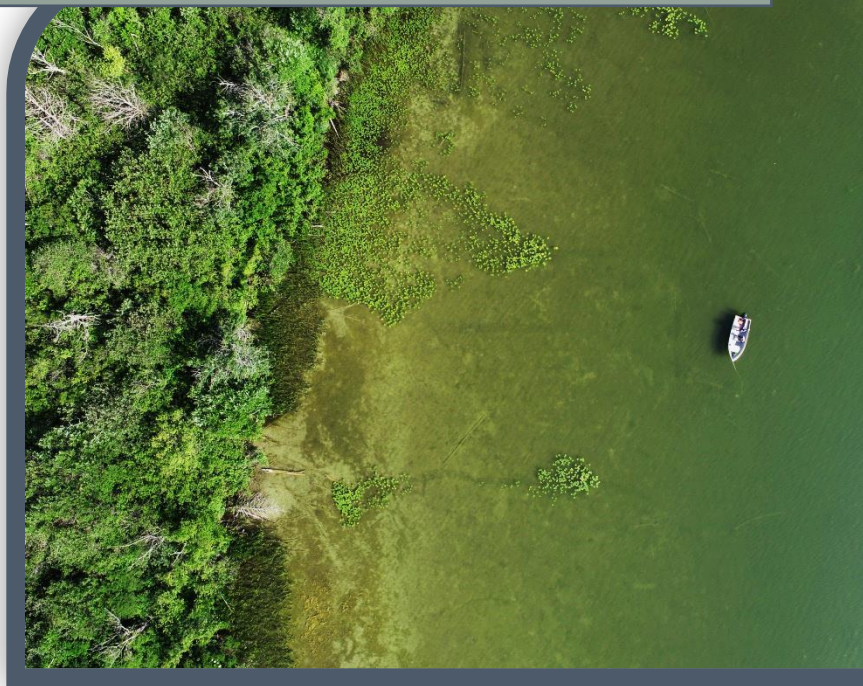


Upper Herring Lake Drone Survey 2020

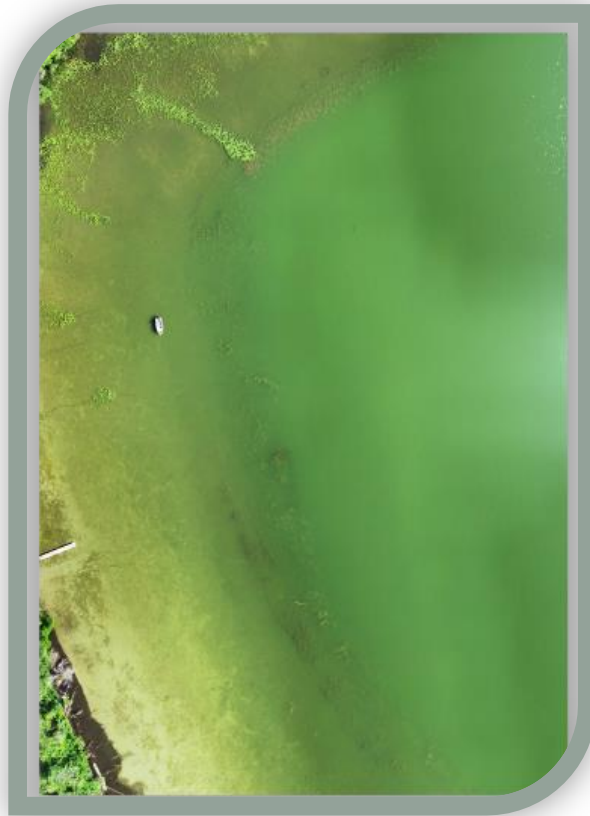


Upper Herring Lake, Water Milfoil Drone Survey
Benzie Conservation District
10/15/20
John@benziecd.org

Executive Summary

Eurasian Watermilfoil is a noxious aquatic invasive plant that can form dense mats, overcrowding native vegetation and degrading the recreational and ecological value of a lakes and streams. In July 2020 the Benzie Conservation District completed a drone survey of known watermilfoil beds in Upper Herring Lake (Benzie County), in order to assess the current total area of EWM in the lake, as well as track changes in size and distribution of EWM in future surveys. The survey covered 130.8 acres in four separate areas of the lake including: Herring Creek inlet (eastern shore; 25.5 acres), south west corner (19.4 acres), western shoreline (53.3 acres), and Herring Creek outlet and DNR boat launch (32.6 acres). In

total 9.61 acres of watermilfoil was found including 3.5 acres of EWM near the outlet and western shore and 6.11 acres of mixed variable leaf milfoil, EWM and northern watermilfoil west of the Herring Creek inlet.



