Flowering Rush Symposium

Sponsored by **The Western Integrated Pest Management Center** at University of California, Davis
Conducted at The Northern Rockies Invasive Plant Council Conference
Northern Quest Resort & Casino, Airway Heights, WA
February 13, 2014

Symposium Program

12:30-12:40 **Welcome and Overview of Flowering Rush Biology**, Tim Miller, Washington State University

12:40-1:00 **The Status of Flowering Rush in Washington**, Jenifer Parsons, Washington State Department of Ecology

1:00-1:20 **The Status of Flowering Rush in Idaho**, Tom Woolf, Idaho Department of Agriculture

1:20-1:40 **History and Status of Flowering Rush in Detroit Lakes—A Manager's Perspective**, Tera Guetter, Pelican River Watershed District, MN

1:40-2:00 **Flowering Rush in Detroit Lakes: From Research to an Operational Management Program**, John Madsen, GRI-Mississippi State University

2:00-2:15 **Distribution and Management of Flowering Rush in Flathead Lake and River**, Virgil DuPuis, Salish Kootenai College, MT

2:15-2:50 **Sampling Methods for Fish and Macroinvertebrates in Flowering Rush Infestations and Changes in Habitat Suitability for The Introduced Fish and Macroinvertebrate Community**, Peter Rice, University of Montana

2:50-3:10 **Break**, Sponsored by SePRO Corporation and Valent USA

3:10-3:30 **Sonar PR and Renovate 3 Combinations for Flowering Rush Control in Lake Pend d'Oreille**, Andrew Skibo, SePRO, CO

3:30-3:50 **Renovate Max G, Aquathol Super K, and Diquat Treatments of Submersed Flowering Rush**, Steve Fleming, Archibald Lake Association, WI

3:50-4:20 **Potential Organisms for Biological Control of Flowering Rush (*Butomus umbellatus*)**, Hariet Hinz, CABI Switzerland

4:20-4:40 **Flowering Rush Biocontrol: Future Funding and Research Needs**, Jennifer Andreas, Washington State University

4:40-5:00 **Discussion session: Where Do We Go From Here?** Moderated by Celestine Duncan, Weed Management Services, MT

Overview of Presentations

Biology, Ecology, Impacts and Distribution

Flowering rush (*Butomus umbellatus* L.) is the only species in the monogeneric plant family Butomaceae, and is a vigorous aquatic perennial that spreads primarily by lateral growth of rhizomes, by rhizome fragmentation, or by corm-like bulbils produced on rhizomes or in the inflorescences. Plants root in the mud and generally emerge from standing water near the shore, although fully submerged forms

also exist. Maximum water depth is about 3 m for the species. Leaves are pith-filled, triangular in outline, up to about 1 m long, and are slightly twisted when viewed from above. Flower stems form in early to mid-summer, terminating in a cymose umbel bearing 20 to 50 light pink flowers. Flowers consist of three pink sepals and three slightly larger pink petals, nine stamens, and six carpels in which some 200 ovules are ripened. Flowers and viable seeds are primarily produced on sexually fertile diploid plants; triploid plants are sterile and rarely flower.

Flowering rush does not simply displace native aquatic vegetation. It colonizes previously nonvegetated portions of variable drawdown zones. These monotypic colonies in previously open water littoral zones are inducing cascading ecosystem and trophic effects. Higher order impacts include alteration of sediment transport and deposition, and formation of new habitat favorable to introduced fish and disadvantage to native trout and salmon. The species composition (fish and aquatic macroinvertebrates) within flowering rush infestations is ecologically and statistically significantly different than that of native vegetation and open water communities.

Flowering rush has spread as a result of escape from cultivation in the ornamental trade and is now found across 17 of the Northern United States and nearly all of the Canadian Provinces. First documented on Flathead Lake, Montana in 1964, the spread of Flowering Rush now encompasses thousands of acres across the Pacific Northwest in habitat that is considered essential for the spawning of a number of salmonid species.

Idaho has observed a rapid expansion of flowering in recent years. First Identified in a small population in Lake Pend Oreille in 2007, it has now expanded throughout the lake and densities are now beginning to interfere with recreation in populated areas. Flowering rush in southern Idaho appears to not be expanding downstream however it has recently been discovered 30 miles upstream of previously known populations. Research plans are moving forward for treatment trial projects in 2014.

In Washington State, flowering rush is currently found in several major rivers, one lake and a few small ponds. The plants growing in deeper water of the river systems do not lend themselves to chemical control due to water flow.

Currently, flowering rush is well established in the Flathead and Clark Fork drainages of western Montana. The Lower Flathead River from the Flathead Indian Reservation boundary to the head of Thompson Falls Reservoir was inventoried in 2013 for aquatic invasive species. Patches, linear populations, and individual plants of flowering rush are found throughout the inventory reach. Previous inventories of Flathead Lake and the Lower Flathead River identified several large flowering rush locations in the lake and upper river, and numerous locations of small and individual plant infestations..

