Hunting for Prussian Carp in the Swift Current Creek and Rush Lake Creek Watersheds

Introduction

One of the biggest threats to the health of the Swift Current and Rush Lake Creek Watersheds is the introduction of invasive species. When the Swift Current Creek Watershed Stewards (SCCWS) met with stakeholders in 2019, the impact of invasive species on watershed health was one of the three priority areas that was identified for the SCCWS to focus its work on. Prussian Carp is a fish species that is invading the waterways of Western Canada which could have a significant impact on the health of the aquatic ecosystem of these watersheds.

Figure 1. Some examples of Prussian Carp

During the 2017 Monitoring Project of the SCCWS, a Prussian carp was captured in the fish sampling component of the project. In discussion with a biologist familiar with Prussian Carp it was suggested that the fish had swam upstream from the South Saskatchewan River. The site where the Prussian Carp was found is approximately 50 kilometres from the confluence of the Swift Current Creek and the South Saskatchewan River. Since then, the SCCWS has heard reports of Prussian Carp being in the Swift Current Creek and irrigation canals and wanted to determine the presence of Prussian Carp in the watersheds. Trying to catch live Prussian Carp in all areas of the two watersheds was too time consuming and expensive for the SCCWS to undertake. To determine where Prussian Carp might be in the two watersheds, the SCCWS collected water samples for eDNA testing at 10 sites important to watershed health and recreational fishing within the watershed. EDNA testing can detect minute amounts of DNA of all the different organisms that are present in the area where the water sample was taken. The eDNA sampling will allow the SCCWS to pinpoint the areas where the Prussian Carp are and then sample for live Prussian Carp at these sites in future studies. The SCCWS took water samples at the same time as the eDNA samples. These water samples were tested for general water quality, to compare water quality in areas with and without Prussian Carp to see if there is a correlation between water quality and Prussian Carp presence.

Description of the Swift Current and Rush Lake Creek Watersheds

The Swift Current Creek watershed is the area of land that drains water into the Swift Current Creek. The creek is 302 kilometers long and begins northeast of Eastend at the foot of the Cypress Hills at an elevation of 1143 meters and empties into the South Saskatchewan River west of Beaver Flat Resort Village at an elevation of 553 meters. The watershed's total drainage area is 5,592 square kilometers. Major municipalities within the watershed include the City of Swift Current and the Town of Shaunavon. The watershed includes tributaries Rock, Jones and Bone Creeks which confluence with the Swift Current Creek approximately twenty kilometers north of Shaunavon ten kilometers west of Highway 37. The watershed also has two lakes, Lac Pelletier and Duncairn Reservoir/Reid Lake which was formed when the creek was dammed by the Duncairn Dam. From the head waters, the creek flows northeast to Duncairn Dam, flowing through the dam it meets the confluence of Pelletier Creek and Lac Pelletier Regional Park. From there it flows through the City of Swift Current, where it is contained by the Swift Current weir near the Water Treatment Plant. The creek then flows through the city, eastward to Waldeck and then north to the South Saskatchewan River.

The Swift Current Creek is formed by spring runoff and ground water springs and flows through agriculture land into urban municipalities and then back into agriculture land. Situated in the semi-arid region of Saskatchewan, water from the creek and its lakes and reservoirs is critical for drinking water supply, irrigation, livestock production and recreation.

Duncairn Dam and the Reservoir it created is a multi-purpose project built by the Prairie Farm Rehabilitation Administration (PFRA) in 1943. Recently ownership and operation of the dam has been transferred from Agriculture and Agri-food Canada (AAFC) to provincial control through Water Security Agency (WSA). The reservoir is 19 meters deep at Full Supply Level and can hold 105,000 $dams^3$ of water. The reservoir was initially built to impound water for irrigation in the area and now provides a dependable supply of water and aids in flood protection for the City of Swift Current. The reservoir has seen increasing recreational uses such as fishing and boating over the last number of years. Lac Pelletier, south of Swift Current is a spring-fed lake that was established as a regional park in 1964. The park includes a nine-hole grass greens golf course, boating, and fishing as the lake is stocked with perch, walleye and northern pike. Development along the shores and near both Duncairn Reservoir and Lac Pelletier has increased over the last ten years.

