NORTH COLUMBIA PRIORITY AQUATIC INVASIVE SPECIES SURVEYS 2015

PREPARED FOR:

The Columbia Shuswap Invasive Species Society.

BY:

Chris Harkness

Introduction:

Aquatic invasive species (AIS) consist of plants, invertebrates, fish, amphibians and other organisms that have been introduced to a waterbody to which they are not native. While some non-native introductions may not survive or thrive in their new environment, AIS have the potential to cause significant economic or ecological damage. The threat of AIS to British Columbia's waterways has been steadily increasing as new species are being found and species that are known to be present in BC are spread throughout the province. Infestations of AIS such as zebra/quagga mussels (ZQM) and flowering rush (*Butomus umbellatus)* have been slowly approaching the borders of British Columbia. In order to minimize the threat of AIS, a number of steps have been taken throughout the province. These include education and outreach programs targeting the main pathways of introduction such as the horticulture (PlantWise) and aquarium (Don't Let it Loose) industries and recreational boaters (Clean, Drain, Dry). Another key component in preventing the spread of AIS is an effective monitoring program. In particular programs such as BC's Early Detection, Rapid Response allow for the detection of AIS before they become established. Once established in a system AIS become much more difficult to control or eradicate.

Methods:

Priority waterbodies were predetermined by CSISS using the Draft Ranking Matrix for Monitoring Priority of Water Bodies available in Appendix C at http://columbiashuswapinvasives.org/wp-content/uploads/2015/03/CB_AIS_Regional_Program_Framework_FINAL_11May2015.pdf . As a result Kinbasket Lake, Lake Revelstoke, The Columbia River and Upper Arrow Lake were ranked as high priorities for AIS monitoring. Sites were also pre-selected by CSISS for each waterbody at high-use public boat launches primarily at Provincial Parks or Forest Recreation Sites. In addition to these sites, a veliger sample was taken at the Mica townsite boat launch and Williamson Lake was sampled for ZQM and plants. AIS surveys for ZQM veligers and aquatic plants were carried out in accordance with British Columbia Aquatic Invasive Species Survey Methods available at https://www.for.gov.bc.ca/hra/invasive-species/Publications/BC_Aquatic_Sampling_March2015.pdf.

At each site ZQM veligers were sampled by watercraft or from boat docks at a depth of up to six meters using a plankton tow net and vertical tows. Samples were then preserved in ethanol and shipped to a government approved laboratory for analysis. Aquatic plants were sampled using a hard rake at 100m intervals in each direction along the shoreline from the boat launch. The distance sampled varied from site to site depending on factors such as substrate, topography and usage pressure. For each sampling point UTM's, depth, substrate, plants found (native and non-native) and other relevant data was recorded. The entire littoral zone of Williamson Lake was surveyed. Where riparian or aquatic invasive plants were found, the data was entered into the IAPP (Invasive Alien Plant Program) database following provincial standards.

Results:

Sampling data for ZQM monitoring is given in Table 1 and results will be available after analysis by the laboratory. No aquatic or riparian invasive plants were found at any of the sampling points (Appendix A) on Kinbasket, Upper Arrow or Williamson Lakes or sections of the Columbia River between Parsons and

Table 1. Zebra/quagga mussel sampling points and data.

