Lake Windermere
Aquatic Invasive Species Inventory
2017

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ECOLOGICAL SERVICES

Table of Contents

List of Figures

1. Introduction/Background

The extinction of species and extreme degradation of habitat that is occurring at an unprecedented rate is a catastrophic and global problem (Novacek & Cleland, 2001; Pimm, Russell, Gittleman, & Brooks, 1995; Sala et al., 2000; Xu et al., 2006). It is widely accepted that invasive species are one of the largest known threats contributing to widespread extinctions and habitat destruction (Gurevitch & Padilla, 2004; Mooney & Cleland, 2001). Furthermore, there are numerous reports that link invasive species to severe economic losses (Pimentel, Zuniga, & Morrison, 2005; Xu et al., 2006). Many invasive wildlife species are reservoirs of infection diseases and pathogens, which threaten human health and domestic animals (Daszak, Cunningham, & Hyatt, 2000) and they can negatively impact recreational pursuits, crops, and infrastructure such as hydroelectric power facilities (Province of British Columbia (BC), 2015).

As of 2015, there were 175 known invasive plant species impacting the Province of BC (Province of BC, 2015). According to the Invasive Species Council of BC (2014), "[a]n invasive species is defined as an organism (plant, animal, fungus, or bacterium) that is not native and has negative effects on our economy, our environment, or our health." There are numerous different 'pathways of invasion' that invasive species use to enter new habitats. For instance, transportation corridors (i.e. roads, railways, transmission lines) disperse invasive plant seeds or plant fragments, leading to colonization of species in areas where they were not previously located. Aquatic invasive plants such as Eurasian Watermilfoil (*Myriophyllum spicatum*), are transported into waterbodies though motorized and non-motorized boat ballast and by boat trailers that are carrying plant fragments. Invasive aquatic mussel larvae (veliger) can be introduced into a new waterbody by attaching to watercraft, for example, through retained ballast water in boat tanks (Ministry of Environment, 2011). In the absence of any native predators to keep these species in ecological balance, the alien invader takes over previously unoccupied habitat and displaces native species.

Since their introduction through ship ballast to the Great Lakes in 1998, zebra and quagga mussels continue to be the cause of great environmental, social, and economic harm in Eastern Canada due to their rapid spread (Ludyanskiy, McDonald, & MacNeil, 1993) (BC Inter-Ministry Invasive Species Working Group, n.d.). Zebra Mussel (*Dreissena polymorph*) can have costly economic impacts on infrastructure such as hydroelectric dams and drinking water facilities. The economic impacts of these mussel species has been estimated at nearly $43 million per year when considering impacts to municipal water supply, recreational boating, hydropower and agricultural irrigation, but this cost does not account for additional impacts to commercial and recreational fisheries (BC Inter-Ministry Invasive Species Working Group, n.d.; Robinson, Knowler, Kyobe, & de la Cueva Bueno, 2013). Due to the severity of devastating impacts that aquatic invasive species (AIS) can have, they have been of growing concern in BC.

As of 2015, there were already 101 AIS known to occur in 27 of British Columbia's 36 watershed drainage units (Province of BC, 2015). Within the Columbia Basin, there are several AIS that have been introduced, e.g. Eurasian Watermilfoil (*Myriophyllum spicatum*), Curlyleaf Pondweed (*Potomogeton crispus*), Northern Pike (*Esox lucius*), Pumpkinseed Fish (*Lepomis gibbosus*), Largemouth Bass

(*Micropterus salmoides*), and American Bullfrog (*Lithobates catesbeianus*). While not known to be present in BC, due to their severe impacts to the economy and environment there is mounting concern about the introduction of invasive Zebra Mussel *(Dreissena polymorph)* and Quagga Mussel (*Dreissena bugensis*).

Due to this concern, there is a major effort underway throughout BC that is working to prevent new AIS like the zebra and quagga mussel from entering the province. In BC, provincial government staff operates watercraft inspection stations that work to decontaminate infected boats at mobile stations spread across the province (Province of BC, n.d.). In 2016, there were eight stations in the province that inspected 24,100 watercraft; 17 boats inspected were carrying adult invasive mussel species (Province of BC, n.d.) and ten of the infested boats were found at the decontamination station located near the Town of Golden, BC (CSISS, 2016). In a regional effort to prevent the spread of AIS in the Canadian portion of the Columbia Basin, a document entitled 'Canadian Columbia Basin Regional Framework for an Aquatic Invasive Species Program: 2015 to 2020' (Craig, 2015) is guiding local efforts.

