Aquatic Invasive Plant Survey for Eurasian watermilfoil and Curlyleaf Pondweed in the Bighorn Reservoir, Montana and Wyoming

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Preface

This report presents data collected by Mississippi State University and Weed Management Services in 2012 in one reservoir of Montana, one reservoir of Wyoming, and the river connecting them. Funding was provided by the Montana Department of Natural Resources and Conservation and Big Horn County (WY) Weed and Pest Control Board. The Bighorn Reservoir National Recreation Area (National Park Service) provided access. We thank Alicia Stickney, Alice Stanley, Ray Beck, Ruth Zeller, Cassidy Bromley, and Beth Bear for assistance with planning and on the ground logistics. Field assistance was provided by Bradley Sartain and John Mark Curtis, Mississippi State University. Any errors in presentation or fact are the responsibility of the authors.

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Executive Summary

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Eurasian watermilfoil (*Myriophyllum spicatum* L.) and curlyleaf pondweed (*Potamogeton crispus* L.) are two non-native, Montana-listed noxious aquatic plants that are increasingly spreading in Montana and the West. Eurasian watermilfoil was identified in Noxon and Toston Reservoirs and the Jefferson River system in 2011; however, the source of the infestation was not determined. Curlyleaf pondweed was known to occur in the upper Missouri, Madison, East Gallatin, and Jefferson River systems, but limited data existed quantifying its actual distribution in the Missouri River watershed. Little information was previously available on invasive aquatic plants in Wyoming.

Within the assigned survey area, Eurasian watermilfoil and curlyleaf pondweed were not observed. This region has a number of natural lakes, man-made impoundments, and rivers with varying degrees of access which will influence the invasion potential for a given water body. The waters surveyed during this inventory had low community richness of native aquatic plants.

Future surveys should continue to monitor for new populations of Eurasian watermilfoil and Curlyleaf pondweed and should be directed towards high risk water bodies in Montana and Wyoming. These include aquatic sites directly associated with infested waters and water bodies that have access points that support motorized boat traffic.

Project Introduction

Understanding the dynamics driving macrophyte populations in a given water body has become increasingly important due to the introduction and spread of numerous non-native plant species. Non-native plants affect aesthetics, drainage, fishing, water quality, fish and wildlife habitat, flood control, human and animal health, hydropower generation, irrigation, navigation, recreation, and ultimately land values (Pimental et al. 2000, Rockwell 2003). The spread of non-native aquatic plants also impacts native plant communities and primary production in littoral zone areas of waterbodies. Littoral areas in freshwater lakes are the most productive regions within a body of water, and an important component of high productivity is a diverse native aquatic plant community (Wetzel 2001). The importance of plants in these areas are paramount as they contribute to the structure, function, and diversity of aquatic ecosystems, aid in nutrient cycling, produce food for aquatic organisms, and provide habitat for invertebrates and fish (Carpenter and Lodge 1986, Ozimek et al. 1990, Madsen et al. 2001). Littoral areas, are however, more prone to invasion by non-native plants as they experience more disturbance than other parts of a water body.

Two non-native aquatic plants that are becoming problematic in Montana and the Pacific Northwest are Eurasian watermilfoil (*Myriophyllum spicatum*) and curlyleaf pondweed (*Potamogeton crispus*). Eurasian watermilfoil is an invasive vascular plant that has invaded freshwater lakes across the United States. The introduction of this species has likely resulted in the alteration of the complex interactions occurring in littoral habitats (Madsen 1997). Eurasian watermilfoil has been associated with declines in native plant species richness and diversity (Madsen et al. 1991a,b, Madsen et al. 2008), reductions in habitat complexity resulting in reduced macroinvertebrate abundance (Krull 1970, Keast 1984), and reductions in fish growth (Lillie and Budd 1992). Eurasian wate*rmilfoil* poses nuisance problems to humans by impeding navigation, limiting recreation opportunities, and increasing flood frequency and intensity (Madsen et al. 1991a). It is primarily spread by fragmentation and can be easily transported between water bodies by many vectors. Once established, it is very difficult to control. Curlyleaf pondweed also causes significant nuisance problems where it has become established (Bolduan et al. 1994, Catling and Dobson 1985, Woolf and Madsen 2003). It is widely considered to be an ecosystem transformer, like Eurasian watermilfoil, but this species tends to accelerate internal nutrient loading and eutrophication (James et al. 2002). Management of this species is often more difficult due to its life history strategy (turion production) and the limited availability of effective management options.

