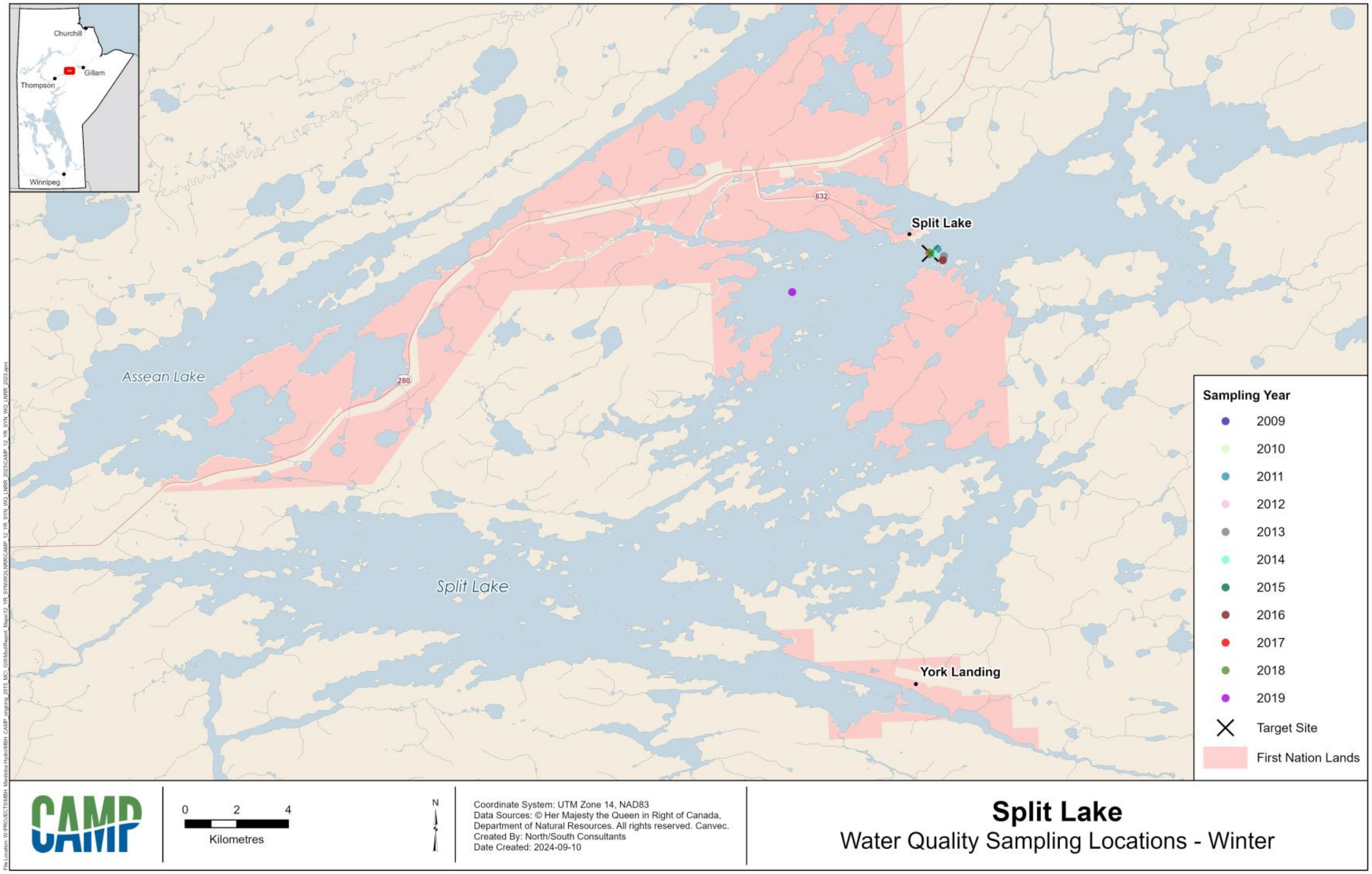


Figure A3-1-8. Winter water quality sampling locations: Split Lake.

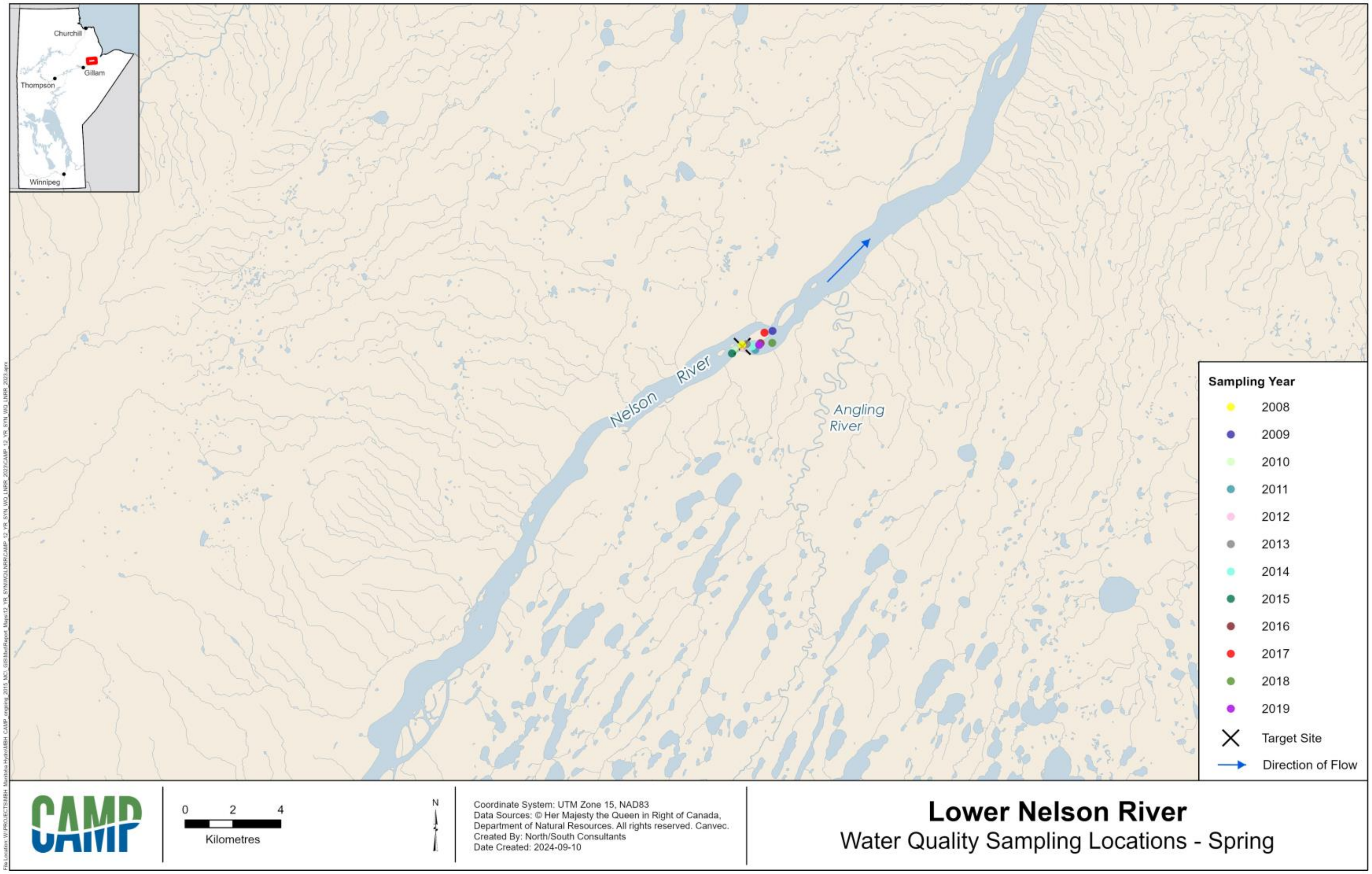


Figure A3-1-9. Spring water quality sampling locations: the Lower Nelson River.

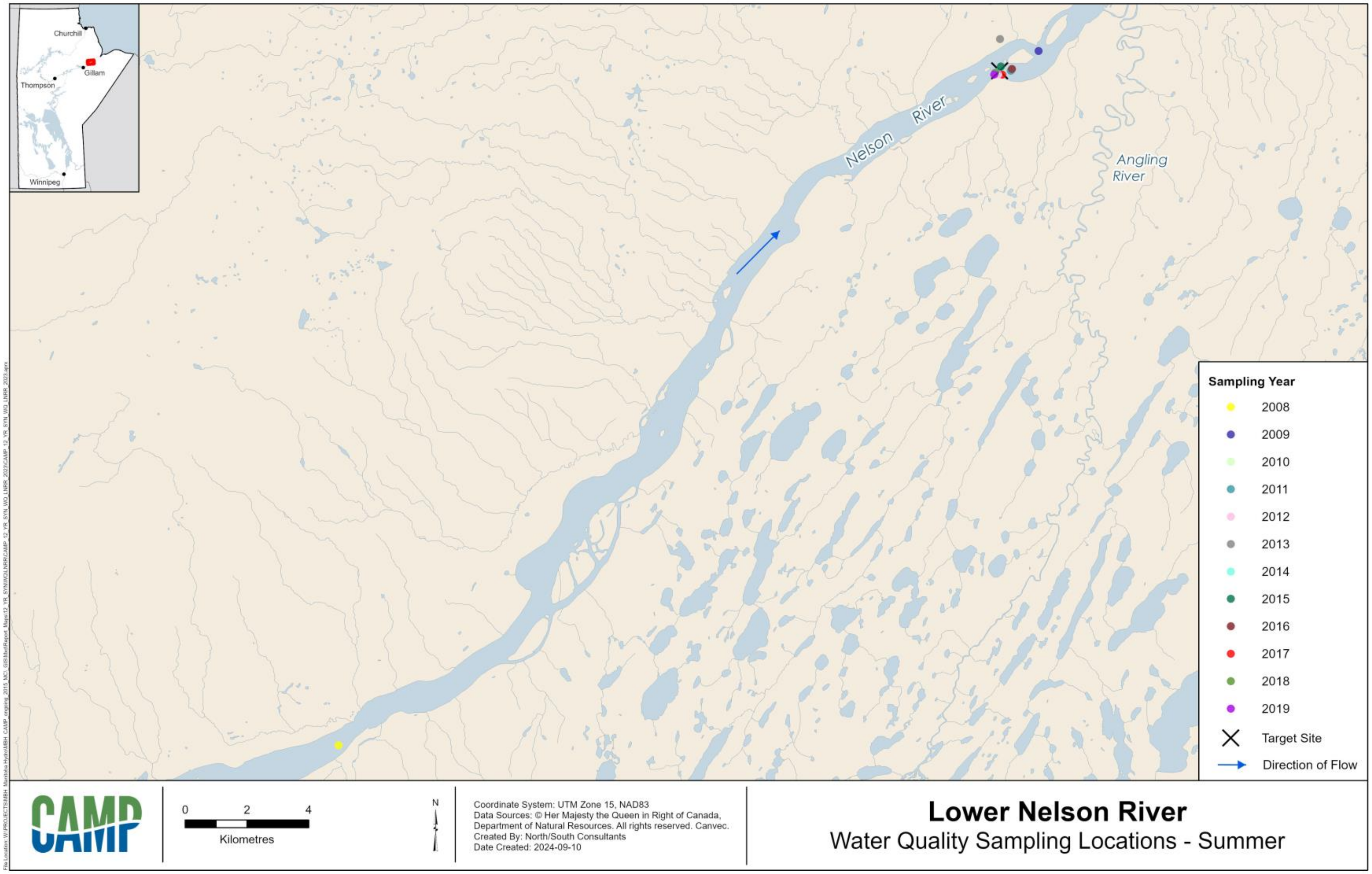


Figure A3-1-10. Summer water quality sampling locations: the Lower Nelson River.

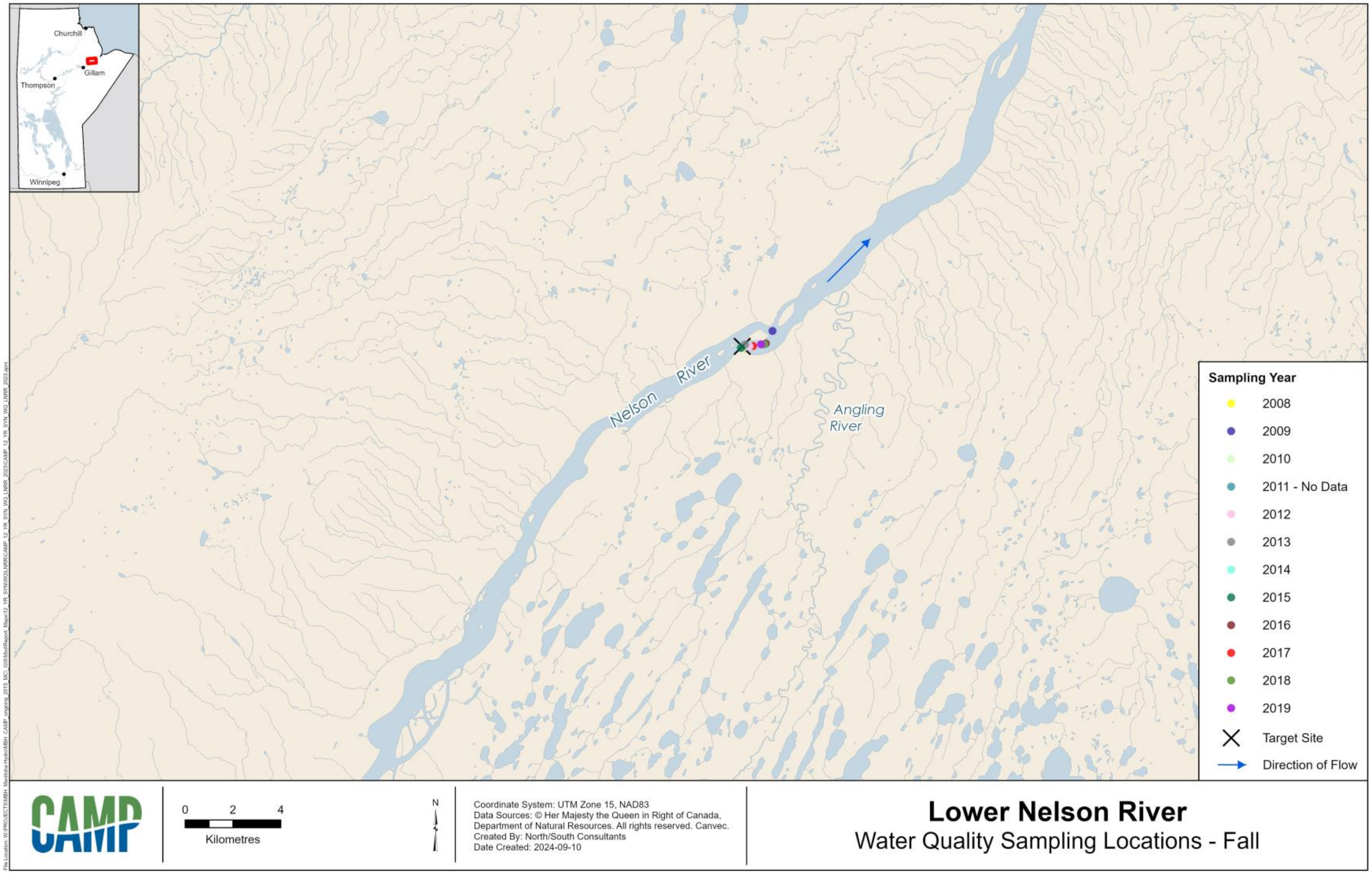


Figure A3-1-11. Fall water quality sampling locations: the Lower Nelson River.

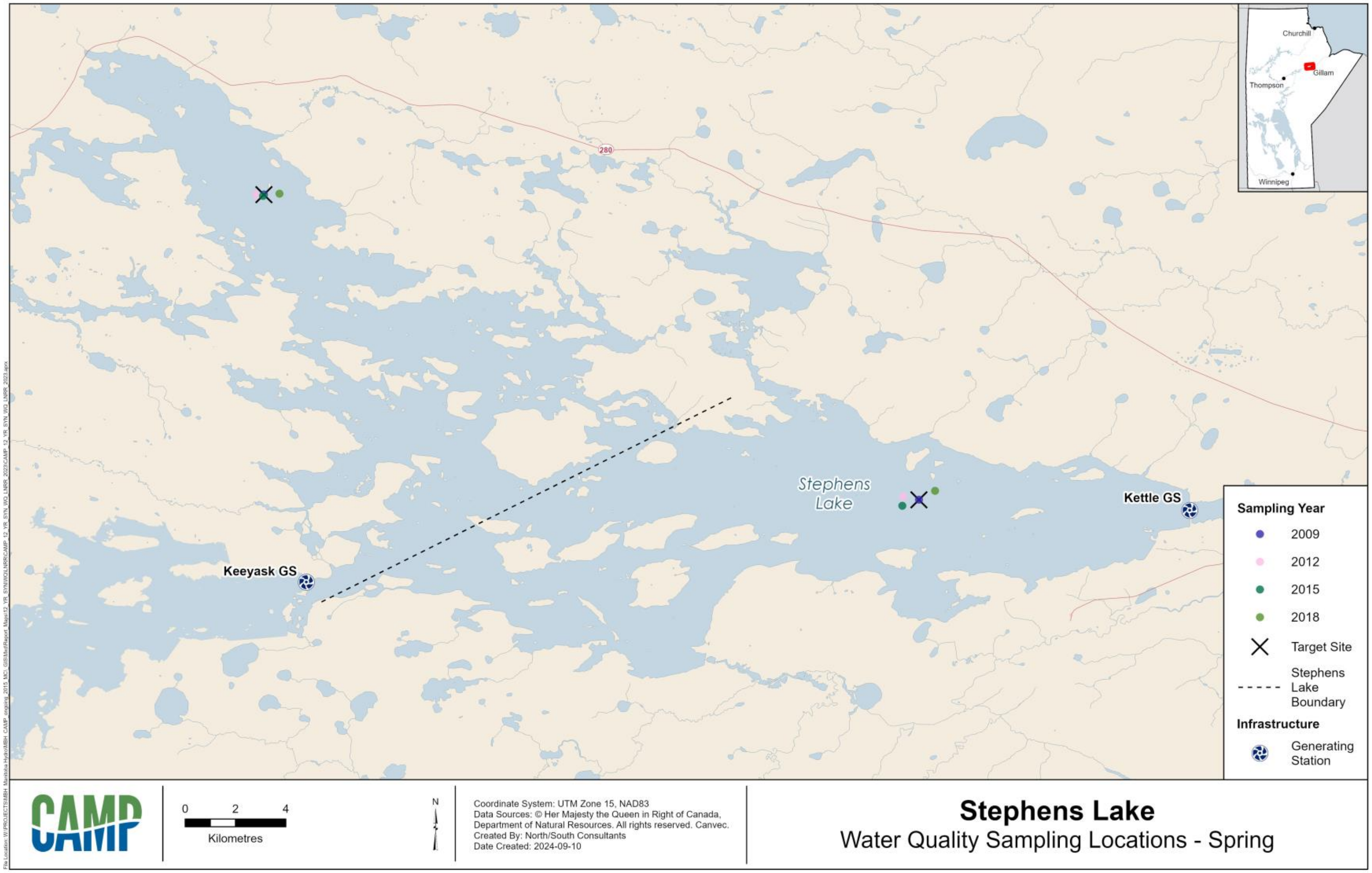


Figure A3-1-13. Spring water quality sampling locations: Stephens Lake.

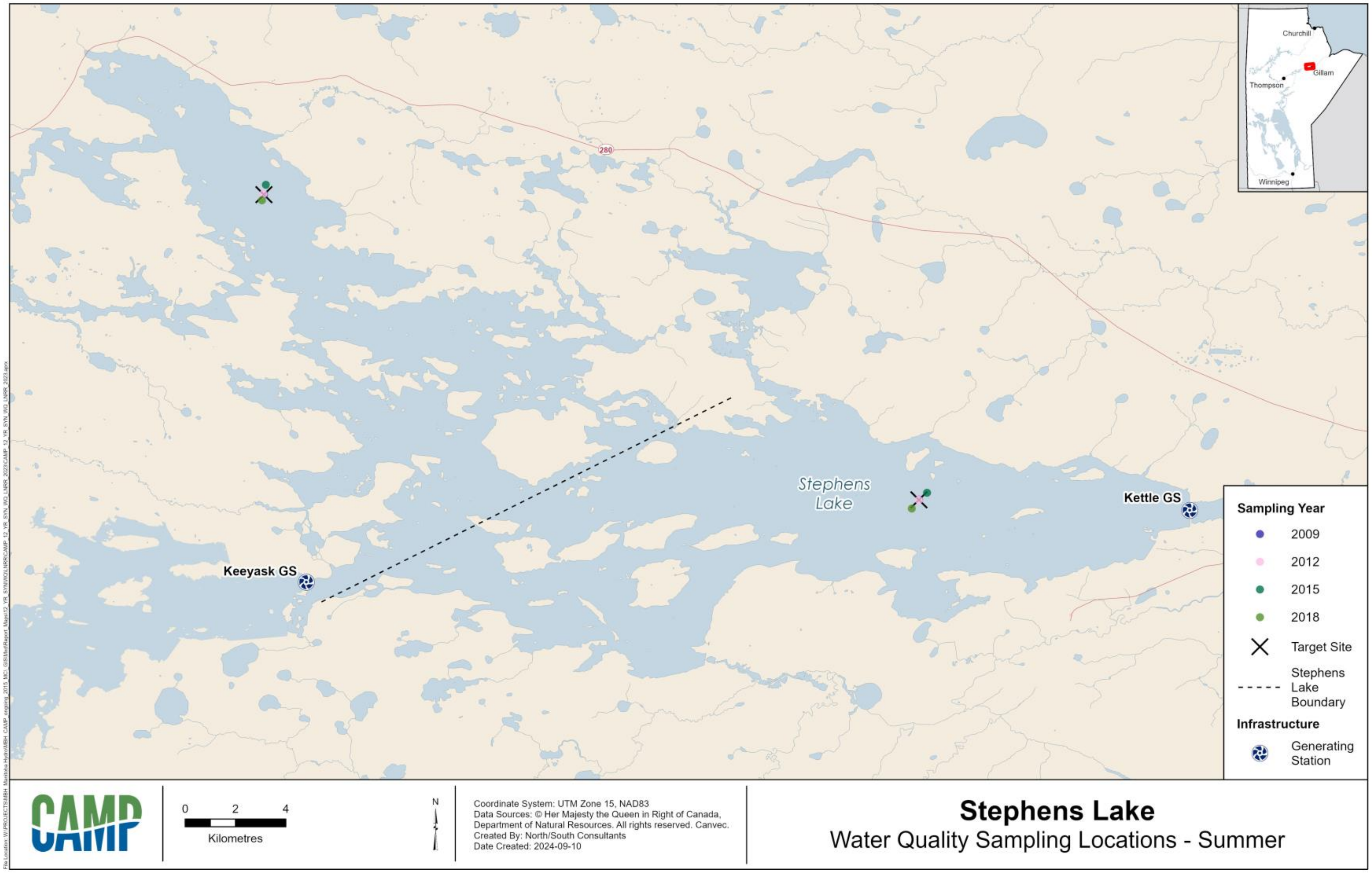


Figure A3-1-14. Summer water quality sampling locations: Stephens Lake.

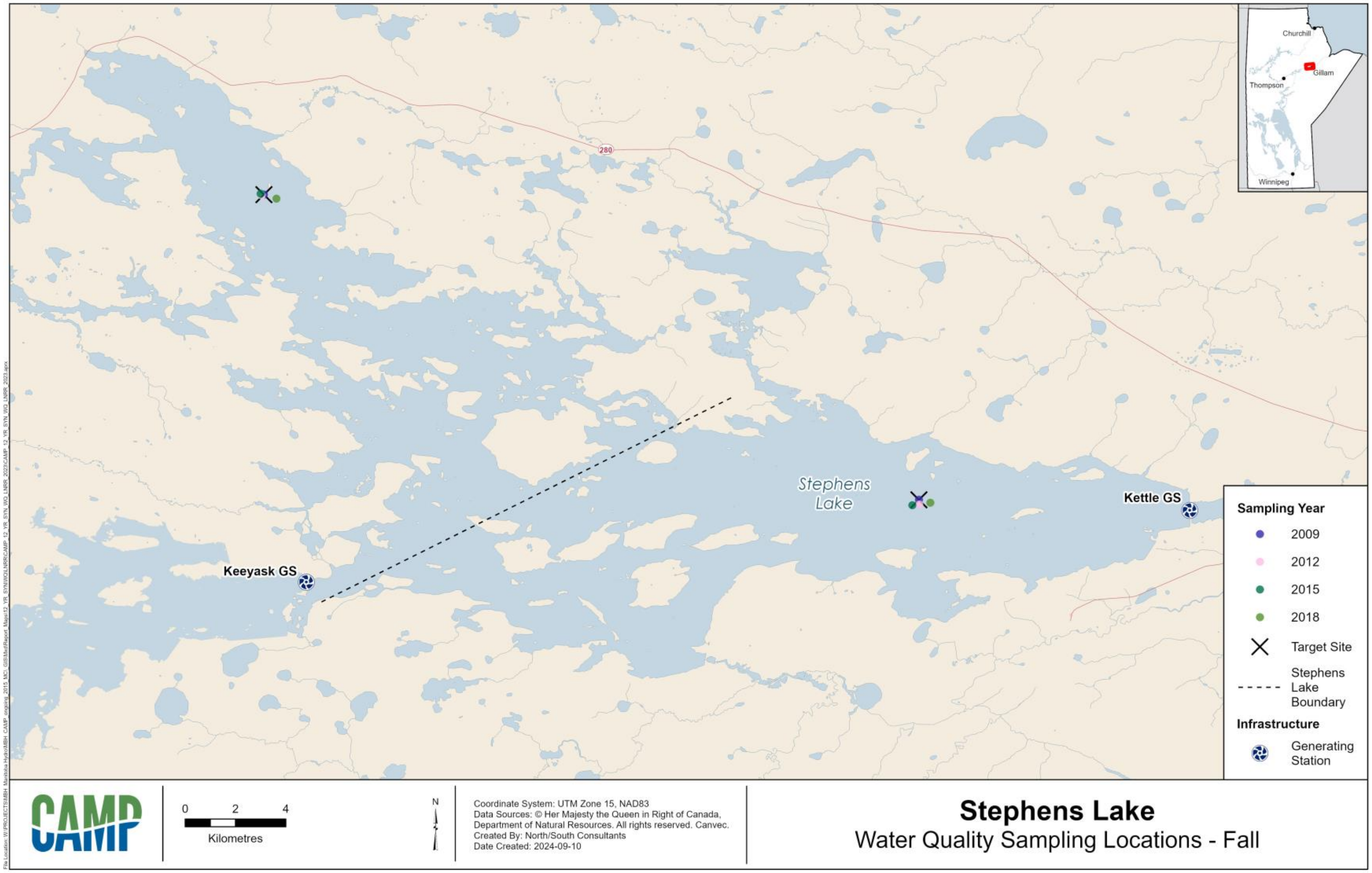


Figure A3-1-15. Fall water quality sampling locations: Stephens Lake.

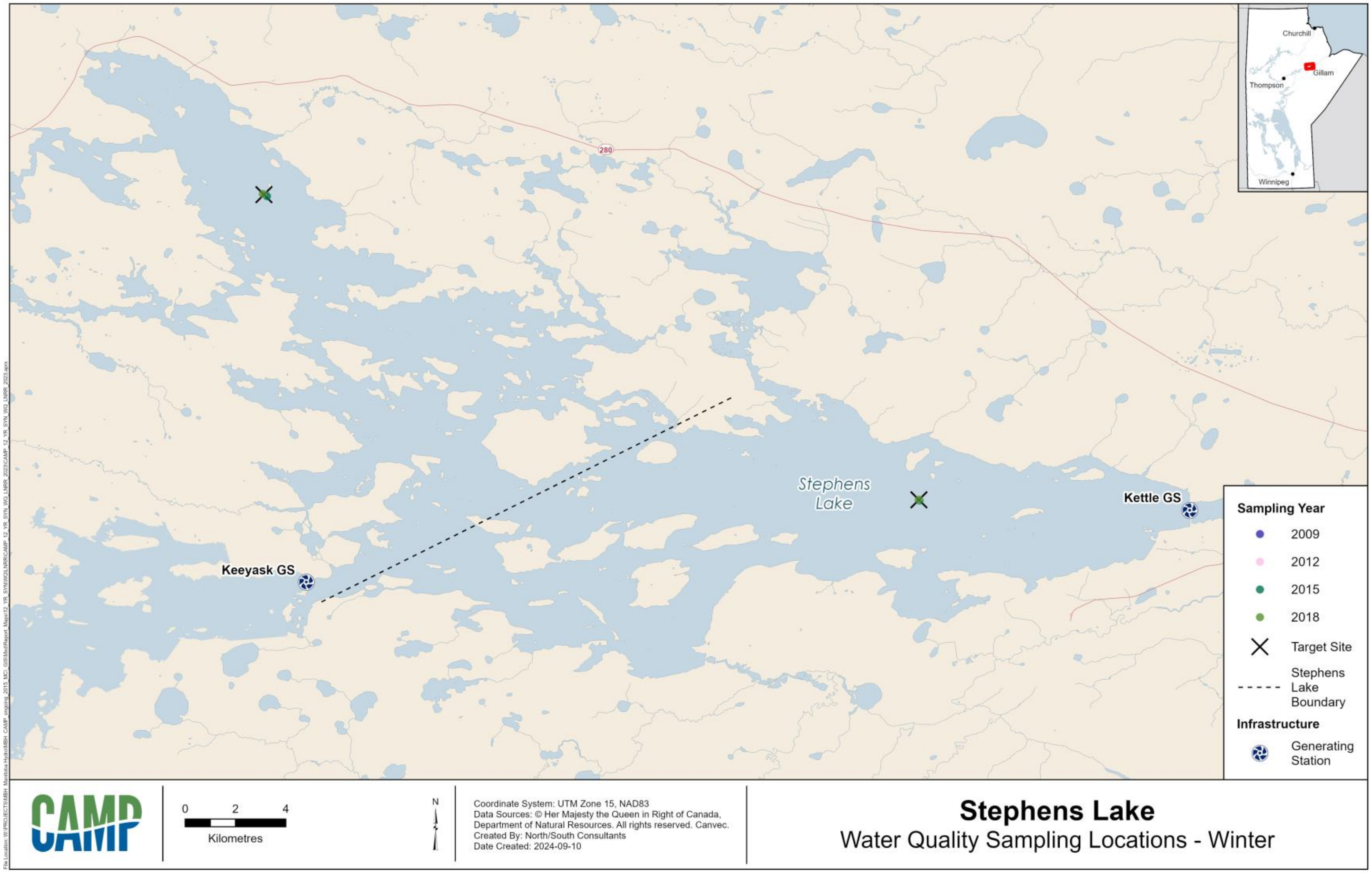


Figure A3-1-16. Winter water quality sampling locations: Stephens Lake.

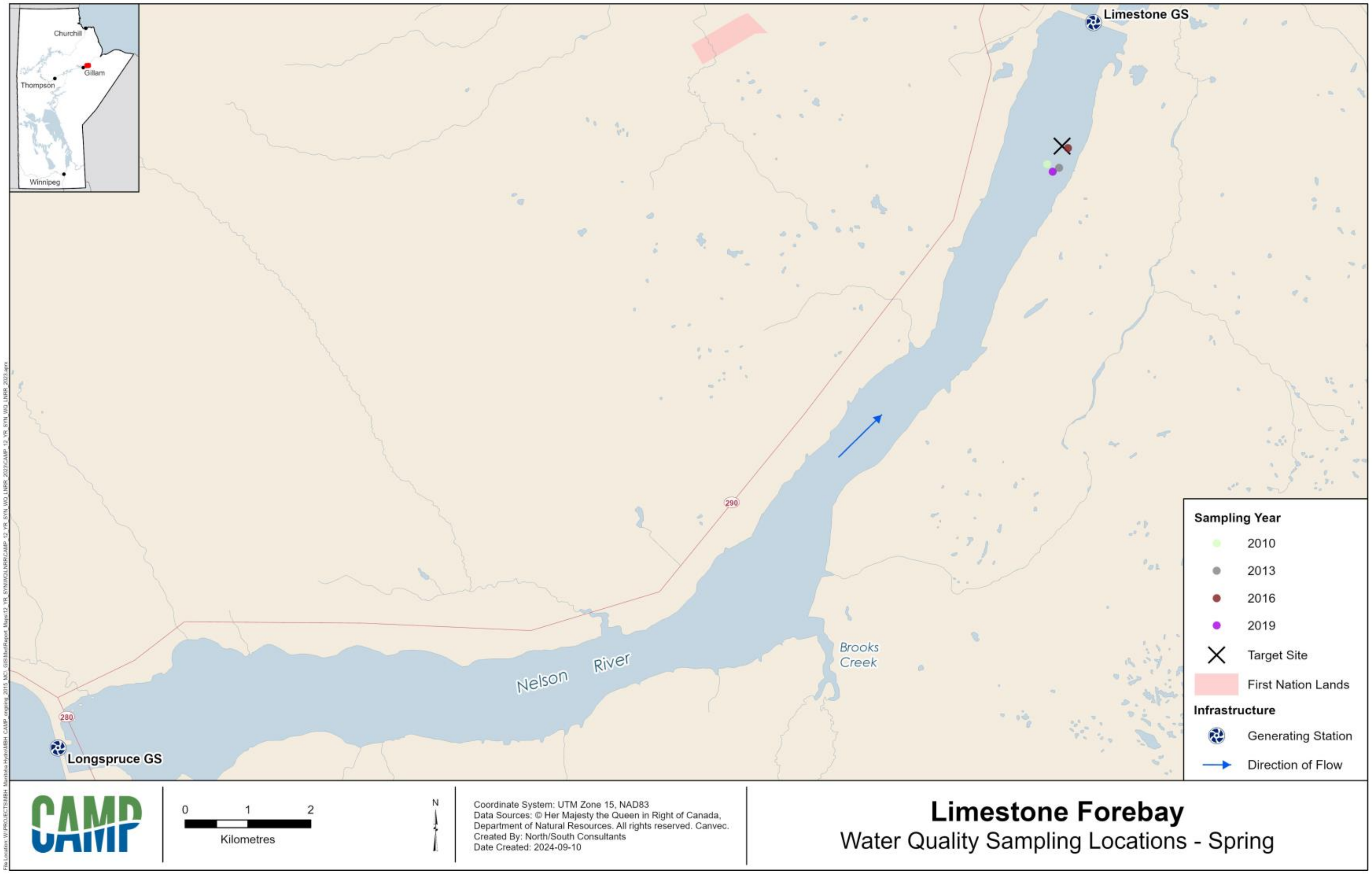


Figure A3-1-17. Spring water quality sampling locations: Limestone Forebay.

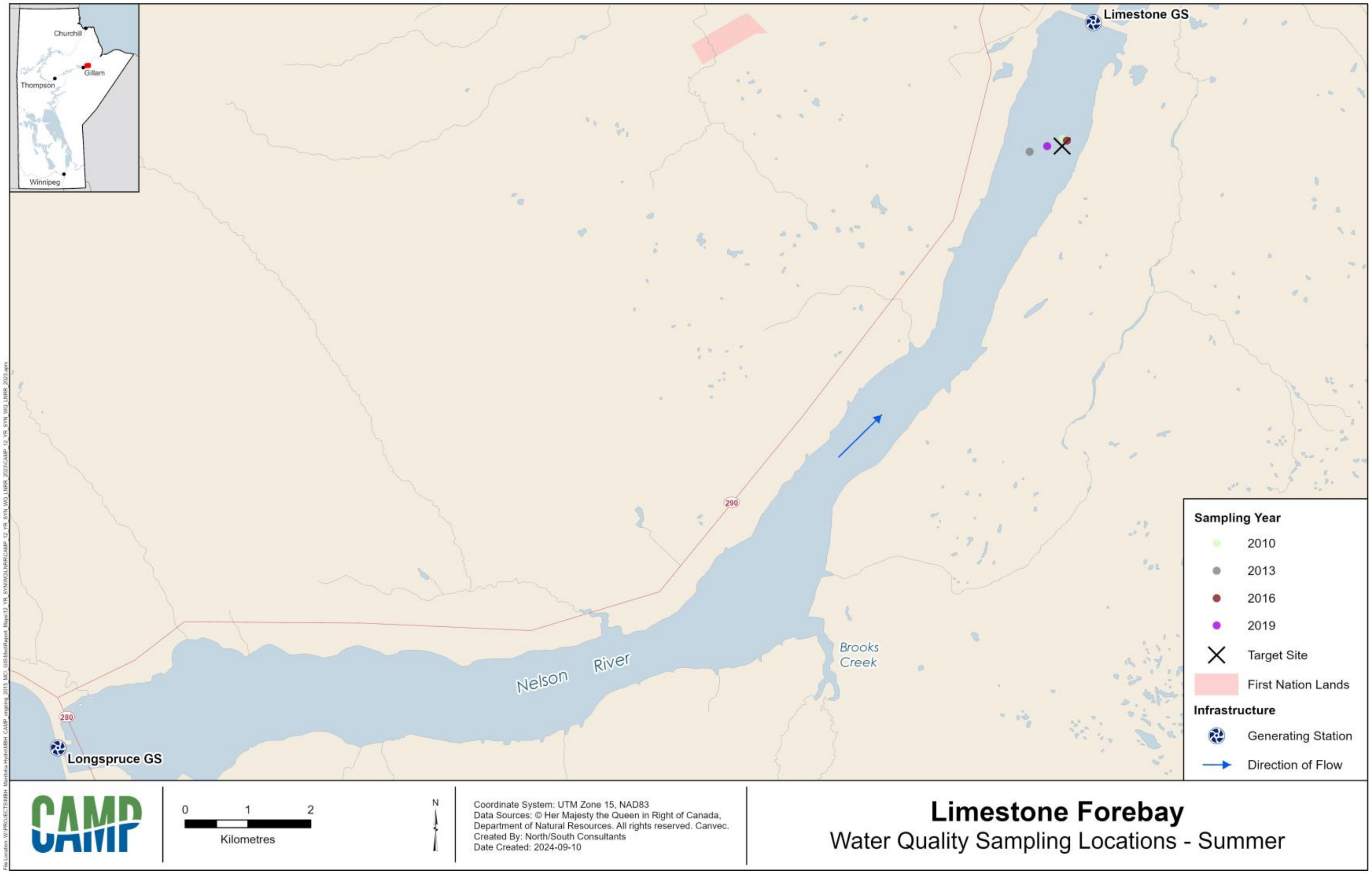


Figure A3-1-18. Summer water quality sampling locations: Limestone Forebay.

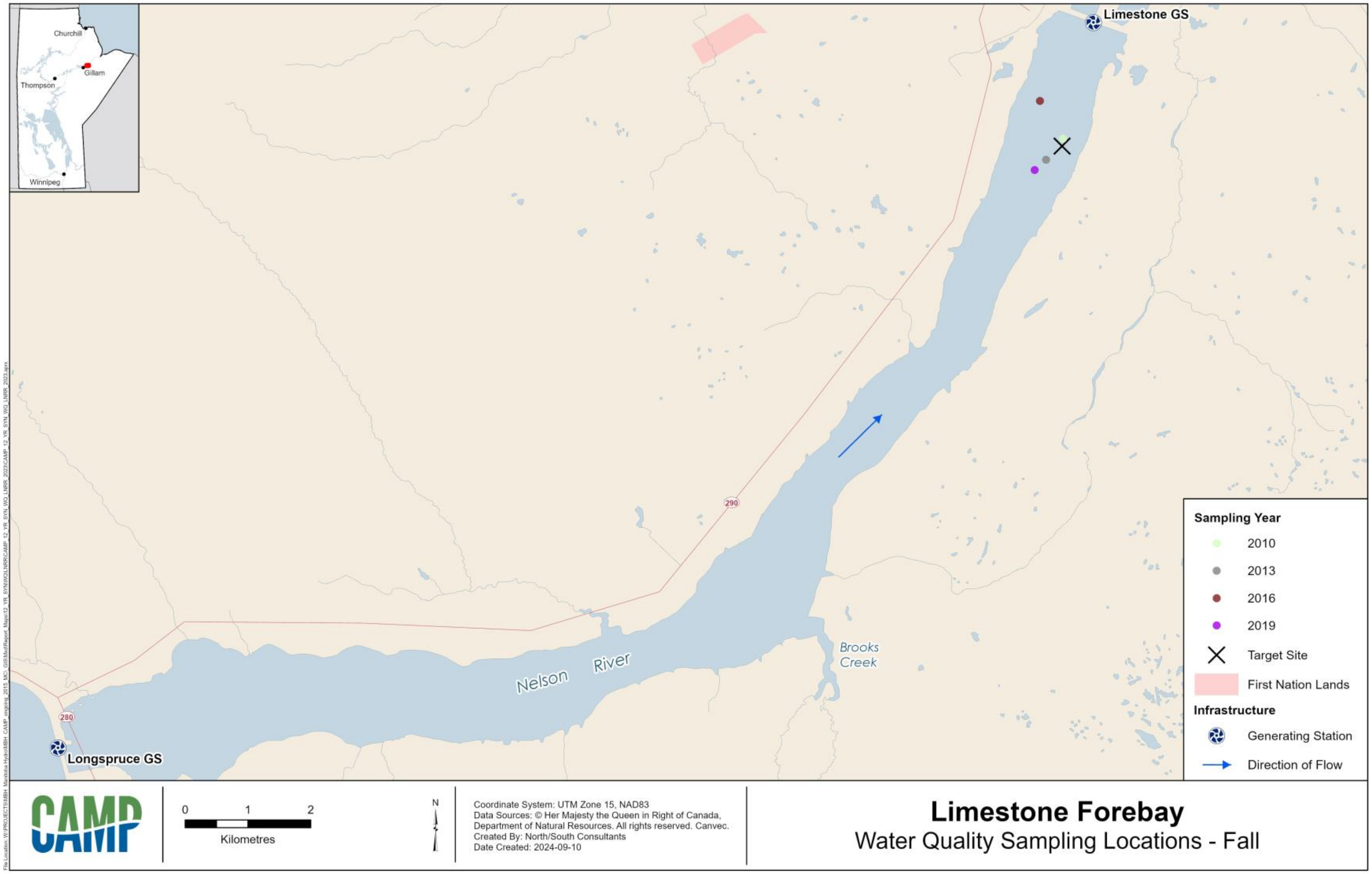


Figure A3-1-19. Fall water quality sampling locations: Limestone Forebay.

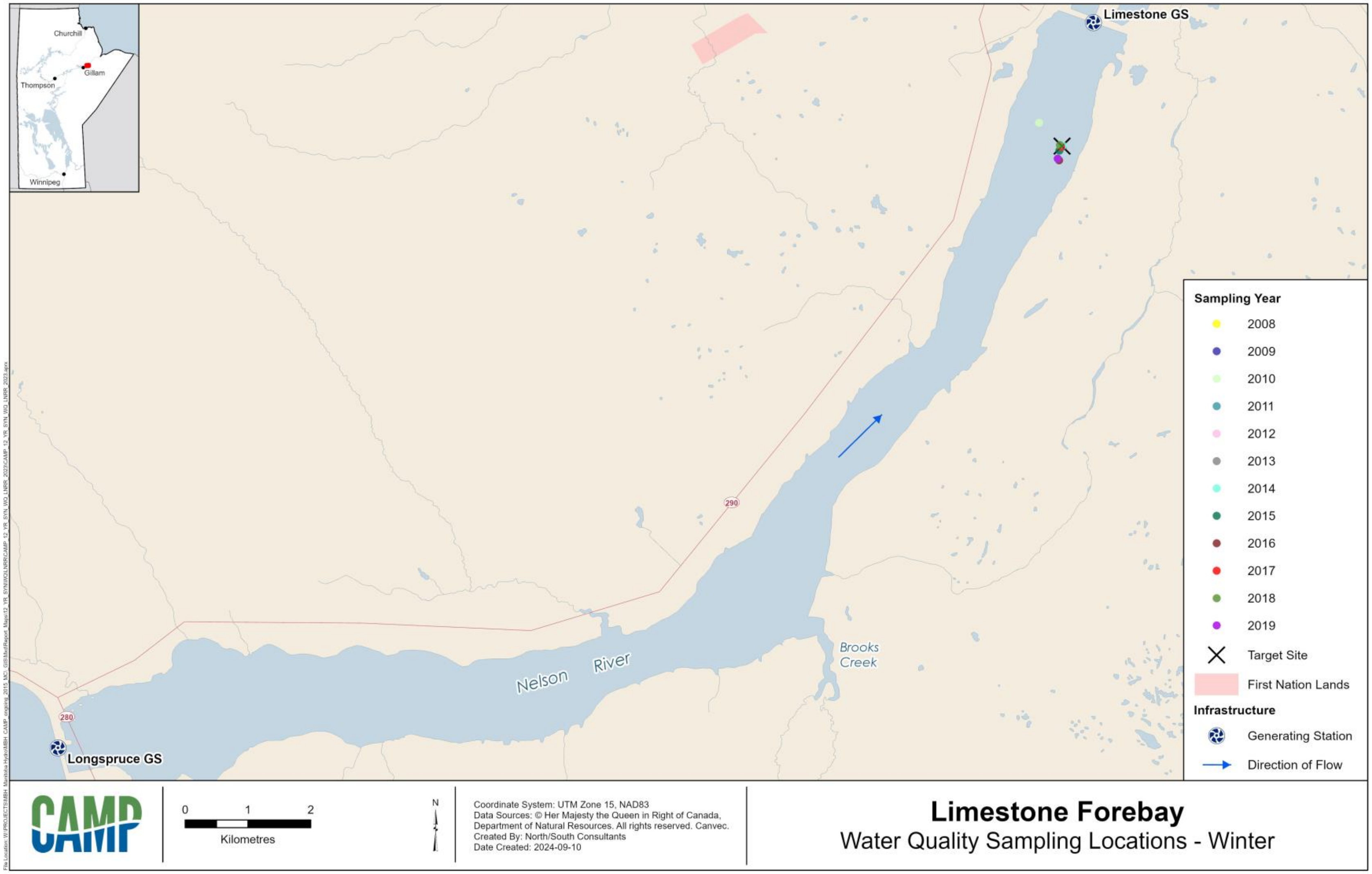


Figure A3-1-20. Winter water quality sampling locations: Limestone Forebay.

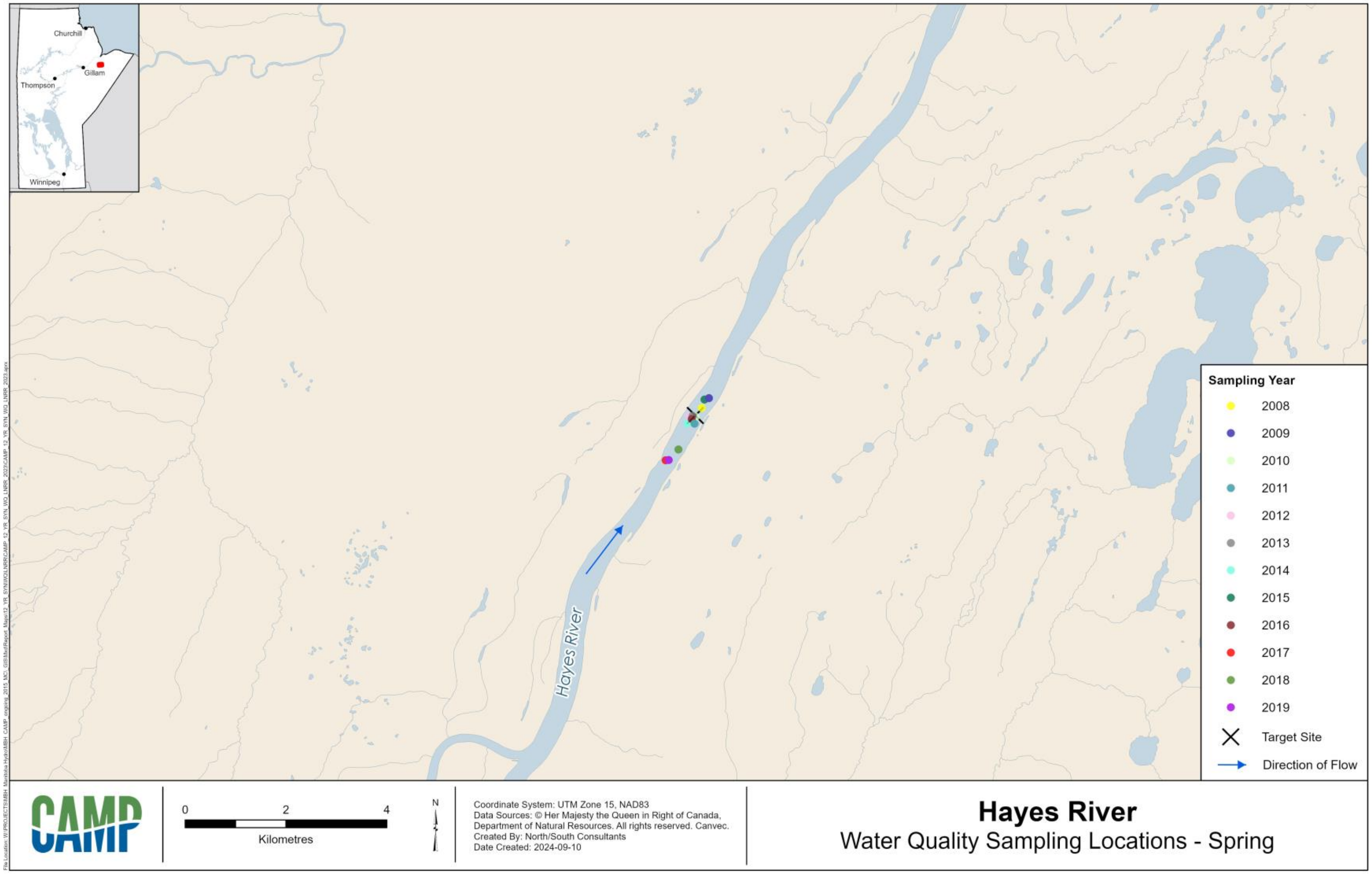


Figure A3-1-21. Spring water quality sampling locations: the Hayes River.

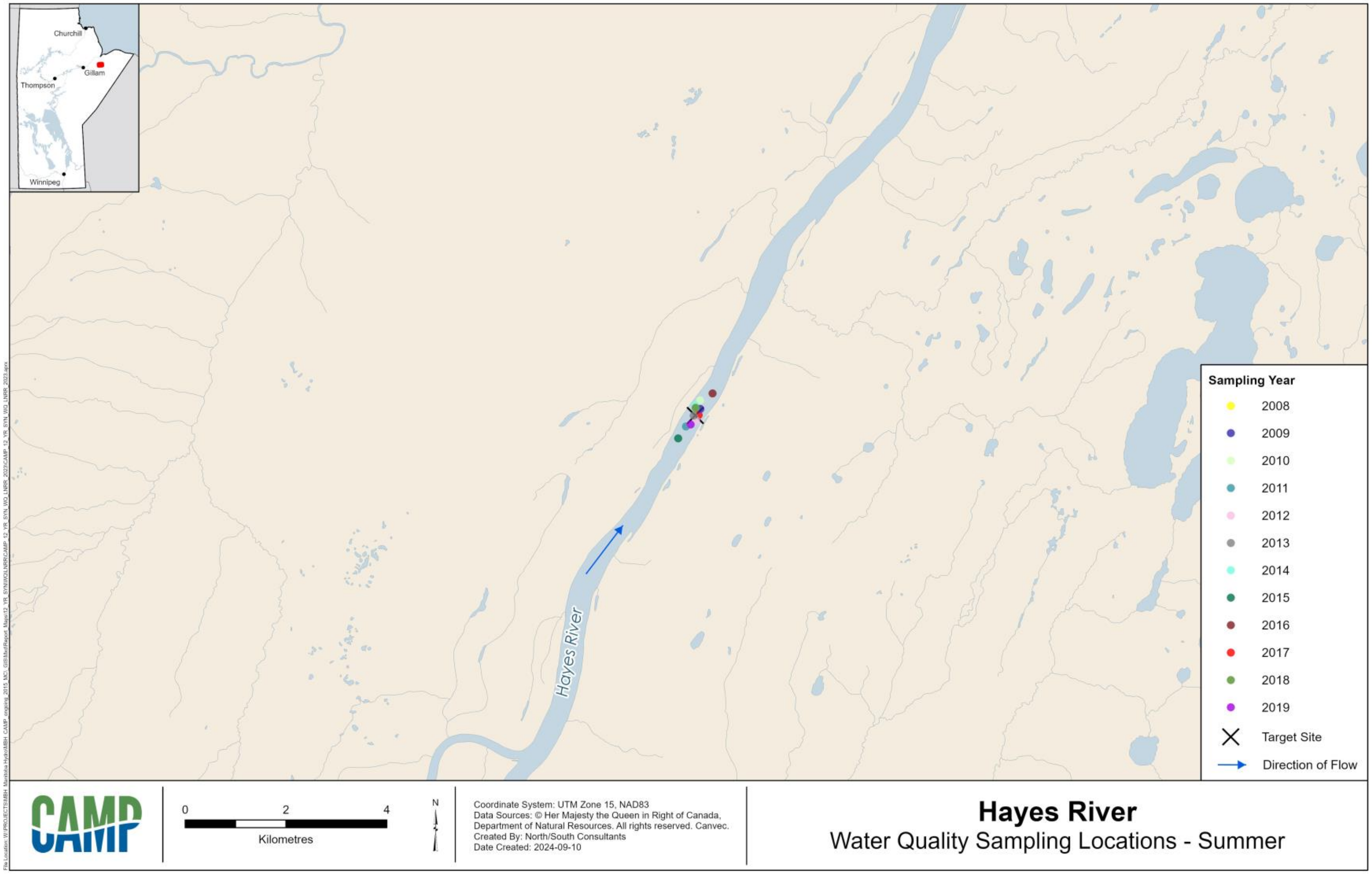


Figure A3-1-22. Summer water quality sampling locations: the Hayes River.

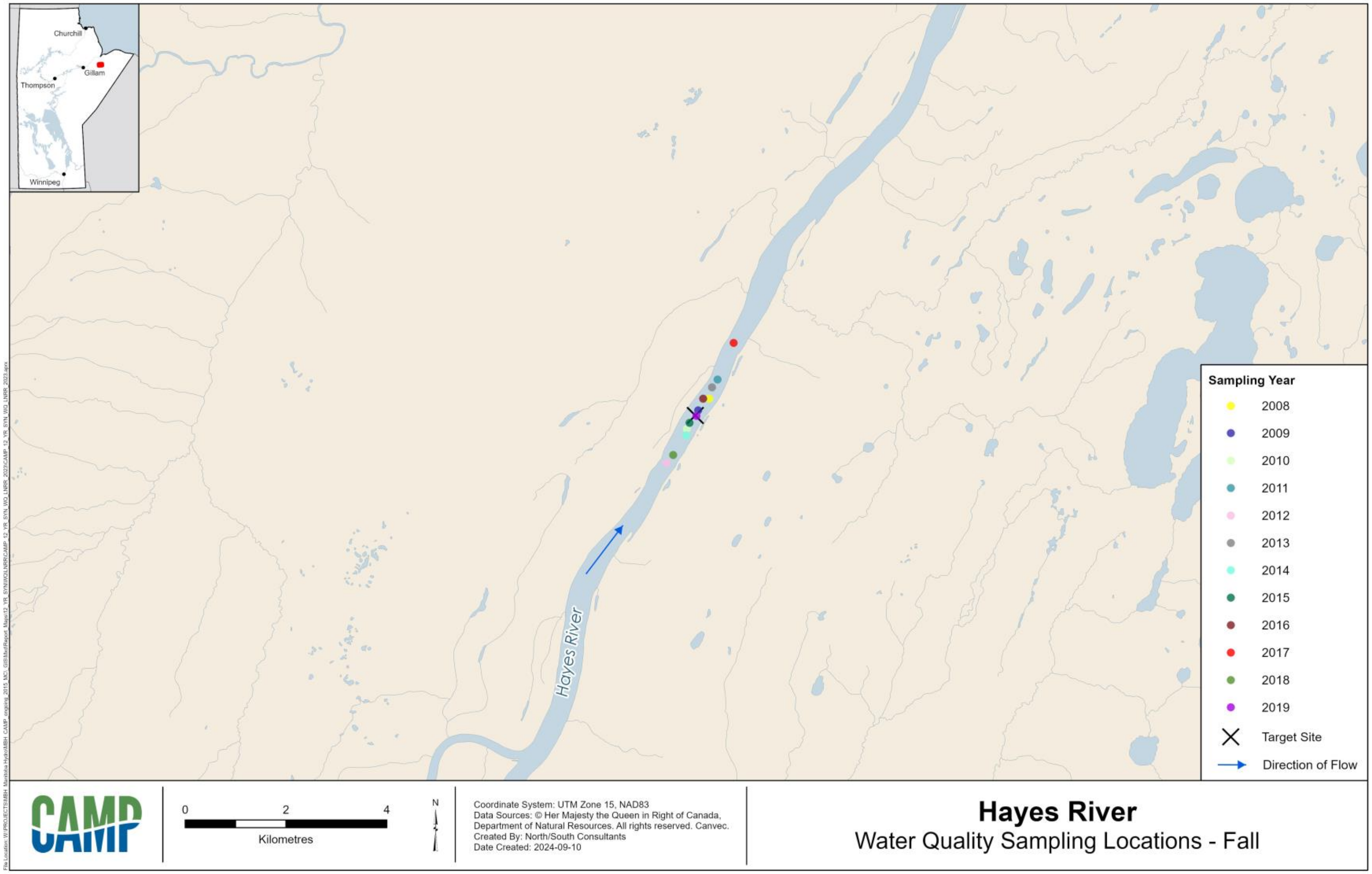


Figure A3-1-23. Fall water quality sampling locations: the Hayes River.

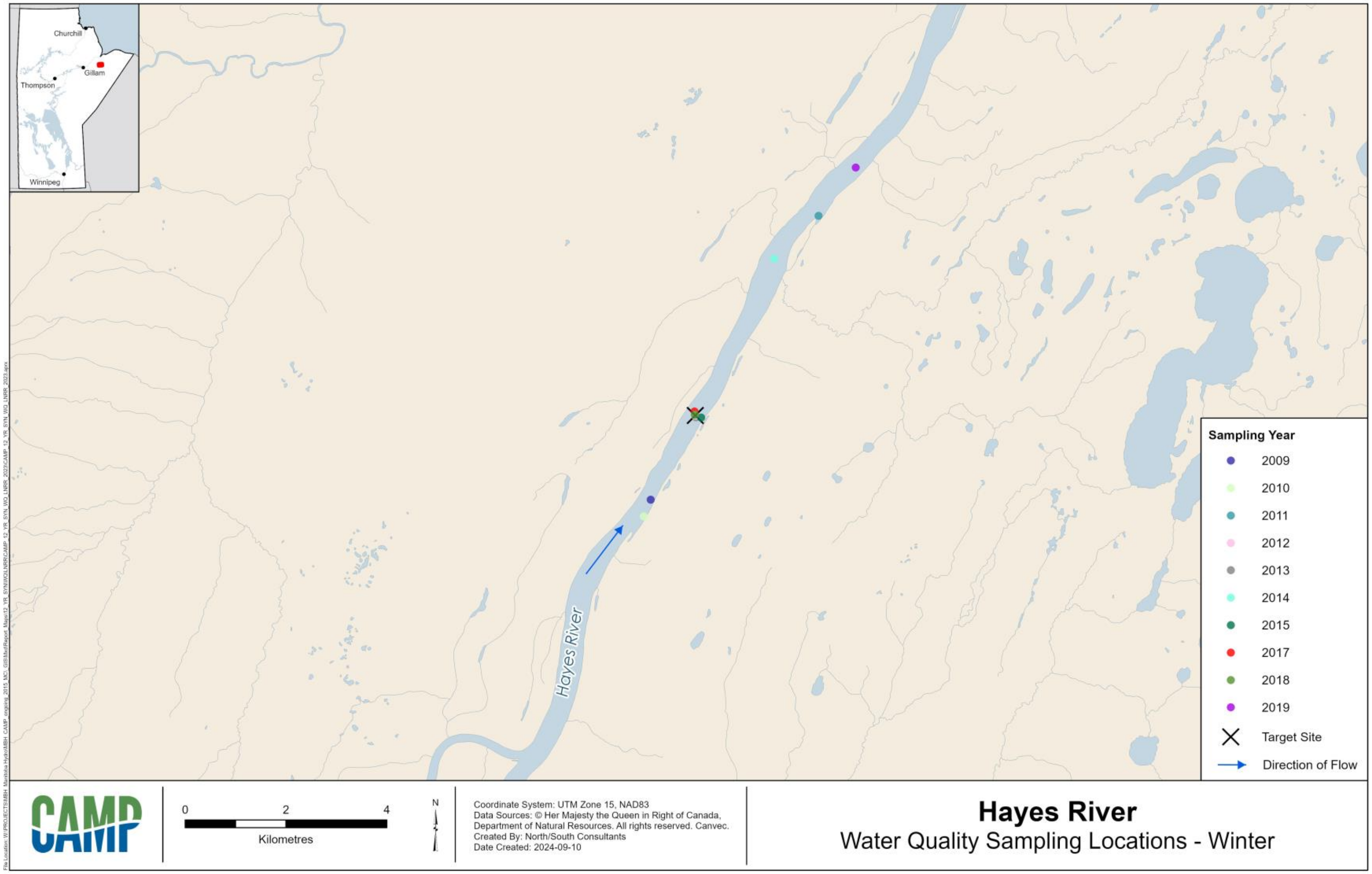


Figure A3-1-24. Winter water quality sampling locations: the Hayes River.

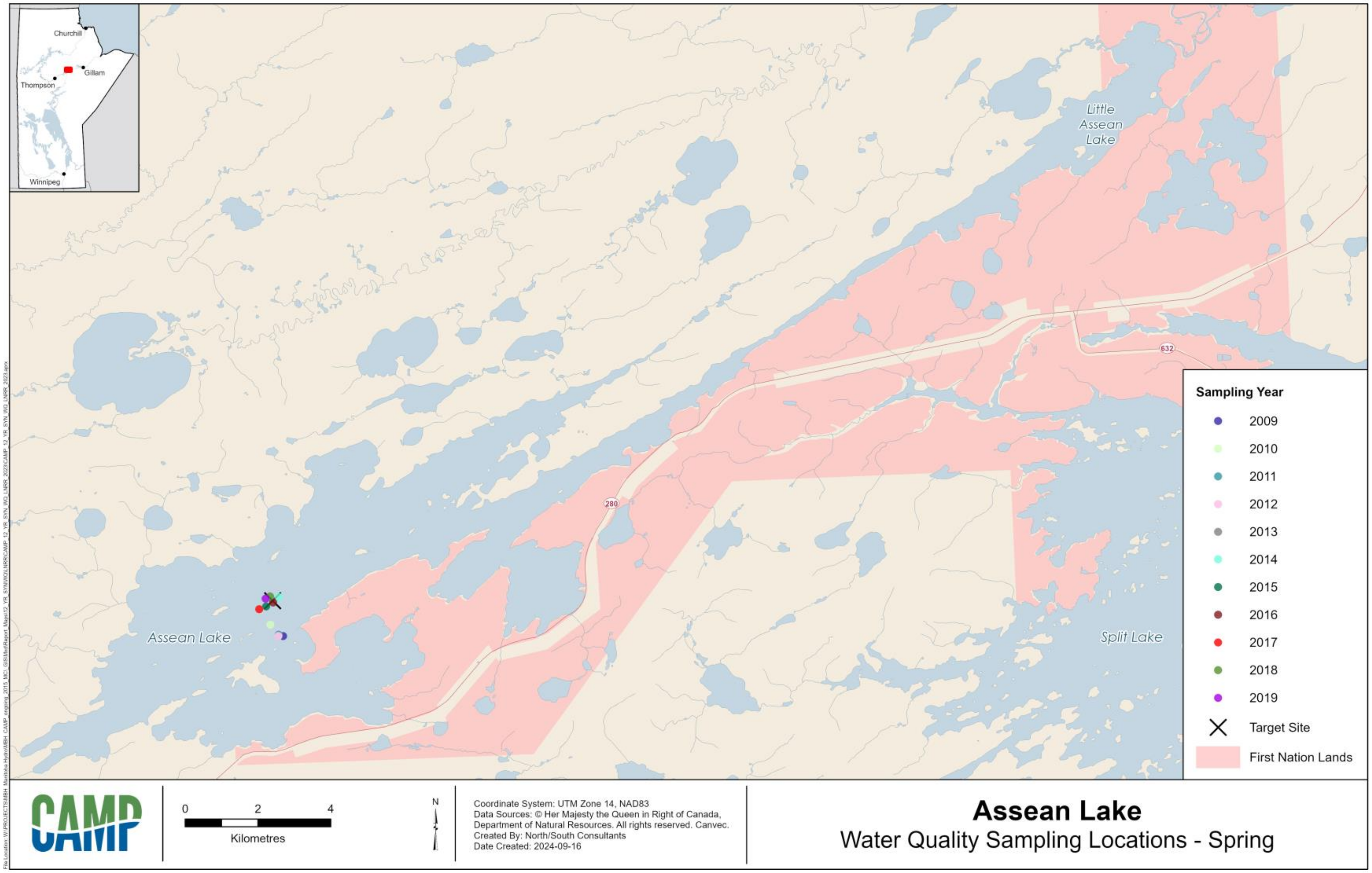


Figure A3-1-25. Spring water quality sampling locations: Assean Lake.

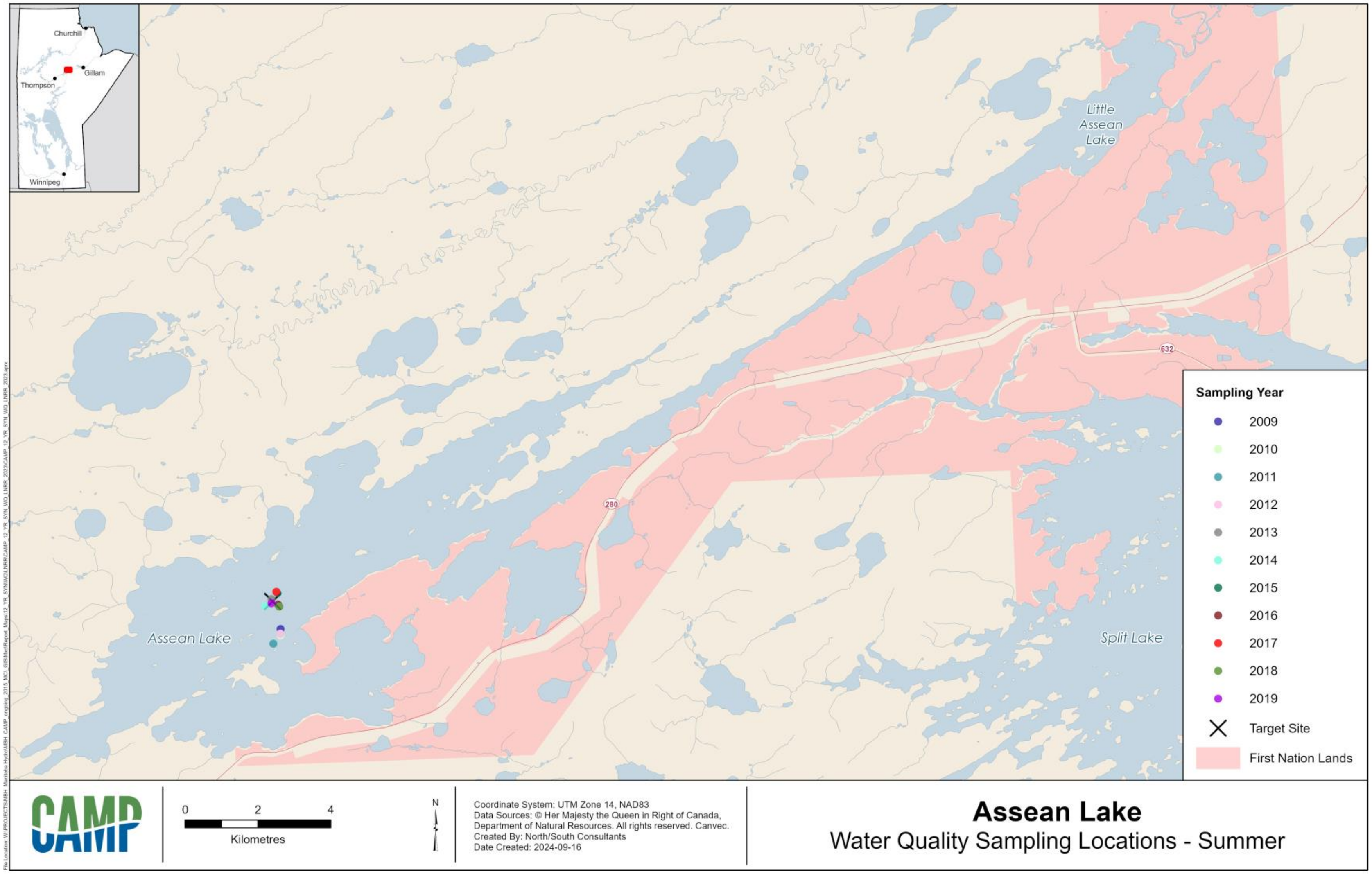


Figure A3-1-26. Summer water quality sampling locations: Assean Lake.

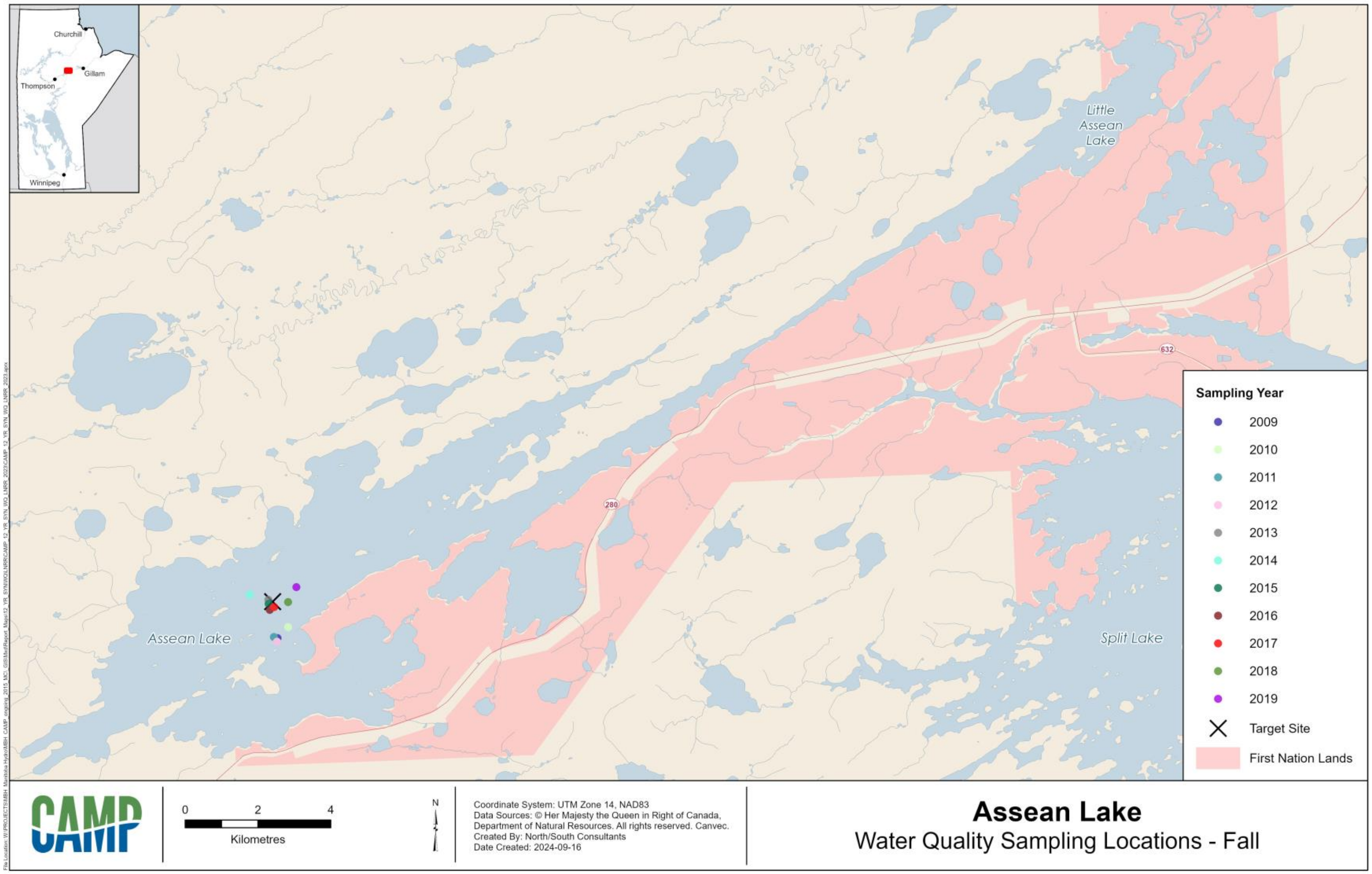


Figure A3-1-27. Fall water quality sampling locations: Assean Lake.