The Lake Windermere AIS Inventory Project has operated annually since 2009, with the exception of the year of 2013. The major goal of the project is to determine if any aquatic invasive plant species are present in the Lake Windermere ecosystem. However, sampling for Zebra/Quagga Mussel also takes place with the assistance of the East Kootenay Invasive Species Council (EKISC). Since the inception of the Lake Windermere AIS Inventory Project, no aquatic invasive plant or mussel species have been detected. This project remains diligent in its efforts of early detection so that a rapid management response can be implemented if an unwanted invader is located.

2. Study Area

Lake Windermere (UTM: 0571182; 5590080) is located in the Columbia River Valley within southeastern BC. The lake is in close proximity to the headwaters of the Columbia River; a river that extends for approximately 2000 kilometers and is the largest river in the Pacific Northwest of North America (Wikipedia, 2017). Lake Windermere is located within the Regional District of the East Kootenay; it extends for approximately 17.7 kilometers in length, and is 0.7 to 2 kilometers wide. There are a few relatively small communities located along the shoreline, the largest populations are found at the Village of Windermere (population: 1,259), and the District of Invermere (population = 3,391). The lake is important for recreational activities such as boating and fishing during the summer, and also for ice skating, ice-fishing and cross-country skiing during winter months when the lake is frozen.

Technically, much of Lake Windermere can be classified as a shallow open water wetland, a transition zone between lakes and marshes where the depth of water is often less than 2 meters (Alberta Wetland Policy, 2017). Lake Windermere can therefore be considered part of the Columbia Wetlands ecosystem, which begins in Canal Flats at the headwaters of the Columbia River, and extends about 180 kilometres downstream to Donald (located about 20 kilometers north of the Town of Golden). The Columbia Wetlands is one of the largest continuous wetlands in all of North America and it is considered to be

important habitat for numerous wildlife species including at-risk species such as the Western Grebe (*Aechmophorus occidentalis*), Horned Grebe (*Podiceps auritus*) and Painted Turtle (*Chrysemys picta*).

The Columbia Wetlands are considered an integral component of the Pacific Flyway (north-south flyway for migratory birds) and are important for over 150 species of migrant and breeding birds. The 'Columbia Wetlands Waterbird Survey' documented over 20,000 individual birds that were counted in a coordinated bird count on October 15, 2016, and which covered only 40% of the wetland ecosystem (including much of Lake Windermere) (Darvill, 2017). The wetlands have been designated as a Ramsar site, which means that they have been recognized as a wetland with international significance under the Convention on Wetlands (Ramsar Convention). The Ramsar designation does not include Lake Windermere.

3. Methods

3.1. Shoreline surveys

All shoreline inventories for aquatic invasive plant species were conducted over a seven hour period on September 12, 2017. The methodology used followed the protocol outlined in the 'Canadian Columbia Basin Regional Framework for an Aquatic Invasive Species Program: 2015 to 2020' (Inter-Ministry Invasive Species Working Group (IMISWG), 2015). Shoreline sampling occurred at six survey stations located a varying distances along the shoreline of Lake Windermere. The surveys stations were selected due to their ease of accessibility and also according to their assessed level of risk for invasion. High-risk sites were chosen and included the locations that were known to have high amounts of trailered boat traffic (boats coming in from other areas that are potentially affected by AIS), public boat launches, or boat marinas with multiple boat docking slips.

A crew of two people conducted the aquatic invasive plant sampling at each station. A thatched rake with a 9.7 meter long rope was use for sampling aquatic plants in the water. The rake was tossed into the water as far as possible and pulled back to the shoreline. This enabled the rake to collect plants present at the location where it was thrown. All aquatic plants collected on the thatched rake were recorded to the family level and where possible, the species level was identified. Rake pulls occurred at the "initial feature" (e.g. public boat launch),at three sites located 100 meters upstream of the initial feature, and at three sites located 100 meters downstream of the initial feature. All upstream/downstream sampling sites were separated by 25 meters. Two rake throws were conducted at each of the seven sites. In total, seven sites were sampled at each of the six survey station locations.