Both species are listed on Montana's noxious weed list and are spreading throughout the state. Eurasian watermilfoil was identified in Toston Reservoir and the Jefferson River system in 2010. Curlyleaf pondweed was known to occur in the upper Missouri, Madison, East Gallatin, and Jefferson River systems, but little data existed regarding its actual distribution in other Montana waterbodies. Pursuant to this, a systematic survey is needed to develop baseline information on the aquatic plant community. The survey would quantify the location and extent of Eurasian watermilfoil and curlyleaf pondweed within lakes/reservoirs in the upper Missouri River watershed and determine the presence of other non-native aquatic plants such as flowering rush (*Butomus umbellatus*). Data such as these are necessary to guide future management decisions, determine funding needs, and coordinate control efforts. Preliminary inventories have identified other submersed aquatic plants in these water bodies, which will also be a factor in developing management protocol.

Objectives

1. Conduct aquatic plant surveys on Bighorn Lake, Bighorn River, and Yellowtail Reservoir in Montana and Wyoming.

1. Reservoir Materials and Methods

Littoral zone point intercept surveys were conducted on Bighorn Lake, Bighorn River, and Yellowtail Reservoir (Figure 1). Surveys were designed and conducted using bathymetric data obtained by the Montana Department of Natural Resources and Conservation. Survey points were established in the littoral zone for each water body, which we designated as double the secchi depth and were based on other surveys conducted in Montana. Survey methods followed those outlined by Madsen (1999), Madsen and Wersal (2009), Wersal et al. (2009), and Wersal and others (2010), where a pre-determined grid of points at set distances from one another were surveyed in each water body. The grid spacing was dependent upon the total size of the reservoir. A systematic or random-systematic survey method is a better survey design when initially surveying a water body as it is more apt to find rare species, in contrast with a random design which will likely under-sample rare but ecologically important species such as Eurasian watermilfoil (Barbour 1999). A systematic survey design also maximizes survey efficiency.

Surveys were conducted by boat using GPS (Global Positioning System) technology to navigate to each point. A Trimble YUMA® computer with integrated GPS receiver was used to conduct and store survey data. At each survey point, a weighted plant rake was deployed to determine the presence of all plant species. Spatial survey data were recorded electronically using FarmWorks Site Mate® software. Site Mate® allowed for the navigation to specific survey points, as well as, the displaying and collecting of geographic and attribute data while in the field. Collecting data in this fashion reduces data entry errors and reduces post survey data processing time. Collected data were recorded in database templates. Voucher specimens were collected if a species was found for the first time and were dried and pressed.

In addition to plant presence/absence data, the depth at each point was recorded using a boat mounted depth finder or with a sounding rod in water depths of less than 10 ft. Water transparency was estimated using a sechhi disk at one to four locations throughout a given reservoir, depending on total size, between 1100 and 1300 hours.

Frequency of occurrence for each species in a water body was calculated by dividing the number of survey points that species was observed by the total number of points surveyed for a given water body, then multiplied by 100 to achieve a percent. Average species richness was estimated by calculating the sum of all species at a given survey point, and then calculating the mean across all survey points for a given water body. Species distributions are reported visually in a series of maps created for each water body surveyed.