Waterbody	Site Description	Date	Zone	Easting	Northing	Temp ^{0}C	#Tows	Depth
Columbia River	Parson's Bridge	21-Sep-15	11U	525009	5657627	10	3	2.5m
Columbia River	Nicholson Bridge	21-Sep-15	11U	506211	5676901	10	3	2m
Kinbasket Lake	Bush Harbour Rec Site boat launch	22-Sep-15	11U	460256	5734043	16.2	4	5m
Kinbasket Lake	Esplanade Bay Rec Site	22-Sep-15	11U	462092	5727773	16	4	6m
Columbia River	Wiseman Rd boat launch	23-Sep-15	11U	487111	5703650	8.4	3	4m
Kinbasket Lake	Kinbasket Lake Resort dock	23-Sep-15	11U	469940	5708588	15	4	3.5m
Columbia River	Centennial Park boat launch, Revelstoke	23-Sep-15	11U	415326	5650739	14.2	3	5m
Lake Revelstoke	5-mile boat launch	24-Sep-15	11U	417743	5658782	12.4	4	6m
Lake Revelstoke	Martha Creek Provincial Park	24-Sep-15	11U	416054	5666795	12	4	6m
Lake Revelstoke	Carnes Creek Rec Site	25-Sep-15	11U	410765	5683152	12.6	4	6m
Lake Revelstoke	Wadey Rec Site	25-Sep-15	11U	415618	5674383	12.6	4	6m
Kinbasket Lake	Sprague Bay Rec Site	26-Sep-15	11U	398796	5772617	13	4	6m
Kinbasket Lake	Potlatch Creek Rec Site	26-Sep-15	11U	395252	5772321	13	4	6m
Lake Revelstoke	Mica Townsite boat launch and dock	27-Sep-15	11U	392243	5763277	8	4	6m
Lake Revelstoke	Bigmouth boat launch	27-Sep-15	11U	387827	5650739	12.4	4	6m
Lake Revelstoke	Goldstream boat launch	27-Sep-15	11U	388722	5718106	12	4	6m
Lake Revelstoke	Trailer Park boat launch	27-Sep-15	11U	392627	5757895	13	4	6m
Lake Revelstoke	Downie Creek Rec Site	28-Sep-15	11U	399021	5703502	12	4	6m
Williamson Lake	Swimming dock	28-Sep-15	11U	417824	5646979	14	4	4.5m
Upper Arrow Lake	Shelter Bay Provincial Park	29-Sep-15	11U	434777	5609860	12	4	6m
Upper Arrow Lake	Galena Bay, Galena Shores boat launch	29-Sep-15	11U	440146	5612468	13	4	6m
Upper Arrow Lake	Beaton public boat launch	29-Sep-15	11U	448185	5621206	13	4	5m

Donald (near Golden). No submerged native vegetation was found on Kinbasket or Upper Arrow Lakes and a limited amount was found on the Columbia River. This is typical of systems with a high degree of continuous disturbance such as fluctuating water levels. Reservoirs such as Kinbasket and Arrow Lakes have dramatic drawdowns of between 15 and 20m (BC Hydro 2015 and Pieters et al. 2008) making establishment of vegetation very difficult.

Williamson Lake had the highest diversity of native vegetation present of all Lakes sampled. Native vegetation was also present at numerous sampling points on Lake Revelstoke.

A number of sampling points along the Columbia River north of the Centennial Park boat launch in Revelstoke had *Fallopia sp.* or *Impatiens glandulifera* present. These were found growing on the river bank below private residences at times along a small creek. *Impatiens glandulifera* was also discovered at a moist, illegal dumping site close to Edelweiss Slough in Golden.

A submerged macrophyte identified as *Myriophyllum spicatum* (Eurasian watermilfoil) was discovered in one section of Lake Revelstoke approximately 500m south of the boat launch at Martha Creek Provincial Park. A sample of this plant has been submitted for DNA analysis in order to confirm its identity. Fragments of this plant were present throughout the immediate area. Native vegetation was also observed at this sampling point as well as many others points throughout the lake.

