

# Battling the Perfect Invader: Overview of Efforts to Control Prussian Carp (*Carassius gibelio*) in City of Calgary Stormwater Ponds



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## 2023 Distribution of Prussian Carp (Alberta and Global)

- Prussian carp are thought to have been introduced to Alberta in the Red Deer River around 2000.
- 2012 fisheries survey found only occasional Prussian carp in the Red Deer River.
- By 2019, survey found they were abundant all the way to the SK border (only 7 years).
- Distribution in Alberta has been doubling every 5 years.
- Known to be present in the Bow River, Nose Creek and WID canal.

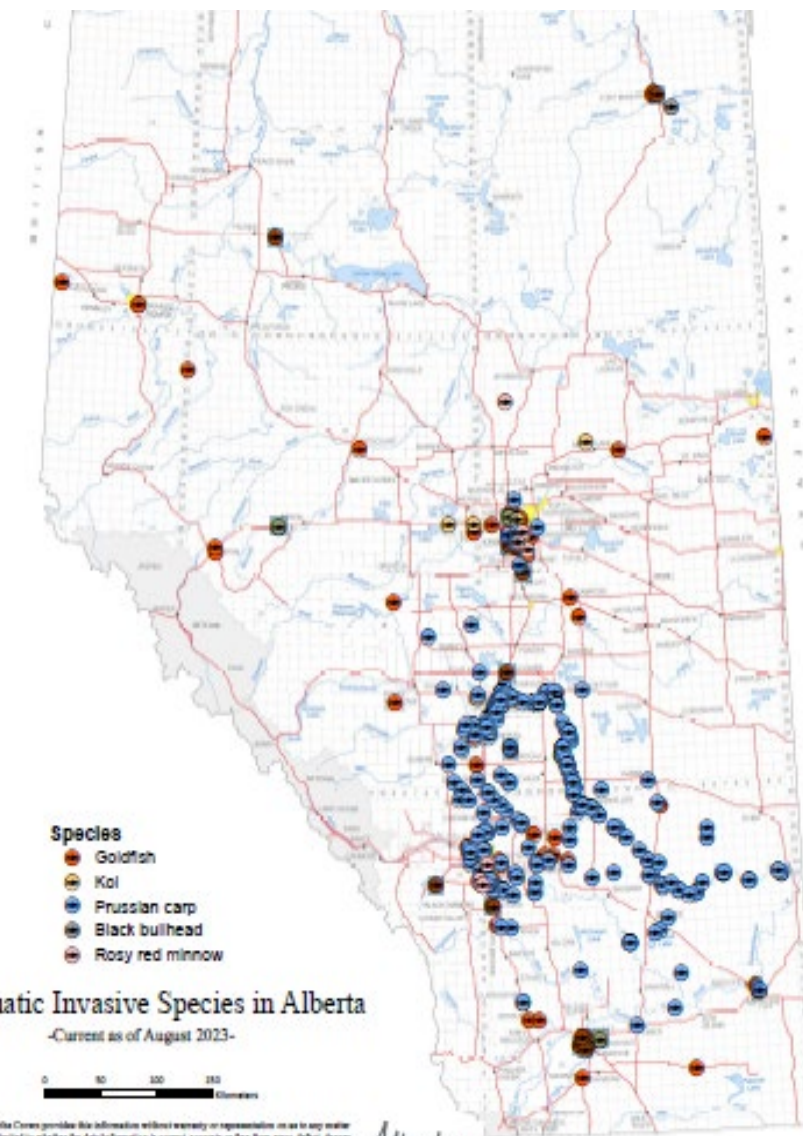


Figure 1. Known global distribution of *Carassius gibelio*. Map from GBIF Secretariat (2019).

## Addressing the Human Factor in the Rapid Spread in Distribution

- Recent changes to the Calgary Stormwater Bylaw (37M2005) prohibit fishing in storm ponds because of safety concerns (including that the fish are not considered safe to eat).
- Because of concerns about citizens transporting invasive fish and other species between storm ponds, changes were also made to prohibit this activity.
- Awareness presentations provided opportunistically to outdoor and community groups, schools, etc.
- Considering expanded awareness campaign through partnerships with AEPA, AISC, ISC, others.