In some cases it was not possible to sample at seven sites per survey station due to obstructions such as private property (i.e. Fairmont side channel), or bushy riparian vegetation embedding movement. The six shoreline survey stations were: Baltac Beach, Fairmont Side Channel, Rushmere Community Docks, end of Ruault Road, Unofficial boat launch near Bayshore Condos and Althalmer/Pete's Marina.

3.2. Offshore surveys

Offshore sampling for aquatic invasive plants was completed with the use of an aluminum boat with outboard motor, and a crew of three people. All offshore sampling occurred on September 21, 2017 at 11 locations considered to be at high-risk for introduction of AIS. As with shoreline surveys, high risk locations were considered to be those areas with an increased incidence of trailered boat traffic (boats coming from places other waterbodies), public boat launches, and boat marina's. The locations sampled were: Rushmere, Lakeshore Resort, Ruault Road, Indian Beach, Tretheway Docks, Akiskinook Resort, end of Coy Road, Baltac Beach, Lakeview Meadows, and Althalmer/Pete's Marina.

To ensure that surveys could be repeatable over time and to maintain consistency with previous years of survey effort, the IMISWG (2015) methods for AIS sampling on a lake with a boat were utilized when possible. However, given the large spatial scale of the study area and limited human/financial resources, a modification was made to the IMISWG protocol; the recommendation to conduct contiguous surveys every 100 meters was not adhered to. A scaled-down survey effort was followed in 2017 (as well as during 2015 and 2016 surveys) and efforts were focused at 11 high-risk locations. At each of these locations, two rake pulls were conducted (right and left side of boat) at the starting point of each high-risk location, and then two pulls were conducted again at the end of a 100 meter transect. The rake was tossed into the water as far as possible and pulled back to the boat, enabling the rake to collect plants present on the lake bottom. All aquatic plants collected on the thatched rake were recorded to the family level and where possible to the species level. During the 100 meter transect between the two rake pull sites, an underwater viewer was utilized to identify all plant species seen in shallow water to optimize the potential for detecting small isolated infestations (IMISWG, 2015). For all 100 meter transects, the boat travelled 100 meters north and parallel to the shoreline.

3.3. Zebra/Quagga mussel veliger surveys

A staff member from the East Kootenay Invasive Species Council (EKISC) conducted veliger sampling for both Zebra Mussel (*Dreissena polymorph*) and Quagga Mussel (*Dreissena bugensis*) on September 21, 2017. The sampling was conducted from the same aluminum boat utilized during the offshore sampling described in Section 3.2. Using a plankton tow net (Figure 1), vertical plankton tows were conducted in the water column at two high-risk locations: 1) Akiskinook Resort (UTM: 0571291; 5591437) and 'Unofficial boat launch near Bayshore Condos' (UTM: O569442; 5595071). Horizontal plankton tows were conducted at Althalmer/Pete's Marina (UTM: 569522; 5596387), by walking along boat docks. Four samples were collected at each location and combined into one sample container, for a total of three sample containers (one per site). All three samples were shipped by the EKISC staff member to a laboratory for analysis. Methodology followed the protocol as outlined by IMISWG, 2015.

Figure 1. Plankton net used for a vertical plankton tow to test for invasive mussel veligers in the water column.

4. Results

4.1. Shoreline surveys

No aquatic invasive plant species were detected during the shoreline surveys. Aquatic invasive plant species detection is the primary focus on this study; however, all native plant species that were collected through rake pulls are listed in Appendix 1. All watermilfoil species (Myriophyllum sp.) detected during surveys had nine (or less) leaflet pairs per leaf. Native watermilfoil species have 5-10 leaflet pairs, whereas invasive Eurasian Watermilfoil (*Myriophyllum spicatum*) has leaves with 12-21 leaflet pairs (Minnesota Sea Grant, 2016). Therefore, all watermilfoil species detected in 2017 were assumed to be native species. There appeared to be a higher amount of Chara species (muskgrass) detected in 2017 when compared to other years of sampling effort in 2015/2016 (Figure 2). Chara species look like plants, but they are actually algae that grow completely submerged in water (Hamel et al., 2001).