For watershed planning purposes, the Rush Lake Creek basin has long been included with the Swift Current Creek Watershed, because water can be moved from the Swift Current Creek Watershed if there is not enough water in the Rush Lake Creek Basin for irrigation or for the Town of Herbert to meet its water needs. This water is moved from the Swift Current Creek to Highfield Reservoir south of Rush Lake via the 30-kilometer-long Swift Current Main Canal. Highfield Reservoir holds 14,934 dam^3 of water. Highfield reservoir is on the Rush Lake Creek and runoff into the creek below the dam helps fill the reservoir. There is some irrigation out of Highfield Reservoir and some fishing along the shore. There is no official boat launch or dock. The Herbert Main Canal starts at the north end of Highfield Dam and runs 26 kilometers to the Herbert Reservoir. Water runs twice a year from Highfield Reservoir to replenish water levels at the Herbert Reservoir. The Herbert Reservoir is 2,700 dam^3 in size.

Water is pumped from the Herbert Reservoir to a dug-out north of Herbert to supply water to its Water Treatment Plant. There are 1,667 acres of irrigation that use water from the Herbert Reservoir. The Herbert Reservoir has been stocked with fish and there is some fishing available from the shore as there is no official boat launch or dock. The Herbert Main Canal also provides water to approximately 3,000 acres of border dike irrigated land in the Rush Lake Irrigation project.

As water levels fluctuate at Highfield and Herbert Reservoirs and water is not always flowing in the canals, these maybe areas that Prussian Carp could thrive. Given the ability of Prussian Carp to swim upstream and to quickly reproduce, the SCCWS wanted to look at these areas to determine if Prussian Carp are present and if there are, did they come from the Swift Current Creek, Lac Pelletier and Duncairn or from the irrigation canals and Highfield and Herbert Reservoirs.

Project Methodology

The SCCWS took eDNA and water samples at ten sites throughout the two watersheds. Site selection was based on choosing strategic locations in the watershed, important sites for recreational fishing and easy access for safe sample collection. These sites are a mix of sites used in previous SCCWS monitoring projects and new sites.

Samples Sites

A10

This site has been sampled during several SCCWS monitoring projects and is located between the confluence of the Jones, Bone, Rock and Swift Current Creek and the Duncairn Reservoir. This site provides a good indication of water quality at the start of the creek before it flows through farmland and into the Duncairn Reservoir. The presence of Prussian Carp here would indicate that they are present at the start of the creek upstream of the Duncairn Reservoir.

Duncairn Reservoir/Reed Lake

This lake is formed by the damming of the Swift Current Creek by Duncairn Dam and is the source of water for the City of Swift Current and for much of the irrigation in the two watersheds. It has also become a recreational destination with many permanent and seasonal residential developments around the lake. This area is also a destination for recreational fishing. The SCCWS has not sampled this area in prior monitoring projects. This location was chosen for this project, as the invasion of Prussian Carp would have a significant negative impact on the ecosystem of the reservoir and lake. This would not only impact recreational fishing, but it could also downgrade water quality for the city of Swift Current, irrigation, and livestock watering from the reservoir and downstream from the dam.

Lac Pelletier

Lac Pelletier is a spring fed lake that has become a recreational destination, with boating and fishing being popular. It is also a popular spot for ice fishing in winter. Some water quality sampling was completed in early projects of the SCCWS, but none has been done in the last number of years. Water from the lake can enter the Swift Current Creek via Pelletier Creek if there is a need to let water out of the lake. Other than the Pelletier Creek there is no connection to the Swift Current Creek, so the

presence of Prussian Carp here would indicate that they have been transported to the lake in boating or other equipment.

C50

This site has been sampled in several SCCWS monitoring projects and is just south of the city of Swift Current upstream of the Swift Current Weir at its Water Treatment Plant. The presence of Prussian Carp here would indicate that they are coming from Duncairn Reservoir as they would not be able to pass through the weir if they swam upstream.

D70

This site just north of the City of Swift Current has been sampled in several SCCWS monitoring projects. Water quality at this site is used to determine the impact of the city on water quality downstream in the creek. This was the site that the Prussian Carp was caught in 2017 by the SCCWS.

Aikens Pond

Aikens Pond is a small body of water within the Swift Current Main Canal. The SCCWS has not sampled this area in prior monitoring projects. It is about 10 kilometres from where the water enters the main canal from the Swift Current Creek. Because of its location close to Swift Current and the #1 Highway it is a popular spot for people looking for an accessible place to fish. Aikens pond is about a kilometre away from another waterbody fed by the Swift Current Main Canal where Prussian Carp had been found.

Highfield Reservoir

Highfield Reservoir is formed by the Highfield Dam on the Rush Lake Creek south of Rush Lake and Herbert. This reservoir has been sampled for projects looking at the quality of water for the Town of Herbert and for irrigation. Water from the Rush Lake Creek is augmented with water from the Swift Current Main Canal if needed to meet water demands in the basin. Due to fluctuating water levels and corresponding changes to oxygen available to fish there are not many fish present and therefore there is not a lot of fishing here. The presence of Prussian Carp would indicate that they are moving from the Swift Current Creek via the main canal and that they can survive in less-than-optimal water quality conditions.