## Acknowledgements

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- Nicole Kimmel, AEPA Invasive Species Team
- Jason Cooper, AEPA Fish and Wildlife Division

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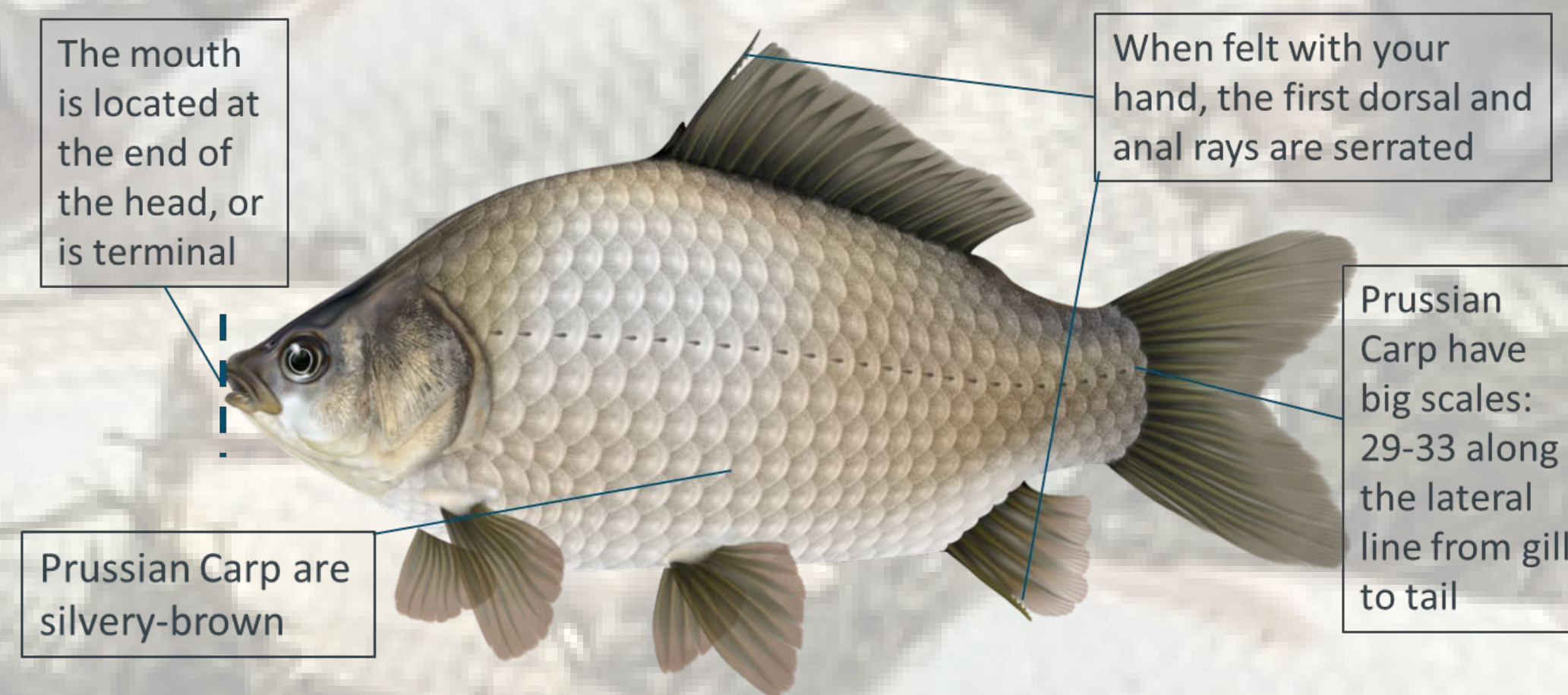
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## Life History Traits of Prussian Carp

- Potential for rapid population growth
  - Multiple spawning events in a season (April- August)
  - 1000's of eggs
  - Mature at 1-2 years old
  - Live up to 10 years
  - Females can reproduce by gynogenesis
- Very tolerant of low oxygen and other poor water quality conditions.