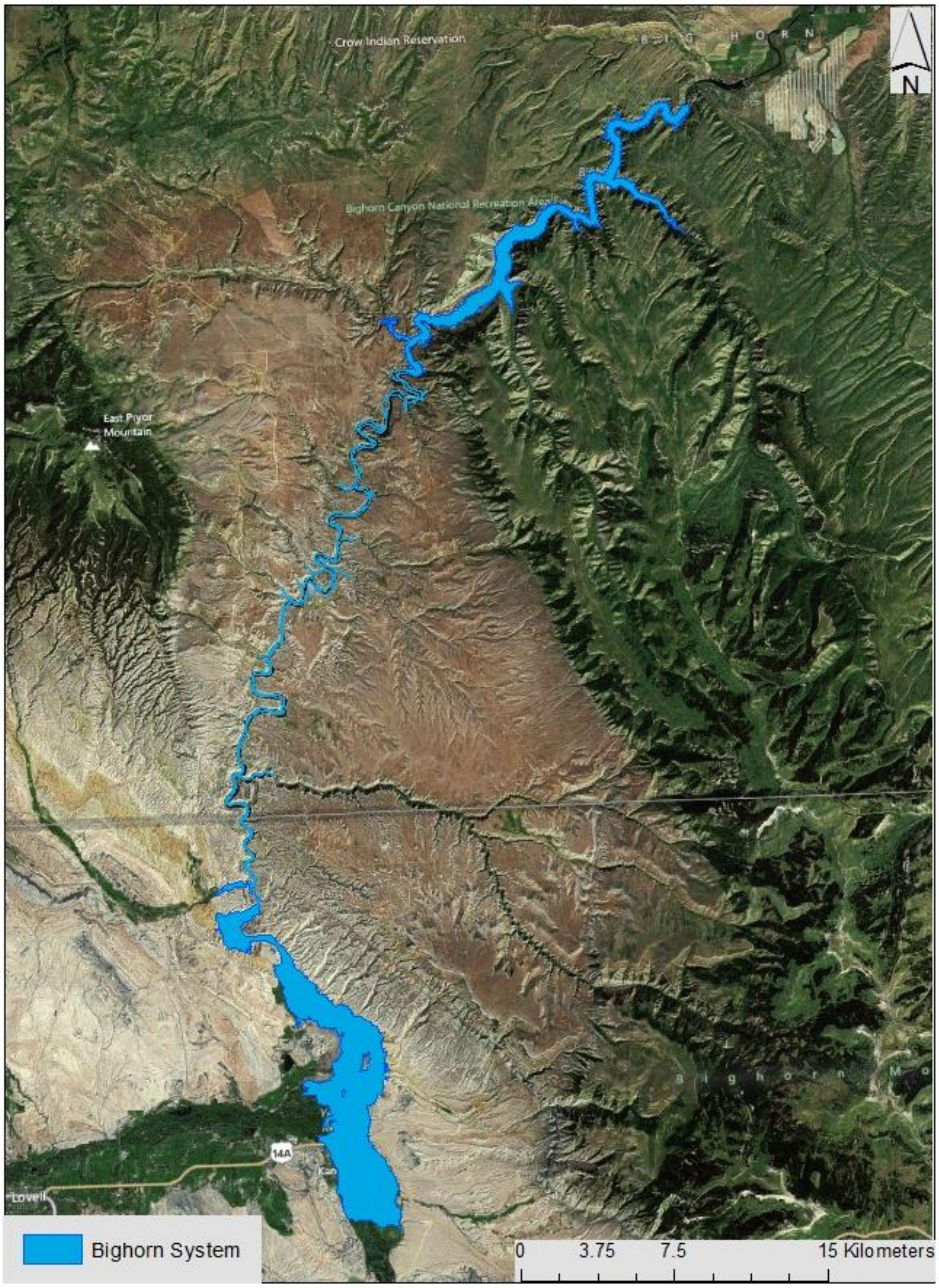

Figure 1. The survey area for 2012 encompassing Bighorn Lake and River, MT and Yellowtail Reservoir, WY. Surveys were conducted in July and August 2012.

1. Reservoir Results and Discussion

Lake Name: Bighorn Lake, MT

Dates Surveyed: August 4, 2012

Secchi: 4.8 m (15 ft)

Points Surveyed: 35

Eurasian watermilfoil = Negative

Curlyleaf Pondweed = Negative

We only surveyed points less than 30 feet deep as this was the most likely area for aquatic vegetation to be found. Average survey depth was 18.9 ft with the deepest survey being 27.5 ft. Bighorn Lake is a narrow reservoir with steep sides so our focus was the waters along the shorelines. Due to the steepness of the sides of this reservoir, the littoral zone is a narrow band along the shore of the reservoir (Figure 2). Of the 35 points sampled, none were vegetated by any species of aquatic plant.