Herbert Reservoir

Herbert Reservoir is west of Herbert and fed from Highfield Reservoir via the Herbert Canal. This reservoir has been sampled for projects looking at the quality of water for the Town of Herbert and for irrigation. There is some fishing from the shore here, but again due to fluctuating water levels there are not many fish. This reservoir is an important migration stop for snow geese and other birds, so changes to the ecosystem due to Prussian Carp invasion may have a negative impact on that population.

I80

The I80 site is on the Swift Current Creek halfway between the city of Swift Current and where the creek enters the South Saskatchewan River. This site has been sampled during previous SCCWS water quality studies and has had the lowest water quality of sites sampled. Determining water quality and the possible presence of Prussian Carp eDNA could show the correlation between water quality and

Prussian Carp. It may also provide information about the movement of Prussian Carp from the South Saskatchewan River.

E90

This site has been used in several SCCWS monitoring projects and is the last vehicle accessible spot along the creek before its confluence with the South Saskatchewan River. This spot will determine if Prussian Carp are moving upstream from the South Saskatchewan River.

EDNA Sampling Protocol

EDNA and water sampling was completed 3 times at each of the 10 sites throughout the summer to get sufficient data for both water quality and eDNA testing. This also determined if there were any changes in water quality throughout the summer.

The water to be tested for the presence of Prussian Carp eDNA was collected in the following steps:

- Water was collected from a suitable distance from the shore of the waterbody in a sterile bag.
- Water collected was drawn into a sterile 100-millilitre syringe.
- Water from the syringe was then passed through a filter until the filter clogged and no more water could pass through.
- Any air trapped in the filter was expelled using the syringe.
- A preservative was added, and the filter was capped and prepared for shipping.
- The filters where then shipped to Nature Metrics lab in Guelph, Ontario for eDNA testing.

The water sampling protocol was:

- Water was collected in a sterile 1 Liter container and 2 smaller containers in the same location that the eDNA samples were collected.
- The one-liter bottle was rinsed 3 times before being used to fill the small containers, which were not rinsed as they contain preservative for testing.
- Once the 2 small containers were filled, the 1 Liter container was filled.
- After testing was completed, samples were sent to the SRC Analytical Laboratory for testing for general water quality parameters.

Figure 2. eDNA and Water Sampling supplies

Water Sampling Results and Discussion

The following water quality parameters are those that are important to aquatic wildlife and general water quality within the Swift Current Creek and Rush Lake Creek Watersheds. For this project, the SCCWS looked at changes within the length of the Swift Current Creek, between Lac Pelletier and Duncairn and in the Rush Lake basin. For this project, Aikens Pond was included in the Rush Lake Basin as it is in the system that feeds water to Highfield and Herbert Reservoirs.

Chloride

Chloride is an indicator of increased urbanization in the watershed due to the use of road salts, effluent leaching, and the release of treated water. There are also areas in the two watersheds with saline soils that would lead to increased levels of chloride in the water due to run-off from them. The guideline for the maximum level of chloride in the water for aquatic wildlife is 100 mg/liter. All samples taken at all sites in this project are well below this level. The chloride levels are the same throughout the Swift Current Creek and the Rush Lake Basin. There is no time of year impact on chloride levels except at the Herbert Reservoir which went up to 26 mg/L in August from 9 mg/L in June and 10 mg/L in August. This could be due to water running through saline areas in the Herbert Main Canal when the Reservoir was filled in July or evaporation of water causing an increase in concentration.

Sodium

Sodium is a member of the alkali metals present as NaCl (formula for table salt) and is an essential element for life. Too much sodium can be dangerous as it disrupts processes for life. The guideline for aquatic wildlife and general water quality in Saskatchewan is that concentrations should be less than 100 mg/L. Samples taken at all sites and all times were below this guideline expect for all samples taken at E90 and July and August samples taken at I80.

Concentrations in the Swift Current Creek increase as move north along the creek as dissolved sodium is carried into the creek from underground springs. Concentrations also increase during the summer, likely due to evaporation increasing concentrations. Levels are constant throughout the summer at Lac Pelletier and Duncairn and increase from Aikens Pond to the Herbert Reservoir but stay stable throughout the summer due to water being added to these reservoirs.

