

Development Of Best Strategies For The Control Of *Butomus umbellatus* L. (Flowering Rush)
In Alberta

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Invasive plants represent a major threat to the economy and environment, with annual economic costs in Canada estimated between \$16.6 billion and \$34.5 billion per year. Aquatic invasives rank among the most destructive, affecting recreational activities such as boating, fishing and swimming, displacing native vegetation, slowing water flows and altering water oxygen levels.

Flowering rush (*Butomus umbellatus* L.) is an aquatic invasive plant species that is currently forming dense stands that interfere with water availability and recreational lake use in Alberta. Native to the majority of mainland Europe, the United Kingdom, Ireland and Western Asia, *B. umbellatus*, is an emergent aquatic perennial whose presence was first recorded in North America in 1897 along the St. Lawrence River. A monotypic member of the family Butomaceae, *B. umbellatus* has the ability to reproduce sexually through seed production or vegetatively via fragmented rhizomes (a continuously growing horizontal underground stem that puts out lateral shoots and roots at intervals) and the production of clonal bulbils. *B. umbellatus* also has two genetic types, being either diploid with 26 chromosomes, or triploid with 39 chromosomes. Populations have been found to be either one or the other but both cytotypes have not been found in the same population. Currently, it is not known which genetic type is in Alberta. The diploid variety appears to be the more invasive of the two genetic types and can spread very rapidly through an area once introduced. There is anecdotal evidence that at Lake Isle the stands of flowering rush are advancing at a rate of 0.8 km (0.5 mi) per year.

The spread of *B. umbellatus* in Alberta would appear to be through the fragmentation of rhizomes and small bulbs known as bulbils. These plant pieces break off the parent plant easily through human, animal or boat

traffic and are buoyant so may easily travel to new areas and establish themselves very quickly. The rhizomes are extremely hardy and have demonstrated the ability to survive out of water at a constant 32 °C for a week before being placed back in water where they germinated new shoots. This makes the inspection of boats from infested lakes critical as any rhizome or bulbil caught in a propeller, etc. can survive out of the water until the boat is launched into an uninfested lake.

The objectives of current research at Lake Isle and Chestermere Lake are to (1) determine if *Butomus umbellatus* in Alberta is diploid or triploid in nature, (or whether there is variation in ploidy levels), while Ontario populations are diploid, populations in Montana appear to be triploid, (2) whether *B. umbellatus* is spreading more through seed or rhizomes, and (3) whether the best control methods used are more effective at controlling spread through seed or rhizomes when ploidy and the diversity of the natural vegetation are taken into account. Two different lakes currently inhabited by *B. umbellatus* will be studied: Chestermere Lake east of Calgary and Lake Isle west of Edmonton. Replicate sites of four 2mx2m plots will be set up along affected shoreline at each lake to test different methods of control. Tags will be placed on a stake in each plot with a description of the treatment to be performed on the plants.

At Chestermere Lake, there are two areas of study. At the south end of the lake, there may be an opportunity to test the effectiveness of diver assisted dredging (hydrovacating) an area of rush infestation. In this method, weeds are manually dug up using SCUBA divers and then hydrovaced to remove rhizome fragments and loose bulbils, preventing their spread. Vegetative matter is screened out and the vacuumed water is returned to the lake. Along a section of canal just west of the weir and train trestle, there are 2m x2m plots set up along the canal where 2 other methods of control are being tested. The first is manual removal where the plants are carefully dug out and a hand search is done to insure no plant material is left behind. The second treatment is the use of a benthic barrier in which a 2mx2m sheet of a heavy felt fabric is laid down over top of the plants. By choking the plants off from sunlight, it is speculated that the plants will need to rely on rhizome stores of energy rather than the usual photosynthesis for survival, therefore, rhizomes will be

depleted of their energy stores and the plants will no longer have the ability to overwinter or resume growth in the spring. Though no official plots have been set up, traditional dredging of the canal will also take place sometime in August to see if this is an effective method of control.

Soil samples have been collected and measured to determine the number of *B. umbellatus* seeds in the seed bank at the south end of the lake. Plant samples have also been collected and grown at the university greenhouse so that an analysis may be performed to determine which genetic type is in the lake. Plant dry masses were also taken and rhizome sizes measured from numerous plant samples. The density of plants in each experimental plot was also measured.

The following growing season, will involve documentation and comparison of the population growth of *B. umbellatus* among treatments, as well as an assessment of the stability of the treatment via observations of the size of individual plants, rhizome biomass and bulbil numbers, and seed abundance in the seed bank of *B. umbellatus*. With this information, I will determine how treatment affects flowering rush rhizome biomass and abundance as well as abundance in the seed bank. If there is variation in ploidy levels, this variable will also be used as a covariate.

Flowering rush in Alberta is very quickly becoming a problem and more information is needed on how to slow its spread and reclaim areas that are already affected. It is hoped that the study of Chestermere Lake will help shed light on this rapidly advancing problem and will help to insure the lake remains healthy for years to come.