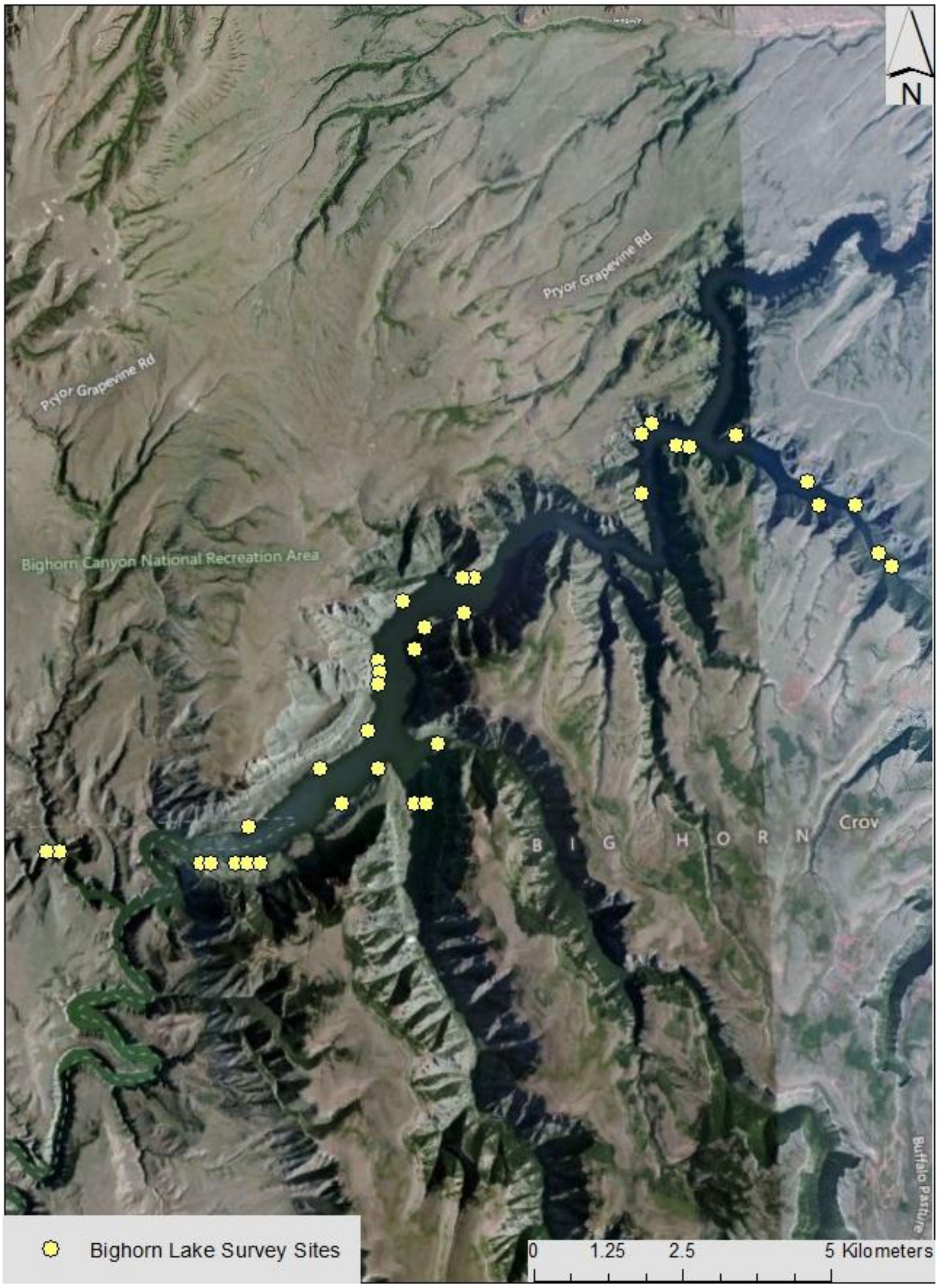

Figure 2. Survey points sampled during the littoral zone survey of Bighorn Lake conducted in August 4, 2012.