Figure 2. High abundance of Chara species (green-colored algae) pulled up during rake toss.

4.2. Offshore surveys

All offshore sampling resulted in the detection of no aquatic invasive plant species. Multiple beds of dense native aquatic plants were located in locations such as Ruault Road and Althalmer/Pete's Marina. While aquatic invasive plant detection was the primary focus of this study, all native aquatic plants were identified to the species level where possible, and are listed in Appendix 2.

4.3. Zebra/Quagga mussel veliger surveys

All veliger samples submitted by the EKISP to the appropriate laboratory were reported back to the EKISC as negative. This indicates that no invasive mussel (Zebra Mussel (*Dreissena polymorph*)/Quagga Mussel (*Dreissena bugensis*) veligers were identified by the laboratory that analyzed the samples.

5. Discussion/Recommendations

No aquatic invasive plant or mussel species were detected in Lake Windermere during the survey effort of 2017 and no aquatic invasive plant or mussel species have been detected previously through any survey effort known effort to-date on Lake Windermere. Due to Lake Windermere's high environmental, economic and societal significance, diligent efforts to inventory for the presence of new aquatic invaders should continue. This would allow for a rapid management response to follow, which would work to eradicate or control any new AIS. The high level of recreational use that Lake Windermere receives puts it at a high level of risk for introducing new AIS into the ecologically significant Columbia Wetlands ecosystem.

5.1. Recommendation for increased level of monitoring for zebra/quagga mussels

The introduction of zebra and/or quagga mussels to Lake Windermere and the Columbia Wetlands could cause severe economic, social and environmental effects that have already been seen in other areas of Canada. Therefore, it is recommended that in order to prevent the wide-spread introduction of these mussels into Lake Windermere and the Columbia Wetlands ecosystem, more diligent and regular monitoring efforts should be implemented. In the British Columbia Aquatic Invasive Species Survey Methods the Inter-Ministry Species Working Group (IMISWG) (2015) states that:

> *[Zebra/Quagga mussel] veligers can exhibit spatial and temporal patchiness in the water column and high sampling frequency (weekly or biweekly) increases the likelihood of collecting veligers. The optimal time to sample veligers in North America is between May and September or when water temperatures are between 16 C and 19 C. Ideally, sample a minimum of three times during the June through October period, and ideally once a month.*

In addition to more frequent veliger sampling, it is recommended that a group such as the Lake Windermere Ambassadors (LWA) consider deploying zebra/quagga mussel substrate samplers at various locations within Lake Windermere. These substrates would allow for widespread, low cost and low effort monitoring of zebra and quagga mussels (IMISWG, 2015). The cost required to construct and deploy substrates would be minimal, and substrates could be set up close to locations where weekly water quality sampling already occurs during summer months. Further information on where to sample, when to sample, and how to construct substrates can be found in the British Columbia Aquatic Invasive Species Survey Methods by the IMISWG (2015).

5.2. Aquatic invasive fish

There have been documented reports of invasive fish (i.e. Pumpkinseed Fish (*Lepomis gibbosus*), Largemouth Bass (*Micropterus salmoides*) in Lake Windermere and/or nearby Columbia Lake (Craig, 2015), yet little is known about the negative effect(s) these fish may be having on lake ecosystems or in

the Columbia Wetlands. It is recommended that surveys for invasive fish be conducted and that local anglers (including local rod and gun clubs) are encouraged "to report any sightings or captures of non-native fish species to the reportinvasives.ca website" (IMISWG, 2015).

