Alberta Conservation Association

2019/20 Project Summary Report

Project Name: Using eDNA to document the distribution of Prussian carp in Alberta

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Partnerships

Alberta Environment and Parks

University of Alberta – Dr. Mark Poesch, Fisheries and Aquatic Conservation Lab

Key Findings

- Of the 15 sites retested for Prussian carp eDNA signal due to inconclusive results from 2018, three sites tested positive while 11 tested negative; samples from one site in the Beaver River remained inhibited as in 2018.
- Positive signals for Prussian carp were detected in the South Saskatchewan, Red Deer, and Bow river systems in 2019 but not in the North Saskatchewan River. These results align with currently known spatial distributions of Prussian carp in the province.
- Overall, results indicate presence of Prussian carp in the Bow, Red Deer, Oldman, and South Saskatchewan River drainages but not in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky Rivers.

Abstract

Prussian carp is a recent invasive fish species to Alberta, now believed to be widely distributed in the Bow, Red Deer, and South Saskatchewan River drainages. Initial surveys suggest their population and range is expanding exponentially across the province; however, the degree to

which the range of Prussian carp has expanded remains unclear. In 2018, ACA used environmental DNA (eDNA) to determine the distribution of Prussian carp in Alberta. However, lab results from 15 of the 83 sites we sampled were inconclusive either due to sample contamination or inhibition. In the summer of 2019, we revisited these 15 sites to collect a second eDNA sample for lab analysis. Of the 15 sites retested for Prussian carp DNA signal, three sites tested positive while 11 tested negative; samples from one site in the Beaver River remained inhibited as in 2018. Positive signals for Prussian carp were detected in the South Saskatchewan, Red Deer, and Bow river systems but not from the North Saskatchewan River. These results align with currently known spatial distributions of Prussian carp in the province. Overall, our data indicates presence of Prussian carp in the Bow, Red Deer, Oldman, and South Saskatchewan River drainages but not in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky Rivers.

Introduction

Prussian carp (C*arassius gibelio*) is a recent invasive fish species to Alberta, confirmed in 2006 through the use of DNA (Elgin et al. 2014) and now believed to be widely distributed in the Bow, Red Deer, and South Saskatchewan River drainages (Docherty et al. 2017). Prussian carp is an aggressive invasive species that can dominate aquatic ecosystems. They can spawn up to three times per year, reproduce asexually, tolerate low dissolved oxygen levels, and have a highly unspecialized, omnivorous diet (Balik 2003, Lamatsch and Stock 2009). Initial surveys suggest their population and range is expanding exponentially (Docherty et al. 2017) across the province. However, the degree to which the range of Prussian carp has expanded remains unclear. Improved knowledge on this invasive species will help inform decisions on how to manage and protect our aquatic ecosystems going forward.

In 2018, Alberta Conservation Association (ACA) began a multi-year project to determine the distribution of Prussian carp across the province of Alberta. In our first year, and in collaboration with Dr. Mark Poesch (Fisheries and Aquatic Conservation Lab, University of Alberta), we used environmental DNA (eDNA) to determine the distribution of Prussian carp. However, lab results from 15 of the 83 sites we sampled were inconclusive either due to sample contamination or

inhibition. In the summer of 2019, we revisited these 15 sites to collect a second eDNA sample for lab analysis.

Methods

From May through August 2019, we collected eDNA samples from 15 sites following protocols established by Laramie et al. 2015 and Carim et al. 2016. At each site, three replicate samples and one control were taken. A sterilized filter cup (0.45µm pore size) was attached to silicone tubing, loaded through a peristaltic pump, and submersed in the water. Once 1,000 ml of water was filtered, the filter was removed from the cup using forceps and placed into a labelled vial filled with anhydrous ethanol. Between replicate samples, forceps were disinfected with a 50% bleach solution and rinsed twice in distilled water. For the control sample, distilled water was passed through a filter to test for contamination from the filter cups or forceps. After eDNA collection was completed, we recorded temperature, dissolved oxygen, conductivity, pH, and total dissolved solids. Between sites, equipment was treated with 50% bleach solution. All samples were processed at the Department of Biological Sciences Molecular Biology Service Unit at the University of Alberta.

Results

Of the 15 sites retested for Prussian carp eDNA signal, three sites tested positive while 11 tested negative; samples from one site in the Beaver River remained inhibited as in 2018 (Table 1). Positive signals for Prussian carp were detected in the South Saskatchewan, Red Deer, and Bow river systems; all three sites retested from the North Saskatchewan River were negative. These results align with currently known spatial distributions of Prussian carp in the province, which indicate presence of Prussian carp in the Bow, Red Deer, Oldman, and South Saskatchewan River drainages but not in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky Rivers (Figure 1).

Table 1. Detection of Prussian carp eDNA signal at 15 sites from various waterbodies retested in 2019 due to inconclusive results from 2018; plus (+) and minus (-) signs indicate presence and absence of eDNA signal, respectively.