Lake Name: Bighorn River

Dates Surveyed: July 18, 2011

Secchi: 2.3 m (7.5 ft)

Points Surveyed: N/A

Eurasian watermilfoil = Negative

Curlyleaf pondweed = Negative

Bighorn River is at the base of a gorge with very steep sides. This river connects Bighorn Lake in Montana to Yellowtail Reservoir in Wyoming. The sides of the canyon are very steep often shading the water below. The littoral zone, where present is a narrow band along the canyon wall with a rock substrate. It is unlikely that aquatic plants would be able to colonize the water in the river. No aquatic plants were observed within the river adding support to this theory.

We surveyed the littoral zone around Bighorn River by boat. No aquatic plants were observed anywhere in the river.

Figure 3. Survey of the littoral zone in Bighorn River conducted in July 2012.

Lake Name: Yellowtail Reservoir, WY

Dates Surveyed: July 16-17, 2011

Secchi: 0.46 m (1.5 ft)

Points Surveyed: 291

Eurasian watermilfoil = Negative

Curlyleaf pondweed = Negative

Yellowtail Reservoir is a large shallow lake (Figure 4). The points at the southern end of the lake were inaccessible by boat. Points were surveyed to a water depth of 10 ft. with the maximum observed depth of plant growth being 5.2 ft. The deepest water depth measured during this survey was 26.9 ft. Of the 291 points surveyed, 10 (3.4%) had an aquatic plant species (*Polygonnum hydropiperoides*) present (Figures 5, 6).

Table 1. Plant species list and percent occurrences for Yellowtail Reservoir, WY, July 2012.

Species	Common Name	Frequency of Occurrence (%)
Polygonum hydropiperoides	Swamp smartweed	3.4
Average Survey Depth (ft)		5.9 ft
Species Richness (avg. number per vegetated point)		1