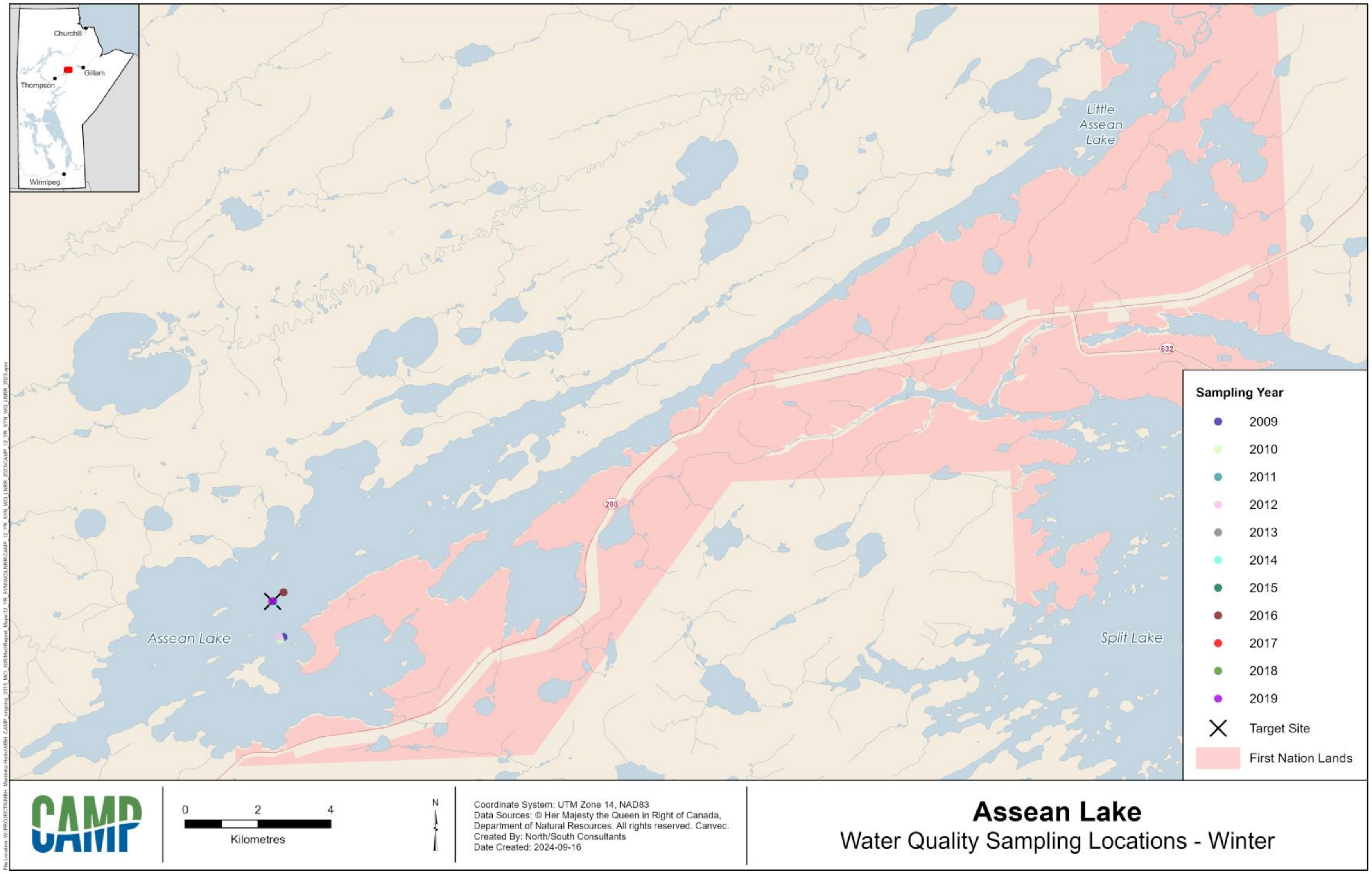


Figure A3-1-28. Winter water quality sampling locations: Assean Lake.

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 Nelson River Region. The 2008 and 2009 benthic invertebrate datasets were excluded due to a significant change in the sampling design in 2010.

Eight waterbodies were monitored in the Lower Nelson River Region: two on-system annual sites (Split Lake and Lower Nelson River downstream of Limestone GS) and four on-system rotational sites (Burntwood River, Stephens Lake - South, Stephens Lake - North and Limestone Forebay); and two off-system annual sites (Hayes River and Assean 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), except in the Hayes River where an offshore sampling polygon is not established due to hard/scoured substrate and/or fast water in the 5 to 10 m water depth range. 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 substrate type(s) and sediment analysis results are presented in Appendix 4-2. Sampling was completed at most of the sites as planned over the period of 2010-2019, with the following exception:

- Fewer than five offshore samples were collected at the lower Nelson River site in 2010 (n=4) and 2013 (n=1) and no samples were collected in 2011, 2012, 2014, and 2015 because of coarse/compact substrate and high-water velocity within the 5 to 10 m water depth range.
- To ensure consistent sampling of the offshore habitat, the target sampling depth range was reduced to 3 to 5 m in 2016, which allowed for successful collection of five samples per year between 2016 and 2019.

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 in 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
SPLIT		-[1]	●	●	●	●	●	●	●	●	●	●
LNR	-[1]	-[1]	●[2]	●[3]	●[3]	●[2]	●[3]	●[3]	●[4]	●[4]	●[4]	●[4]
BURNT				●			●			●		
STL-S					●			●			●	
STL-N					●			●			●	
LMFB			●			●			●			●
ASSN		-[1]	●	●	●	●	●	●	●	●	●	●
HAYES[3]	-[1]	-[1]	●	●	●	●	●	●	●	●	●	●

Notes:

1. Dataset excluded from analysis and reporting due to change in sampling design in 2010.
2. Less than five offshore samples collected due to coarse/compact substrate.
3. Offshore habitat not sampled due to coarse/compact substrate and/or high-water velocity.
4. Offshore target water depth was reduced to 3 to 5 m.

Table 4.1-2. Benthic invertebrate indicators and metrics.

Indicator	Metric	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)	-

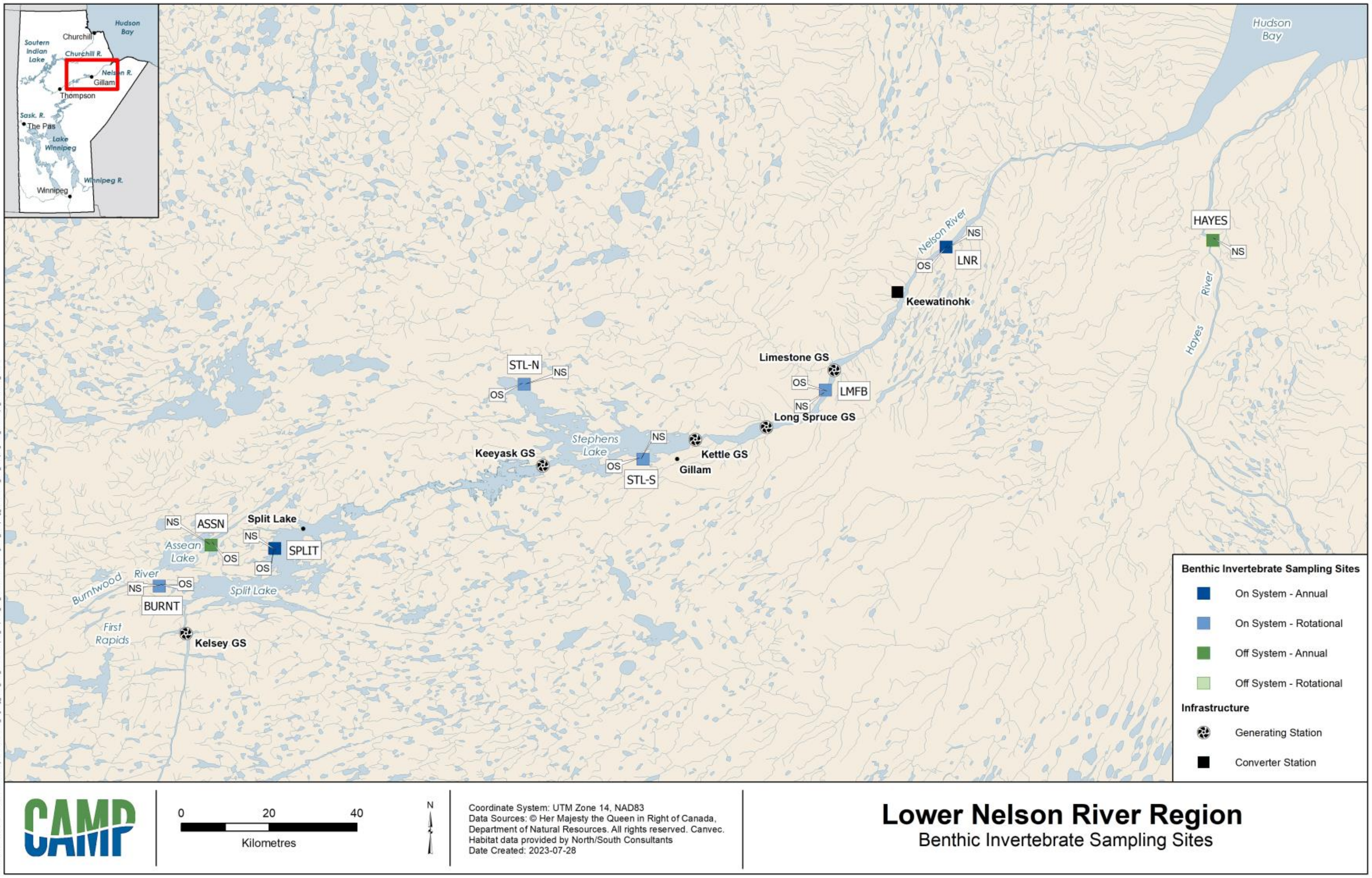


Figure 4.1-1. 2010 to 2019 Benthic invertebrate nearshore (NS) and offshore (OS) sampling sites.

4.2 ABUNDANCE

4.2.1 TOTAL INVERTEBRATE ABUNDANCE

4.2.1.1 ON-SYSTEM SITES

Split Lake

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 244 invertebrates per sample (2017) to 4,665 invertebrates per sample (2019; Figure 4.2-1). The overall mean abundance was 1,491 invertebrates per sample, the overall median abundance was 845 invertebrates per sample, and the IQR was 371 to 1,816 invertebrates per sample. Annual means were below the IQR in 2010 and 2017, and above the IQR in 2012, 2016 and 2019.

Offshore Habitat

Annual mean abundance (density) over the ten years of monitoring ranged from 2,392 invertebrates per m^2 (2016) to 14,653 invertebrates per m^2 (2013; Figure 4.2-2). The overall mean abundance was 4,990 invertebrates per m^2, the overall median abundance was 3,477 invertebrates per m^2, and the IQR was 2,579 to 4,822 invertebrates per m^2. Annual means were below the IQR from 2016 to 2019, and above the IQR in 2010, 2011, 2013 and 2014.

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 94 invertebrates per sample (2018) to 2,276 invertebrates per sample (2012; Figure 4.2-1). The overall mean abundance was 946 invertebrates per sample, the overall median abundance was 432 invertebrates per sample, and the IQR was 117 to 1,484 invertebrates per sample. Annual means were below the IQR in 2018, and above the IQR in 2012, 2014 and 2016.

Offshore Habitat

Annual mean abundance (density) over the six years of monitoring ranged from 130 invertebrates per m^2 (2013, n=1) to 7,364 invertebrates per m^2 (2019; Figure 4.2-2). The overall mean abundance was 4,646 invertebrates per m^2, the overall median abundance was 2,424 invertebrates per m^2, and the IQR was 1,399 to 6,290 invertebrates per m^2. Annual means were below the IQR in 2013 and 2017, and above the IQR in 2016 and 2019.

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean abundance over the three years of monitoring ranged from 436 invertebrates per sample (2017) to 2,037 invertebrates per sample (2011; Figure 4.2-1). The overall mean abundance was 1,449 invertebrates per sample, the overall median abundance was 1,836 invertebrates per sample, and the IQR was 556 to 1,982 invertebrates per sample. Annual means were below the IQR in 2017, and above the IQR in 2011.

Offshore Habitat

Annual mean abundance (density) over the three years of monitoring ranged from 312 invertebrates per m^2 (2011) to 972 invertebrates per m^2 (2017; Figure 4.2-2). The overall mean abundance was 715 invertebrates per m^2, the overall median abundance was 693 invertebrates per m^2, and the IQR was 317 to 959 invertebrates per m^2. Annual means were below the IQR in 2011, and above the IQR in 2017.

Stephens Lake – South

Nearshore Habitat

Annual mean abundance over the three years of monitoring ranged from 110 invertebrates per sample (2012) to 535 invertebrates per sample (2015; Figure 4.2-1). The overall mean abundance was 290 invertebrates per sample, the overall median abundance was 150 invertebrates per sample, and the IQR was 95 to 274 invertebrates per sample. Annual means were within the IQR, except in 2015 (above).

Offshore Habitat

Annual mean abundance (density) over the three years of monitoring ranged from 2,421 invertebrates per m^2 (2018) to 3,180 invertebrates per m^2 (2012; Figure 4.2-2). The overall mean abundance was 2,732 invertebrates per m^2, the overall median abundance was 2,597 invertebrates per m^2, and the IQR was 2,431 to 3,239 invertebrates per m^2. Annual means were within the IQR, except in 2018 (below).

Stephens Lake - North

Nearshore Habitat

Annual mean abundance over the three years of monitoring ranged from 38 invertebrates per sample (2015) to 1,056 invertebrates per sample (2012; Figure 4.2-1). The overall mean abundance was 416 invertebrates per sample, the overall median abundance was 131 invertebrates per sample, and the IQR was 62 to 622 invertebrates per sample. Annual means were below the IQR in 2015, and above the IQR in 2012.

Offshore Habitat

Annual mean abundance (density) over the three years of monitoring ranged from 188 invertebrates per m^2 (2015) to 915 invertebrates per m^2 (2012; Figure 4.2-2). The overall mean abundance was 541 invertebrates per m^2, the overall median abundance was 519 invertebrates per m^2, and the IQR was 274 to 613 invertebrates per m^2. Annual means were below the IQR in 2015, and above the IQR in 2012.

Limestone Forebay

Nearshore Habitat

Annual mean abundance over the four years of monitoring ranged from 109 invertebrates per sample (2010) to 1,958 invertebrates per sample (2019; Figure 4.2-1). The overall mean abundance was 944 invertebrates per sample, the overall median abundance was 796 invertebrates per sample, and the IQR was 183 to 1,610 invertebrates per sample. Annual means were below the IQR in 2010, and above the IQR in 2019.

Offshore Habitat

Annual mean abundance (density) over the four years of monitoring ranged from 1,296 invertebrates per m^2 (2016) to 1,838 invertebrates per m^2 (2010; Figure 4.2-2). The overall mean abundance was 1,533 invertebrates per m^2, the overall median abundance was 1,277 invertebrates per m^2, and the IQR was 909 to 1,742 invertebrates per m^2. Annual means were within the IQR, except in 2010 (above).

4.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 315 invertebrates per sample (2018) to 2125 invertebrates per sample (2010; Figure 4.2-1). The overall mean abundance was 1039 invertebrates per sample, the overall median abundance was 906 invertebrates per sample, and the IQR was 457 to 1414 invertebrates per sample. Annual means were below the IQR in 2014, 2015 and 2018, and above the IQR in 2010 and 2013.

Offshore Habitat

Annual mean abundance (density) over the ten years of monitoring ranged from 335 invertebrates per m^2 (2017) to 1,913 invertebrates per m^2 (2013; Figure 4.2-2). The overall mean abundance was 1,048 invertebrates per m^2, the overall median abundance was 743 invertebrates per m^2, and the IQR was 523 to 1,443 invertebrates per m^2. Annual means were below the IQR in 2014 and 2017, and above the IQR in 2013 and 2018.

Hayes River

Nearshore Habitat

Annual mean abundance over the ten years of monitoring ranged from 295 invertebrates per sample (2018) to 5,107 invertebrates per sample (2019; Figure 4.2-1). The overall mean abundance was 1,552 invertebrates per sample, the overall median abundance was 1,169 invertebrates per sample, and the IQR was 599 to 1,862 invertebrates per sample. Annual means were below the IQR in 2018, and above the IQR in 2019.

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

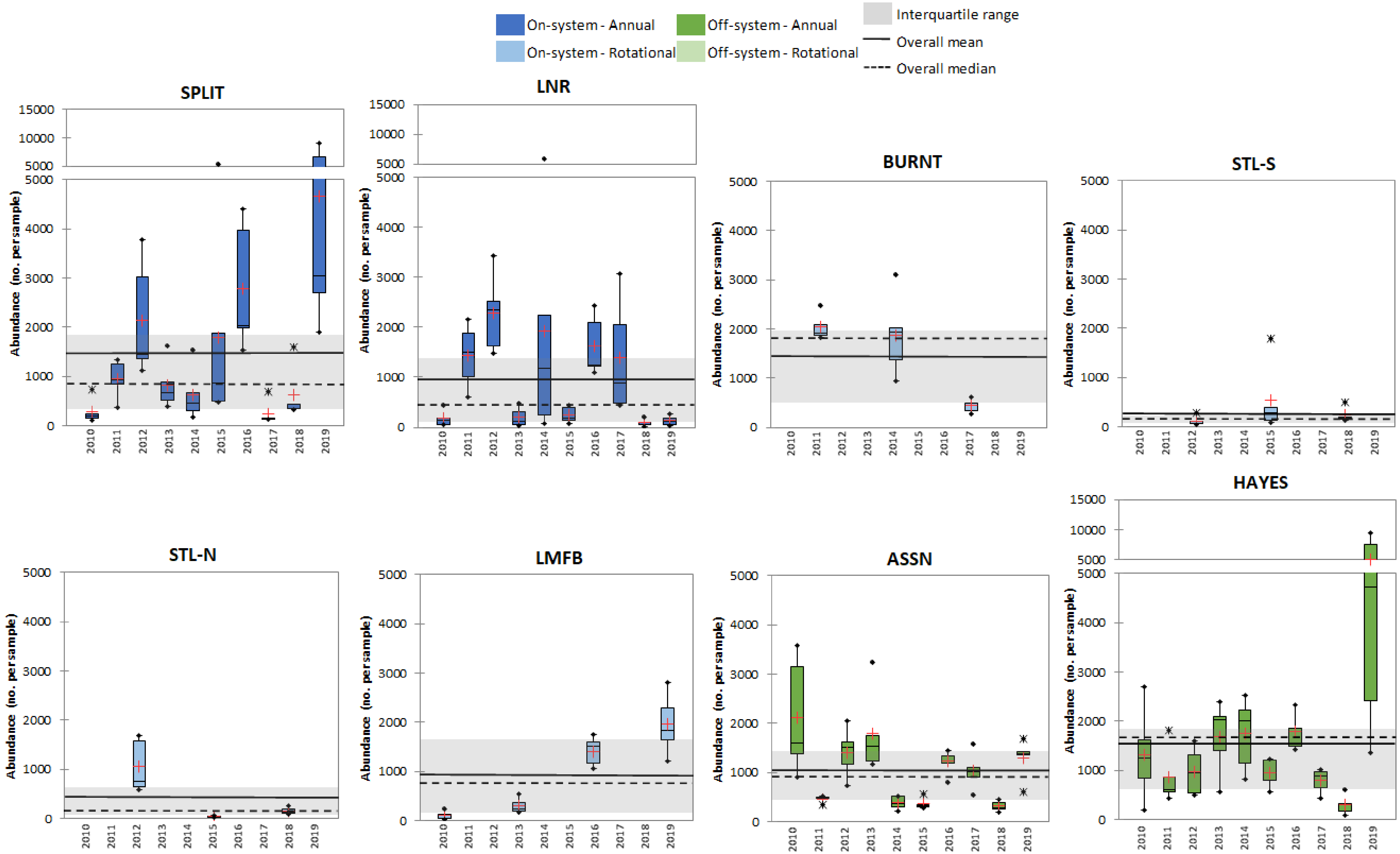


Figure 4.2-1. 2010 to 2019 Nearshore benthic invertebrate abundance (total no. per sample).

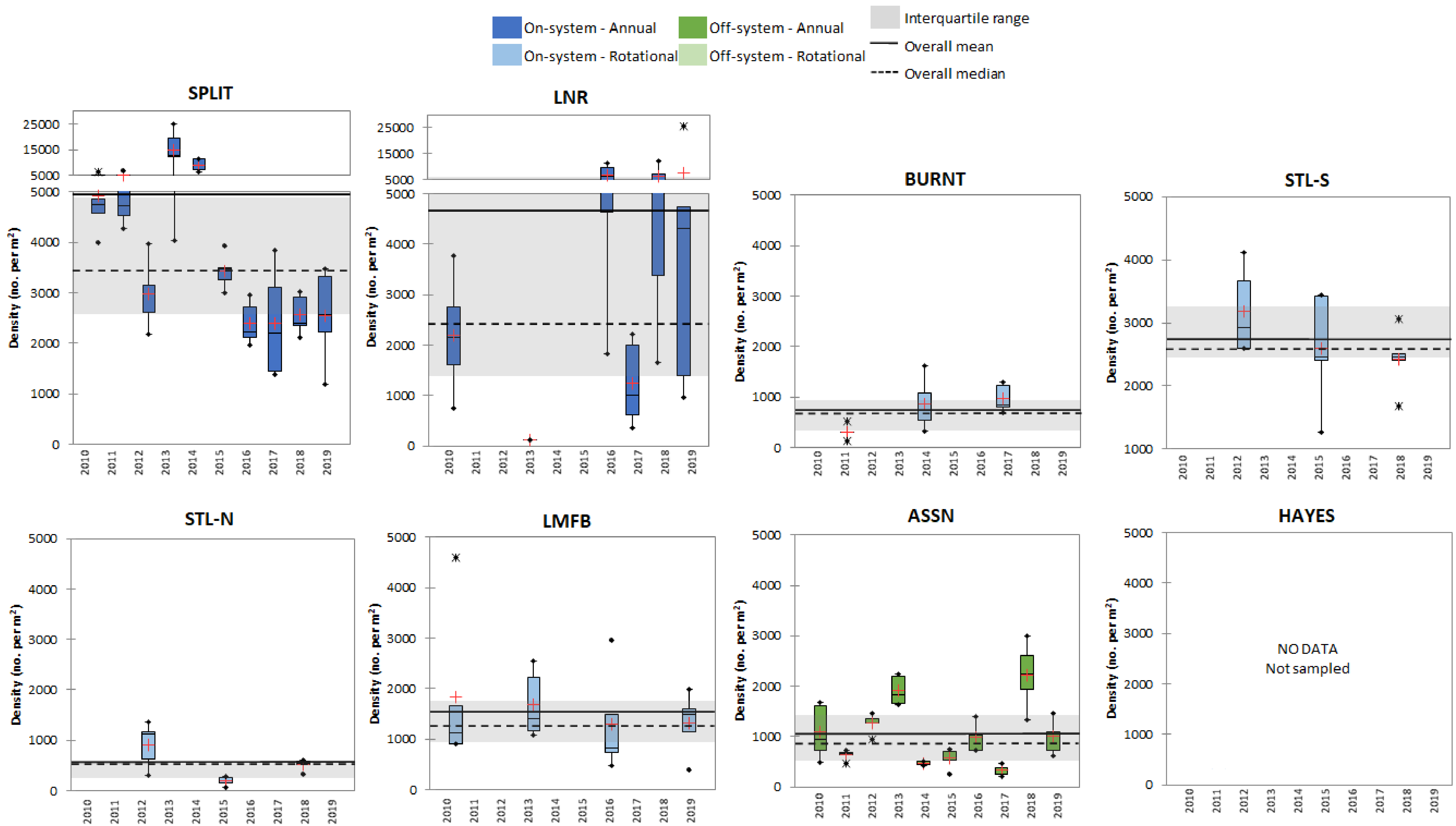


Figure 4.2-2. 2010 to 2019 Offshore benthic invertebrate abundance (density; total no. per m^2; LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

4.3 COMMUNITY COMPOSITION

4.3.1 RELATIVE ABUNDANCE

4.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

Amphipoda (freshwater shrimps, mainly Hyalellidae) dominated the benthic invertebrate community in nine of the ten years of monitoring (2010 to 2017, and 2019; Table 4.3-1). Among those years, mean annual relative abundances of Amphipoda ranged between 40% (2010 and 2012) and 75% (2011). Oligochaeta (aquatic segmented worms, 21%), Amphipoda (19%), and Chironomidae (non-biting midges, 24%) were the dominant taxa in 2018.

Offshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-2). Bivalvia (clams, mainly Sphaeriidae) dominated in 2010 (36%) and 2011 (38%). Amphipoda (freshwater shrimps, Pontoporeiidae, 33%) and Bivalvia (Sphaeriidae, 30%) were nearly co-dominant in 2012. Gastropoda (snails, mainly Hydrobiidae) was the dominant taxon in 2013 (62%) and 2014 (62%). Amphipoda (mainly Pontoporeiidae) dominated in the remaining years with mean annual relative abundances ranging from 62% (2015 and 2016) to 77% (2019).

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-3). Chironomidae (non-biting midges) dominated in 2010 (43%), 2012 (46%), 2013 (37%), 2015 (78%), 2016 (65%), and 2019 (62%). Oligochaeta (aquatic segmented worms) and Chironomidae were co-dominant in 2011 (25%). Oligochaeta was the dominant taxon in 2014 (53%), 2017 (52%), and 2018 (48%).

Offshore Habitat

Benthic invertebrate community composition varied over the six years of monitoring (2010, 2013, and 2016 to 2019; Table 4.3-4). Of four samples collected in 2010, Oligochaeta (aquatic segmented worms, 26%), Chironomidae (non-biting midges, 36%), and Trichoptera (caddisflies, mainly Hydropsychidae, 27%) dominated. From the one sample collected in 2013, Ceratopogonidae (biting midges, 56%) dominated. Sampling within the shallower water depth range yielded five benthic samples in 2016 to 2019. Among those years, Oligochaeta dominated the invertebrate community in 2016 (52%) and 2019 (69%); Oligochaeta (33%) and Gastropoda (snails, mainly Hydrobiidae, 37%) were co-dominant in 2017; and Gastropoda (Hydrobiidae) was the dominant taxon in 2018 (52%).

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Amphipoda (freshwater shrimps, mainly Hyalellidae) dominated the benthic invertebrate community over the three years of monitoring (2011, 2014, and 2017; Table 4.3-5). Mean annual relative abundances of Amphipoda ranged between 40% (2014) and 53% (2011). Chironomidae (non-biting midges) was the next most dominant taxon in 2014 (30%). Amphipoda (45%), Chironomidae (22%) and Ephemeroptera (mayflies, mainly Baetidae, 15%) dominated in 2017.

Offshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2011, 2014, and 2017; Table 4.3-6). Chironomidae (44%) and Trichoptera (caddisflies, 29%, mainly Hydropsychidae) dominated in 2011; and Bivalvia (calms, mainly Sphaeriidae) dominated in 2014 (59%) and 2017 (67%).

Stephens Lake - South

Nearshore Habitat

Oligochaeta (aquatic segmented worms) dominated the benthic invertebrate community over the three years of monitoring (2012, 2015, and 2018; Table 4.3-7). Mean annual relative abundances of Oligochaeta ranged between 44% (2018) and 85% (2015). Chironomidae (non-biting midges) was the next dominant taxon with mean annual relative abundances ranging from 13% (2015) to 30% (2018).

Offshore Habitat

Amphipoda (freshwater shrimps, mainly Pontoporeiidae) dominated the benthic invertebrate community over the three years of monitoring (2012, 2015, and 2018; Table 4.3-8). Mean annual relative abundances of Amphipoda ranged between 56% (2012) and 78% (2015).

Stephens Lake - North

Nearshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2012, 2015, and 2018; Table 4.3-9). Chironomidae (non-biting midges) dominated in 2012 (78%); and Corixidae (water boatmen) dominated in 2015 (47%) and 2018 (59%).

Offshore Habitat

Benthic invertebrate community composition varied over the three years of monitoring (2012, 2015, and 2018; Table 4.3-10). Ephemeroptera (mayflies, Ephemeridae) was the dominant taxon in 2012 (60%); and Chironomidae (non-biting midges) dominated in 2015 (52%) and 2018 (57%).

Limestone Forebay

Nearshore Habitat

Benthic invertebrate community composition varied over the four years of monitoring (2010, 2013, 2016, and 2019; Table 4.3-11). Chironomidae (non-biting midges) dominated in 2010 (65%). Chironomidae (30%) and Corixidae (water boatmen, 27%) were co-dominant in 2013. Oligochaeta (aquatic segmented worms) was the dominant taxon in 2016 (70%). Corixidae (36%) dominated in 2019.

Offshore Habitat

Benthic invertebrate community composition varied over the four years of monitoring (2010, 2013, 2016, and 2019; Table 4.3-12). Bivalvia (clams, mainly Sphaeriidae) dominated in 2010 (35%) and 2016 (27%). Oligochaeta (aquatic segmented worms, 25%) dominated in 2013. Chironomidae (non-biting midges) was the dominant taxon in 2019 (28%).

4.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-13). Amphipoda (freshwater shrimps, 34%, mainly Hyalellidae) and Ephemeroptera (mayflies, mainly Caenidae, 40%) were co-dominant in 2010. Corixidae (water boatmen) was the dominant group in 2011 (39%), 2014 (34%), 2015 (55%), and 2018 (67%). Amphipoda (mainly Hyalellidae) dominated in 2012 (43%), 2017 (39%), and 2019 (32%). Oligochaeta (aquatic segmented worms, 27%) and Amphipoda (33%, mainly Hyalellidae) dominated in 2013. Oligochaeta (19%), Amphipoda (18%, mainly Hyalellidae), and Ephemeroptera (18%) were co-dominant in 2016.

Offshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-14). Ephemeroptera (mayflies, mainly Ephemeridae) was the dominant taxon in 2010 (46%), 2011 (45%), 2012 (67%), and 2019 (41%). Bivalvia (clams, 37%, mainly Sphaeriidae) and Ephemeroptera (36%, mainly Ephemeridae) were co-dominant in 2013. Bivalvia (48%, mainly Sphaeriidae) was the dominant group in 2014. Chironomidae (34%) and Ephemeroptera (35%, mainly Ephemeridae) were co-dominant in 2015. Bivalvia (34%, mainly Sphaeriidae) and Chironomidae (35%) were co-dominant in 2017. Chironomidae was dominant in 2016 (67%) and 2018 (46%).

Hayes River

Nearshore Habitat

Benthic invertebrate community composition varied over the ten years of monitoring (2010 to 2019; Table 4.3-15). Corixidae (water boatmen) dominated in 2010 (95%), 2011 (59%), 2014 (54%), and 2015 (34%). Bivalvia (Sphaeriidae, fingernail clams, 26%), Chironomidae (non-biting midges, 22%), and Ephemeroptera (mayflies, 24%, mainly Baetidae and Heptageniidae) dominated in 2012. Chironomidae dominated in 2013 (66%), 2016 (24%), and 2018 (45%). Bivalvia (Sphaeriidae, 24%) and Corixidae (25%) were co-dominant in 2017. Chironomidae and Corixidae were co-dominant in 2019 (30%).

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

Table 4.3-1. 2010 to 2019 Split 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	11%	1%	5%	12%	10%	7%	19%	5%	21%	6%
Amphipoda	40%	75%	40%	47%	63%	73%	46%	50%	19%	67%
Bivalvia	0%	0%	3%	<1%	0%	1%	<1%	0%	6%	7%
Gastropoda	<1%	2%	3%	<1%	<1%	<1%	1%	1%	2%	2%
Ceratopogonidae	<1%	<1%	1%	1%	0%	1%	<1%	<1%	2%	1%
Chironomidae	17%	15%	17%	8%	17%	6%	19%	18%	24%	7%
Other Diptera	0%	<1%	<1%	<1%	<1%	0%	0%	<1%	0%	<1%
Ephemeroptera	21%	3%	29%	26%	6%	3%	8%	19%	10%	4%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	1%	1%	1%	1%	<1%	<1%	2%	1%	1%	2%
Corixidae	6%	2%	3%	3%	3%	7%	4%	5%	14%	4%
Coleoptera	1%	1%	<1%	<1%	<1%	<1%	<1%	0%	1%	<1%
All other taxa	1%	<1%	<1%	2%	1%	1%	1%	1%	1%	1%

Table 4.3-2. 2010 to 2019 Split 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	1%	<1%	2%	<1%	<1%	1%	1%	2%	<1%	1%
Amphipoda	17%	14%	33%	13%	18%	62%	62%	68%	75%	77%
Bivalvia	36%	38%	30%	9%	8%	10%	4%	1%	<1%	<1%
Gastropoda	14%	22%	2%	62%	62%	3%	2%	<1%	0%	1%
Ceratopogonidae	<1%	<1%	<1%	<1%	<1%	<1%	<1%	0%	<1%	<1%
Chironomidae	8%	2%	12%	3%	2%	13%	6%	4%	5%	4%
Other Diptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ephemeroptera	21%	22%	20%	11%	7%	6%	21%	17%	17%	13%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	1%	1%	1%	1%	1%	2%	2%	8%	2%	4%
Corixidae	0%	0%	0%	0%	0%	0%	0%	0%	<1%	<1%
Coleoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All other taxa	1%	<1%	<1%	<1%	2%	2%	2%	1%	1%	<1%

Table 4.3-3. 2010 to 2019 Lower Nelson 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	2018	2019
Oligochaeta	6%	25%	12%	13%	53%	15%	18%	52%	48%	32%
Amphipoda	1%	2%	<1%	1%	1%	<1%	3%	1%	<1%	0%
Bivalvia	0%	0%	<1%	0%	0%	1%	<1%	0%	1%	<1%
Gastropoda	1%	19%	10%	6%	12%	2%	<1%	22%	<1%	<1%
Ceratopogonidae	<1%	0%	0%	2%	0%	0%	0%	<1%	0%	<1%
Chironomidae	43%	25%	46%	37%	8%	78%	65%	13%	27%	62%
Other Diptera	1%	<1%	<1%	5%	<1%	2%	<1%	0%	3%	3%
Ephemeroptera	12%	3%	2%	3%	<1%	0%	1%	<1%	<1%	0%
Plecoptera	<1%	0%	0%	0%	0%	0%	<1%	0%	0%	0%
Trichoptera	<1%	1%	1%	<1%	<1%	<1%	<1%	1%	<1%	<1%
Corixidae	35%	19%	30%	29%	25%	3%	12%	11%	20%	1%
Coleoptera	2%	0%	<1%	5%	0%	0%	0%	0%	0%	0%
All other taxa	1%	5%	<1%	0%	<1%	<1%	<1%	<1%	0%	0%

Table 4.3-4. 2010 to 2019 Lower Nelson River offshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2010 (n=4)	2011 (n=0)	2012 (n=0)	2013 (n=1)	2014 (n=0)	2015 (n=0)	2016	2017	2018	2019
Oligochaeta	26%	-	-	11%	-	-	52%	33%	22%	69%
Amphipoda	0%	-	-	11%	-	-	<1%	2%	0%	0%
Bivalvia	3%	-	-	0%	-	-	7%	14%	16%	4%
Gastropoda	8%	-	-	0%	-	-	26%	37%	52%	7%
Ceratopogonidae	<1%	-	-	56%	-	-	<1%	0%	0%	0%
Chironomidae	36%	-	-	0%	-	-	15%	10%	10%	20%
Other Diptera	0%	-	-	0%	-	-	0%	0%	0%	0%
Ephemeroptera	0%	-	-	11%	-	-	<1%	1%	<1%	<1%
Plecoptera	0%	-	-	0%	-	-	0%	0%	0%	<1%
Trichoptera	27%	-	-	0%	-	-	<1%	3%	0%	<1%
Corixidae	0%	-	-	11%	-	-	0%	0%	0%	0%
Coleoptera	0%	-	-	0%	-	-	0%	0%	0%	0%
All other taxa	0%	-	-	0%	-	-	<1%	0%	<1%	<1%

Table 4.3-5. 2010 to 2019 Burntwood River nearshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2011	2014	2017
Oligochaeta	7%	12%	9%
Amphipoda	53%	40%	45%
Bivalvia	<1%	0%	<1%
Gastropoda	8%	3%	2%
Ceratopogonidae	<1%	<1%	<1%
Chironomidae	11%	30%	22%
Other Diptera	<1%	<1%	<1%
Ephemeroptera	5%	7%	15%
Plecoptera	0%	0%	0%
Trichoptera	1%	2%	1%
Corixidae	14%	4%	4%
Coleoptera	1%	<1%	<1%
All other taxa	<1%	2%	2%

Table 4.3-6. 2010 to 2019 Burntwood River offshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2011	2014	2017
Oligochaeta	0%	1%	1%
Amphipoda	2%	1%	1%
Bivalvia	16%	59%	67%
Gastropoda	1%	<1%	0%
Ceratopogonidae	2%	1%	1%
Chironomidae	44%	15%	18%
Other Diptera	4%	3%	1%
Ephemeroptera	4%	7%	2%
Plecoptera	0%	0%	0%
Trichoptera	29%	11%	11%
Corixidae	0%	0%	0%
Coleoptera	0%	0%	0%
All other taxa	0%	<1%	0%

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

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

Invertebrate Taxa	2012	2015	2018
Oligochaeta	48%	85%	44%
Amphipoda	6%	<1%	5%
Bivalvia	0%	0%	<1%
Gastropoda	1%	0%	4%
Ceratopogonidae	0%	0%	0%
Chironomidae	29%	13%	30%
Other Diptera	0%	0%	<1%
Ephemeroptera	14%	2%	5%
Plecoptera	0%	0%	0%
Trichoptera	0%	<1%	<1%
Corixidae	1%	<1%	9%
Coleoptera	0%	0%	0%
All other taxa	1%	0%	1%

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

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

Invertebrate Taxa	2012	2015	2018
Oligochaeta	<1%	<1%	0%
Amphipoda	56%	78%	76%
Bivalvia	0%	0%	0%
Gastropoda	0%	0%	2%
Ceratopogonidae	<1%	<1%	0%
Chironomidae	23%	11%	11%
Other Diptera	0%	0%	0%
Ephemeroptera	20%	11%	10%
Plecoptera	0%	0%	0%
Trichoptera	0%	<1%	1%
Corixidae	0%	0%	0%
Coleoptera	0%	0%	0%
All other taxa	0%	0%	0%

Table 4.3-9. 2010 to 2019 Stephens Lake – North nearshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2012	2015	2018
Oligochaeta	13%	20%	13%
Amphipoda	2%	8%	2%
Bivalvia	0%	0%	0%
Gastropoda	<1%	2%	1%
Ceratopogonidae	<1%	0%	0%
Chironomidae	78%	18%	16%
Other Diptera	1%	1%	1%
Ephemeroptera	3%	0%	7%
Plecoptera	0%	0%	0%
Trichoptera	2%	0%	1%
Corixidae	<1%	47%	59%
Coleoptera	0%	1%	<1%
All other taxa	1%	4%	1%

Table 4.3-10. 2010 to 2019 Stephens Lake – North offshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2012	2015	2018
Oligochaeta	9%	18%	9%
Amphipoda	0%	0%	1%
Bivalvia	<1%	0%	0%
Gastropoda	0%	0%	0%
Ceratopogonidae	5%	3%	6%
Chironomidae	25%	52%	57%
Other Diptera	0%	0%	0%
Ephemeroptera	60%	26%	26%
Plecoptera	0%	0%	0%
Trichoptera	2%	0%	1%
Corixidae	0%	0%	0%
Coleoptera	0%	0%	0%
All other taxa	0%	0%	0%

Table 4.3-11. 2010 to 2019 Limestone Forebay nearshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2010	2013	2016	2019
Oligochaeta	10%	14%	70%	18%
Amphipoda	2%	7%	2%	14%
Bivalvia	<1%	<1%	0%	1%
Gastropoda	<1%	12%	1%	6%
Ceratopogonidae	0%	0%	<1%	<1%
Chironomidae	65%	30%	18%	22%
Other Diptera	<1%	<1%	<1%	0%
Ephemeroptera	1%	9%	<1%	1%
Plecoptera	0%	0%	0%	0%
Trichoptera	<1%	1%	2%	1%
Corixidae	20%	27%	6%	36%
Coleoptera	0%	<1%	0%	0%
All other taxa	<1%	1%	<1%	1%

Table 4.3-12. 2010 to 2019 Limestone Forebay offshore benthic invertebrate relative abundance.

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

Invertebrate Taxa	2010	2013	2016	2019
Oligochaeta	11%	25%	9%	10%
Amphipoda	4%	3%	3%	4%
Bivalvia	35%	7%	27%	22%
Gastropoda	4%	8%	13%	6%
Ceratopogonidae	<1%	1%	1%	2%
Chironomidae	17%	14%	24%	28%
Other Diptera	0%	0%	0%	0%
Ephemeroptera	11%	15%	11%	10%
Plecoptera	0%	0%	0%	0%
Trichoptera	8%	14%	6%	10%
Corixidae	<1%	0%	0%	<1%
Coleoptera	0%	0%	0%	0%
All other taxa	10%	14%	7%	9%

Table 4.3-13. 2010 to 2019 Assean 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	6%	9%	5%	27%	8%	11%	19%	25%	2%	11%
Amphipoda	34%	15%	43%	33%	26%	10%	18%	39%	15%	32%
Bivalvia	6%	2%	7%	8%	2%	0%	9%	<1%	1%	13%
Gastropoda	1%	11%	9%	2%	3%	1%	4%	3%	2%	5%
Ceratopogonidae	0%	0%	0%	<1%	0%	0%	<1%	0%	0%	0%
Chironomidae	3%	14%	6%	11%	18%	13%	15%	18%	8%	16%
Other Diptera	<1%	<1%	0%	0%	0%	0%	0%	0%	0%	0%
Ephemeroptera	40%	2%	14%	10%	4%	<1%	18%	3%	3%	12%
Plecoptera	0%	<1%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	3%	5%	6%	4%	2%	1%	4%	3%	1%	6%
Corixidae	4%	39%	8%	4%	34%	55%	8%	8%	67%	4%
Coleoptera	2%	1%	1%	1%	1%	1%	2%	1%	1%	1%
All other taxa	1%	1%	1%	1%	2%	6%	2%	2%	1%	1%

Table 4.3-14. 2010 to 2019 Assean 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	0%	0%	0%	<1%	1%	0%	0%	0%	<1%	0%
Amphipoda	0%	0%	1%	0%	0%	0%	0%	4%	<1%	2%
Bivalvia	25%	25%	21%	37%	48%	22%	18%	34%	18%	23%
Gastropoda	2%	<1%	1%	1%	2%	1%	0%	1%	1%	0%
Ceratopogonidae	4%	2%	1%	1%	3%	6%	2%	2%	1%	2%
Chironomidae	21%	18%	7%	18%	17%	34%	67%	35%	46%	28%
Other Diptera	0%	0%	0%	0%	0%	0%	<1%	0%	0%	0%
Ephemeroptera	46%	45%	67%	36%	27%	35%	12%	16%	27%	41%
Plecoptera	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trichoptera	1%	5%	1%	3%	1%	1%	0%	3%	4%	1%
Corixidae	1%	2%	<1%	0%	0%	0%	0%	0%	1%	1%
Coleoptera	0%	0%	<1%	0%	0%	0%	0%	0%	0%	0%
All other taxa	<1%	3%	<1%	3%	1%	2%	1%	4%	2%	1%

Table 4.3-15. 2010 to 2019 Hayes 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	2018	2019
Oligochaeta	1%	5%	12%	5%	5%	8%	17%	4%	7%	11%
Amphipoda	<1%	<1%	<1%	0%	<1%	0%	0%	<1%	<1%	0%
Bivalvia	<1%	5%	26%	10%	13%	21%	18%	24%	17%	13%
Gastropoda	0%	1%	1%	<1%	1%	5%	9%	13%	3%	8%
Ceratopogonidae	0%	0%	<1%	0%	<1%	<1%	<1%	<1%	<1%	0%
Chironomidae	1%	15%	22%	66%	21%	19%	24%	17%	45%	30%
Other Diptera	<1%	<1%	1%	<1%	<1%	<1%	<1%	<1%	1%	<1%
Ephemeroptera	2%	11%	24%	4%	4%	10%	11%	14%	14%	8%
Plecoptera	0%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	0%
Trichoptera	<1%	1%	4%	<1%	1%	1%	1%	2%	10%	<1%
Corixidae	95%	59%	9%	14%	54%	34%	18%	25%	<1%	30%
Coleoptera	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	1%	0%
All other taxa	<1%	1%	1%	<1%	<1%	1%	1%	1%	2%	<1%

4.3.2 EPT INDEX

4.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 4% (2011 and 2015) to 34% (2012; Figure 4.3-1). The overall mean was 15%, the overall median was 9%, and the interquartile range was 5% to 22%. Annual means were below the IQR in 2011 and 2015, and above the IQR in 2010, 2012 and 2013.

Offshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 8% (2014 and 2015) to 25% (2017; Figure 4.3-2). The overall mean was 19%, the overall median was 19%, and the interquartile range was 13% to 24%. Annual means were below the IQR in 2014 and 2015, and above the IQR in 2017.

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 0% (2015 and 2018) to 13% (2010; Figure 4.3-1). The overall mean was 3%, the overall median was 1%, and the interquartile range was less than one (0.3%) to 3%. Annual means were below the IQR in 2015 above the IQR in 2010, 2011 and 2013.

Offshore Habitat

Annual mean EPT Index over the six years of monitoring ranged from 0% (2018) to 18% (2010, n=4; Figure 4.3-2). The overall mean was 5%, the overall median was 1%, and the interquartile range was 0% to 2%. Annual means were within the IQR, except in 2010, 2013 (n=1) and 2017 (above).

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 6% (2011) to 18% (2017; Figure 4.3-1). The overall mean was 11%, the overall median was 8%, and the interquartile range was 5% to 15%. Annual means were within the IQR, except in 2017 (above).

Offshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 14% (2017) to 36% (2011; Figure 4.3-2). The overall mean was 23%, the overall median was 16%, and the interquartile range was 10% to 30%. Annual means were within the IQR, except in 2011 (above).

Stephens Lake - South

Nearshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 4% (2015) to 19% (2012; Figure 4.3-1). The overall mean was 10%, the overall median was 6%, and the interquartile range was 5% to 12%. Annual means were below the IQR in 2015, and above the IQR in 2012.

Offshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 11% (2018) to 21% (2012; Figure 4.3-2). The overall mean was 15%, the overall median was 12%, and the interquartile range was 10% to 20%. Annual means were within the IQR, except in 2012 (above).

Stephens Lake - North

Nearshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 0% (2015) to 9% (2018; Figure 4.3-1). The overall mean was 5%, the overall median was 3%, and the interquartile range was 0% to 8%. Annual means were within the IQR, except in 2018 (above).

Offshore Habitat

Annual mean EPT Index over the three years of monitoring ranged from 26% (2018) to 52% (2012; Figure 4.3-2). The overall mean was 35%, the overall median was 33%, and the interquartile range was 21% to 47%. Annual means were within the IQR, except in 2012 (above).

Limestone Forebay

Nearshore Habitat

Annual mean EPT Index over the four years of monitoring ranged from 1% (2010) to 10% (2013; Figure 4.3-1). The overall mean was 4%, the overall median was 3%, and the interquartile range was 2% to 4%. Annual means were below the IQR in 2010, and above the IQR in 2013.

Offshore Habitat

Annual mean EPT Index over the four years of monitoring ranged from 19% (2019) to 30% (2013; Figure 4.3-2). The overall mean was 24%, the overall median was 22%, and the interquartile range was 19% to 29%. Annual means were below the IQR in 2019, and above the IQR in 2013.

4.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 2% (2015) to 46% (2010; Figure 4.3-1). The overall mean was 14%, the overall median was 9%, and the interquartile range was 5% to 19%. Annual means were below the IQR in 2015 and 2018, and above the IQR in 2010, 2012 and 2016.

Offshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 11% (2016) to 67% (2012; Figure 4.3-2). The overall mean was 38%, the overall median was 38%, and the interquartile range was 27% to 47%. Annual means were below the IQR in 2016 and 2017, and above the IQR from 2010 to 2012.

Hayes River

Nearshore Habitat

Annual mean EPT Index over the ten years of monitoring ranged from 6% (2010 and 2013) to 30% (2012; Figure 4.3-1). The overall mean was 15%, the overall median was 12%, and the interquartile range was 3% to 25%. Annual means were within the IQR, except in 2012 (above).

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

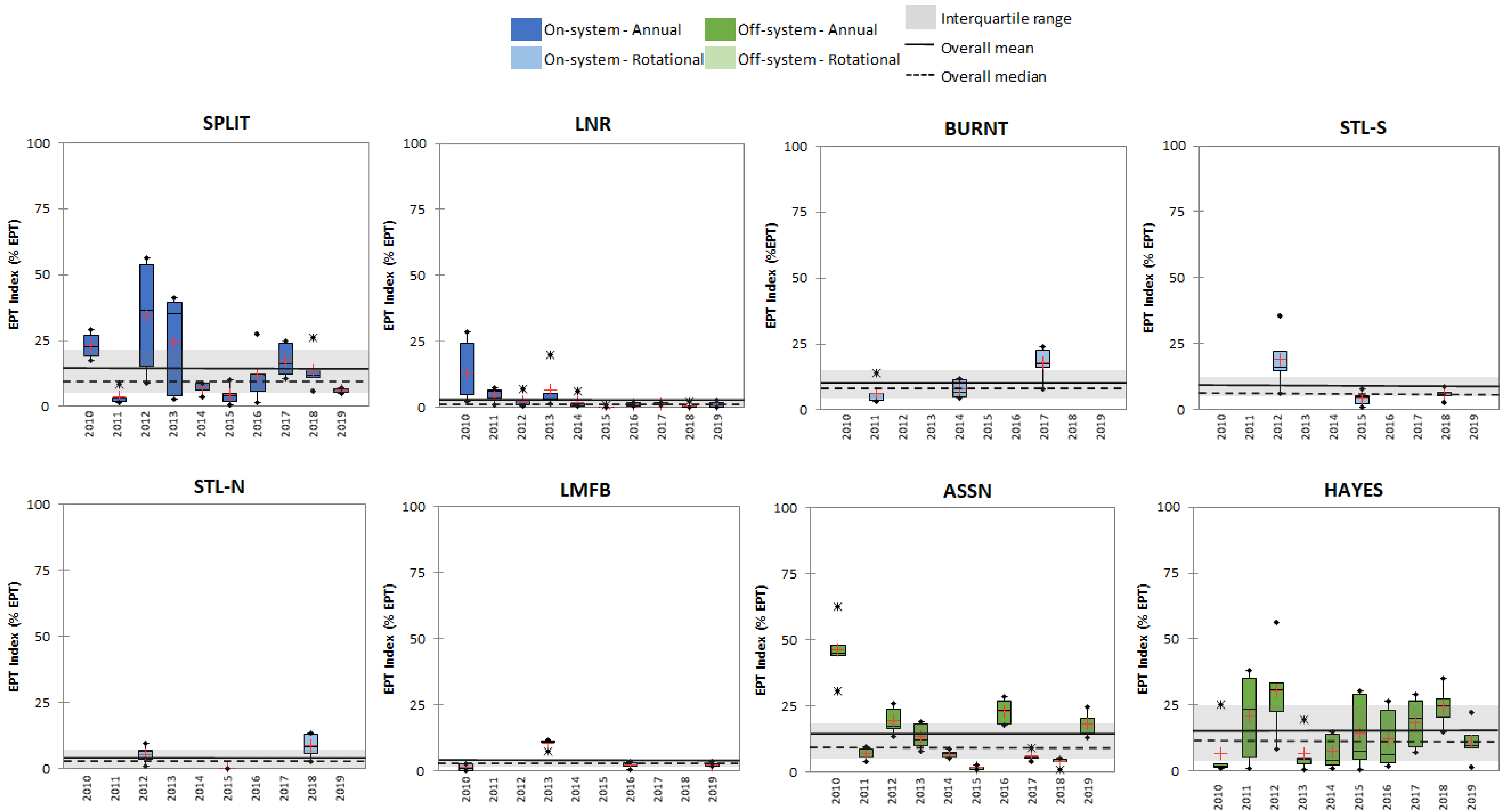


Figure 4.3-1. 2010 to 2019 Nearshore benthic invertebrate EPT Index.

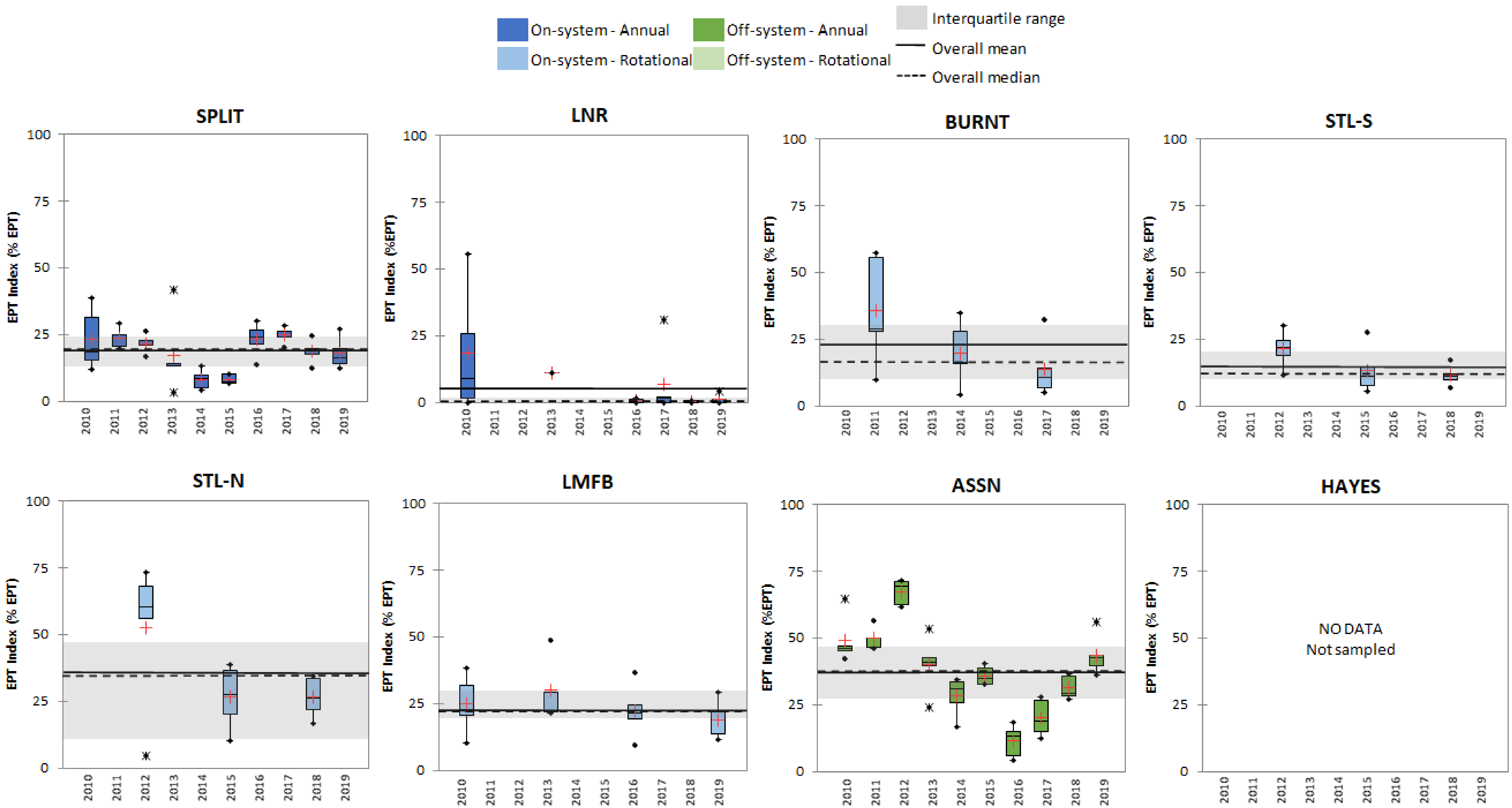


Figure 4.3-2. 2010 to 2019 Offshore benthic invertebrate EPT Index (LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

4.3.3 O+C INDEX

4.3.3.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 13% (2019) to 38% (2018; Figure 4.3-3). The overall mean was 25%, the overall median was 22%, and the interquartile range was 17% to 34%. Annual means were below the IQR in 2015 and 2019, and above the IQR in 2016 and 2018.

Offshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 2% (2014) to 14% (2012 and 2015; Figure 4.3-4). The overall mean was 7%, the overall median was 6%, and the interquartile range was 3% to 10%. Annual means were below the IQR in 2011 and 2014, and above the IQR in 2012 and 2015.

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 43% (2010) to 93% (2019; Figure 4.3-3). The overall mean was 65%, the overall median was 63%, and the interquartile range was 49% to 86%. Annual means were below the IQR in 2010, 2011, 2013 and 2014, and above the IQR in 2015 and 2019.

Offshore Habitat

Annual mean O+C Index over the six years of monitoring ranged from 11% (2013, n=1) to 76% (2019; Figure 4.3-4). The overall mean was 52%, the overall median was 49%, and the interquartile range was 30% to 77%. Annual means were within the IQR, except in 2013 and 2018 (below).

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 18% (2011) to 38% (2014; Figure 4.3-3). The overall mean was 29%, the overall median was 24%, and the interquartile range was 19% to 37%. Annual means were below the IQR in 2011, and above the IQR in 2014.

Offshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 19% (2017) to 46% (2011; Figure 4.3-4). The overall mean was 28%, the overall median was 19%, and the interquartile range was 15% to 34%. Annual means were within the IQR, except in 2011 (above).

Stephens Lake - South

Nearshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 69% (2018) to 96% (2015; Figure 4.3-3). The overall mean was 78%, the overall median was 80%, and the interquartile range was 68% to 93%. Annual means were within the IQR, except in 2015 (above).

Offshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 11% (2018) to 24% (2012; Figure 4.3-4). The overall mean was 16%, the overall median was 16%, and the interquartile range was 11% to 19%. Annual means were within the IQR, except in 2012 (above).

Stephens Lake - North

Nearshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 34% (2018) to 91% (2012; Figure 4.3-3). The overall mean was 54%, the overall median was 48%, and the interquartile range was 33% to 89%. Annual means were within the IQR, except in 2012 (above).

Offshore Habitat

Annual mean O+C Index over the three years of monitoring ranged from 40% (2012) to 71% (2015; Figure 4.3-4). The overall mean was 59%, the overall median was 60%, and the interquartile range was 47% to 75%. Annual means were within the IQR, except in 2012 (below).

Limestone Forebay

Nearshore Habitat

Annual mean O+C Index over the four years of monitoring ranged from 40% (2019) to 88% (2016; Figure 4.3-3). The overall mean was 60%, the overall median was 57%, and the interquartile range was 41% to 84%. Annual means were below the IQR in 2019, and above the IQR in 2016.

Offshore Habitat

Annual mean O+C Index over the four years of monitoring ranged from 30% (2010) to 40% (2019; Figure 4.3-4). The overall mean was 35%, the overall median was 33%, and the interquartile range was 27% to 45%. Annual means for all years fell within the interquartile range.

4.3.3.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 9% (2010) to 41% (2017; Figure 4.3-3). The overall mean was 25%, the overall median was 22%, and the interquartile range was 14% to 34%. Annual means were below the IQR in 2010, 2012 and 2018, and above the IQR in 2013 and 2017.

Offshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 8% (2012) to 69% (2016; Figure 4.3-4). The overall mean was 29%, the overall median was 23%, and the interquartile range was 15% to 40%. Annual means were below the IQR in 2012, and above the IQR in 2016 and 2018.

Hayes River

Nearshore Habitat

Annual mean O+C Index over the ten years of monitoring ranged from 5% (2010) to 66% (2013; Figure 4.3-3). The overall mean was 32%, the overall median was 31%, and the interquartile range was 17% to 41%. Annual means were below the IQR in 2010, and above the IQR in 2013 and 2018.

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

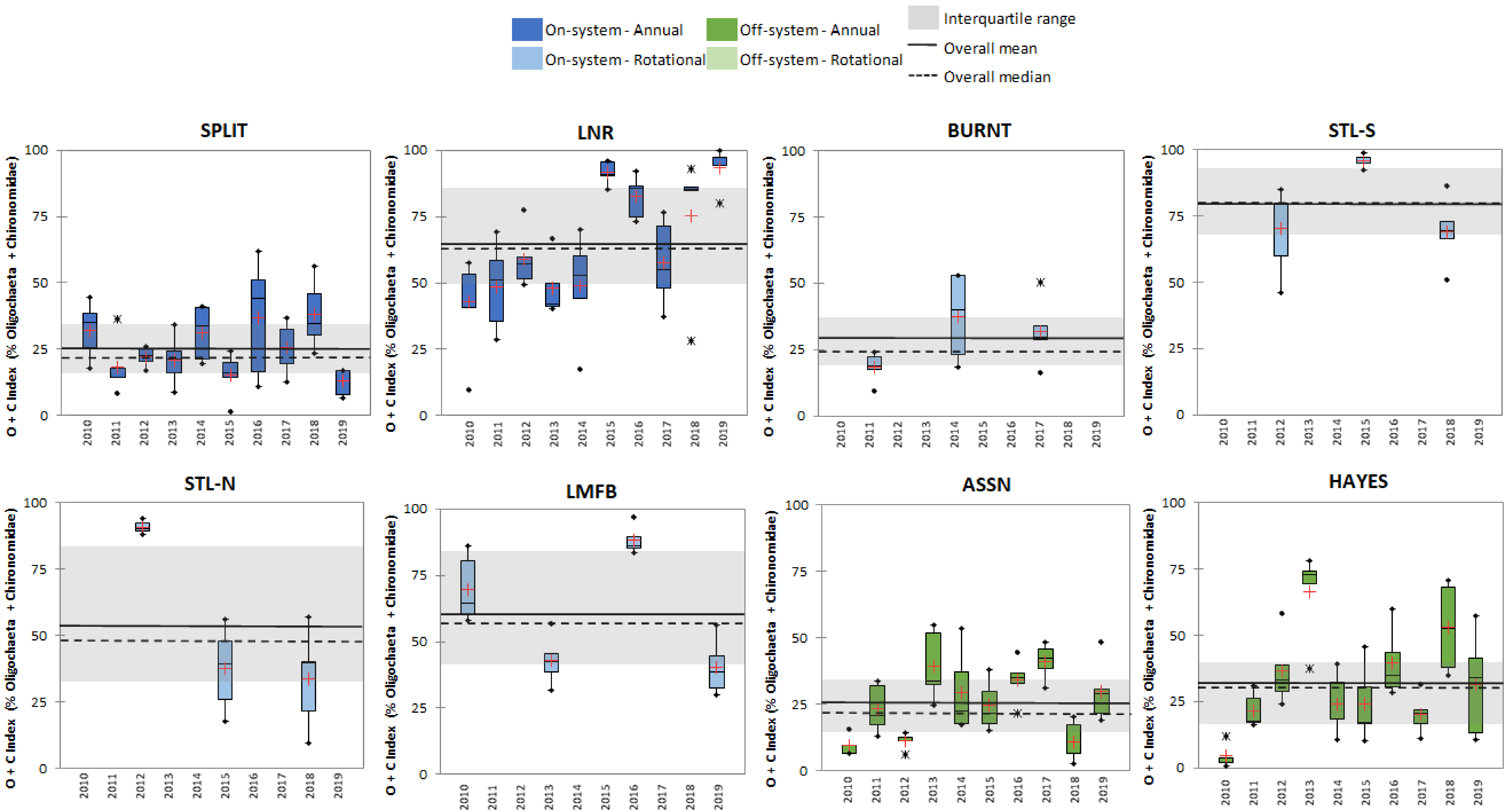


Figure 4.3-3. 2010 to 2019 Nearshore benthic invertebrate O+C Index.

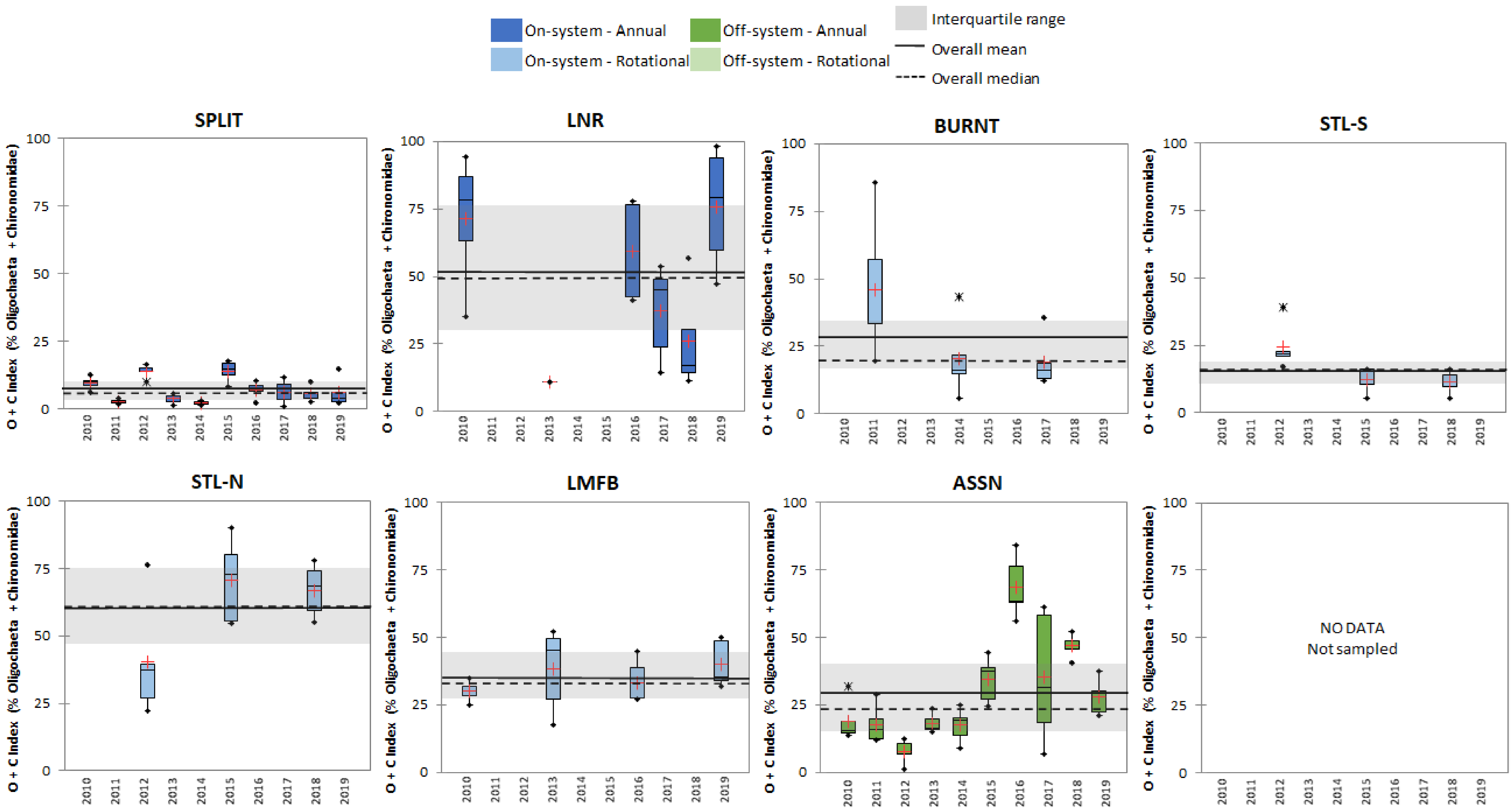


Figure 4.3-4. 2010 to 2019 Offshore benthic invertebrate O+C Index (LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

4.4 RICHNESS

4.4.1 TOTAL TAXA RICHNESS

4.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from ten families (2014) to 19 families (2019; Figure 4.4-1). The overall mean and median were 15 families, and the interquartile range was 12 to 18 families. Annual means were below the IQR in 2014 and 2017, and above the IQR in 2012 and 2019.

Offshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from six families (2018 and 2019) to ten families (2015; Figure 4.4-2). The overall mean and median were eight families, and the interquartile range was 7 to 10 families. Annual means were within the IQR, except in 2018 and 2019 (below).

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from five families (2019) to 14 families (2011; Figure 4.4-1). The overall mean and median were nine families, and the interquartile range was 6 to 11 families. Annual means were below the IQR in 2018 and 2019, and above the IQR in 2011.

Offshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from five families (2010, n=4 and 2013, n=1) to seven families (2019; Figure 4.4-2). The overall mean and median were six families, and the interquartile range was 5 to 7 families. Annual means for all years fell within the interquartile range.

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from 16 families (2011) to 19 families (2017; Figure 4.4-1). The overall mean and median were 18 families, and the interquartile range was 16 to 19 families. Annual means for all years fell within the interquartile range.

Offshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from six families (2011) to seven families (2014 and 2017; Figure 4.4-2). The overall mean and median were six families, and the interquartile range was less than 6 to 7 families. Annual means for all years fell within the interquartile range.

Stephens Lake - South

Nearshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from six families (2015) to 12 families (2018; Figure 4.4-1). The overall mean was nine families, the overall median was eight families, and the interquartile range was 6 to less than12 families. Annual means were below the IQR in 2015, and above the IQR in 2018.

Offshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from four families (2012 and 2015) to five families (2018; Figure 4.4-2). The overall mean and median were four families, and the interquartile range was 4 to 5 families. Annual means for all years fell within the interquartile range.

Stephens Lake - North

Nearshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from six families (2015) to 13 families (2012; Figure 4.4-1). The overall mean and median were nine families, and the interquartile range was 7 to less than 13 families. Annual means were below the IQR in 2015, and above the IQR in 2012.

Offshore Habitat

Annual mean total taxa richness over the three years of monitoring ranged from three families (2015) to five families (2012; Figure 4.4-2). The overall mean and median were four families, and the interquartile range was 3 to less than 5 families. Annual means were within the IQR, except in 2012 (above).

Limestone Forebay

Nearshore Habitat

Annual mean total taxa richness over the four years of monitoring ranged from six families (2010) to 17 families (2013; Figure 4.4-1). The overall mean was 12 families, the overall median was 13 families, and the interquartile range was 8 to 16 families. Annual means were below the IQR in 2010, and above the IQR in 2013.

Offshore Habitat

Annual mean total taxa richness over the four years of monitoring ranged from eight families (2016) to 12 families (2019; Figure 4.4-2). The overall mean and median were ten families, and the interquartile range was 8 to 11 families. Annual means were within the IQR, except in 2019 (above).

4.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from 13 families (2015) to 24 families (2012; Figure 4.4-1). The overall mean and median were 20 families, and the interquartile range was 17 to 23 families. Annual means were below the IQR in 2015 and 2018, and above the IQR in 2012.

Offshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from four families (2014 and 2016) to ten families (2013; Figure 4.4-2). The overall mean and median were six families, and the interquartile range was 4 to 8 families. Annual means were above the IQR in 2013 and 2018.

Hayes River

Nearshore Habitat

Annual mean total taxa richness over the ten years of monitoring ranged from eight families (2010) to 24 families (2017; Figure 4.4-1). The overall mean and median were 17 families, and the interquartile range was 13 to 23 families. Annual means were below the IQR in 2010, and above the IQR in 2017.

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

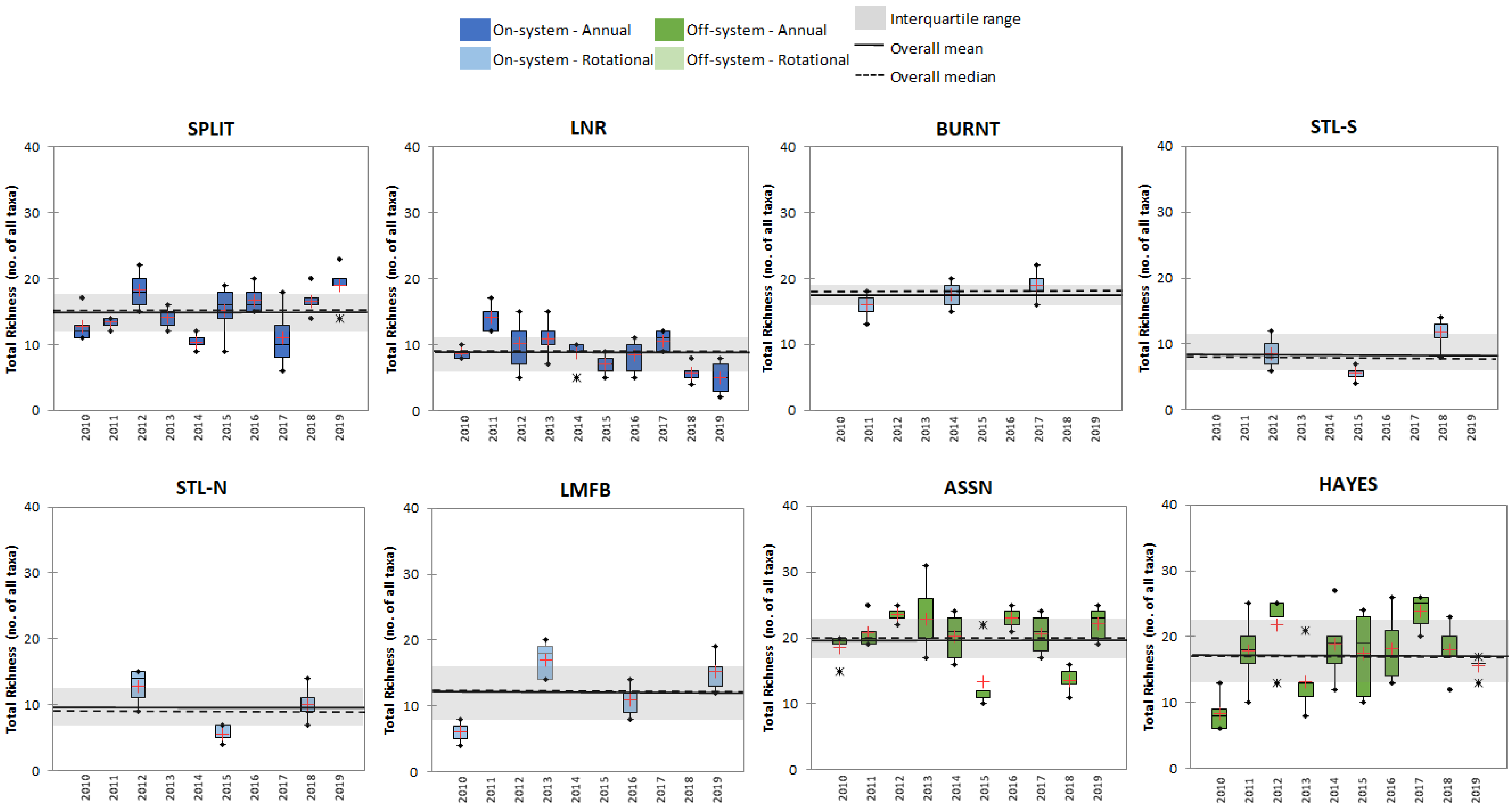


Figure 4.4-1. 2010 to 2019 Nearshore benthic invertebrate total richness (family-level).

