Alberta Conservation Association

2020/21 Project Summary Report

Project Name: ACA Fish Stocking Pond Rehabilitation

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Partnerships:

Alberta Environment and Parks

Key Findings

- Baseline water quality data collected from six ACA stocked ponds will be used in a before/after, control/impact study design to determine if alum can improve overwintering potential.
- A pilot test for alum treatment indicates a 25 mL of alum per liter of pond water maintained favourable water quality for fish and invertebrate survival (pH of 7.5, alkalinity of 72 mg/L) while significantly reducing total phosphorus (85% reduction).
- All six ponds sampled for baseline water quality data had high total phosphorus concentrations with four ponds (Rainbow Park Pond, Daysland Pond, Heritage Lake, and Lamont Pond) being hypereutrophic and the other two ponds (Innisfree Trout Pond and Pleasure Island Fish Pond) being eutrophic.

Abstract

Fishing pressure at ACA stocked ponds can exceed 2,000 h/ha in the summer months, indicating these ponds can be popular among anglers. However, some ACA ponds may not be capable of supporting trout survival beyond mid-summer due to low dissolved oxygen (DO). Furthermore, these ponds will not overwinter trout. Six ponds, sampled for baseline water quality data, had high total phosphorus concentrations, with four of six ponds being hypereutrophic: Rainbow Park Pond (114 ± 45 µg/L), Daysland Pond (268 ± 36 µg/L), Heritage Lake (334 ± 173 µg/L), and Lamont Pond (116 ± 84 µg/L). The remaining two ponds were eutrophic: Innisfree Trout Pond (98 ± 21 µg/L) and Pleasure Island Fish Pond (91 ± 53) µg/L. Alum treatment will reduce bioavailable phosphorus, thereby improving water quality and DO concentration. Rainbow Park Pond will act as an alum pilot case. Through alum dosing jar tests, we determined that a total of 25 mL (59.5g Al/liter solution) of alum per liter of Rainbow Park Pond water maintained favourable water quality for fish and invertebrate survival (pH of 7.5; alkalinity of 72 mg/L) while significantly reducing total phosphorus (85% reduction). We will use the six lakes to conduct a before/after control/impact experiment to determine if alum treatment can improve overall water quality and overwintering DO concentrations.

Introduction

Alberta Conservation Association (ACA) stocks ponds throughout the province of Alberta as part of our Fish Stocking (FS) project. Several of ACA's stocked ponds are very popular angling destinations receiving >2,000 angler h/ha. Yet, our recent data suggest that some of these ponds may not be capable of supporting trout survival beyond mid-summer due to poor water quality, particularly due to low dissolved oxygen (DO) and temperature (Fitzsimmons and Keeling 2015). This is not surprising since most FS ponds tend to be shallow and enriched with nutrients. Low DO can be improved through minimizing in-situ phosphorus (P) availability through aluminum sulphate (alum) treatment. Alum inactivates water column P and pond sediment P, limiting primary productivity and biological oxygen demand (BOD), thereby improving summer DO and summer-long survival of fish. However, it is unclear whether alum treatment can improve winter DO concentrations. We will use a before/after, control/impact (BACI) study design with six ponds, including Rainbow Park Pond (formerly Westlock Pond), to determine if alum treatment can improve both overall water quality and overwintering DO in ACA stocked

ponds with marginal trout habitat. Rainbow Park Pond will be used as a pilot case to determine the appropriate alum dose for treatment. Summer and winter DO concentration, secchi depth, BOD and total P concentration will be used as indicators of water quality.

Methods

We collected monthly (May to September) DO and temperature profiles and vertically integrated, composite water samples from three locations within six ponds (Rainbow Park Pond, Daysland Pond, Heritage Lake, Lamont Pond, Innisfree Trout Pond, and Pleasure Island Fish Pond) that were analyzed by a lab for nutrient concentration, chlorophyll*a*, pH, and water hardness. This data will be used to establish baseline conditions prior to alum treatment and will act as the "before" category for our BACI study design.

We also completed alum dosing jar tests, in triplicate, to determine the maximum safe dose of alum that could be applied to Rainbow Park Pond without adversely effecting aquatic life. Briefly, we added 20 mL and 25 mL of alum (59.5g Al/liter solution) to 1 L composite water samples taken from Rainbow Park Pond, collected in October, following the alkalinity method (Kennedy and Cooke 1983). We compared doses to determine which achieved maximum phosphorus precipitation while maintaining a pH >6, and a residual alkalinity ≥25%.

Results

All six ponds exhibit high total phosphorus concentrations (TP range 91 – 334 µg/L) and primary productivity (chlorophyll*a* range 18 – 33 µg/L), indicating they are eutrophic to hypereutrophic (Table 1).

The ponds are also slightly basic (pH range 7.92 – 8.68) and alkaline (total alkalinity range 132 – 484 mg/L), with Innisfree Pond being almost twice as alkaline as the other five ponds. The high alkalinity and pH indicate that the ponds are able to be dosed with a high concentration of alum. Jar tests indicate that the maximum safe alum dose for our pilot case, Rainbow Park Pond, is 25 mL (of a 59.5g Al/liter solution) of alum per liter of pond water. At a rate of 25 ml alum/liter of pond water we were able to maintain a pH of 7.5, alkalinity of 72 mg/L and reduce total phosphorus by 85%.

Table 1. Mean ± SD water quality characteristics of six ponds investigated for suitability for alum treatment in 2020.