Sulfate

Sulfate is a naturally occurring substance containing sulphur and oxygen. It is present in various mineral salts in soils of the watershed. Sources of sulphate in the water include leaching from soil, decaying plant and animal material and sulphur fertilizer. High concentrations in the can be dangerous to livestock and wildlife who drink the water. The guideline for general water quality and for livestock drinking water is concentrations less than 500 mg/liter. All samples taken during this project were below the guideline concentration except for E90 in August.

Sulfate concentrations increase as move north in the Swift Current Creek and increase slightly during the summer. Sulfate concentrations are much higher in Duncairn Reservoir than Lac Pelletier which is probably due to leaching from run-off into the creek and reservoir. Lac Pelletier is a spring fed lake, with little run-off to contribute sulphate to the water. Levels of sulfate stayed static throughout the summer

at both sites. Levels increase from Aikens Pond to Herbert Reservoir in the Rush Lake system, are similar during the three sampling periods in the summer.

Nitrogen

Nitrogen is essential for all organisms as it is an essential building block of protein. Sources of nitrogen include fertilizer, sewage, manure and decaying plant and animal material. Excess rain can cause increased leaching into soils and carry more in run-off into waterbodies. Nitrogen acts a nutrient to aid aquatic plants and algae to grow, increased levels of nitrogen can cause the algae to grow rapidly. As the algae grows and then dies, microorganisms consume the decaying matter, these microorganisms need oxygen to consume the matter which rapidly decreases oxygen levels in the water. This is called eutrophication and could result in the death of fish in the water body.

All nitrogen levels are below what the laboratory can detect except for a few samples, which maybe related to algae blooms or other possible point source contamination at sampling sites.

Total Dissolved Solids

Total Dissolved Solids (TDS) is the concentration of inorganic substances in the water including minerals, salts and metal cations and anions. This includes sodium, magnesium, potassium, bicarbonate, and sulfate. Sources include minerals springs, urban run-off, road salts and water softener salts. Increased TDS levels indicate high levels of salts and minerals in the water and further testing maybe required to determine the salts and minerals that are causing the high levels.

TDS was calculated using 64% of the Specific Conductivity as analyzed by the laboratory. There are several conversion factors to calculate TDS from Specific Conductivity but 64% is the most common factor for areas like our watershed.

The guidelines for concentrations of TDS for general water quality is that they should be below 700 mg/liter. All samples at all sites were below these levels except for all samples taken at E90 and in August at I80.

TDS levels increase as move north along the Swift Current Creek. Levels are the same in June and July but increase a bit in August at all sites. Levels at Lac Pelletier are lower than at Duncairn and are the same throughout the summer. Levels increase from Aikens Pond to the Herbert Reservoir and are the same throughout the summer.

pH

pH is a measure of the acidity or alkalinity of a solution. pH levels affect aquatic organisms by allowing basic regulatory processes such as proper respiratory exchange of gases and salts to function properly to sustain life. Factors that affect pH include agriculture and industrial run-off and wastewater. It can also be affected by carbonate levels in surrounding rocks and minerals.

Optimum pH levels of aquatic wildlife survival are between 6.5 to 8.5. Many of the samples that were taken were higher than 8.5, this includes all samples from Highfield Reservoir, Herbert Reservoir and Lac Pelletier, in July at I80, June and July at C50 and at Duncairn Reservoir in August.

pH levels are generally low at A10, high at C50, lower at D70, increase at I80 and then lower again at I80 as move along the Swift Current Creek, but there are anomalies. pH levels were higher in June, lower in

July and higher in August. Levels were lower at Duncairn Reservoir in June and July than Lac Pelletier but were the same in August. pH levels increase from Aikens Pond to Herbert Reservoir and increase slightly over the summer.

EDNA Testing Results and Discussion

The Nature Metrics Laboratory tests for several different eDNA profiles for fish and other species that may be present in the study area along with testing for Prussian Carp eDNA. The results confirm the presence of many of the fish species that the SCCWS have detected in previous monitoring projects. These species include White Sucker, Lake Chubb, Fathead Minnow, Dace species, Iowa Darter, Yellow Perch, and Walleye. These results confirm healthy populations of aquatic wildlife especially for species important to recreational fishing in the Swift Current Creek and Rush Lake Creek Watersheds.

For reporting purposes. the eDNA for Prussian Carp was combined with that of Goldfish as they have too similar of a DNA profile to separate during laboratory procedures. This eDNA was present at sites D70, E80 and I90 which is the area north of the City of Swift Current to the confluence of the Swift Current Creek with the South Saskatchewan River. At site D70 which is just north of the City of Swift Current, the eDNA was detected in all 3 samples taken and represents between 1 to 3.5% of all the eDNA found at this site. At E90 which is the site just south of the confluence of the Swift Current Creek and South Saskatchewan River, the eDNA was detected in 2 samples and was between approximately 0.1% and 2% of all the eDNA found at that site. At I80, the eDNA was detected in 2 samples and represented between 0.16% and 0.34% of all the DNA found at that site.