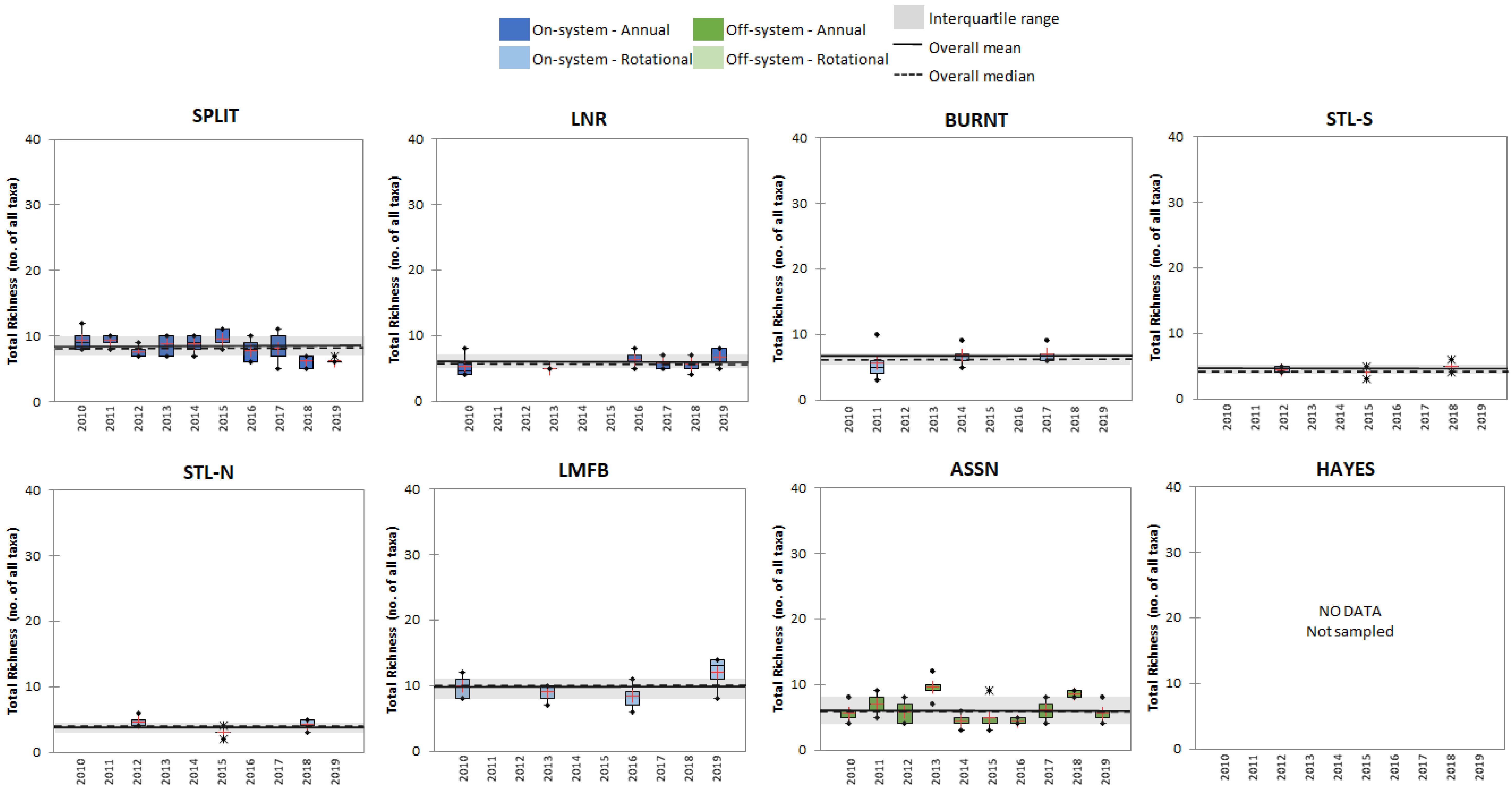


Figure 4.4-2. 2010 to 2019 Offshore benthic invertebrate total richness (family-level; LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

4.4.2 EPT TAXA RICHNESS

4.4.2.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from two families (2014) to seven families (2016; Figure 4.4-3). The overall mean and median were five families, and the interquartile range was 4 to 7 families. Annual means were below the IQR in 2014, and above the IQR in 2016.

Offshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from two families (2010, 2012, 2013 to 2016, 2018 and 2019) to four families (2017; Figure 4.4-4). The overall mean and median were two families, and the interquartile range was 2 to 3 families. Annual means were below the IQR in 2010 and 2012, and above the IQR in 2011 and 2017.

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from zero families (2015 and 2019) to five families (2011; Figure 4.4-3). The overall mean and median were two families, and the interquartile range was 1 to 3 families. Annual means were below the IQR in 2015, 2018 and 2019, and above the IQR in 2011.

Offshore Habitat

Annual mean EPT taxa richness over the six years of monitoring ranged from zero families (2018) to one family (2010, n=4; 2013, n=1; 2016; 2017; and 2019; Figure 4.4-4). The overall mean and median were one family, and the interquartile range was 0 to 1 family. Annual means were within the IQR, except in 2010 (above).

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from four families (2011 and 2014) to seven families (2017; Figure 4.4-3). The overall mean and median were five families, and the interquartile range was 4 to 6 families. Annual means were within the IQR, except in 2017 (above).

Offshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from two families (2011 and 2014) to three families (2017; Figure 4.4-4). The overall mean was two families, the overall median was three families, and the interquartile range was 2 to 3 families. Annual means for all years fell within the interquartile range.

Stephens Lake - South

Nearshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from three families (2012 and 2015) to four families (2018; Figure 4.4-3). The overall mean and median were three families, and the interquartile range was three. Annual means were below the IQR in 2015, and above the IQR in 2018.

Offshore Habitat

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

Stephens Lake - North

Nearshore Habitat

Annual mean EPT taxa richness over the three years of monitoring ranged from zero families (2015) to five families (2012; Figure 4.4-3). The overall mean and median were three families, and the interquartile range was zero to less than 5 families. Annual means were within the IQR, except in 2012 (above).

Offshore Habitat

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

Limestone Forebay

Nearshore Habitat

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

Offshore Habitat

Annual mean EPT taxa richness over the four years of monitoring was three families (2010, 2013, 2016 and 2019; Figure 4.4-4). The overall mean and median were three families, and the interquartile range was 2 to 3 families. Annual means for all years fell within the interquartile range.

4.4.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from three families (2015) to nine families (2012, 2013, 2016 and 2019; Figure 4.4-3). The overall mean and median were eight families, and the interquartile range was 6 to 9 families. Annual means were below the IQR in 2015 and 2018, and above the IQR in 2013, 2016 and 2019.

Offshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from one family (2012 and 2014 to 2016) to three families (2011 and 2013; Figure 4.4-4). The overall mean and median were two families, and the interquartile range was 1 to 2 families. Annual means were above the IQR in 2011 and 2013.

Hayes River

Nearshore Habitat

Annual mean EPT taxa richness over the ten years of monitoring ranged from four families (2010) to 12 families (2012; Figure 4.4-3). The overall mean and median were eight families, and the interquartile range was 5 to 11 families. Annual means were below the IQR in 2010, and above the IQR in 2012 and 2017.

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

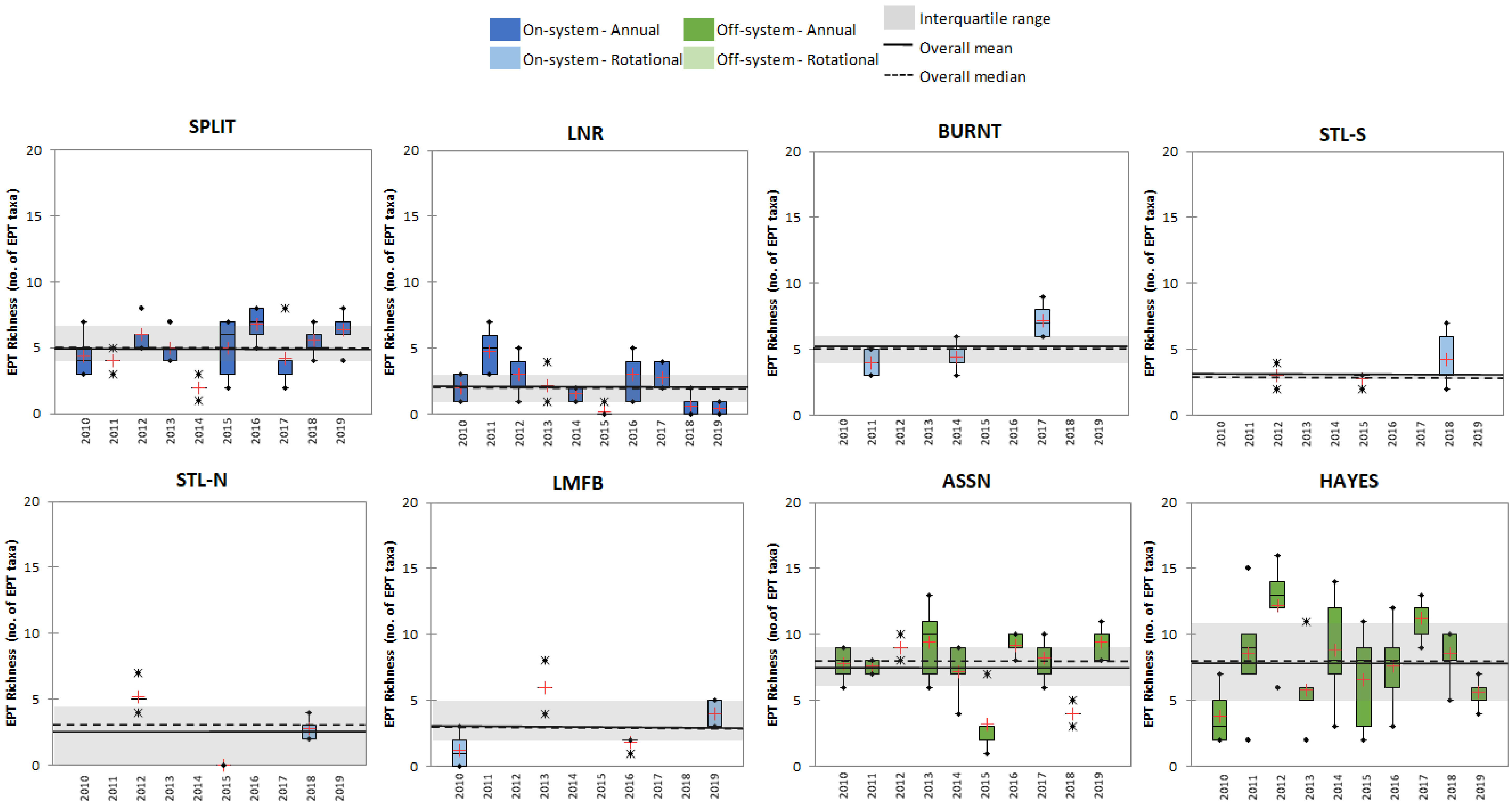


Figure 4.4-3. 2010 to 2019 Nearshore benthic invertebrate EPT richness (family-level).

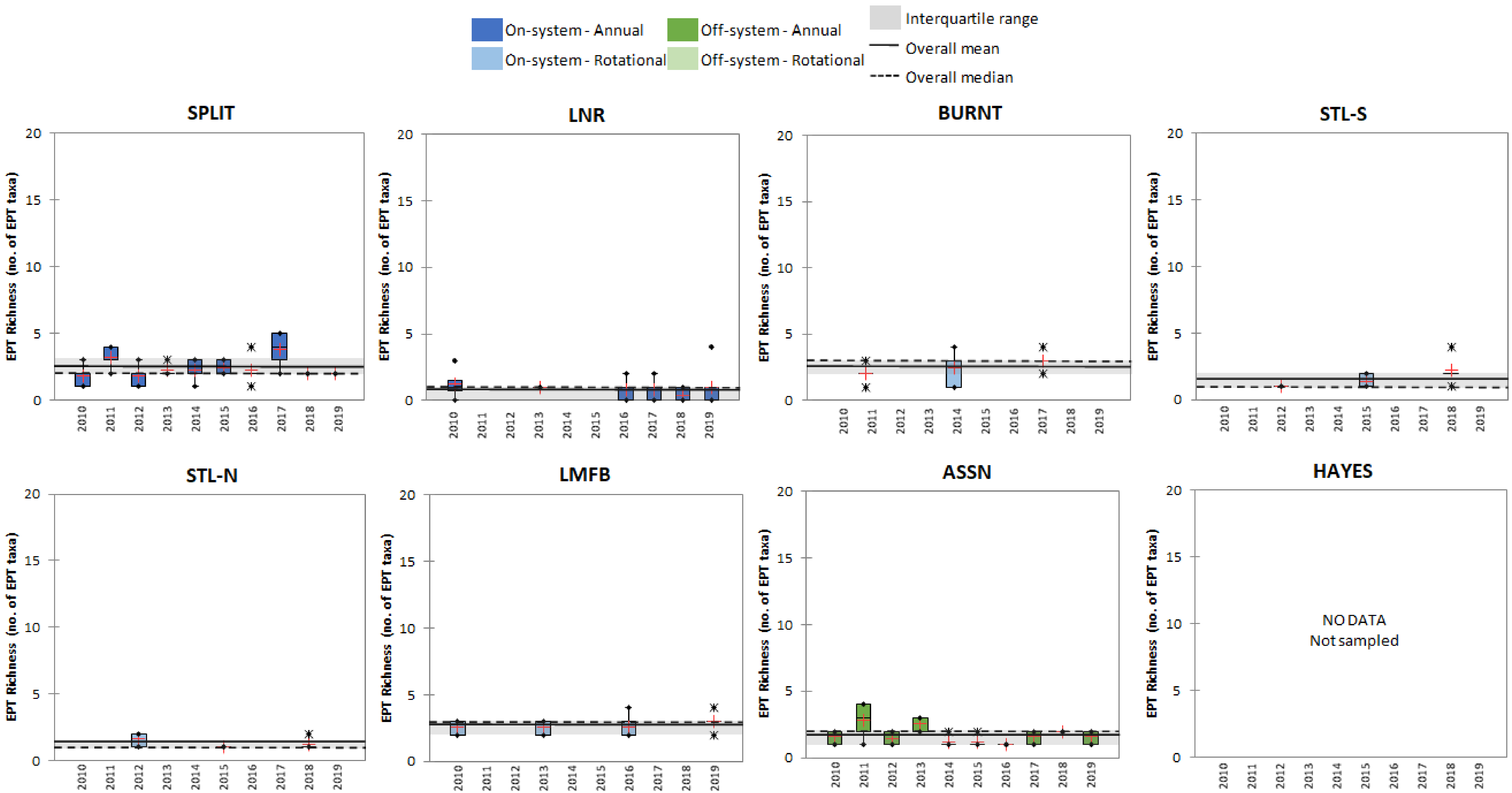


Figure 4.4-4. 2010 to 2019 Offshore benthic invertebrate EPT richness (family-level; LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

4.5 DIVERSITY

4.5.1 HILL'S EFFECTIVE RICHNESS

4.5.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Nearshore Habitat

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

Offshore Habitat

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

Lower Nelson River – downstream of Limestone GS

Nearshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from two (2015 and 2019) to six (2011; Figure 4.5-1). The overall mean was four, the overall median was three, and the interquartile range was 2 to 4. Annual means were below the IQR in 2015 and 2019, and above the IQR in 2011 and 2013.

Offshore Habitat

Annual mean Hill's index over the six years of monitoring ranged from three (2010, n=4, 2018, and 2019) to four (2013, n=1, 2016, and 2017; Figure 4.5-2). The overall mean and median were three, and the interquartile range was less than 3 to less than 4. Annual means were within the IQR, except in 2013 and 2017 (above).

ROTATIONAL SITES

Burntwood River

Nearshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from five (2011 and 2014) to six (2017; Figure 4.5-1). The overall mean and median were five, and the interquartile range was 4 to 6. Annual means for all years fell within the interquartile range.

Offshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from three (2014 and 2017) to four (2011; Figure 4.5-2). The overall mean and median were three, and the interquartile range was less than 3 to 4. Annual means were within the IQR, except in 2011 (above).

Stephens Lake - South

Nearshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from two (2015) to five (2018; Figure 4.5-1). The overall mean and median were four, and the interquartile range was 2 to 5. Annual means were within the IQR, except in 2015 (below).

Offshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from two (2015 and 2018) to three (2012; Figure 4.5-2). The overall mean and median were two, and the interquartile range was 2 to 3. Annual means were within the IQR, except in 2012 (above).

Stephens Lake - North

Nearshore Habitat

Annual mean Hill's index over the three years of monitoring ranged from two (2012) to four (2015 and 2018); Figure 4.5-1). The overall mean and median were three, and the interquartile range was 2 to 4. Annual means were below the IQR in 2012, and above the IQR in 2018.

Offshore Habitat

Annual mean Hill's index over the three years of monitoring was three (2012, 2015 and 2018; Figure 4.5-2). The overall mean and median were three, and the interquartile range was within three. Annual means for all years fell within the interquartile range.

Limestone Forebay

Nearshore Habitat

Annual mean Hill's index over the four years of monitoring ranged from three (2010 and 2016) to six (2013; Figure 4.5-1). The overall mean and median were four, and the interquartile range was less than 3 to 6. Annual means were within the IQR, except in 2013 (above).

Offshore Habitat

Annual mean Hill's index over the four years of monitoring ranged from six (2010, 2013 and 2016) to seven (2019; Figure 4.5-2). The overall mean and median were six, and the interquartile range was 5 to 8. Annual means for all years fell within the interquartile range.

4.5.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Nearshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from three (2018) to 10 (2016; Figure 4.5-2). The overall mean and median were six, and the interquartile range was 5 to 8. Annual means were below the IQR in 2015 and 2018, and above the IQR in 2016 and 2019.

Offshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from three (2012, 2014 and 2016) to four (2011, 2013, 2015 and 2017 to 2019; Figure 4.5-2). The overall mean was four, the overall median was three, and the interquartile range was less than 3 to 4. Annual means were below the IQR in 2012 and 2016, and above the IQR in 2011.

Hayes River

Nearshore Habitat

Annual mean Hill's index over the ten years of monitoring ranged from two (2010) to eight (2017; Figure 4.5-1). The overall mean was six, the overall median was five, and the interquartile range was less than 4 to more than 7. Annual means were below the IQR in 2010 and 2013, and above the IQR in 2012 and 2017.

Offshore Habitat

Not sampled due to hard/scoured substrate and/or high-water velocity.

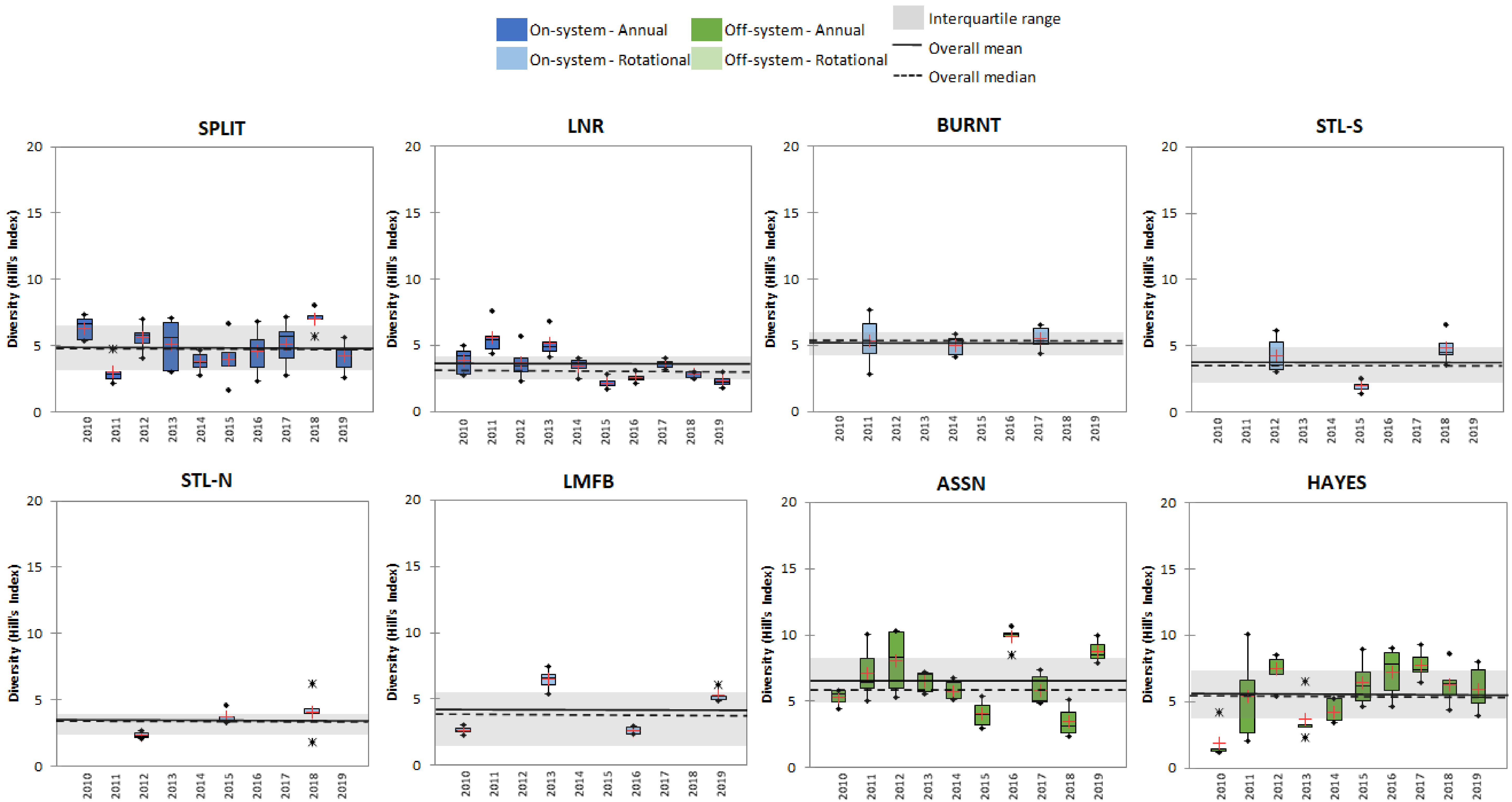


Figure 4.5-1. 2010 to 2019 Nearshore benthic invertebrate diversity (Hill's Index to family-level).

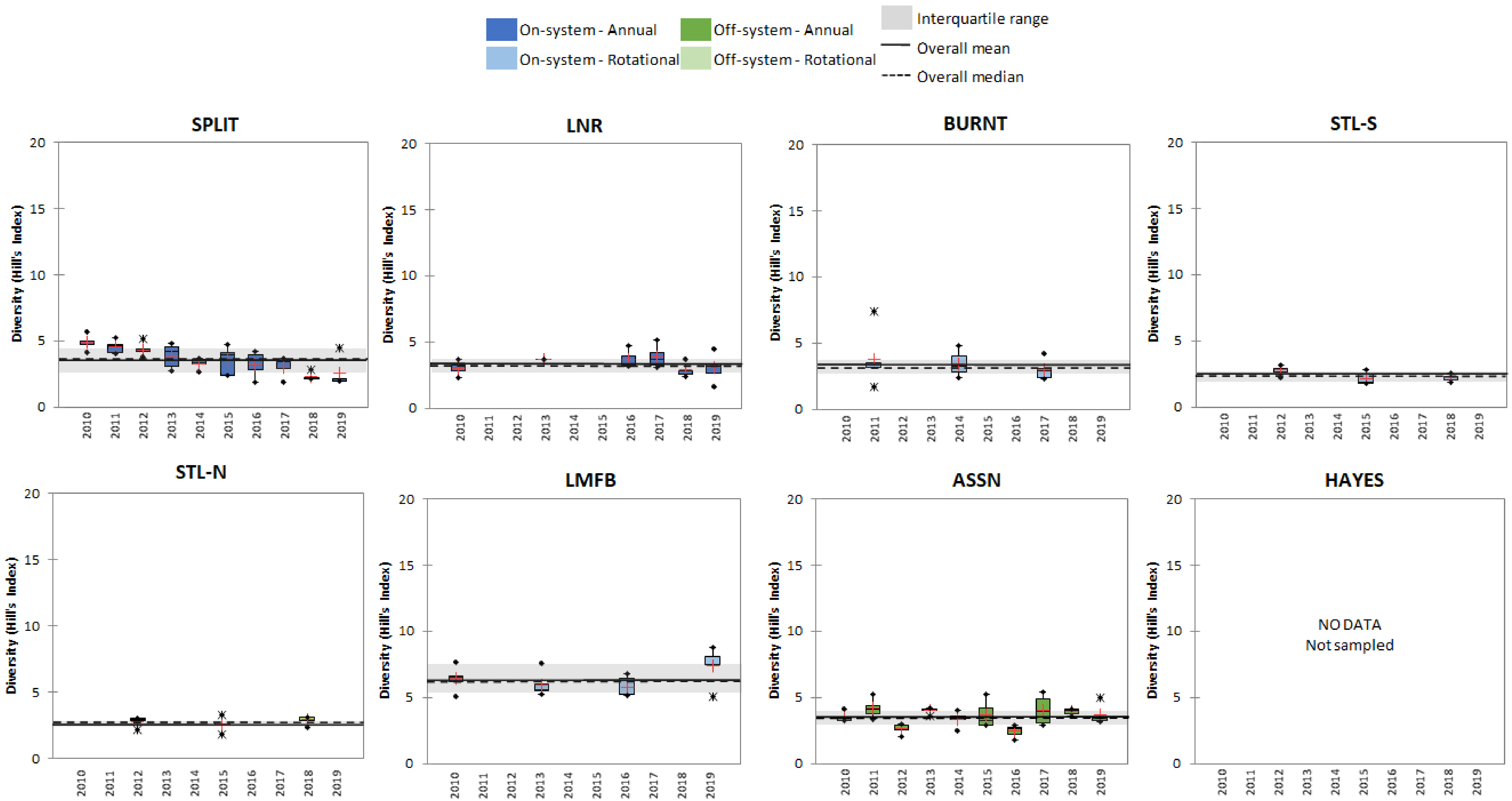


Figure 4.5-2. 2010 to 2019 Offshore benthic invertebrate diversity (Hill's Index to family-level; LNR 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

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

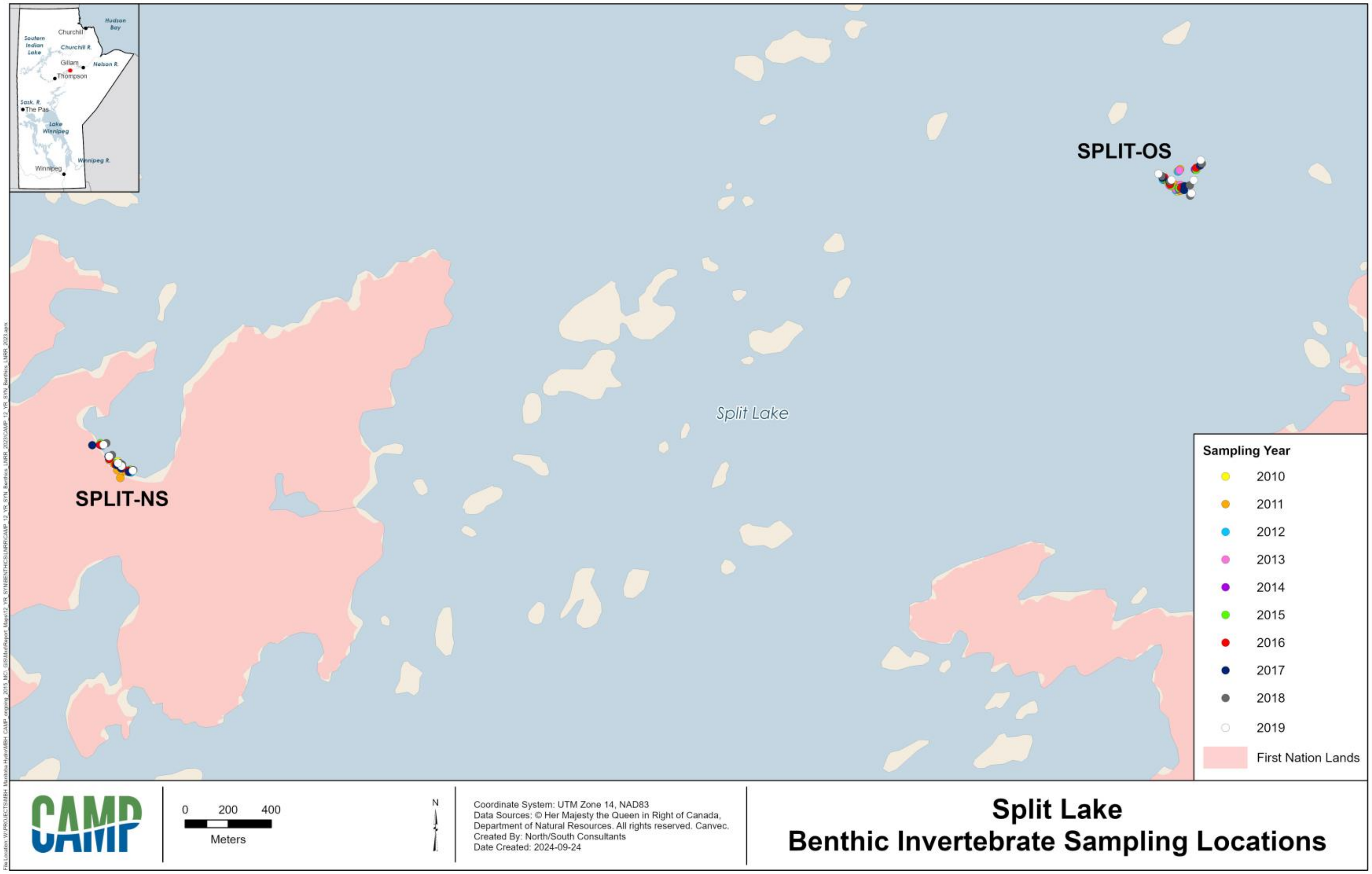


Figure A4-1-1. 2010 to 2019 Split Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

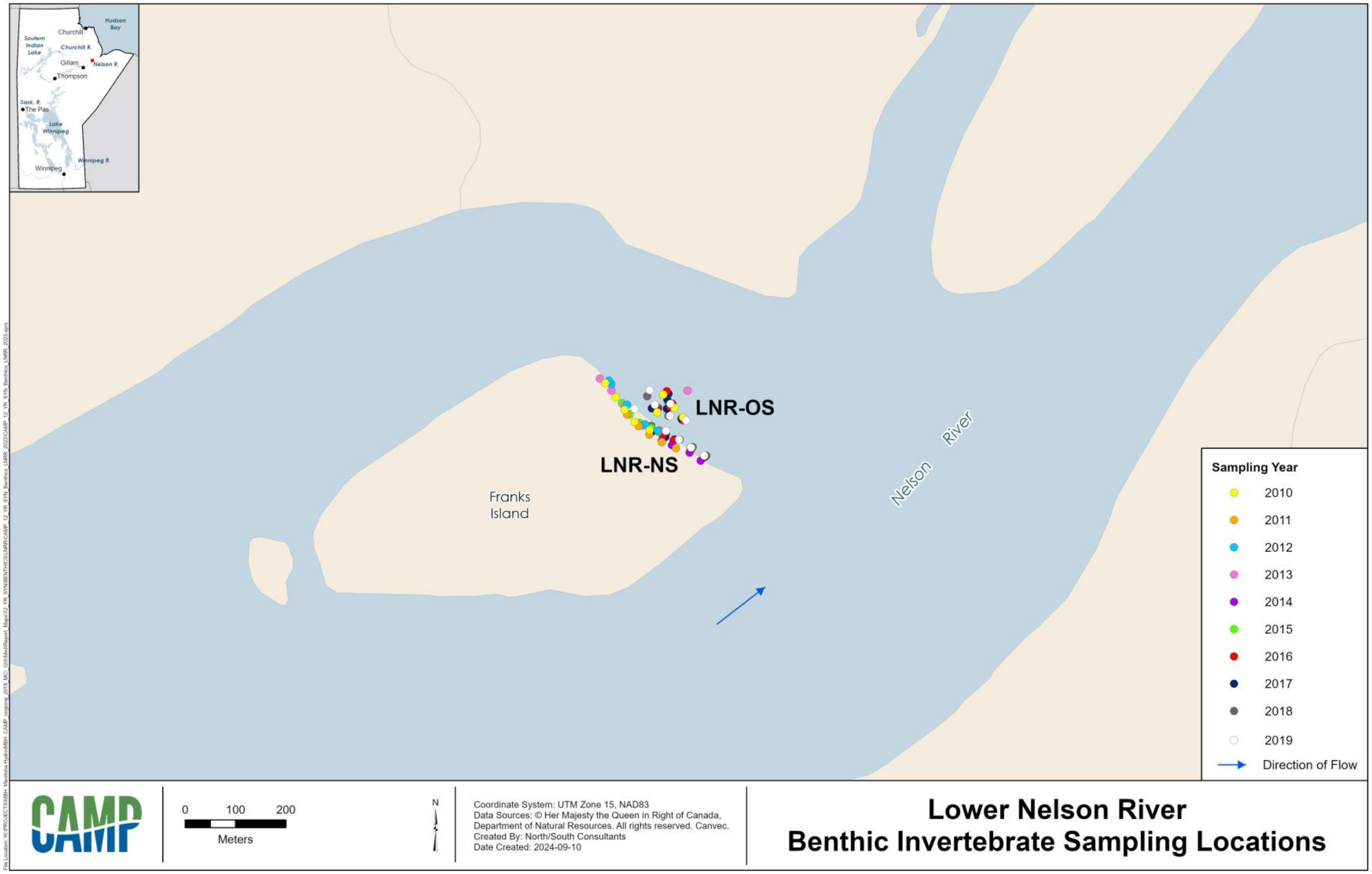


Figure A4-1-2. 2010 to 2019 Lower Nelson River – downstream of Limestone GS nearshore (NS) and offshore (OS) benthic invertebrate sampling sites (LNR OS 2010 n=4, 2011, 2012, and 2014 n=0, and 2013 n=1).

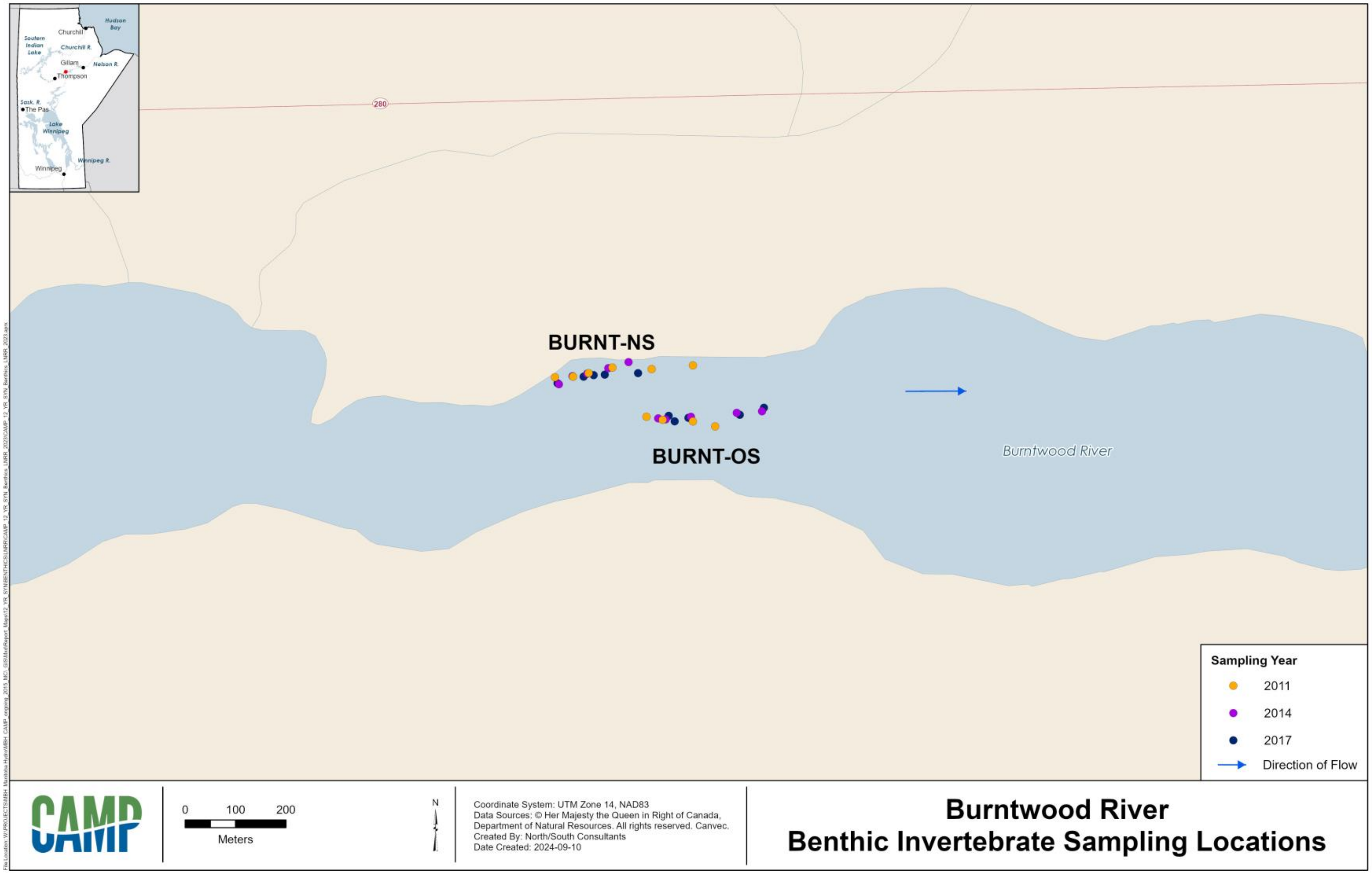


Figure A4-1-3. 2010 to 2019 Burntwood River nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

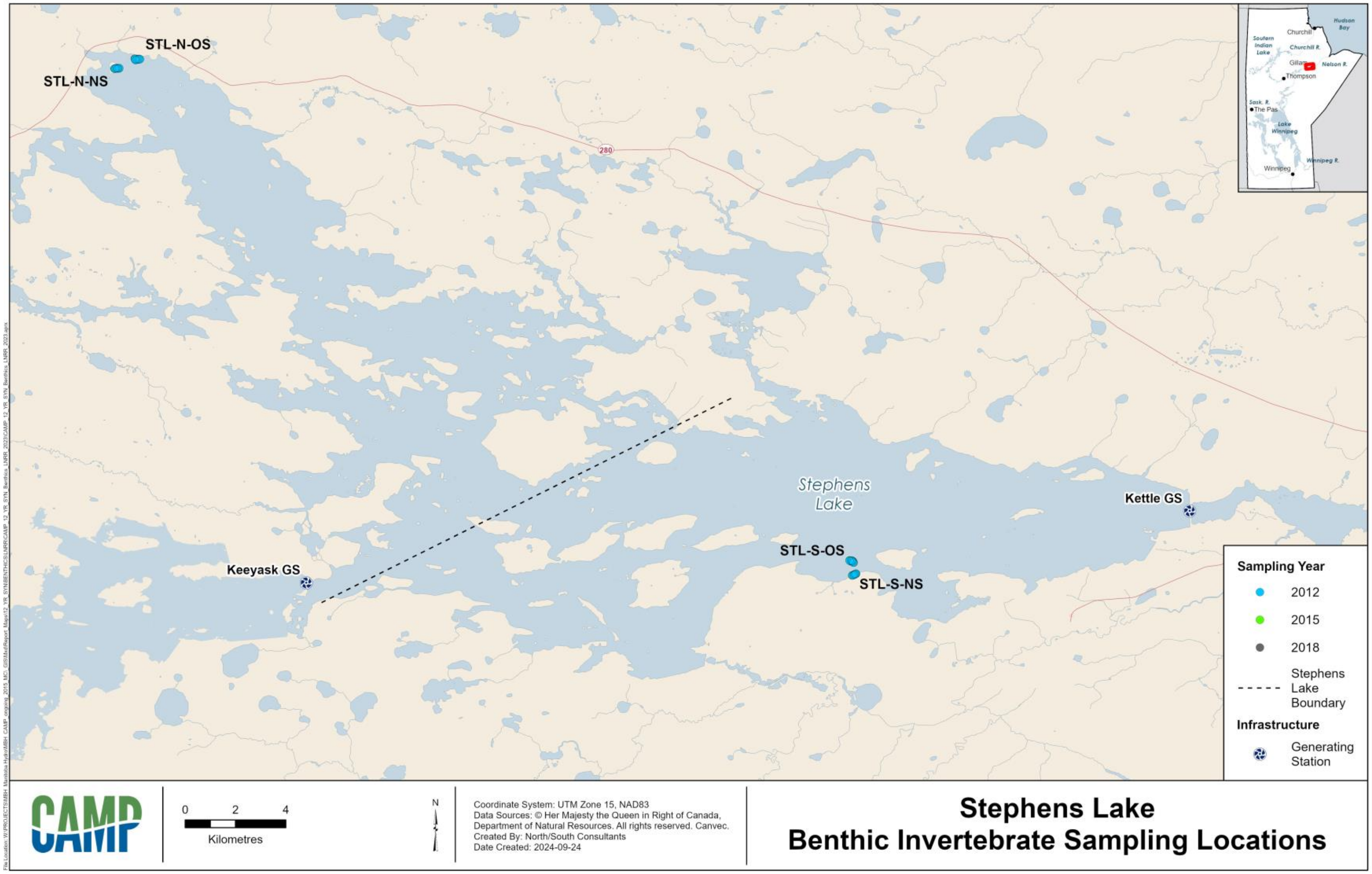


Figure A4-1-4. 2010 to 2019 Stephens Lake – South and North nearshore (NS) and offshore (OS) benthic invertebrate sampling sites - overview.

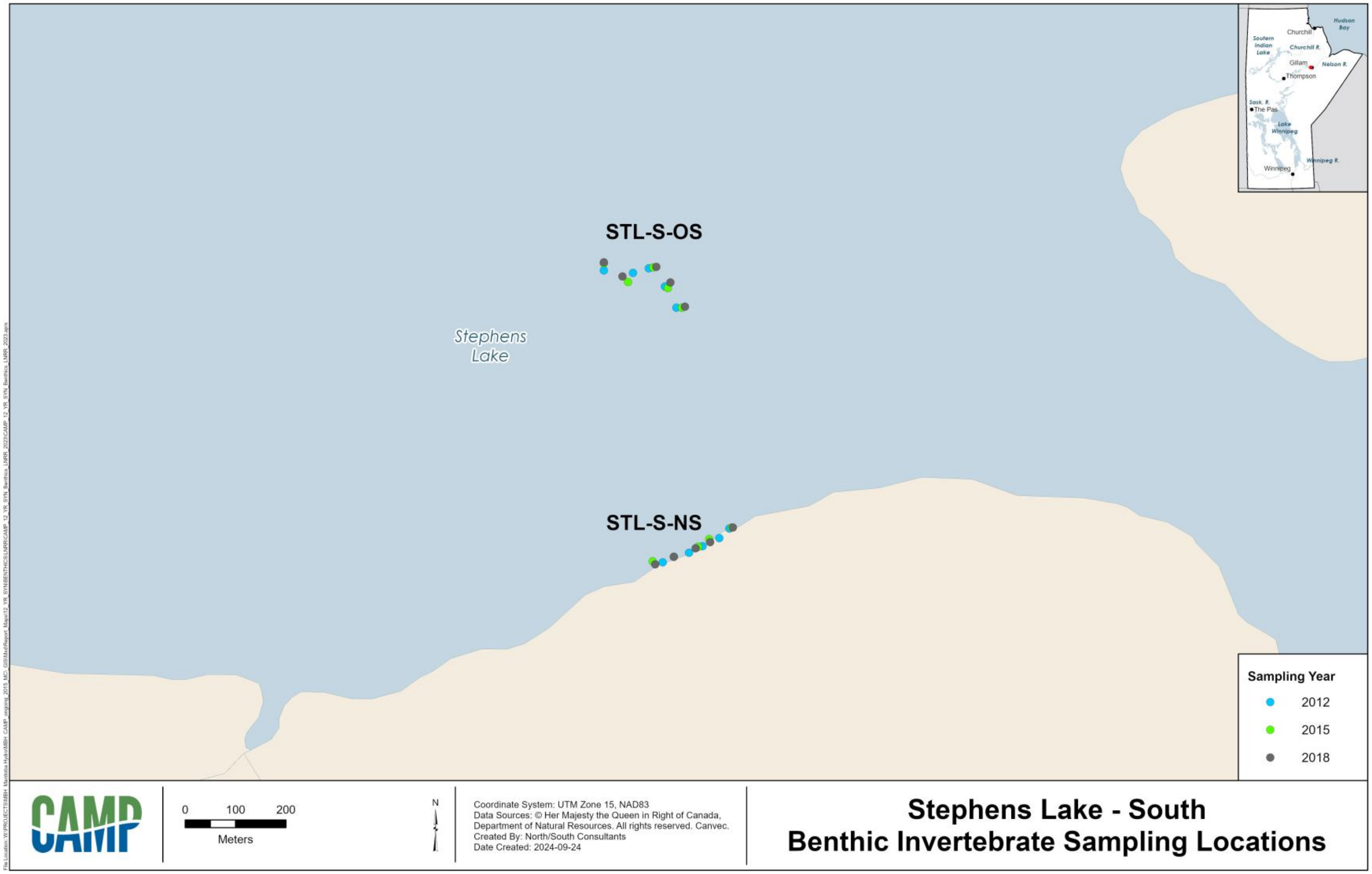


Figure A4-1-5. 2010 to 2019 Stephens Lake - South nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

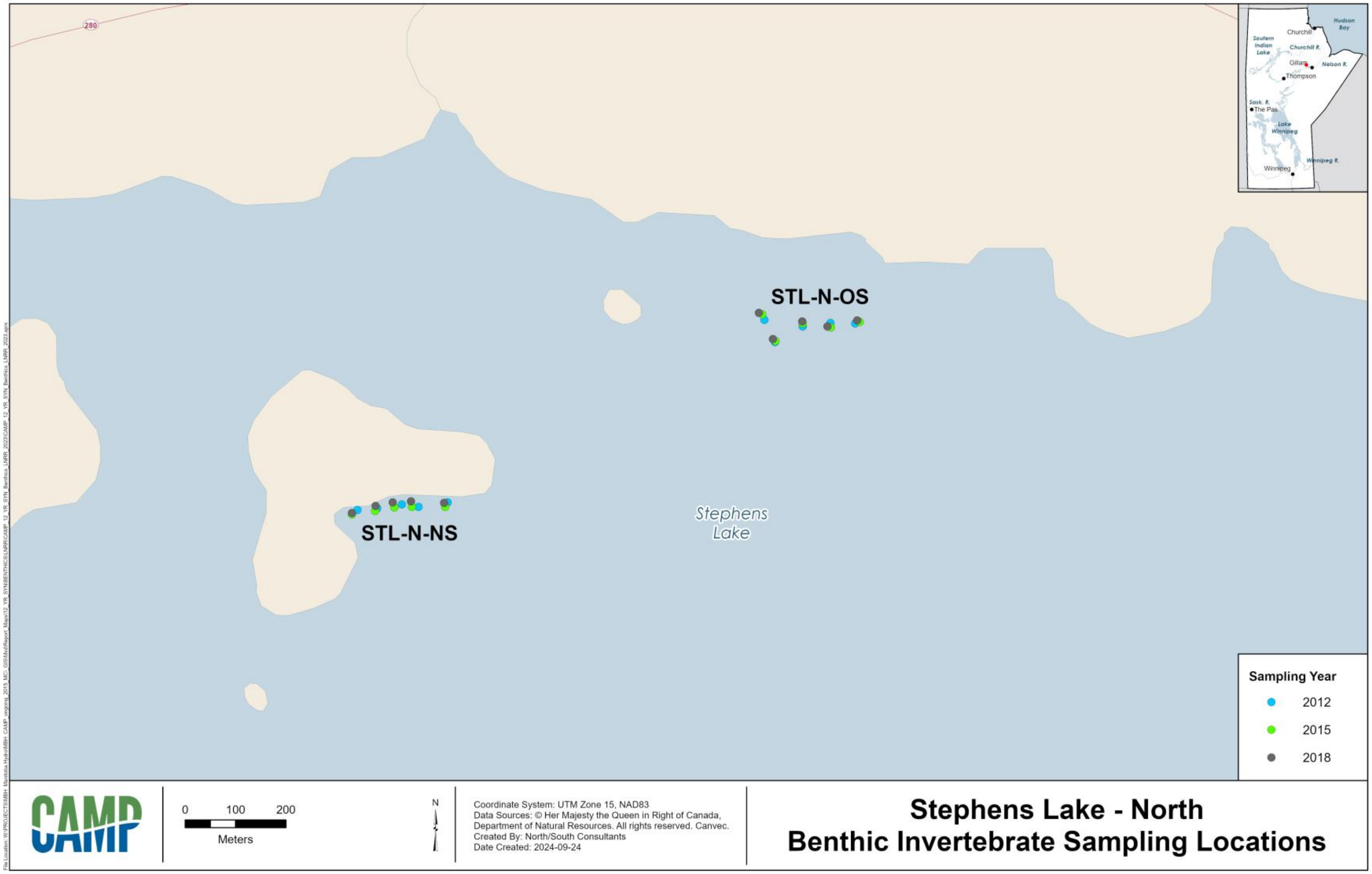


Figure A4-1-6. 2010 to 2019 Stephens Lake - North nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

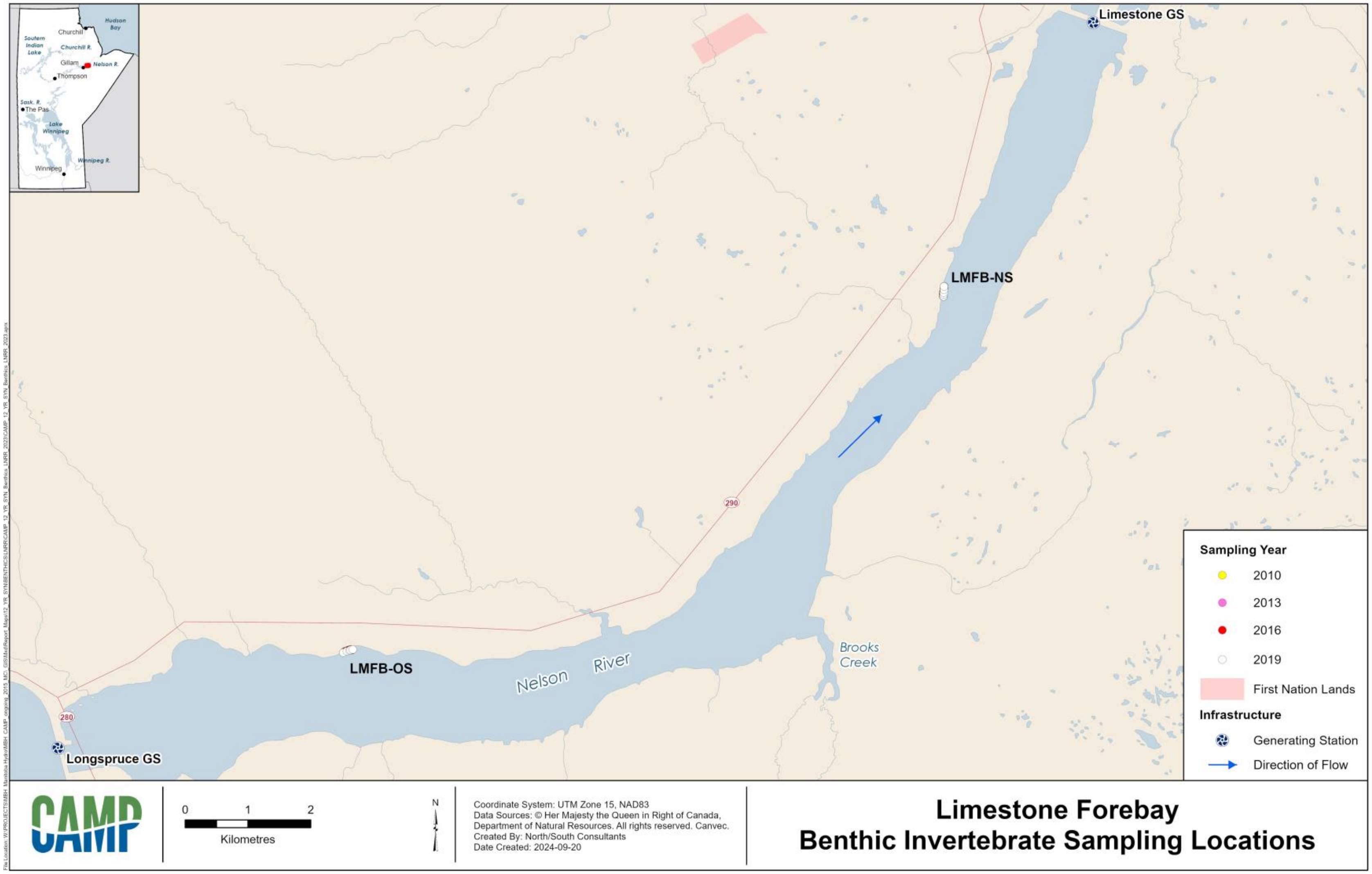


Figure A4-1-7. 2010 to 2019 Limestone Forebay nearshore (NS) and offshore (OS) benthic invertebrate sampling sites - overview.

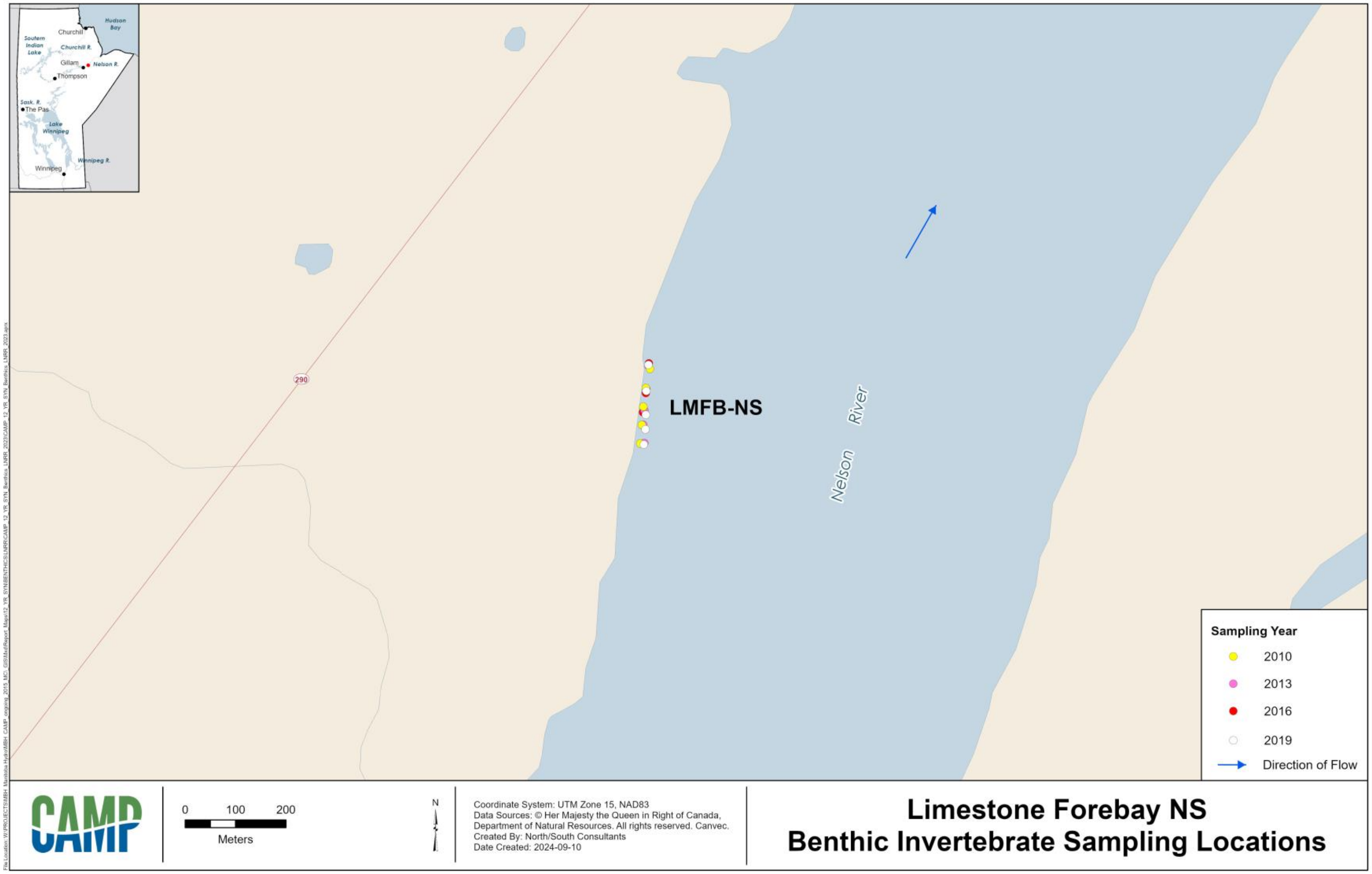


Figure A4-1-8. 2010 to 2019 Limestone Forebay nearshore (NS) benthic invertebrate sampling sites.

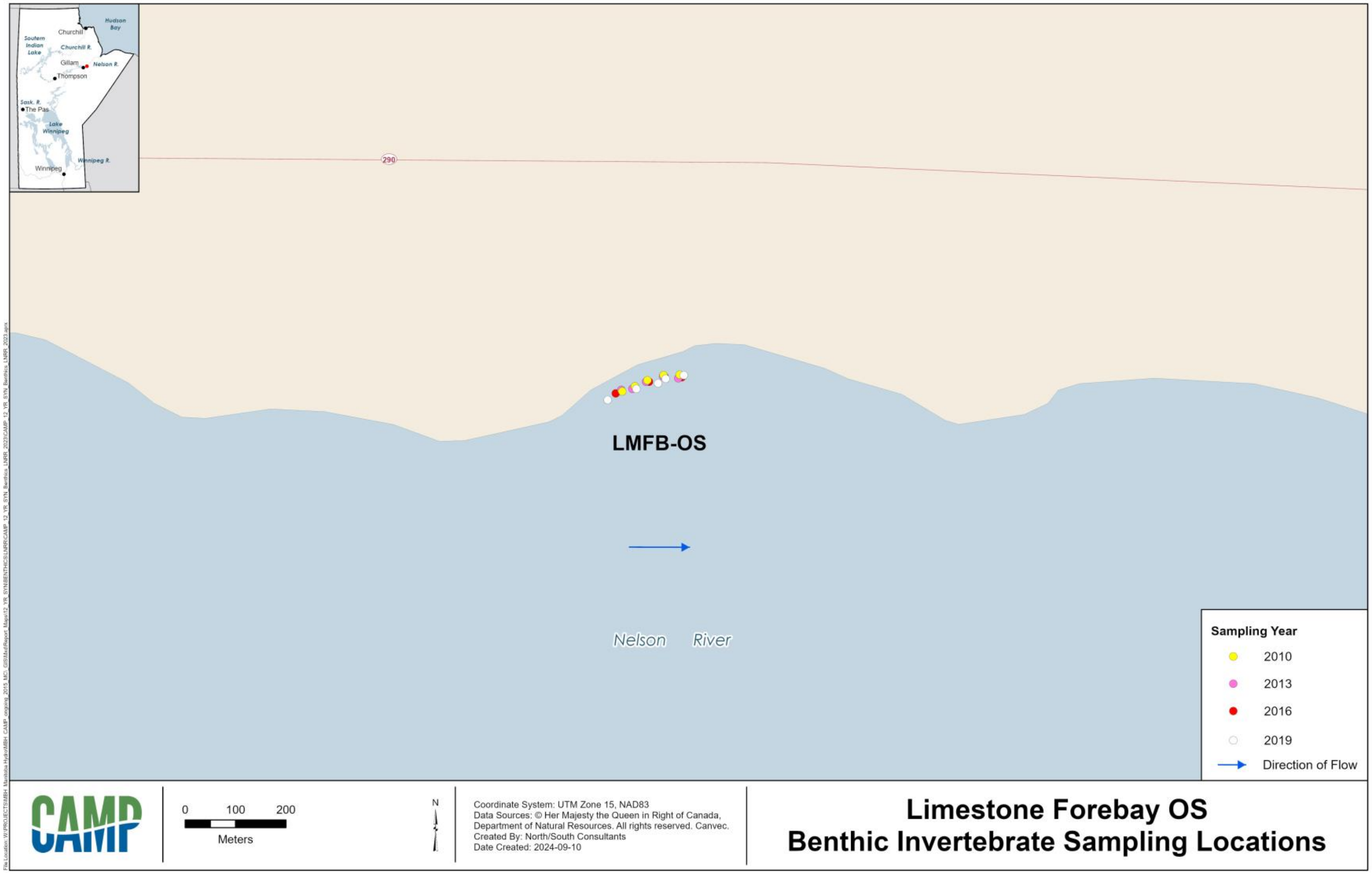


Figure A4-1-9. 2010 to 2019 Limestone Forebay offshore (OS) benthic invertebrate sampling sites.

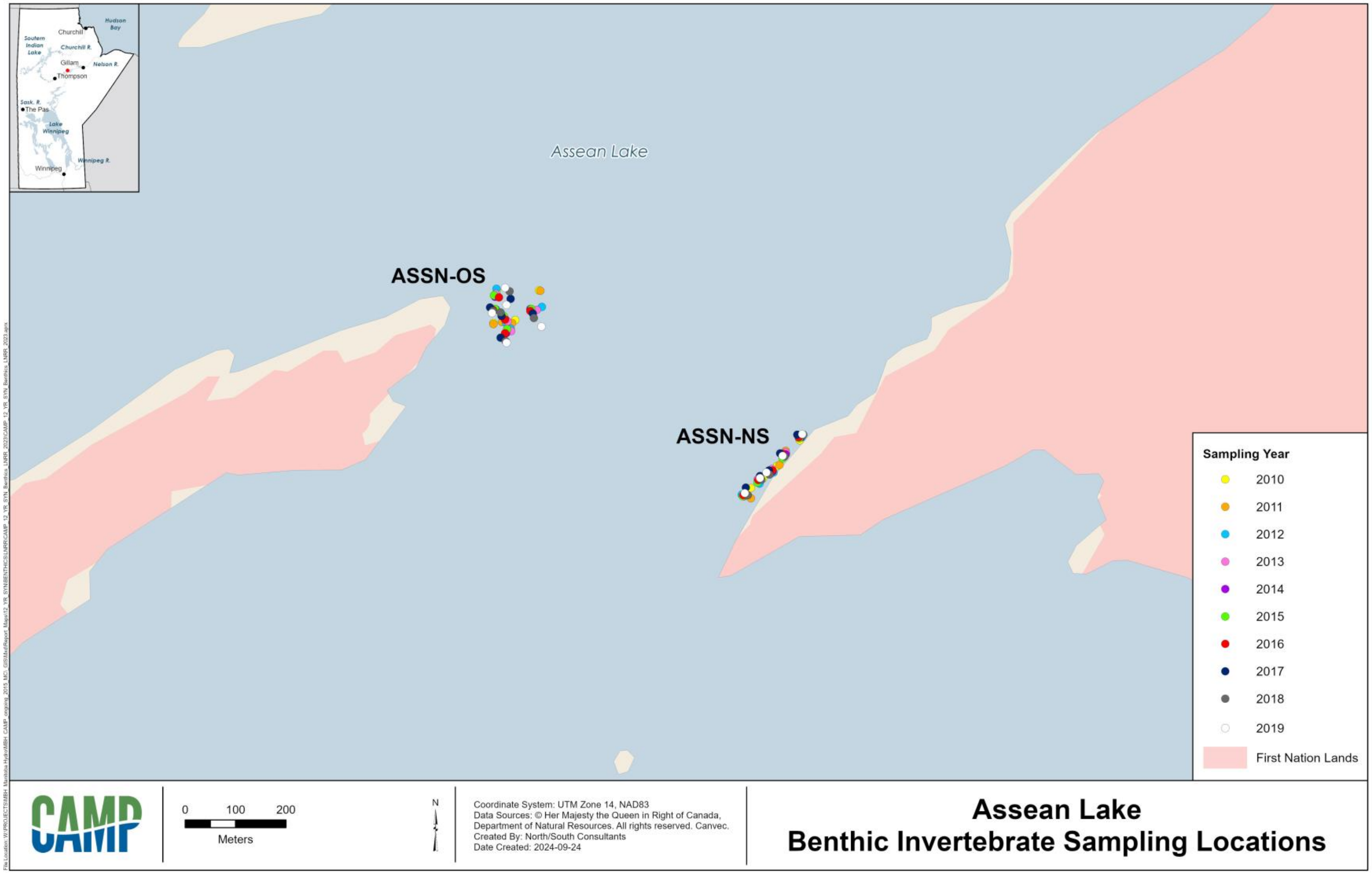


Figure A4-1-10. 2010 to 2019 Assean Lake nearshore (NS) and offshore (OS) benthic invertebrate sampling sites.

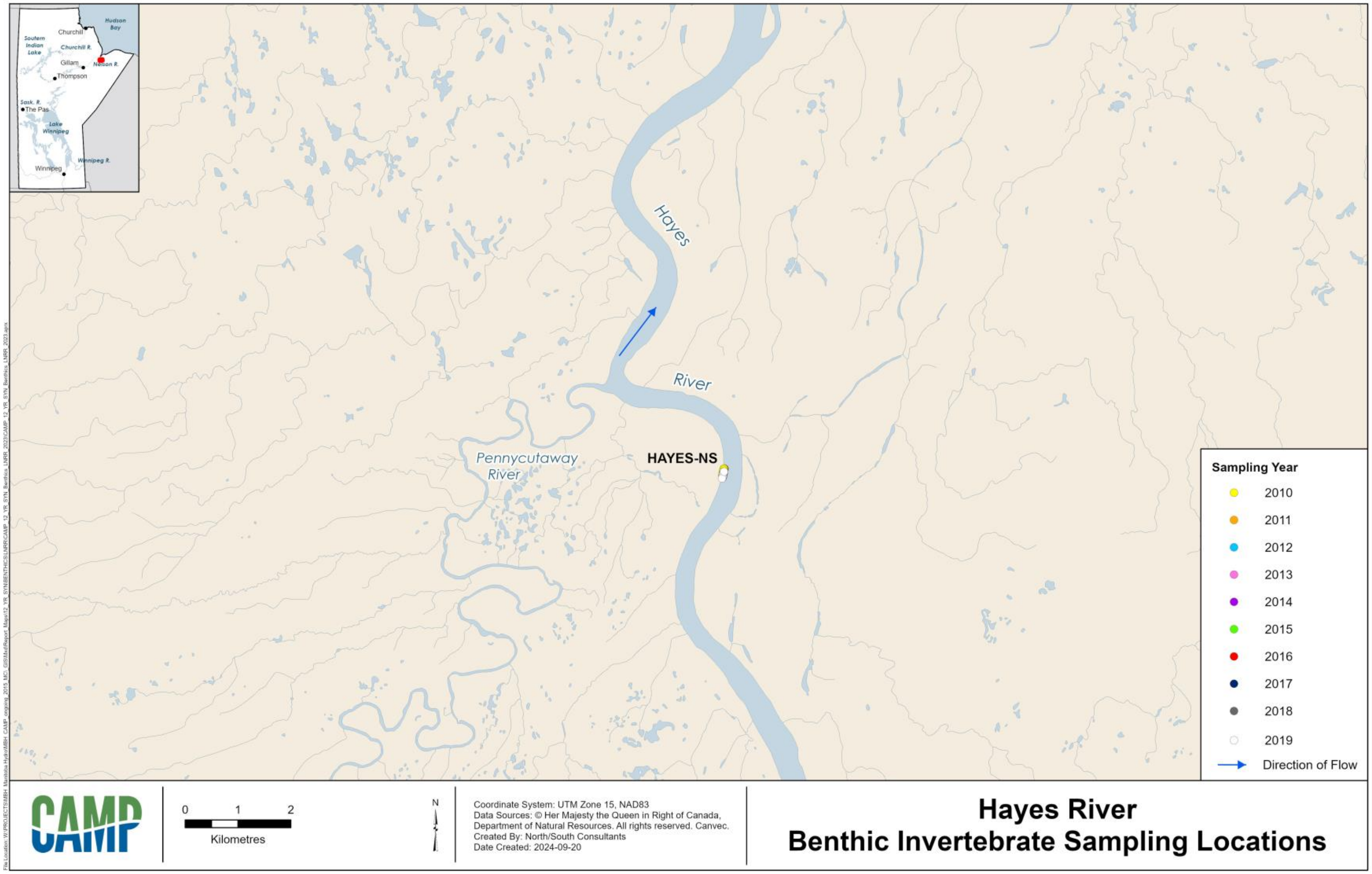


Figure A4-1-11. 2010 to 2019 Hayes River nearshore (NS) benthic invertebrate sampling sites - overview.

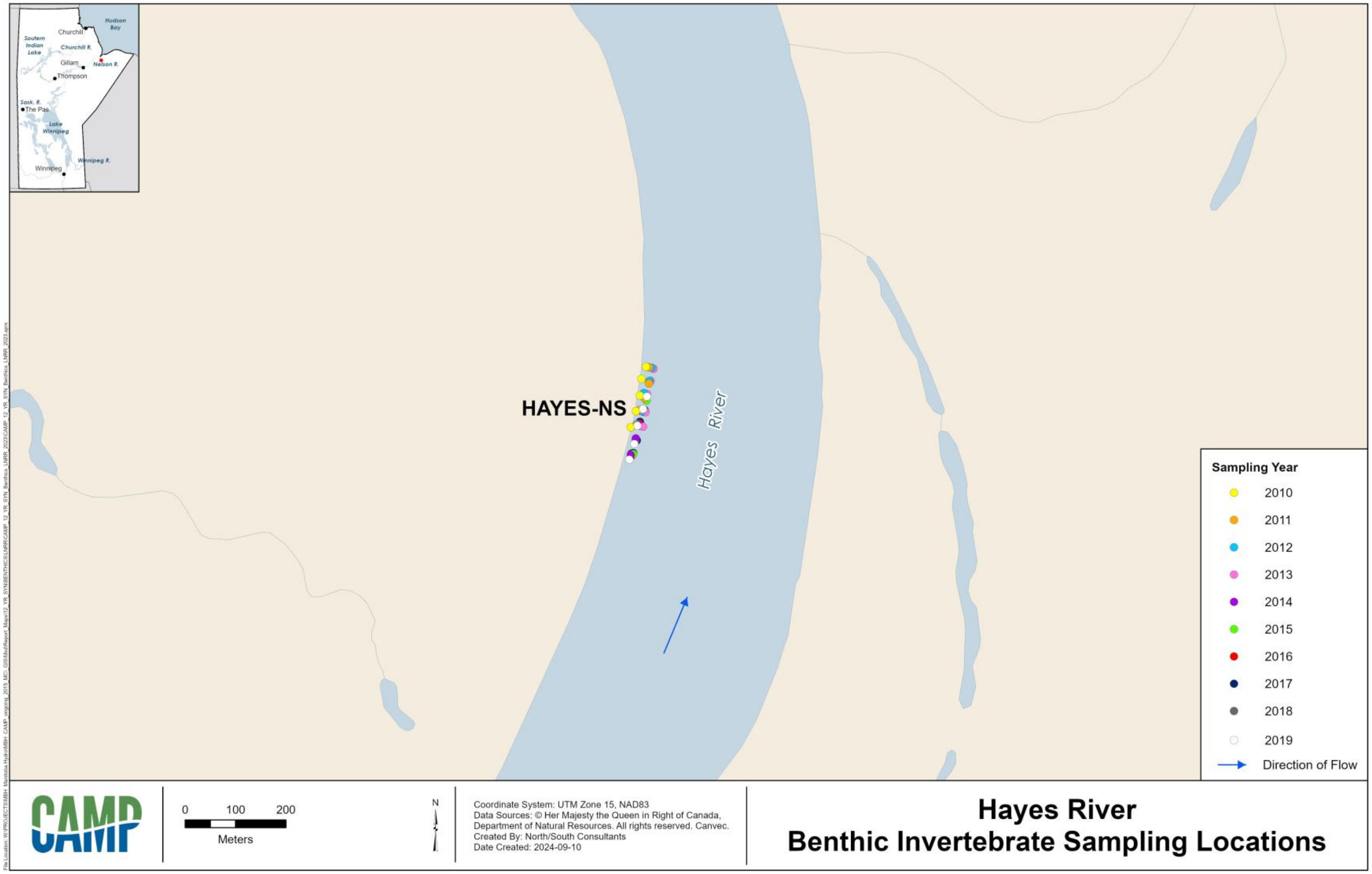


Figure A4-1-12. 2010 to 2019 Hayes River nearshore (NS) benthic invertebrate sampling sites.

