

Alberta Conservation Association
2018/19 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

- Collected eDNA samples from 83 sites distributed over major watersheds throughout the province and tested them for the presence of Prussian carp.
- Detected Prussian carp DNA at 12 of 83 sampled sites, genetically confirming the presence of Prussian carp in the Red Deer, Bow, Oldman, and South Saskatchewan river drainages.
- Found no evidence of Prussian carp DNA in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky rivers.
- Results expand the known range of Prussian carp within the province and provide baseline data for areas where they have not yet spread.

Introduction

Prussian carp (*Carassius 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). Invasive species are one of the greatest ecological and economical threats to aquatic ecosystems (Sala *et al.* 2000); therefore, the presence of Prussian carp in Alberta is of considerable concern.

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, Ruppert *et al.* 2017, Şaşı 2008). Furthermore, they are easily mistaken for goldfish (*Carassius auratus*) based on body characteristics alone, which can lead to delayed detection and reporting (Ruppert *et al.* 2017). Initial surveys suggest their population and range is expanding exponentially (Docherty *et al.* 2017) across the province and may be having a negative impact on native fish and invertebrates (Ruppert *et al.* 2017). However, the degree to which the range of Prussian carp has expanded, and scope of their potential impacts 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, ACA began a multi-year project to determine: 1) the distribution of Prussian carp in Alberta; 2) their population demographics; 3) habitat characteristics associated with, or, that predict their presence; and 4) their potential to impact native species. 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 in Alberta. Our results will help contribute to the knowledge and information needed to develop effective control and management plans for this invasive species.

Methods

We collected eDNA samples from 83 sites distributed over major watersheds and irrigation canals throughout the province (Figure 1) 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

We surveyed 83 sites, covering 13 major rivers in the province as well as some major tributaries and irrigation canals. Of the 83 sites sampled, 12 tested positive for Prussian carp DNA (Figure 1 and 2), indicating their presence in the Bow, Red Deer, Oldman, and South Saskatchewan River drainages. We found no evidence of Prussian carp DNA in the Athabasca, Battle, Beaver, McLeod, Milk, North Saskatchewan, Peace, Pembina, or Smoky Rivers. We had three sites that were contaminated and 12 sites where DNA amplification was inhibited during lab analysis; therefore, results from these sites are inconclusive and will be resampled in 2019.

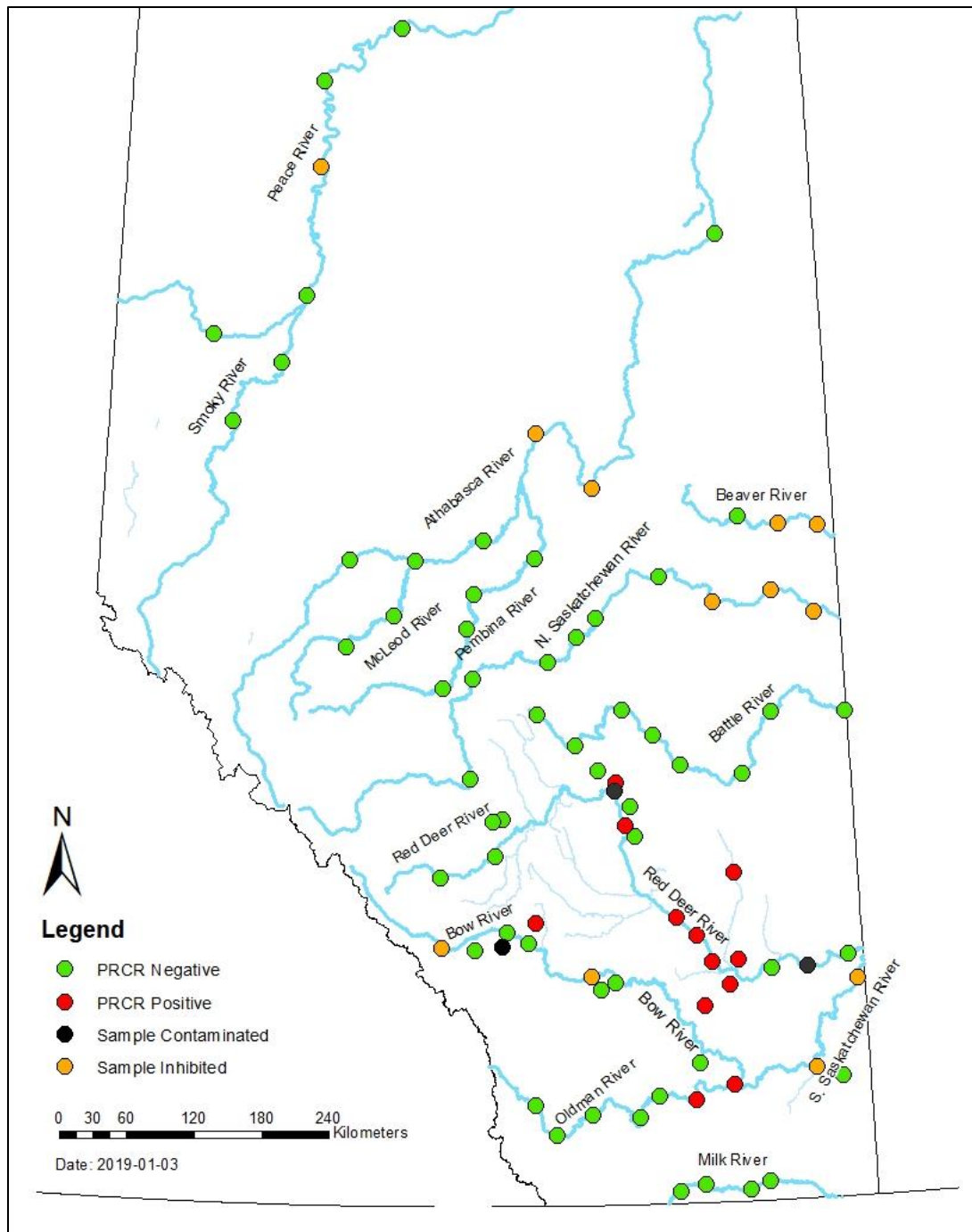


Figure 1. Distribution of 83 sampled sites and results of lab analysis for Prussian carp (PRCR) DNA.