5.3. Outreach and education

Groups such as the East Kootenay Invasive Species Council and the Lake Windermere Ambassadors are great spokespersons of the widespread provincial messaging that is part of the 'Clean, Drain, Dry' campaign. This messaging helps to encourage recreationalists to clean their gear (motorboats, kayaks, paddleboards, waders) and the transmission of such information should continue through multiple means of communications by as many groups as possible. Furthermore, native aquatic plants are an important component to any lake or wetland ecosystem. Some recreationalists think that these plants are a nuisance and pose an impediment to some recreational activities on the lake. While this may be true for some activities, it is important to relay the beneficial role that native aquatic plants play in an aquatic ecosystem. For example, native aquatic plants contribute oxygen to the water, they consume carbon dioxide below the water, remove carbon dioxide from the atmosphere, prevent shoreline erosion and they anchor soil in place (Hawthorn & McCormick, 1972). Native plants also provide places of attachment for sessile organisms like protozoa and algae, which thereby enables the lake ecosystem to have the capacity to support other organisms higher up in the food chain such as fish crustaceans and insects (Hawthorn & McCormick, 1972) such as dragonflies and damselflies. Native aquatic plants create hiding places for fish and they are important for birds; they are used for nest building material and are an important food source for waterfowl. Many aquatic plants have been, and continue to be, used by the indigenous peoples of North America for food, clothing and shelter (Hamel et al, 2001).

6. Acknowledgements

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8. Appendices

Appendix 1. Results from the Lake Windermere shoreline surveys for aquatic invasive plants.

Site	AIS sampling location	Aquatic Plants Identified (ranked in order of % in the pull)	Observations/Notes
1. Baltac Beach	Launch (Public Boat Launch) UTM: 0570748; 5593608	**Pull 1**: *Chara sp.* (1 fragment) **Pull 2**: *Chara sp.*	
	South 1 (25m) UTM: 0570750; 5593583	**Pull 1:** *Chara sp.* (1 fragment) **Pull 2:** *Chara sp.*	
	South 2 (50m) UTM: 0570760; 5593559	**Pull 1**: *Chara sp.* **Pull 2**: No plants.	Directly beside small private dock.
	South 3 (75m) UTM: 0570779; 5593544	**Pull 1:** No plants. **Pull 2**: No plants	
	North 1 (25m) UTM: 0570739; 5593631	**Pull 1**: *Chara sp.*(2 fragments) **Pull 2:** No plants.	
	North 2 (50m) UTM: 0570728; 5593656	**Pull 1:** *Chara sp.* **Pull 2**: *Chara sp.*	
	North 3 (75m) UTM: 0570714; 5593672	**Pull 1:** *Chara sp.*. **Pull 2:** *Chara sp.*	
2. Rushmere Community Docks	Launch (centre of private docks) UTM: 0574650; 5585352	**Pull 1:** No plants. **Pull 2**: No plants	
	South 1 (25m) UTM: 0574659; 5585334	**Pull 1**: *Utricularia sp*, aquatic moss, *Chara sp.* **Pull 2**: *Chara sp., aquatic moss.*	Rake pulls conducted from a small dock.
	South 2 (50m) UTM: 0574666; 5585311	**Pull 1:** *Potamogeton amplifolius Tuckerman, Utricularia sp*, *Chara sp., Najas sp.* **Pull 2:** No plants.	
	South 3 (75m) UTM: 0574674; 5585287	**Pull 1:** *Utricularia sp.,* aquatic moss, Chara sp., *Potamogeton natans, Myriophyllum sp.* **Pull 2:** *Utricularia sp., Chara sp., Potamogeton natans.*	Large amounts of washed up Myriophyllum washed up on shoreline.
	North 1 (25m) UTM: 0574637; 5585375	**Pull 1**: No plants. **Pull 2**: *Ranunculus aquatilis (1 fragment)*	
	North 2 (50m) UTM: 0574623; 5585394	**Pull 1:** *Myriophyllum sp. (*1 fragment)*, Chara sp.* (1 fragment) **Pull 2:** No plants.	
	North 3 (75m) UTM: 0574611; 5585417	**Pull 1:** aquatic moss, *Chara sp.* **Pull 2:** aquatic moss, *Chara sp.*	N/A
3. Fairmont Side Channel	Boat launch UTM: 0580441; 5577289	**Pull 1:** *Chara sp.* **Pull 2:** *Chara sp, Potamogeton sp. (likely P. vaginatus).*	Outhouse, picnic tables, garbage cans.
	South 1 (25m) UTM: 0580421; 5577269	**Pull 1:** *Chara sp., Potamogeton sp.* (likely *P. vaginatus*). **Pull 2**: *Chara sp., Potamogeton sp.* (likely *P. vaginatus*)	Could not go further south due to private property. Did not sample further south here in 2015, 2016 or 2017.
	North 1 (25m)	**Pull 1:** *Potamogeton sp. (likely P. vaginatus), Chara*	