The actual results are contained in Appendix A and B of this report.

These results confirm that Prussian Carp is present in the Swift Current Creek but is confined to an approximately 50-kilometre section of the creek between the City of Swift Current and the South Saskatchewan River. This may show that the Prussian Carp are swimming upstream from the South Saskatchewan River as has been suggested by some biologists who are studying Prussian Carp. The Prussian Carp have not gotten further downstream possibly because their migration is stopped by the CPR Wier and City Weir by the Swift Current Water Treatment Plant.

Another explanation for the presence of Prussian Carp that has been put forward is that migratory waterfowl such as ducks and geese could transport the eggs of species such as Prussian Carp. A study published in June 2020 showed that Prussian Carp eggs could still be viable after being ingested and excreted by ducks. Given the fact that fish roe can be a source of protein and lipids for these birds, they are likely to eat them and there is a good chance that they maybe helping the Prussian Carp to expand their range (*Experimental evidence of dispersal of cyprinid eggs inside migratory waterfowl*, Adam Lovas-Kiss, et al, Acad Sci Proc Natl USA June 22,2022). This maybe an explanation for the results that were found, however given the numbers of waterfowl in the Swift Current Creek and Rush Lake Creek Watersheds, we should see a greater distribution of Prussian Carp throughout the two watersheds.

As the eDNA for both Goldfish and Prussian Carp were reported together, another explanation for the results that were generated is that the eDNA that was detected was primarily goldfish rather than Prussian Carp. This area is downstream of the City of Swift Current and the eDNA detected could be from goldfish that were improperly disposed of either directly into the creek or through the Swift Current sewer system and the Wastewater Treatment Plant. A simple Google search of invasive Goldfish

shows many examples of Goldfish that are released into the wild creating a negative impact like or possibly worse than Prussian Carp, so it is important to determine the extent of this introduced, invasive species as well.

Figure 3. Adult goldfish

The results show that the presence of Prussian Carp and invasive Goldfish has yet to have a negative impact on native aquatic species in the Swift Current Creek and other waterbodies in the two watersheds. The eDNA and water quality results are inconclusive on how Prussian Carp impacts water quality and how water quality impacts the presence of Prussian Carp.

Conclusions

The presence of Prussian Carp in the Swift Current Creek was confirmed with the results of the eDNA testing, but the presence is confined to the area of the creek between the City of Swift Current and the South Saskatchewan River. The results also show that water quality has not yet been impacted by Prussian Carp presence and that degraded water quality and habitat have not increased the presence of Prussian Carp in the Swift Current Creek and Rush Lake Creek Watersheds. The results also show that the ecosystem with native fish is still functioning and that there are still many opportunities for recreational fishing in the two watersheds.

Recommendations

Further testing in the area where the Prussian Carp/Goldfish eDNA was detected should be undertaken. This includes expanding the study area to include the Swift Current Creek from the City Weir at the south end of the city to the confluence of the South Saskatchewan River. This monitoring should also include the netting of fish in these areas to do species counts to confirm the eDNA results, further understand the fish species composition in these areas and if live Prussian Carp/Goldfish are present and their numbers in this area.

Education about Prussian Carp, how to identify and what to do with them if they are caught needs to continue. Education about the release of goldfish and other fish into the creek and their impact on native fish species and the watershed needs to be started. This education can be done by the Swift Current Creek Watershed through its newsletters, social media, newspaper articles and its youth education program, Froghoppers.