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

Table A4-2-1. 2010 to 2019 Split 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	0.7	66.6	25.9	7.5	1.4	Sand
2011	fines and organics	1.0	52.4	17.4	30.2	0.7	Sandy clay loam
2012	organics and fines	0.6	26.2	50.6	23.2	5.8	Sandy loam
2013	fines	0.7	71.3	13.4	15.2	1.3	Sand
2014	fines	0.5	27.0	24.3	48.7	0.7	Clay
2015	fines	0.6	79.2	8.1	12.7	1.2	Sand
2016	fines	0.6	41.3	30.1	28.5	0.7	Sand
2017	fines	0.7	63.7	11.3	25.1	0.8	Sandy clay
2018	fines and organics	0.5	26.2	59.9	19.1	9.3	Silt loam
2019	fines and organics	0.3	66.6	23.9	9.5	5.1	Sandy loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-2. 2010 to 2019 Split 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	6.9	4.4	62.9	32.7	1.3	Silty clay loam
2011	fines	8.4	15.6	56.9	27.5	1.3	Silt loam/Silty clay loam
2012	fines	6.1	20.2	74.0	5.8	1.3	Silt loam
2013	fines	7.3	18.6	61.4	20.0	1.1	Silt loam
2014	fines	7.8	18.5	53.4	28.0	1.3	Silty clay loam
2015	fines	5.9	16.2	65.8	18.0	1.3	Silt loam
2016	fines	7.0	13.2	56.0	30.7	2.1	Silt loam/ Silty clay loam
2017	fines	7.2	15.0	64.9	20.1	2.1	Silt loam
2018	fines and organics	6.5	16.3	74.9	8.9	1.8	Silt loam
2019	fines and organics	6.9	22.9	71.3	5.8	1.7	Silt loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-3. 2010 to 2019 Lower Nelson River – downstream of Limestone GS 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	0.3	72.9	18.2	8.9	0.7	Sandy loam
2011	fines and coarse	1.0	81.1	13.2	5.7	0.7	Sand
2012	fines	0.5	86.6	10.0	3.5	0.4	Loamy sand
2013	fines	0.8	67.1	23.3	9.6	0.7	Sandy loam
2014	fines and coarse	1.0	93.9	4.6	1.5	0.4	Sand
2015	fines	0.3	69.9	22.4	7.7	0.5	Sandy loam
2016	fines	0.5	95.0	3.2	1.8	1.2	Sand
2017	fines	0.8	86.6	10.2	3.2	1.2	Sand
2018	fines and coarse	0.3	91.1	6.1	2.9	1.3	Loamy sand
2019	fines and coarse	0.9	86.7	10.3	3.5	1.2	Sand / Loamy sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-4. 2010 to 2019 Lower Nelson River – downstream of Limestone GS 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 (n=4)	fines and coarse	4.4	93.1	5.7	1.2	0.4	Sand
2011 (n=0)	coarse, compact	--	--	--	--	--	--
2012 (n=0)	coarse, compact	--	--	--	--	--	--
2013 (n=1)	fines	5.4	96.7	2.2	1.2	0.1	Sand
2014 (n=0)	coarse, compact	--	--	--	--	--	--
2015 (n=0)	coarse, compact	--	--	--	--	--	--
2016	fines	3.7	92.3	6.4	1.7	1.6	Sand
2017	fines	3.9	90.0	7.4	2.6	1.7	Loamy sand
2018	fines and organics	2.2	86.0	10.3	3.8	1.7	Loamy sand
2019	fines and coarse	2.2	91.8	6.2	2.0	1.2	Sand

Notes:
1. TOC = Total organic carbon.

Table A4-2-5. 2010 to 2019 Burntwood 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		
2011	organic and fines	1.0	0.9	51.7	47.4	18.7	Silty clay
2014	fines and organics	0.6	0.1	51.5	48.4	21.2	Silty clay
2017	fines	0.7	2.6	75.5	22.9	4.2	Silt loam / Silty clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-6. 2010 to 2019 Burntwood 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		
2011	fines	9.0	4.4	62.5	33.0	1.7	Silty clay loam
2014	fines and organics	8.1	11.5	57.8	30.6	1.7	Silty clay loam
2017	fines	7.7	9.5	63.1	27.4	2.3	Silty loam

Notes:

1. TOC = Total organic carbon.

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

Year	Dominant Substrate	Sample Water Depth (m)	Supporting Substrate Analysis				
			Composition (mean %)			TOC (mean %)	Texture
			Sand	Silt	Clay		
2012	fines and coarse	0.4	93.8	5.2	1.0	0.4	Sand
2015	coarse and fines	0.6	88.4	3.7	7.9	0.3	Sand
2018	fines and coarse	0.4	47.9	20.0	32.1	0.8	Clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-8. 2010 to 2019 Stephens Lake - South 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	8.6	0.3	83.8	15.9	2.1	Silt loam
2015	fines	8.9	0.3	87.4	12.4	2.1	Silt loam
2018	fines	8.9	--	74.7	24.9	2.8	Silt loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-9. 2010 to 2019 Stephens Lake - North 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	0.5	79.8	14.3	5.9	1.4	Sandy loam
2015	fines and coarse	0.6	24.9	49.0	26.2	0.4	Silt loam
2018	fines and coarse	0.4	42.2	32.9	24.9	1.6	Silty clay loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-10. 2010 to 2019 Stephens Lake - North 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	9.0	1.0	51.4	47.7	1.2	Silty clay
2015	fines	8.5	5.3	57.1	37.7	0.8	Silty clay loam
2018	fines	9.0	1.9	52.6	46.4	1.5	Silty clay

Notes:

1. TOC = Total organic carbon.

Table A4-2-11. 2010 to 2019 Limestone Forebay 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	0.5	62.9	23.8	13.3	0.2	Sandy loam
2013	coarse	0.8	44.8	38.0	17.1	0.6	Loam
2016	coarse	0.5	75.8	14.2	9.9	1.6	Sand
2019	fines and coarse	0.3	63.3	22.7	14.0	1.6	Sandy loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-12. 2010 to 2019 Limestone Forebay 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	7.0	16.4	66.5	17.1	1.1	Silt loam
2013	fines	7.3	18.6	64.1	17.2	0.9	Silt loam
2016	fines	7.6	16.1	67.7	16.3	2.8	Silt loam
2019	fines and coarse	6.0	24.0	65.0	11.0	2.3	Silt loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-13. 2010 to 2019 Assean 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	0.8	88.9	8.4	2.7	0.8	Sand
2011	coarse and hard	0.7	87.7	9.4	3.0	2.0	Sand
2012	hard and coarse	no sample	--	--	--	--	--
2013	coarse	no sample	--	--	--	--	--
2014	hard and coarse	no sample	--	--	--	--	--
2015	hard	no sample	--	--	--	--	--
2016	coarse	no sample	--	--	--	--	--
2017	hard	no sample	--	--	--	--	--
2018	hard and coarse	no sample	--	--	--	--	--
2019	hard, coarse, and fines	no sample	--	--	--	--	--

Notes:

1. TOC = Total organic carbon.

Table A4-2-14. 2010 to 2019 Assean 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	5.5	35.6	52.7	11.6	1.6	Loam
2011	fines	6.2	31.6	36.2	32.3	1.7	Clay loam
2012	fines	6.2	31.3	59.2	9.4	1.7	Silt loam
2013	fines	5.5	36.3	45.5	18.2	1.6	Sandy clay loam
2014	fines	6.4	28.9	39.0	32.1	1.6	Clay loam
2015	fines and coarse	6.8	27.5	54.6	17.9	1.6	Silt loam
2016	fines	6.1	22.2	57.1	20.7	2.2	Silt loam
2017	fines and organics	6.0	27.0	48.1	24.9	2.1	Silty clay loam
2018	fines and organics	6.2	42.8	37.7	19.5	1.9	Sandy clay loam
2019	fines, coarse, and organics	5.6	33.7	49.6	16.7	1.7	Loam

Notes:

1. TOC = Total organic carbon.

Table A4-2-15. 2010 to 2019 Hayes 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	fines and coarse	0.3	88.2	10.7	1.2	0.3	Loamy sand
2011	fines and coarse	1.0	84.0	14.2	1.8	0.3	Loamy sand
2012	coarse	0.5	81.2	15.4	4.2	0.3	Sand
2013	coarse	no sample	--	--	--	--	--
2014	coarse and fines	1.0	84.1	14.3	1.6	0.5	Sand
2015	fines and coarse	1.0	75.0	22.3	2.7	0.4	Sandy loam / Loamy sand
2016	coarse and fines	0.5	89.1	9.2	2.2	1.7	Sand
2017	fines and coarse	0.8	82.0	16.4	1.6	1.7	Sand
2018	fines and coarse	0.5	79.0	18.5	3.0	1.5	Loamy sand
2019	fines, coarse, and hard	1.0	75.0	22.1	2.8	1.9	Sand

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 Nelson River Region. Eight waterbodies were monitored in the Lower Nelson River Region: two on-system annual sites (Split Lake and the lower Nelson River downstream of the Limestone GS); four on-system rotational sites (the Burntwood River downstream of First Rapids, the Limestone Forebay, Stephens Lake - North, and Stephens Lake - South); and two off-system annual sites (Assean Lake and the Hayes River; Table 5.1-1 and Figure 5.1-1). There were no departures from the planned field sampling during the 12-year period.

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. All fish captured at each site were counted by mesh size and species. Individual metrics (e.g., length, weight, deformities, erosion, lesions, and tumours [collectively referred to as DELT], sex and maturity, age) were collected for species of management interest (i.e., “target” species). These include: Lake Whitefish (LKWH; *Coregonus clupeaformis*), Northern Pike (NRPK; *Esox lucius*), Walleye (WALL; *Sander vitreus*) from all waterbodies in all years; Sauger (SAUG; *S. canadensis*) from all waterbodies starting in 2017; and White Sucker (WHSC; *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
SPLIT		●	●	●	●	●	●	●	●	●	●	●
LNR	●	●	●	●	●	●	●	●	●	●	●	●
BURNT				●			●			●		
LMFB			●			●			●			●
STL-N		●			●			●			●	
STL-S		●			●			●			●	
ASSN		●	●	●	●	●	●	●	●	●	●	●
HAYES	●	●	●	●	●	●	●	●	●	●	●	●

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

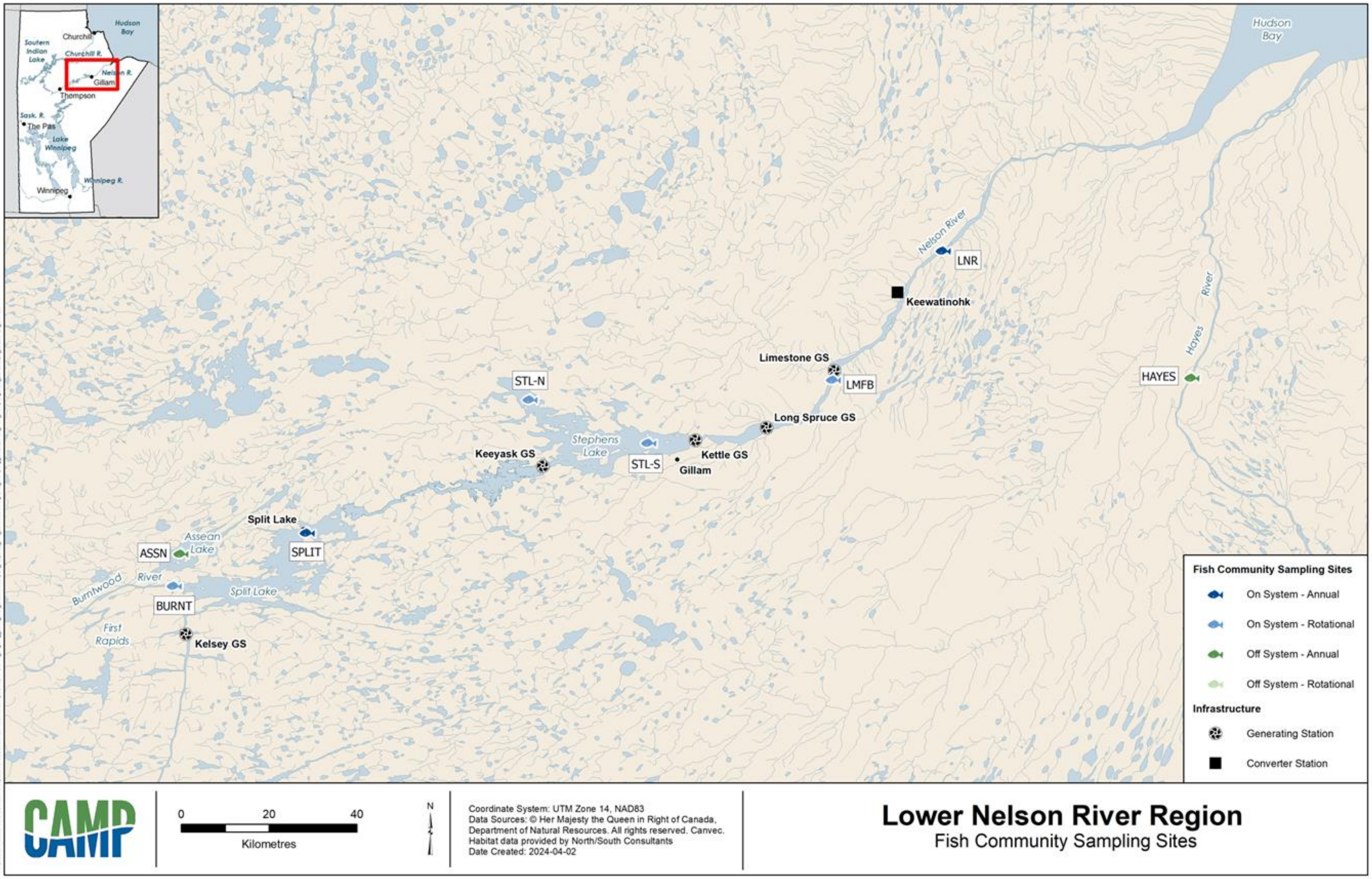


Figure 5.1-1. 2008-2019 Fish community sampling sites.

5.2 ABUNDANCE

5.2.1 CATCH-PER-UNIT-EFFORT

5.2.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the 11 years of monitoring was generally similar among years ranging from a low of 27.3 in 2019 to a high of 38.9 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 35.2, the median was 36.7, and the interquartile range (IQR) was 33.4-38.0 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in 2009, 2017, and 2019 when it was below 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 8.4 in 2010 to a high of 202.3 fish/30 m/24 h in 2014 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 106.9, the median was 101.5, and the IQR was 71.5-146.6 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2009, 2010, and 2012 when it was below the IQR and in 2011, 2013, and 2014 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were relatively low in Split Lake over the 11 years of monitoring, with the annual mean CPUE ranging from a low of 0.7 in 2009 to a high of 2.4 fish/100 m/24 h in 2011, 2017, and 2018 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 1.8 and the IQR was 1.5-2.2 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2009 and 2014 when it was below the IQR.

Northern Pike

The annual mean CPUE over the 11 years of monitoring varied up to about two-fold from year-to-year, with the mean ranging from a low of 2.3 in 2016 and 2017 to a high of 5.3 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 3.6, the median was 3.8, and the IQR was 2.6-4.0 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2012 and 2013 when it was above the IQR.

Sauger

The annual mean CPUE over the 11 years of monitoring varied up to about four-fold from year-to-year, with the mean ranging from a low of 2.0 in 2013 to a high of 8.5 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-5).

The overall mean CPUE was 5.8, the median was 6.4, and the IQR was 4.2-7.4 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE fell within the overall IQR except in 2013 and 2019 when it was below the IQR and in 2014 and 2016 when it was above the IQR.

Walleye

The annual mean CPUE over the 11 years of monitoring varied by up to about four-fold from year-to-year, ranging from a low of 3.6 in 2019 to a high of 13.0 fish/100 m/24 h in 2009 and 2013 (Table 5.2-1; Figure 5.2-6).

The overall mean and median CPUE were 8.8 and the IQR was 5.5-12.0 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2019 when it was below the IQR and in 2009 and 2013 when it was slightly above the IQR.

White Sucker

The annual mean CPUE over the 11 years of monitoring varied by up to about two-fold from year-to-year, ranging from a low of 6.6 in 2009 to a high of 14.9 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 11.8, the median was 11.9, and the IQR was 11.2-13.5 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2009 and 2011 when it was below the IQR and in 2012 and 2018 when it was above the IQR.

Lower Nelson River

Standard Gang Index Gill Nets

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 12.0 in 2016 to a high of 36.3 fish/100 m/24 h in 2011 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 22.8, the median was 21.7, and the IQR was 19.2-25.1 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in 2016 when it was below the IQR and in 2009, 2010, and 2011 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 2.3 in 2018 to a high of 40.0 fish/30 m/24 h in 2015 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 16.2, the median was 15.3, and the IQR was 7.2-19.0 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2018 when it was below the IQR and in 2009, 2010, and in 2015 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were relatively low in the lower Nelson River over the 12 years of monitoring, with the annual mean ranging from 0.5 in 2016 to a high of 3.1 fish/100 m/24 in 2011 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 1.5 and the IQR was 0.9-1.8 fish/100 m/24 (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2016 and 2018 when it was below the IQR and in 2009, 2010, and 2011 when it was above the IQR.

Northern Pike

The annual mean CPUE over the 12 years of monitoring varied up to about three-fold from year-to-year, with the annual mean ranging from a low of 3.4 in 2016 to a high of 10.3 fish/100 m/24 in 2012 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE were 6.5 and the IQR was 4.8-8.4 fish/100 m/24 (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2016 and 2018 when it was below the IQR and in 2009, 2011, and 2012 when it was above the IQR.

Sauger

Catches of Sauger were low in the lower Nelson River over the 12 years of monitoring, with the annual mean ranging from a low of none in 2008, 2009, 2013, and 2019 to a high of 0.7 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-5).

The overall mean CPUE was 0.2, the median was 0.1, and the IQR was 0-0.1 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE fell within the overall IQR except in 2011, 2014, and 2015 when it was above the IQR.

Walleye

The annual mean CPUE over the 12 years of monitoring varied up to about six-fold from year-to-year, with the mean ranging from a low of 0.9 in 2008 to a high of 5.6 fish/100 m/24 h in 2009 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 2.7, the median was 2.5, and the IQR was 1.6-3.5 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2008 when it was below the IQR and in 2009 when it was above the IQR.

White Sucker

The annual mean CPUE over the 12 years of monitoring varied up to about ten-fold from year-to-year, with the mean ranging from a low of 0.4 in 2008 to a high of 4.1 fish/100 m/24 h in 2011 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 1.9, the median was 1.5, and the IQR was 1.1-2.8 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2008 when it was below the IQR and in 2011 when it was above the IQR.

ROTATIONAL SITES

Burntwood River

Standard Gang Index Gill Nets

The annual mean CPUE over the three years of monitoring was generally similar among years ranging from a low of 10.1 in 2014 to a high of 12.7 fish/100 m/24 h in 2017 (Table 5.2-1; Figure 5.2-1).

The overall mean was 11.5, the median was 11.8, and the IQR was 10.9-12.2 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was within or similar to the IQR in all three years.

Small Mesh Index Gill Nets

The annual mean CPUE over the three years of monitoring varied by up to about four-fold from year-to-year, with the mean ranging from a low of 2.4 in 2014 to a high of 8.9 fish/30 m/24 h in 2017 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 6.2, the median was 7.3, and the IQR was 4.8-8.1 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2014 and was slightly above the IQR in 2017.

Lake Whitefish

Catches of Lake Whitefish were low in the Burntwood River over the three years of monitoring, with the annual mean ranging from a low of none in 2011 to a high of 0.7 fish/100 m/24 in 2017 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 0.4 and the IQR was 0.2-0.5 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was within or similar to the IQR in all three years.

Northern Pike

Catches of Northern Pike were relatively low in the Burntwood River over the three years of monitoring, with the annual mean ranging from a low of 0.7 in 2017 to a high of 1.2 fish/100 m/24 in 2011 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE were 1.0 and the IQR was 0.8-1.1 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was within or similar to the IQR in all three years.

Sauger

The annual mean CPUE over the three years of monitoring was generally similar among years ranging from a low of 1.3 in 2017 to a high of 1.6 fish/100 m/24 h in 2011 (Table 5.2-1; Figure 5.2-5).

The overall mean and median CPUE were 1.5 and the IQR was 1.4-1.6 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE was within or similar to the IQR in all three years.

Walleye

The annual mean CPUE over the three years of monitoring was generally similar among years ranging from a low of 3.2 in 2014 to a high of 5.7 fish/100 m/24 h in 2011 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 4.4, the median was 4.1, and the IQR was 3.7-4.9 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was within or similar to the IQR in all three years.

White Sucker

Catches of White Sucker were relatively low in the Burntwood River over the three years of monitoring, with the annual mean ranging from a low of 0.8 in 2011 to a high of 1.7 fish/100 m/24 h in 2014 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 1.3, the median was 1.2, and the IQR was 1.0-1.5 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was within or similar to the IQR in all three years.

Limestone Forebay

Standard Gang Index Gill Nets

The annual mean CPUE over the four years of monitoring varied up to about two-fold from year-to-year, with the mean ranging from a low of 10.1 in 2016 to a high of 17.5 fish/100 m/24 h in 2019 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 13.0, the median was 12.3, and the IQR was 10.3-15.0 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was above the IQR in 2019.

Small Mesh Index Gill Nets

The annual mean CPUE over the four years of monitoring varied by up to about six-fold from year-to-year, with the mean ranging from a low of 3.0 in 2019 to a high of 17.6 fish/30 m/24 h in 2010 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 10.8, the median was 11.3, and the IQR was 4.8-17.3 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2019.

Lake Whitefish

Catches of Lake Whitefish were low in the Limestone Forebay over the four years of monitoring, with the annual mean ranging from none in 2019 to a high of 0.2 fish/100 m/24 in 2013 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE and IQR were 0.1 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was within or similar to the IQR in all four years.

Northern Pike

Catches of Northern Pike were relatively low in the Limestone Forebay over the four years of monitoring, with the annual mean ranging from a low of none in 2016 to a high of 4.1 fish/100 m/24 in 2010 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 1.4, the median was 0.7, and the IQR was 0.2-1.8 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was above the IQR in 2010.

Sauger

Catches of Sauger were low in the Limestone Forebay over the four years of monitoring, with the annual mean ranging from a low of 0.2 in 2016 and 2019 to a high of 0.7 fish/100 m/24 h in 2013 (Table 5.2-1; Figure 5.2-5).

The overall mean and median CPUE were 0.4 and the IQR was 0.2-0.6 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE was within or similar to the IQR in all four years.

Walleye

Catches of Walleye were relatively low in the Limestone Forebay over the four years of monitoring, with the annual mean ranging from a low of 0.5 in 2010 to a high of 1.3 fish/100 m/24 h in 2019 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 0.9, the median was 0.8, and the IQR was 0.6-1.1 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was within or similar to the IQR in all four years.

White Sucker

The annual mean CPUE over the four years of monitoring varied by about four-fold, with the mean ranging from a low of 1.2 in 2010 to a high of 4.5 fish/100 m/24 h in 2016 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 3.0, the median was 3.1, and the IQR was 2.5-3.6 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was below the IQR in 2010 and was above the IQR in 2016.

Stephens Lake – North

Standard Gang Index Gill Nets

The annual mean CPUE over the four years of monitoring varied up to about two-fold from year-to-year, with the annual mean ranging from a low of 16.8 in 2012 to a high of 32.2 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 22.5, the median was 20.4, and the IQR was 18.6-24.3 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was slightly below the IQR in 2012 and was above the IQR in 2015.

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 20.7 in 2012 to a high of 186.1 fish/30 m/24 h in 2015 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 86.3 the median was 69.2, and the IQR was 55.2-100.3 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2012 and was above the IQR in 2015.

Lake Whitefish

Catches of Lake Whitefish were relatively low in Stephens Lake - North over the four years of monitoring, with the annual mean ranging from 0.6 in 2012 to a high of 2.0 fish/100 m/24 in 2015 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 1.3 and the IQR was 0.9-1.8 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was within or similar to the IQR in all four years.

Northern Pike

The annual mean CPUE over the four years of monitoring varied up to about three-fold from year-to-year, with the mean ranging from a low of 2.4 in 2018 to a high of 7.5 fish/100 m/24 in 2015 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 5.6, the median was 6.3, and the IQR was 4.5-7.3 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was below the IQR in 2018.

Sauger

Catches of Sauger were low in Stephens Lake - North over the four years of monitoring, with the annual mean ranging a low of none in 2009, 2012, and 2015 to a high of 2.3 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-5).

The overall mean was 0.6, the median was 0, and the IQR was 0-0.6 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE was above the IQR in 2018.

Walleye

The annual mean CPUE over the four years of monitoring was generally similar among years ranging from a low of 9.6 in 2009 to a high of 14.7 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 11.5, the median was 10.8, and the IQR was 9.7-12.6 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE and was above the IQR in 2015.

White Sucker

The annual mean CPUE over the four years of monitoring varied up to about six-fold from year-to-year, with the annual mean ranging from a low of 0.5 in 2009 to a high of 3.0 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 1.5, the median was 1.3, and the IQR was 0.7-2.1 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was above the IQR in 2018.

Stephens Lake – South

Standard Gang Index Gill Nets

The annual mean CPUE over the four years of monitoring varied up to about two-fold from year-to-year, with the annual mean ranging from a low of 17.7 in 2012 to a high of 31.6 fish/100 m/24 h in 2009 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 22.8, the median was 21.0, and the IQR was 19.2-24.7 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE was slightly below the IQR in 2012 and was above the IQR in 2009.

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 43.6 in 2009 to a high of 155.7 fish/30 m/24 h in 2015 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 95.8, the median was 92.0, and the IQR was 70.0-117.9 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE was below the IQR in 2009 and was above the IQR in 2015.

Lake Whitefish

Catches of Lake Whitefish were low in Stephens Lake - South over the four years of monitoring, with the annual mean ranging from 0.2 in 2012 to a high of 0.7 fish/100 m/24 in 2015 (Table 5.2-1; Figure 5.2-3).

The overall mean and median CPUE were 0.5 and the IQR was 0.4-0.6 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE was within or similar to the IQR in all four years.

Northern Pike

The annual mean CPUE over the four years of monitoring varied up to about two-fold from year-to-year, with the mean ranging from a low of 3.4 in 2018 to a high of 7.0 fish/100 m/24 in 2009 (Table 5.2-1; Figure 5.2-4).

The overall mean CPUE was 4.8, the median was 4.3, and the IQR was 3.8-5.3 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE was above the IQR in 2009.

Sauger

Catches of Sauger were relatively low in Stephens Lake - South over the four years of monitoring, with the annual mean ranging from a low of 0.3 in 2018 to a high of 3.1 fish/100 m/24 h in 2009 (Table 5.2-1; Figure 5.2-5).

The overall mean and median CPUE were 1.8 and the IQR was 0.5-3.0 fish/100 m/24 h (Figure 5.2-5). The annual mean CPUE was within or similar to the IQR in all four years.

Walleye

The annual mean CPUE over the four years of monitoring varied by up to about four-fold from year-to-year, with the mean ranging from a low of 6.5 in 2012 to a high of 17.0 fish/100 m/24 h in 2009 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 10.0, the median was 8.2, and the IQR was 6.7-11.6 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE was above the IQR in 2009.

White Sucker

The annual mean CPUE over the four years of monitoring varied by up to about four-fold from year-to-year, with the mean ranging from a low of 1.5 in 2009 to a high of 6.5 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 4.1, the median was 4.3, and the IQR was 2.3-6.2 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE was below the IQR in 2009.

5.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Standard Gang Index Gill Nets

The annual mean CPUE over the 11 years of monitoring varied by up to about two-fold from year-to-year, with the mean ranging from a low of 34.4 in 2013 to a high of 67.6 fish/100 m/24 h in 2010 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 50.2, the median was 53.2, and the IQR was 41.2-55.0 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in in 2013 and 2014 when it was below the IQR and in 2010 and 2017 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 69.6 in 2009 to a high of 449.8 fish/30 m/24 h in 2015 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 216.0, the median was 195.4, and the IQR was 185.1-233.6 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2009 and 2013 when it was below the IQR and in 2014, 2015, and 2018 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were relatively low in Assean Lake over the 11 years of monitoring, with the annual mean CPUE ranging from a low of 0.6 in 2019 to a high of 8.5 fish/100 m/24 h in 2011 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 3.1, the median was 1.5, and the IQR was 1.0-5.1 fish/100 m/24 h (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2019 when it was below the IQR and in 2010, 2011, and 2012 when it was above the IQR.

Northern Pike

The annual mean CPUE over the 11 years of monitoring varied up to about two-fold from year-to-year, with the mean ranging from a low of 5.2 in 2018 to a high of 9.6 fish/100 m/24 h in 2012 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE were 6.9 and the IQR was 6.0-7.4 fish/100 m/24 h (Figure 5.2-4). The annual mean CPUE fell within the overall IQR except in 2018 when it was below the IQR and in 2012 when it was above the IQR.

Sauger

Sauger were not captured in Assean Lake over the 11 years of monitoring (Table 5.2-1).

Walleye

The annual mean CPUE over the 11 years of monitoring varied by up to about two-fold, with the mean ranging from a low of 18.6 in 2016 to a high of 36.0 fish/100 m/24 h in 2018 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 25.9, the median was 24.0, and the IQR was 22.1-29.5 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except 2013 and 2016 when it was below the IQR and in 2010, 2018, and 2019 when it was above the IQR.

White Sucker

The annual mean CPUE over the 11 years of monitoring varied by up to about three-fold, with the mean ranging from a low of 6.5 in 2009 to a high of 22.0 fish/100 m/24 h in 2017 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 10.2, the median was 9.4, and the IQR was 7.2-11.7 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2017 when it was above the IQR.

Hayes River

Standard Gang Index Gill Nets

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 5.8 in 2009 to a high of 20.0 fish/100 m/24 h in 2015 (Table 5.2-1; Figure 5.2-1).

The overall mean CPUE was 13.5, the median was 14.5, and the IQR was 9.8-16.6 fish/100 m/24 h (Figure 5.2-1). The annual mean CPUE fell within the overall IQR except in 2009, 2011, and 2012 when it was below the IQR and in 2014, 2015, and 2016 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 from a low of 1.2 in 2009 to a high of 16.4 fish/30 m/24 h in 2018 (Table 5.2-1; Figure 5.2-2).

The overall mean CPUE was 6.1, the median was 4.9, and the IQR was 4.0-6.2 fish/30 m/24 h (Figure 5.2-2). The annual mean CPUE fell within the overall IQR except in 2009, 2013, and 2015 when it was below the IQR and in 2018 and 2019 when it was above the IQR.

Lake Whitefish

Catches of Lake Whitefish were low in the Hayes River over the 12 years of monitoring, with the annual mean ranging from none in 2013 to a high of 4.7 fish/100 m/24 in 2015 (Table 5.2-1; Figure 5.2-3).

The overall mean CPUE was 1.7, the median was 1.2, and the IQR was 0.5-2.7 fish/100 m/24 (Figure 5.2-3). The annual mean CPUE fell within the overall IQR except in 2009 and 2013 when it was below the IQR and in 2015, 2016, and 2018 when it was above the IQR.

Northern Pike

Catches of Northern Pike were low in the Hayes River over the 12 years of monitoring, with the annual mean ranging from a low of 0.2 in 2009 to a high of 1.9 fish/100 m/24 in 2015 (Table 5.2-1; Figure 5.2-4).

The overall mean and median CPUE were 1.0 and the IQR was 0.5-1.3 fish/100 m/24 (Figure 5.2-4). The annual mean CPUE was within or similar to the IQR in all 12 years.

Sauger

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

Walleye

The annual mean CPUE over the 12 years of monitoring varied by up to about three-fold, with the mean ranging from a low of 1.6 in 2009 to a high of 4.4 fish/100 m/24 h in 2019 (Table 5.2-1; Figure 5.2-6).

The overall mean CPUE was 3.5, the median was 3.7, and the IQR was 3.1-4.2 fish/100 m/24 h (Figure 5.2-6). The annual mean CPUE fell within the overall IQR except in 2009 and 2011 when it was below the IQR.

White Sucker

Catches of White Sucker were relatively low in the Hayes River over the 12 years of monitoring, with the annual mean ranging from a low of 0.4 in 2008 to a high of 2.6 fish/100 m/24 h in 2013 (Table 5.2-1; Figure 5.2-7).

The overall mean CPUE was 1.2, the median was 1.1, and the IQR was 0.6-1.6 fish/100 m/24 h (Figure 5.2-7). The annual mean CPUE fell within the overall IQR except in 2013 when it was above the IQR.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

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
SPLIT	2009	4	296	68.3	24.5	12	465	31.9	5.5	10	0.7	0.3	58	4.0	1.0	68	4.7	1.8	189	13.0	5.6	97	6.6	1.3
	2010	2	18	8.4	6.0	9	402	34.8	6.7	25	2.1	0.6	27	2.4	1.2	42	3.8	0.9	124	10.8	4.5	128	10.8	3.1
	2011	4	735	179.5	66.3	12	516	38.6	6.1	34	2.4	1.3	54	3.9	1.1	110	7.7	2.2	150	12.0	4.9	122	9.0	1.7
	2012	4	236	55.9	13.9	12	544	38.6	4.3	29	2.1	0.4	77	5.3	2.1	96	6.8	1.2	75	5.4	1.8	209	14.9	4.1
	2013	4	647	173.1	80.7	12	478	36.8	3.3	20	1.5	0.6	64	4.8	1.4	27	2.0	0.7	171	13.0	1.9	162	12.8	2.3
	2014	4	794	202.3	93.1	12	534	38.9	4.5	11	0.8	0.3	47	3.5	1.5	117	8.5	1.6	163	12.0	4.0	167	11.9	2.1
	2015	4	355	90.0	43.3	12	503	37.5	3.6	22	1.7	0.7	53	4.0	1.3	95	7.1	1.3	118	8.8	1.9	163	12.0	2.6
	2016	4	347	101.5	54.7	12	437	35.0	4.7	23	1.8	0.7	28	2.3	0.6	104	8.2	1.7	95	7.6	1.9	146	11.6	1.7
	2017	4	309	74.6	30.5	12	455	31.4	3.7	34	2.4	0.6	33	2.3	0.9	84	5.8	1.5	72	5.0	1.2	206	14.2	2.7
	2018	4	431	120.1	79.4	12	454	36.7	4.2	29	2.4	0.8	48	3.8	1.2	79	6.4	1.2	68	5.7	2.1	182	14.5	2.3
	2019	4	385	101.7	52.5	12	369	27.3	2.1	20	1.6	0.8	38	2.8	0.7	47	3.4	1.3	50	3.6	1.0	155	11.7	1.7
LNR	2008	2	30	17.1	12.1	9	164	19.2	3.8	8	0.8	0.5	61	6.0	2.2	-	-	-	8	0.9	0.2	4	0.4	0.2
	2009	3	59	24.6	15.2	9	265	30.4	4.9	20	2.3	0.7	82	9.2	3.2	-	-	-	47	5.6	2.5	26	2.9	1.2
	2010	3	108	32.4	14.2	9	286	26.4	6.9	25	2.3	1.2	80	7.6	2.9	1	0.1	0.1	46	4.1	2.5	19	1.7	0.5
	2011	3	50	15.3	10.4	9	382	36.3	5.8	33	3.1	1.6	95	9.0	3.9	4	0.4	0.2	33	3.0	1.0	43	4.1	1.7
	2012	3	21	6.9	2.9	9	214	21.6	4.4	15	1.5	0.7	106	10.3	4.7	1	0.1	0.1	16	1.6	0.9	9	1.0	0.4
	2013	3	48	15.3	6.8	9	198	19.1	3.4	10	0.9	0.4	85	8.2	3.4	-	-	-	35	3.3	1.2	12	1.1	0.5
	2014	3	50	17.2	2.7	9	242	24.7	6.0	14	1.5	1.2	65	7.0	4.1	7	0.7	0.3	28	2.8	0.8	11	1.1	0.4
	2015	3	109	40.0	18.7	9	186	19.2	1.8	15	1.6	0.8	41	4.4	1.5	2	0.2	0.2	21	2.2	1.1	12	1.2	0.5
	2016	3	18	6.6	1.8	9	106	12.0	2.3	5	0.5	0.2	32	3.4	1.5	1	0.1	0.1	10	1.2	0.7	24	2.8	0.7
	2017	3	27	8.9	6.5	9	225	20.8	5.3	16	1.4	0.6	55	5.1	2.3	1	0.1	0.1	42	3.9	1.0	27	2.5	1.0
	2018	2	5	2.3	1.0	8	209	21.8	3.5	5	0.5	0.2	34	3.5	1.9	1	0.1	0.1	13	1.4	0.3	13	1.4	0.4
	2019	3	23	7.3	3.7	9	233	22.4	4.2	13	1.2	0.6	53	4.9	3.2	-	-	-	18	1.7	0.4	30	2.8	1.1
BURNT	2011	3	23	7.3	2.6	9	122	11.8	1.6	-	-	-	12	1.2	0.7	17	1.6	0.4	59	5.7	1.2	9	0.8	0.2
	2014	3	7	2.4	1.0	9	100	10.1	2.0	4	0.4	0.3	10	1.0	0.6	15	1.5	0.6	32	3.2	1.5	17	1.7	0.4
	2017	3	27	8.9	6.0	9	134	12.7	2.0	7	0.7	0.2	7	0.7	0.3	14	1.3	0.5	44	4.1	0.9	13	1.2	0.3
LMFB	2010	3	56	17.6	7.0	9	148	14.1	1.9	1.0	0.1	0.1	43	4.1	1.6	5	0.5	0.5	5	0.5	0.4	12	1.2	0.5
	2013	3	50	17.2	4.1	9	103	10.4	1.6	2.0	0.2	0.1	11	1.1	0.5	7	0.7	0.6	10	1.1	0.8	29	2.9	1.0
	2016	3	15	5.4	3.0	9	90	10.1	1.9	1.0	0.1	0.1	-	-	-	2	0.2	0.1	5	0.6	0.3	40	4.5	1.1
	2019	3	8	3.0	2.0	9	173	17.5	3.3	-	-	-	3	0.3	0.1	2	0.2	0.1	13	1.3	0.6	32	3.2	0.9
STL-N	2009	3	206	66.7	20.9	9	198	19.2	3.8	10	1.0	0.5	77	7.3	1.1	-	-	-	97	9.6	3.5	5	0.5	0.2
	2012	2	40	20.7	5.7	7	130	16.8	5.2	5	0.6	0.4	41	5.3	1.8	-	-	-	75	9.7	3.3	6	0.8	0.3
	2015	3	500	186.1	23.0	9	301	32.2	5.7	19	2.0	0.4	70	7.5	0.8	-	-	-	147	14.7	3.9	15	1.8	0.7
	2018	3	177	71.7	23.6	9	187	21.6	3.3	15	1.7	0.8	20	2.4	0.8	19	2.3	1.3	103	11.8	2.4	26	3.0	1.0
STL-S	2009	3	130	43.6	18.0	9	328	31.6	8.0	6	0.6	0.3	74	7.0	2.0	31	3.1	2.6	177	17.0	7.3	15	1.5	0.6
	2012	2	161	78.8	38.2	7	140	17.7	3.4	2	0.2	0.2	31	3.9	1.4	24	3.0	1.1	52	6.5	2.4	20	2.5	0.8
	2015	3	398	155.7	56.8	9	209	22.3	3.4	6	0.7	0.2	44	4.8	1.6	5	0.6	0.3	93	9.8	2.0	55	6.0	1.4
	2018	3	291	105.3	32.3	9	173	19.7	5.4	4	0.4	0.2	29	3.4	0.9	2	0.3	0.2	60	6.7	2.1	59	6.5	2.6

Table 5.2-1. continued.

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
ASSN	2009	3	198	69.6	11.1	9	449	42.7	6.1	40	3.8	1.6	66	6.2	1.1	-	-	-	237	22.9	7.2	70	6.5	1.6
	2010	2	425	199.8	8.8	8	647	67.6	6.6	62	6.4	2.4	67	7.0	1.1	-	-	-	289	30.5	7.9	69	7.2	1.2
	2011	3	594	202.9	23.8	9	547	54.8	7.5	84	8.5	1.2	67	6.9	1.1	-	-	-	284	28.5	7.8	97	9.4	2.3
	2012	3	552	178.9	27.5	9	565	53.2	6.6	78	7.5	1.7	102	9.6	1.4	-	-	-	286	26.7	7.3	74	7.0	2.2
	2013	3	465	156.9	52.1	9	333	34.4	3.6	8	0.8	0.2	67	6.9	0.7	-	-	-	183	18.8	2.7	73	7.7	2.2
	2014	3	722	264.3	79.9	9	403	39.4	5.9	10	1.0	0.4	79	7.8	0.7	-	-	-	240	23.2	6.1	72	7.1	1.1
	2015	3	1248	449.8	103.3	9	469	49.8	8.1	12	1.2	0.4	67	6.9	0.9	-	-	-	223	24.0	8.4	117	12.2	2.6
	2016	3	533	195.4	22.1	9	376	39.8	3.5	9	1.0	0.3	56	5.8	0.7	-	-	-	173	18.6	3.8	111	11.7	2.7
	2017	3	614	191.3	6.3	9	674	60.5	6.1	21	1.9	0.9	89	7.9	1.6	-	-	-	236	21.3	3.3	244	22.0	4.4
	2018	3	694	273.1	74.8	9	537	55.2	10.2	13	1.5	0.6	50	5.2	0.8	-	-	-	356	36.0	8.3	90	9.7	2.9
	2019	3	533	194.5	50.1	9	496	54.4	5.4	5	0.6	0.2	53	5.7	1.1	-	-	-	310	34.4	6.0	109	11.7	2.9
HAYES	2008	3	12	6.0	3.9	9	80	10.2	2.9	10	1.4	0.8	4	0.5	0.2	-	-	-	29	3.6	1.0	3	0.4	0.2
	2009	3	3	1.2	0.9	9	56	5.8	2.0	1	0.1	0.1	2	0.2	0.1	-	-	-	16	1.6	0.5	7	0.7	0.2
	2010	3	15	5.1	2.9	9	159	15.3	1.5	10	0.9	0.3	10	0.9	0.3	-	-	-	44	4.2	0.7	13	1.2	0.4
	2011	3	11	4.7	2.8	9	79	8.6	1.9	5	0.6	0.2	4	0.5	0.3	-	-	-	18	1.7	0.8	15	1.6	0.6
	2012	3	18	6.9	3.2	9	72	8.4	1.5	3	0.4	0.2	4	0.4	0.3	-	-	-	32	3.8	0.6	4	0.5	0.2
	2013	3	8	2.9	1.2	9	135	14.2	2.4	-	-	-	8	0.7	0.4	-	-	-	40	4.3	0.9	25	2.6	0.8
	2014	3	12	4.3	0.1	9	177	18.4	3.1	19	2.0	0.8	12	1.2	0.4	-	-	-	30	3.1	0.5	19	2.0	0.2
	2015	3	8	2.6	1.2	9	195	20.0	3.7	48	4.7	1.6	19	1.9	0.8	-	-	-	42	4.2	0.6	6	0.7	0.2
	2016	3	13	5.8	4.8	9	130	17.2	3.5	24	3.2	1.0	14	1.8	0.6	-	-	-	30	3.9	0.9	11	1.5	0.4
	2017	3	11	4.3	1.9	9	117	12.2	1.2	10	1.1	0.5	14	1.5	0.5	-	-	-	32	3.1	0.7	5	0.5	0.2
	2018	3	45	16.4	0.4	9	152	16.4	3.5	30	3.2	1.5	10	1.1	0.4	-	-	-	32	3.5	1.0	10	1.1	0.3
	2019	3	35	13.0	5.1	9	137	14.9	2.3	23	2.5	0.6	11	1.2	0.6	-	-	-	39	4.4	0.9	15	1.7	0.5

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.

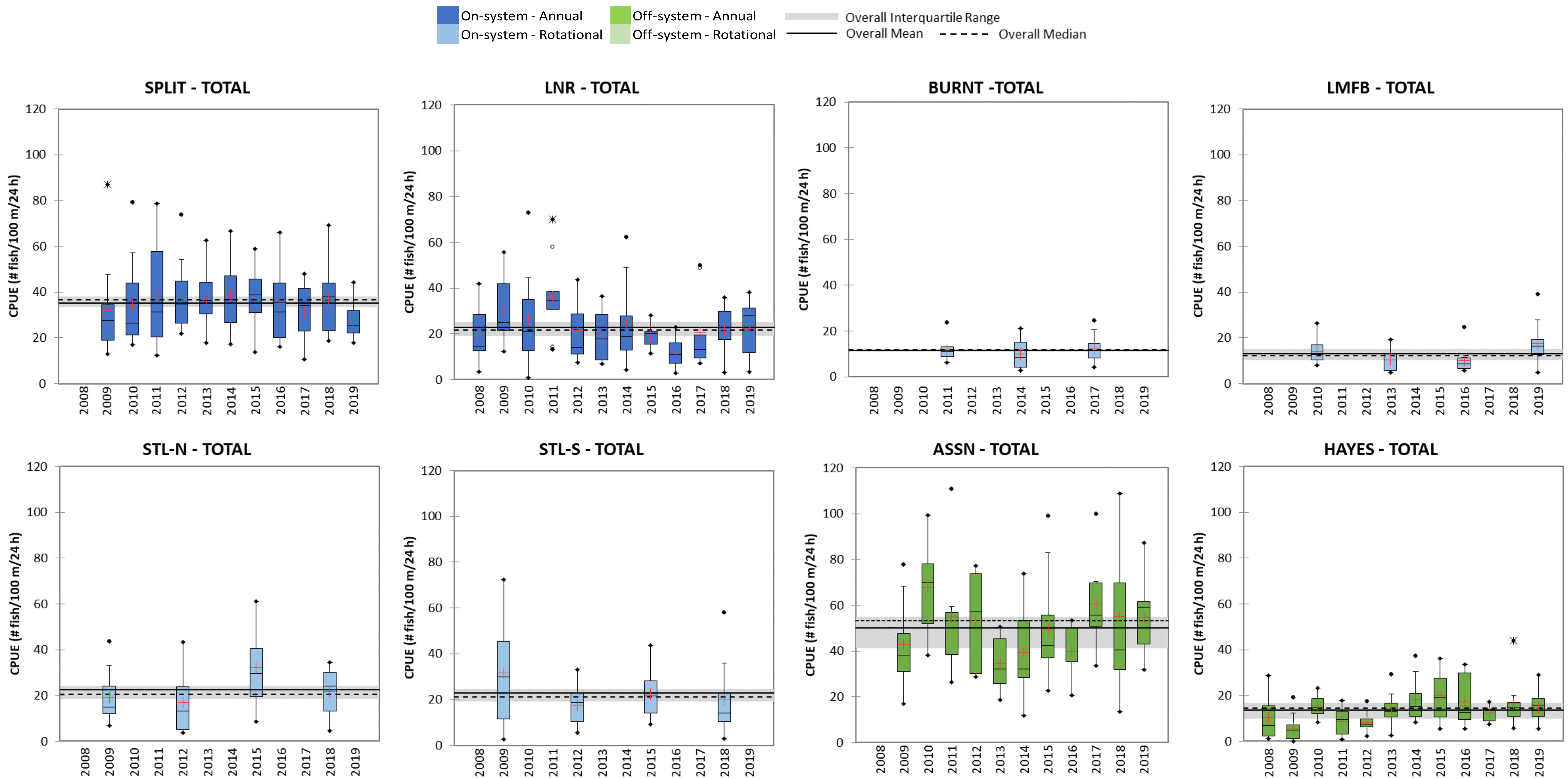


Figure 5.2-1. 2008-2019 Catch-per-unit-effort (CPUE) of standard gang index gill nets.

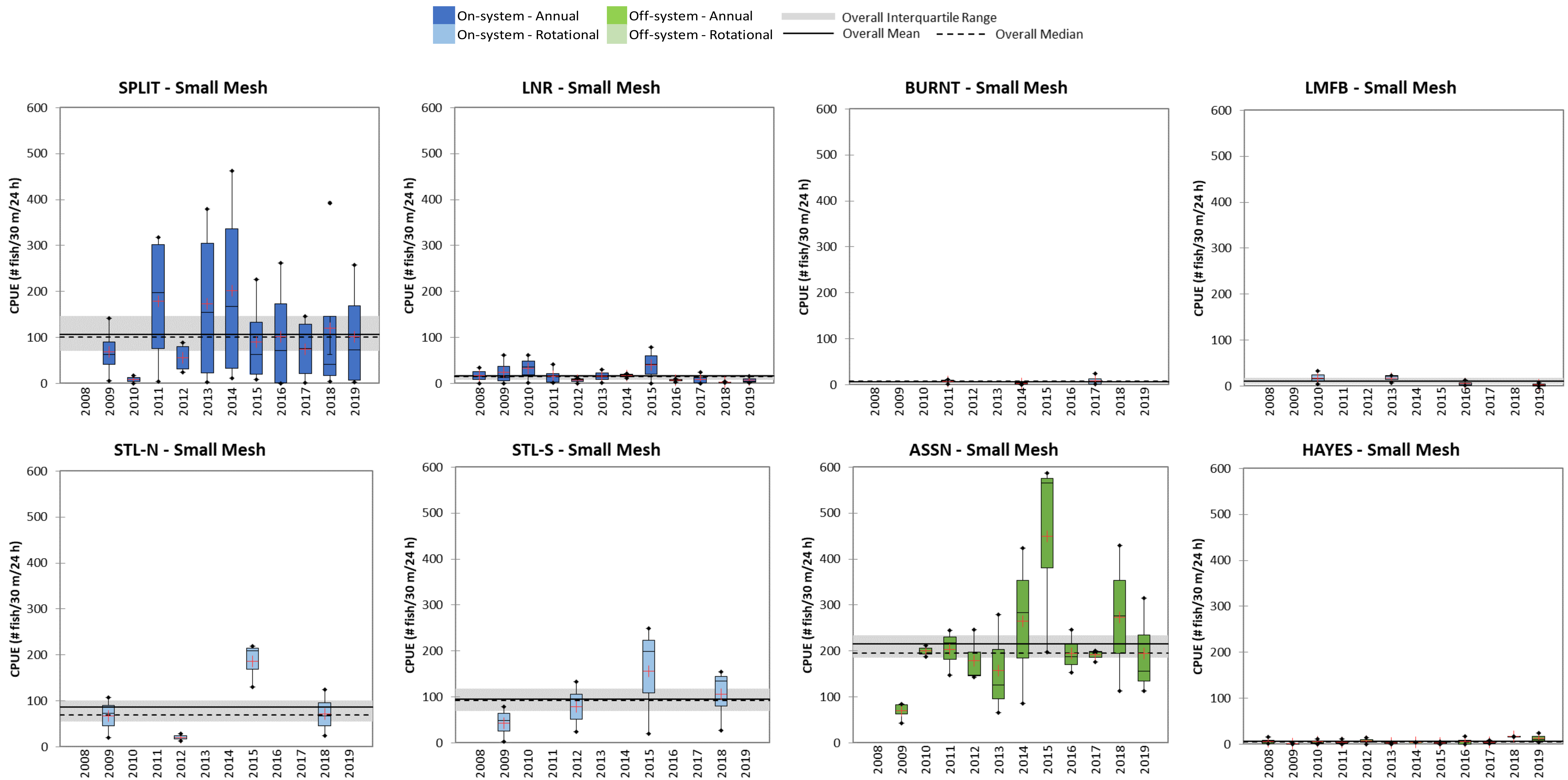


Figure 5.2-2. 2008-2019 Catch-per-unit-effort (CPUE) of small mesh index gill nets.

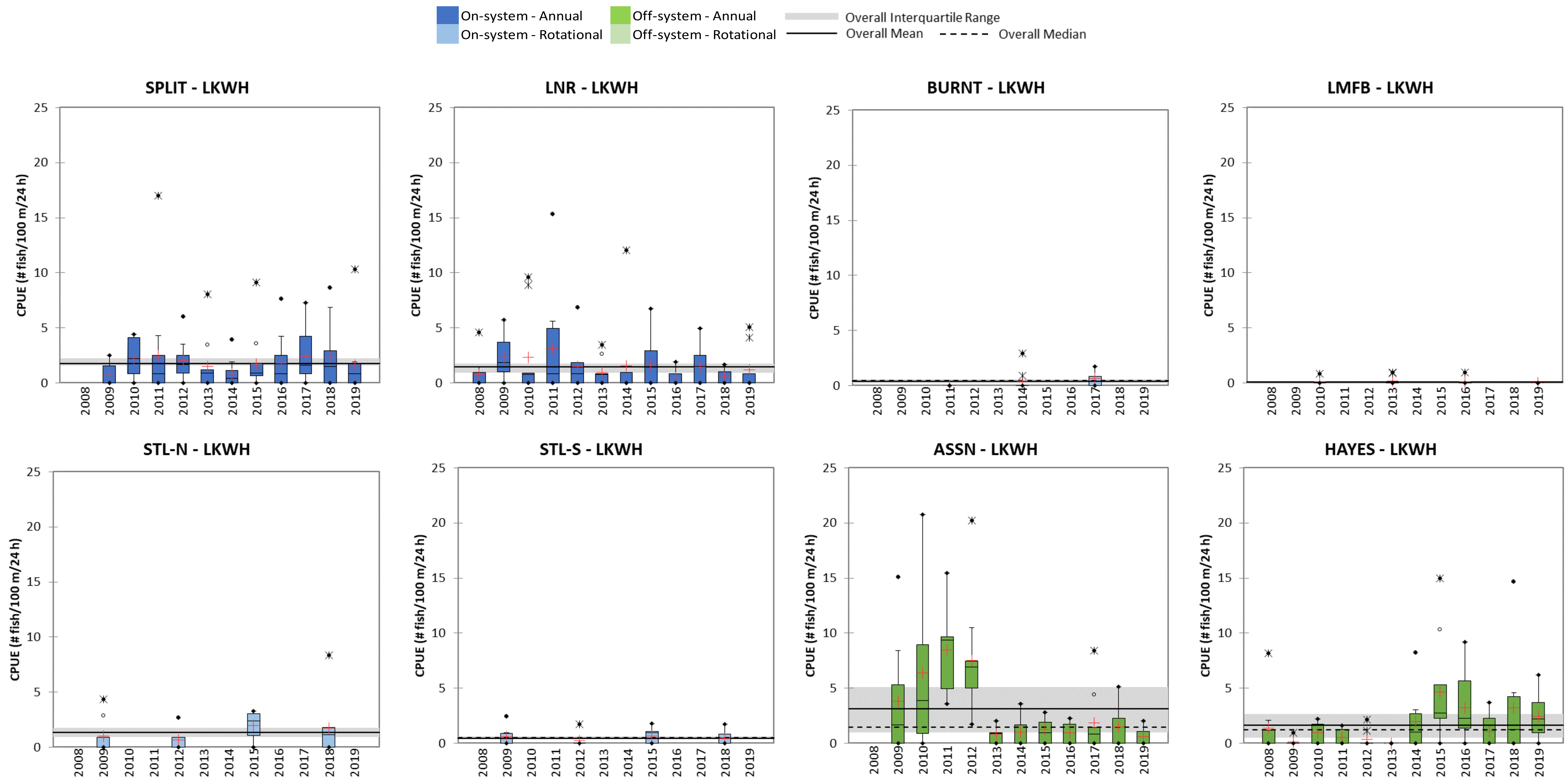


Figure 5.2-3. 2008-2019 Catch-per-unit-effort (CPUE) of Lake Whitefish.

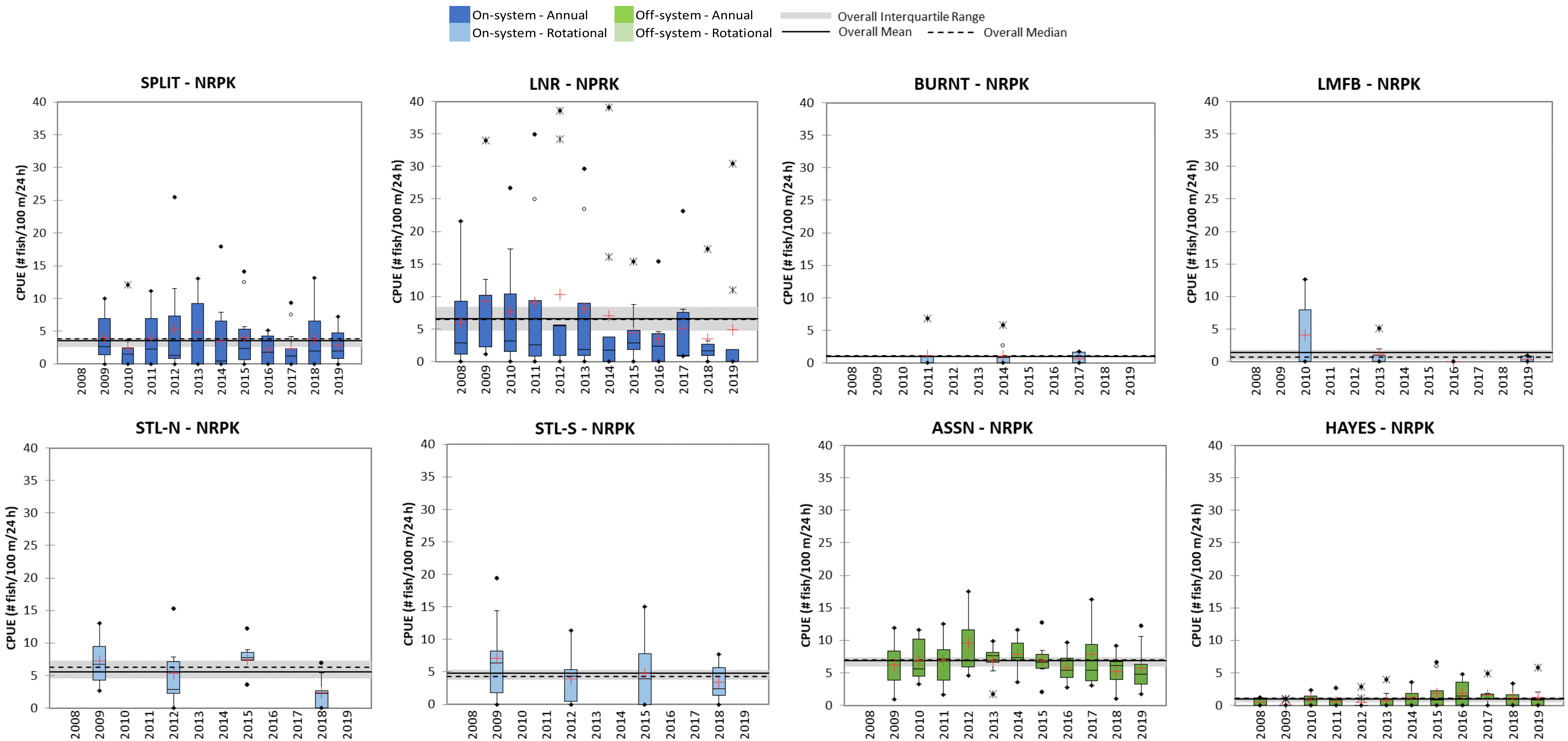


Figure 5.2-4. 2008-2019 Catch-per-unit-effort (CPUE) of Northern Pike.

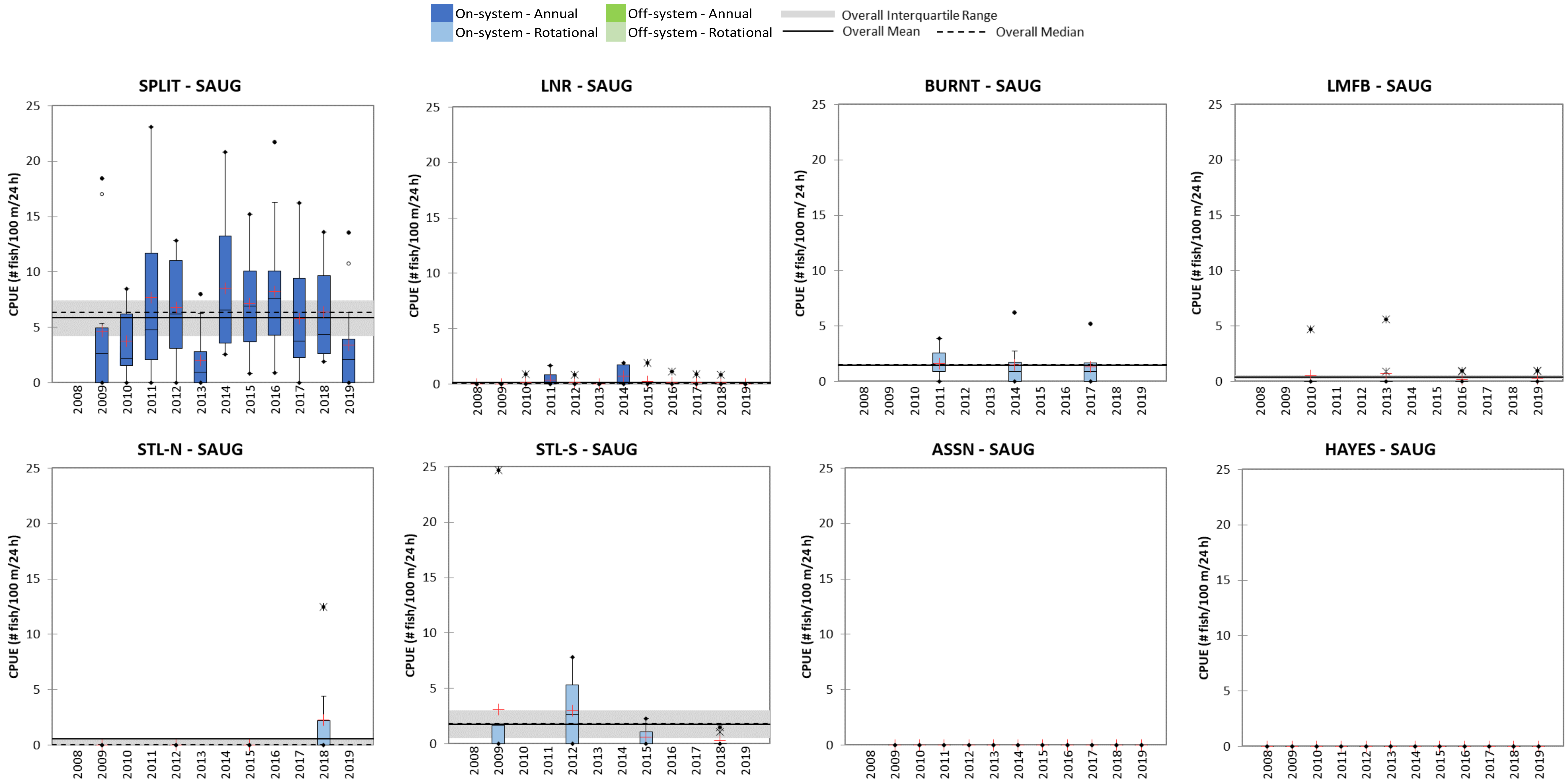


Figure 5.2-5 2008-2019 Catch-per-unit-effort (CPUE) of Sauger.

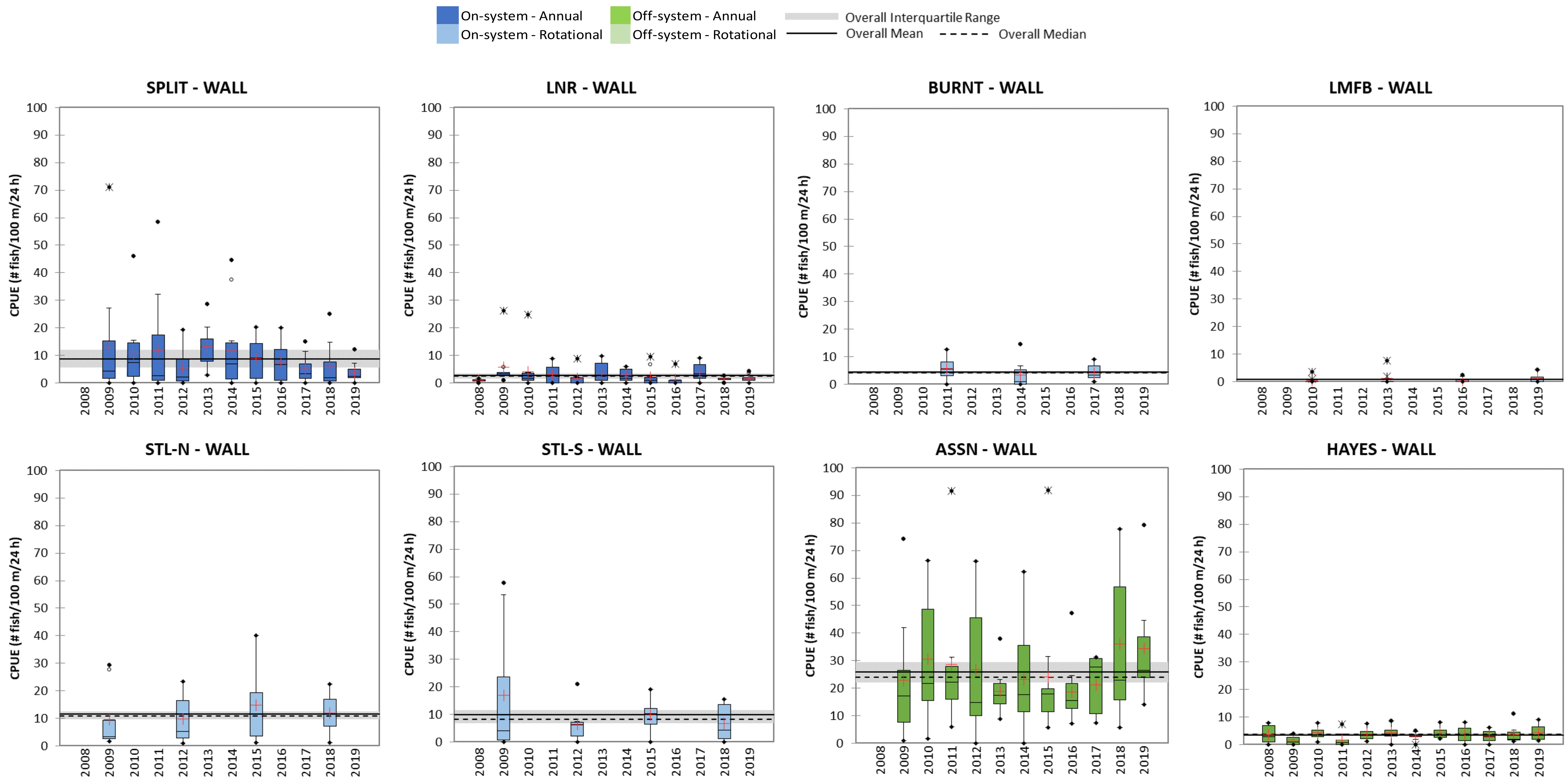


Figure 5.2-6. 2008-2019 Catch-per-unit-effort (CPUE) of Walleye.

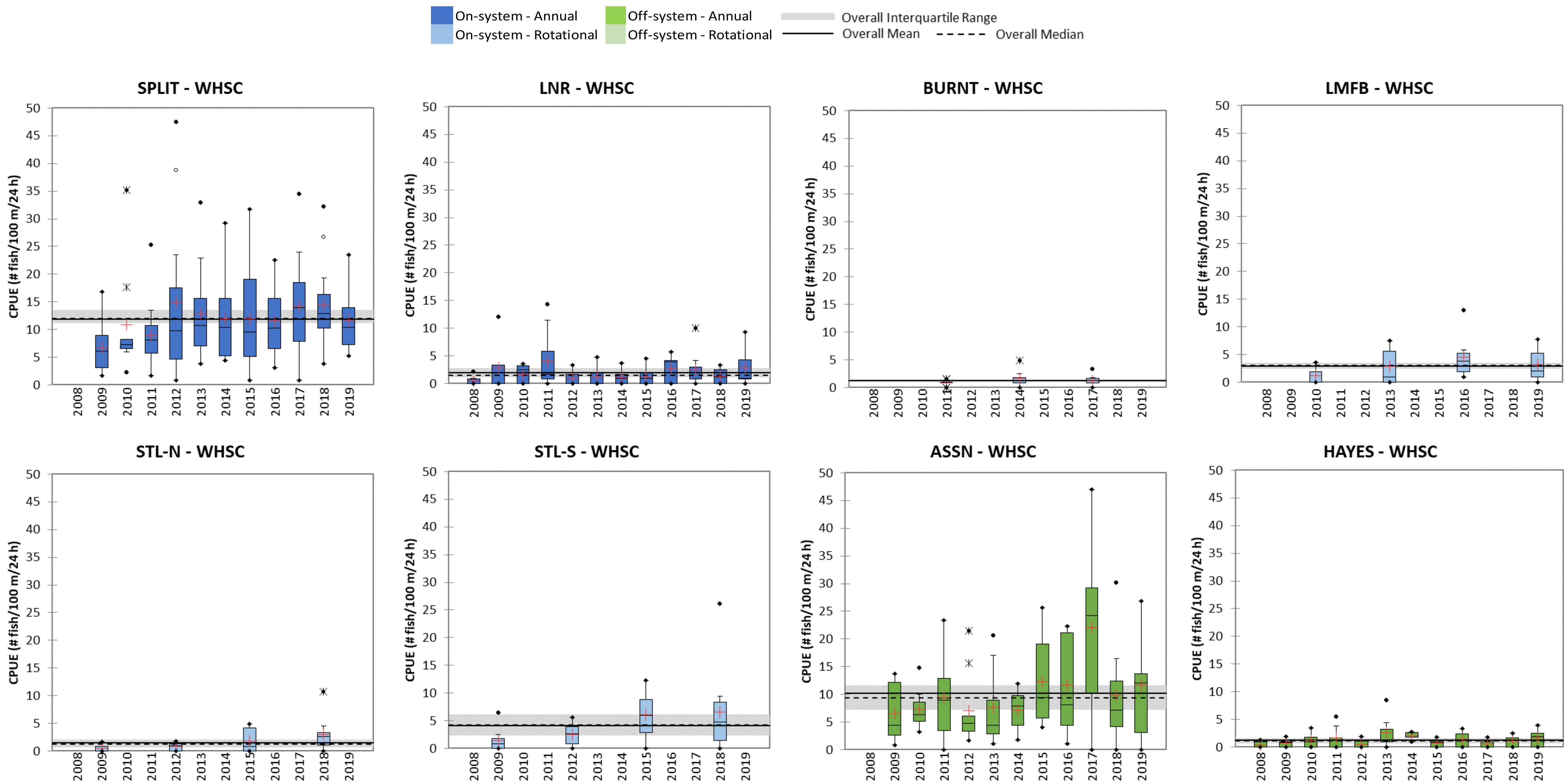


Figure 5.2-7. 2008-2019 Catch-per-unit-effort (CPUE) of White Sucker.

5.3 CONDITION

5.3.1 FULTON'S CONDITION FACTOR

5.3.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

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 1.57 in 2013 to a high of 1.93 in 2009 (Table 5.3-1; Figure 5.3-1).

The overall mean and median KF were 1.67 and the IQR was 1.65-1.71 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2012 and 2013 when it was below the IQR and in 2009 and 2016 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 0.64 in 2018 to a high of 0.77 in 2011 (Table 5.3-1; Figure 5.3-2).

The overall mean KF was 0.70, the median was 0.71, and the IQR was 0.67-0.74 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2017 and 2018 when it was below the IQR and in 2010 and 2011 when it was above the IQR.

Sauger

Sauger was not a target species in Split Lake until 2017; the annual mean KF of Sauger between 200 and 349 mm in fork length over the three years of monitoring ranged from a low of 0.98 in 2017 to a high of 1.01 in 2018 and 2019 (Table 5.3-1; Figure 5.3-3).

The overall mean KF was 1.00, the median was 1.01, and the IQR was 0.98-1.01 (Figure 5.3-3). The annual mean KF was equal to or fell within the overall IQR in all three years.

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 1.06 in 2017 to a high of 1.33 in 2011 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.21, the median was 1.15, and the IQR was 1.12-1.32 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2017, 2018, and 2019 when it was below the IQR.

White Sucker

White Sucker was not a target species in Split 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 1.58 in 2018 to a high of 1.72 in 2011 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.63, the median was 1.60, and the IQR was 1.60-1.64 (Figure 5.3-5). The annual mean KF fell within the overall IQR except in 2018 when it was below the IQR and 2010, 2011, and 2016 when it was above the IQR.

Lower Nelson River

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 1.40 in 2008 and 2010 to a high of 1.63 in 2016 (Table 5.3-1; Figure 5.3-1).

The overall mean and median KF were 1.49 and the IQR was 1.42-1.54 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2008 and 2010 when it was below the IQR and in 2009 and 2016 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 0.66 in 2014 to a high of 0.77 in 2011 (Table 5.3-1; Figure 5.3-2).

The overall mean KF was 0.71, the median was 0.70, and the IQR was 0.69-0.74 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2012 and 2014 when it was below the IQR and in 2011 when it was above the IQR.

Sauger

Only a single Sauger between 200 and 349 mm in fork length has been collected over the three years of monitoring since it was a target species in the lower Nelson River. The KF of this fish was 0.86 in 2017 (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 0.97 in 2018 to a high of 1.31 in 2010 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.17, the median was 1.15, and the IQR was 1.01-1.29 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2018 when it was below the IQR and in 2010 when it was above the IQR.

White Sucker

White Sucker was not a target species in the lower Nelson River 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 1.35 in 2015 to a high of 1.54 in 2014 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.49, the median was 1.50, and the IQR was 1.48-1.53 (Figure 5.3-5). The annual mean KF fell within the overall IQR except in 2015 and 2018 when it was below the IQR.

ROTATIONAL SITES

Burntwood River

Lake Whitefish

Over the three years of monitoring Lake Whitefish between 300 and 499 mm in fork length were only captured in 2014 and 2017 (Table 5.3-1). The mean KF in these years was 1.66 and 1.75, respectively (Figure 5.3-1).

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 2014 to a high of 0.72 in 2017 (Table 5.3-1; Figure 5.3-2).

The overall mean KF was 0.69, the median was 0.70, and the IQR was 0.66-0.72 (Figure 5.3-2). The annual mean KF was equal to or fell within the overall IQR in all three years.

Sauger

Over the three years of monitoring, Sauger was only a target species in the Burntwood River in 2017. In this year, Sauger between 200 and 349 mm in fork length had a mean KF of 0.93 (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 1.10 in 2017 to a high of 1.28 in 2011 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.19, the median was 1.14, and the IQR was 1.10-1.28 (Figure 5.3-4). The annual mean KF was equal to or fell within the overall IQR in all three years.

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 1.56 in 2011 and 2014 to a high of 1.57 in 2017 (Table 5.3-1; Figure 5.3-5).

The overall mean and median KF were 1.56 and the IQR was 1.56-1.57 (Figure 5.3-5). The annual mean KF fell within or was equal to the overall IQR in all three years.

Limestone Forebay

Lake Whitefish

Over the four years of monitoring a single Lake Whitefish between 300 and 499 mm in fork length was captured in only 2013 and 2016 (Table 5.3-1). The KF of these fish was 1.49 and 1.60, respectively (Figure 5.3-1).