	UTM: 0580450; 5577309	*sp.* **Pull 2:** *Potamogeton sp. (likely P. vaginatus), Chara sp.*	
	North 2 (50m) UTM: 0580451; 5577332	Pull 1: Chara sp., Potamogeton sp. (likely P. vaginatus), Potomogeton richardsonii. Pull 2: Chara sp., Potamogeton sp. (likely P. vaginatus), Potomogeton richardsonii.	
	Additional Notes: It was not possible to sample at more than three locations at Fairmont Side Channel due to private property.		
4. End of Ruault Road	Boat Launch UTM: 0572641; 5587665	**Pull 1:** *Chara sp.* **Pull 2:** *Chara sp.*	
	North 1 (25m) UTM: 0572619; 5587674	**Pull 1**: *Chara sp*. **Pull 2:** *Chara sp., Ranunculus aquatilis.*	Bulrushes located north of 25 m did not enable for pulls further north. Did not sample here in 2015, 2016 or 2017.
	South 1 (25m) UTM: 0572664; 5587657	**Pull 1**: *Chara sp*., *Potamogeton sp. (likely P.gramineus).* **Pull 2:** *Chara sp., Potamogeton sp.(likely P.gramineus), Najas sp.*	
	South 2 (50m) UTM: 0572687; 5587647	Pull 1: Chara sp., Potamogeton sp.(likely P.gramineus) Pull 2: Chara sp., Najas sp.	
	South 3 (75m) UTM: 0572711; 5587639	**Pull 1**: *Chara sp.* **Pull 2**: *Chara sp.*	Small amounts of *Chara sp*. coming up with rake pulls.
	Additional Notes: Could not go further north beyond the 25m north because of extensive shoreline plants, i.e. did not perform rake pulls 50m north (North 2), or 75m north (North 3) at 'end of Ruault Road' site.		
5. Unofficial boat launch near Bayshore Condos	Launch UTM: 0569389; 5595010	**Pull 1:** *Najas sp.* **Pull 2**: No plants	
	North 1 (25m) UTM: 0569390; 5595037	**Pull 1**: No plants. **Pull 2:** No plants.	
	North 2 (50m) UTM: 0569380; 5595059	**Pull 1:** *Chara sp., Myriophyllum sp.* (1fragment) **Pull 2:** *Chara sp. Elodea canadensis, Potomogeton praelongus, Potamogeton sp. (likely P.gramineus), Myriophyllum sp., Potamogeton pectinatus*	
	North 3 (75m) UTM: 0569363; 5595076	**Pull 1:** *Chara sp., Potamogeton sp. (likely P.gramineus)* **Pull 2***: Chara sp., Najas sp.*	
	South 1 (25m) UTM: 0569390; 5594986	**Pull 1:** *Chara sp*. (1 fragment) **Pull 2:** *Chara sp.*	
	South 2 (50m) UTM: 0569389; 5594972	**Pull 1**: *Chara sp.* **Pull 2**: *Chara sp., Utricularia sp.* (1 fragment)	
	South 3 (75m) UTM: 0569401; 5594942	**Pull 1:** *Potamogeton sp. (possibly P.Gramineus).* **Pull 2:** *Chara sp*., *Myriophyllum sp. (1 fragment)*	
6. Althalmer/ Pete's Marina	Boat Launch UTM: 0569527; 5596336	**Pull 1:** *Chara sp., Najas sp., Elodea canadensis, Potamogeton sp., Myriophyllum sp.* (1 fragment) **Pull 2***: Najas sp., Chara sp., Utricularia sp.,* aquatic moss, *Potamogeton richardsonii.*	Most heavily used public boat launch access point on Lake Windermere.
	South 1 (25m) UTM: 0569536; 5596313	**Pull 1:** Chara sp., *Elodea canadensis, Myriophyllum sp., Potomogeton richardsonii, Ranunculus aquatilis.* **Pull 2:** *Myriophyllum sp., Elodea canadensis, Najas sp., Chara sp., Potomogeton richardsonii*	
	South 2 (50m) UTM: 0569543; 5596290	**Pull 1:** *Chara sp., Elodea canadensis, Myriophyllum sp., Najas sp., Potamogeton richardsonii.* **Pull 2:** *Myriophyllum sp., Chara sp., Elodea canadensis, Potamogeton richardsonii, Najas sp.*	High abundance of submerged aquatic plants present at this site.