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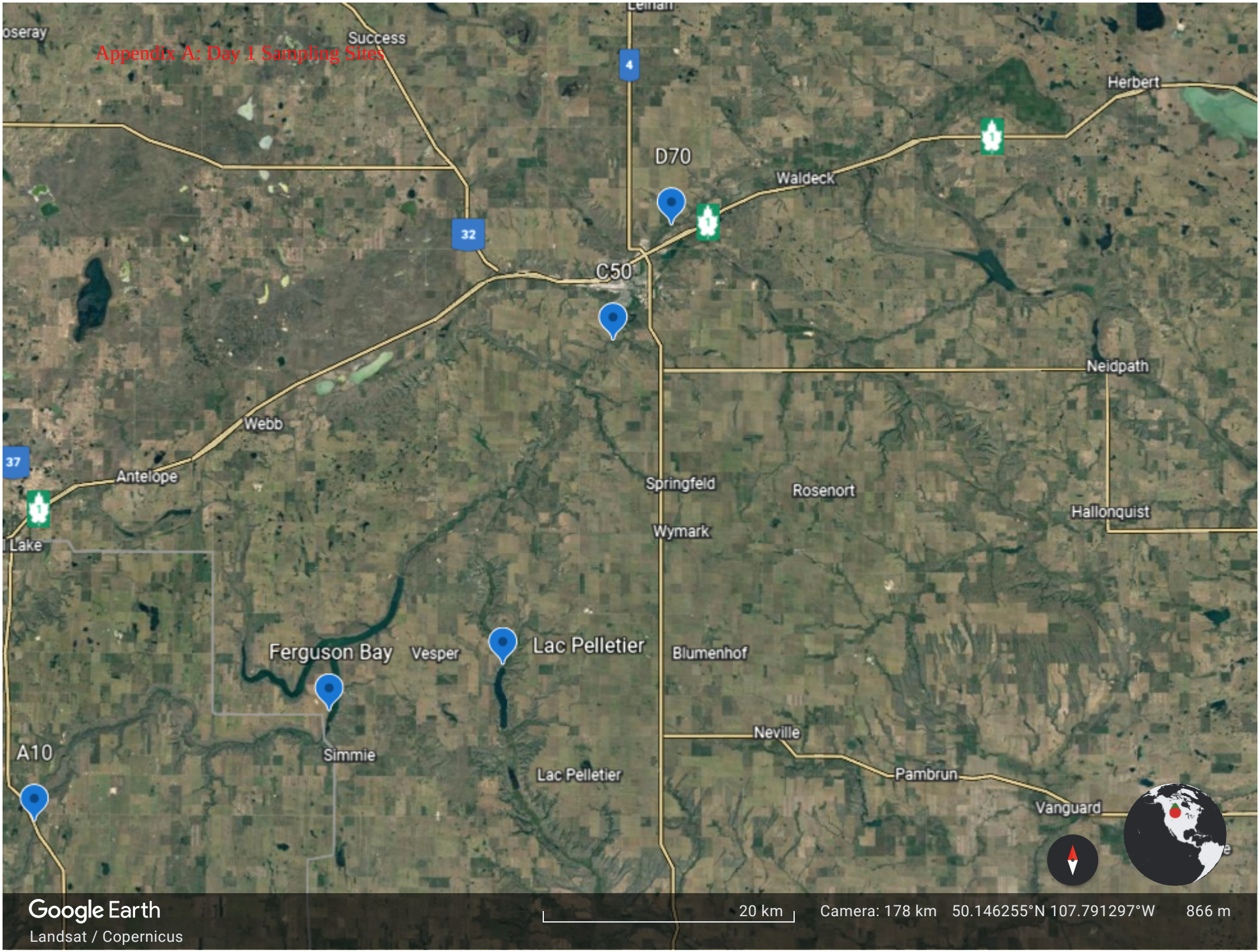
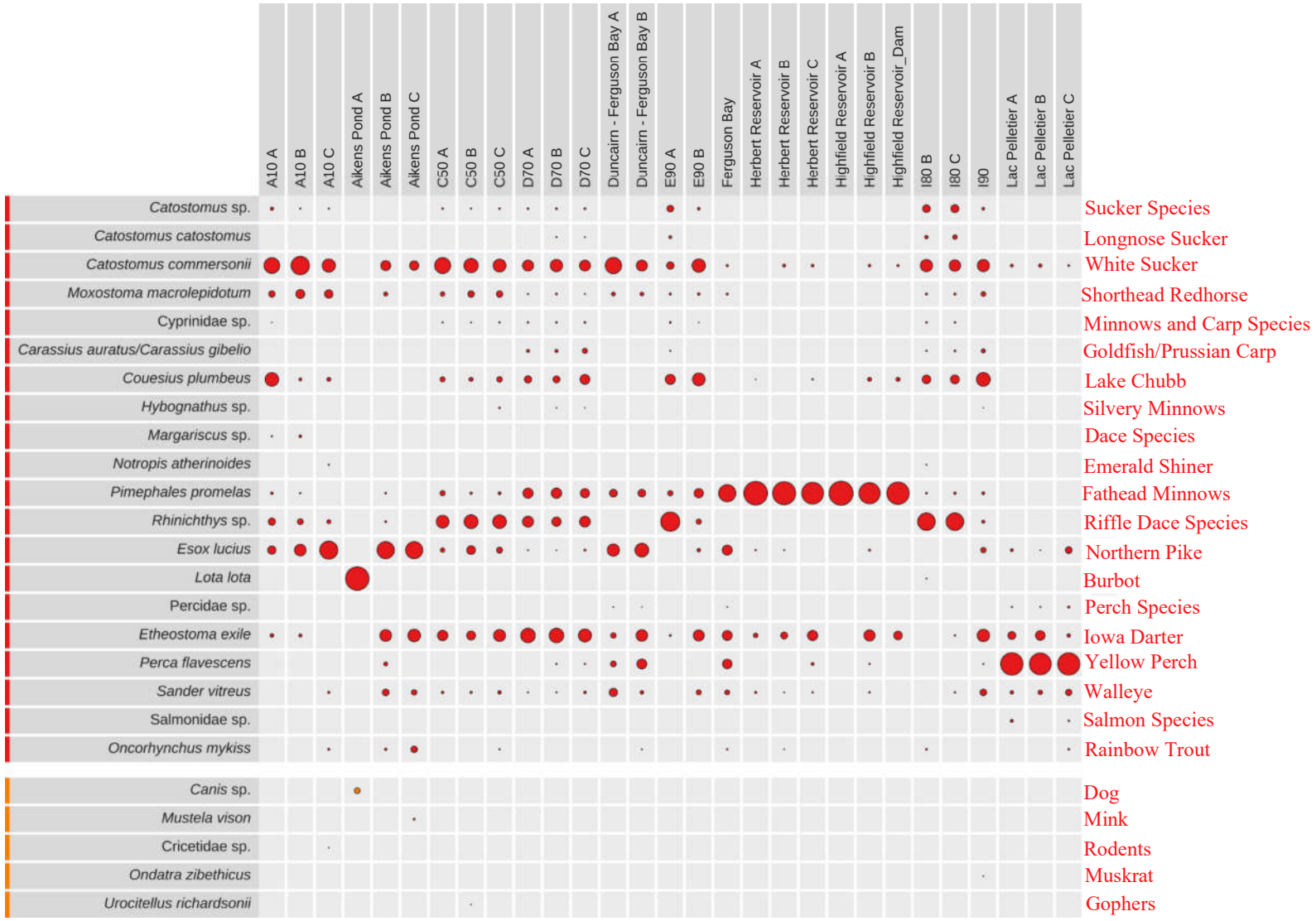
- SRC Analytical Lab for completing the water quality testing.
- Matty Hagman, SCCWS Summer Stewardship Coordinator for completing the sampling and entering data.