Pond	TP (ug/L ± SD)	Chlorophyll*a* (µg/L ± SD)	Total alkalinity (mg/L ± SD)	pH
Rainbow Park	114 ± 46	30 ± 20	132 ± 13	7.96 ± 0.18
Daysland	268 ± 36	28 ± 25	176 ± 17	7.92 ± 0.44
Heritage	334 ± 173	18 ± 14	166 ± 11	8.27 ± 0.14
Innisfree	98 ± 21	25 ± 10	484 ± 23	8.68 ± 0.08
Lamont	116 ± 84	33 ± 23	294 ± 29	8.68 ± 0.29
Pleasure Island	91 ± 53	28 ± 22	190 ± 109	8.25 ± 0.44

Conclusions

Rainbow Park Pond is a good candidate for alum treatment because the high alkalinity/buffering capacity can accommodate a high concentration of alum dosing without having an adverse effect on aquatic life. We will apply 25 mL of alum over two treatments. We collected baseline water quality data on all six ponds as part of a BACI experiment to determine if alum treatment can improve both overall water quality and overwintering DO. All ponds were eutrophic-hypereutrophic with high concentrations of total phosphorus. We are working with Alberta Environment and Parks to secure permits to apply alum to Rainbow Park Pond.

Communications

Not applicable

Literature Cited

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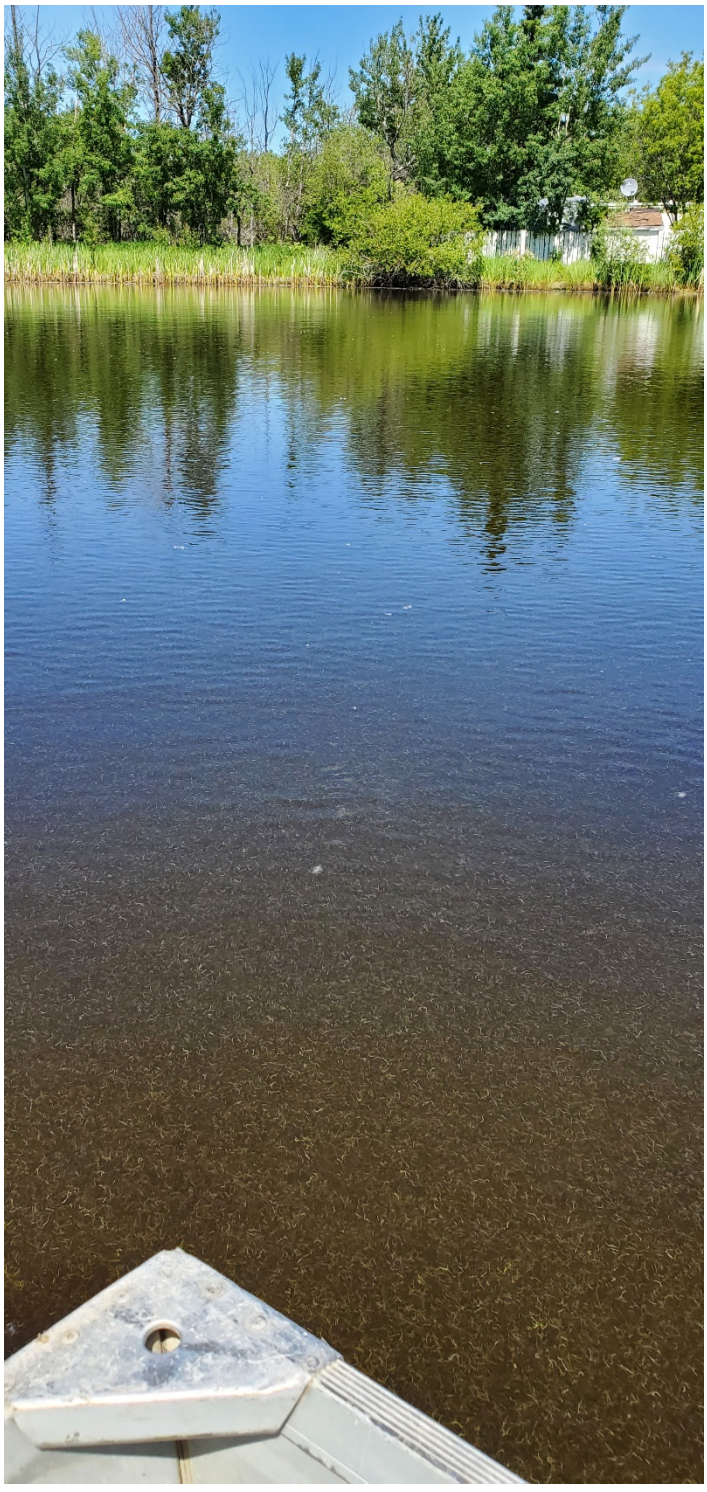
Fitzsimmons, K., and B. Keeling. 2015. Survival of stocked trout and a creel based sport fishery assessment of 12 Alberta Conservation Association stocked ponds. Data Report, produced by Alberta Conservation Association, Sherwood Park, Alberta, Canada. 25 pp + App.

Kennedy, R., and D. Cook. 1982. Control of lake phosphorus with aluminum sulfate: dose determination and application techniques. *Journal of American Water Resources*. 18(3): 389-395.

Photos



Algal bloom off the bow of the boat (has the appearance of grass clippings) in Rainbow Park Pond. Photo: Troy Furukawa

Turbid water in Lamont Pond which is being used in our study to determine alum treatment efficacy. Photo: Troy Furukawa