	South 3 (75m)	N/A	Could not conduct this pull due to extensive riparian shrubs obstructing sampling location. Did not sample here in 2015, 2016 or 2017.
	North 1 (25m) UTM: 0569523; 5596361	**Pull 1**: Potamogeton praelongus, *Elodea canadensis, Potamogeton pectinatus, Chara sp.* **Pull 2:** *Potamogeton richardsonii or P.praelongus, Elodea canadensis, Chara sp., Najas sp., Potamogeton pectinatus.*	N/A
	North 2 (50m) UTM: 0569515; 5596382	**Pull 1:** *Elodea canadensis, Potamogeton pectinatus, Potamogeton praelongus, Potomogeton richardsonii , Myriophyllum sp., Potomogeton sp., Najas sp.* **Pull 2:** *Elodea canadensis, Sago, Potamogeton praelongus, Myriophyllum sp., Potomogeton richardsonii, Potomogeton sp., Najas sp.*	N/A
	North 3 (75m) UTM: 0569507; 5596414	**Pull 1:** *Elodea canadensis, Najas sp., Potamogeton praelongus, Myriophyllum sp., Potamogeton pectinatus.* **Pull 2:** *Chara sp., Sago, Elodea canadensis, Najas sp., Myriophyllum sp., Utricularia sp., Ranunculus aquatilis, Potamogeton praelongus.*	Althalmer Slough/Pete's Marina has the highest located biomass of aquatic plants seen during aquatic invasive plant surveys.

Appendix 2. Results from the rake pulls conducted during offshore aquatic invasive plant inventories at 11 survey stations on Lake Windermere.

Site Name	GPS coordinates (UTM)	Distance from shoreline (m)	Rake Pull # or transect survey	Aquatic Plant Species
Rushmere	0574873; 5585577	317	1	*Potamogeton praelongus, Myriophyllum sp.*
Rushmere	0574873; 5585577	317	2	*Ranunculus aquatilis, Potamogeton praelongus, Elodea canadensis*
Rushmere	N/A	variable	100 m transect	*Chara sp., Potamogeton natans, Potamogeton praelongus*
Rushmere	0574816; 5585629	289	1	*Potamogeton natans, Potamogeton praelongus, Chara, Myriophyllum sp.*
Rushmere	0574816; 5585629	289	2	*Potamogeton natans, Chara, Utricularia sp., Myriophyllum sp.*
Lakeshore Resort	0574736; 5586600	112	1	*Chara sp., Potamogeton natans*
Lakeshore Resort	0574736; 5586600	112	2	*Chara sp., Potamogeton natans*
Lakeshore Resort	N/A		100m transect	*Did not complete transect due to wave action.*
Lakeshore Resort	0574678; 5586662	95	1	*Chara sp., Potamogeton natans, Elodea canadensis, Myriophyllum sp., Potamogeton richardsonii, Potamogeton robbinsii*
Lakeshore Resort	0574678; 5586662	95	2	*Elodea canadensis, Myriophyllum sp., Potamogeton natans, Chara sp., Potamogeton robbinsii*
Ruault Road	0573101; 5587234	20	1	*Elodea canadensis*
Ruault Road	0573101; 5587234	20	2	*Potamogeton richardsonii, Elodea canadensis, Myriophyllum sp., Potamogeton natans*
Ruault Road	N/A	variable	100m transect	*Myriophyllum sp., Potamogeton natans, Potamogeton praelongus, Elodea canadensis, Potamogeton richardsonii*
Ruault Road	0573061; 5587313	112	1	*Chara sp., Potamogeton natans, Myriophyllum sp., Elodea canadensis*
Ruault Road	0573061; 5587313	112	2	*Potamogeton natans, Myriophyllum sp., Utricularia sp.*
Indian Beach	0572410; 5589115	50	1	*Chara sp.*
Indian Beach	0572410; 5589115	50	2	*Chara sp.*
Indian Beach	N/A	variable	100m transect	*Chara sp., Potamogeton richardsonii, Potamogeton pictinatus*
Indian Beach	N/A	53	1	*Potamogeton natans, Chara sp.*
Indian Beach	N/A	53	2	*Chara sp.*
Tretheway Docks	0571744; 5589712	115	1	*Chara sp.*
Tretheway Docks	0571744; 5589712	115	2	*Chara sp.*
Tretheway Docks	N/A	variable	100m transect	*Chara sp.*
Tretheway Docks	0571662; 5589769	30	1	No plants.
Tretheway Docks	0571662; 5589769	30	2	No plants.
Akisknook Docks	0571288; 5591445	65	1	*Myriophyllum sp., Potamogeton richardsonii*
Akisknook Docks	0571288; 5591445	65	2	*Myriophyllum sp.*
Akisknook Docks	N/A	variable	100m transect	N/A
Akisknook Docks	0571242; 5591536	83	1	*Elodea canadensis*
Akisknook Docks	0571242; 5591536	83	2	*Elodea canadensis, Potamogeton praelongus*
End of Coy Road	0570109; 5590975	55	1	*Chara sp., Potamogeton natans, Myriophyllum sp., Elodea canadensis, Potamogeton zosteriformis, Potamogeton robbinsii*
End of Coy Road	0570109; 5590975	55	2	*Potamogeton natans, Chara sp., Potamogeton richardsonii, Myriophyllum sp.*
End of Coy Road	N/A	variable	100m transect	*Chara sp., Potamogeton natans, Myriophyllum sp., Potamogeton zosteriformis*
End of Coy Road	0570066; 5591069	78	1	*Chara sp., Potamogeton natans, Potamogeton zosteriformis*
End of Coy Road	0570066; 5591069	78	2	*Chara sp., Potamogeton natans*
Baltac Beach	0571094; 5593411	101	1	*Chara sp.*
Baltac Beach	0571094; 5593411	101	2	*Chara sp.*