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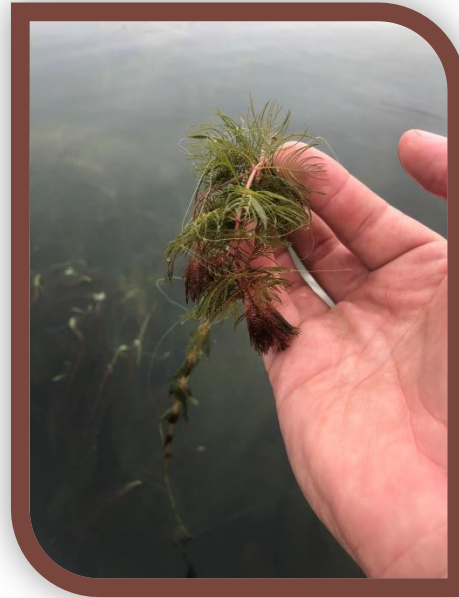
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Background

Eurasian Watermilfoil (EWM) is a noxious aquatic invasive plant that can form dense mats, overcrowding native vegetation and degrading the recreational and ecological value of a lakes and streams. Upper Herring Lake is the largest water body in the watershed, covering 572.5 acres and with just over 4 miles of shoreline. Upper Herring Lake is a mesotrophic lake with a maximum depth of 26 feet and average depth of 22 feet.

A macrophyte survey of Upper Herring Lake was conducted in the summers of 2012, 2013, and 2015 found no non-native macrophytes in the lake. A snorkeling survey conducted in 2017 by the Benzie Conservation District near the inlet and outlet discovered sparse areas of EWM foil near the DNR boat launch/outlet and dense patches of variable leaf milfoil near the Herring Creek inlet. In September 2019 PLM Lake & Land Management Corp conducted a rake toss survey and found ~9 acres of EWM bed along the western littoral zone of the lake.



Methods

In July 2020 the Benzie Conservation District completed a drone survey of known watermilfoil beds in Upper Herring Lake (Benzie County), in order to assess the current total area of EWM in the lake, as well as track changes in size and distribution of EWM in future surveys. The survey focused on the areas identified to have EWM in the 2019 PLM report. A DJI phantom 4 pro v2 drone was used to capture a series of photos of predesignated areas within the lake. The survey followed the patented methods described under US Patent US 10,628,672 B2. The georeferenced photos were then stitched together using the Drone Deploy software to create ortho-mosaic photos. The ortho-mosaic photos were then uploaded into the Google Earth Program and overlaid onto the satellite imagery. The milfoil beds identified from the drone images could then be marked (center point gps coordinates), outlined, and measured using the Google Earth software.

Results

The survey covered 130.8 acres in four separate areas of the lake including: Herring Creek inlet (eastern shore; 25.5 acres), southwest corner (19.4 acres), western shoreline (53.3 acres), and Herring Creek outlet and DNR boat launch (32.6 acres). In total 9.61 acres of watermilfoil was found including 3.5 acres of EWM near the outlet and western shore and 6.11 acres of mixed variable leaf milfoil, EWM, and northern watermilfoil west of the Herring Creek inlet.

The largest and most dense area of EWM was near the Outlet/DNR boat launch (101,226 ft²:figure 4). EWM was found in this area in 2018 during a snorkeling survey found the EWM to be well mixed with native pondweeds and was not outcompeting other vegetation. The large patches of milfoil near the inlet were mostly variable leaf milfoil, however EWM and northern milfoil was also found within those patches (figure 1). EWM patches along the south and west shore lines were smaller and mixed with native pondweeds (figures 2,3).

Table 1. Location, area, and site ID for each water milfoil patch surveyed in July 2020.