Discussion:

In order to maximize the probability of collecting ZQM veligers in a plankton tow it is recommended that sampling be carried out at multiple times throughout the sampling season (eg. monthly). This will also ensure that sampling will occur when veligers are most active, that is when water temperatures are between 16 and 19 degrees Celsius. Temperatures varied significantly from waterbody to waterbody as well as within waterbodies throughout the study area (Table 1). Although it is preferable to sample from a boat, there are two sampling points on Lake Revelstoke (Mica Townsite boat launch and Martha Creek Provincial Park) and two points on Kinbasket Lake (Bush Harbour Recreation Site and Kinbasket Resort) that could be sampled effectively from docks periodically over the summer months. These areas are located at great distances from each other in their respective lakes and could be sampled by one person substantially reducing labour costs. There is another possible site that can be sampled from a dock and boat launch at the privately owned Downie RV Resort at the west end of Downie Arm. Substrate samplers should also be installed at these locations and monitored on the same visit that a plankton tow is collected. At private sites such as Kinbasket and Downie RV Resorts a resident could monitor the substrate sampler at a greater frequency. Upper Arrow Lakes, the Columbia River and additional points on Lake Revelstoke or Kinbasket would still require a watercraft for sampling and could be conducted during aquatic plant sampling. Additional samples could be taken from a canoe or kayak in these waterbodies.

Upper Arrow and Kinbasket Lakes are large oligotrophic systems that experience extreme fluctuations in water levels throughout the year. Warrington (1980) found no aquatic vegetation present in a number of systems in the Fraser Valley that experience a high degree of continuous disturbance as a result of impoundment. The lack of vegetation at any of the sampling points in Upper Arrow or Kinbasket Lakes suggest that native (and non-native) submerged plants have difficulty in establishing in these systems. This would most likely drastically slow the growth and spread of any invasive plant that did enter these reservoirs. This may not be the case for emergent plants such as *Butomus umbellatus* which has

colonized previously unvegetated portions of variable drawdown zones in the Flathead system in Montana (Rice and Dupuis, 2009). Aquatic invasive plant surveys should be planned with target species in mind in order to maximize the efficiency of available resources.

In general, the suitable habitats in oligotrophic lakes are usually much smaller and more isolated than those in eutrophic lakes and aquatic plants are limited in distribution (Madsen 1994). *M. spicatum* is likely to invade areas in oligotrophic lakes that have native species already present because these areas provide an optimal environment for growth (Madsen and Wersal 2009). This was the case with Lake Revelstoke where a patch of what is believed to be *M. spicatum* was discovered amongst native vegetation in a sheltered bay in close proximity to a high-use boat launch at Martha Creek Provincial Park (Figure 1). The availability of suitable habitats for plants and a moderate yearly fluctuation in water levels of 5m (Pieters et al. 2008) has allowed native vegetation to establish in many areas throughout Lake Revelstoke. Should the sample of *Myriophyllum sp.* submitted for DNA analysis be confirmed to be *M. spicatum*, it has a