Baltac Beach	N/A	variable	100m transect	*Chara sp.*
Baltac Beach	0570996; 5593445	73	1	*Chara sp.*
Baltac Beach	0570996; 5593445	73	2	*Chara sp.*
Lakeview Meadows	0570174; 5594069	32	1	*Elodea canadensis, Potamogeton pictinatus, Myriophyllum sp., Chara sp.*
Lakeview Meadows	0570174; 5594069	32	2	*Elodea canadensis, Potamogeton pictinatus, Chara sp., Potamogeton richardsonii*
Lakeview Meadows	N/A	variable	100m transect	*Potamogeton richardsonii, Potamogeton praelongus, Myriophyllum sp.*
Lakeview Meadows	0570191; 5594166	103	1	*Chara sp.*
Lakeview Meadows	0570191; 5594166	103	2	*Chara sp.*
Unofficial boat launch near Bayshore Condos	0569442; 5595071	67	1	*Chara sp.*
Unofficial boat launch near Bayshore Condos	0569442; 5595071	67	2	*Myriophyllum sp., Chara sp.*
Unofficial boat launch near Bayshore Condos	N/A	variable	100m transect	N/A
Unofficial boat launch near Bayshore Condos	0569419; 5595152	84	1	No plants.
Unofficial boat launch near Bayshore Condos	0569419; 5595152	84	2	No plants.
Althalmer/Pete's Marina	0569563; 5596317	21	1	*Chara sp., Myriophyllum sp., Potamogeton pictinatus, Potomogeton richardsonii,*
Althalmer/Pete's Marina	0569563; 5596317	21	2	*Chara sp., Myriophyllum sp., Sago, Potamogeton richardsonii,*
Althalmer/Pete's Marina	N/A	variable	100m transect	*Potamogeton pictinatus, Myriophyllum sp., Potamogeton richardsonii, Chara sp.,*
Althalmer/Pete's Marina	0569531; 5596404	27	1	*Chara sp.*
Althalmer/Pete's Marina	0569531; 5596404	27	2	*Chara sp., Myriophyllum sp.,* aquatic moss