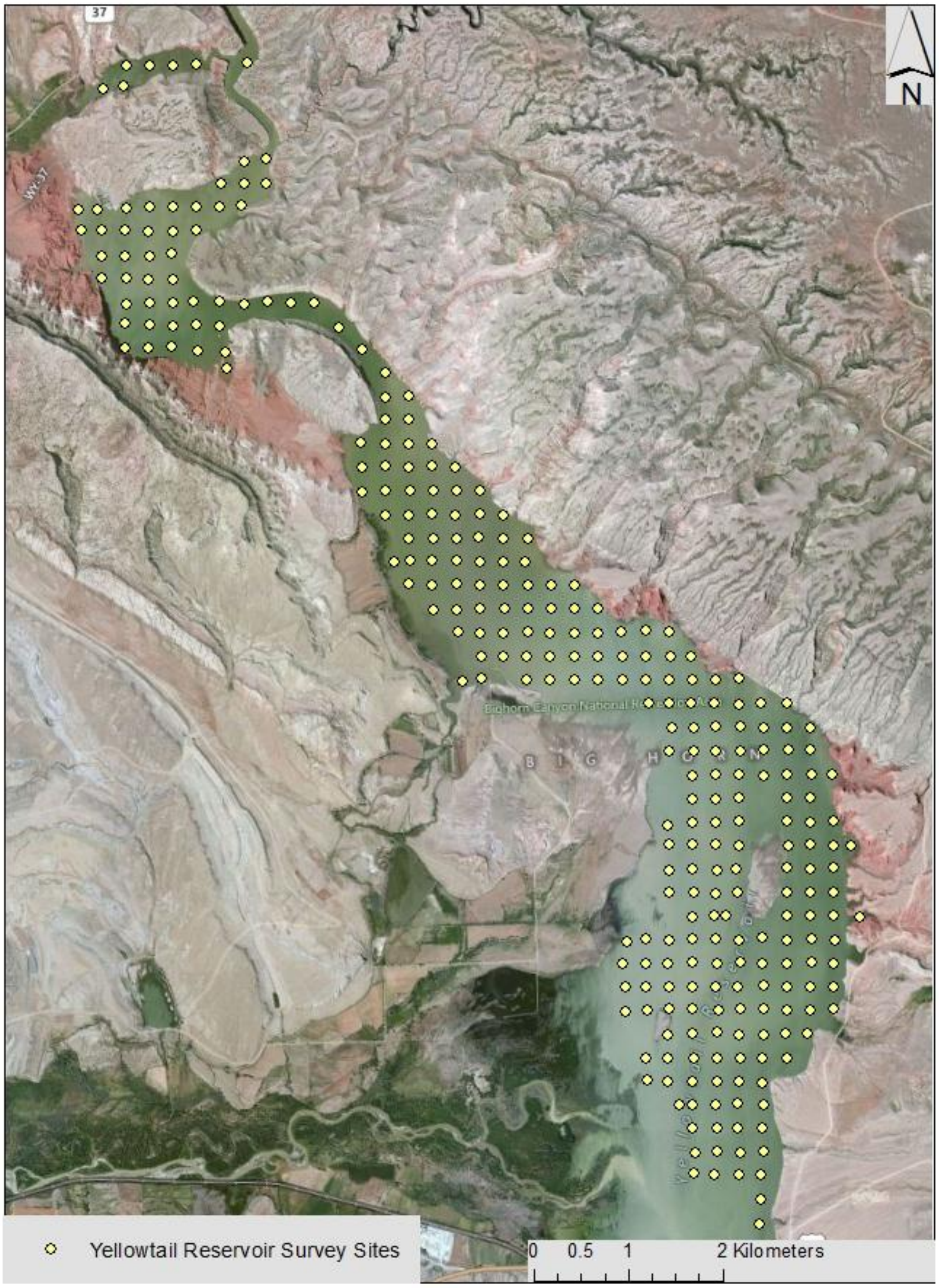

Figure 4. Survey points sampled on Yellowtail Reservoir during the littoral zone survey conducted in July 2012.