Management (Mechanical and Chemical Control)

Detroit Lake, MI: In 1976, a flowering rush infestation was first documented in Curfman Lake (Becker County, MN) and has spread through the Pelican River chain into Detroit, Muskrat, Sallie, Melissa, Mill Pond, and Buck Lakes. By the mid-1980's, flowering rush reached nuisance conditions in the near shore areas and the first flowering rush management efforts included hand-digging, deflowering, and limited chemical treatments which failed to curb the spread. At this time, the Pelican River Watershed District, a local unit of government, was petitioned by its citizens to set up projects, funded by assessments, to control aquatic plants on three lakes. The District began to use mechanical harvesting as the principal management tool for controlling flowering rush. However, by 2000, it became evident the use of mechanical harvesting was contributing towards the further spread of flowering rush. With only a few lakes in MN recreationally affected by flowering rush, little was known about the biology, ecological impacts, or effective control methods. Frustrated with the lack of research or knowledge base to effectively control flowering rush, the District reached out to various agencies and institutions to begin a coordinated applied science research effort to understand the biology and ecology of flowering rush and use and build upon this knowledge base to further research and develop effective herbicide control measures. A research program was begun in 2010 to better understand the biology and ecology of flowering rush and experiment with management techniques. In 2012 we were able to demonstrate an operational-scale program of management, achieving over 90% reduction in nuisance growth and reducing rhizome buds by 80%. Because flowering rush is a perennial, the problem is not solved by one year of treatment, but we do have program that is effective at both reducing nuisance growth and reducing the ability of flowering rush to regrow the following year. Further research and monitoring will safeguard

the diversity of native plant growth and fish habitat, and provide other alternatives for management in the future.

Previous mesocosm and field studies examining both preemergent, foliar, and in-water herbicide applications have examined the efficacy of a number of aquatically registered herbicides such as imazapyr, imazamox, fluridone, triclopyr, 2,4-D, endothall, and diquat. Systemic herbicides such as fluridone, imazapyr, and imazamox applied either as a preëmergent, bareground application during periods of system drawdown or applied in-season as in-water applications have shown excellent results the season of application into the following growth season while contact herbicides such as diquat, flumioxazin, endothall, and diquat have given variable results on foliar materials and demonstrated little effect at reducing below ground biomass. The Archibald Lake Association in northeastern Wisconsin has also been seeing positive results in small littoral zone trials, particularly in trials testing Renovate Max G, Diquat, and Aquathol Super K. Based on these results, a field trial was initiated on Lake Pend d'Oreille, Idaho in 2013 to further quantitate the single and sequential season efficacy of granular fluridone (Sonar PR) and triclopyr (Renovate OTF) combinations on emergent and below ground biomass reduction. Monitoring of triclopyr concentrations showed effective exposure out to 72 hours after treatment with a building concentration of fluridone that was maintained until the end of monitoring period at time of site scheduled dewatering in October. Efficacy of the combination protocol was assessed through pre-treatment point-intercept survey, species biodensity ratings, hydroacoustic survey, and a repeat hydroacoustic survey on day of the repeat application. Plans call for both spring and late summer 2014 re-assessments.

In Washington, field control trials of glyphosate, imazapyr and triclopyr on emergent plants have shown that imazapyr provided the best control when at least 2 ft of leaf was above water. Field trials were also conducted on submersed growth with 2,4-D, triclopyr, imazamox and diquat. Results showed repeated treatments with diquat reduced biomass and plant abundance. Control in rivers systems in Washington included hand pulling, both from shore and with divers, and some use of bottom barriers with discouraging results. In Idaho, herbicides and mechanical treatments have been conducted but results have been disappointing.

Management (Biological Control)

Although appropriate chemical and mechanical control methods of flowering rush continue to be explored, they have thus far been relatively ineffective, creating concerns that the flowering rush populations will continue to expand and spread without restriction. In looking for possible control methods, we are taking a proactive approach by pursuing potential biological weed control agents and have formed the Flowering Rush Biocontrol Consortium to coordinate the project. In 2013, CABI began foreign exploration with funds acquired from Montana, Washington and British Columbia agencies. A literature search has so far revealed two fungal pathogens and 18 insect species that are recorded to develop on flowering rush in Europe. Four of these species, two weevils and two flies, are potentially monophagous on flowering rush and are expected to damage the plant. All are described to feed in the leaves and stems of flowering rush. Several field trips were conducted to northern Germany and one to the Czech and Slovak Republic with the aim to find one of the two weevil species (*Bagous nodulosus*) and to collect any other phytophagous species found on the plant. We frequently found larvae and pupae of three fly and two moth species and adults and larvae of a reed beetle in the genus *Donacia*. All reared or collected adult specimens are currently being sent off for identification. A total of 54 *B. nodulosus* were found, taken back to Switzerland and observations on its biology and behavior started. Adults make characteristic feeding marks on the leaves, often at the leaf tip, which makes it relatively easy to verify their presence in the field. Eggs are laid into the leaves, either above or below the water level. Hatching larvae are very mobile and move, mostly externally, down into the leaf bases where they feed during a few weeks. Some larvae were also found damaging parts of the rhizome. The aims for 2014 are to establish a rearing colony of *B. nodulosus* at CABI and to start with host-specificity tests. A test plant list was established and a first shipment of plants made to Switzerland. In addition, we will continue with surveys and will try to start work on one other potential agent. Based on these very first results, prospects for the biological control of flowering rush are promising. Research on the impacts of flowering rush and input into the final test plant

list are needed to strengthen the overall success of the project. In addition, future funding is critical to continue the project past 2014.