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 0.71 in 2013 to a high of 0.75 in 2010 (Table 5.3-1; Figure 5.3-2). Northern Pike were not collected from the Limestone Forebay in 2016.

The overall mean KF was 0.74, the median was 0.72, and the IQR was 0.75 (Figure 5.3-2). The annual mean KF was equal to the overall IQR except in 2013 and 2019 when it was below the IQR.

Sauger

Over the four years of monitoring, Sauger was only a target species in the Limestone Forebay in 2019. In this year, Sauger between 200 and 349 mm in fork length had a mean KF of 0.91 (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 1.09 in 2019 to a high of 1.45 in 2010 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.14, the median was 1.09, and the IQR was 1.09-1.16 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2010 when in 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 1.61 in 2013 to a high of 1.74 in 2019 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.69, the median was 1.68, and the IQR was 1.68-1.74 (Figure 5.3-5). The annual mean KF fell within or was equal to the overall IQR except in 2013 when in was below the IQR.

Stephens Lake – North

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the four year of monitoring ranged from a low of 1.50 in 2012 to a high of 1.97 in 2009 (Table 5.3-1).

The overall mean KF was 1.61, the median was 1.55, and the IQR was 1.55-1.57 (Figure 5.3-1). The annual mean KF fell within or was equal to 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 ranged from a low of 0.65 in 2015 to a high of 0.73 in 2009 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.70 and the IQR was 0.65-0.73 (Figure 5.3-2). The annual mean KF was equal to or fell within the overall IQR in all four years.

Sauger

Over the four years of monitoring, Sauger was only a target species in the Stephens Lake - North in 2018. In this year, Sauger between 200 and 349 mm in fork length had a mean KF of 0.99 (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 2018 to a high of 1.39 in 2009 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.21, the median was 1.16, and the IQR was 1.08-1.25 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2009 when it was above the IQR.

White Sucker

White Sucker was not a target species in Stephens Lake - North until 2012; 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 1.65 in 2015 to a high of 1.74 in 2018 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.71, the median was 1.74, and the IQR was 1.65-1.74 (Figure 5.3-5). The annual mean KF was equal to or fell within the overall IQR in all three years.

Stephens Lake – South

Lake Whitefish

The annual mean KF of Lake Whitefish between 300 and 499 mm in fork length over the four year of monitoring ranged from a low of 1.69 in 2012 to a high of 2.01 in 2009 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.92, the median was 1.90, and the IQR was 1.89-2.01 (Figure 5.3-1). The annual mean KF fell within or was equal to the overall IQR except in 2012 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 four years of monitoring ranged from a low of 0.67 in 2018 to a high of 0.76 in 2009 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.72 and the IQR was 0.68-0.76 (Figure 5.3-2). The annual mean KF was equal to or fell within the overall IQR in all four years.

Sauger

Over the four years of monitoring, Sauger was only a target species in Stephens Lake - South in 2018. In this year, Sauger between 200 and 349 mm in fork length had a mean KF of 0.97 (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 1.10 in 2018 to a high of 1.40 in 2009 (Table 5.3-1; Figure 5.3-4).

The overall mean and median KF were 1.28 and the IQR was 1.16-1.40 (Figure 5.3-4). The annual mean KF fell within or was equal to the overall IQR except in 2018 when it was below the IQR.

White Sucker

White Sucker was not a target species in Stephens Lake - South until 2012; 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 1.68 in 2018 to a high of 1.74 in 2015 (Table 5.3-1; Figure 5.3-5).

The overall mean and median KF were 1.71 and the IQR was 1.68-1.74 (Figure 5.3-5). The annual mean KF was equal to or fell within the overall IQR in all three years.

5.3.1.2 OFF-SYSTEM SITES

ANNUAL SITES

<u>Assean Lake</u>

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 1.32 in 2013 to a high of 1.92 in 2015 (Table 5.3-1; Figure 5.3-1).

The overall mean and median KF were 1.58 and the IQR was 1.49-1.61 (Figure 5.3-1). The annual mean KF fell within the overall IQR except in 2013 and 2018 when it was below the IQR and in 2015, 2016, 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 11 years of monitoring ranged from a low of 0.63 in 2009 to a high of 0.71 in 2011 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.67 and the IQR was 0.64-0.68 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2011 when it was above the IQR.

Sauger

Sauger were not captured in Assean Lake over the 11 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 1.04 in 2013 to a high of 1.18 in 2011 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.10, the median was 1.09, and the IQR was 1.08-1.12 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2013 and 2018 when it was below the IQR and in 2011 when it was above the IQR.

White Sucker

White Sucker was not a target species in Assean 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 1.56 in 2014 to a high of 1.68 in 2010 (Table 5.3-1; Figure 5.3-5).

The overall mean and median KF were 1.62 and the IQR was 1.59-1.65 (Figure 5.3-5). The annual mean KF fell within the overall IQR except in 2014 when it was below the IQR and in 2010 when it was above the IQR.

Hayes River

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 1.29 in 2011 to a high of 1.51 in 2009 (Table 5.3-1; Figure 5.3-1).

The overall mean KF was 1.42, the median was 1.37, and the IQR was 1.37-1.48 (Figure 5.3-1). The annual mean KF fell within the overall IQR except 2011 and 2017 when it was below the IQR and in 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 12 years of monitoring ranged from a low of 0.63 in 2008 to a high of 0.77 in 2016 (Table 5.3-1; Figure 5.3-2).

The overall mean and median KF were 0.72 and the IQR was 0.70-0.75 (Figure 5.3-2). The annual mean KF fell within the overall IQR except in 2008, 2012, and 2017 when it was below the IQR and in 2016 when it was above the IQR.

Sauger

Sauger were not captured in the Hayes River 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 1.02 in 2017 to a high of 1.19 in 2016 (Table 5.3-1; Figure 5.3-4).

The overall mean KF was 1.10, the median was 1.12, and the IQR was 1.06-1.14 (Figure 5.3-4). The annual mean KF fell within the overall IQR except in 2017 when it was below the IQR and in 2016 when it was above the IQR.

White Sucker

White Sucker was not a target species in the Hayes River 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 1.34 in 2016 to a high of 1.51 in 2014 (Table 5.3-1; Figure 5.3-5).

The overall mean KF was 1.45, the median was 1.47, and the IQR was 1.40-1.49 (Figure 5.3-5). The annual mean KF fell within the overall IQR except in 2011 and 2016 when it was below the IQR and in 2014 when it was above the IQR.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

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
SPLIT	2009	5	1.93	0.07	41	0.74	0.01				166	1.32	0.01			
	2010	21	1.65	0.04	55	0.75	0.01				151	1.30	0.01	141	1.67	0.01
	2011	23	1.71	0.03	47	0.77	0.01				97	1.33	0.01	97	1.72	0.02
	2012	26	1.62	0.04	57	0.71	0.01				46	1.19	0.01	165	1.60	0.01
	2013	19	1.57	0.04	51	0.67	0.01				132	1.15	0.01	143	1.60	0.01
	2014	10	1.68	0.03	47	0.71	0.01				115	1.15	0.01	151	1.60	0.01
	2015	21	1.67	0.03	47	0.68	0.01				89	1.12	0.01	140	1.64	0.01
	2016	22	1.74	0.03	19	0.67	0.02				51	1.12	0.02	127	1.68	0.01
	2017	33	1.67	0.03	27	0.66	0.01	55	0.98	0.02	56	1.06	0.01	191	1.62	0.01
	2018	28	1.65	0.04	35	0.64	0.01	56	1.01	0.02	33	1.08	0.02	160	1.58	0.01
	2019	18	1.72	0.04	36	0.67	0.02	44	1.01	0.03	42	1.10	0.02	146	1.60	0.01
LNR	2008	8	1.40	0.05	37	0.69	0.01				5	1.16	0.04			
	2009	20	1.58	0.03	55	0.73	0.01				43	1.29	0.01			
	2010	24	1.40	0.02	58	0.74	0.01				35	1.31	0.02	15	1.48	0.04
	2011	30	1.54	0.04	69	0.77	0.01				23	1.26	0.03	33	1.50	0.03
	2012	14	1.54	0.03	58	0.67	0.01				6	1.22	0.02	8	1.49	0.04
	2013	10	1.51	0.05	56	0.69	0.01				13	1.15	0.04	8	1.48	0.03
	2014	11	1.46	0.04	43	0.66	0.01				24	1.14	0.02	9	1.54	0.04
	2015	12	1.42	0.04	25	0.72	0.02				14	1.15	0.05	9	1.35	0.04
	2016	4	1.63	0.04	19	0.69	0.01				6	1.24	0.04	13	1.53	0.05
	2017	15	1.49	0.05	27	0.69	0.02	1	0.86	-	39	1.01	0.02	21	1.49	0.04
	2018	6	1.43	0.07	14	0.74	0.02	-	-	-	18	0.97	0.03	13	1.42	0.05
	2019	13	1.44	0.04	26	0.70	0.02	-	-	-	18	1.01	0.03	30	1.53	0.03
BURNT	2011	-	-	-	8	0.70	0.03				48	1.28	0.02	8	1.56	0.04
	2014	4	1.66	0.06	9	0.66	0.02				22	1.14	0.02	11	1.56	0.04
	2017	5	1.75	0.07	6	0.72	0.03	11	0.93	0.04	35	1.10	0.02	11	1.57	0.03
LMFB	2010	-	-	-	36	0.75	0.01				2	1.45	0.02	10	1.69	0.06
	2013	1	1.49	-	9	0.71	0.01				6	1.16	0.06	21	1.61	0.03
	2016	1	1.60	-	-	-	-				5	1.14	0.04	30	1.68	0.02
	2019	-	-	-	2	0.73	0.05	2	0.91	0.00	13	1.09	0.03	30	1.74	0.03
STL-N	2009	5	1.97	0.12	67	0.73	0.01				77	1.39	0.01			
	2012	5	1.50	0.08	47	0.70	0.01				75	1.25	0.01	9	1.68	0.04
	2015	9	1.57	0.05	59	0.65	0.01				114	1.16	0.01	11	1.65	0.04
	2018	14	1.55	0.06	18	0.69	0.03	10	0.99	0.03	102	1.08	0.01	24	1.74	0.03
STL-S	2009	4	2.01	0.07	54	0.76	0.01				123	1.40	0.01			
	2012	1	1.69	-	50	0.72	0.01				42	1.28	0.02	23	1.71	0.03
	2015	3	1.90	0.14	38	0.68	0.01				63	1.16	0.01	46	1.74	0.02
	2018	3	1.89	0.03	22	0.67	0.01	3	0.97	0.04	48	1.10	0.02	51	1.68	0.02
ASSN	2009	20	1.62	0.03	43	0.63	0.01	-	-	-	199	1.13	0.01			
	2010	55	1.61	0.02	68	0.64	0.01	-	-	-	290	1.09	0.00	79	1.68	0.01
	2011	68	1.49	0.01	60	0.71	0.01	-	-	-	251	1.18	0.01	69	1.58	0.01
	2012	75	1.58	0.02	90	0.68	0.01	-	-	-	249	1.12	0.01	64	1.58	0.01
	2013	8	1.32	0.05	61	0.69	0.01	-	-	-	158	1.04	0.01	67	1.59	0.01
	2014	10	1.59	0.03	62	0.66	0.01	-	-	-	186	1.10	0.01	69	1.56	0.01
	2015	9	1.92	0.06	48	0.68	0.01	-	-	-	156	1.08	0.01	100	1.61	0.01
	2016	7	1.90	0.12	40	0.64	0.01	-	-	-	110	1.08	0.01	88	1.65	0.01
	2017	6	1.66	0.06	70	0.67	0.01	-	-	-	159	1.07	0.00	219	1.62	0.01
	2018	8	1.46	0.06	39	0.64	0.01	-	-	-	260	1.05	0.01	82	1.59	0.02
	2019	3	1.77	0.12	41	0.66	0.01	-	-	-	291	1.09	0.00	103	1.65	0.01
HAYES	2008	10	1.37	0.05	1	0.63	-	-	-	-	18	1.07	0.02			
	2009	1	1.51	-	2	0.72	0.01	-	-	-	12	1.06	0.02			
	2010	9	1.46	0.02	6	0.73	0.03	-	-	-	26	1.15	0.02	10	1.48	0.04
	2011	4	1.29	0.03	2	0.71	0.03	-	-	-	12	1.06	0.03	12	1.37	0.02
	2012	3	1.44	0.03	2	0.67	0.05	-	-	-	17	1.11	0.02	4	1.49	0.03
	2013	-	-	-	4	0.75	0.03	-	-	-	23	1.05	0.01	18	1.47	0.03
	2014	17	1.50	0.03	6	0.72	0.02	-	-	-	21	1.13	0.02	16	1.51	0.03
	2015	44	1.37	0.02	5	0.76	0.02	-	-	-	28	1.12	0.02	5	1.45	0.06
	2016	22	1.37	0.04	4	0.77	0.03	-	-	-	15	1.19	0.03	10	1.34	0.05
	2017	8	1.30	0.04	7	0.66	0.02	-	-	-	24	1.02	0.01	5	1.40	0.05
	2018	28	1.48	0.03	2	0.72	0.01	-	-	-	20	1.14	0.02	8	1.49	0.05
	2019	21	1.49	0.08	2	0.70	0.02	-	-	-	21	1.13	0.02	10	1.43	0.06

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.

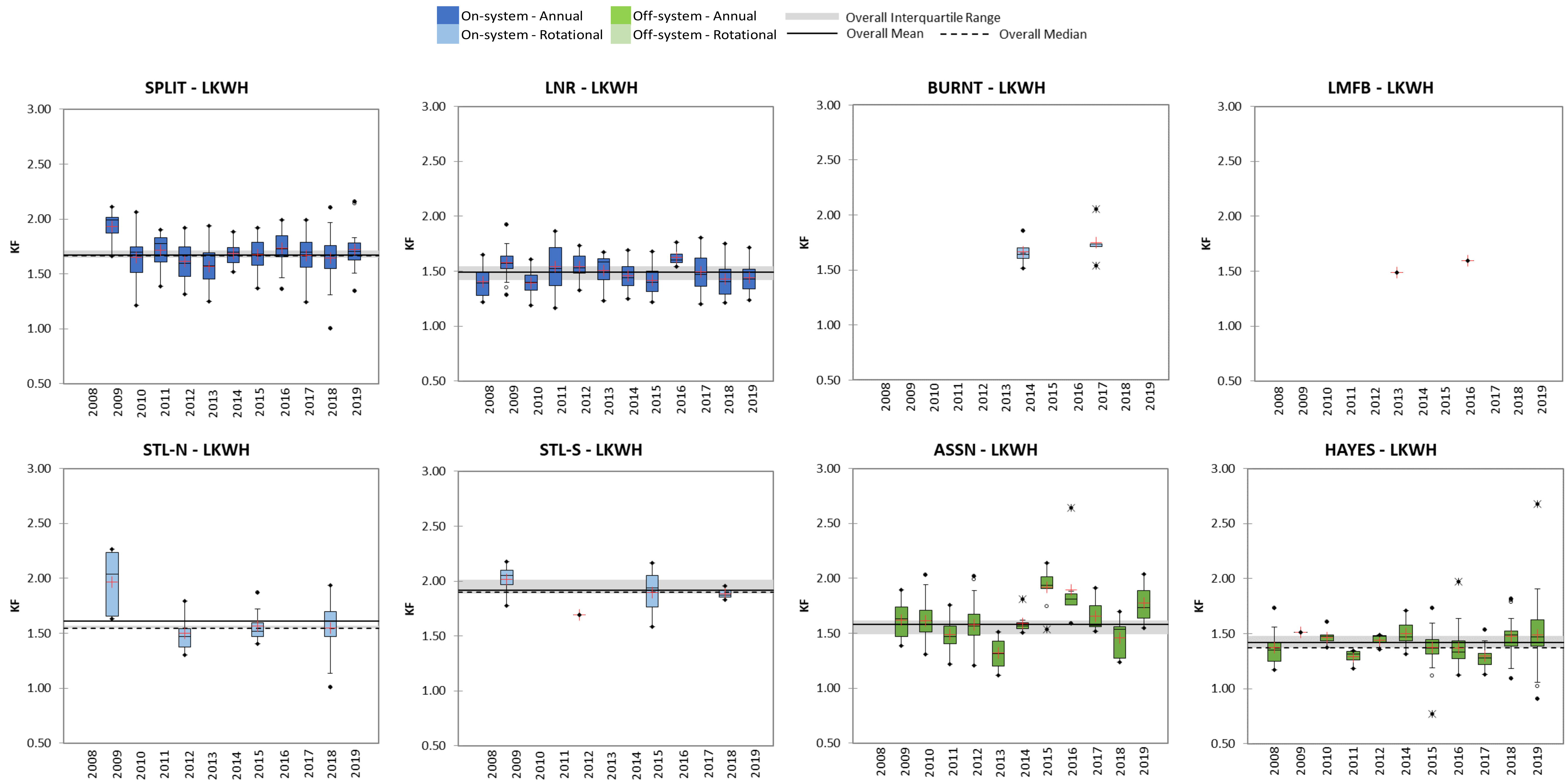


Figure 5.3-1. 2008-2019 Fulton's condition factor (KF) of Lake Whitefish.

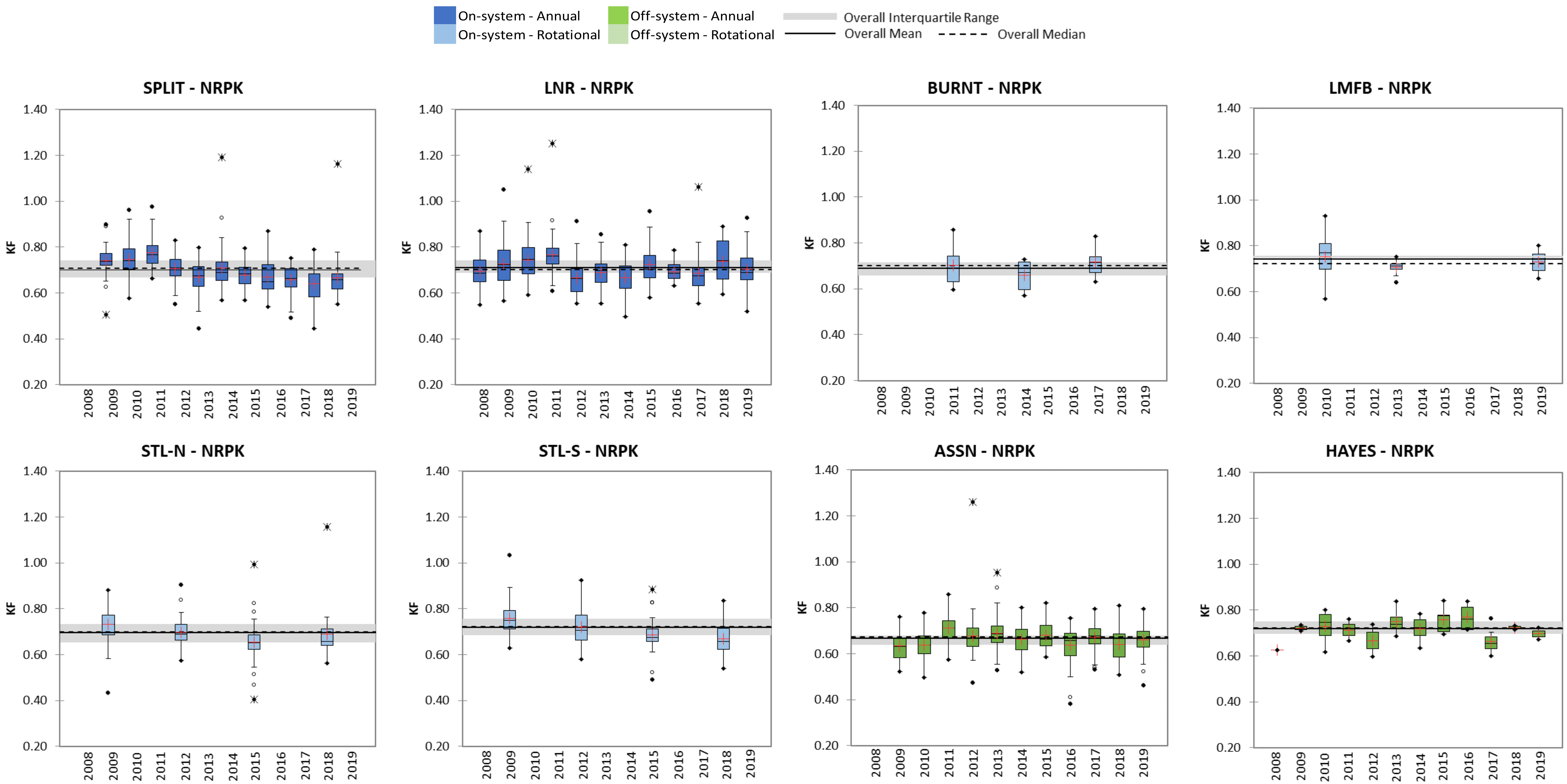


Figure 5.3-2. 2008-2019 Fulton's condition factor (KF) of Northern Pike.

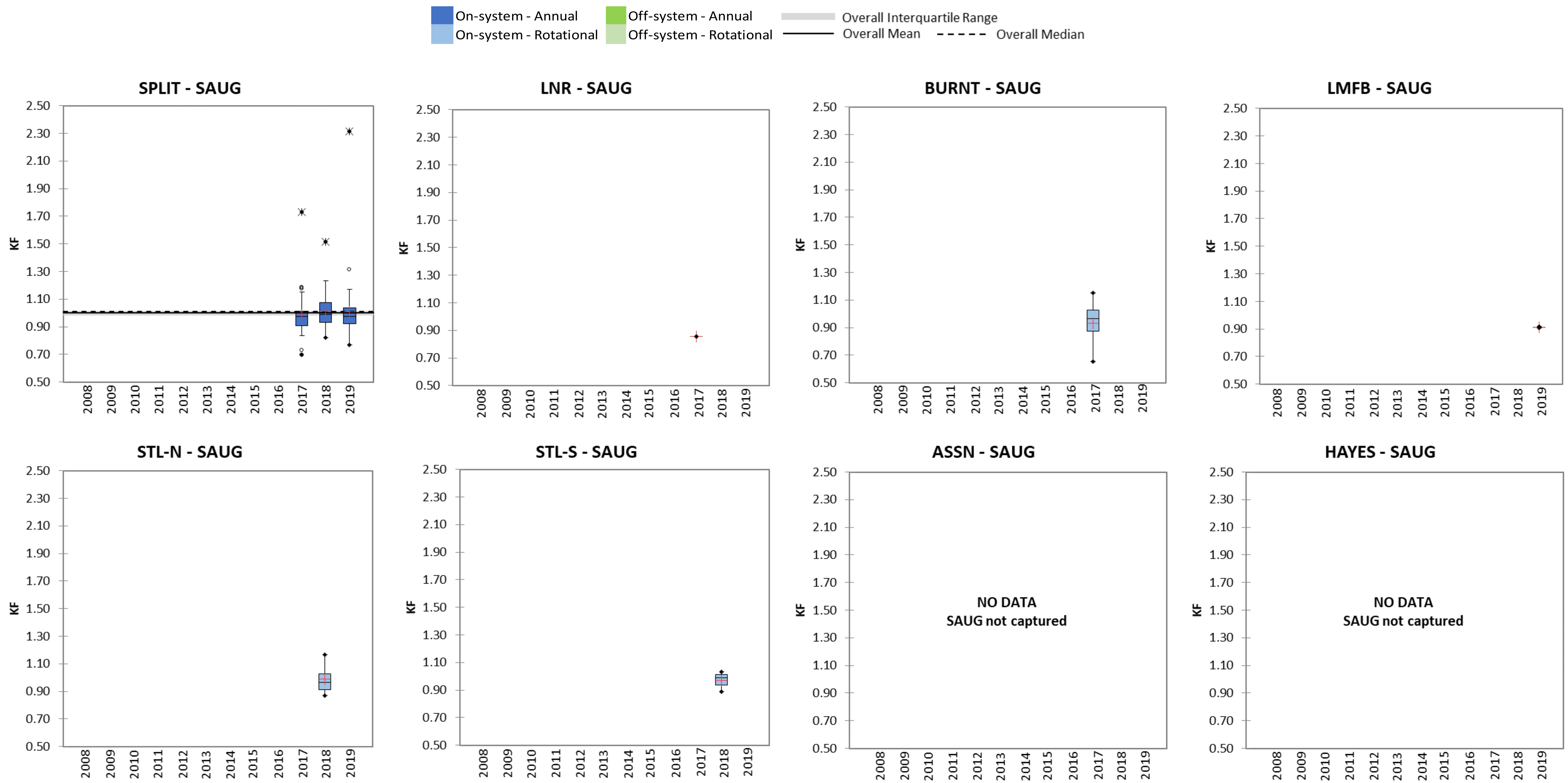


Figure 5.3-3. 2008-2019 Fulton's condition factor (KF) of Sauger.

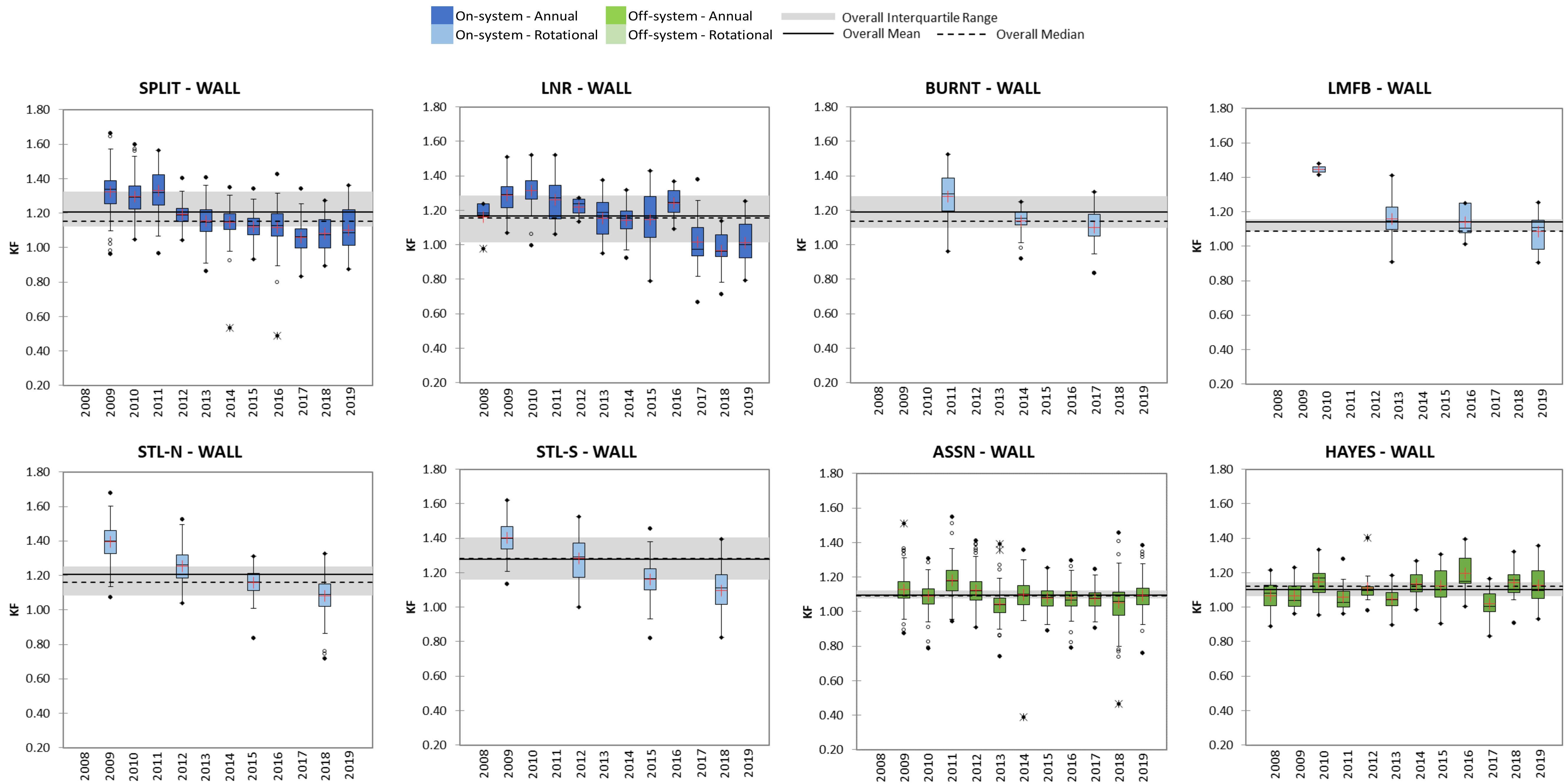


Figure 5.3-4. 2008-2019 Fulton's condition factor (KF) of Walleye.

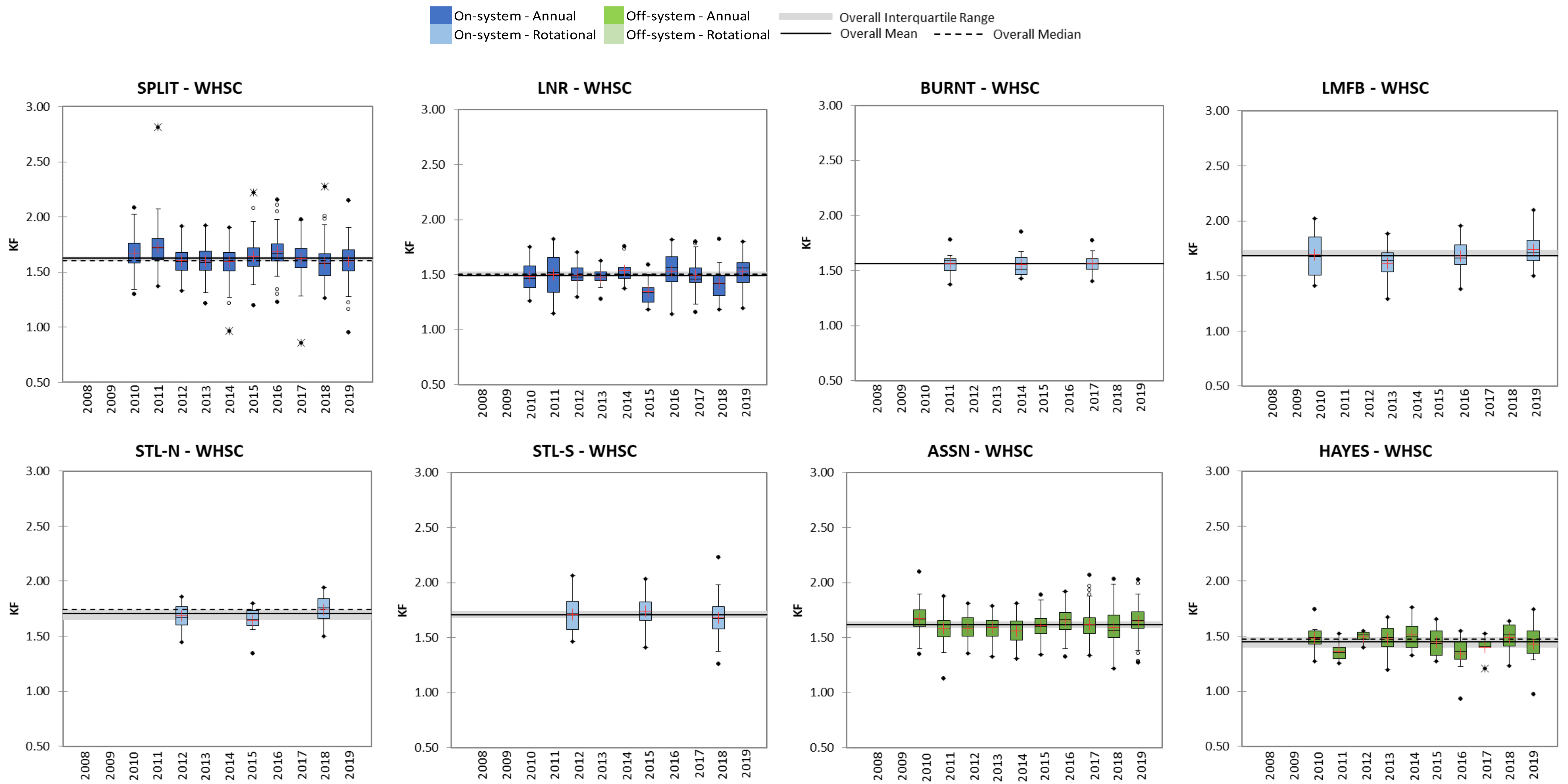


Figure 5.3-5. 2008-2019 Fulton's condition factor (KF) of White Sucker.

5.3.2 RELATIVE WEIGHT

5.3.2.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the 11 years of monitoring ranged from a low of 110 in 2013 to a high of 130 in 2009 (Table 5.3-2; Figure 5.3-6).

The overall mean and median Wr were 116 and the IQR was 113-116 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2013 when it was below the IQR and in 2009 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 11 years of monitoring ranged from a low of 83 in 2017, 2018, and 2019 to a high of 96 in 2011 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 88 and the IQR was 84-93 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2018 when it was below the IQR and in 2011 when it was above the IQR.

Sauger

Sauger was not a target species in Split Lake until 2017; the annual mean Wr of Sauger greater than 69 mm in total length over the three years of monitoring ranged from a low of 92 in 2017 to a high of 95 in 2019 (Table 5.3-2; Figure 5.3-8).

The overall mean and median Wr were 93 and the IQR was 92-93 (Figure 5.3-8). The annual mean Wr fell within the overall IQR except in 2019 when it was above the IQR.

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 86 in 2017 to a high of 106 in 2009 and 2011 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 96, the median was 93, and the IQR was 92-101 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2017, 2018, and 2019 when it was below the IQR and in 2009 and 2011 when it was above the IQR.

White Sucker

White Sucker was not a target species in Split 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 102 in 2012, 2014, and 2018 to a high of 109 in 2011 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 104, the median was 103, and the IQR was 102-107 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2011 when it was above the IQR.

Lower Nelson River

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 97 in 2008 to a high of 115 in 2016 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 104, the median was 103, and the IQR was 98-107 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2009 and 2016 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 ranged from a low of 84 in 2014 to a high of 95 in 2019 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 90, the median was 91, and the IQR was 87-93 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2014 when it was below the IQR and in 2019 when it was above the IQR.

Sauger

Sauger was not a target species in the lower Nelson River until 2017; only two Sauger greater than 69 mm in total length over the three years of monitoring (Table 5.3-2) The Wr of these fish was 80 in 2017 and 72 in 2018 (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 81 in 2018 to a high of 102 in 2010 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 93 and the IQR was 91-99 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2017, 2018, and 2019 when it was below the IQR and in 2010 when it was above the IQR.

White Sucker

White Sucker was not a target species in the lower Nelson River 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 87 in 2015 to a high of 99 in 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean and median Wr were 94 and the IQR was 93-96 (Figure 5.3-10). The annual mean KF fell within the overall IQR except in 2015 and 2018 when it was below the IQR and in 2019 when it was above the IQR.

ROTATIONAL SITES

Burntwood River

Lake Whitefish

Over the three years of monitoring Lake Whitefish between 99 mm and 701 mm in total length were only captured in 2014 and 2017 (Table 5.3-2). The mean Wr in each of these years was 115 (Figure 5.3-6).

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 81 in 2014 to a high of 89 in 2017 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 86, the median was 88, and the IQR was 81-88 (Figure 5.3-7). The annual mean Wr was equal to or fell within the overall IQR in all three years.

Sauger

Over the three years of monitoring, Sauger was only a target species in the Burntwood River in 2017. In this year, Sauger greater than 69 mm in total length had a mean Wr of 89 (Table 5.3-2; Figure 5.3-8).

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 87 in 2017 to a high of 101 in 2011 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 94, the median was 92, and the IQR was 87-101 (Figure 5.3-9). The annual mean Wr was equal to or fell within the overall IQR in all three years.

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 98 in 2014 to a high of 102 in 2017 (Table 5.3-2; Figure 5.3-10).

The overall mean and median Wr were 100 and the IQR was 98-102 (Figure 5.3-10). The annual mean Wr was equal to or fell within the overall IQR in all three years.

Limestone Forebay

Lake Whitefish

Over the four years of monitoring four Lake Whitefish between 99 and 701 mm in total length were captured (Table 5.3-2). The annual mean Wr of these fish was 116 in 2010, 108 in 2013, and 110 in 2016 (Figure 5.3-6).

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 87 in 2013 and 2019 to a high of 93 in 2010 (Table 5.3-2; Figure 5.3-7). Northern Pike were not collected from the Limestone Forebay in 2016.

The overall mean Wr was 91, the median was 93, and the IQR was 87-93 (Figure 5.3-7). The annual mean Wr was equal to or fell within the overall IQR in all three years.

Sauger

Over four years of monitoring, Sauger was only a target species in the Limestone Forebay in 2019. In this year, Sauger greater than 69 mm in total length had a mean Wr of 86 (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 87 in 2019 to a high of 103 in 2010 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 91, the median was 90, and the IQR was 87-92 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2010 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 102 in 2013 to a high of 112 in 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 106, the median was 104, and the IQR was 102-112 (Figure 5.3-10). The annual mean Wr was equal to or fell within the overall IQR in all four years.

Stephens Lake – North

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 102 in 2012 to a high of 130 in 2009 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 110, the median was 107, and the IQR was 105-107 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2012 when it was below the IQR and 2009 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 82 in 2015 to a high of 91 in 2009 (Table 5.3-2; Figure 5.3-7).

The overall mean and median Wr were 86 and the IQR was 82-91 (Figure 5.3-7). The annual mean Wr was equal to or fell within the overall IQR in all four years.

Sauger

Over the four years of monitoring, Sauger was only a target species in Stephens Lake - North in 2018. In this year, Sauger greater than 69 mm in total length had a mean Wr of 99 (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 88 in 2018 to a high of 110 in 2009 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 97, the median was 93, and the IQR was 93-100 (Figure 5.3-9). The annual mean Wr 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 a target species in Stephens Lake - North 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 102 in 2015 to a high of 111 in 2018 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 108, the median was 111, and the IQR was 102-111 (Figure 5.3-10). The annual mean Wr was equal to or fell within the overall IQR in all three years.

Stephens Lake – South

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 110 in 2015 to a high of 138 in 2009 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 123, the median was 121, and the IQR was 110-129 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2009 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 85 in 2018 to a high of 93 in 2009 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 89, the median was 88, and the IQR was 86-93 (Figure 5.3-7). The annual mean Wr was equal to or fell within the overall IQR in all four years.

Sauger

Over the four years of monitoring, Sauger was only a target species in Stephens Lake - South in 2018. In this year, Sauger greater than 69 mm in total length had a mean Wr of 95 (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 87 in 2018 to a high of 111 in 2009 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 100, the median was 101, and the IQR was 91-111 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2018 when it was below the IQR.

White Sucker

White Sucker was not a target species in Stephens Lake - South 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 106 in 2012 to a high of 111 in 2015 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 109, the median was 108, and the IQR was 108-111 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2012 when it was below the IQR.

5.3.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Lake Whitefish

The annual mean Wr of Lake Whitefish between 99 mm and 701 mm in total length over the 11 years of monitoring ranged from a low of 92 in 2013 to a high of 128 in 2015 (Table 5.3-2; Figure 5.3-6).

The overall mean and median Wr were 110 and the IQR was 105-113 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2013 and 2018 when it was below the IQR and in 2009, 2015, and 2016 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 it was a target species ranged from a low of 79 in 2016 to a high of 88 in 2011 and 2016 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 83, the median was 84, and the IQR was 80-85 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2011 when it was above the IQR.

Sauger

Sauger were not captured in Assean Lake over the 11 years of monitoring (Table 5.2-1).

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 82 in 2018 to a high of 94 in 2011 (Table 5.3-2; Figure 5.3-9).

The overall mean Wr was 87, the median was 88, and the IQR was 86-89 (Figure 5.3-9). The annual mean Wr fell within the overall IQR except in 2013 and 2018 when it was below the IQR and in 2009 and 2011 when it was above the IQR.

White Sucker

White Sucker was not a target species in Assean 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 97 in 2011 to a high of 105 in 2010 and 2019 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 102, the median was 103, and the IQR was 101-104 (Figure 5.3-10). The annual mean Wr fell within the overall IQR except in 2011 and 2014 when it was below the IQR.

Hayes River

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 70 in 2013 to a high of 108 in 2009 (Table 5.3-2; Figure 5.3-6).

The overall mean Wr was 101, the median was 99, and the IQR was 99-106 (Figure 5.3-6). The annual mean Wr fell within the overall IQR except in 2011 and 2017 when it was below the IQR and in 2009 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 ranged from a low of 84 in 2008 to a high of 98 in 2015 (Table 5.3-2; Figure 5.3-7).

The overall mean Wr was 91, the median was 90, and the IQR was 88-94 (Figure 5.3-7). The annual mean Wr fell within the overall IQR except in 2008 and 2018 when it was below the IQR and in 2015 when it was above the IQR.

Sauger

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

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 78 in 2018 to a high of 93 in 2016 (Table 5.3-2; Figure 5.3-9).

The overall mean and median Wr were 86 and the IQR was 82-91 (Figure 5.3-9). The annual mean Wr fell within the overall IQR in all years except 2018 when it was below the IQR and in 2016 when it was above the IQR.

White Sucker

White Sucker was not a target species in the Hayes River 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 85 in 2011 to a high of 99 in 2014 (Table 5.3-2; Figure 5.3-10).

The overall mean Wr was 92, the median was 93, and the IQR was 87-95 (Figure 5.3-10). The annual mean Wr fell within the overall IQR in all years except in 2011 when it was below the IQR and in 2014 when it was above the IQR

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

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
SPLIT	2009	10	130	3	58	93	1				189	106	1			
	2010	28	114	3	76	93	1				199	101	1	154	107	1
	2011	34	116	2	54	96	1				150	106	1	122	109	1
	2012	29	112	2	82	89	1				78	96	1	207	102	1
	2013	20	110	3	69	84	1				172	92	1	162	103	1
	2014	11	116	2	50	88	2				175	92	1	167	102	1
	2015	22	116	2	59	84	1				125	89	1	163	104	1
	2016	23	121	2	34	87	2				101	93	1	146	108	1
	2017	34	116	2	35	83	1	102	92	1	83	86	1	208	104	1
	2018	29	113	3	50	83	2	86	93	1	69	88	1	183	102	1
	2019	19	121	3	41	83	2	52	95	3	59	89	2	155	103	1
LNR	2008	8	97	3	61	87	1				8	91	2			
	2009	20	109	2	82	91	1				54	99	1			
	2010	25	98	1	80	93	1				45	102	2	19	94	2
	2011	32	107	2	94	94	1				32	99	2	41	93	2
	2012	15	106	2	106	86	1				16	92	2	9	97	2
	2013	10	104	3	86	87	1				50	93	2	12	94	2
	2014	14	98	3	65	84	1				28	91	2	11	96	3
	2015	15	103	3	41	89	2				23	94	3	12	87	2
	2016	5	115	2	32	89	1				10	100	4	24	95	3
	2017	16	103	3	55	91	2	1	80	-	44	82	2	27	93	3
	2018	7	103	5	34	94	2	1	72	-	21	81	3	14	90	3
	2019	13	101	3	53	95	2	-	-	-	18	82	2	30	99	2
BURNT	2011	-	-	-	12	88	3				59	101	1	9	100	3
	2014	4	115	3.53	10	81	2				32	92	1	16	98	2
	2017	7	115	4.96	7	89	3	15	89	2.9	46	87	1	13	102	2
LMFB	2010	1	116	-	41	93	2				5	103	5	12	106	4
	2013	2	108	2	11	87	1				10	92	3	29	102	2
	2016	1	110	-	-	-	-				5	90	3	41	104	2
	2019	-	-	-	3	87	5	2	86	0	15	87	2	32	112	2
STL-N	2009	11	130	4	80	91	1				109	110	1			
	2012	7	102	4	56	86	1				109	100	1	9	109	3
	2015	19	105	3	83	82	1				155	93	1	15	102	3
	2018	17	107	4	21	84	3	21	99	-	115	88	1	26	111	2
STL-S	2009	6	138	4	74	93	1				178	111	1			
	2012	5	121	2	65	88	1				81	101	1	34	106	3
	2015	9	110	9	49	86	2				96	91	1	56	111	1
	2018	4	129	2	28	85	2	5	95	-	66	87	1	58	108	2
ASSN	2009	40	115	2	66	80	1	-	-	-	237	91	1			
	2010	81	113	1	85	80	1	-	-	-	332	88	0	93	105	1
	2011	81	105	1	67	88	1	-	-	-	282	94	0	97	97	1
	2012	82	110	1	113	84	1	-	-	-	341	88	0	76	100	1
	2013	8	92	4	74	85	1	-	-	-	208	84	1	74	101	1
	2014	10	109	2	82	82	1	-	-	-	308	86	1	75	98	2
	2015	12	128	4	68	85	1	-	-	-	302	86	0	118	103	1
	2016	9	125	8	59	79	1	-	-	-	187	88	1	111	104	1
	2017	28	107	3	95	84	1	-	-	-	302	87	0	246	103	1
	2018	13	99	3	51	80	1	-	-	-	429	82	1	92	101	1
	2019	5	111	7	55	82	1	-	-	-	358	89	0	112	105	1
HAYES	2008	10	98	3	4	84	5	-	-	-	29	85	1			
	2009	1	108	-	2	88	1	-	-	-	16	86	2			
	2010	11	106	2	10	88	2	-	-	-	45	88	2	13	95	2
	2011	5	94	2	4	87	2	-	-	-	18	83	2	15	85	2
	2012	3	103	3	4	94	8	-	-	-	41	86	2	4	96	2
	2013	1	70	-	8	94	3	-	-	-	45	82	1	25	93	2
	2014	19	107	2	12	88	3	-	-	-	30	91	1	19	99	2
	2015	48	99	1	19	98	2	-	-	-	45	89	2	6	93	4
	2016	24	99	3	14	92	3	-	-	-	33	93	2	11	87	3
	2017	10	92	2	14	88	2	-	-	-	35	81	1	7	86	4
	2018	30	105	2	10	86	3	-	-	-	59	78	2	10	95	4
	2019	24	106	5	13	90	5	-	-	-	61	91	5	15	89	4

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.

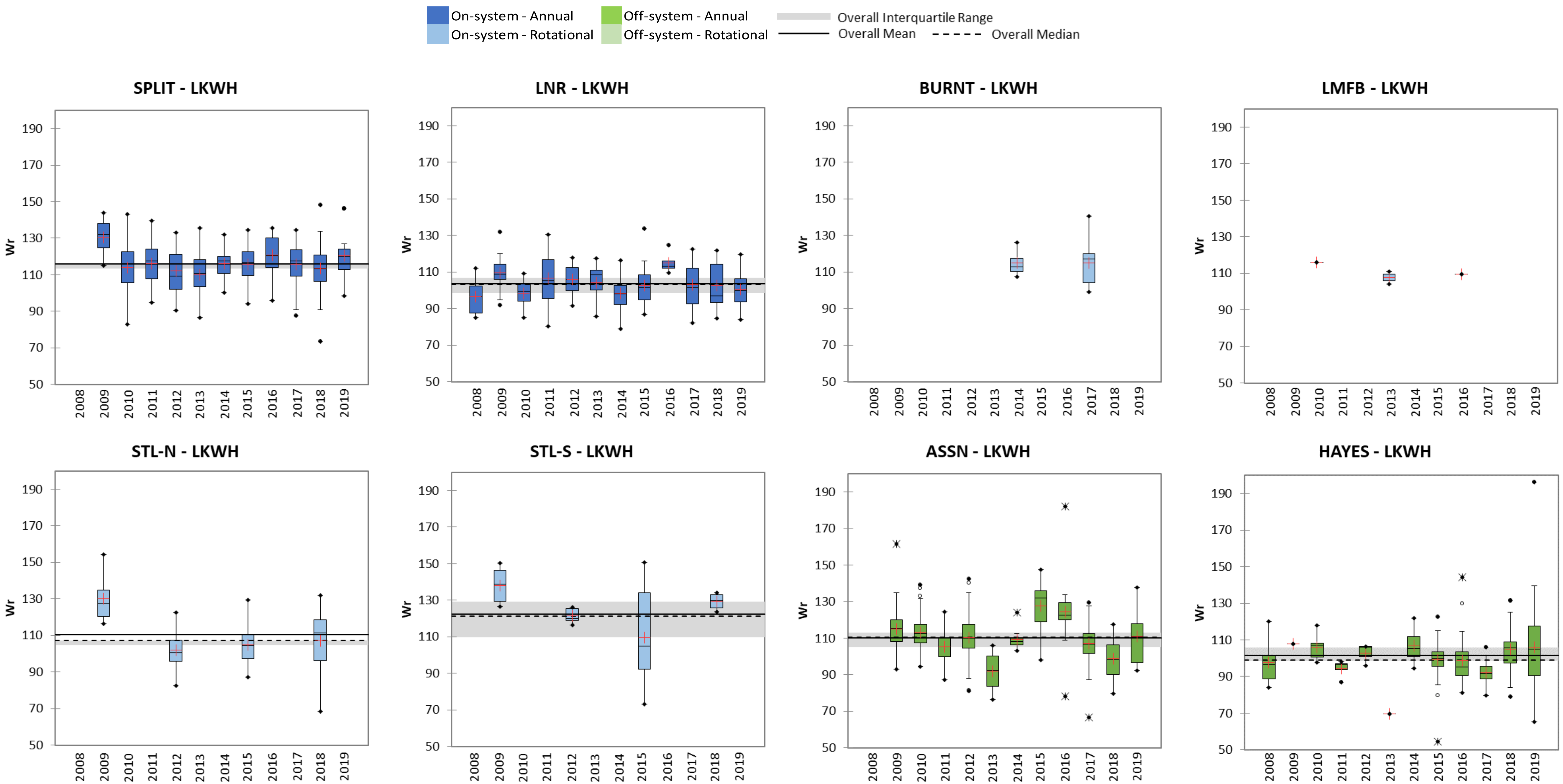


Figure 5.3-6. 2008-2019 Relative weight (Wr) of Lake Whitefish.

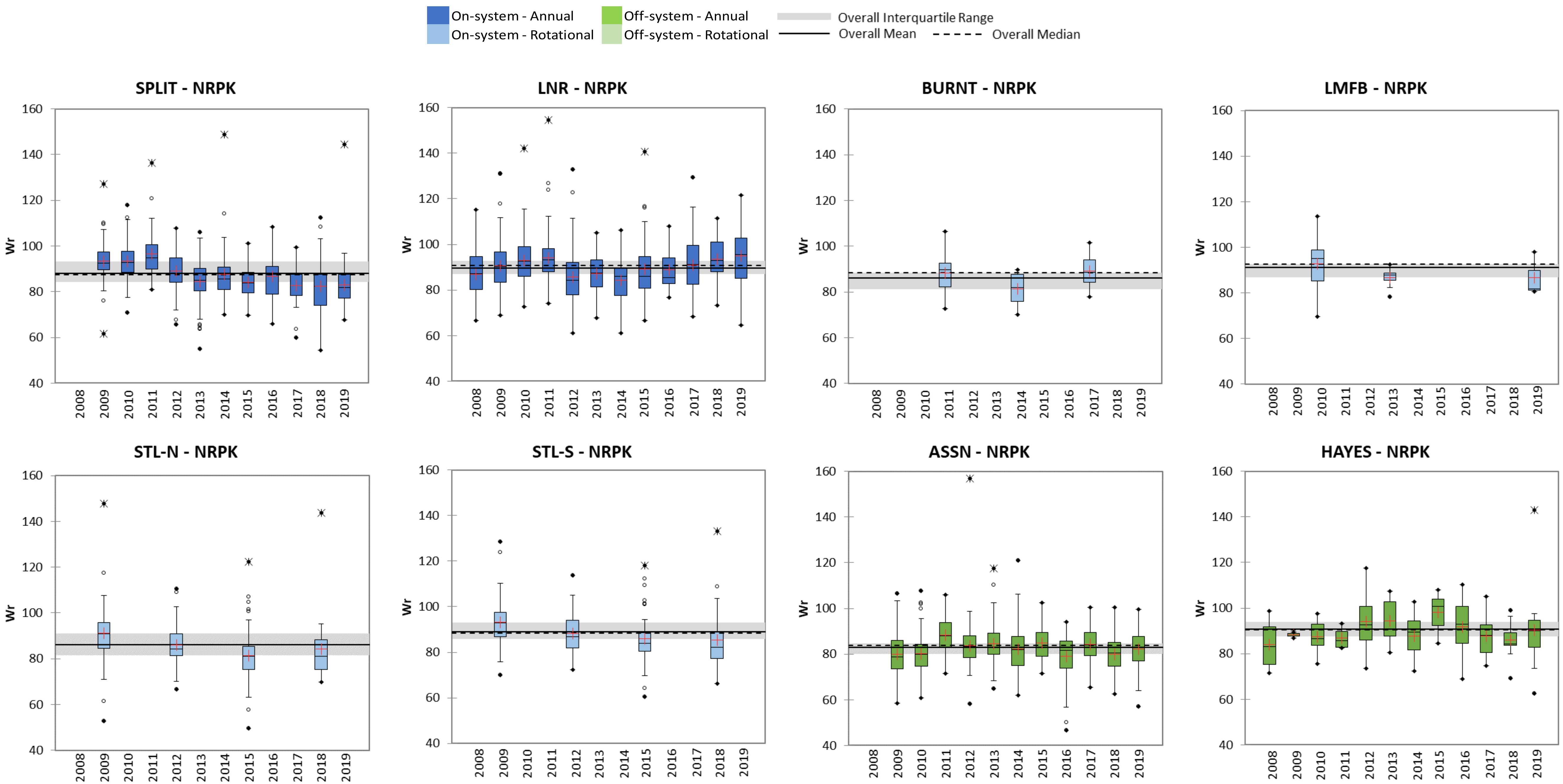


Figure 5.3-7. 2008-2019 Relative weight (Wr) of Northern Pike.

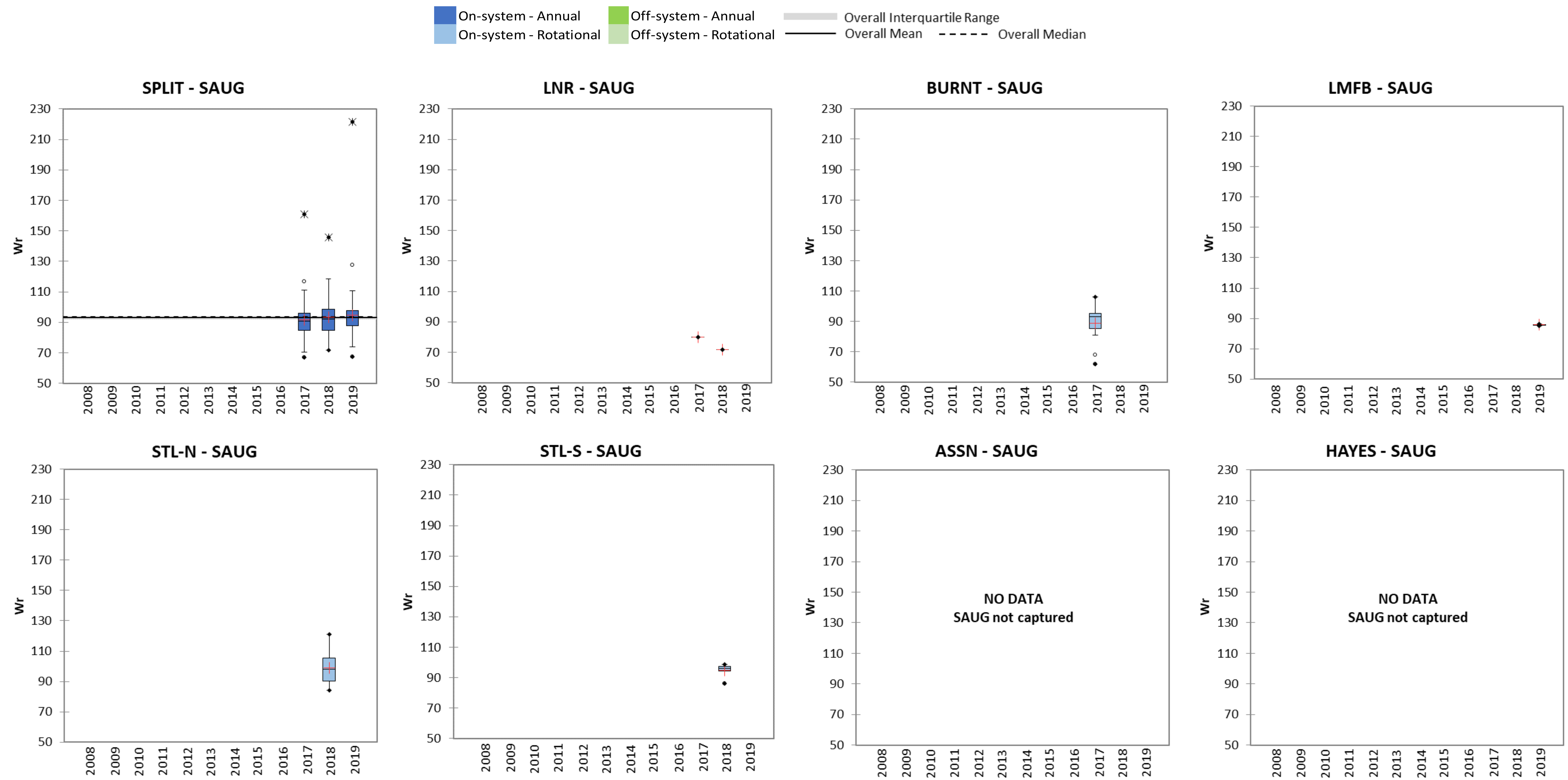


Figure 5.3-8. 2008-2019 Relative weight (Wr) of Sauger.

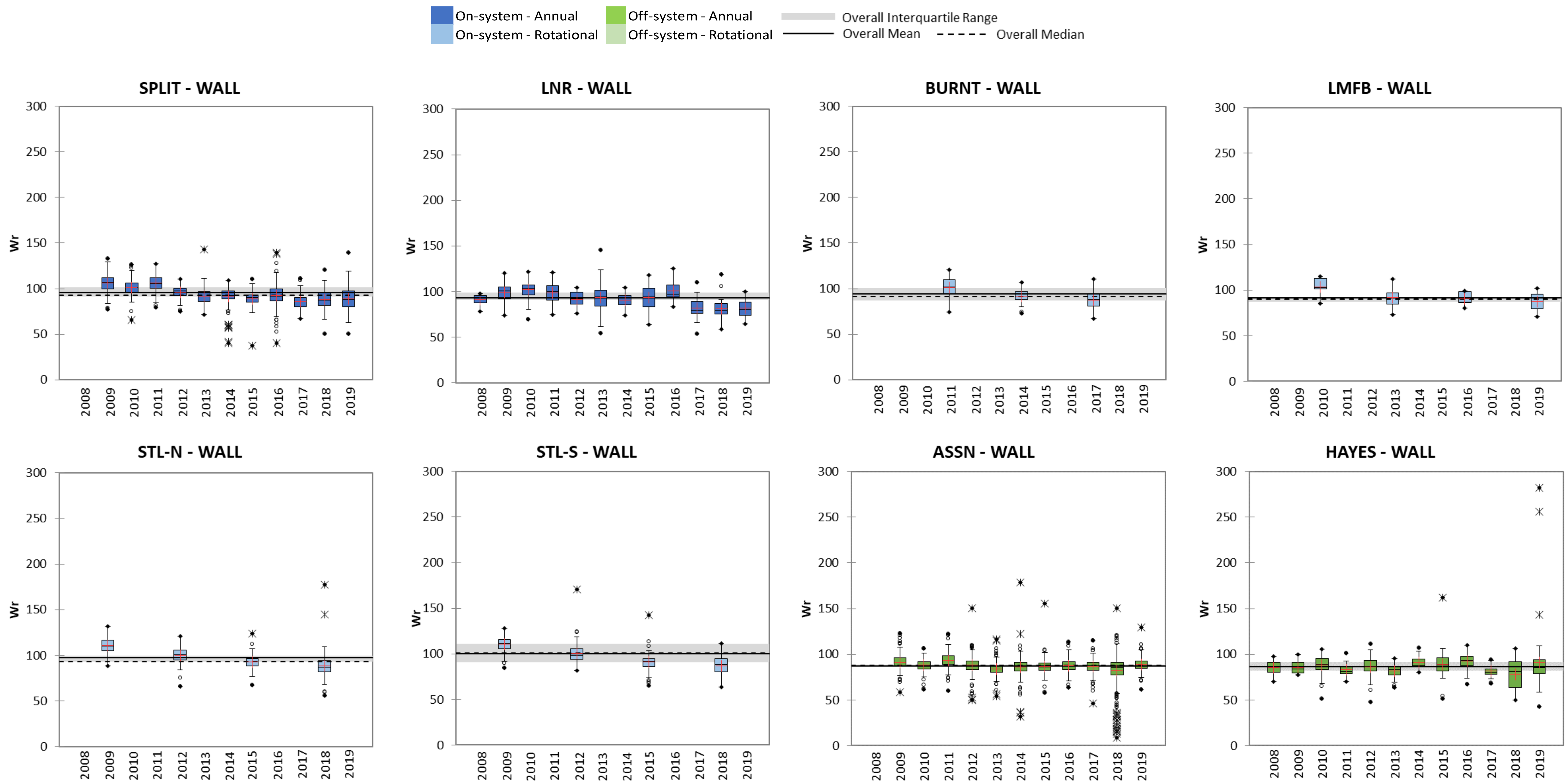


Figure 5.3-9. 2008-2019 Relative weight (Wr) of Walleye.

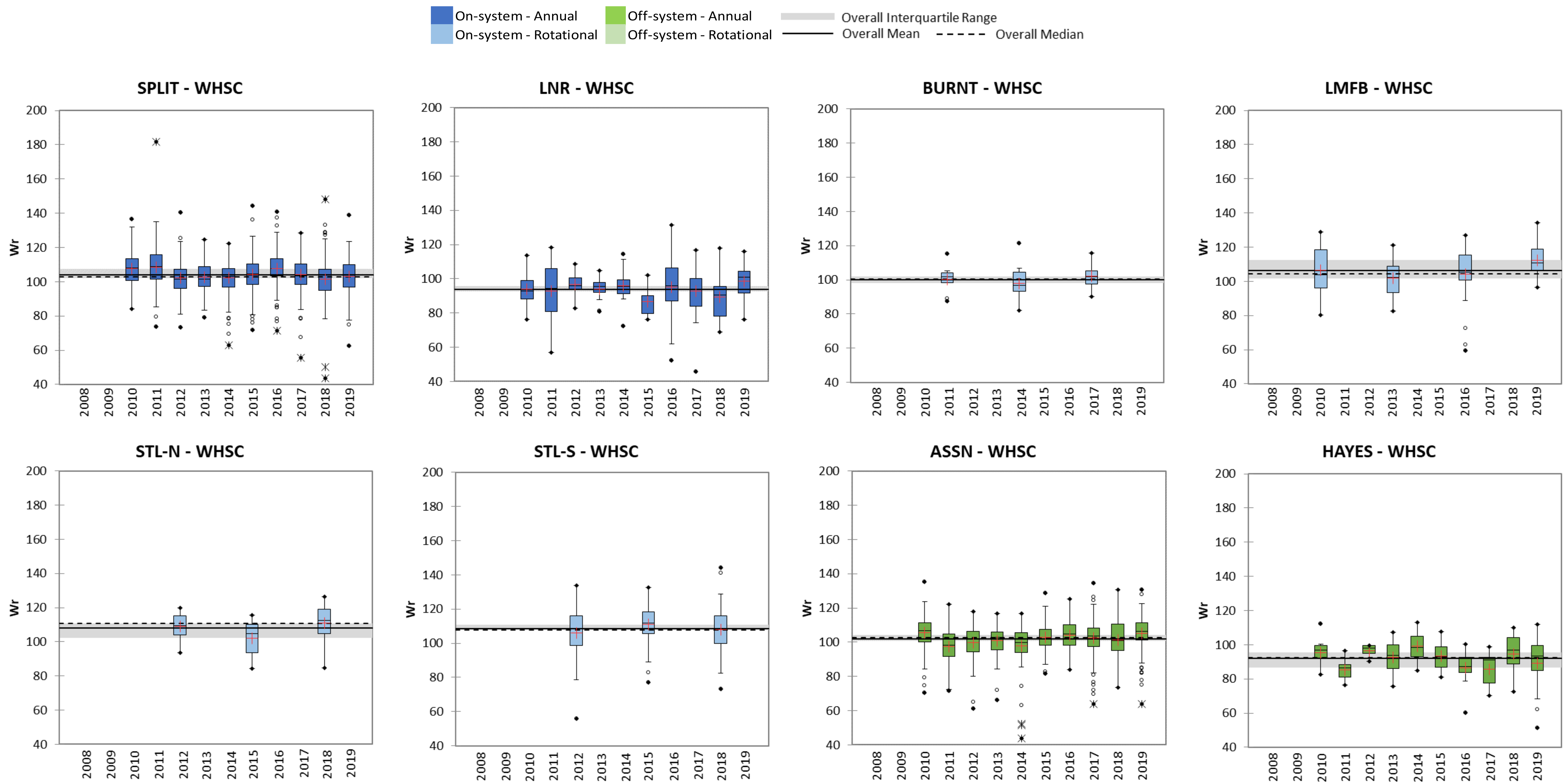


Figure 5.3-10. 2008-2019 Relative weight (Wr) of White Sucker.

5.4 GROWTH

5.4.1 LENGTH-AT-AGE

5.4.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Lake Whitefish

Over the 11 years of monitoring 4-year-old Lake Whitefish were captured in only 2011 and 2012 (Table 5.4-1). The annual mean FLA of these fish was 310 and 301 mm, respectively (Figure 5.4-1).

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the 11 years of monitoring ranged from a low of 420 in 2012 to a high of 521 mm in 2014 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 465, the median was 460, and the IQR was 453-481 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009, 2010, and 2012 when it was below the IQR and in 2014 and 2015 when it was above the IQR.

Sauger

Sauger was not a target species in Split Lake until 2017; the annual mean FLA of 3-year-old Sauger over the three years of monitoring ranged from a low of 235 in 2019 to a high of 244 mm in 2017 (Table 5.4-1; Figure 5.4-3).

The overall mean FLA was 240, the median was 242, and the IQR was 235-242 mm (Figure 5.4-3). The annual mean FLA fell within the overall IQR except in 2017 when it was slightly above the IQR.

Walleye

The annual mean FLA of 3-year-old Walleye over the 11 years of monitoring ranged from a low of 230 in 2018 to a high of 307 mm in 2010 (Table 5.4-1; Figure 5.4-4).

The overall mean FLA was 274, the median was 279, and the IQR was 258-285 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2009, 2017, 2018, and 2019 when it was below the IQR and in 2010 and 2014 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

Lower Nelson River

Lake Whitefish

Over the 12 years of monitoring 4-year-old Lake Whitefish were captured in only 2015, 2016, and 2017 (Table 5.4-1). The annual mean FLA of these fish ranged from a low of 330 mm in 2017 to a high of 402 mm in 2016 (Figure 5.4-1).

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the 12 years of monitoring ranged from a low of 462 in 2018 to a high of 590 mm in 2015 (Table 5.4-1; Figure 5.4-2). Four-year olds were not caught in 2011.

The overall mean FLA was 535, the median was 563, and the IQR was 498-570 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009, 2010, and 2018 when it was below the IQR and in 2015 and 2017 when it was above the IQR.

Sauger

Over the three years of monitoring that Sauger was a target species in the lower Nelson River, no 3-year-old Sauger were collected (Table 5.4-1).

Walleye

The annual mean FLA of 3-year-old Walleye over the 12 years of monitoring ranged from a low of 155 in 2009 to a high of 318 mm in 2014 (Table 5.4-1; Figure 5.4-4). Three-year-olds were not caught in 2008, 2012, or 2019.

The overall mean FLA was 258, the median was 270, and the IQR was 252-270 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2009 and 2010 when it was below the IQR and in 2014 and 2015 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

Burntwood River

Lake Whitefish

Over the three years of monitoring 4-year-old Lake Whitefish were not caught in the Burntwood River (Table 5.4-1).

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the three years of monitoring ranged from a low of 390 in 2011 to a high of 494 mm in 2014 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 454, the median was 490, and the IQR was 390-494 mm (Figure 5.4-2).

Sauger

Over the three years of monitoring, Sauger was only a target species in the Burntwood River in 2017 and no 3-year-old Sauger were collected (Table 5.4-1).

Walleye

The annual mean FLA of 3-year-old Walleye over the three years of monitoring ranged from a low of 233 in 2014 to a high of 282 mm in 2011 (Table 5.4-1; Figure 5.4-4).

There were too few 3-year-old Walleye captured in the Burntwood River to calculate the overall metrics.

White Sucker

White Sucker was not aged as part of CAMP.

Limestone Forebay

Lake Whitefish

Over the four years of monitoring 4-year-old Lake Whitefish were not caught in the Limestone Forebay (Table 5.4-1).

Northern Pike

Over the four years of monitoring 4-year-old Northern Pike were captured in only 2010 and 2013 (Table 5.4-1). The annual mean FLA in these years was 511 and 548 mm, respectively (Figure 5.4-2).

Sauger

Over the four years of monitoring, Sauger was only a target species in the Limestone Forebay in 2019 (Table 5.4-1). In this year, the single 3-year-old Sauger collected had a FLA of 260 mm (Figure 5.3-3).

Walleye

Over the four years of monitoring 3-year-old Walleye were not caught in the Limestone Forebay (Table 5.4-1).

White Sucker

White Sucker was not aged as part of CAMP.

Stephens Lake – North

Lake Whitefish

Over the four years of monitoring a single 4-year-old Lake Whitefish was collected in Stephens Lake - North in 2018 (Table 5.4-1). This fish had a FLA of 251 mm (Figure 5.4-1).

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the four years of monitoring ranged from a low of 464 in 2018 to a high of 489 mm in 2015 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 478 the median was 472, and the IQR was 472-489 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2018 when it was below the IQR.

Sauger

Over the four years of monitoring, Sauger was only a target species in Stephens Lake - North in 2018. In this year, 3-year-old Sauger had a mean FLA of 248 mm (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 224 in 2018 to a high of 317 mm in 2012 (Table 5.4-1; Figure 5.4-4).

There were too few 3-year-old Walleye captured in the Stephens Lake - North to calculate the overall metrics.

White Sucker

White Sucker was not aged as part of CAMP.

Stephens Lake – South

Lake Whitefish

Over the four years of monitoring 4-year-old Lake Whitefish were not caught in Stephens Lake - South (Table 5.4-1).

Northern Pike

The annual mean FLA of 4-year-old Northern Pike over the four years of monitoring ranged from a low of 460 in 2009 to a high of 496 mm in 2018 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 473, the median was 467, and the IQR was 462-496 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009 when it was slightly below the IQR.

Sauger

Over the four years of monitoring, Sauger was only a target species in Stephens Lake - South in 2018. In this year, the single 3-year-old Sauger collected had a FLA of 248 mm (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 2018 to a high of 230 mm in 2009 (Table 5.4-1; Figure 5.4-4). Three-year-old Walleye were not captured in 2013.

White Sucker

White Sucker was not aged as part of CAMP.

5.4.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the 11 years of monitoring ranged from a low of 274 in 2018 to a high of 389 mm in 2013 (Table 5.4-1; Figure 5.4-1). Four-year olds were not caught in 2014, 2015, or 2016.

The overall mean FLA was 318, the median was 327, and the IQR was 276-339 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2018 when it was slightly below the IQR and in 2013 and 2017 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 397 in 2009 to a high of 495 mm in 2019 (Table 5.4-1; Figure 5.4-2).

The overall mean FLA was 461, the median was 456, and the IQR was 450-480 mm (Figure 5.4-2). The annual mean FLA fell within the overall IQR except in 2009, 2010, and 2011 when it was below the IQR and in 2013 and 2019 when it was above the IQR.

Sauger

Sauger were not captured in Assean Lake over the 11 years of monitoring (Table 5.2-1).

Walleye

The annual mean FLA of 3-year-old Walleye over the 11 years of monitoring ranged from a low of 214 in 2012 to a high of 247 mm in 2014 (Table 5.4-1; Figure 5.4-4).

The overall mean FLA was 233, the median was 228, and the IQR was 226-246 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2009 and 2012 when it was below the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

Hayes River

Lake Whitefish

The annual mean FLA of 4-year-old Lake Whitefish over the 12 years of monitoring ranged from a low of 202 in 2011 to a high of 338 mm in 2019 (Table 5.4-1; Figure 5.4-1). Four-year olds were not caught in 2008, 2009, 2012, or 2013.

The overall mean FLA was 310, the median was 319, and the IQR was 307-319 mm (Figure 5.4-1). The annual mean FLA fell within the overall IQR except in 2011, 2016, 2017, and 2018 when it was below the IQR and in 2019 when it was above the IQR.

Northern Pike

Over the 12 years of monitoring, 4-year-old Northern Pike were captured in only 2010, 2014, and 2017. In these years, the annual mean FLA was 405, 482, and 646 mm, respectively (Table 5.4-1; Figure 5.4-2).

Sauger

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

Walleye

The annual mean FLA of 3-year-old Walleye over the 12 years of monitoring ranged from a low of 253 in 2018 to a high of 300 mm in 2019 (Table 5.4-1; Figure 5.4-4). Three-year olds were not caught in 2008, 2009, 2010, 2011, or 2017.