Appendix A: Day 1 Sampling Sites
Success
Herbert
D70
Waldeck
C50
Neidpath
Webb
Antelope
Springfeld
Rosenort
Hallonquist
Wymark
Lake
Ferguson Bay
Vesper
Lac Pelletier
Blumenhof
A10
Simmie
Neville
Pambrun
Vanguard
Google Earth
Landsat / Copernicus
20 km
Camera: 178 km 50.146255°N 107.791297°W 866 m


Appendix B;Day 2 Sampling Sites
Matador
Log Valley
I 90
Gouldtown
Aquadell
Glen Kerr
Main Centre
Prairie View
Leinan
Herbert Reservoir
E80
Herbert
Morse
Aikens
Waldeck
Highfield
Swift Current
Flowing Well
Google Earth
Landsat / Copernicus
10 km
Camera: 147 km 50.535035°N 107.324657°W 772 m

Appendix C: eDNA Sampling Results



Appendix D: Water Quality Sampling Results

Sample Date	Sample Site I.D	Sample I.D #	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Hydroxide (mg/L)	P. Alkalinity (mg/L)	pH (pH units)	Specific conductivity (uS/cm)	Sum of Ions (mg/L)	Total alkalinity (mg/L)	Total hardness (mg/L)	Nitrate (mg/L)	Fluoride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Sulfate (mg/L)	Iron (mg/L)	Manganese (mg/L)	TDS (mg/L) (0.64 of conductivity)
06/22/2022	Aikens Pond	24786	261	<1	7	<1	<1	8.17	848	658	214	329	<0.04	0.23	71	37	9.8	52	220	0.16	0.074	543
07/19/2022	Aikens Pond	28571	251	<1	6	<1	<1	7.74	786	659	206	309	0.10	0.23	63	37	11	51	240	0.16	0.930	503
08/10/2022	Aikens Pond	31365	246	7	6	<1	6	8.43	825	635	214	318	<0.04	0.21	68	36	9.8	52	210	0.059	0.073	528
06/22/2022	E90	247787	279	10	14	<1	8	8.50	1150	890	245	399	<0.04	0.26	76	51	10	100	350	0.13	0.025	736
07/19/2022	E90	28572	287	<1	14	<1	<1	8.10	1200	967	235	448	<0.04	0.26	84	58	10	104	410	0.29	0.300	768
08/10/2022	E90	31366	331	5	15	<1	4	8.36	1490	1180	279	540	<0.04	0.27	98	72	11	130	520	0.3	0.170	953
06/22/2022	Highfield	24788	215	16	9	<1	13	8.69	924	720	202	330	23.00	0.23	60	44	13	70	270	1.7	0.260	591
07/20/2022	Highfield	28575	167	23	8	<1	19	8.79	867	660	175	309	0.26	0.23	53	43	14	72	280	0.14	0.210	555
08/10/2022	Highfield	31367	126	58	8	<1	48	9.02	923	671	199	320	<0.04	0.24	56	44	14	75	290	0.26	0.094	591
06/22/2022	Herbert Res.	24784	217	31	10	<1	26	8.89	1010	755	230	342	<0.04	0.25	53	51	19	84	290	0.093	0.059	646
07/19/2022	Herbert Res.	28573	144	42	9	<1	35	9.05	909	669	188	322	<0.04	0.25	50	48	16	80	280	0.079	0.040	582
08/10/2022	Herbert Res.	31368	128	59	26	<1	49	9.24	934	685	203	320	<0.4	0.24	51	47	16	78	280	0.19	0.063	598
06/22/2022	I80	24785	300	<1	12	<1	<1	8.24	1080	841	246	403	<0.04	0.26	81	49	10	79	310	2.4	0.460	691
07/19/2022	I80	28574	205	35	13	<1	29	8.57	1090	834	226	340	<0.04	0.24	62	45	10	114	350	0.26	0.033	697
08/10/2022	I80	31369	262	8	17	<1	7	8.49	1420	1070	229	419	<0.04	0.27	64	63	11	152	490	0.15	0.014	909
06/27/2022	A10	25355	381	8	7	<1	7	8.44	944	774	326	318	<0.04	0.24	70	35	4.1	89	180	0.3	0.100	604
07/21/2022	A10	28783	368	<1	4	<1	<1	8.14	788	663	302	330	<0.04	0.25	73	36	4.3	48	130	0.21	0.140	504
08/11/2022	A10	31371	356	<1	5	<1	<1	8.24	898	741	292	365	<0.04	0.26	74	44	5.1	57	200	0.28	0.230	575
06/27/2022	C50	25356	224	16	6	<1	13	8.66	816	619	210	318	<0.04	0.22	68	36	9.3	50	210	0.17	0.140	522
07/2/2022	C50	28784	248	5	6	<1	4	8.40	803	622	211	315	<0.04	0.22	67	36	9.7	50	200	0.14	0.180	514
08/11/2022	C50	31372	252	10	6	<1	8	8.52	810	642	223	315	<0.04	0.21	67	36	9.5	51	210	0.2	0.150	518
06/27/2022	Lac Pelletier	25357	361	25	9	<1	21	8.65	726	604	338	302	0.19	0.53	29	56	14	41	69	0.024	0.018	464
07/21/2022	Lac Pelletier	28785	327	38	8	<1	32	8.77	695	575	332	295	<0.04	0.53	26	56	14	41	65	0.02	0.028	445
08/11/2022	Lac Pelletier	31373	332	34	8	<1	28	8.72	705	574	328	295	<0.04	0.54	26	56	14	40	64	0.029	0.036	451
06/27/2022	Duncairn	25358	256	8	6	<1	7	8.47	794	615	224	308	<0.04	0.21	66	35	7.8	46	190	0.049	0.054	508
07/21/2022	Duncairn	28786	249	6	6	<1	5	8.42	789	621	214	303	<0.04	0.2	62	36	7.8	54	200	0.04	0.077	505
08/11/2022	Duncairn	31374	207	22	6	<1	18	8.72	785	594	206	298	<0.04	0.21	60	36	8.5	54	200	0.063	0.064	502
06/27/2022	D70	25359	268	4	9	<1	3	8.36	902	698	226	339	<0.04	0.25	70	40	9.5	58	240	0.094	0.180	577
07/21/2022	D70	28787	255	<1	10	<1	<1	8.23	870	669	209	328	0.46	0.24	64	41	9.6	59	230	0.11	0.160	557
08/11/2022	D70	31375	273	1	11	<1	1	8.33	948	735	226	355	<0.04	0.24	70	44	10	66	260	0.1	0.140	607