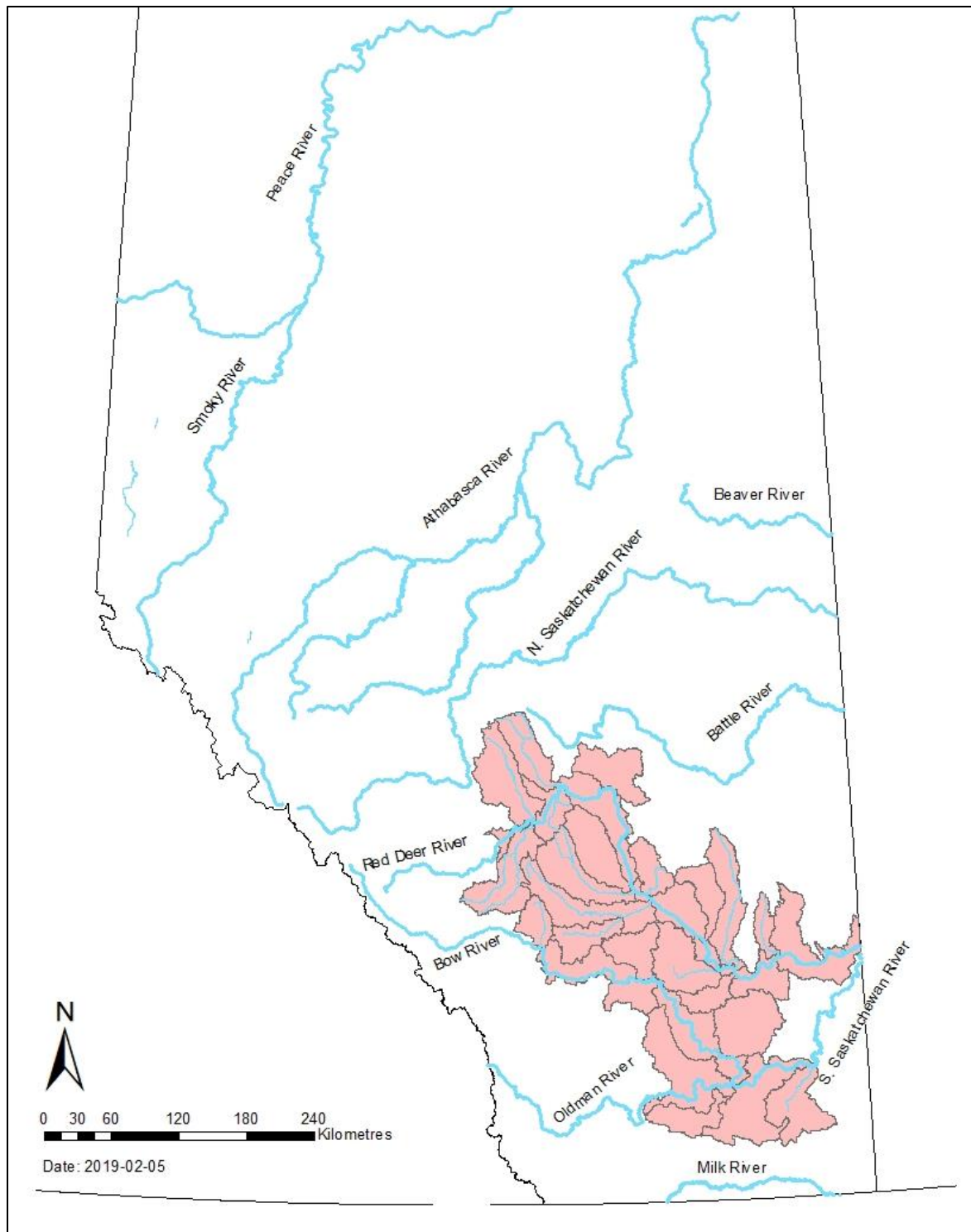


Figure 2. Current distribution of Prussian carp in Alberta as of summer 2018, represented by shaded level 8 hydrological units.

Conclusion

Our results provide genetic evidence that areas that had previously been reported as having Prussian carp are indeed positive with this species rather than a close looking relative like goldfish. Additionally, our results help fill in gaps and expand the known range of Prussian carp. Furthermore, they provide a 2018 baseline in areas where we sampled but did not detect Prussian carp DNA, offering further evidence that Prussian carp have not spread beyond known positive drainages into other major mainstems in the province.

Communications

- Recorded *YourForest* podcast with Matthew Kristoff.
- Segment on *Let's Go Outdoors* with Michael Short.
- University of Alberta *Renew* newsletter article.
- Presented results at the 2019 Great Plains Fishery Workers Association Workshop in Lethbridge, AB.
- Presented results at the 2019 Alberta Fish & Game Association Annual Conference in Calgary, AB.

Literature Cited

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Photos



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



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