The overall mean FLA was 284, the median was 288, and the IQR was 271-288 mm (Figure 5.4-4). The annual mean FLA fell within the overall IQR except in 2012 and 2018 when it was below the IQR and in 2014 and 2019 when it was above the IQR.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

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
SPLIT	2009	-	-	-	6	432	4				8	236	6
	2010	-	-	-	12	450	16				19	307	4
	2011	2	310	4	13	460	8				22	279	7
	2012	2	301	9	9	420	22				1	264	-
	2013	-	-	-	15	453	15				22	279	6
	2014	-	-	-	7	521	10				12	288	8
	2015	-	-	-	20	486	10				29	285	5
	2016	-	-	-	6	479	42				17	258	6
	2017	-	-	-	7	481	19	7	244	8	12	246	5
	2018	-	-	-	14	460	15	16	242	4	5	230	5
	2019	-	-	-	14	473	11	15	235	4	5	238	6
LNR	2008	-	-	-	8	563	17				-	-	-
	2009	-	-	-	11	481	15				3	155	17
	2010	-	-	-	6	476	26				4	241	8
	2011	-	-	-	-	-	-				6	259	9
	2012	-	-	-	4	498	18				-	-	-
	2013	-	-	-	12	502	24				10	270	6
	2014	-	-	-	9	570	8				2	318	12
	2015	4	332	11	5	590	13				4	284	28
	2016	1	402	-	3	518	8				3	270	18
	2017	1	330	-	12	582	28	-	-	-	2	252	1
	2018	-	-	-	3	462	19	-	-	-	-	-	-
	2019	-	-	-	12	569	27	-	-	-	-	-	-
BURNT	2011	-	-	-	3	390	12				4	282	9
	2014	-	-	-	4	494	32				1	233	-
	2017	-	-	-	1	490	-	-	-	-	2	239	4
LMFB	2010	-	-	-	2	511	4				-	-	-
	2013	-	-	-	6	548	19				-	-	-
	2016	-	-	-	-	-	-				-	-	-
	2019	-	-	-	-	-	-	1	260	-	-	-	-
STL-N	2009	-	-	-	16	472	11				2	265	32
	2012	-	-	-	6	472	10				1	317	-
	2015	-	-	-	23	489	8				6	235	5
	2018	1	251	-	8	464	16	4	248	3	1	224	
STL-S	2009	-	-	-	7	460	6				5	230	6
	2012	-	-	-	9	462	14				-	-	-
	2015	-	-	-	13	467	11				1	229	-
	2018	-	-	-	11	496	16	1	248	-	1	219	-
ASSN	2009	14	276	7	3	397	42	-	-	-	4	224	4
	2010	12	327	9	11	439	18	-	-	-	3	240	4
	2011	14	339	11	6	438	17	-	-	-	15	236	2
	2012	6	325	14	8	451	14	-	-	-	14	214	5
	2013	1	389	-	11	482	14	-	-	-	18	246	5
	2014	-	-	-	23	450	15	-	-	-	46	247	6
	2015	-	-	-	9	456	14	-	-	-	46	228	2
	2016	-	-	-	8	456	18	-	-	-	28	226	5
	2017	3	376	12	14	463	9	-	-	-	23	225	2
	2018	2	274	0	14	480	10	-	-	-	12	228	3
	2019	1	279	-	15	495	13	-	-	-	7	243	12
HAYES	2008	-	-	-	-	-	-	-	-	-	-	-	-
	2009	-	-	-	-	-	-	-	-	-	-	-	-
	2010	1	310	-	1	405	-	-	-	-	-	-	-
	2011	1	202	-	-	-	-	-	-	-	-	-	-
	2012	-	-	-	-	-	-	-	-	-	1	262	-
	2013	-	-	-	-	-	-	-	-	-	13	288	4
	2014	3	307	5	1	482	-	-	-	-	3	298	20
	2015	20	319	4	-	-	-	-	-	-	2	279	5
	2016	2	290	11	-	-	-	-	-	-	5	271	5
	2017	2	295	12	3	646	26	-	-	-	-	-	-
	2018	1	295	-	-	-	-	-	-	-	1	253	-
	2019	1	338	-	-	-	-	-	-	-	2	300	3

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.

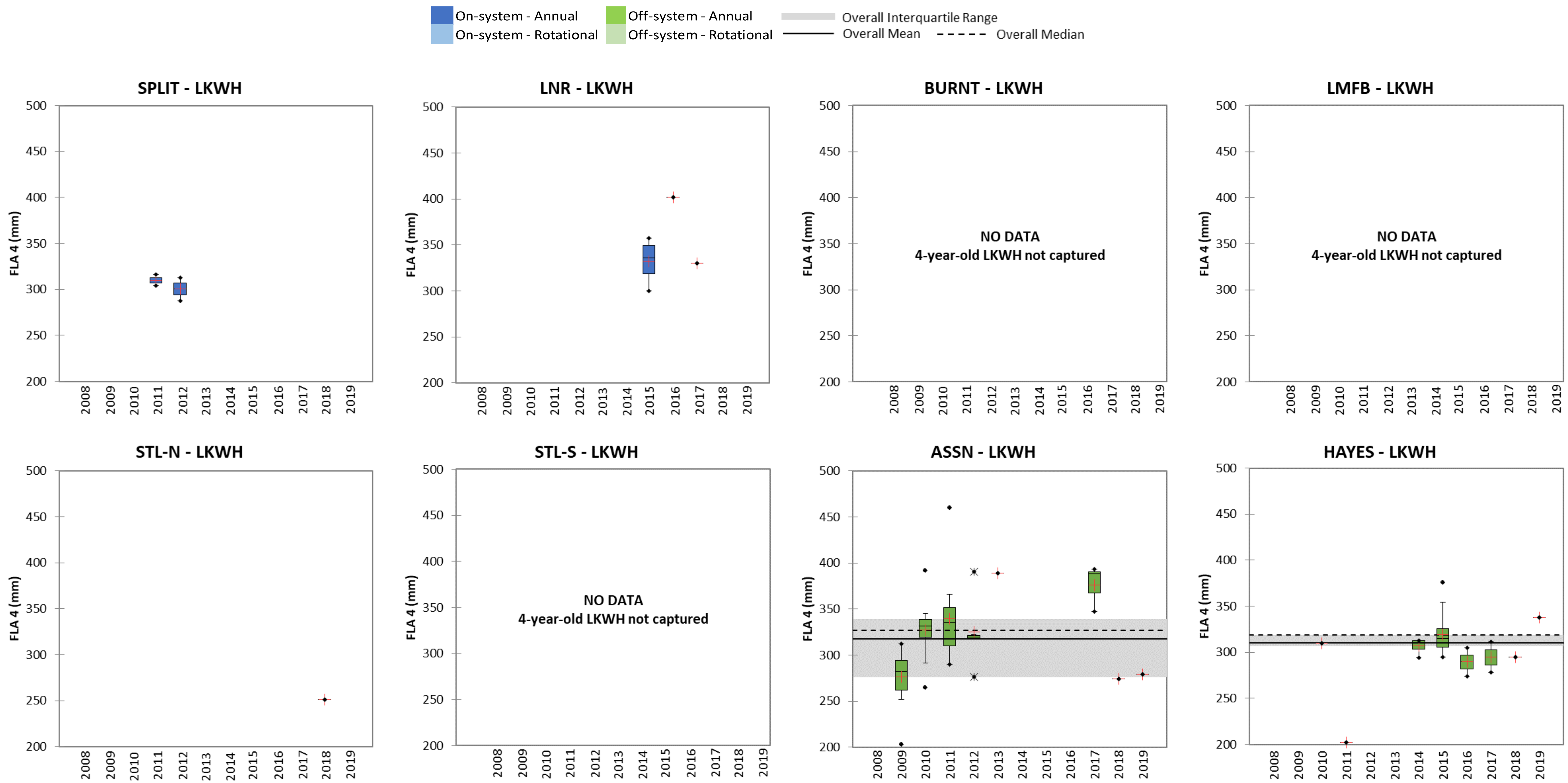


Figure 5.4-1. 2008-2019 Fork length-at-age (FLA) 4 of Lake Whitefish.

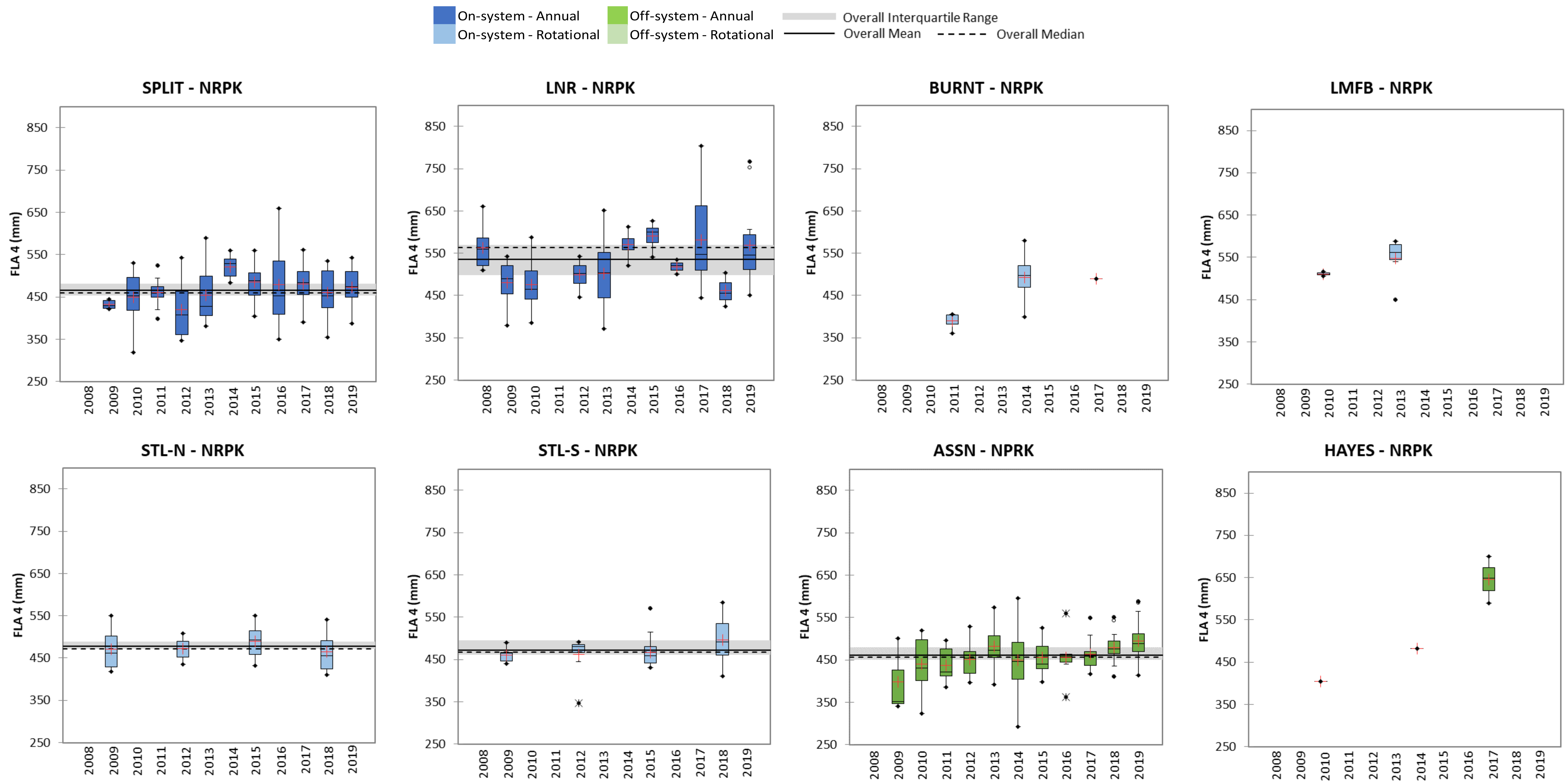


Figure 5.4-2. 2008-2019 Fork length-at-age (FLA) 4 of Northern Pike.

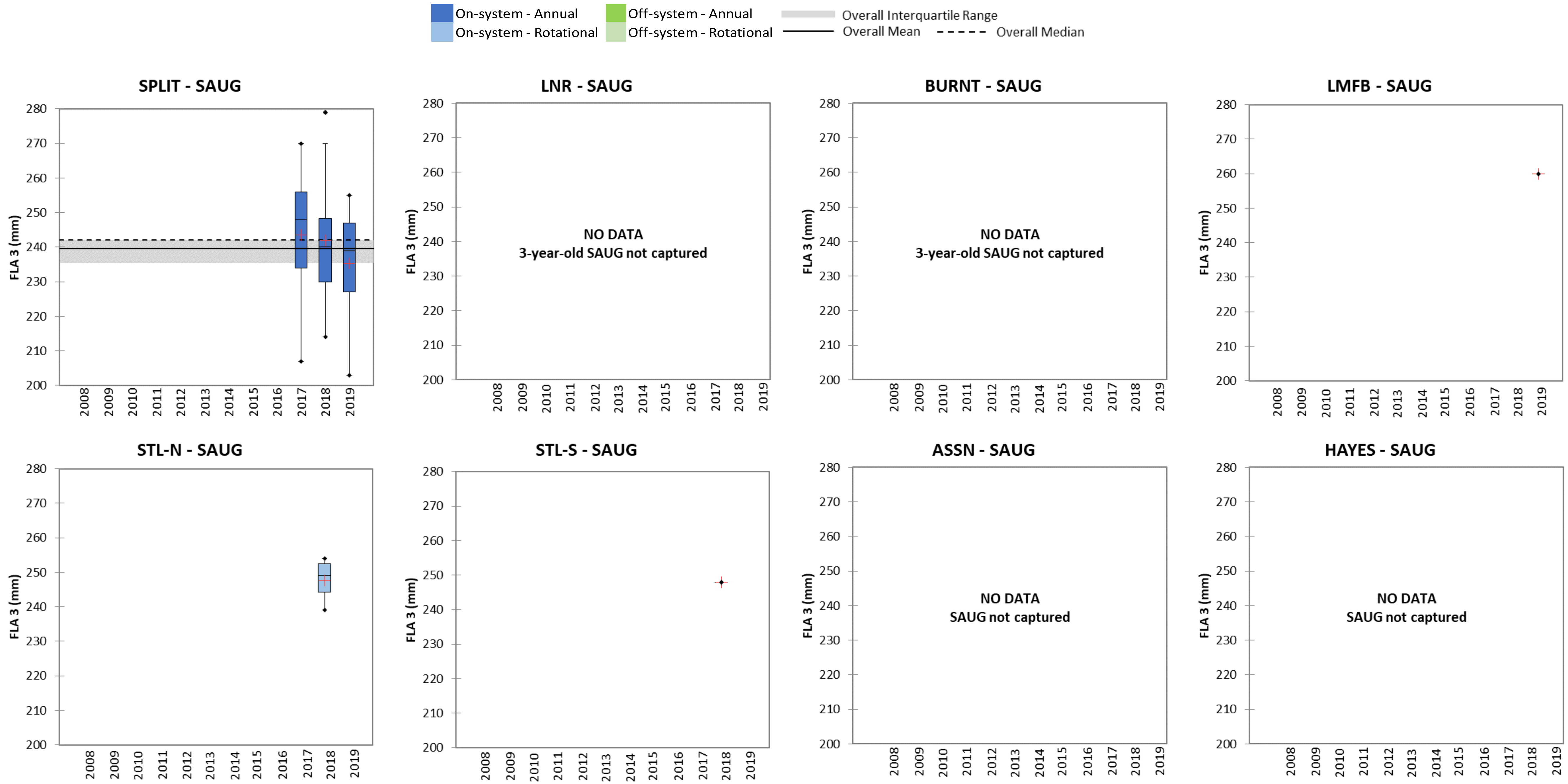


Figure 5.4-3. 2008-2019 Fork length-at-age (FLA) 3 of Sauger.

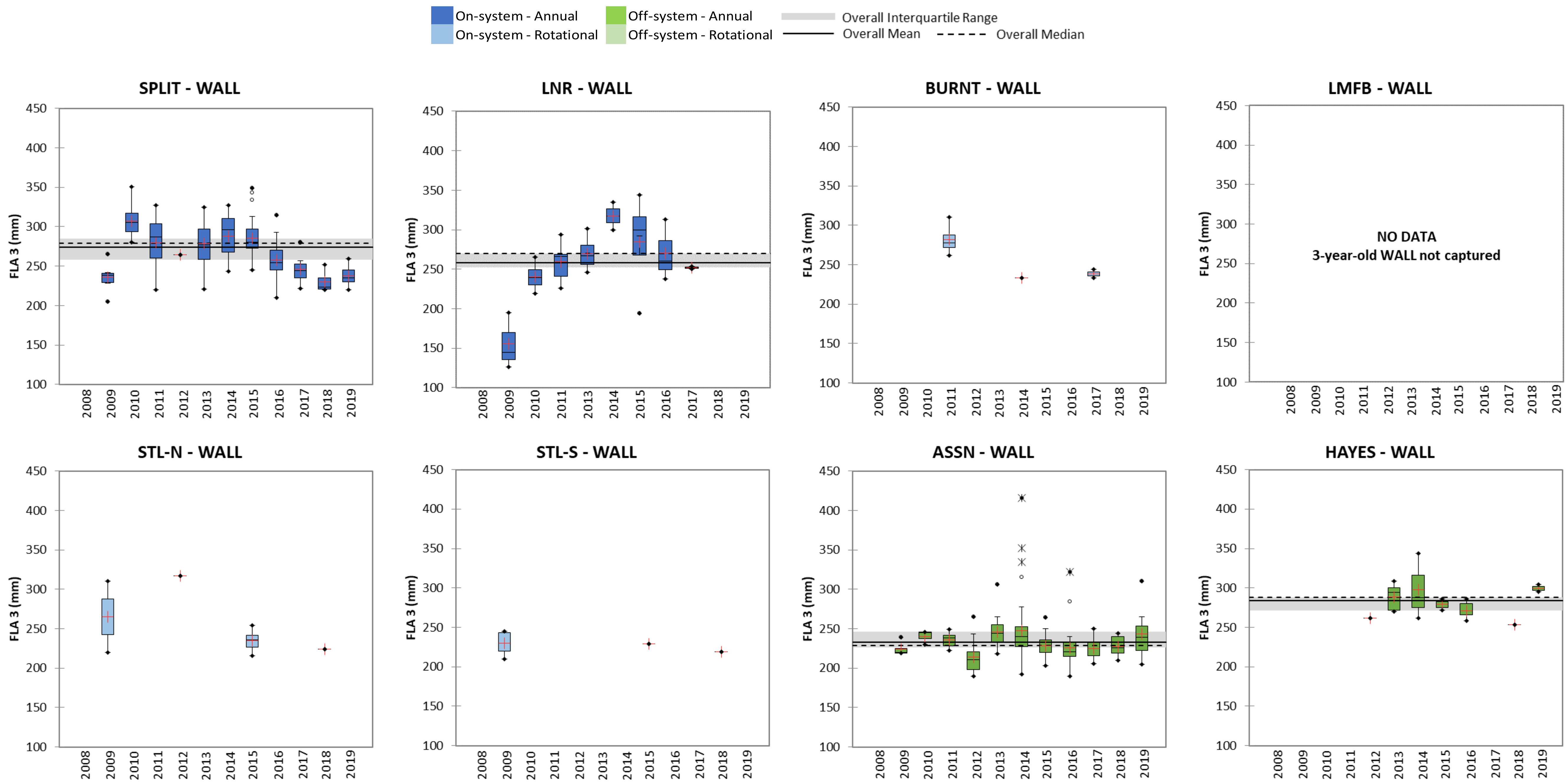


Figure 5.4-4. 2008-2019 Fork length-at-age (FLA) 3 of Walleye.

5.5 RECRUITMENT

5.5.1 RELATIVE YEAR-CLASS STRENGTH

5.5.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

Lake Whitefish

Age data for Lake Whitefish were insufficient to allow year-class strength determination.

Northern Pike

The RYCS of Northern Pike over the 11 years of monitoring ranged from a low of 58 for the 2010 cohort to a high of 137 for the 2011 cohort (Figure 5.5-1). There were no missing cohorts from 2004-2014. Strong cohorts (>100) were produced in over half of the years, from 2004-2005, and then every other year in 2007, 2009, 2011, and 2013.

Sauger

The RYCS of Sauger over the three years of monitoring that it was a target species ranged from a low of 62 for the 2013 cohort to a high of 108 for the 2014 cohort (Figure 5.5-2). There were no missing cohorts from 2009-2014. A strong cohort (>100) was only produced in 2014.

Walleye

The RYCS of Walleye over the 11 years of monitoring ranged from a low of 43 for the 2006 cohort to a high of 157 for the 2010 cohort (Figure 5.5-3). There were no missing cohorts from 2004-2014. Strong cohorts (>100) were produced in 2008, 2010, 2011, 2012, and 2014.

White Sucker

White Sucker was not aged as part of CAMP.

Lower Nelson River

Lake Whitefish

Age data for Lake Whitefish were insufficient to allow year-class strength determination.

Northern Pike

The RYCS of Northern Pike over the 12 years of monitoring ranged from a low of 54 for the 2007 cohort to a high of 151 for the 2005 cohort (Figure 5.5-1). There were no missing cohorts from 2003-2014. Particularly strong cohorts (>100) were produced in half of the years, in 2003 and 2005, then again from 2010-2011 and 2013-2014.

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 14 for the 2014 cohort to a high of 248 for the 2010 cohort (Figure 5.5-3). There were no missing cohorts from 2001-2014. Strong cohorts (>100) were produced from 2002-2003 and from 2010-2013. Particularly weak cohorts (<50) occurred in 2001, 2006, 2007, and 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

Assean Lake

Lake Whitefish

Age data for Lake Whitefish were insufficient to allow year-class strength determination.

Northern Pike

The RYCS of Northern Pike over the 11 years of monitoring ranged from a low of 67 for the 2007 cohort to a high of 147 for the 2014 cohort (Figure 5.5-1). There were no missing cohorts from 2004-2014. Strong cohorts (>100) were produced over a three-year period from 2004-2006, then again in 2010 and 2014.

Sauger

Sauger were not captured in Assean Lake over the 11 years of monitoring (Table 5.2-1).

Walleye

The RYCS of Walleye over the 11 years of monitoring ranged from a low of 36 for the 2009 cohort to a high of 185 for the 2013 cohort (Figure 5.5-3). There were no missing cohorts from 2004-2014. Strong cohorts (>100) were produced in over half of the years, from 2005-2006, in 2008, and again from 2010-2013 following a particularly weak cohort (<50) in 2009.

White Sucker

White Sucker was not aged as part of CAMP.

<u>Hayes River</u>

Lake Whitefish

Age data for Lake Whitefish were insufficient to allow year-class strength determination.

Northern Pike

Age data for Northern Pike were insufficient to allow year-class strength determination.

Sauger

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

Walleye

Age data for Walleye were insufficient to allow year-class strength determination.

White Sucker

White Sucker was not aged as part of CAMP.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

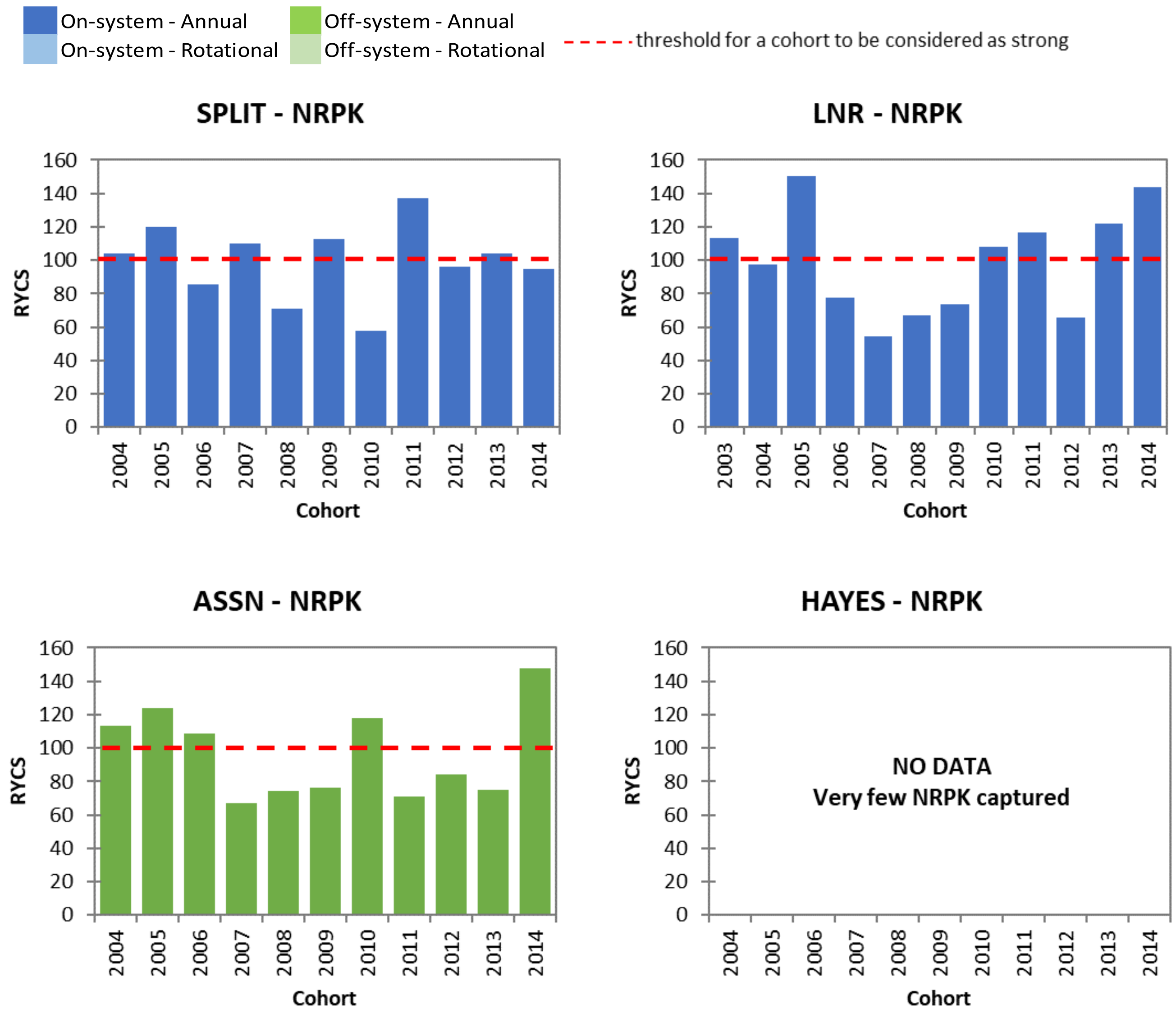


Figure 5.5-1. Relative year-class strength (RYCS) of Northern Pike.

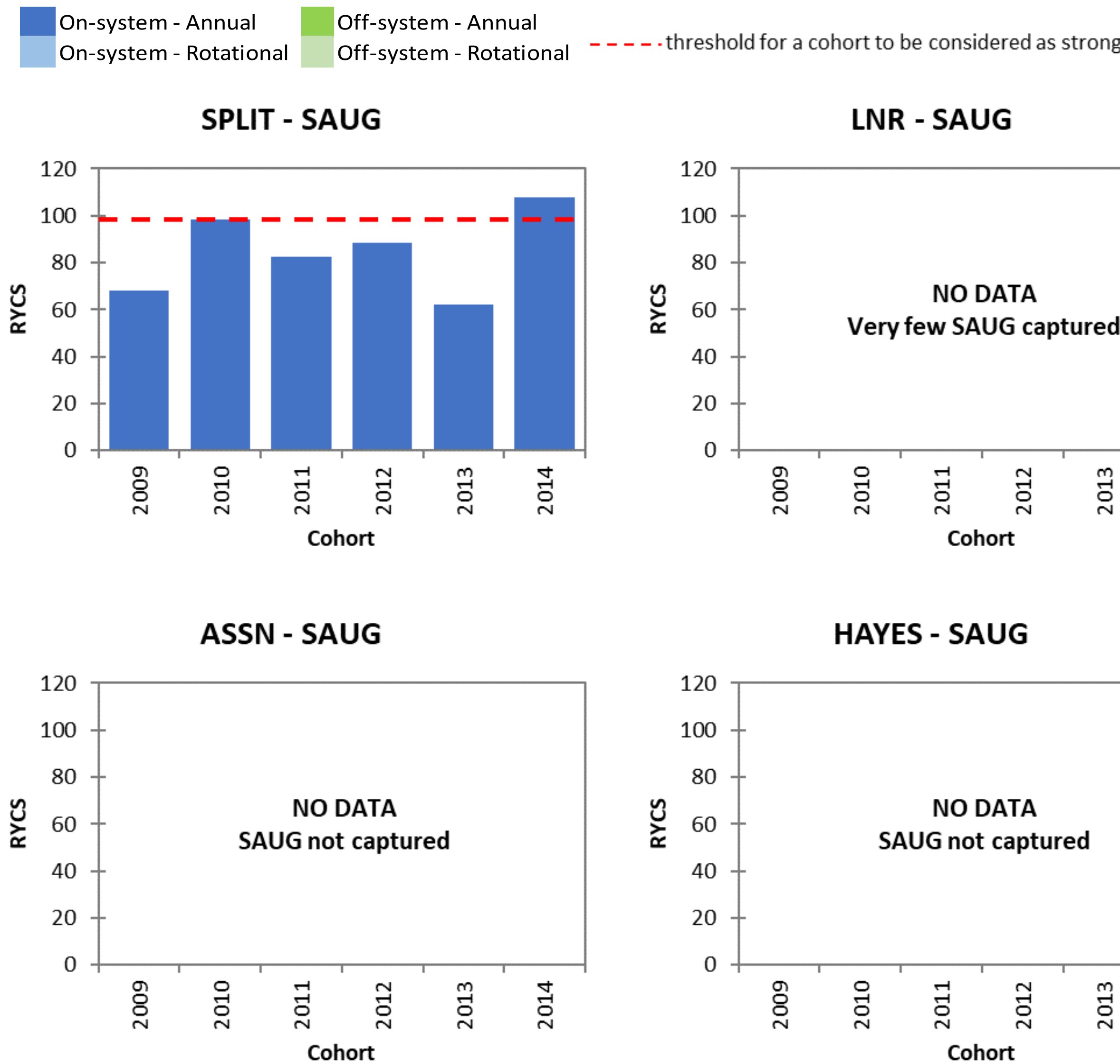


Figure 5.5-2. Relative year-class strength (RYCS) of Sauger.

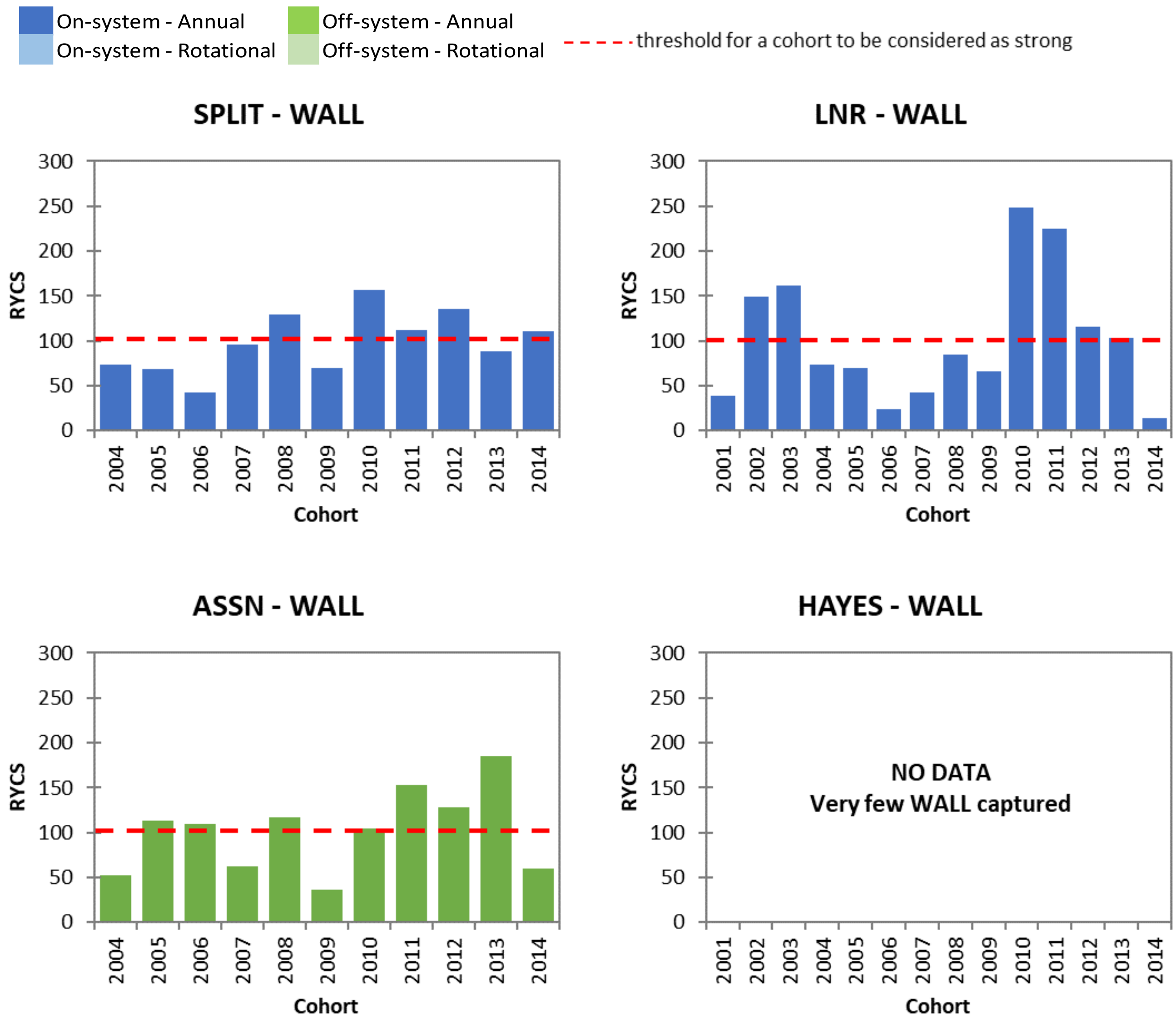


Figure 5.5-3. Relative year-class strength (RYCS) of Walleye.

5.6 DIVERSITY

5.6.1 RELATIVE SPECIES ABUNDANCE

5.6.1.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

A total of 23 fish species was captured in the combined standard and small mesh gangs in Split Lake over the 11 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 13-18 species (Tables 5.6-2 and 5.6-3).

Standard Gang Index Gill Nets

White Sucker was the most frequently captured species at Split Lake over the 11 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-2). The annual RSA for White Sucker ranged from a low of 21% in 2009 to a high of 45% in 2017. Walleye accounted for >25% of the catch in 2009, 2010, 2011, 2013, and 2014.

Small Mesh Index Gill Nets

The most common species captured in Split Lake over the 11 years of monitoring was Spottail Shiner (*Notropis hudsonius*), accounting for an average of >25% of the catch (Table 5.6-3). The annual RSA for Spottail Shiner ranged from a low of 0% in 2010 to a high of 61% in 2013. Three species accounted for >25% of the catch in some years, Rainbow Smelt (*Osmerus mordax*) in 2009, 2010, and 2011, Emerald Shiner (*Notropis atherinoides*) in 2014 and 2019, and Trout-perch (*Percopsis omiscomaycus*) in 2010, 2011, 2012, and 2016.

Lower Nelson River

A total of 21 fish species was captured in the combined standard and small mesh gangs at the lower Nelson River over the 12 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 7-16 species (Tables 5.6-4 and 5.6-5).

Standard Gang Index Gill Nets

Northern Pike was the most frequently captured species at the lower Nelson River over the 12 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-4). The annual RSA for Northern Pike ranged from a low of 16% in 2018 to a high of 50% in 2012. Two species accounted for >25% of the catch in some years, Lake Sturgeon (*Acipenser fulvescens*) in 2014, 2015, and 2018 and Longnose Sucker (*Catostomus catostomus*) in 2008, 2011, 2017, 2018, and 2019.

Small Mesh Index Gill Nets

The most common species captured in the lower Nelson River over the 12 years of monitoring were Emerald Shiner and Trout-perch, each accounting for an average of >25% of the catch (Table 5.6-5). The annual RSA for Emerald Shiner ranged from a low of 0% in 2009, 2011, and 2018 to a high of 83% in 2015. The annual RSA for Trout-perch ranged from a low of 0% in 2019 to a high of 67% in 2012. Three species accounted for >25% of the catch in some years, Longnose Sucker in 2011 and 2018, Rainbow Smelt in 2010 and 2011, and Walleye in 2013.

ROTATIONAL SITES

Burntwood River

A total of 16 fish species was captured in the combined standard and small mesh gangs at the Burntwood River over the three years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 12-14 species (Tables 5.6-6 and 5.6-7).

Standard Gang Index Gill Nets

Walleye was the most frequently captured species at the Burntwood River over the three years of monitoring, accounting for an average of >25% of the catch (Table 5.6-6). The annual RSA for Walleye ranged from a low of 32% in 2014 to a high of 48% in 2011.

Small Mesh Index Gill Nets

The most common species captured at the Burntwood River over the three years of monitoring was Emerald Shiner, which accounted for an average of >25% of the catch (Table 5.6-7). The annual RSA for Emerald Shiner ranged from a low of 0% in 2014 to a high of 78% in 2017. Two species accounted for >25% of the catch in some years, Spottail Shiner in 2011 and Sauger in 2014.

Limestone Forebay

A total of 17 fish species was captured in the combined standard and small mesh gangs at the Limestone Forebay over the four years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 9-10 species (Tables 5.6-8 and 5.6-9).

Standard Gang Index Gill Nets

Longnose Sucker was the most frequently captured species at the Limestone Forebay over the four years of monitoring, accounting for an average of >25% of the catch (Table 5.6-8). The annual RSA of Longnose Sucker ranged from a low of 40% in 2013 to a high of 68% in 2019. Two species accounted for >25% of the catch in some years, Northern Pike in 2010 and White Sucker in 2013 and 2016.

Small Mesh Index Gill Nets

The most common species captured in the Limestone Forebay over the four 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 38% in 2019 to a high of 96% in 2013.

Stephens Lake – North

A total of 15 fish species was captured in the combined standard and small mesh gangs in Stephens Lake - North over the four years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 10-12 species (Tables 5.6-10 and 5.6-11).

Standard Gang Index Gill Nets

Walleye and Northern Pike were the most frequently captured species in Stephens Lake - North over the 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 49% in 2009 and 2015 to a high of 58% in 2012. The annual RSA of Northern Pike ranged from a low of 11% in 2018 to a high of 39% in 2009.

Small Mesh Index Gill Nets

The most common species captured in Stephens Lake - North over the four years of monitoring was Spottail Shiner, which accounted for an average of >25% of the catch (Table 5.6-11). The annual RSA for Spottail Shiner ranged from a low of 26% in 2018 to a high of 58% in 2012. Two species accounted for >25% of the catch in some years, Emerald Shiner in 2015 and 2018 and Rainbow Smelt in 2009.

Stephens Lake – South

A total of 18 fish species were captured in the combined standard and small mesh gangs in Stephens Lake - South over the four years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 10-15 species (Tables 5.6-12 and 5.6-13).

Standard Gang Index Gill Nets

Walleye was the most frequently captured species in Stephens Lake - South over the four years of monitoring, accounting for an average of >25% of the catch (Table 5.6-12). The annual RSA for Walleye ranged from a low of 35% in 2018 to a high of 54% in 2009. White Sucker accounted for >25% of the catch in 2015 and 2018.

Small Mesh Index Gill Nets

The most common species captured in Stephens Lake - South over four years of monitoring was Spottail Shiner, which accounted for an average of >25% of the catch (Table 5.6-13). The annual RSA for Spottail Shiner ranged from a low of 24% in 2009 to a high of 70% in 2015. Three species accounted for >25% of the catch in some years, Emerald Shiner in 2018, Rainbow Smelt in 2009, and Trout-perch in 2009 and 2012.

5.6.1.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

A total of 11 fish species were captured in the combined standard and small mesh gangs at Assean Lake over the 11 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 9-10 species (Tables 5.6-14 and 5.6-15). Sauger and Rainbow Smelt were not captured at Assean Lake.

Standard Gang Index Gill Nets

Walleye was the most frequently captured species at Assean Lake over the 11 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 35% in 2017 to a high of 66% in 2018. White Sucker accounted for >25% of the catch in 2016 and 2017.

Small Mesh Index Gill Nets

The most common species captured in Assean Lake over the 11 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 20% in 2010 to a high of 60% in 2016. Three other species accounted for >25% of the catch in some years, Emerald Shiner in 2015, 2018, and 2019, Yellow Perch (YLPR; *Perca flavescens*) in 2010 and 2011, and Walleye in 2009.

Hayes River

A total of 19 fish species were captured in the combined standard and small mesh gangs at the Hayes River over the 12 years of monitoring (Table 5.6-1), with the number of species caught each year ranging from 8-12 species (Tables 5.6-16 and 5.6-17). Sauger and Rainbow Smelt were not captured at the Hayes River.

Standard Gang Index Gill Nets

Lake Sturgeon and Walleye were the most frequently captured species at the Hayes River over the 12 years of monitoring, accounting for an average of >25% of the catch (Table 5.6-16). The annual RSA for Lake Sturgeon ranged from a low of 15% in 2008 to a high of 45% in 2014. The annual RSA for Walleye ranged from a low of 17% in 2014 to a high of 44% in 2012.

Small Mesh Index Gill Nets

The most common species captured in the Hayes River over the 12 years of monitoring was Walleye, which accounted for an average of >25% of the catch (Table 5.6-17). The annual RSA for Walleye ranged from a low of 0% in 2009 to a high of 77% in 2016. Five other species accounted for >25% of the catch in some years, Lake Sturgeon in 2009 and 2010, Lake Chub (*Couesius plumbeus*) in 2009 and 2011, Longnose Dace (*Rhinichthys cataractae*) in 2009, Longnose Sucker in 2011, and Trout-perch in 2012 and 2015.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

Table 5.6-1. 2008-2019 Inventory of fish species.

Family	Species	Abbreviation	Status[1]	Target Species	SPLIT	LNR	BURNT	LMFB	STL-N	STL-S	ASSN	HAYES
Petromyzontidae	Silver Lamprey	SLLM	Native			●						●
Acipenseridae	Lake Sturgeon[2]	LKST	Native		●	●	●	●		●		●
Hiodontidae	Mooneye	MOON	Native		●	●	●	●	●	●		
Cyprinidae	Lake Chub	LKCH	Native		●	●		●		●		●
	Common Carp	CARP	Introduced		●				●			
	Emerald Shiner	EMSH	Native		●	●	●	●	●	●	●	●
	Spottail Shiner	SPSH	Native		●	●	●	●	●	●	●	●
	Longnose Dace	LNDC	Native			●		●				●
Catostomidae	Longnose Sucker	LNSC	Native		●	●	●	●	●	●	●	●
	White Sucker	WHSC	Native	●	●	●	●	●	●	●	●	●
	Shorthead Redhorse	SHRD	Native		●	●	●	●	●	●		●
	Silver Redhorse	SLRD	Native		●							
Esocidae	Northern Pike	NRPK	Native	●	●	●	●	●	●	●	●	●
Osmeridae	Rainbow Smelt	RNSM	Introduced		●	●	●	●	●	●		
Salmonidae	Cisco	CISC	Native		●	●	●		●		●	●
	Lake Whitefish	LKWH	Native	●	●	●	●	●	●	●	●	●
	Brook Trout	BRTR	Native			●						●
Percopsidae	Trout-perch	TRPR	Native		●	●	●	●	●	●	●	●
Gadidae	Burbot	BURB	Native		●	●	●			●	●	●
Cottidae	Mottled Sculpin	MTSC	Native		●							
	Slimy Sculpin	SLSC	Native		●			●				●
	Spoonhead Sculpin	SPSC	Native				●					
Percidae	Johnny Darter	JHDR	Native									●
	Yellow Perch	YLPR	Native		●	●			●	●	●	
	Logperch	LGPR	Native		●					●		●
	Sauger	SAUG	Native	●	●	●	●	●	●	●		
	Walleye	WALL	Native	●	●	●	●	●	●	●	●	●
Sciaenidae	Freshwater Drum	FRDR	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 Split Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	2%	6%	7%	5%	4%	2%	4%	5%	7%	6%	5%	5%
	NRPK	12%	7%	10%	14%	13%	9%	11%	6%	7%	11%	10%	10%
	SAUG	15%	10%	21%	18%	6%	22%	19%	24%	18%	17%	13%	17%
	WALL	41%	31%	29%	14%	36%	31%	23%	22%	16%	15%	14%	25%
	WHSC	21%	32%	24%	38%	34%	31%	32%	33%	45%	40%	42%	34%
Lampreys	SLLM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sturgeon	LKST	0%	0.5%	1%	0%	0.4%	1%	2%	2%	2%	1%	0%	1%
Mooneyes	MOON	2%	3%	0%	2%	1%	1%	3%	4%	1%	4%	2%	2%
Minnows	LKCH	0%	0%	0%	0%	0%	0%	0.2%	0.2%	0%	0%	0.3%	0.1%
	CARP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.02%
Suckers	LNSC	2%	6%	2%	5%	2%	2%	2%	1%	2%	2%	3%	3%
	SLRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0.02%
	SHRD	1%	1%	0.4%	0.4%	1%	1%	3%	1%	1%	1%	6%	1%
Smelts	RNSM	2%	1%	2%	1%	0%	0.2%	0%	0.2%	0%	0%	0%	1%
Coregonids	CISC	0.4%	0%	1%	1%	1%	0%	1%	0%	0%	2%	2%	1%
Salmonids	BRTR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0.4%	0.2%	0%	0%	0.2%	0%	0.2%	0%	0.1%
Codfishes	BURB	2%	2%	2%	0%	0%	0.2%	0%	0.2%	0%	1%	1%	1%
Perch	YLPR	0.4%	0%	0%	1%	1%	1%	0.4%	1%	0%	0.2%	1%	1%
Drums	FRDR	0%	0.2%	1%	0.2%	0.2%	0%	1%	0%	0%	0.2%	0%	0.2%

Table 5.6-3. 2008-2019 Relative species abundance in small mesh index gill nets in Split Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Sturgeon	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mooneyes	MOON	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	5%	0%	0.4%	0%	1%	2%	10%	2%	7%	3%	6%	3%
	EMSH	10%	0%	1%	17%	19%	31%	13%	14%	13%	16%	32%	15%
	SPSH	29%	0%	22%	36%	61%	51%	48%	34%	52%	55%	45%	39%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WHSC	1%	0%	0%	0%	0%	0%	1%	4%	1%	0%	0%	1%
	SHRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pikes	NRPK	2%	0%	0.3%	2%	1%	0.4%	2%	2%	1%	0.5%	1%	1%
Smelts	RNSM	35%	56%	44%	5%	6%	1%	3%	4%	2%	1%	2%	14%
Coregonids	CISC	0%	0%	0%	1%	0%	0%	0.3%	4%	1%	7%	8%	2%
	LKWH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	14%	39%	31%	34%	11%	11%	18%	33%	12%	13%	3%	20%
Codfishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0.4%	0%	0%	0%	0%	0%	0%	0%	0.04%
	SLSC	2%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0.2%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Sculpin species (spp.)	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0%	0%	0.03%
Perch	JHDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	YLPR	1%	0%	0%	0%	0%	0.3%	2%	0.3%	1%	2%	0.3%	0.6%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.3%	0.02%
	SAUG	0.3%	6%	1%	3%	0.2%	1%	1%	0%	6%	2%	1%	2%
	WALL	1%	0%	0.3%	1%	0.3%	2%	2%	2%	4%	0.2%	2%	1%
Drums	FRDR	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 Nelson River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	5%	8%	9%	9%	7%	5%	6%	8%	5%	7%	2%	6%	6%
	NRPK	37%	31%	28%	25%	50%	43%	27%	22%	30%	24%	16%	23%	30%
	SAUG	0%	0%	0%	1%	0.5%	0%	3%	1%	1%	0.4%	0.5%	0%	1%
	WALL	5%	18%	16%	9%	7%	18%	12%	11%	9%	19%	6%	8%	11%
	WHSC	2%	10%	7%	11%	4%	6%	5%	6%	23%	12%	6%	13%	9%
Lampreys	SLLM	0%	0%	0.3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.03%
Sturgeon	LKST	22%	6%	15%	10%	14%	12%	26%	32%	12%	4%	25%	12%	16%
Mooneyes	MOON	1%	2%	0.3%	1%	0%	1%	0.4%	0%	0%	0%	0%	0%	0.4%
Minnows	LKCH	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	CARP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	27%	22%	20%	32%	16%	12%	20%	14%	20%	29%	43%	39%	25%
	SLRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SHRD	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0.1%
Smelts	RNSM	0%	3%	3%	0.3%	0%	0%	0%	1%	0%	0%	0%	0%	1%
Coregonids	CISC	0%	0.4%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%	0.1%
Salmonids	BRTR	0%	0%	0%	0.3%	0%	1%	0.4%	1%	0%	0.4%	0%	0%	0.2%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Codfishes	BURB	1%	0.4%	1%	0.3%	0.5%	1%	0%	1%	0%	0%	0%	0%	0.3%
Perch	YLPR	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0.04%
Drums	FRDR	0%	0%	0%	2%	1%	2%	1%	3%	0%	2%	0%	0%	1%

Table 5.6-5. 2008-2019 Relative species abundance in small mesh index gill nets in the lower Nelson River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Sturgeon	LKST	0%	0%	1%	0%	0%	2%	0%	0%	6%	0%	20%	22%	4%
Mooneyes	MOON	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0.4%
Minnows	LKCH	0%	2%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0.3%
	EMSH	3%	0%	32%	0%	14%	27%	36%	83%	28%	41%	0%	65%	27%
	SPSH	0%	14%	1%	0%	0%	0%	2%	1%	17%	0%	0%	0%	3%
	LNDC	0%	0%	0%	0%	0%	0%	2%	0%	0%	4%	0%	0%	0.5%
Suckers	LNSC	7%	0%	5%	30%	5%	0%	0%	2%	6%	4%	40%	0%	8%
	WHSC	23%	14%	0%	0%	5%	2%	0%	0%	0%	0%	0%	0%	4%
	SHRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pikes	NRPK	0%	0%	2%	2%	5%	2%	0%	0%	0%	0%	0%	0%	1%
Smelts	RNSM	17%	19%	55%	50%	0%	2%	6%	6%	0%	0%	0%	0%	13%
Coregonids	CISC	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0.1%
	LKWH	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	13%	1%
Trout-perch	TRPR	40%	29%	4%	12%	67%	29%	50%	5%	39%	37%	20%	0%	28%
Codfishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	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%
	Sculpin spp.	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0.2%
Perch	JHDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	YLPR	3%	12%	0%	0%	0%	2%	0%	0%	6%	7%	0%	0%	3%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SAUG	0%	0%	0%	0%	0%	0%	2%	2%	0%	0%	0%	0%	0.3%
	WALL	7%	12%	1%	4%	0%	31%	0%	2%	0%	7%	20%	0%	7%
Drums	FRDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-6. 2008-2019 Relative species abundance in standard gang index gill nets in the Burntwood River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2011	2014	2017	Mean
Target	LKWH	0%	4%	5%	3%
	NRPK	10%	10%	5%	8%
	SAUG	14%	15%	10%	13%
	WALL	48%	32%	33%	38%
	WHSC	7%	17%	10%	11%
Lampreys	SLLM	0%	0%	0%	0%
Sturgeon	LKST	6%	12%	7%	8%
Mooneyes	MOON	0%	2%	14%	5%
Minnows	LKCH	0%	0%	0%	0%
	CARP	0%	0%	0%	0%
Suckers	LNSC	2%	7%	8%	6%
	SLRD	0%	0%	0%	0%
	SHRD	3%	0%	7%	3%
Smelts	RNSM	0%	0%	0%	0%
Coregonids	CISC	0%	0%	0%	0%
Salmonids	BRTR	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%
Codfishes	BURB	10%	1%	1%	4%
Perch	YLPR	0%	0%	0%	0%
Drums	FRDR	0%	0%	0%	0%

Table 5.6-7. 2008-2019 Relative species abundance in small mesh index gill nets in the Burntwood River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2011	2014	2017	Mean
Sturgeon	LKST	0%	14%	0%	5%
Mooneyes	MOON	4%	0%	4%	3%
Minnows	LKCH	0%	0%	0%	0%
	EMSH	26%	0%	78%	35%
	SPSH	35%	14%	0%	16%
	LNDC	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0%	0%
	WHSC	4%	0%	0%	1%
	SHRD	0%	0%	0%	0%
Pikes	NRPK	0%	0%	0%	0%
Smelts	RNSM	4%	14%	0%	6%
Coregonids	CISC	0%	0%	4%	1%
	LKWH	0%	0%	0%	0%
Trout-perch	TRPR	4%	14%	0%	6%
Codfishes	BURB	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%
	SLSC	0%	0%	0%	0%
	SPSC	4%	0%	0%	1%
	Sculpin spp.	0%	0%	4%	1%
Perch	JHDR	0%	0%	0%	0%
	YLPR	0%	0%	0%	0%
	LGPR	0%	0%	0%	0%
	SAUG	17%	43%	4%	21%
	WALL	0%	0%	7%	2%
Drums	FRDR	0%	0%	0%	0%

Table 5.6-8. 2008-2019 Relative species abundance in standard gang index gill nets in the Limestone Forebay.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2010	2013	2016	2019	Mean
Target	LKWH	1%	2%	1%	0%	1%
	NRPK	29%	11%	0%	2%	10%
	SAUG	3%	7%	2%	1%	3%
	WALL	3%	10%	6%	8%	7%
	WHSC	8%	28%	44%	18%	25%
Lampreys	SLLM	0%	0%	0%	0%	0%
Sturgeon	LKST	0%	0%	0%	1%	0.3%
Mooneyes	MOON	4%	0%	0%	0%	1%
Minnows	LKCH	0%	0%	1%	0%	0%
	CARP	0%	0%	0%	0%	0%
Suckers	LNSC	51%	40%	46%	68%	51%
	SLRD	0%	0%	0%	0%	0%
	SHRD	0%	1%	0%	0%	0.2%
Smelts	RNSM	0%	0%	0%	0%	0%
Coregonids	CISC	0%	0%	0%	0%	0%
Salmonids	BRTR	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%
Codfishes	BURB	0%	0%	0%	0%	0%
Perch	YLPR	0%	0%	0%	0%	0%
Drums	FRDR	0%	2%	0%	2%	1%

Table 5.6-9. 2008-2019 Relative species abundance in small mesh index gill nets in the Limestone Forebay.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2010	2013	2016	2019	Mean
Sturgeon	LKST	0%	0%	0%	0%	0%
Mooneyes	MOON	0%	0%	0%	0%	0%
Minnows	LKCH	0%	0%	0%	0%	0%
	EMSH	2%	0%	0%	0%	0.4%
	SPSH	14%	0%	0%	0%	4%
	LNDC	0%	0%	7%	0%	2%
Suckers	LNSC	4%	2%	0%	0%	1%
	WHSC	0%	0%	13%	13%	6%
	SHRD	0%	0%	0%	0%	0%
Pikes	NRPK	0%	0%	0%	0%	0%
Smelts	RNSM	0%	2%	13%	13%	7%
Coregonids	CISC	0%	0%	0%	0%	0%
	LKWH	0%	0%	0%	0%	0%
Trout-perch	TRPR	80%	96%	67%	38%	70%
Codfishes	BURB	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%
	SLSC	0%	0%	0%	13%	3%
	SPSC	0%	0%	0%	0%	0%
	Sculpin spp.	0%	0%	0%	0%	0%
Perch	JHDR	0%	0%	0%	0%	0%
	YLPR	0%	0%	0%	0%	0%
	LGPR	0%	0%	0%	0%	0%
	SAUG	0%	0%	0%	0%	0%
	WALL	0%	0%	0%	25%	6%
Drums	FRDR	0%	0%	0%	0%	0%

Table 5.6-10. 2008-2019 Relative species abundance in standard gang index gill nets in Stephens Lake – North.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2012	2015	2018	Mean
Target	LKWH	5%	4%	6%	8%	6%
	NRPK	39%	32%	23%	11%	26%
	SAUG	0%	0%	0%	10%	3%
	WALL	49%	58%	49%	55%	53%
	WHSC	3%	5%	5%	14%	7%
Lampreys	SLLM	0%	0%	0%	0%	0%
Sturgeon	LKST	0%	0%	0%	0%	0%
Mooneyes	MOON	0%	0%	13%	0%	3%
Minnows	LKCH	0%	0%	0%	0%	0%
	CARP	1%	0%	0%	0%	0.1%
Suckers	LNSC	0%	0%	0.3%	0%	0.1%
	SLRD	0%	0%	0%	0%	0%
	SHRD	0%	1%	0%	1%	0.5%
Smelts	RNSM	4%	0%	2%	0%	1%
Coregonids	CISC	0%	2%	2%	1%	1%
Salmonids	BRTR	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%
Codfishes	BURB	0%	0%	0%	0%	0%
Perch	YLPR	0%	0%	0%	0%	0%
Drums	FRDR	0%	0%	0%	0%	0%

Table 5.6-11. 2008-2019 Relative species abundance in small mesh index gill nets in Stephens Lake – North.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2012	2015	2018	Mean
Sturgeon	LKST	0%	0%	0%	0%	0%
Mooneyes	MOON	0%	3%	0%	0%	1%
Minnows	LKCH	0%	0%	0%	0%	0%
	EMSH	17%	0%	36%	36%	22%
	SPSH	42%	58%	57%	26%	46%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0%	0%	0%
	WHSC	0%	0%	0%	0%	0%
	SHRD	0%	0%	0%	0%	0%
Pikes	NRPK	1%	0%	3%	2%	1%
Smelts	RNSM	32%	8%	1%	1%	10%
Coregonids	CISC	0%	0%	0%	5%	1%
	LKWH	0.5%	0%	0%	1%	0.4%
Trout-perch	TRPR	0.5%	25%	2%	18%	11%
Codfishes	BURB	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%
	SLSC	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%
	Sculpin spp.	0%	0%	0%	0%	0%
Perch	JHDR	0%	0%	0%	0%	0%
	YLPR	1%	0%	0.2%	2%	1%
	LGPR	0%	0%	0%	0%	0%
	SAUG	0%	0%	0%	2%	0.4%
	WALL	6%	8%	2%	9%	6%
Drums	FRDR	0%	0%	0%	0%	0%

Table 5.6-12. 2008-2019 Relative species abundance in standard gang index gill nets in Stephens Lake – South.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2012	2015	2018	Mean
Target	LKWH	2%	1%	3%	2%	2%
	NRPK	23%	22%	21%	17%	21%
	SAUG	9%	17%	2%	1%	8%
	WALL	54%	37%	44%	35%	43%
	WHSC	5%	14%	26%	34%	20%
Lampreys	SLLM	0%	0%	0%	0%	0%
Sturgeon	LKST	0%	1%	0.5%	0%	0.3%
Mooneyes	MOON	4%	1%	0%	3%	2%
Minnows	LKCH	0%	0%	0%	0%	0%
	CARP	0%	0%	0%	0%	0%
Suckers	LNSC	0%	4%	2%	2%	2%
	SLRD	0%	0%	0%	0%	0%
	SHRD	0%	0%	0%	4%	1%
Smelts	RNSM	4%	1%	0%	0%	1%
Coregonids	CISC	0%	0%	0%	0%	0%
Salmonids	BRTR	0%	0%	0%	0%	0%
Trout-perch	TRPR	0.3%	0%	0%	0%	0.1%
Codfishes	BURB	0%	0%	0%	1%	0.3%
Perch	YLPR	0%	1%	0.5%	1%	1%
Drums	FRDR	0%	0%	0%	0%	0%

Table 5.6-13. 2008-2019 Relative species abundance in small mesh index gill nets in Stephens Lake – South.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2012	2015	2018	Mean
Sturgeon	LKST	0%	0%	0%	0%	0%
Mooneyes	MOON	0%	0%	0%	1%	0.3%
Minnows	LKCH	0%	0%	0.3%	0%	0.1%
	EMSH	0%	0%	13%	46%	15%
	SPSH	24%	50%	70%	29%	43%
	LNDC	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	1%	0%	0.3%
	WHSC	3%	0%	0.3%	1%	1%
	SHRD	0%	1%	0%	0%	0.2%
Pikes	NRPK	0%	1%	1%	0%	0.5%
Smelts	RNSM	35%	2%	2%	0%	10%
Coregonids	CISC	0%	0%	0%	0%	0%
	LKWH	0.0%	0.0%	2%	4%	1%
Trout-perch	TRPR	32%	38%	8%	8%	21%
Codfishes	BURB	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%
	SLSC	0%	0%	0%	0%	0%
	SPSC	0%	0%	0%	0%	0%
	Sculpin spp.	0%	0%	0%	0%	0%
Perch	JHDR	0%	0%	0%	0%	0%
	YLPR	2%	2%	1%	2%	2%
	LGPR	0%	1%	0%	0%	0.2%
	SAUG	4%	2%	1%	2%	2%
	WALL	1%	1%	1%	6%	2%
Drums	FRDR	0%	2%	0%	0%	1%

Table 5.6-14. 2008-2019 Relative species abundance in standard gang index gill nets in Assean Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	9%	10%	15%	14%	2%	2%	3%	2%	3%	2%	1%	6%
	NRPK	15%	10%	12%	18%	20%	20%	14%	15%	13%	9%	11%	14%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	53%	45%	52%	51%	55%	60%	48%	46%	35%	66%	63%	52%
	WHSC	16%	11%	18%	13%	22%	18%	25%	30%	36%	17%	22%	21%
Lampreys	SLLM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sturgeon	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mooneyes	MOON	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%
	CARP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.2%	0%	0.02%
	SLRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SHRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Smelts	RNSM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coregonids	CISC	7%	23%	1%	2%	0%	0.2%	9%	4%	5%	3%	1%	5%
Salmonids	BRTR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0.1%	0%	0%	0.01%
Codfishes	BURB	0%	0.2%	0%	0%	0.3%	0%	0.2%	0%	0%	0%	0.2%	0.1%
Perch	YLPR	1%	2%	2%	3%	0.3%	0.2%	1%	3%	7%	2%	2%	2%
Drums	FRDR	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 Assean Lake.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Sturgeon	LKST	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mooneyes	MOON	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%
	EMSH	4%	0.5%	15%	14%	25%	24%	31%	13%	18%	44%	44%	21%
	SPSH	48%	20%	36%	47%	53%	55%	53%	60%	43%	32%	34%	44%
	LNDC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WHSC	5%	0%	0.2%	1%	0.2%	1%	0.3%	0%	0.3%	1%	1%	1%
	SHRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pikes	NRPK	3%	1%	1%	2%	2%	1%	0.2%	1%	1%	0.3%	1%	1%
Smelts	RNSM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coregonids	CISC	1%	1%	3%	2%	0.4%	0%	6%	0.4%	6%	5%	2%	2%
	LKWH	1%	1%	1%	1%	0%	0%	0%	0%	2%	0%	0%	1%
Trout-perch	TRPR	4%	8%	11%	6%	11%	8%	1%	5%	11%	6%	3%	7%
Codfishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	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%
	Sculpin spp.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Perch	JHDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	YLPR	7%	66%	27%	18%	2%	2%	2%	18%	8%	1%	6%	14%
	LGPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	28%	3%	6%	11%	7%	10%	7%	3%	11%	11%	9%	10%
Drums	FRDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-16. 2008-2019 Relative species abundance in standard gang index gill nets in the Hayes River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Target	LKWH	13%	2%	6%	6%	4%	0%	11%	25%	18%	9%	20%	17%	11%
	NRPK	5%	4%	6%	5%	6%	6%	7%	10%	11%	12%	7%	8%	7%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	36%	29%	28%	23%	44%	30%	17%	22%	23%	27%	21%	28%	27%
	WHSC	4%	13%	8%	19%	6%	19%	11%	3%	8%	4%	7%	11%	9%
Lampreys	SLLM	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%
Sturgeon	LKST	15%	25%	38%	30%	24%	24%	45%	30%	26%	30%	34%	28%	29%
Mooneyes	MOON	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%
	CARP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Suckers	LNSC	14%	18%	5%	9%	13%	16%	9%	9%	9%	18%	10%	6%	11%
	SLRD	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SHRD	14%	5%	4%	5%	0%	4%	1%	2%	4%	0%	3%	1%	4%
Smelts	RNSM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coregonids	CISC	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0.1%
Salmonids	BRTR	0%	4%	5%	1%	0%	2%	0%	1%	0%	0%	0%	0%	1%
Trout-perch	TRPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Codfishes	BURB	0%	0%	0%	1%	3%	0%	0%	1%	0%	0%	0%	0%	0.4%
Perch	YLPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Drums	FRDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5.6-17. 2008-2019 Relative species abundance in small mesh index gill nets in the Hayes River.

0%	>0-5%	>5-10%	>10-25%	>25-50%	>50%

Group	Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
Sturgeon	LKST	25%	33%	40%	0%	0%	13%	8%	0%	0%	0%	11%	0%	11%
Mooneyes	MOON	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Minnows	LKCH	25%	33%	0%	36%	6%	0%	8%	0%	0%	9%	2%	0%	10%
	EMSH	0%	0%	0%	0%	11%	0%	0%	0%	15%	0%	0%	0%	2%
	SPSH	0%	0%	0%	9%	0%	0%	0%	0%	0%	9%	4%	3%	2%
	LNDC	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	3%
Suckers	LNSC	17%	0%	13%	27%	0%	0%	0%	13%	0%	9%	0%	3%	7%
	WHSC	0%	0%	0%	0%	0%	0%	8%	0%	8%	18%	0%	3%	3%
	SHRD	8%	0%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Pikes	NRPK	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%	0.5%
Smelts	RNSM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Coregonids	CISC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LKWH	0%	0%	7%	0%	0%	13%	0%	0%	0%	0%	0%	9%	2%
Trout-perch	TRPR	0%	0%	0%	0%	33%	13%	17%	50%	0%	9%	9%	9%	12%
Codfishes	BURB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sculpins	MTSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SLSC	0%	0%	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	1%
	SPSC	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Sculpin spp.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Perch	JHDR	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	1%
	YLPR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LGPR	0%	0%	0%	0%	0%	0%	8%	0%	0%	0%	0%	3%	1%
	SAUG	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	WALL	25%	0%	33%	18%	50%	63%	42%	38%	77%	45%	71%	66%	44%
Drums	FRDR	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

5.6.2 HILL'S EFFECTIVE RICHNESS

5.6.2.1 ON-SYSTEM SITES

ANNUAL SITES

Split Lake

The Hill's effective species richness over the 11 years of monitoring ranged from a low of 6.8 in 2010 to a high of 9.9 species in 2015 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 8.6, the median was 9.2, and the IQR was 7.6-9.5 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2010, 2013, and 2014 when it was below the IQR and in 2015 when it was above the IQR.

Lower Nelson River

The Hill's effective species richness over the 12 years of monitoring ranged from a low of 4.4 in 2018 to a high of 8.4 species in 2009 and 2014 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 7.0, the median was 7.4, and the IQR was 6.2-7.9 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2012, 2018, and 2019 when it was below the IQR and in 2009, 2010, and 2014 when it was above the IQR.

ROTATIONAL SITES

Burntwood Rivver

The Hill's effective species richness over the three years of monitoring ranged from a low of 7.2 in 2011 to a high of 8.6 species in 2017 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 7.7, the median was 7.3, and the IQR was 7.2-7.9 species (Figure 5.6-1). The annual mean Hill's index value was above the IQR in 2017.

Limestone Forebay

The Hill's effective species richness over the four years of monitoring ranged from a low of 3.2 in 2019 to a high of 5.6 species in 2013 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 4.5, the median was 4.6, and the IQR was 3.8-5.3 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2019 when it was below the IQR and in 2013 when it was above the IQR.

Stephens Lake – North

The Hill's effective species richness over the four years of monitoring ranged from a low of 4.7 in 2012 to a high of 7.4 species in 2018 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 5.8, the median was 5.6, and the IQR was 5.4-6.1 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2012 when it was below the IQR and in 2018 when it was above the IQR.

Stephens Lake – South

The Hill's effective species richness over the four years of monitoring ranged from a low of 5.8 in 2015 to a high of 7.5 species in 2018 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 6.7, the median was 6.9, and the IQR was 6.2-7.4 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2015 when it was below the IQR.

5.6.2.2 OFF-SYSTEM SITES

ANNUAL SITES

Assean Lake

The Hill's effective species richness over the 11 years of monitoring ranged from a low of 5.2 in 2014 to a high of 7.3 species in 2017 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 6.0, the median was 5.7, and the IQR was 5.4-6.5 species (Figure 5.6-1). The annual mean Hill's index value fell within the overall IQR except in 2014 and 2015 when it was below the IQR and in 2011, 2012, and 2017 when it was above the IQR.

Hayes River

The Hill's effective species richness over the 12 years of monitoring ranged from a low of 5.4 in 2010 to a high of 7.4 species in 2011 (Table 5.6-18; Figure 5.6-1).

The overall mean Hill's index value was 6.0, the median was 5.8, and the IQR was 5.7-6.1 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 and in 2009 and 2011 when it was above the IQR.

ROTATIONAL SITES

There are no off-system waterbodies in the Lower Nelson River Region that are monitored on a rotational basis.

Table 5.6-18. 2008-2019 Hill's effective species richness.

Waterbody	Year	n_F[1]	n_{spp}[2]	Value
SPLIT	2009	761	17	9.5
	2010	420	13	6.8
	2011	1251	17	7.9
	2012	780	18	9.2
	2013	1125	17	7.4
	2014	1328	16	7.3
	2015	858	17	9.9
	2016	784	17	9.6
	2017	763	17	8.5
	2018	885	18	9.3
	2019	754	18	9.6
LNR	2008	194	12	6.3
	2009	324	14	8.4
	2010	394	14	8.2
	2011	432	13	7.0
	2012	235	12	5.7
	2013	246	16	7.4
	2014	292	16	8.4
	2015	295	16	7.8
	2016	194	11	7.5
	2017	252	14	7.5
	2018	214	8	4.4
	2019	256	7	5.7
BURNT	2011	145	14	7.2
	2014	107	12	7.3
	2017	160	12	8.6
LMFB	2010	204	10	5.3
	2013	153	10	5.6
	2016	105	9	4.0
	2019	181	10	3.2
STL-N	2009	404	10	5.7
	2012	170	10	4.7
	2015	801	12	5.6
	2018	364	12	7.4
STL-S	2009	458	10	6.3
	2012	301	15	7.4
	2015	607	13	5.8
	2018	464	13	7.5
ASSN	2009	647	9	5.3
	2010	1072	10	6.3
	2011	1141	9	7.2
	2012	1117	9	6.7
	2013	798	10	5.7
	2014	1125	9	5.2
	2015	1717	10	5.3
	2016	909	9	6.1
	2017	1288	9	7.3
	2018	1231	10	5.6
	2019	1029	10	5.6
HAYES	2008	92	8	6.1
	2009	59	11	6.8
	2010	174	8	5.4
	2011	90	12	7.4
	2012	90	11	5.7
	2013	143	9	5.7
	2014	189	11	5.5
	2015	203	10	5.8
	2016	143	8	6.2
	2017	128	9	5.6
	2018	197	11	5.9
	2019	172	10	5.7

Notes:

1. nF = number of fish caught in standard and small mesh gill nets.
2. nspp = number of species caught in standard and small mesh gill nets.

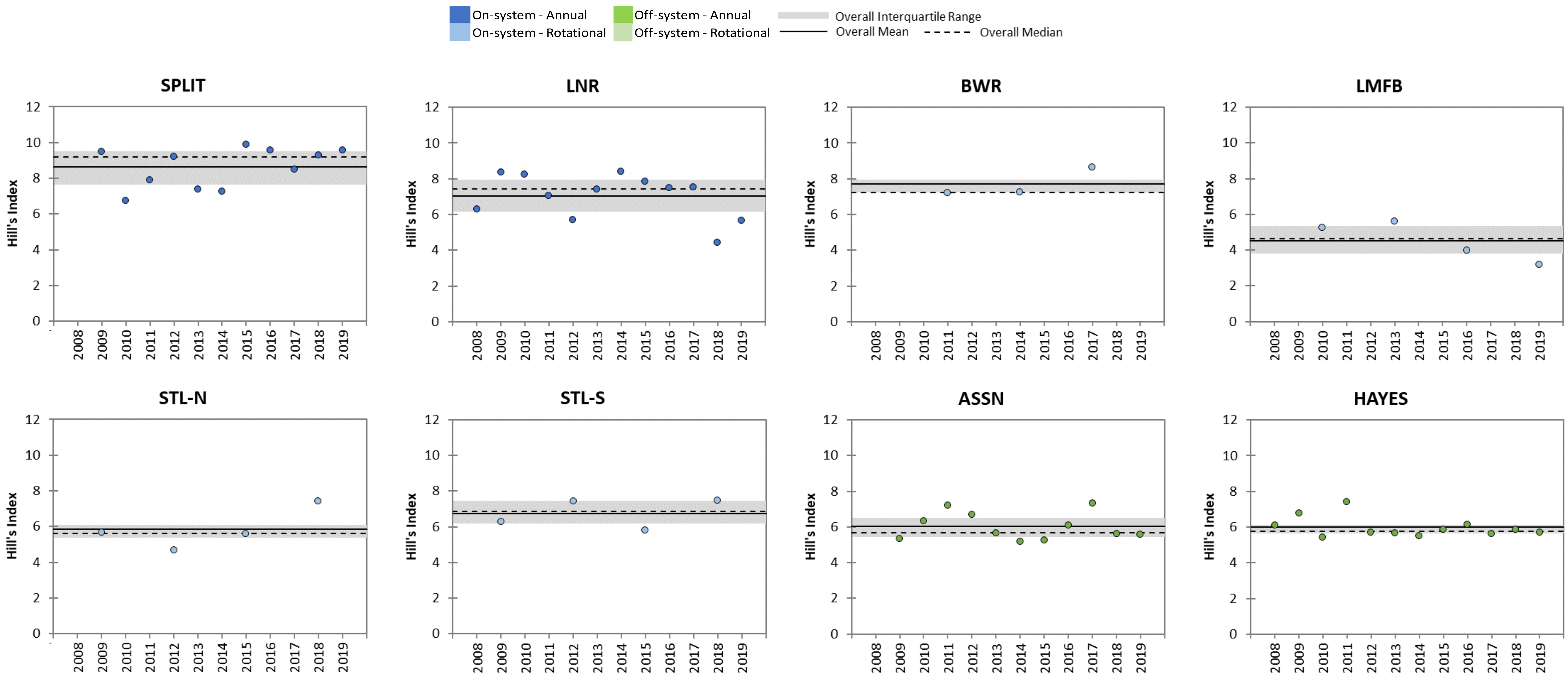


Figure 5.6-1. 2008-2019 Hill's effective species richness.