Section	Site ID	Latitude	Longitude	Area (ft ²)
Inlet (east shore)	Milfoil 1	44°33'40.96"N	86°10'22.15"W	27,525
Inlet (east shore)	Milfoil 2	44°33'38.98"N	86°10'24.53"W	22,338
Inlet (east shore)	Milfoil 3	44°33'34.80"N	86°10'20.60"W	207,256
Inlet (east shore)	Milfoil 4	44°33'31.15"N	86°10'26.38"W	7,339
Inlet (east shore)	Milfoil 5	44°33'30.87"N	86°10'23.88"W	1,956
Southwest corner	EWM 6	44°33'14.12"N	86°11'37.10"W	3,286
Southwest corner	EWM 7	44°33'15.56"N	86°11'37.30"W	192
Southwest corner	EWM 8	44°33'18.81"N	86°11'36.78"W	167
West shore	EWM 9	44°33'34.15"N	86°11'16.74"W	1,434
West shore	EWM 10	44°33'34.98"N	86°11'15.93"W	205
West shore	EWM 11	44°33'35.69"N	86°11'15.00"W	544
West shore	EWM 12	44°33'45.79"N	86°11'7.45"W	942
Outlet/DNR boat launch	EWM 13	44°34'1.15"N	86°11'6.42"W	19,292
Outlet/DNR boat launch	EWM 14	44°34'7.72"N	86°11'9.62"W	19,947
Outlet/DNR boat launch	EWM 15	44°34'11.64"N	86°11'10.39"W	101,226
Outlet/DNR boat launch	EWM 16	44°34'11.88"N	86°11'5.68"W	5,210
	Total ft²			418,859
	Total Acres			9.616

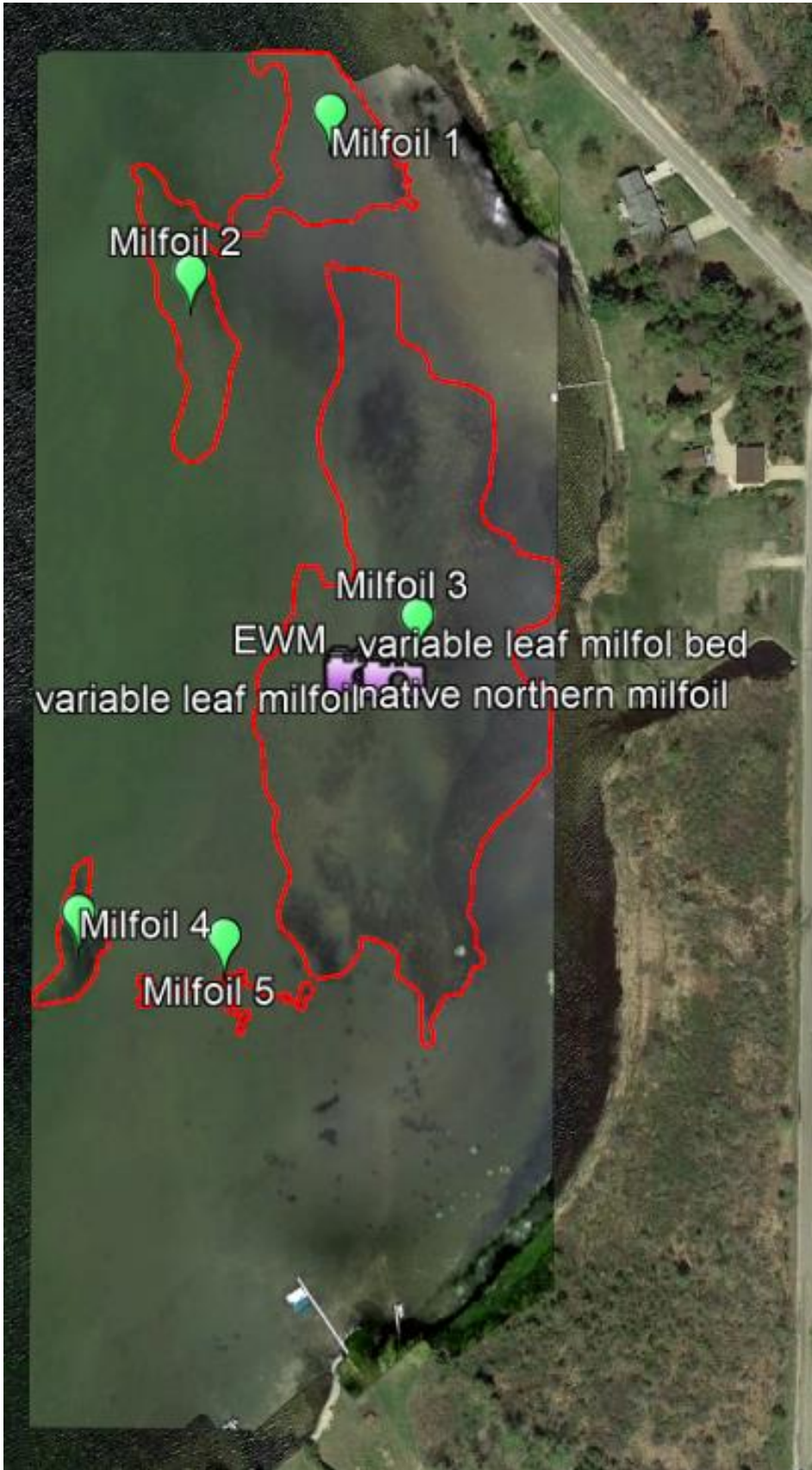


Figure 1. Ortho-mosaic photo 1 Upper Herring Lake littoral zone - inlet (east shore).