Site ID	Waterbody	Prussian carp eDNA detection	
		2018	2019
2	South Saskatchewan River mainstem	inhibited	+
57	Red Deer River mainstem	contaminated	+
47	Carlsland Canal (Bow River watershed)	inhibited	+
1	South Saskatchewan River mainstem	inhibited	-
8	Bow River mainstem	inhibited	-
25	Red Deer River mainstem	contaminated	-
30	Jumping Pound Creek	contaminated	-
42	North Saskatchewan River mainstem	inhibited	-
43	North Saskatchewan River mainstem	inhibited	-
44	North Saskatchewan River mainstem	inhibited	-
67	Beaver River	inhibited	-
70	Athabasca River	inhibited	-
88	Peace River	inhibited	-
72	Athabasca River	inhibited	-
66	Beaver River	inhibited	inhibited

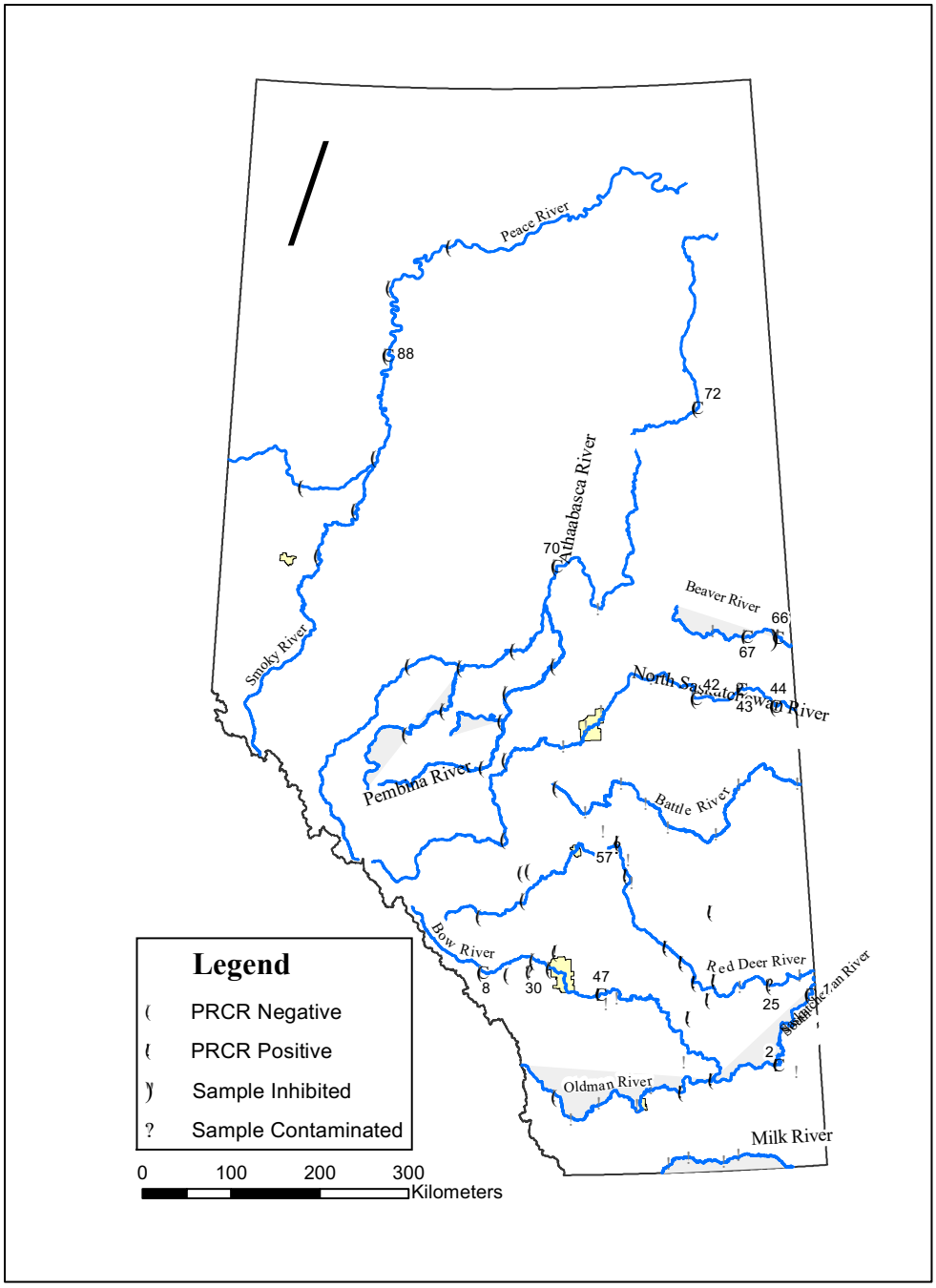

Figure 1. Distribution of 83 sampled sites and results of Prussian carp eDNA from 2018 and 2019; numbers are Site IDs for the 15 sites re-sampled in 2019.

Conclusion

In 2019, we detected positive eDNA signals for Prussian carp in the South Saskatchewan, Red Deer, and Bow river systems but not in the North Saskatchewan River. These results align with currently known spatial distributions of Prussian carp in the province, genetically confirming drainages previously identified as Prussian carp positive. Overall, our data indicates presence of Prussian carp in the Bow, Red Deer, Oldman, and South Saskatchewan River drainages but not in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky Rivers.

Literature Cited

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Photos

Prussian carp captured from Dewitt's Pond. Photo: Kevin Fitzsimmons

ACA summer seasonal staff member, Jamie Card, filtering distilled water control sample. Photo: Britt Schmidt