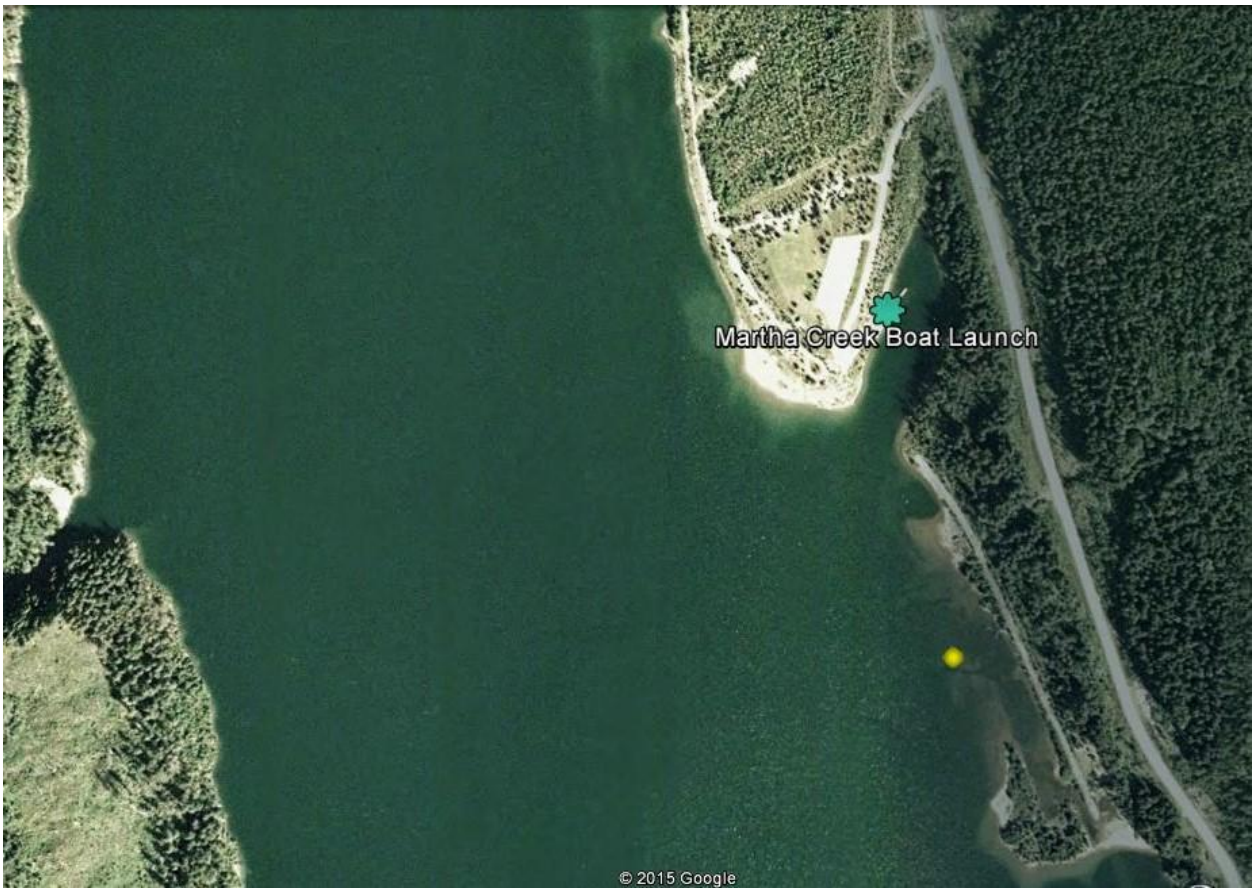

Figure 1. Map of the Martha Creek Provincial Park area of Lake Revelstoke indicating ●-presence of *M. spicatum*.

high probability of establishing in other parts of Lake Revelstoke being spread either passively or by boating activity. Fragments of *M. spicatum* (unconfirmed) were immediately present upon entering the boat launch area at Martha Creek and may have settled in other areas of the lake. A more detailed survey should be conducted in order to determine the extent of colonization of *M. spicatum* in order to

develop a containment and possible eradication strategy. Fragments of *Myriophyllum sp.* were not found at any of the other sampling sites on the lake. Signage should be erected alerting the public of the presence of *M. spicatum* in the lake as well as the importance of the "Clean, Drain, Dry" program in preventing its spread. There is only one access road on the east side of the lake and the most developed boat launches are also on this side. Signage placed at strategic intervals along the road would reach the majority of visitors. A pressurized car wash is well situated at the start of the road to decontaminate boats entering and leaving both Lake Revelstoke and Kinbasket Lake and would most likely allow a sign to be erected on their property. Signage should also be placed at boat launches throughout the lake instructing the public to remove all fragments from their boats as there is a high probability of transferring *M. spicatum* within the lake or to Kinbasket Lake when moving between boat launches.

AIS activities should continue throughout the region in order to minimize the spread of *M. spicatum* and to minimize the impact of new introductions of AIS such as ZQM into the region. Smaller lakes, such as Mitten Lake, which receive a high level of boating pressure should also be surveyed in 2016. Due to the inter-connectivity of waterways throughout the Columbia Basin, collaboration with existing partners and forging new relationships with a variety of stakeholders (stewardship goups, boating associations, etc.) are also key factors in mitigating the impacts of AIS

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