## Potential Impacts of Prussian Carp in Alberta

- In the eastern hemisphere, Prussian carp is considered one of the most harmful non-native fish species:
  - Aggressively colonize new habitats and become dominant, displacing native species.
  - Degrade and alter non-flowing water habitats by disturbing sediment ("bioturbation").
  - Omnivorous diet.
  - Rapid population growth by unique ability to reproduce asexually through gynogenesis.
- Impacts have been studied in the Red Deer River and in reservoirs in Alberta (e.g., Blood Indian Reservoir) by the UoFA and AEPA:
  - Prussian carp displace native forage fish (like sticklebacks and fathead minnows) and important gamefish (such as trout).
  - Cause declines in water quality (e.g, turbidity) by disturbing the bottom.
  - Significantly impact invertebrate and amphibian species (such as frogs and salamanders) because they are opportunistic omnivorous feeders.

## Assessment of Control Options

- Dewatering and freezing (may combine with dredging)
- Rotene
- Physical Barriers
- Water Quality Manipulation
- Use of Natural Predators and Biocontrols
- Behavioural Barriers
- Manual Removal

## Results of Pilot Studies

### Winter 2022-2023 – 2 Ponds

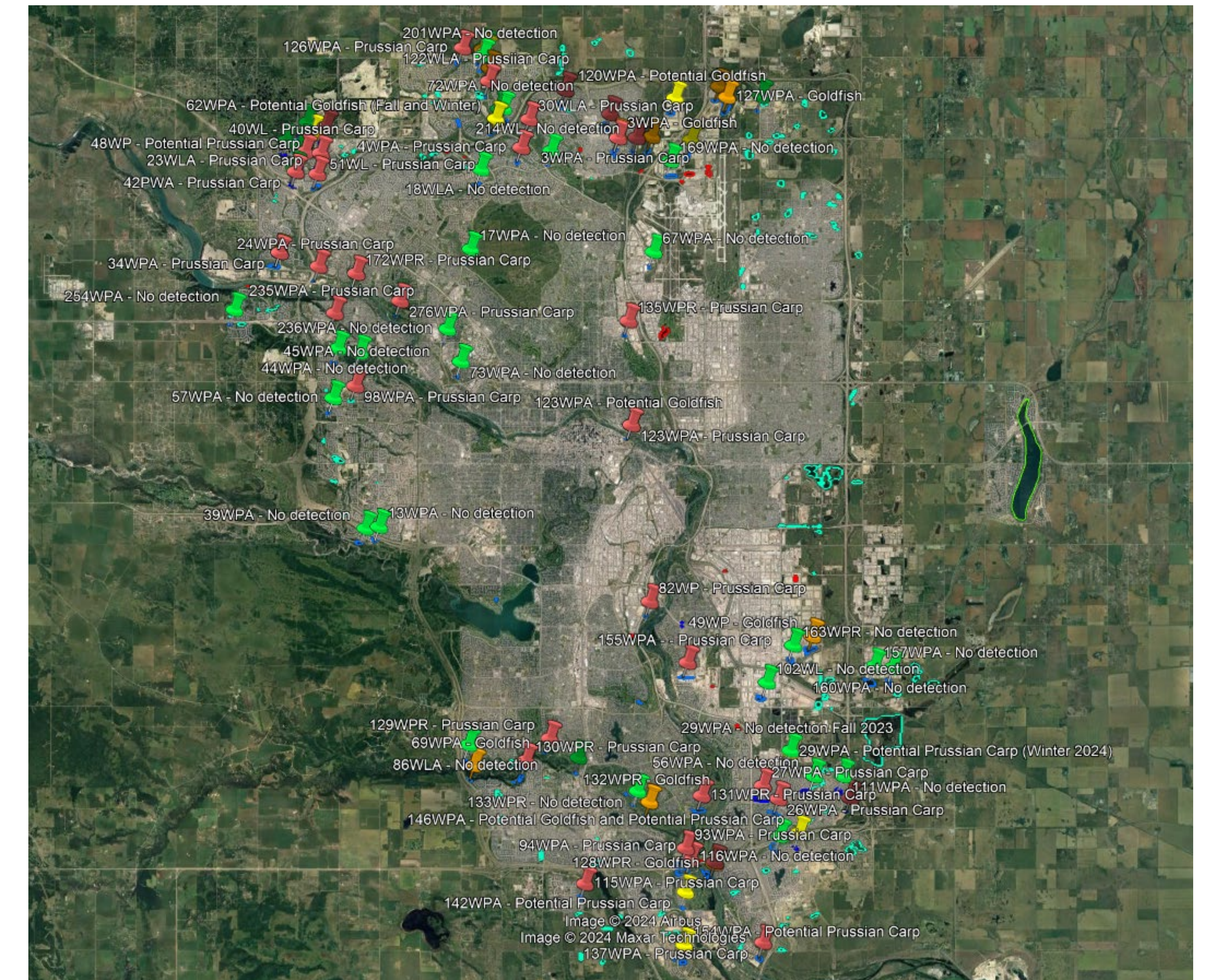
Species	Tanglewood Wetlands		Edgemont Wetland	
	Before Treatment	After Treatment	Before Treatment	After Treatment
Prussian carp	536	348	7810	0
All fish (Prussian carp and native species)	18282	3357	7810	6