Figure 2. Ortho-mosaic photo 2 Upper Herring Lake littoral zone - southwest corner.





Figure 3. Ortho-mosaic photo 3 Upper Herring Lake littoral zone - west shore



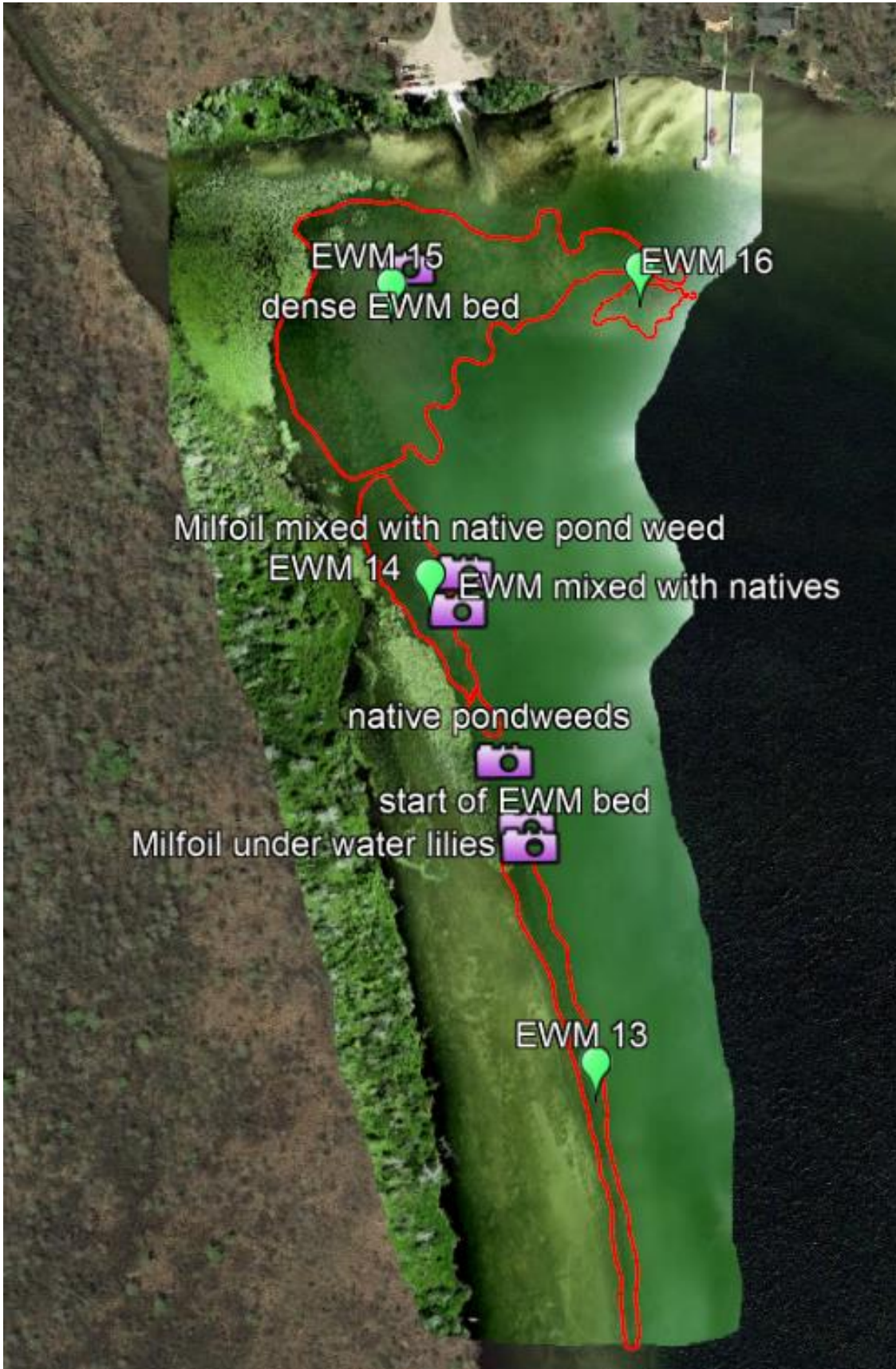


Figure 4. Ortho-mosaic photo 4 Upper Herring Lake littoral zone - Outlet/DNR boat launch.