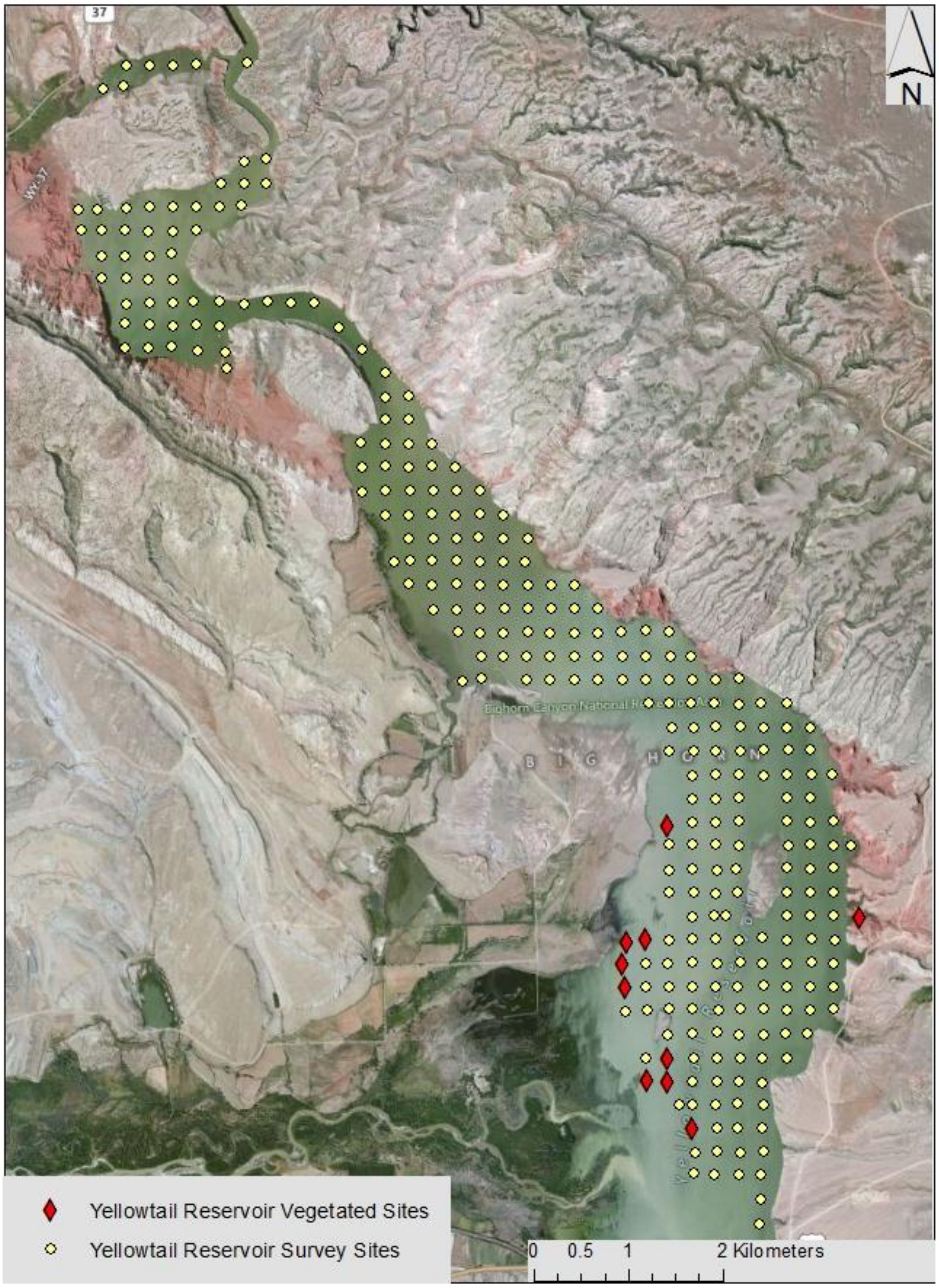

Figure 5. Vegetated survey points in Yellowtail Reservoir during the littoral zone survey conducted in July 2012.

Figure 6. The distribution of *Polygonum hydropiperoides* in Yellowtail Reservoir during the littoral zone survey conducted in July 2012.

2. Conclusions and Recommendations

The waterbodies surveyed had poor species richness for their aquatic plant communities. Bighorn Lake and river did not appear to have aquatic plants. Eurasian watermilfoil and curlyleaf pondweed were not found in any of the waterbodies surveyed. Utilizing the point intercept survey method to survey the littoral zone of each waterbody allowed for a more direct, quantitative approach in areas more likely to support aquatic plant growth.

Given the remoteness of the majority of these water bodies, the lack of access points, and the poor water quality the probability of invasion by Eurasian watermilfoil and curlyleaf pondweed is low. The primary means of spreading these species between water bodies is by motorized watercraft. Therefore, priority should be given to waterbodies that have improved access for motorized watercraft and are important recreation areas. Continued surveys and monitoring should be conducted on these waterbodies.

One cautionary note is that plant establishment is limited by the poor visibility of the upper lake, and the large amplitude of water level variation (Figure 7). A dramatic increase in transparency, or a dramatic decrease in water level fluctuation, may increase probability of invasion. Secchi disk transparency in the upper lake is 1.5’, in the canyon it is 7.5’, and in the lower lake (Montana) it is 15’. Significant settling of particulates is occurring in the reservoir.

If populations of these species do become established in these water bodies, it is recommended that only control methods that have been shown to be effective via peer-reviewed literature and under similar use patterns should be evaluated for possible use. If data do not exist it may be necessary to conduct the necessary research to develop use patterns for a specific management technique in a given water body. It is much more cost efficient to manage a non-native species when the population is small.

Figure 7. This sign at the boatlaunch on the afterbay of Bighorn Reservoir explains why plants are not growing in this system. Large water level fluctuations will prohibit the establishment of most aquatic plants, particularly submersed plants.

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