## Learnings - 2022 to 2024

- Pilot studies suggest dewatering and freezing is an effective eradication method if done correctly.
- Major challenge is keeping stormwater pond dewatered through a Calgary winter – can be done but requires consistent monitoring and pumping.
- Pilot study on Prussian carp movement confirm all life stages (eggs through adult) will move between stormponds.
- Coincidental observation: Evidence of Prussian carp winter kills in two stormponds in spring 2023 suggest the species may not be as tolerant to low oxygen as thought.

## 2024 Distribution of Prussian Carp in Calgary (determined by eDNA analysis)

- 2016 survey found invasive carp in 12 of 28 ponds (43%)
- Based on 311 records of fishing in ponds, distribution seems to be increasing
- Developing use of eDNA as a screening tool for detection of Prussian carp and goldfish in collaboration with U of A and others (see map to the right).
- Evidence suggests there is a "human factor" contributing to spread in Calgary.
- Stormwater ponds could be an ideal habitat for spawning and rearing Prussian carp that then enter the Bow River watershed.
- Prussian carp appear to be more common in Calgary stormwater ponds than the closely related goldfish.



## Map Legend

- Red pins = positive Prussian carp detection.
- Orange pins = positive goldfish detection.
- Yellow pins = potential goldfish or Prussian carp.
- Green pins = no detection of invasive carp.
- Ponds outlined in blue have been sampled.
- Ponds outlined in red had accessibility issues, will be sampled in current round.
- Ponds outlined in green have not yet been sampled.



Prussian Carp (*Carassius gibelio*)



Goldfish (*Carassius auratus*)



Winter 2023-2024 – 3 Ponds

## Gaps and Potential Next Steps

### Province-wide:

- Targeted education and enforcement programs to reduce "human factor" in rapid spread.
- Need a forum for sharing findings amongst AEPA, municipalities and other partners.
- Continue to refine eDNA methods to track changes in distribution
- Need a better understanding of the biology of invasive carp in Alberta through research partnerships:
  - fish movement (eggs, young, adults),
  - population dynamics/food web (what they eat, what eats them),
  - environmental tolerances.

### Calgary:

- Focus control efforts on high-risk "end sequence" stormwater ponds (last pond in a sequence before connection to the river).
- Need to operationalize control methods that are effective into existing/augmented stormwater pond maintenance program for sustainability.
- Long-term wish list: develop and implement design specs for new ponds and pond retrofits to enable control of invasive species including carp (e.g., ease of dewatering, winter flow bypass, outlet structures)