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 Nelson River Region:

Split Lake

- Gill nets were set at the target locations in all 11 years with the following exceptions:
  - SN-22 was not a target location but was included as alternate location to SN-11 in 2011 since it was set in close proximity.
  - The locations of GN-13 and GN-29 were reversed in 2013 and 2019.

Lower Nelson River

- Gill nets were set at the target locations in all 12 years with the following exceptions:
  - In 2011 several nets were not set at the target location in error:
    i) the locations of GN-02 and GN-03 were reversed,
    ii) GN/SN-07 was set at the target location of GN/SN-09,
    iii) GN-09 was set at the target location of GN-08,
    iv) GN-06 was set farther upstream from the target location, and
    v) SN-04 and SN-08 were not target locations but were included as alternate locations to SN-03 and SN-09 since they were set in close proximity.
  - In 2014 two nets were not set at the target locations in error:
    i) GN-08 was set farther upstream from the target location, and
    ii) GN-07 was set at the target location of GN-08.

Burntwood River

- Gill nets were set at the target locations in all three years.

Limestone Forebay

- Gill nets were set at the target locations in all four years.

Stephens Lake – North

- Gill nets were set at the target locations in all four years.

Stephens Lake – South

- Gill nets were set at the target locations in all four years.

Assean Lake

- Gill nets were set at the target locations in all 11 years with the following modifications:
  - GN/SN-06 was set in 2009, 2010, and 2012 and GN/SN-11 was set in 2011.
  - GN/SN-11 was selected as the official target location starting in 2013.

Hayes River

- Gill nets were set at the target locations in all 12 years with the following exception:
  - SN-05 was set in in lieu of SN-06 in 2011 and was included in the analysis since it was set in close proximity.

Table A5-1-1. 2008-2019 Set information for gillnetting sites.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	GN-03	15	316492	6237800	27-Aug-09	26.0	3.2	4.5	14.0
	GN-05	14	673559	6236207	22-Aug-09	25.4	2.8	3.7	16.0
	GN-06	14	673487	6233791	21-Aug-09	27.3	2.4	3.9	16.0
	GN-13	14	669910	6221792	20-Aug-09	25.5	4.6	5.8	16.0
	GN-15	14	657459	6221683	18-Aug-09	25.3	4.5	3.0	12.0
	GN-18	14	669466	6225217	19-Aug-09	22.5	3.4	3.9	16.0
	GN-20	14	682951	6236532	27-Aug-09	24.6	10.2	8.3	14.0
	GN-21	14	675199	6233925	21-Aug-09	26.2	7.1	9.7	16.0
	GN-22	14	677869	6232988	22-Aug-09	24.7	12.8	13.9	16.0
	GN-26	14	670725	6225619	19-Aug-09	21.8	12.3	8.8	16.0
	GN-28	14	657810	6221887	18-Aug-09	26.2	8.0	14.4	12.0
	GN-29	14	670742	6221973	20-Aug-09	26.1	9.4	9.0	16.0
	SN-03	15	316404	6237958	27-Aug-09	26.0	3.2	4.5	14.0
	SN-06	14	673641	6233840	21-Aug-09	27.3	2.4	3.9	16.0
	SN-20	14	683125	6236598	27-Aug-09	24.6	10.2	8.3	14.0
	SN-26	14	670854	6225508	19-Aug-09	21.8	12.3	8.8	16.0
	GN-03	15	316477	6237843	23-Aug-10	48.6	4.8	5.2	16.0
	GN-05	14	673580	6236345	23-Aug-10	45.1	3.5	3.5	15.0
	GN-06	14	673465	6233853	23-Aug-10	45.5	3.5	3.7	15.0
	GN-13	14	669781	6221741	22-Aug-10	28.6	5.5	4.7	16.0
	GN-15	14	657349	6221655	21-Aug-10	25.9	2.7	3.8	16.0
	GN-18	14	669558	6225261	22-Aug-10	28.7	3.9	3.6	15.5
	GN-20	14	683018	6236587	20-Aug-10	25.6	10.8	9.5	16.0
	GN-21	14	675244	6233962	20-Aug-10	25.3	8.9	7.0	16.0
	GN-22	14	677978	6233132	20-Aug-10	24.8	10.2	11.8	16.0
	GN-26	14	670883	6225531	21-Aug-10	27.2	11.4	11.3	16.0
	GN-28	14	657720	6221822	21-Aug-10	27.1	15.9	14.7	16.0
	GN-29	14	670875	6222070	22-Aug-10	28.6	8.2	9.2	16.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	SN-03	15	316518	6237827	23-Aug-10	48.6	4.6	4.8	15.0
	SN-06	14	673465	6233853	23-Aug-10	45.5	3.5	2.6	15.0
	SN-20	14	683018	6236587	20-Aug-10	25.6	10.8	10.7	16.0
	SN-26	14	670883	6225531	21-Aug-10	27.2	11.4	12.0	16.0
	GN-03	14	616419	6237643	12-Aug-11	24.8	5.8	4.3	20.0
	GN-05	14	673192	6236322	14-Aug-11	23.5	4.0	4.5	19.0
	GN-06	14	673603	6233824	14-Aug-11	24.5	5.0	5.5	19.0
	GN-13	14	669919	6221765	11-Aug-11	24.0	5.3	5.6	20.0
	GN-15	14	657310	6221700	9-Aug-11	18.7	3.5	6.0	20.0
	GN-18	14	669629	6225202	10-Aug-11	24.7	4.9	5.3	19.0
	GN-20	14	683863	6236240	12-Aug-11	25.4	6.0	6.0	20.0
	GN-21	14	675025	6233917	13-Aug-11	24.4	5.7	6.7	20.0
	GN-22	14	677897	6232606	13-Aug-11	25.8	6.9	7.0	20.0
	GN-26	14	670566	6225597	10-Aug-11	25.4	5.2	12.0	19.0
	GN-28	14	657831	6221826	9-Aug-11	19.9	17.0	6.1	20.0
	GN-29	14	670625	6221948	11-Aug-11	25.0	9.5	9.5	20.0
	SN-03	14	616419	6237643	12-Aug-11	24.8	5.8	5.8	20.0
	SN-06	14	673603	6233824	14-Aug-11	24.5	5.0	5.0	19.0
	SN-22	14	677897	6232606	13-Aug-11	24.0	6.9	6.9	20.0
	SN-26	14	670566	6225597	10-Aug-11	25.4	5.2	5.2	19.0
	GN-03	15	316427	6237869	16-Aug-12	25.2	3.8	4.9	17.5
	GN-05	14	673636	6236211	15-Aug-12	25.5	2.7	2.6	19.5
	GN-06	14	673601	6233748	14-Aug-12	25.6	3.9	2.7	19.0
	GN-13	14	669994	6221769	11-Aug-12	23.8	3.8	3.9	20.0
	GN-15	14	657496	6221710	12-Aug-12	23.8	3.7	2.3	20.5
	GN-18	14	669515	6225287	13-Aug-12	24.4	3.1	3.5	20.0
	GN-20	14	683173	6236572	16-Aug-12	25.6	8.7	10.4	17.5
	GN-21	14	675247	6233977	15-Aug-12	24.5	7.2	8.9	19.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	GN-22	14	677981	6233148	14-Aug-12	25.0	10.4	12.9	19.0
	GN-26	14	670868	6225542	13-Aug-12	25.0	10.3	11.3	20.0
	GN-28	14	657691	6221815	12-Aug-12	23.9	15.2	14.1	20.5
	GN-29	14	670780	6221986	11-Aug-12	24.3	8.4	7.3	20.0
	SN-03	15	316454	6237853	16-Aug-12	25.3	3.8	3.8	17.5
	SN-06	14	673629	6233733	14-Aug-12	25.2	3.9	3.9	19.0
	SN-20	14	683206	6236574	16-Aug-12	25.8	8.7	8.7	17.5
	SN-26	14	670829	6225559	13-Aug-12	25.0	9.4	10.3	20.0
	GN-03	15	316541	6237642	18-Aug-13	21.2	3.9	5.1	17.0
	GN-05	14	673739	6236213	17-Aug-13	23.7	3.8	3.9	17.0
	GN-06	14	673513	6233829	16-Aug-13	24.1	3.6	4.5	17.5
	GN-13	14	670755	6222005	13-Aug-13	20.2	8.8	8.6	17.0
	GN-15	14	657492	6221704	14-Aug-13	23.6	4.3	2.5	17.0
	GN-18	14	669629	6225267	15-Aug-13	21.3	4.1	4.3	17.5
	GN-20	14	683018	6236482	18-Aug-13	22.8	9.5	6.1	17.0
	GN-21	14	675131	6233853	17-Aug-13	23.4	5.5	7.0	17.0
	GN-22	14	677966	6233095	16-Aug-13	23.7	10.3	12.9	17.5
	GN-26	14	670910	6225517	15-Aug-13	21.9	11.6	12.7	17.5
	GN-28	14	657713	6221832	14-Aug-13	24.3	16.4	10.0	17.0
	GN-29	14	669757	6221667	13-Aug-13	19.8	5.1	5.4	17.0
	SN-03	15	316542	6237698	18-Aug-13	21.2	2.3	3.9	17.0
	SN-06	14	673490	6233856	16-Aug-13	24.1	3.1	3.6	17.5
	SN-20	14	683034	6236519	18-Aug-13	22.8	9.3	9.5	17.0
	SN-26	14	670875	6225555	15-Aug-13	21.9	9.1	11.6	17.5
	GN-03	15	316228	6237908	14-Aug-14	23.4	3.6	5.9	21.0
	GN-05	14	673555	6236336	10-Aug-14	22.7	3.9	3.8	19.0
	GN-06	14	673466	6233840	9-Aug-14	23.5	3.4	3.3	21.0
	GN-13	14	670005	6221782	12-Aug-14	24.7	3.9	5.7	21.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	GN-15	14	657376	6221631	11-Aug-14	23.9	4.6	3.4	21.0
	GN-18	14	669528	6225349	10-Aug-14	21.2	4.5	4.6	19.0
	GN-20	14	683058	6236551	14-Aug-14	24.6	9.5	9.9	21.0
	GN-21	14	675274	6234001	9-Aug-14	22.2	8.6	7.9	21.0
	GN-22	14	677970	6233154	13-Aug-14	25.2	12.0	13.0	21.0
	GN-26	14	670993	6225485	11-Aug-14	25.7	7.6	12.5	20.0
	GN-28	14	657836	6221847	11-Aug-14	24.5	15.4	16.6	21.0
	GN-29	14	670889	6222072	12-Aug-14	25.9	9.7	8.5	21.0
	SN-03	15	316362	6237966	14-Aug-14	23.4	2.5	3.6	21.0
	SN-06	14	673492	6233868	9-Aug-14	23.5	3.4	3.4	21.0
	SN-20	14	683215	6236589	14-Aug-14	24.6	9.1	9.5	21.0
	SN-26	14	670957	6225585	11-Aug-14	25.7	4.7	7.6	20.0
	GN-03	15	316466	6237833	14-Aug-15	23.5	3.7	4.1	20.0
	GN-05	14	673687	6236230	14-Aug-15	24.1	2.4	2.7	19.0
	GN-06	14	673500	6233821	16-Aug-15	23.8	2.6	3.7	18.0
	GN-13	14	669785	6221742	16-Aug-15	24.4	4.6	5.5	18.0
	GN-15	14	657457	6221742	17-Aug-15	22.1	4.4	1.8	19.0
	GN-18	14	669566	6225263	16-Aug-15	20.7	3.0	3.4	18.0
	GN-20	14	683051	6236584	15-Aug-15	24.8	9.0	9.6	20.0
	GN-21	14	675143	6233872	14-Aug-15	23.8	4.3	5.7	19.0
	GN-22	14	677986	6233149	15-Aug-15	24.8	10.3	12.3	19.0
	GN-26	14	670918	6225489	17-Aug-15	24.3	11.2	12.1	17.0
	GN-28	14	657733	6221830	17-Aug-15	21.6	15.0	10.2	19.0
	GN-29	14	670856	6222040	15-Aug-15	23.9	7.7	6.1	19.0
	SN-03	15	316497	6237819	14-Aug-15	23.5	3.6	3.7	20.0
	SN-06	14	673478	6233854	16-Aug-15	23.8	2.3	2.6	18.0
	SN-20	14	683082	6236586	15-Aug-15	24.8	8.7	9.0	20.0
	SN-26	14	670896	6225514	17-Aug-15	24.3	11.1	11.2	17.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	GN-03	15	316317	6237887	17-Aug-16	20.5	4.8	4.8	18.5
	GN-05	14	673638	6236345	17-Aug-16	25.3	3.4	3.2	18.5
	GN-06	14	673628	6233742	16-Aug-16	20.5	4.4	3.5	18.5
	GN-13	14	669788	6221707	15-Aug-16	24.8	5.5	5.0	18.0
	GN-15	14	657497	6221690	13-Aug-16	18.1	3.8	2.7	19.0
	GN-18	14	669502	6225313	14-Aug-16	24.7	3.8	4.1	17.0
	GN-20	14	682923	6236540	17-Aug-16	21.7	9.4	9.7	18.5
	GN-21	14	675123	6233854	16-Aug-16	21.9	5.2	6.0	18.5
	GN-22	14	678043	6233194	16-Aug-16	23.2	10.2	7.0	18.5
	GN-26	14	670863	6225449	14-Aug-16	24.8	12.0	11.4	17.0
	GN-28	14	657748	6221766	13-Aug-16	18.7	6.3	13.9	19.0
	GN-29	14	670772	6222046	15-Aug-16	24.3	5.4	8.5	18.0
	SN-03	15	316236	6238033	17-Aug-16	20.5	4.7	4.8	18.5
	SN-06	14	673503	6233866	16-Aug-16	20.5	2.7	3.5	18.5
	SN-20	14	683098	6236585	17-Aug-16	21.7	9.5	9.7	18.5
	SN-26	14	670724	6225528	14-Aug-16	24.8	11.0	11.4	17.0
	GN-03	15	316363	6237877	22-Aug-17	24.7	4.7	4.1	19.0
	GN-05	14	673641	6236216	25-Aug-17	25.2	3.3	3.1	19.0
	GN-06	14	673505	6233815	25-Aug-17	24.8	3.4	4.5	19.0
	GN-13	14	669836	6221665	24-Aug-17	25.8	4.6	3.8	19.5
	GN-15	14	657502	6221705	26-Aug-17	25.2	4.3	2.8	20.0
	GN-18	14	669523	6225290	27-Aug-17	23.9	3.7	4.0	19.5
	GN-20	14	683137	6236551	23-Aug-17	25.8	9.3	10.1	19.0
	GN-21	14	675231	6233990	22-Aug-17	25.3	7.3	9.0	19.0
	GN-22	14	678015	6233158	23-Aug-17	25.0	9.7	13.0	19.0
	GN-26	14	670879	6225507	27-Aug-17	23.8	11.6	11.8	19.5
	GN-28	14	657690	6221827	26-Aug-17	25.8	15.8	13.6	20.0
	GN-29	14	670770	6221994	24-Aug-17	26.2	9.0	8.7	19.5

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	SN-03	15	316363	6237877	22-Aug-17	24.7	4.7	4.6	19.0
	SN-06	14	673505	6233815	25-Aug-17	24.8	3.4	3.1	19.0
	SN-20	14	683137	6236551	23-Aug-17	25.8	9.3	9.4	19.0
	SN-26	14	670879	6225507	27-Aug-17	23.8	11.6	11.5	19.5
	GN-03	15	316327	6237835	19-Aug-18	21.4	3.5	2.9	17.0
	GN-05	14	673575	6236331	19-Aug-18	22.6	1.8	1.9	17.0
	GN-06	14	673487	6233810	22-Aug-18	22.3	2.3	3.1	16.0
	GN-13	14	669924	6221742	20-Aug-18	18.5	2.7	7.2	17.0
	GN-15	14	657484	6221715	21-Aug-18	21.3	3.3	1.7	16.0
	GN-18	14	669507	6225347	20-Aug-18	21.2	2.6	2.9	17.0
	GN-20	14	683119	6236917	19-Aug-18	22.0	7.9	7.9	17.0
	GN-21	14	675185	6233885	22-Aug-18	21.8	4.4	6.6	16.0
	GN-22	14	677960	6233189	22-Aug-18	21.8	11.6	12.3	16.0
	GN-26	14	670925	6225493	20-Aug-18	20.2	10.7	11.5	17.0
	GN-28	14	657681	6221815	21-Aug-18	22.2	14.7	14.1	16.0
	GN-29	14	670817	6222036	21-Aug-18	25.3	7.2	7.7	16.0
	SN-03	15	316341	6237808	19-Aug-18	21.4	3.4	3.5	17.0
	SN-06	14	673460	6233830	22-Aug-18	22.3	2.0	2.3	16.0
	SN-20	14	683149	6236526	19-Aug-18	22.0	8.1	7.9	17.0
	SN-26	14	670904	6225514	20-Aug-18	20.2	10.4	10.7	17.0
	GN-03	15	316430	6237847	4-Sep-19	23.2	3.6	4.1	13.0
	GN-05	14	673694	6236199	4-Sep-19	24.0	2.5	2.3	13.0
	GN-06	14	673546	6233819	5-Sep-19	21.8	3.6	3.8	13.0
	GN-13	14	671015	6222208	23-Aug-19	22.5	5.0	3.4	17.4
	GN-15	14	657547	6221718	23-Aug-19	27.1	2.1	2.1	16.0
	GN-18	14	669625	6225413	22-Aug-19	20.3	3.1	3.1	17.5
	GN-20	14	683220	6236494	4-Sep-19	23.4	7.5	9.1	13.0
	GN-21	14	675159	6234028	24-Aug-19	26.4	3.9	3.8	17.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
SPLIT	GN-22	14	678002	6233133	24-Aug-19	26.3	8.6	11.2	17.0
	GN-26	14	670952	6225558	22-Aug-19	19.9	8.2	5.8	17.0
	GN-28	14	657901	6222037	23-Aug-19	27.5	6.5	14.2	16.0
	GN-29	14	670055	6221742	22-Aug-19	20.4	4.0	4.1	18.0
	SN-03	15	316430	6237847	4-Sep-19	23.2	3.4	3.6	13.0
	SN-06	14	673471	6233851	5-Sep-19	21.8	4.1	3.6	13.0
	SN-20	14	683256	6236471	4-Sep-19	23.4	7.2	7.5	13.0
	SN-26	14	671042	6225504	22-Aug-19	19.9	10.8	8.2	17.0
LNR	GN-01	15	443329	6271561	12-Aug-08	27.3	2.3	3.4	20.0
	GN-02	15	445800	6273839	12-Aug-08	22.6	0.9	1.8	20.5
	GN-03	15	445152	6273017	12-Aug-08	24.8	1.5	2.3	21.0
	GN-04	15	448032	6276646	13-Aug-08	14.5	1.5	2.4	21.0
	GN-05	15	448088	6278129	13-Aug-08	15.0	1.9	1.5	21.0
	GN-06	15	469692	6300756	16-Aug-08	28.7	3.3	0.5	20.0
	GN-07	15	468666	6298720	17-Aug-08	21.5	1.6	3.3	20.0
	GN-08	15	468191	6297013	15-Aug-08	25.2	2.4	0.5	21.0
	GN-09	15	462183	6290251	17-Aug-08	23.0	2.3	1.6	20.0
	SN-03	15	445132	6272991	12-Aug-08	24.8	1.5	1.5	21.0
	SN-07	15	468654	6298676	17-Aug-08	21.5	1.6	1.6	20.0
	GN-01	15	443342	6271647	4-Aug-09	17.7	1.6	1.4	18.0
	GN-02	15	446438	6274299	4-Aug-09	18.3	3.5	1.3	18.0
	GN-03	15	445236	6273113	5-Aug-09	21.6	1.4	1.9	16.0
	GN-04	15	448025	6276627	5-Aug-09	22.7	1.5	3.0	16.0
	GN-05	15	447986	6277985	6-Aug-09	20.5	1.2	1.5	16.0
	GN-06	15	469755	6300802	6-Aug-09	18.6	4.1	1.8	17.0
	GN-07	15	468658	6298711	6-Aug-09	18.9	2.9	3.8	17.0
	GN-08	15	468165	6297143	7-Aug-09	22.7	1.0	3.0	17.0
	GN-09	15	462380	6290315	7-Aug-09	19.3	2.5	0.8	17.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LNR	SN-03	15	445142	6272972	5-Aug-09	22.7	1.5	1.9	16.0
	SN-07	15	468643	6298696	6-Aug-09	19.0	1.4	2.9	17.0
	SN-09	15	462447	6290403	7-Aug-09	19.3	2.5	4.2	17.0
	GN-01	15	443364	6271568	5-Aug-10	23.5	1.2	1.6	20.0
	GN-02	15	446436	6274306	5-Aug-10	24.2	1.4	2.3	20.0
	GN-03	15	445153	6273019	5-Aug-10	25.2	2.0	2.0	20.0
	GN-04	15	447959	6276542	6-Aug-10	26.4	2.5	1.0	20.0
	GN-05	15	448044	6278002	6-Aug-10	26.8	1.5	1.0	20.0
	GN-06	15	469929	6300885	7-Aug-10	28.1	4.8	2.1	20.0
	GN-07	15	468798	6298797	7-Aug-10	26.2	2.1	2.1	20.0
	GN-08	15	468274	6297213	8-Aug-10	23.2	5.7	5.7	20.0
	GN-09	15	462474	6290371	8-Aug-10	23.3	5.3	1.7	20.0
	SN-03	15	445134	6272999	5-Aug-10	25.2	0.5	0.5	20.0
	SN-07	15	468748	6298798	7-Aug-10	27.6	2.1	2.1	20.0
	SN-09	15	462485	6290392	8-Aug-10	23.2	5.6	5.6	20.0
	GN-01	15	443470	6271495	20-Jul-11	24.6	2.4	1.4	19.0
	GN-02	15	445137	6272994	20-Jul-11	25.2	2.0	2.0	19.0
	GN-03	15	446378	6274197	21-Jul-11	22.3	1.5	1.2	19.0
	GN-04	15	447959	6276516	21-Jul-11	23.5	2.7	1.2	19.0
	GN-05	15	448129	6278078	22-Jul-11	24.9	2.3	2.4	18.0
	GN-06	15	459652	6288836	23-Jul-11	25.0	6.0	2.5	18.0
	GN-07	15	462302	6290285	23-Jul-11	26.1	2.6	3.5	17.0
	GN-08	15	468887	6296627	24-Jul-11	23.5	7.2	7.3	18.0
	GN-09	15	468217	6297041	24-Jul-11	25.5	4.7	3.2	18.0
	SN-04	15	448019	6276641	21-Jul-11	23.3	2.7	2.9	19.0
	SN-07	15	462271	6290249	23-Jul-11	26.5	2.3	2.6	17.0
	SN-08	15	468871	6296588	24-Jul-11	23.8	7.7	7.2	18.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LNR	GN-01	15	443310	6271638	26-Jul-12	24.5	2.0	0.8	20.0
	GN-02	15	446377	6274208	26-Jul-12	22.7	0.8	2.2	20.0
	GN-03	15	445226	6273061	26-Jul-12	25.0	2.0	0.5	20.0
	GN-04	15	447952	6276521	27-Jul-12	18.9	0.5	3.0	20.0
	GN-05	15	448193	6278154	26-Jul-12	18.2	1.8	1.8	20.0
	GN-06	15	469991	6300868	30-Jul-12	25.3	2.6	0.5	21.0
	GN-07	15	468910	6298853	30-Jul-12	24.5	2.0	2.0	21.0
	GN-08	15	468324	6297302	31-Jul-12	22.4	1.8	0.8	21.0
	GN-09	15	462417	6290356	31-Jul-12	23.8	1.5	3.3	21.0
	SN-03	15	445246	6273088	26-Jul-12	24.9	2.0	2.0	20.0
	SN-07	15	468880	6298844	30-Jul-12	24.8	0.5	2.0	21.0
	SN-09	15	462394	6290321	31-Jul-12	24.0	0.5	1.5	21.0
	GN-01	15	443316	6271550	7-Aug-13	24.1	1.4	1.7	17.0
	GN-02	15	446377	6274227	7-Aug-13	24.3	1.6	1.7	16.5
	GN-03	15	445219	6273071	7-Aug-13	24.2	1.9	1.9	17.0
	GN-04	15	447966	6276504	6-Aug-13	21.6	1.6	3.1	18.0
	GN-05	15	448179	6278153	6-Aug-13	21.4	1.7	2.0	18.0
	GN-06	15	469989	6300951	9-Aug-13	22.2	6.5	2.0	17.5
	GN-07	15	468920	6298842	9-Aug-13	22.5	5.3	4.0	18.0
	GN-08	15	468331	6297267	10-Aug-13	26.5	3.3	1.7	17.0
	GN-09	15	462390	6290377	8-Aug-13	25.8	2.4	3.0	16.5
	SN-03	15	445255	6273113	7-Aug-13	24.2	1.8	1.9	17.0
	SN-07	15	468877	6298807	9-Aug-13	22.5	3.1	5.3	18.0
	SN-09	15	462340	6290312	8-Aug-13	25.8	2.3	2.4	16.5
	GN-01	15	443471	6271500	29-Jul-14	20.9	1.5	1.8	20.0
	GN-02	15	446378	6274132	30-Jul-14	22.2	1.4	1.6	20.0
	GN-03	15	445140	6272992	29-Jul-14	22.1	2.0	1.8	20.5
	GN-04	15	447958	6276501	30-Jul-14	22.6	1.7	2.8	18.5

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LNR	GN-05	15	443112	6278047	31-Jul-14	29.5	1.9	1.6	20.0
	GN-06	15	470015	6300998	1-Aug-14	24.8	6.7	2.8	19.5
	GN-07	15	468319	6297178	1-Aug-14	24.0	3.5	6.0	19.5
	GN-08	15	464620	6293874	1-Aug-14	23.2	3.7	4.8	19.0
	GN-09	15	462359	6290355	31-Jul-14	24.5	4.0	3.9	20.0
	SN-03	15	445140	6272992	29-Jul-14	22.1	2.0	1.8	20.5
	SN-07	15	468291	6297165	1-Aug-14	24.0	2.9	3.5	19.5
	SN-09	15	462296	6290291	31-Jul-14	24.5	3.3	4.0	20.0
	GN-01	15	443417	6271647	10-Aug-15	21.7	2.4	2.0	18.5
	GN-02	15	446380	6274203	10-Aug-15	22.0	1.8	1.7	18.5
	GN-03	15	445158	6273014	10-Aug-15	21.8	0.9	1.8	18.5
	GN-04	15	447960	6276469	11-Aug-15	23.1	1.0	2.5	18.5
	GN-05	15	448112	6278049	11-Aug-15	22.9	1.0	1.5	18.5
	GN-06	15	469675	6300755	12-Aug-15	21.9	-	-	19.0
	GN-07	15	468995	6298847	12-Aug-15	23.1	-	-	19.0
	GN-08	15	468438	6297343	12-Aug-15	24.5	-	-	19.0
	GN-09	15	462279	6290301	11-Aug-15	21.8	2.6	-	19.0
	SN-03	15	445135	6272991	10-Aug-15	21.8	0.9	0.9	18.5
	SN-07	15	469017	6298845	12-Aug-15	23.1	-	-	19.0
	SN-09	15	462252	6290283	11-Aug-15	21.8	1.5	2.6	19.0
	GN-01	15	443354	6271579	21-Jul-16	21.8	2.0	1.5	18.0
	GN-02	15	446439	6274300	21-Jul-16	24.8	2.3	0.0	18.0
	GN-03	15	445138	6273010	21-Jul-16	24.5	1.8	1.9	18.0
	GN-04	15	447956	6276500	22-Jul-16	18.2	0.5	2.8	18.0
	GN-05	15	448115	6278047	22-Jul-16	18.3	0.5	1.7	18.0
	GN-06	15	469793	6300679	23-Jul-16	21.3	2.6	2.7	19.0
	GN-07	15	468970	6298880	23-Jul-16	21.6	2.8	2.7	19.0
	GN-08	15	468483	6297518	23-Jul-16	20.6	2.7	2.2	19.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LNR	GN-09	15	462374	6290315	22-Jul-16	18.5	2.1	3.7	18.0
	SN-03	15	445127	6272986	21-Jul-16	24.5	1.2	1.8	18.0
	SN-07	15	468945	6298862	23-Jul-16	21.6	2.8	2.8	19.0
	SN-09	15	462383	6290301	22-Jul-16	18.5	0.5	2.1	18.0
	GN-01	15	443377	6271568	2-Aug-17	25.4	2.2	1.3	19.0
	GN-02	15	446375	6274196	2-Aug-17	27.8	1.0	3.0	19.0
	GN-03	15	445159	6273027	1-Aug-17	23.4	2.0	1.7	19.0
	GN-04	15	447979	6276507	1-Aug-17	25.2	1.8	2.3	19.0
	GN-05	15	448187	6278166	1-Aug-17	26.9	2.1	2.0	19.0
	GN-06	15	469746	6300588	3-Aug-17	23.7	5.0	4.8	18.5
	GN-07	15	468996	6298910	3-Aug-17	23.8	4.9	5.4	18.5
	GN-08	15	468427	6297619	3-Aug-17	24.3	4.0	4.6	18.5
	GN-09	15	462406	6290332	2-Aug-17	24.3	2.9	4.9	19.0
	SN-03	15	445141	6273004	1-Aug-17	23.4	1.9	2.0	19.0
	SN-07	15	468980	6298887	3-Aug-17	23.8	4.8	4.9	18.5
	SN-09	15	462402	6290298	2-Aug-17	24.3	2.3	2.9	19.0
	GN-01	15	443451	6271514	14-Aug-18	25.5	1.3	1.9	18.0
	GN-02	15	446367	6274235	14-Aug-18	26.3	1.2	1.8	18.0
	GN-03	15	445169	6273035	14-Aug-18	25.8	1.6	1.7	18.0
	GN-04	15	447798	6276542	13-Aug-18	25.5	1.3	2.4	18.0
	GN-05	15	448056	6278039	13-Aug-18	25.8	1.8	1.2	18.0
	GN-06	15	469710	6300686	12-Aug-18	23.7	1.2	1.1	19.0
	GN-07	15	468912	6298740	12-Aug-18	24.5	2.0	3.5	19.0
	GN-08	15	468390	6297126	12-Aug-18	25.0	2.9	3.1	19.0
	GN-09	15	462360	6290349	13-Aug-18	46.5	0.8	3.0	18.0
	SN-03	15	445145	6273008	14-Aug-18	25.8	1.8	1.6	18.0
	SN-07	15	468884	6298730	12-Aug-18	24.5	1.0	2.0	19.0
	SN-09	15	462471	6290423	13-Aug-18	46.5	3.0	2.8	18.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LNR	GN-01	15	443447	6271467	17-Aug-19	25.5	2.0	2.2	16.0
	GN-02	15	446354	6274229	17-Aug-19	24.7	1.2	3.0	16.0
	GN-03	15	445153	6273019	17-Aug-19	25.2	1.8	3.0	16.0
	GN-04	15	448010	6276577	16-Aug-19	22.8	2.0	-	16.0
	GN-05	15	448143	6277873	16-Aug-19	23.3	-	2.0	16.0
	GN-06	15	469776	6300583	15-Aug-19	23.8	1.4	1.6	16.0
	GN-07	15	468958	6299373	15-Aug-19	24.7	1.9	1.5	16.0
	GN-08	15	468391	6297459	15-Aug-19	25.2	1.5	2.0	16.0
	GN-09	15	462289	6290388	16-Aug-19	24.7	2.2	2.9	16.0
	SN-03	15	445132	6272991	17-Aug-19	25.2	1.2	1.8	16.0
	SN-07	15	468957	6299338	15-Aug-19	24.7	1.2	1.9	16.0
	SN-09	15	462289	6290388	16-Aug-19	24.7	2.4	2.2	16.0
BURNT	GN-01	14	645119	6224377	3-Aug-11	22.9	12.0	12.0	19.5
	GN-02	14	642049	6224302	3-Aug-11	23.2	8.3	5.0	19.5
	GN-03	14	630580	6219261	4-Aug-11	24.7	3.3	3.3	19.0
	GN-04	14	637014	6223151	4-Aug-11	22.5	7.3	7.7	19.0
	GN-05	14	630770	6218621	5-Aug-11	27.0	9.1	9.5	19.0
	GN-06	14	631332	6218633	5-Aug-11	26.1	4.3	5.5	19.0
	GN-07	14	635618	6219095	5-Aug-11	23.8	5.5	4.3	19.0
	GN-08	14	630639	6214549	6-Aug-11	23.1	4.2	3.7	19.5
	GN-09	14	632819	6216102	6-Aug-11	22.2	3.9	3.2	19.5
	SN-02	14	642185	6224284	3-Aug-11	23.2	9.5	8.3	19.5
	SN-05	14	630724	6218635	5-Aug-11	27.0	7.3	9.1	19.0
	SN-08	14	630618	6214508	6-Aug-11	23.1	4.8	4.2	19.5
	GN-01	14	645140	6224383	9-Aug-14	22.9	11.3	10.4	20.0
	GN-02	14	642053	6224297	9-Aug-14	23.1	5.7	4.5	20.0
	GN-03	14	630576	6219258	10-Aug-14	21.7	2.8	3.1	18.5
	GN-04	14	637018	6223151	9-Aug-14	23.6	6.8	7.9	20.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
BURNT	GN-05	14	630859	6218586	10-Aug-14	23.9	7.4	9.7	19.0
	GN-06	14	631426	6218543	10-Aug-14	24.3	3.7	4.6	18.0
	GN-07	14	635572	6219001	11-Aug-14	23.4	4.4	5.9	18.0
	GN-08	14	630635	6214556	11-Aug-14	24.2	3.9	3.7	18.0
	GN-09	14	632735	6216046	11-Aug-14	24.6	3.6	3.1	18.0
	SN-02	14	642171	6224278	9-Aug-14	23.1	7.5	7.5	20.0
	SN-05	14	630734	6218652	10-Aug-14	23.9	4.3	4.3	19.0
	SN-08	14	630635	6214556	11-Aug-14	24.2	4.5	4.5	18.0
	GN-01	14	645142	6224391	6-Aug-17	24.1	9.8	10.8	20.0
	GN-02	14	642150	6224284	6-Aug-17	24.3	5.5	5.2	20.0
	GN-03	14	630642	6219362	7-Aug-17	24.8	2.0	2.4	20.0
	GN-04	14	637025	6223154	6-Aug-17	25.3	7.0	8.6	20.0
	GN-05	14	630733	6218660	7-Aug-17	24.3	7.8	8.0	20.0
	GN-06	14	631334	6218625	7-Aug-17	24.1	4.9	5.3	20.0
	GN-07	14	635526	6219110	5-Aug-17	25.4	6.0	6.0	21.0
	GN-08	14	630641	6214563	5-Aug-17	24.4	3.5	3.5	21.0
	GN-09	14	632825	6216122	5-Aug-17	25.2	2.5	3.6	21.0
	SN-02	14	642185	6224281	6-Aug-17	24.3	6.8	5.5	20.0
	SN-05	14	630707	6218681	7-Aug-17	24.3	3.7	7.8	20.0
	SN-08	14	630636	6214526	5-Aug-17	24.4	4.4	3.5	21.0
LMFB	GN-01	15	432376	6262734	12-Jul-10	24.9	4.0	2.7	19.0
	GN-02	15	430571	6261417	12-Jul-10	23.9	23.8	12.2	19.0
	GN-03	15	427953	6256825	13-Jul-10	26.5	1.9	1.2	20.0
	GN-04	15	430019	6257845	13-Jul-10	26.4	18.5	18.6	20.0
	GN-05	15	427310	6255991	14-Jul-10	24.5	16.7	16.5	19.0
	GN-06	15	423756	6252134	14-Jul-10	24.3	16.0	14.8	19.0
	GN-07	15	420755	6252963	15-Jul-10	23.8	1.6	4.8	18.0
	GN-08	15	418465	6251618	15-Jul-10	22.8	1.7	1.2	18.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LMFB	GN-09	15	421951	6252789	15-Jul-10	22.4	12.8	11.5	18.0
	SN-01	15	432399	6262782	12-Jul-10	25.2	4.2	4.0	19.0
	SN-04	15	430034	6257872	13-Jul-10	26.3	17.8	18.5	20.0
	SN-06	15	423756	6252134	14-Jul-10	24.1	16.0	15.2	19.0
	GN-01	15	432337	6262710	23-Jul-13	24.1	9.0	1.8	18.8
	GN-02	15	428022	6256942	22-Jul-13	22.1	15.4	22.6	17.0
	GN-03	15	430521	6261311	22-Jul-13	21.1	3.0	9.3	17.0
	GN-04	15	430040	6257815	23-Jul-13	22.3	15.0	6.9	18.0
	GN-05	15	427357	6256059	24-Jul-13	24.8	16.6	17.1	18.7
	GN-06	15	423777	6252137	25-Jul-13	23.2	15.1	14.1	18.2
	GN-07	15	420751	6252960	25-Jul-13	24.8	4.8	8.4	18.2
	GN-08	15	418459	6251545	24-Jul-13	21.9	6.7	6.8	18.7
	GN-09	15	421946	6252793	25-Jul-13	22.5	12.2	12.1	18.2
	SN-01	15	432348	6262740	23-Jul-13	24.1	11.0	9.0	18.8
	SN-04	15	430056	6257846	23-Jul-13	22.3	11.7	15.0	18.0
	SN-06	15	423808	6252157	25-Jul-13	23.2	15.0	15.1	18.2
	GN-01	15	432341	6262761	20-Jul-16	24.0	19.6	17.6	18.0
	GN-02	15	428975	6257786	20-Jul-16	22.2	13.9	17.0	18.0
	GN-03	15	430529	6261460	20-Jul-16	22.5	10.0	12.0	18.0
	GN-04	15	430123	6258066	19-Jul-16	21.7	15.8	15.5	18.0
	GN-05	15	427320	6256030	19-Jul-16	21.8	18.0	17.3	18.0
	GN-06	15	423923	6252168	18-Jul-16	18.1	15.2	13.5	18.0
	GN-07	15	420917	6252991	18-Jul-16	24.0	9.4	10.0	18.0
	GN-08	15	418588	6251594	18-Jul-16	17.7	5.8	5.8	18.0
	GN-09	15	421968	6252800	19-Jul-16	21.7	12.5	12.6	18.0
	SN-01	15	432367	6262785	20-Jul-16	22.7	8.0	17.6	18.0
	SN-04	15	430047	6257905	19-Jul-16	21.7	17.1	15.8	18.0
	SN-06	15	423754	6252064	18-Jul-16	18.1	15.2	15.2	18.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
LMFB	GN-01	15	432307	6262679	24-Jul-19	21.5	12.2	16.1	19.5
	GN-02	15	430561	6261412	24-Jul-19	22.6	23.0	23.4	19.5
	GN-03	15	428053	6256917	22-Jul-19	21.7	17.1	11.4	19.5
	GN-04	15	430052	6257978	24-Jul-19	20.5	18.3	18.4	19.5
	GN-05	15	427438	6256117	22-Jul-19	22.6	17.0	16.7	19.5
	GN-06	15	423885	6252240	22-Jul-19	23.6	15.6	15.0	19.5
	GN-07	15	420656	6252917	23-Jul-19	24.2	7.5	9.5	19.5
	GN-08	15	418588	6251651	23-Jul-19	24.1	7.2	4.6	19.5
	GN-09	15	421843	6252726	23-Jul-19	24.4	10.9	12.2	19.5
	SN-01	15	432307	6262679	24-Jul-19	21.5	6.9	12.2	19.5
	SN-04	15	430080	6258014	24-Jul-19	20.5	18.0	18.3	19.5
	SN-06	15	423909	6252264	22-Jul-19	23.6	15.2	15.6	19.5
STL-N	GN-01	15	359072	6265735	9-Sep-09	24.5	8.4	3.6	15.0
	GN-02	15	358236	6264487	9-Sep-09	24.9	5.9	7.1	15.0
	GN-04	15	362483	6264772	8-Sep-09	25.3	2.2	2.3	15.0
	GN-05	15	359695	6262150	8-Sep-09	24.2	1.9	2.4	15.0
	GN-09	15	364630	6259308	10-Sep-09	25.4	6.7	3.6	14.0
	GN-26	15	369332	6252009	11-Sep-09	22.2	3.0	5.6	16.0
	GN-31	15	367225	6248992	7-Sep-09	25.1	2.0	3.4	15.0
	GN-34	15	368355	6249515	11-Sep-09	23.5	1.5	2.9	16.0
	GN-35	15	370445	6249859	7-Sep-09	25.8	2.4	2.0	15.0
	SN-04	15	362435	6264757	8-Sep-09	26.0	2.2	2.3	15.0
	SN-09	15	364646	6259347	10-Sep-09	26.2	4.0	6.7	14.0
	SN-34	15	368309	6249519	11-Sep-09	23.5	1.4	1.2	16.0
	GN-01	15	359202	6265075	13-Sep-12	22.8	9.7	5.5	14.0
	GN-02	15	358155	6264656	14-Sep-12	23.1	8.5	9.1	14.0
	GN-04	15	362231	6264335	13-Sep-12	22.8	8.0	10.1	14.0
	GN-05	15	359901	6262228	14-Sep-12	23.3	2.2	2.9	14.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
STL-N	GN-09	15	364600	6259187	11-Sep-12	47.0	6.6	7.9	16.0
	GN-26	15	369363	6252234	11-Sep-12	46.7	9.1	5.2	16.0
	GN-31	15	367302	6249201	8-Sep-12	22.3	5.1	4.8	15.0
	GN-34	15	368315	6249432	10-Sep-12	23.0	4.6	2.2	15.0
	GN-35	15	370460	6249897	10-Sep-12	24.1	3.8	3.6	15.0
	SN-04	15	362643	6264353	13-Sep-12	22.8	6.6	8.0	14.0
	SN-09	15	364589	6259142	11-Sep-12	47.7	5.2	6.6	16.0
	SN-34	15	368374	6249448	10-Sep-12	23.4	4.9	4.6	15.0
	GN-01	15	359096	6265681	3-Sep-15	25.7	7.5	8.0	15.5
	GN-02	15	358155	6264656	3-Sep-15	25.9	7.3	7.0	15.5
	GN-04	15	362616	6264360	3-Sep-15	26.8	2.2	5.3	15.5
	GN-05	15	359924	6262295	4-Sep-15	20.7	2.2	2.3	16.0
	GN-09	15	364624	6259158	4-Sep-15	19.9	5.1	7.0	16.5
	GN-26	15	369344	6252258	4-Sep-15	21.5	8.2	4.3	16.5
	GN-31	15	367276	6249208	2-Sep-15	17.7	3.9	4.5	18.0
	GN-34	15	368348	6249418	2-Sep-15	17.4	2.7	1.3	18.0
	GN-35	15	370527	6249925	2-Sep-15	17.2	2.3	2.7	18.0
	SN-04	15	362649	6264379	3-Sep-15	26.8	2.2	2.2	15.5
	SN-09	15	364592	6259135	4-Sep-15	19.9	3.6	5.1	16.5
	SN-34	15	368373	6249433	2-Sep-15	17.4	1.6	2.7	18.0
	GN-01	15	359007	6265599	1-Sep-18	18.2	5.5	8.4	13.5
	GN-02	15	358353	6264473	1-Sep-18	18.7	2.6	8.9	13.5
	GN-04	15	362365	6264748	1-Sep-18	17.8	3.0	3.2	13.5
	GN-05	15	359690	6262134	2-Sep-18	23.4	1.2	2.2	11.0
	GN-09	15	364605	6259161	2-Sep-18	23.6	6.2	7.8	11.0
	GN-26	15	369295	6252115	3-Sep-18	20.2	8.3	3.0	11.0
	GN-31	15	367335	6248876	3-Sep-18	19.0	1.9	3.0	11.5
	GN-34	15	368336	6249478	3-Sep-18	19.0	2.0	4.4	11.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
STL-N	GN-35	15	370295	6249702	3-Sep-18	19.6	2.1	3.0	11.0
	SN-04	15	362404	6264741	1-Sep-18	17.8	2.2	3.0	13.5
	SN-09	15	364595	6259292	2-Sep-18	23.6	6.2	6.2	11.0
	SN-34	15	368379	6249504	3-Sep-18	19.0	2.0	2.0	11.0
STL-S	GN-13	15	397669	6249302	13-Sep-09	24.2	23.3	4.2	16.0
	GN-14	15	397005	6248157	13-Sep-09	25.6	3.4	3.7	16.0
	GN-15	15	397389	6251227	14-Sep-09	23.7	7.8	5.1	16.0
	GN-16	15	395049	6252194	15-Sep-09	25.6	2.0	2.8	14.0
	GN-17	15	392830	6246993	13-Sep-09	25.9	1.9	2.7	16.0
	GN-22	15	387318	6246252	16-Sep-09	21.8	2.7	2.1	15.5
	GN-30	15	368047	6246983	3-Sep-09	23.2	2.4	1.8	16.0
	GN-32	15	369421	6247610	3-Sep-09	22.9	14.1	13.6	16.0
	GN-33	15	370979	6246147	4-Sep-09	25.0	1.6	1.8	15.0
	SN-14	15	396959	6248155	13-Sep-09	25.2	3.2	3.4	16.0
	SN-22	15	387342	6246217	16-Sep-09	21.8	2.7	2.9	15.5
	SN-32	15	369342	6247374	3-Sep-09	22.9	14.1	14.7	16.0
	GN-13	15	397581	6249303	3-Sep-12	23.7	2.7	8.9	18.0
	GN-14	15	397061	6248218	3-Sep-12	24.1	3.4	6.9	18.0
	GN-15	15	397426	6251172	4-Sep-12	24.1	9.9	5.1	17.0
	GN-16	15	395047	6252154	4-Sep-12	23.3	4.8	4.5	17.0
	GN-17	15	392734	6247112	5-Sep-12	48.4	4.8	5.6	16.5
	GN-22	15	387462	6246252	5-Sep-12	48.0	3.8	3.5	16.5
	GN-30	15	367875	6246959	8-Sep-12	22.5	8.0	8.7	15.0
	GN-32	15	369379	6247724	7-Sep-12	23.9	10.4	6.6	16.0
	GN-33	15	371007	6246205	7-Sep-12	24.1	3.0	3.5	16.0
	SN-14	15	397044	6248190	3-Sep-12	24.6	3.5	3.4	18.0
	SN-22	15	387485	6246282	5-Sep-12	47.8	4.0	3.8	16.5
	SN-32	15	369399	6247752	7-Sep-12	24.3	5.3	10.4	16.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
STL-S	GN-13	15	397555	6249384	8-Sep-15	19.1	7.3	15.3	16.0
	GN-14	15	397051	6248155	8-Sep-15	18.8	2.3	4.5	15.0
	GN-15	15	397399	6251152	8-Sep-15	19.2	13.6	8.7	16.0
	GN-16	15	395096	6252041	8-Sep-15	18.9	5.0	3.0	16.0
	GN-17	15	392715	6247087	7-Sep-15	21.5	4.5	6.0	15.5
	GN-22	15	387443	6246302	7-Sep-15	21.1	2.4	1.6	14.0
	GN-30	15	368014	6246987	6-Sep-15	30.3	7.8	8.7	17.0
	GN-32	15	369396	6247724	6-Sep-15	29.2	9.8	6.5	17.0
	GN-33	15	371115	6246205	6-Sep-15	23.8	2.5	2.1	16.0
	SN-14	15	397036	6248146	8-Sep-15	18.8	2.1	2.3	15.0
	SN-22	15	387476	6246309	7-Sep-15	21.1	2.8	2.4	14.0
	SN-32	15	369432	6247739	6-Sep-15	29.2	10.0	9.8	17.0
	GN-13	15	397678	6249179	29-Aug-18	18.4	2.5	1.8	12.5
	GN-14	15	397099	6248262	29-Aug-18	19.2	3.4	3.1	12.5
	GN-15	15	397380	6251226	29-Aug-18	17.6	9.9	17.8	12.5
	GN-16	15	395035	6252172	30-Aug-18	30.0	2.7	6.2	12.0
	GN-17	15	392904	6247053	30-Aug-18	24.6	1.8	3.1	15.0
	GN-22	15	387352	6246289	30-Aug-18	26.1	2.5	3.9	14.5
	GN-30	15	368251	6247019	31-Aug-18	13.9	3.9	3.3	12.5
	GN-32	15	369353	6247461	31-Aug-18	14.2	9.4	14.7	12.5
	GN-33	15	371028	6246169	31-Aug-18	14.8	1.9	2.1	13.5
	SN-14	15	396974	6248265	29-Aug-18	19.2	3.4	3.4	12.5
	SN-22	15	387302	6246284	30-Aug-18	26.1	2.3	2.5	14.5
	SN-32	15	369366	6247527	31-Aug-18	14.2	8.0	9.4	12.5
ASSN	GN-01	14	659325	6234906	25-Aug-09	22.9	11.0	11.0	12.0
	GN-03	14	656723	6231966	25-Aug-09	23.6	2.7	3.0	12.0
	GN-04	14	659763	6231527	25-Aug-09	20.6	4.4	4.8	12.0
	GN-05	14	654404	6232902	26-Aug-09	25.0	5.8	6.5	12.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
ASSN	GN-06	14	654376	6228594	26-Aug-09	23.7	1.7	2.3	12.0
	GN-07	14	654215	6232630	26-Aug-09	26.4	5.4	2.9	12.0
	GN-08	14	664661	6238272	24-Aug-09	24.4	6.7	7.1	14.0
	GN-09	14	671128	6242106	24-Aug-09	27.5	2.2	4.4	14.0
	GN-10	14	673918	6245012	24-Aug-09	27.3	6.6	6.7	14.0
	SN-04	14	659937	6231583	25-Aug-09	20.6	4.4	4.8	12.0
	SN-06	14	654517	6228495	26-Aug-09	23.7	1.7	2.3	12.0
	SN-08	14	664782	6238387	24-Aug-09	24.4	6.7	7.1	14.0
	GN-01	14	659411	6234940	17-Aug-10	25.9	10.2	9.7	11.0
	GN-03	14	656701	6231968	18-Aug-10	25.3	1.7	2.3	9.0
	GN-04	14	659412	6231645	14-Aug-10	72.8	3.8	3.7	15.0
	GN-05	14	654543	6232827	12-Aug-10	23.1	5.0	4.4	20.0
	GN-07	14	654015	6232579	12-Aug-10	24.0	5.7	5.7	20.0
	GN-08	14	664620	6238238	17-Aug-10	25.3	5.6	5.6	11.0
	GN-09	14	671137	6242179	13-Aug-10	25.6	3.4	3.4	23.0
	GN-10	14	673873	6244968	13-Aug-10	25.9	5.5	5.5	23.0
	GN-11	14	657043	6235845	18-Aug-10	25.8	4.1	3.5	11.0
	SN-04	14	659436	6231680	14-Aug-10	72.8	4.1	3.8	15.0
	SN-08	14	664600	6238215	17-Aug-10	25.3	5.8	5.6	11.0
	SN-11	14	656851	6235879	18-Aug-10	25.8	2.8	3.5	11.0
	GN-01	14	659540	6235069	15-Aug-11	21.8	10.0	12.0	20.0
	GN-03	14	656806	6232113	17-Aug-11	24.4	3.2	3.7	19.0
	GN-04	14	674010	6244983	17-Aug-11	25.5	4.5	4.9	19.0
	GN-05	14	656881	6232275	18-Aug-11	23.6	1.8	5.5	19.0
	GN-06	14	654108	6228632	18-Aug-11	17.5	1.8	2.0	19.0
	GN-07	14	654883	6233071	18-Aug-11	23.3	5.0	5.6	19.0
	GN-08	14	664637	6238392	15-Aug-11	25.1	5.5	6.8	20.0
	GN-09	14	671089	6242107	16-Aug-11	24.6	1.2	4.3	19.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
ASSN	GN-10	14	673841	6244985	16-Aug-11	22.3	6.3	6.9	19.0
	SN-04	14	674010	6244983	17-Aug-11	25.5	4.5	4.5	19.0
	SN-06	14	654108	6228632	18-Aug-11	17.5	1.8	1.8	19.0
	SN-08	14	664637	6238392	15-Aug-11	25.1	5.5	5.5	20.0
	GN-01	14	659400	6234827	18-Aug-12	24.4	17.6	9.4	19.0
	GN-03	14	656688	6232018	18-Aug-12	25.1	1.4	2.7	19.0
	GN-04	14	659435	6231676	20-Aug-12	22.8	4.3	4.3	18.0
	GN-05	14	654538	6232831	19-Aug-12	25.0	5.0	5.2	18.0
	GN-06	14	654474	6228598	19-Aug-12	23.9	1.5	1.5	18.0
	GN-07	14	653984	6232431	20-Aug-12	26.3	5.4	5.3	18.0
	GN-08	14	664639	6238197	20-Aug-12	25.3	6.2	6.3	18.0
	GN-09	14	671146	6242176	21-Aug-12	24.3	4.1	3.9	18.0
	GN-10	14	673876	6244967	21-Aug-12	24.2	6.3	6.4	19.0
	SN-04	14	659409	6231653	20-Aug-12	23.5	4.3	4.3	18.0
	SN-06	14	654460	6228560	19-Aug-12	24.7	1.4	1.5	18.0
	SN-08	14	664633	6238237	20-Aug-12	25.8	6.1	6.2	18.0
	GN-01	14	659518	6234899	22-Aug-13	23.3	16.7	12.3	16.0
	GN-03	14	656764	6232012	20-Aug-13	22.2	2.1	2.9	16.5
	GN-04	14	659460	6231782	20-Aug-13	24.5	4.3	4.0	16.5
	GN-05	14	654721	6232830	21-Aug-13	23.4	4.6	4.5	16.5
	GN-07	14	654291	6232482	20-Aug-13	21.8	5.3	4.9	16.5
	GN-08	14	664611	6238220	21-Aug-13	23.8	6.3	5.6	16.5
	GN-09	14	671215	6242350	19-Aug-13	20.6	3.7	3.5	16.5
	GN-10	14	674008	6244990	19-Aug-13	20.3	6.2	5.5	16.5
	GN-11	14	656915	6235829	22-Aug-13	23.5	3.9	4.1	16.0
	SN-04	14	659485	6231803	20-Aug-13	24.5	3.9	4.3	16.5
	SN-08	14	664576	6238183	21-Aug-13	23.8	5.6	6.3	16.5
	SN-11	14	656887	6235825	22-Aug-13	23.5	3.7	3.9	16.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
ASSN	GN-01	14	659411	6234940	19-Aug-14	23.6	12.4	10.8	20.0
	GN-03	14	656689	6231973	20-Aug-14	23.0	1.3	2.1	22.0
	GN-04	14	659403	6231504	22-Aug-14	22.0	-	-	18.0
	GN-05	14	654370	6232834	21-Aug-14	25.4	5.2	5.5	20.0
	GN-07	14	653997	6232564	23-Aug-14	26.0	5.5	5.3	18.0
	GN-08	14	664721	6238304	26-Aug-14	23.4	-	6.2	14.0
	GN-09	14	671052	6242240	27-Aug-14	21.1	4.5	1.3	15.0
	GN-10	14	673853	6244956	26-Aug-14	25.8	6.3	5.9	14.0
	GN-11	14	656973	6235802	24-Aug-14	21.4	-	4.7	-
	SN-04	14	659423	6231647	22-Aug-14	22.0	-	-	18.0
	SN-08	14	664620	6238213	26-Aug-14	23.4	-	6.6	14.0
	SN-11	14	656820	6235757	24-Aug-14	21.4	9.5	-	-
	GN-01	14	659562	6234990	11-Aug-15	20.8	12.9	15.8	17.0
	GN-03	14	656706	6231971	11-Aug-15	22.4	2.9	3.5	18.0
	GN-04	14	659359	6231701	12-Aug-15	21.9	4.9	5.9	18.0
	GN-05	14	654565	6232802	12-Aug-15	22.1	5.5	5.7	18.0
	GN-07	14	654003	6232585	12-Aug-15	22.3	5.9	6.1	18.0
	GN-08	14	664749	6238270	10-Aug-15	23.3	5.7	7.0	16.0
	GN-09	14	671180	6242314	10-Aug-15	23.1	4.5	4.7	16.0
	GN-10	14	673864	6244973	10-Aug-15	23.3	6.6	6.7	16.0
	GN-11	14	656749	6235748	11-Aug-15	21.3	4.6	5.2	18.0
	SN-04	14	659373	6231743	12-Aug-15	21.9	5.9	4.9	18.0
	SN-08	14	664756	6238240	10-Aug-15	23.3	7.0	6.8	16.0
	SN-11	14	656732	6235772	11-Aug-15	21.3	3.0	4.6	18.0
	GN-01	14	659630	6235006	9-Aug-16	20.0	16.3	12.3	17.0
	GN-03	14	656881	6231950	12-Aug-16	21.8	2.8	3.0	17.0
	GN-04	14	659287	6231650	12-Aug-16	22.6	4.2	4.2	17.0
	GN-05	14	654545	6232775	11-Aug-16	24.3	4.8	4.7	17.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
ASSN	GN-07	14	654197	6232801	11-Aug-16	23.9	4.2	5.0	17.0
	GN-08	14	664728	6238329	9-Aug-16	18.7	6.2	6.1	17.0
	GN-09	14	671200	6242294	10-Aug-16	23.3	3.9	3.9	17.0
	GN-10	14	673992	6244956	11-Aug-16	23.1	6.4	6.3	17.0
	GN-11	14	656776	6235717	11-Aug-16	23.2	4.0	4.5	17.0
	SN-04	14	659328	6231616	12-Aug-16	22.6	4.4	4.2	17.0
	SN-08	14	664715	6238360	9-Aug-16	18.7	5.7	6.2	17.0
	SN-11	14	656756	6235758	11-Aug-16	23.2	4.0	4.0	17.0
	GN-01	14	659475	6234966	17-Aug-17	27.5	13.7	17.2	20.5
	GN-03	14	656684	6232017	16-Aug-17	25.7	2.2	2.7	20.5
	GN-04	14	659546	6231791	17-Aug-17	28.0	4.2	4.4	20.5
	GN-05	14	654650	6232749	15-Aug-17	23.4	5.2	5.0	22.5
	GN-07	14	653979	6232434	15-Aug-17	23.1	5.2	5.2	22.5
	GN-08	14	664681	6238080	18-Aug-17	23.8	6.1	6.2	21.0
	GN-09	14	671240	6242332	18-Aug-17	29.0	4.1	4.1	20.5
	GN-10	14	674018	6244967	18-Aug-17	28.1	6.4	6.3	20.5
	GN-11	14	656791	6235714	16-Aug-17	25.1	4.4	4.8	21.0
	SN-04	14	659580	6231795	17-Aug-17	28.0	4.2	4.6	20.5
	SN-08	14	664681	6238044	18-Aug-17	23.8	6.1	6.2	21.0
	SN-11	14	656778	6235745	16-Aug-17	25.1	4.4	4.3	21.0
	GN-01	14	659493	6234959	16-Aug-18	20.5	17.4	15.0	18.0
	GN-03	14	656706	6232011	16-Aug-18	20.4	2.5	2.6	18.0
	GN-04	14	659397	6231796	16-Aug-18	18.7	-	-	18.0
	GN-05	14	654614	6232855	15-Aug-18	26.6	5.2	5.3	18.0
	GN-07	14	654057	6232432	15-Aug-18	24.8	-	-	17.0
	GN-08	14	664707	6238142	17-Aug-18	20.2	6.4	6.6	18.0
	GN-09	14	671115	6242164	17-Aug-18	21.8	4.3	3.8	18.0
	GN-10	14	673880	6244939	17-Aug-18	21.6	6.5	6.4	18.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
ASSN	GN-11	14	656766	6235701	15-Aug-18	22.9	4.4	4.8	18.0
	SN-04	14	659429	6231796	16-Aug-18	18.7	4.0	4.5	18.0
	SN-08	14	664683	6238117	17-Aug-18	20.2	6.5	6.4	18.0
	SN-11	14	656749	6235738	15-Aug-18	22.9	4.1	4.4	18.0
	GN-01	14	659706	6234993	19-Aug-19	23.7	16.0	15.0	15.0
	GN-03	14	656724	6232017	18-Aug-19	20.0	1.7	2.2	15.0
	GN-04	14	659369	6231694	19-Aug-19	21.9	3.2	3.2	15.0
	GN-05	14	654523	6232864	18-Aug-19	19.2	1.2	1.5	15.0
	GN-07	14	654085	6232734	17-Aug-19	20.4	4.3	4.8	15.0
	GN-08	14	664666	6238244	19-Aug-19	26.0	5.2	5.3	15.0
	GN-09	14	671283	6242327	20-Aug-19	21.7	3.2	3.1	16.0
	GN-10	14	673873	6245096	20-Aug-19	22.4	2.8	5.5	15.2
	GN-11	14	656885	6235690	17-Aug-19	19.0	3.5	2.9	15.0
	SN-04	14	659317	6231703	19-Aug-19	21.9	3.5	3.2	15.0
	SN-08	14	664692	6238291	19-Aug-19	26.0	5.2	5.2	15.0
	SN-11	14	656903	6235663	17-Aug-19	19.0	4.0	3.5	15.0
HAYES	GN-01	15	520203	6285732	6-Aug-08	15.4	1.4	3.5	20.0
	GN-02	15	518655	6286319	6-Aug-08	17.3	2.8	1.4	20.0
	GN-03	15	518265	6287086	6-Aug-08	18.5	3.6	2.5	20.0
	GN-04	15	518930	6289492	7-Aug-08	21.8	4.8	2.0	18.5
	GN-05	15	518571	6290811	7-Aug-08	20.3	2.7	0.9	19.0
	GN-06	15	519822	6292272	7-Aug-08	18.5	1.4	2.7	19.0
	GN-07	15	520351	6284900	8-Aug-08	21.7	3.4	0.9	19.0
	GN-08	15	519904	6283756	8-Aug-08	20.2	3.4	1.0	19.0
	GN-09	15	520817	6280710	8-Aug-08	18.8	1.2	2.4	20.0
	SN-01	15	520192	6285701	6-Aug-08	15.5	1.4	1.6	20.0
	SN-06	15	519780	6292288	7-Aug-08	18.9	1.1	1.4	19.0
	SN-09	15	520836	6280676	8-Aug-08	18.8	1.0	1.2	20.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
HAYES	GN-01	15	520063	6285866	23-Jul-09	19.0	1.4	2.5	20.0
	GN-02	15	518546	6286221	23-Jul-09	20.8	3.3	1.1	20.0
	GN-03	15	518457	6287073	24-Jul-09	24.9	1.6	3.0	20.0
	GN-04	15	518670	6289393	24-Jul-09	23.8	1.4	1.5	20.0
	GN-05	15	518657	6290826	25-Jul-09	23.2	1.0	1.3	19.5
	GN-06	15	519938	6292346	25-Jul-09	22.3	1.9	2.0	19.5
	GN-07	15	520309	6285048	26-Jul-09	25.3	3.5	3.6	19.0
	GN-08	15	520066	6283803	26-Jul-09	24.6	3.3	3.1	19.0
	GN-09	15	520848	6280210	27-Jul-09	22.5	2.8	2.2	19.0
	SN-01	15	520179	6285734	23-Jul-09	20.7	1.5	1.2	20.0
	SN-06	15	520053	6292440	25-Jul-09	21.7	2.6	3.0	19.5
	SN-09	15	520719	6280464	27-Jul-09	22.2	2.7	2.4	19.0
	GN-01	15	519853	6286142	18-Jul-10	21.7	2.8	2.7	18.0
	GN-02	15	518539	6286310	18-Jul-10	21.5	1.0	1.2	18.0
	GN-03	15	518400	6287034	18-Jul-10	21.4	2.3	2.1	19.0
	GN-04	15	519082	6288952	19-Jul-10	28.5	3.2	2.4	20.0
	GN-05	15	519009	6291514	19-Jul-10	27.7	2.1	3.1	20.0
	GN-06	15	519832	6292226	19-Jul-10	27.0	1.6	2.6	20.0
	GN-07	15	520292	6285057	20-Jul-10	24.4	1.7	1.3	22.0
	GN-08	15	520123	6283913	20-Jul-10	24.3	2.1	1.8	22.0
	GN-09	15	520942	6280508	20-Jul-10	24.2	2.8	2.5	22.0
	SN-01	15	519823	6286164	18-Jul-10	21.6	2.8	3.3	18.0
	SN-06	15	519832	6292226	19-Jul-10	27.3	0.9	1.6	20.0
	SN-09	15	520942	6280508	20-Jul-10	24.0	2.9	2.8	22.0
	GN-01	15	519853	6286106	27-Jul-11	16.5	2.9	3.4	20.0
	GN-02	15	518553	6286305	27-Jul-11	15.5	2.1	2.9	20.0
	GN-03	15	518422	6286999	27-Jul-11	15.4	0.8	3.4	20.0
	GN-04	15	519007	6289046	28-Jul-11	26.9	2.2	2.6	19.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
HAYES	GN-05	15	518726	6290975	28-Jul-11	26.2	1.8	1.8	18.0
	GN-06	15	519855	6292285	28-Jul-11	25.2	2.1	2.9	18.0
	GN-07	15	520338	6284969	29-Jul-11	25.1	2.2	2.5	19.0
	GN-08	15	520228	6284116	29-Jul-11	24.6	1.6	1.3	19.0
	GN-09	15	520790	6280805	29-Jul-11	24.0	2.4	1.9	19.0
	SN-01	15	519883	6286086	27-Jul-11	17.0	2.7	2.9	20.0
	SN-05	15	518808	6291069	28-Jul-11	26.0	1.8	1.8	18.0
	SN-09	15	520677	6280971	29-Jul-11	23.8	2.4	2.6	19.0
	GN-01	15	519849	6286097	16-Aug-12	23.3	2.2	4.3	14.0
	GN-02	15	519863	6286071	16-Aug-12	21.7	1.8	2.2	14.0
	GN-03	15	518425	6287119	16-Aug-12	20.2	3.5	1.5	14.0
	GN-04	15	518557	6286264	18-Aug-12	18.8	3.5	3.0	14.0
	GN-05	15	520363	6285162	18-Aug-12	19.3	3.8	4.5	14.0
	GN-06	15	519639	6283201	18-Aug-12	19.3	2.0	3.5	14.0
	GN-07	15	520899	6280663	17-Aug-12	18.7	2.5	2.9	14.0
	GN-08	15	520862	6280717	17-Aug-12	19.8	2.2	2.5	14.0
	GN-09	15	519018	6289060	17-Aug-12	19.0	2.0	1.5	14.0
	SN-01	15	519149	6291690	16-Aug-12	23.4	1.8	2.2	14.0
	SN-06	15	520262	6292510	18-Aug-12	19.4	1.0	2.0	14.0
	SN-09	15	520235	6292489	17-Aug-12	19.1	2.5	2.0	14.0
	GN-01	15	519847	6286117	29-Jul-13	25.3	2.6	2.9	17.0
	GN-02	15	518608	6286298	29-Jul-13	26.5	1.1	1.8	17.0
	GN-03	15	518414	6287099	29-Jul-13	21.5	2.0	2.1	17.0
	GN-04	15	519053	6289063	28-Jul-13	21.8	3.0	3.0	17.0
	GN-05	15	519111	6291670	28-Jul-13	19.3	2.8	3.7	17.0
	GN-06	15	520273	6292511	28-Jul-13	17.8	3.0	3.4	17.0
	GN-07	15	520381	6285140	30-Jul-13	24.8	1.6	1.9	17.0
	GN-08	15	519606	6283207	30-Jul-13	23.6	2.2	3.0	17.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
HAYES	GN-09	15	520865	6280745	30-Jul-13	22.3	1.9	1.8	17.0
	SN-01	15	519879	6286091	29-Jul-13	25.3	1.9	2.6	17.0
	SN-06	15	520245	6292500	28-Jul-13	17.8	2.2	3.0	17.0
	SN-09	15	520865	6280745	30-Jul-13	22.3	1.8	1.9	17.0
	GN-01	15	519818	6286123	7-Aug-14	20.7	-	3.5	21.0
	GN-02	15	518572	6286301	7-Aug-14	21.3	1.5	2.8	21.0
	GN-03	15	518377	6287058	7-Aug-14	22.0	3.6	2.5	21.0
	GN-04	15	518752	6289476	6-Aug-14	23.0	2.3	1.9	21.0
	GN-05	15	519315	6291942	6-Aug-14	22.5	1.1	1.0	21.0
	GN-06	15	520371	6292633	6-Aug-14	22.5	2.8	-	21.0
	GN-07	15	520354	6285028	7-Aug-14	23.7	2.5	2.2	21.0
	GN-08	15	519594	6283046	7-Aug-14	23.3	1.5	2.5	21.0
	GN-09	15	520715	6280840	7-Aug-14	23.3	2.0	2.3	21.0
	SN-01	15	519845	6286090	7-Aug-14	20.7	1.2	-	21.0
	SN-06	15	520371	6292522	6-Aug-14	22.5	-	1.0	21.0
	SN-09	15	520659	6280952	7-Aug-14	23.3	2.3	2.3	21.0
	GN-01	15	519945	6286050	8-Aug-15	23.0	1.9	4.1	14.0
	GN-02	15	518487	6286306	8-Aug-15	24.3	1.2	3.2	14.0
	GN-03	15	518422	6287074	8-Aug-15	23.7	2.5	3.4	14.0
	GN-04	15	518925	6289215	7-Aug-15	25.2	1.2	1.9	14.0
	GN-05	15	518776	6291407	7-Aug-15	26.3	2.3	3.8	14.0
	GN-06	15	520271	6292502	7-Aug-15	27.3	2.8	3.3	14.0
	GN-07	15	520368	6285050	6-Aug-15	18.5	1.6	2.3	15.0
	GN-08	15	519589	6283076	6-Aug-15	19.7	1.9	2.3	15.0
	GN-09	15	520722	6280910	6-Aug-15	19.8	2.2	2.0	15.0
	SN-01	15	519955	6286010	8-Aug-15	23.0	1.5	1.9	14.0
	SN-06	15	520231	6292488	7-Aug-15	27.3	1.0	2.8	14.0
	SN-09	15	520696	6280956	6-Aug-15	19.8	2.2	2.2	15.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
HAYES	GN-01	15	519936	6286063	8-Aug-16	17.8	2.3	3.1	18.5
	GN-02	15	518458	6286348	8-Aug-16	18.3	1.9	2.7	18.5
	GN-03	15	518386	6287058	8-Aug-16	19.3	3.5	3.0	18.5
	GN-04	15	518992	6289065	9-Aug-16	14.8	1.6	2.5	18.5
	GN-05	15	518688	6291298	9-Aug-16	15.2	3.7	1.9	18.5
	GN-06	15	520307	6292532	9-Aug-16	15.8	3.7	2.9	18.5
	GN-07	15	520353	6285010	7-Aug-16	17.5	1.0	2.6	18.0
	GN-08	15	519581	6283086	7-Aug-16	18.8	2.2	3.4	18.0
	GN-09	15	520522	6280765	7-Aug-16	20.1	1.7	2.8	18.0
	SN-01	15	519936	6286063	8-Aug-16	17.8	1.6	2.3	18.5
	SN-06	15	520307	6292532	9-Aug-16	15.8	2.0	3.7	18.5
	SN-09	15	520713	6280951	7-Aug-16	20.1	2.8	2.6	18.0
	GN-01	15	519911	6286074	9-Aug-17	18.8	2.5	2.8	18.5
	GN-02	15	518466	6286354	9-Aug-17	17.1	2.1	2.8	18.5
	GN-03	15	518434	6287161	9-Aug-17	15.8	3.0	3.0	18.5
	GN-04	15	518969	6289175	10-Aug-17	27.1	2.3	2.4	18.5
	GN-05	15	518778	6291388	10-Aug-17	25.8	2.2	3.6	18.5
	GN-06	15	520333	6292552	10-Aug-17	23.3	3.8	2.8	18.5
	GN-07	15	520350	6285013	11-Aug-17	22.5	2.3	2.0	19.0
	GN-08	15	519585	6283212	11-Aug-17	23.7	3.3	1.8	19.0
	GN-09	15	520626	6281090	11-Aug-17	24.0	2.7	2.6	19.0
	SN-01	15	519930	6286058	9-Aug-17	18.8	2.5	2.1	18.5
	SN-06	15	520314	6292530	10-Aug-17	23.3	4.1	3.8	18.5
	SN-09	15	520594	6281120	11-Aug-17	24.0	2.7	2.7	19.0
	GN-01	15	519604	6286196	8-Aug-18	16.8	1.5	4.2	20.0
	GN-02	15	518395	6286392	8-Aug-18	18.6	1.7	3.6	20.0
	GN-03	15	518397	6287012	8-Aug-18	20.4	2.0	2.3	20.0
	GN-04	15	519040	6288936	9-Aug-18	27.5	1.6	2.4	19.0

Table A5-1-1. continued.

Location	Site	UTM Coordinates			Set Date	Set Duration (h)[1]	Water Depth (m)		Set Water Temperature (°C)
		Zone	Easting	Northing			Start	End	
HAYES	GN-05	15	519207	6291856	9-Aug-18	26.3	1.5	2.3	19.0
	GN-06	15	520342	6292628	9-Aug-18	24.9	3.0	1.7	19.0
	GN-07	15	520313	6285157	10-Aug-18	23.0	1.0	2.0	20.0
	GN-08	15	519586	6283038	10-Aug-18	24.9	1.6	1.7	20.0
	GN-09	15	520756	6280806	10-Aug-18	23.7	1.0	2.0	20.0
	SN-01	15	519620	6286164	8-Aug-18	16.8	1.5	1.5	20.0
	SN-06	15	520311	6292608	9-Aug-18	24.9	1.6	3.0	19.0
	SN-09	15	520773	6280772	10-Aug-18	23.7	1.0	1.0	20.0
	GN-01	15	519604	6286196	9-Aug-19	20.3	1.4	2.7	16.0
	GN-02	15	518532	6286316	9-Aug-19	18.2	1.8	3.2	16.0
	GN-03	15	518441	6287147	9-Aug-19	16.0	2.9	3.3	16.0
	GN-04	15	519018	6289182	10-Aug-19	26.5	3.0	2.5	16.0
	GN-05	15	519281	6291925	10-Aug-19	28.5	1.4	1.4	16.0
	GN-06	15	520268	6292510	10-Aug-19	27.0	2.0	2.5	16.0
	GN-07	15	520364	6285076	11-Aug-19	22.2	2.5	1.5	16.0
	GN-08	15	519590	6283129	11-Aug-19	25.2	2.0	2.0	16.0
	GN-09	15	520285	6281322	11-Aug-19	22.6	1.3	2.0	16.0
	SN-01	15	519620	6286164	9-Aug-19	20.3	1.3	1.4	16.0
	SN-06	15	520235	6292495	10-Aug-19	27.0	1.0	2.0	16.0
	SN-09	15	520297	6281297	11-Aug-19	22.6	1.1	1.3	16.0

Notes:

1. Gill nets that were set for >36 h (red font) were excluded from the data analysis for abundance and diversity metrics.

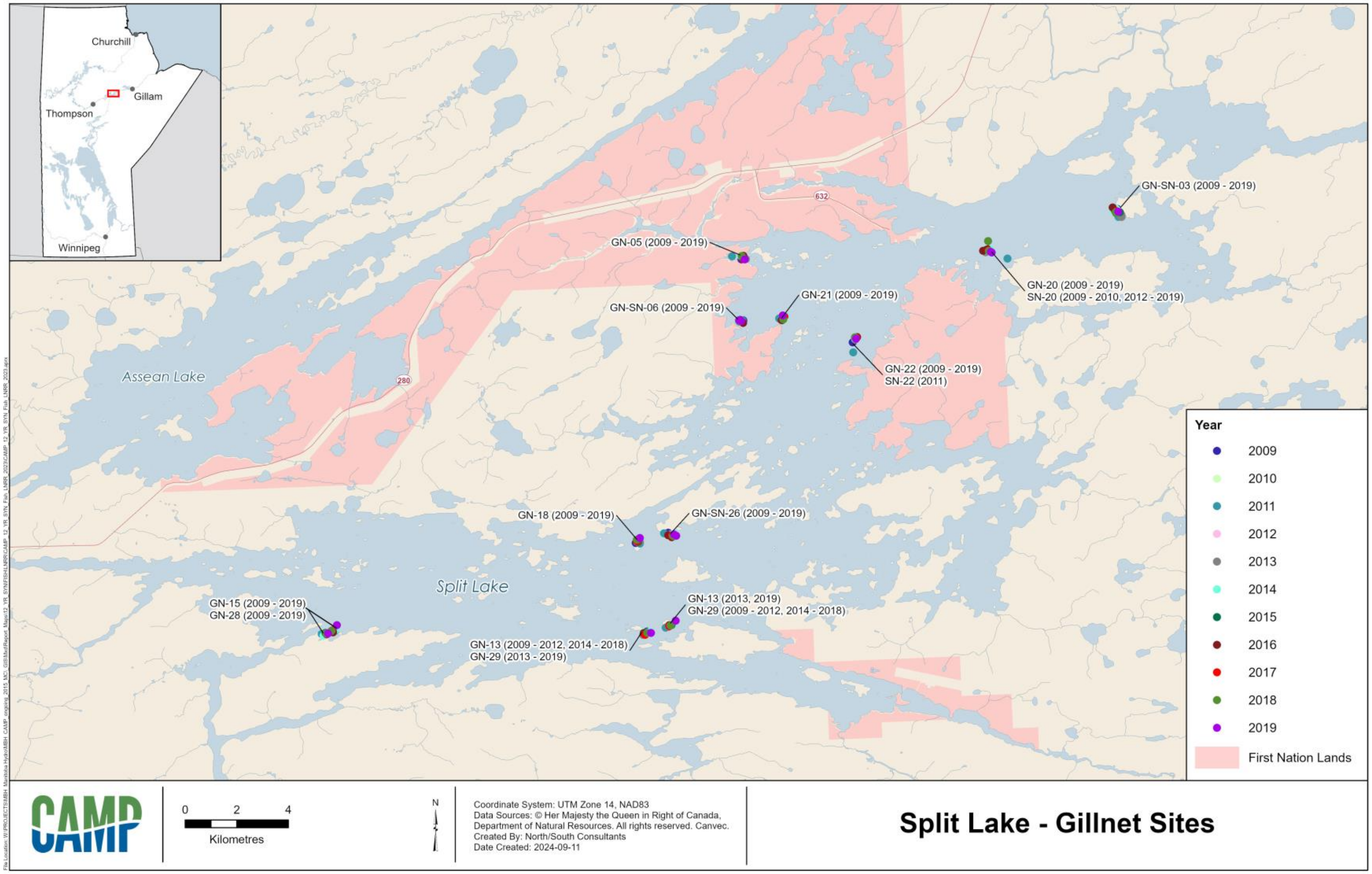


Figure A5-1-1. 2009-2019 Gillnetting sites in Split Lake.

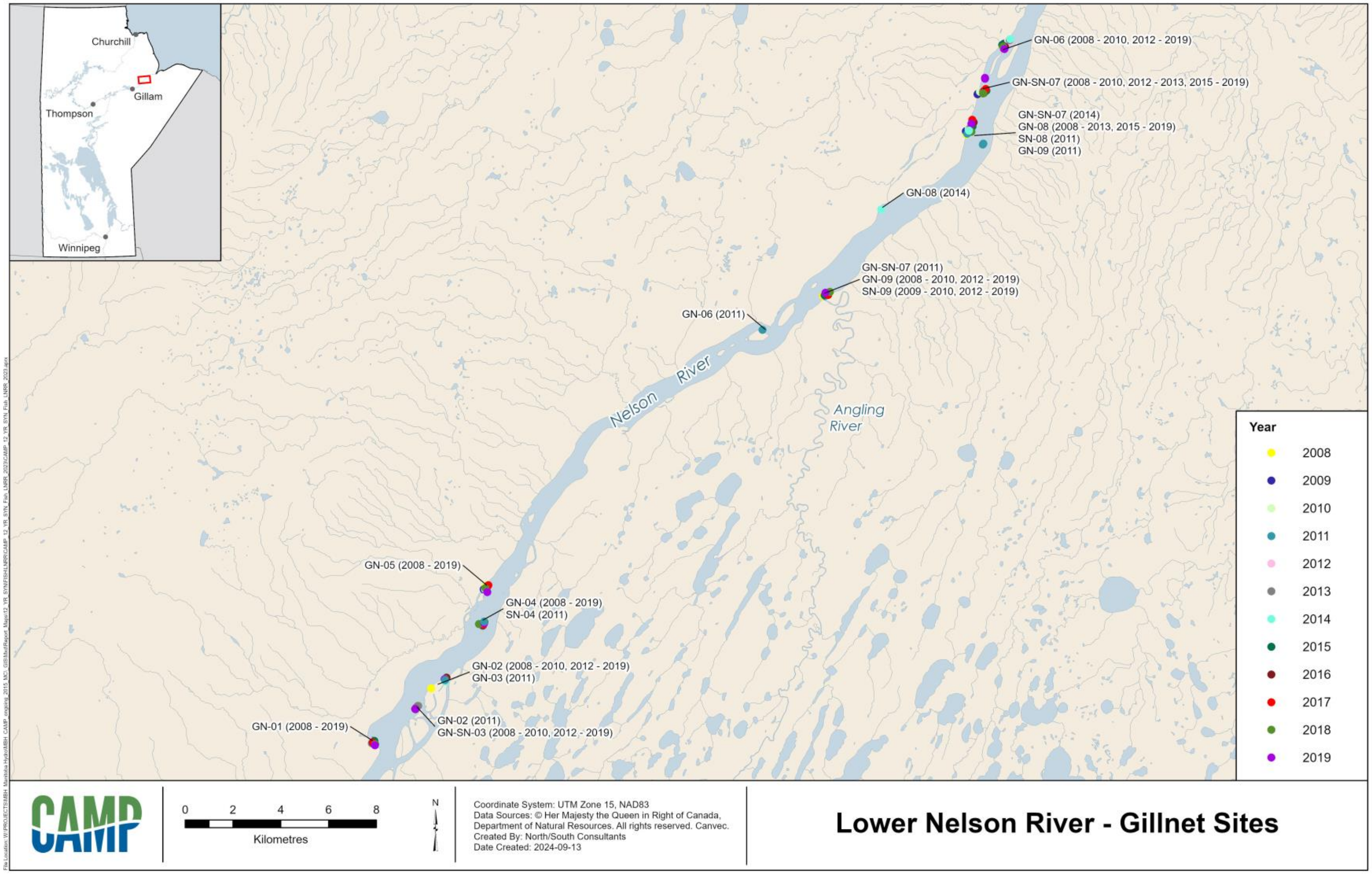


Figure A5-1-2. 2008-2019 Gillnetting sites in the lower Nelson River.

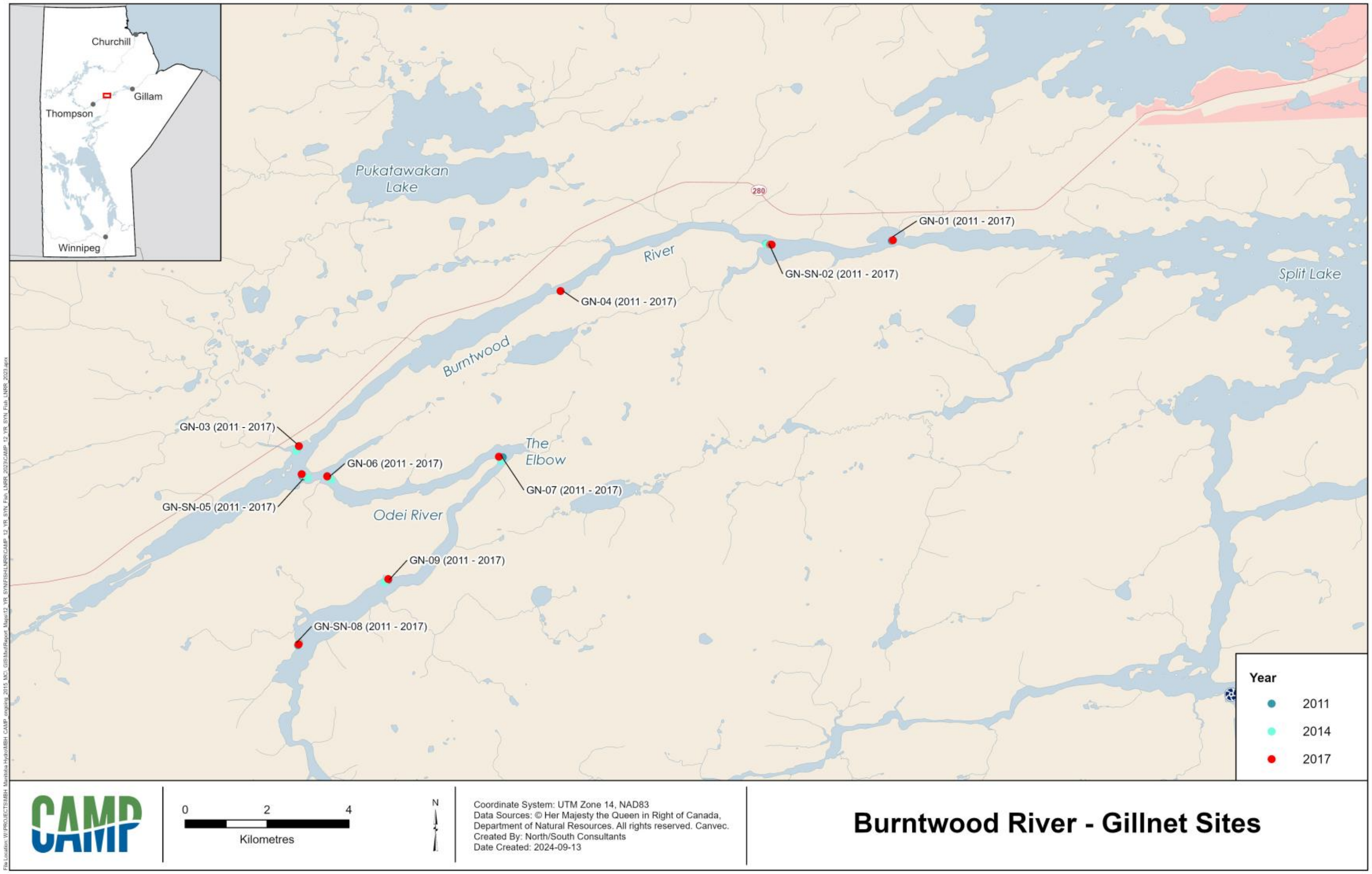


Figure A5-1-3. 2011-2017 Gillnetting sites in the Burntwood River.

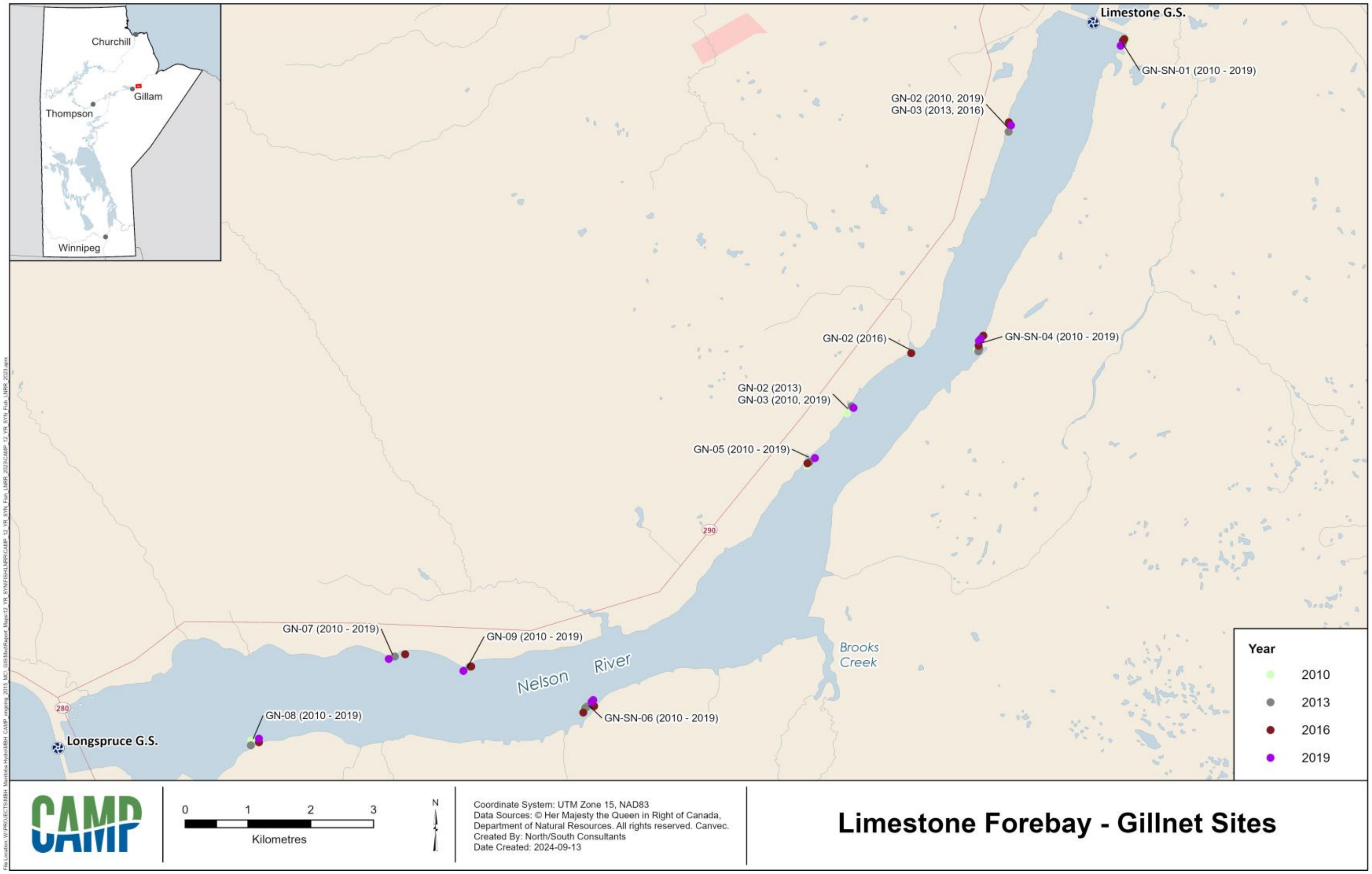


Figure A5-1-4. 2010-2019 Gillnetting sites in the Limestone Forebay.

Figure A5-1-5. 2009-2018 Gillnetting sites in Stephens Lake - North and South.

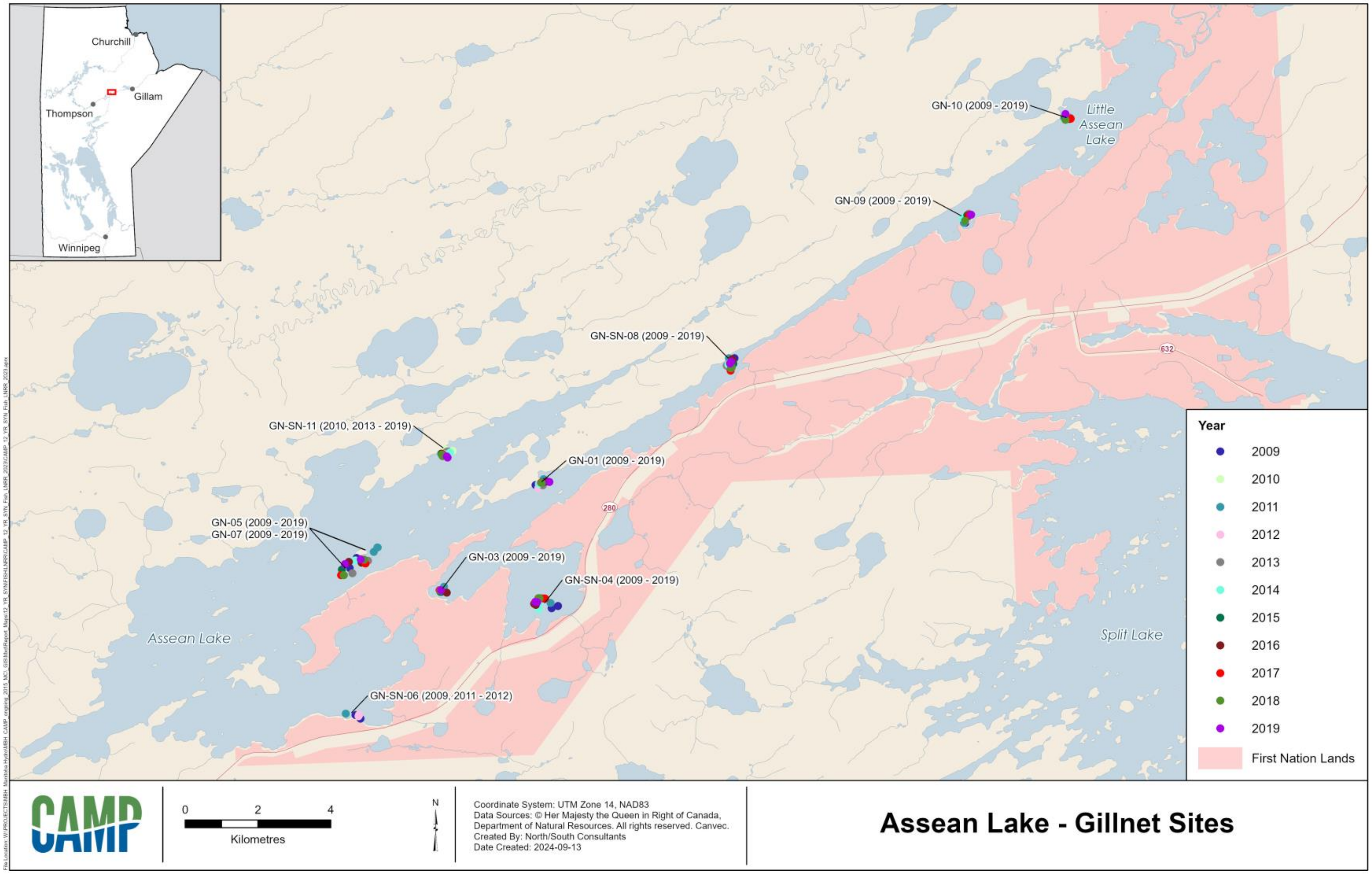


Figure A5-1-6. 2009-2019 Gillnetting sites in Assean Lake.

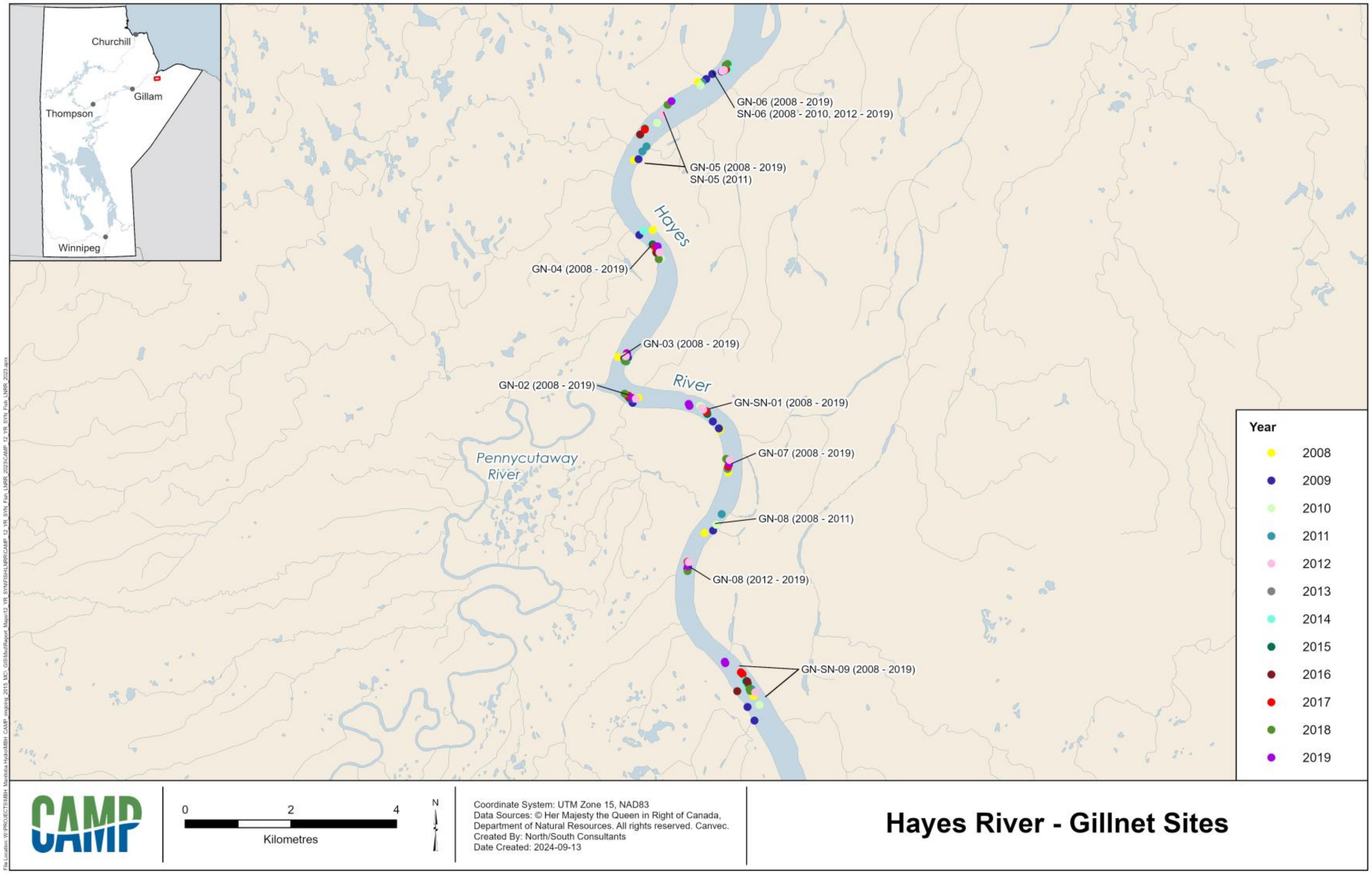


Figure A5-1-7. 2008-2019 Gillnetting sites in the Hayes River.

6.0 MERCURY IN FISH

6.1 INTRODUCTION

The following presents the results of fish mercury monitoring conducted from 2008-2019 in the Lower Nelson River Region. Fish mercury sampling was conducted on a three-year rotation beginning in 2009 at one on-system waterbody, Stephens Lake - South (Table 6-1.1; Figure 6.1-1). Sampling in the other three on-system waterbodies, Split Lake, the Limestone Forebay, and the lower Nelson River downstream of the Limestone Generating Station, and the off-system Assean Lake and the Hayes River started in 2010.

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 sampling was repeated on the Hayes River in 2011 because of low catches in 2010.

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
SPLIT			●			●			●			●
STL-S [1]		●			●			●			●	
LFB			●			●			●			●
LNR			●			●			●			●
ASSN			●			●			●			●
HAYES			●	● [2]		●			●			●

Notes:

1. To increase sample size, some samples collected from sites in STL-N in close proximity to STL-S.
2. Northern Pike and Lake Whitefish only; samples collected in 2011 due to low catches in 2010.

Table 6.1-2. Mercury in fish indicators and metrics.

Indicator	Metric	Units
Mercury in Fish	• Arithmetic mean mercury concentration	Parts per million (ppm)
	• Length-standardized mean mercury concentration of large-bodied species	ppm

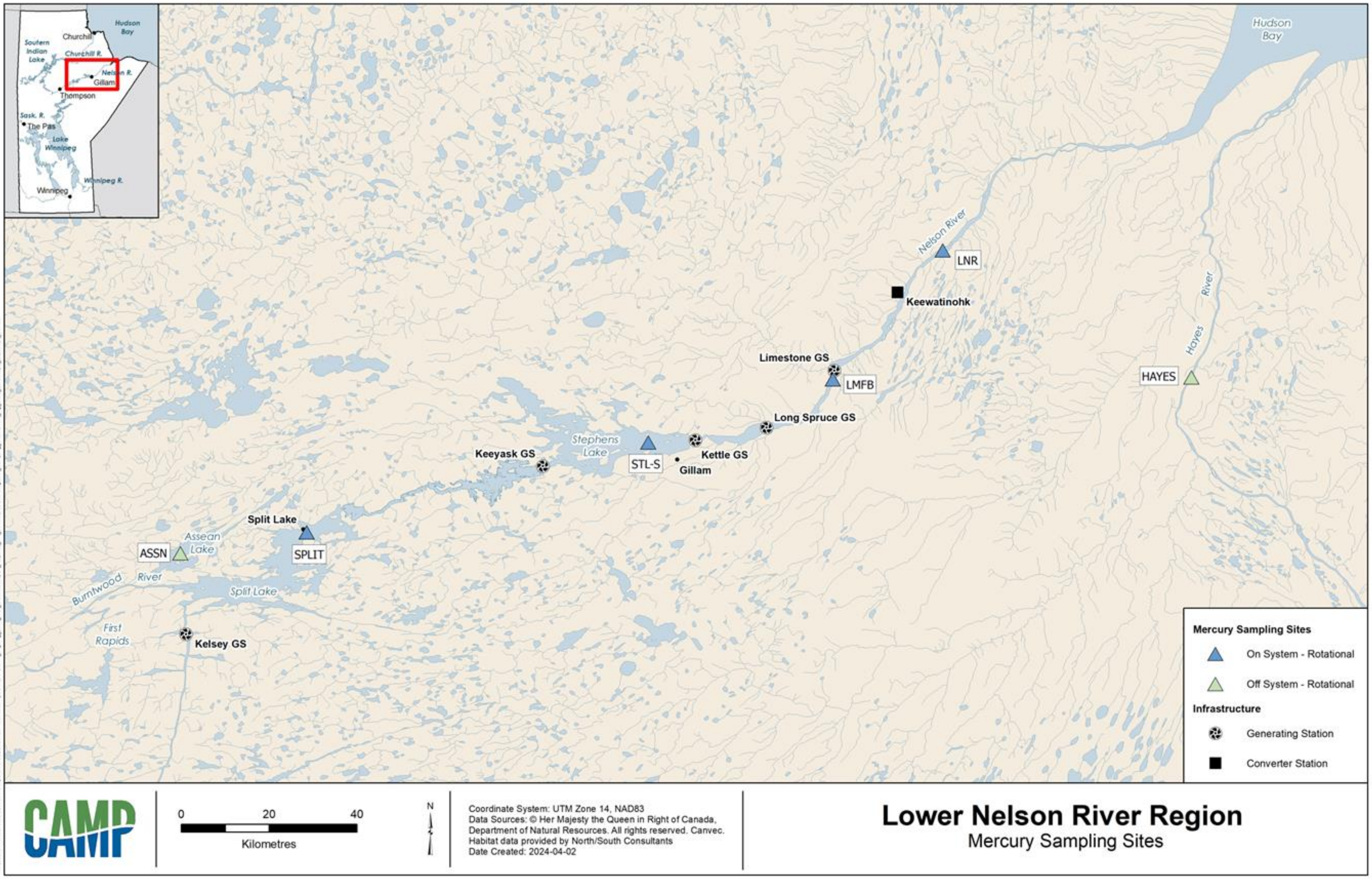


Figure 6.1-1. 2008-2019 Fish mercury sampling sites.

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 Nelson River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Split Lake

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.072 parts per million (ppm) in 2016 to a high of 0.150 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 four years of monitoring ranged from a low of 0.262 ppm in 2016 to a high of 0.363 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 0.197 ppm in 2010 to a high of 0.368 ppm in 2013 (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 in 2016 (<0.010 ppm) and was 0.016 ppm in 2019 (Figure 6.2-4; Table 6.2-2). No Yellow Perch were submitted for mercury analysis in 2013.

Stephens Lake – South

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.116 ppm in 2018 to a high of 0.188 ppm in 2015 (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 0.266 ppm in 2012 to a high of 0.382 ppm in 2015 (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 0.315 ppm in 2009 to a high of 0.592 ppm in 2015 (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 three years of monitoring, the arithmetic mean mercury concentration of 1-year-old Yellow Perch was 0.035 ppm in 2018 (Figure 6.2-4; Table 6.2-2). None of the Yellow Perch collected for mercury analysis in 2012 or 2015 were 1-year-old.

Limestone Forebay

Lake Whitefish

Over the four years of monitoring, only four Lake Whitefish were analyzed for mercury, two in 2013 and one in 2010 and 2016 (Figure 6.2-1). The arithmetic mean mercury concentrations in these years ranged from a low of 0.174 ppm in 2016 to a high of 0.304 ppm in 2010 (Table 6.2-1).

Northern Pike

The arithmetic mean mercury concentration of Northern Pike over the four years of monitoring ranged from a low of 0.262 ppm in 2013 to a high of 0.610 ppm in 2019 (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 0.372 ppm in 2019 to a high of 0.727 ppm in 2016 (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 only submitted for mercury analysis in 2013. The mercury concentration of the single 1-year-old Yellow Perch in this year was below the laboratory detection limit (<0.010 ppm) (Table 6.2-2).

Lower Nelson River

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.075 ppm in 2016 to a high of 0.190 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 four years of monitoring ranged from a low of 0.369 ppm in 2010 to a high of 0.457 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 0.259 ppm in 2016 to a high of 0.323 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 only submitted for mercury analysis in in 2016. The mercury concentration of the single 1-year-old Yellow Perch in this year was below the laboratory detection limit (<0.025 ppm) (Table 6.2-2).

6.2.1.2 OFF-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Nelson River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Assean Lake

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the four years of monitoring ranged from a low of 0.039 ppm in 2010 to a high of 0.060 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 four years of monitoring ranged from a low of 0.217 ppm in 2016 to a high of 0.253 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 0.178 ppm in 2019 to a high of 0.251 ppm in 2013 (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 four years of monitoring ranged from below the detection limit (<0.010 ppm) in 2013 to a high of 0.026 ppm in 2019 (Figure 6.2-4; Table 6.2-2). None of the Yellow Perch collected for mercury analysis in 2016 were 1-year-old.

Hayes River

Lake Whitefish

The arithmetic mean mercury concentration of Lake Whitefish over the five years of monitoring ranged from a low of 0.063 ppm in 2010 to a high of 0.074 ppm in 2016 (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 five years of monitoring ranged from a low of 0.262 ppm in 2010 to a high of 0.571 ppm in 2019 (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 0.309 ppm in 2016 to a high of 0.724 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

Yellow Perch were not submitted for mercury analysis from the Hayes River because they have not been caught there as part of the index gillnetting program (Table 6.2-2).

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	SPLIT	2010	16	412	190	523	19	15	7	2	17	1	16	0.092	0.032	0.193	0.013	0.062	0.049-0.078
		2013	20	413	338	530	11	19	9	5	13	1	20	0.150	0.076	0.322	0.013	0.102	0.082-0.128
		2016	22	429	378	519	8	22	9	6	14	1	22	0.072	0.038	0.130	0.005	0.037	0.030-0.047
		2019	21	443	307	555	11	21	10	5	17	1	21	0.102	0.053	0.228	0.009	0.065	0.048-0.090
	STL-S	2009	7	483	360	582	28	6	13	5	19	2	7	0.159	0.042	0.267	0.029	0.046	0.025-0.084
		2012	5	526	440	560	22	5	16	8	24	3	5	0.168	0.100	0.221	0.020	0.053	0.024-0.115
		2015	6	481	410	549	27	6	13	6	24	3	6	0.188	0.079	0.394	0.050	0.107	0.081-0.141
		2018	13	441	251	541	23	13	11	4	27	2	13	0.116	0.040	0.279	0.019	0.059	0.045-0.078
	LMFB	2010	1	512	-	-	-	1	14	-	-	-	1	0.304	-	-	-	-	
		2013	2	477	401	552	76	2	14	9	18	5	2	0.242	0.124	0.360	0.118	-	
		2016	1	450	-	-	-	1	14	-	-	-	1	0.174	-	-	-	-	
		2019	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	
	LNR	2010	21	400	340	502	12	19	12	6	22	1	21	0.178	0.048	0.509	0.029	0.070	0.056-0.089
		2013	10	429	374	489	12	10	9	7	16	1	10	0.190	0.0890	0.350	0.021	not significant	
		2016	7	407	365	500	17	6	7	4	13	1	7	0.075	0.040	0.156	0.016	0.036	0.021-0.064
		2019	12	416	330	497	18	11	11	7	20	1	12	0.131	0.062	0.282	0.022	0.070	0.053-0.092
	ASSN	2010	36	333	177	501	17	32	5	1	17	1	36	0.039	0.013	0.089	0.003	0.039	0.035-0.043
		2013	9	409	382	455	7	9	7	4	9	1	9	0.060	0.029	0.103	0.008	not significant	
		2016	12	403	148	525	41	12	9	1	23	2	12	0.049	0.010	0.093	0.007	0.039	0.030-0.051
		2019	6	371	279	498	38	6	7	3	13	2	6	0.042	0.0222	0.081	0.011	0.034	0.027-0.042
	HAYES	2010	9	318	165	374	21	8	6	4	7	0	9	0.063	0.026	0.083	0.006	0.070	0.064-0.077
		2011	5	290	202	325	22	5	6	4	7	1	5	0.066	0.059	0.075	0.003	not significant	
		2013	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	
		2016	24	340	176	399	9	23	6	1	10	0	24	0.074	0.029	0.143	0.005	0.074	0.066-0.083
		2019	16	327	172	418	15	14	6	3	10	1	16	0.068	0.040	0.105	0.004	0.072	0.067-0.077
NRPK	SPLIT	2010	24	584	238	862	33	24	6	1	13	1	24	0.363	0.063	0.807	0.043	0.289	0.249-0.335
		2013	37	506	248	811	22	36	5	2	10	0	37	0.354	0.097	0.768	0.032	0.375	0.333-0.422
		2016	34	504	270	832	26	34	5	2	15	0	34	0.262	0.079	0.809	0.029	0.278	0.251-0.308
		2019	36	449	240	875	21	36	4	2	9	0	36	0.312	0.0452	2.40	0.064	0.383	0.318-0.461
	STL-S	2009	36	526	210	888	32	28	7	2	15	1	36	0.295	0.059	0.904	0.043	0.261	0.230-0.297
		2012	42	511	231	811	22	42	6	2	16	0	42	0.266	0.084	0.607	0.022	0.275	0.249-0.304
		2015	34	555	304	828	23	34	6	3	12	0	34	0.382	0.122	1.64	0.054	0.333	0.284-0.390
		2018	36	540	231	874	24	34	5	2	10	0	36	0.372	0.122	1.45	0.049	0.329	0.289-0.375
	LMFB	2010	36	612	329	770	14	36	7	3	9	0	36	0.398	0.113	0.837	0.027	0.292	0.264-0.324
		2013	11	559	290	729	34	11	5	3	8	0	11	0.262	0.082	0.533	0.035	0.242	0.216-0.271
		2016	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	
		2019	3	743	580	1020	139	3	9	6	14	3	3	0.610	0.339	1.13	0.260	not significant	
	LNR	2010	36	625	385	885	23	35	7	4	12	0	36	0.369	0.043	0.868	0.032	0.243	0.207-0.285
		2013	36	622	319	878	27	36	6	3	11	0	36	0.457	0.067	0.950	0.043	0.296	0.268-0.328

Table 6.2-1. continued.

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]
NRPK	LNR	2016	35	625	340	895	22	35	6	2	13	0	35	0.438	0.048	0.910	0.039	0.280	0.241-0.325
		2019	36	650	406	905	25	36	5	2	9	0	36	0.390	0.078	0.725	0.033	0.240	0.211-0.273
	ASSN	2010	36	510	146	797	29	36	6	1	12	0	36	0.253	0.011	0.672	0.029	0.249	0.221-0.282
		2013	37	539	134	905	26	37	5	1	13	0	37	0.251	0.053	0.595	0.022	0.233	0.202-0.269
		2016	34	508	225	860	27	34	5	1	8	0	34	0.217	0.025	0.949	0.034	0.208	0.176-0.245
		2019	36	531	215	920	30	36	4	1	10	0	36	0.252	0.030	1.06	0.037	0.229	0.210-0.249
	HAYES	2010	10	620	377	768	44	10	7	3	10	1	10	0.262	0.080	0.369	0.030	0.203	0.179-0.230
		2011	3	728	601	825	66	3	9	7	12	1	3	0.302	0.277	0.323	0.013	0.265	0.233-0.301
		2013	8	707	586	905	42	8	9	7	12	1	8	0.391	0.161	0.780	0.081	0.171	0.098-0.296
		2016	13	746	624	878	20	13	6	5	8	0	13	0.320	0.148	0.605	0.037	0.100	0.070-0.143
		2019	11	784	400	947	46	11	7	3	10	1	11	0.571	0.134	1.04	0.090	0.217	0.157-0.301
WALL	SPLIT	2010	33	376	184	576	19	33	5	2	15	1	33	0.197	0.034	0.658	0.023	0.196	0.173-0.222
		2013	37	345	160	670	21	37	6	1	19	1	37	0.368	0.061	1.12	0.043	0.413	0.355-0.481
		2016	36	343	161	685	22	35	6	1	26	1	36	0.238	0.076	1.14	0.033	0.262	0.230-0.298
		2019	32	270	176	395	12	30	5	2	9	0	32	0.231	0.062	0.545	0.021	0.370	0.284-0.482
	STL-S	2009	36	419	210	631	19	33	12	3	30	1	36	0.315	0.077	0.800	0.030	0.262	0.236-0.291
		2012	41	462	185	615	15	41	9	1	28	1	41	0.431	0.127	1.33	0.046	0.283	0.248-0.322
		2015	36	416	170	585	18	36	12	2	26	1	36	0.592	0.117	1.24	0.051	0.498	0.427-0.582
		2018	36	403	158	671	19	35	9	1	21	1	36	0.447	0.093	1.16	0.051	0.380	0.336-0.431
	LMFB	2010	5	498	405	536	24	4	12	7	17	2	5	0.526	0.255	0.693	0.074	0.250	0.179-0.347
		2013	10	445	262	591	30	10	11	2	23	2	10	0.527	0.198	1.11	0.092	0.392	0.28-0.548
		2016	5	433	382	485	17	5	11	5	13	1	5	0.727	0.325	0.980	0.116	not significant	
		2019	15	379	97	466	23	15	9	1	23	1	15	0.372	0.0669	1.19	0.068	0.353	0.276-0.452
	LNR	2010	36	410	219	571	14	36	7	2	15	0	36	0.323	0.069	0.687	0.025	0.278	0.256-0.303
		2013	36	376	167	573	20	35	6	2	18	1	36	0.295	0.052	1.04	0.038	0.281	0.240-0.329
		2016	12	330	194	535	27	11	4	2	11	1	12	0.259	0.088	1.01	0.074	0.284	0.175-0.462
		2019	17	379	345	480	8	17	8	7	15	0	17	0.304	0.145	0.853	0.046	0.329	0.255-0.424
	ASSN	2010	36	348	187	471	13	32	8	4	13	0	36	0.195	0.055	0.392	0.012	0.236	0.216-0.257
		2013	37	328	80	494	17	37	8	1	17	1	37	0.251	0.011	0.551	0.021	0.317	0.275-0.365
		2016	37	318	171	515	14	37	6	2	17	1	37	0.196	0.078	0.526	0.019	0.257	0.228-0.289
		2019	34	332	140	494	18	34	7	1	17	1	34	0.178	0.034	0.582	0.017	0.218	0.197-0.241
	HAYES	2010	36	471	297	684	17	36	13	4	26	1	36	0.724	0.205	1.52	0.061	0.463	0.403-0.532
		2013	38	407	74	665	22	38	9	0	24	1	38	0.364	0.013	1.52	0.050	0.290	0.248-0.340
		2016	33	380	88	651	25	33	7	1	19	1	33	0.309	0.040	0.755	0.038	0.294	0.267-0.324
		2019	36	447	188	637	18	32	11	2	28	1	36	0.622	0.091	1.77	0.073	0.409	0.353-0.472

Notes:

1. n = sample size.
2. Min = minimum; Max = maximum.
3. SE = standard error.
4. For standard lengths of 350 mm for LKWH, 550 mm for NRPK, and 400 mm for WALL.
5. CL = confidence limits.

Table 6.2-2. 2010-2019 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	SPLIT	2013	0	-	-	-	-	-	-	-	-
		2016	1	73	-	-	-	<0.010	-	-	-
		2019	2	85	83	86	1	0.016	0.0147	0.018	0.001
	STL	2012	0	-	-	-	-	-	-	-	-
		2015	0	-	-	-	-	-	-	-	-
		2018	9	94	74	117	5	0.035	0.0161	0.080	0.007
	LMFB	2013	1	73	-	-	-	<0.010	-	-	-
		2016	0	-	-	-	-	-	-	-	-
		2019	0	-	-	-	-	-	-	-	-
	LNR	2013	0	-	-	-	-	-	-	-	-
		2016	1	65	-	-	-	<0.025	-	-	-
		2019	0	-	-	-	-	-	-	-	-
	ASSN	2011	0	-	-	-	-	-	-	-	-
		2013	3	58	54	62	2	<0.010	<0.010	0.014	-
		2016	0	-	-	-	-	-	-	-	-
		2019	5	80	75	87	2	0.026	0.021	0.036	0.003
	HAYES	2013	0	-	-	-	-	-	-	-	-
		2016	0	-	-	-	-	-	-	-	-
		2019	0	-	-	-	-	-	-	-	-

Notes:

1. n = sample size.
2. Min = minimum; Max = maximum.
3. SE = standard error.

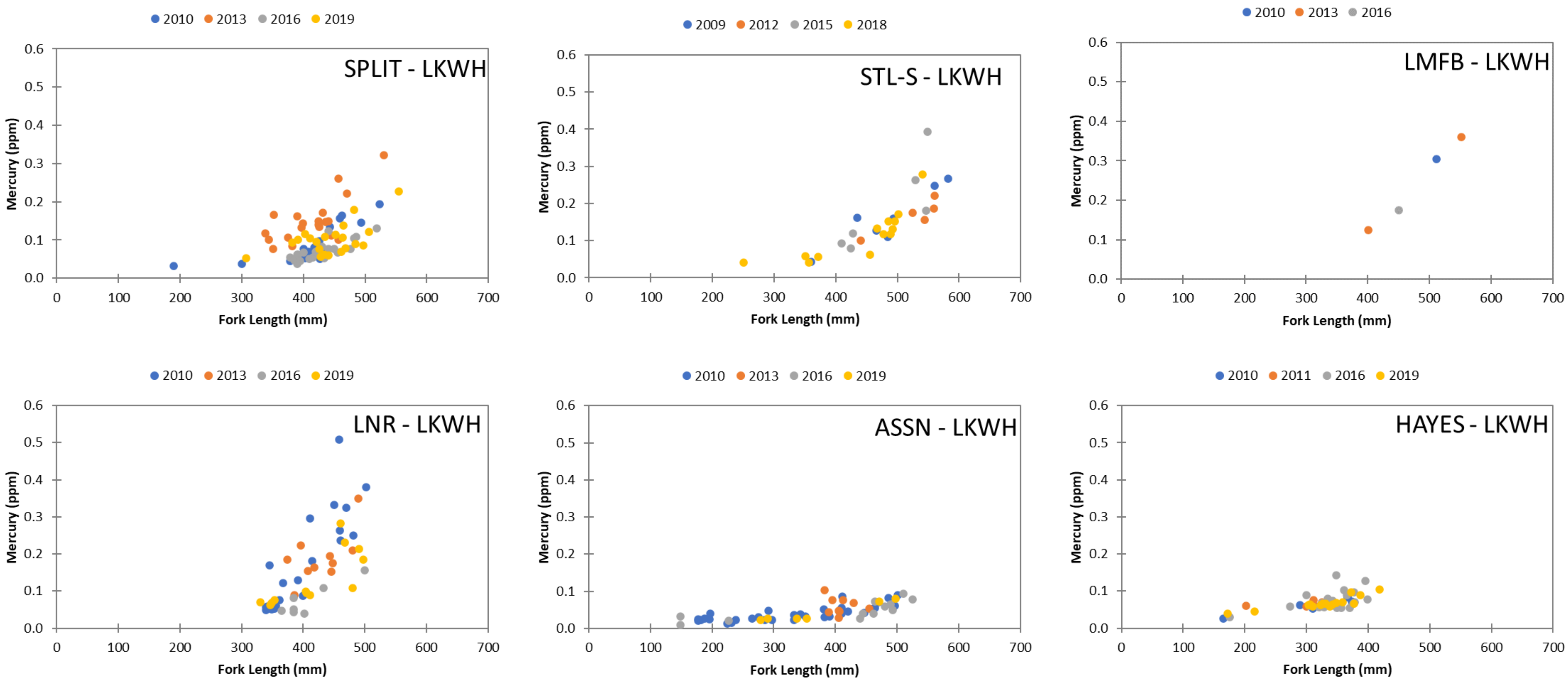


Figure 6.2-1. 2009-2019 Mercury concentration versus fork length of Lake Whitefish.

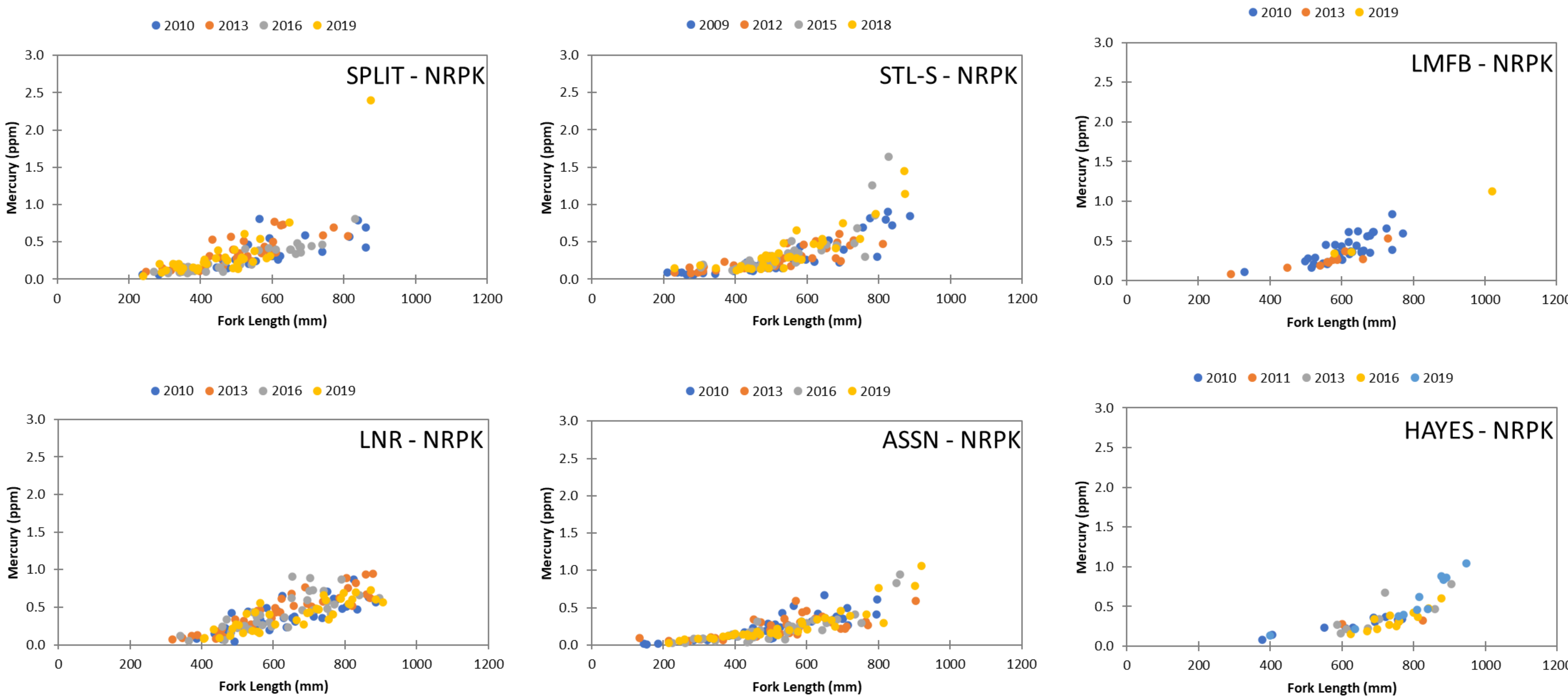


Figure 6.2-2. 2009-2019 Mercury concentration versus fork length of Northern Pike.

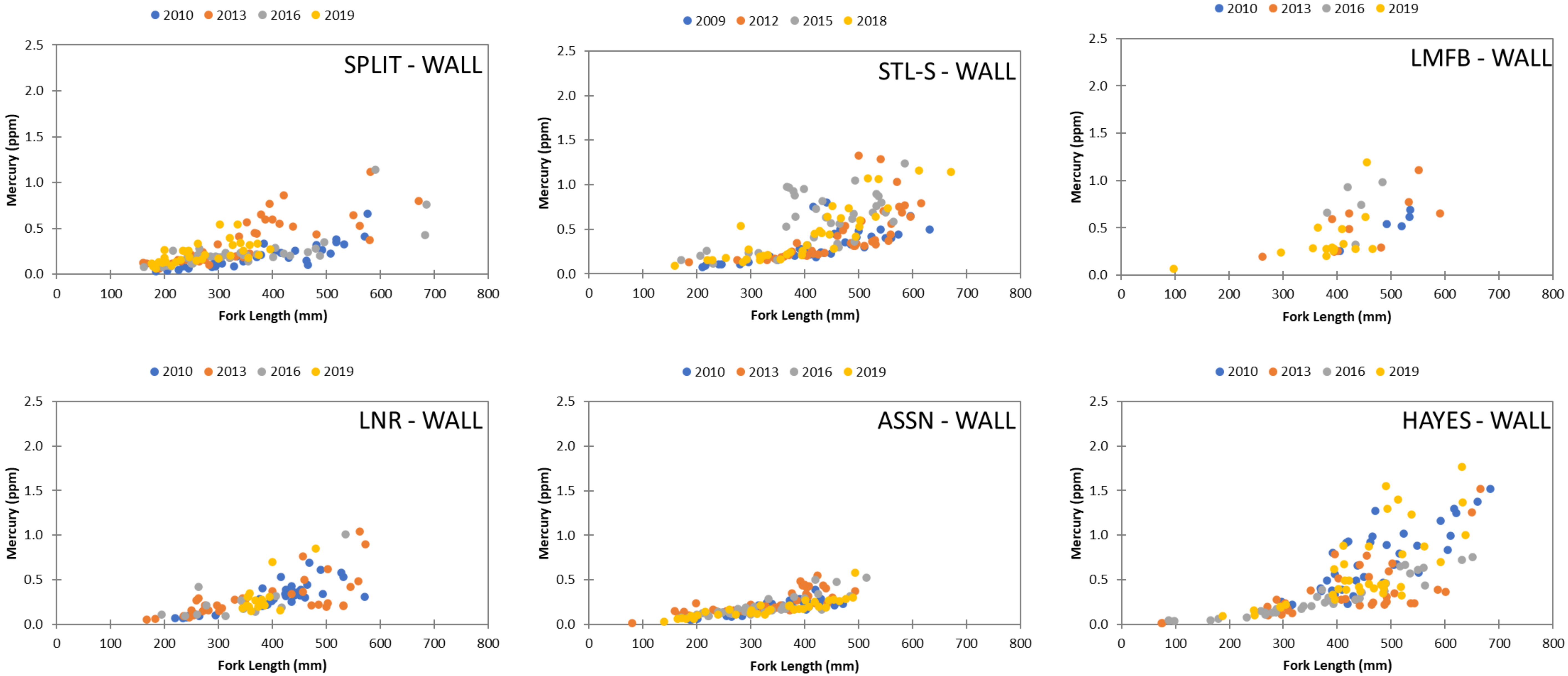


Figure 6.2-3. 2009-2019 Mercury concentration versus fork length of Walleye.

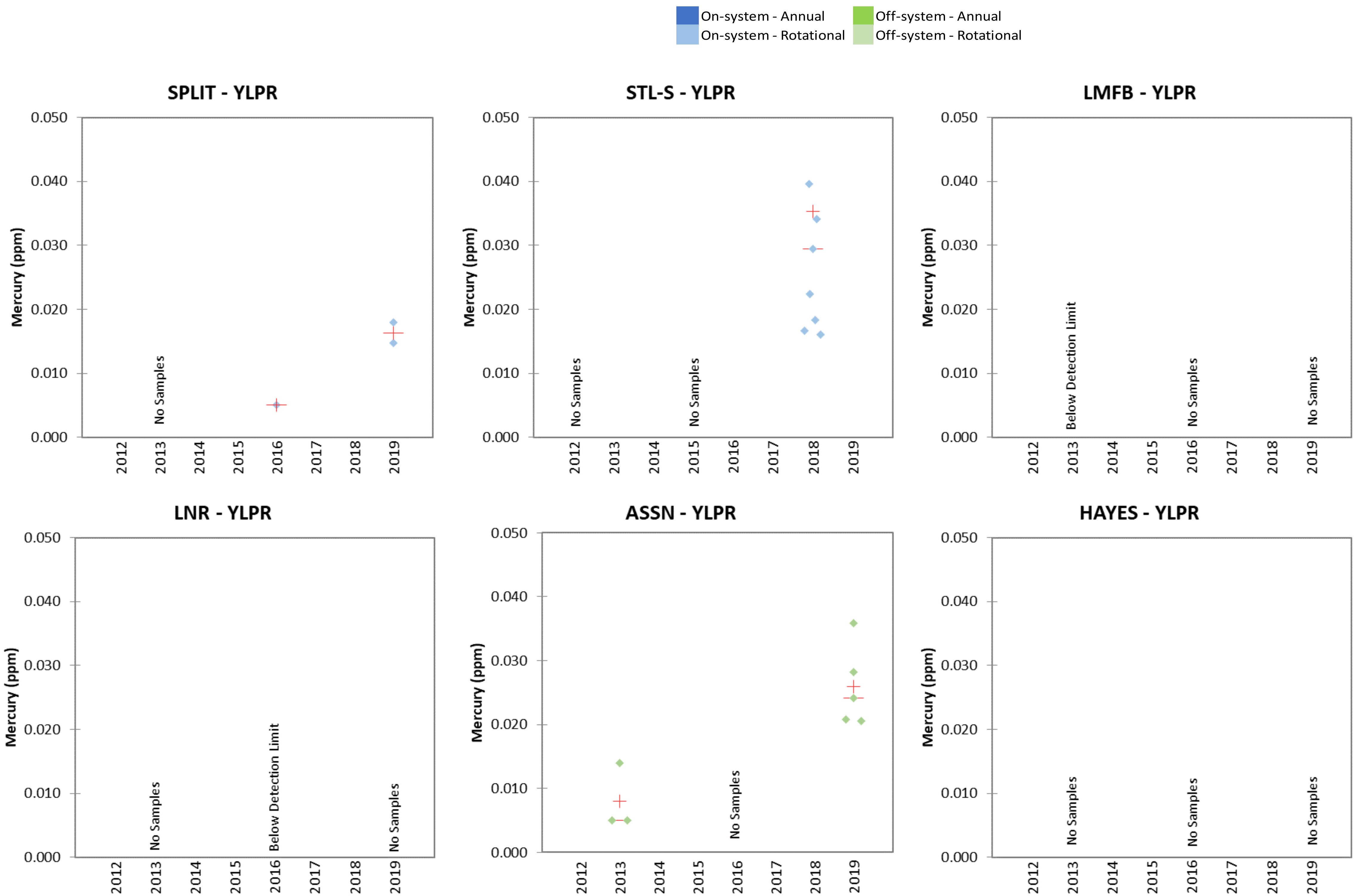


Figure 6.2-4. 2012-2019 Mercury concentrations of 1-year-old Yellow Perch.

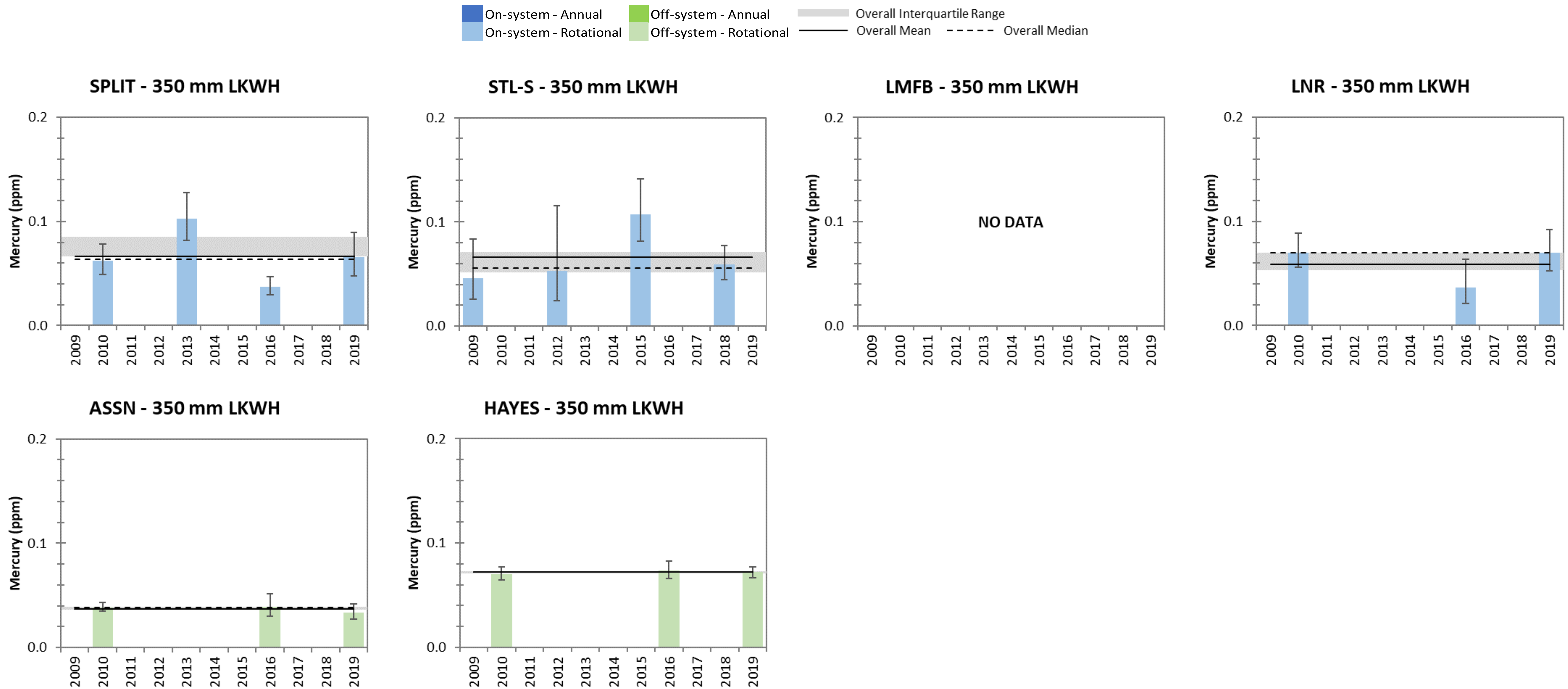


Figure 6.2-5. 2009-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Lake Whitefish.

6.2.2 LENGTH-STANDARDIZED MEAN CONCENTRATION

6.2.2.1 ON-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Nelson River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Split Lake

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the four years of monitoring ranged from 0.037 in 2016 to a high of 0.102 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.067 ppm, the median concentration was 0.064 ppm, and the IQR was 0.056–0.075 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 2013 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 0.278 ppm in 2016 to a high of 0.383 ppm in 2019 (Table 6.2-1).

The overall mean concentration was 0.331 ppm, the median concentration was 0.332 ppm, and the IQR was 0.286–0.377 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 2019 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 0.196 ppm in 2010 to a high of 0.413 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.310 ppm, the median concentration was 0.316 ppm, and the IQR was 0.245–0.381 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.

Stephens Lake – South

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the four years of monitoring ranged from 0.046 in 2009 to a high of 0.107 ppm in 2015 (Table 6.2-1).

The overall mean concentration was 0.066 ppm, the median concentration was 0.056 ppm, and the IQR was 0.051–0.071 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2009 when it was below the IQR and in 2015 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 0.261 ppm in 2009 to a high of 0.333 ppm in 2015 (Table 6.2-1).

The overall mean concentration was 0.300 ppm, the median concentration was 0.302 ppm, and the IQR was 0.272–0.330 ppm (Figure 6.2-6). The annual mean mercury concentration fell within the IQR except in 2009 when it was below the IQR and in 2015 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 0.262 ppm in 2009 to a high of 0.498 ppm in 2015 (Table 6.2-1).

The overall mean concentration was 0.356 ppm, the median concentration was 0.331 ppm, and the IQR was 0.278–0.410 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2009 when it was below the IQR and in 2015 when it was above the IQR.

Limestone Forebay

Lake Whitefish

A standard mean could not be calculated over the four years of monitoring because too few Lake Whitefish were analyzed for mercury from the Limestone Forebay (Table 6.2-1).

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 0.242 ppm in 2013 to a high of 0.292 ppm in 2010 (Table

6.2-1). A standard mean could not be calculated for 2019 because there was not a significant relationship between mercury concentration and fork length or in 2016 because no Northern Pike were analyzed for mercury.

Walleye

The length-standardized mean mercury concentration of a 400 mm Walleye over the four years of monitoring ranged from a low of 0.250 ppm in 2010 to a high of 0.392 ppm in 2013 (Table 6.2-1). A standard mean could not be calculated for 2016 because there was not a significant relationship between mercury concentration and fork length.

The overall mean concentration was 0.332 ppm, the median concentration was 0.353 ppm, and the IQR was 0.301-0.373 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 Nelson River

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish ranged from a low of 0.036 ppm in 2016 to a high of 0.070 ppm in 2010 and 2019 (Table 6.2-1). A standard mean could not be calculated for 2013 because there was not a significant relationship between mercury concentration and fork length.

The overall mean concentration was 0.059 ppm, the median concentration was 0.070 ppm, and the IQR was 0.053–0.070 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2016 when it was below 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 0.240 ppm in 2019 to a high of 0.296 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.265 ppm, the median concentration was 0.261 ppm, and the IQR was 0.242–0.284 ppm (Figure 6.2-6). The annual mean mercury concentration fell within the IQR except in 2019 when it was below the IQR and in 2013 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 0.278 ppm in 2010 to a high of 0.329 ppm in 2019 (Table 6.2-1).

The overall mean concentration was 0.293 ppm, the median concentration was 0.282 ppm, and the IQR was 0.280–0.295 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2010 when it was below the IQR and 2019 when it was above the IQR.

6.2.2.2 OFF-SYSTEM SITES

ANNUAL SITES

There are no waterbodies in the Lower Nelson River Region that are monitored for fish mercury annually.

ROTATIONAL SITES

Assean Lake

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish ranged from a low of 0.034 ppm in 2019 to a high of 0.039 ppm in 2010 and 2016 (Table 6.2-1). A standard mean could not be calculated for 2013 because there was not a significant relationship between mercury concentration and fork length.

The overall mean concentration was 0.037 ppm, the median concentration was 0.039 ppm, and the IQR was 0.036–0.039 ppm (Figure 6.2-5). The annual mean mercury concentration fell within the IQR except in 2019 when it was below 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 0.208 ppm in 2016 to a high of 0.249 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.230 ppm, the median concentration was 0.231 ppm, and the IQR was 0.223–0.237 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 0.218 ppm in 2019 to a high of 0.317 ppm in 2013 (Table 6.2-1).

The overall mean concentration was 0.257 ppm, the median concentration was 0.246 ppm, and the IQR was 0.231–0.272 ppm (Figure 6.2-7). The annual mean mercury concentration fell within the IQR except in 2019 when it was below the IQR and in 2013 when it was above the IQR.

Hayes River

Lake Whitefish

The length-standardized mean mercury concentration of a 350 mm Lake Whitefish over the five years of monitoring ranged from 0.070 in 2010 to a high of 0.074 ppm in 2016 (Table 6.2-1). A standard mean could not be calculated for 2011 because there was not a significant relationship between mercury concentration and fork length or in 2013 because no Lake Whitefish were analyzed for mercury.

The overall mean and median concentrations were 0.072 ppm and the IQR was 0.071–0.073 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 2016 when it was above the IQR.

Northern Pike

The length-standardized mean mercury concentration of a 550 mm Northern Pike over the five years of monitoring ranged from a low of 0.100 ppm in 2016 to a high of 0.265 ppm in 2011 (Table 6.2-1).

The overall mean concentration was 0.191 ppm, the median concentration was 0.203 ppm, and the IQR was 0.171–0.217 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 2011 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 0.290 ppm in 2013 to a high of 0.463 ppm in 2010 (Table 6.2-1).

The overall mean concentration was 0.364 ppm, the median concentration was 0.351 ppm, and the IQR was 0.293–0.422 ppm (Figure 6.2-7). 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.

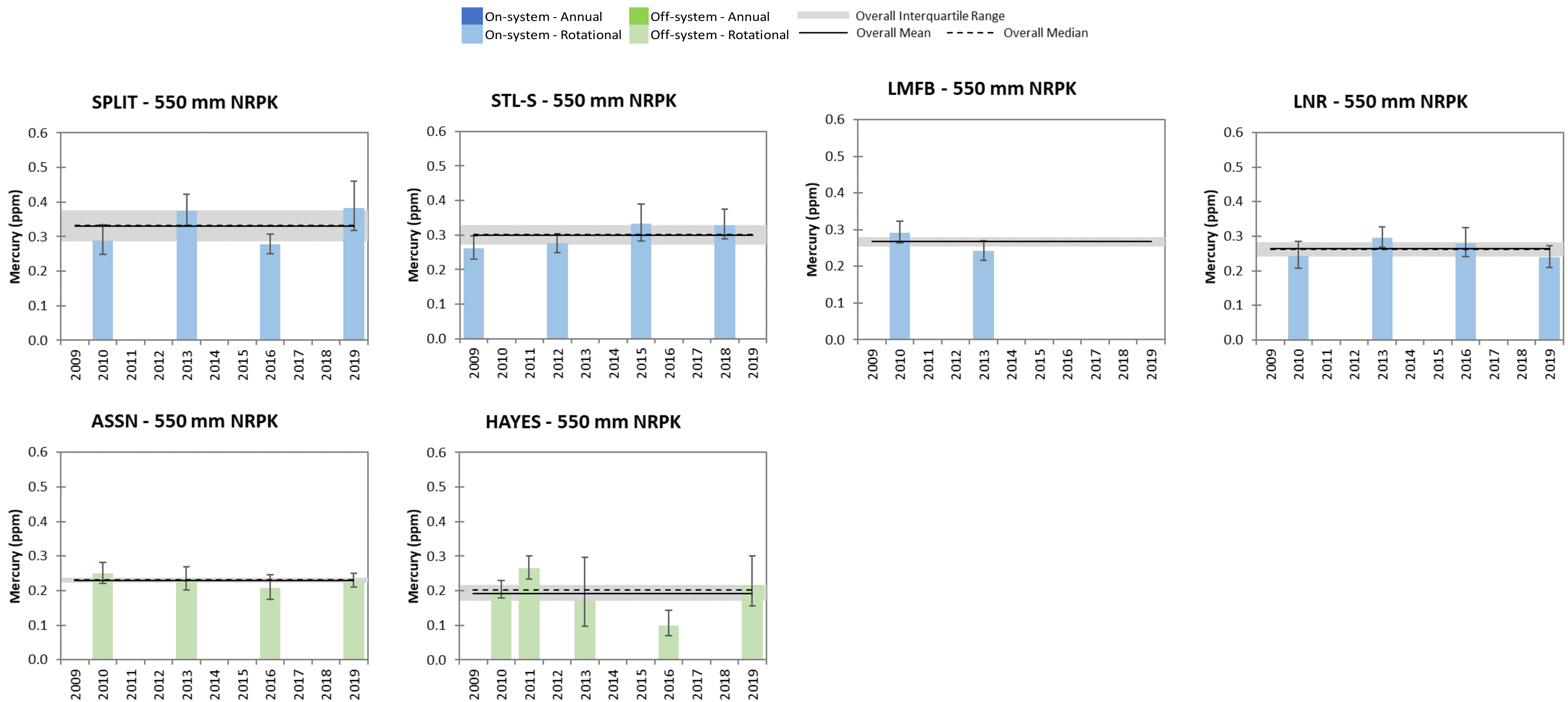


Figure 6.2-6. 2009-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Northern Pike.

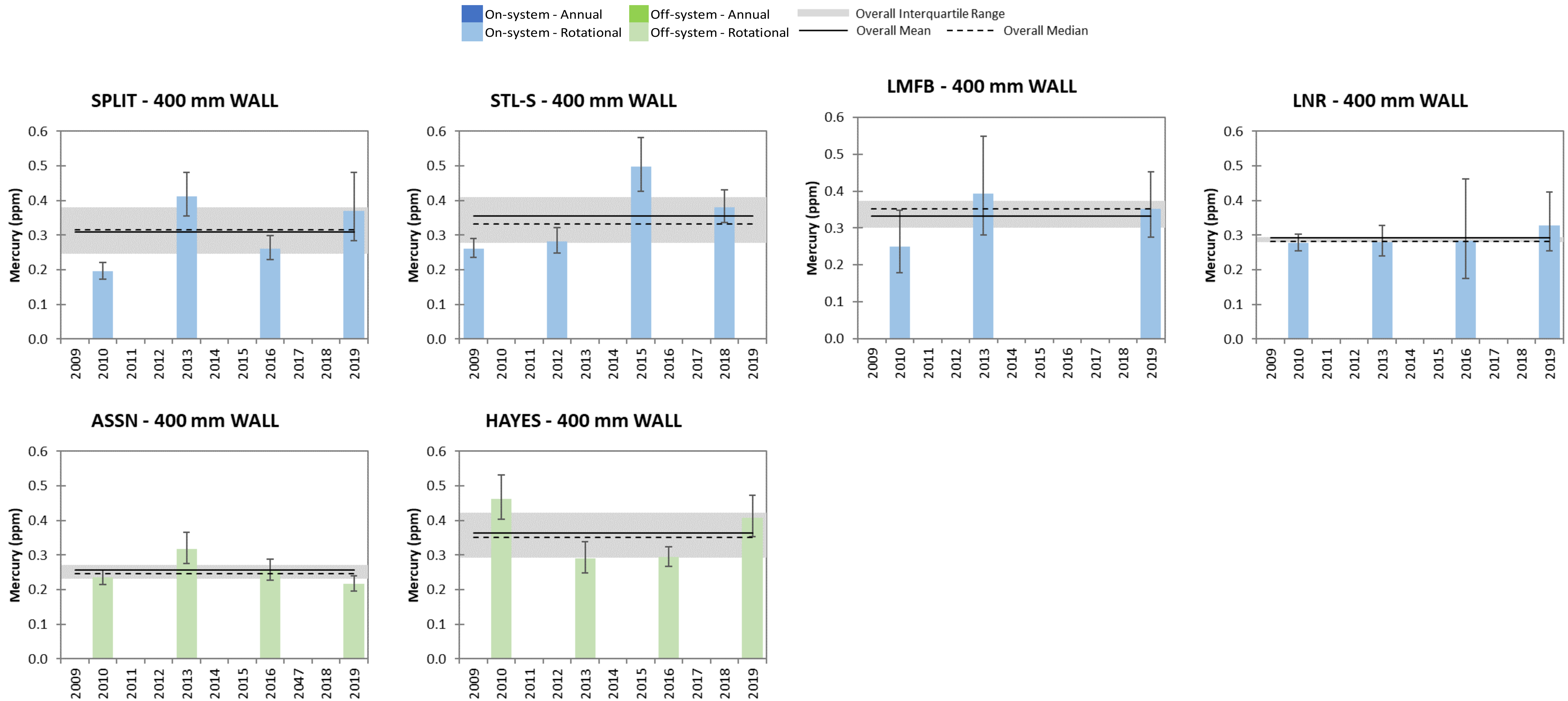


Figure 6.2-7. 2009-2019 Length-standardized mean mercury concentrations (±95% confidence intervals) of Walleye.

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