Aquatic Plant Community of Pine Lake and Lake Holcombe Flowage Chippewa County

Assessment of
Eurasian Watermilfoil
(*Myriophyllum spicatum*)
And
Milfoil Weevils
(*Euhrychiopis lecontei*)

Interim Report

Wisconsin Department of Natural Resources
January 2013

Table of Contents

Figures

Executive Summary

Purpose of Survey

Three distinct areas of *Myriophyllum spicatum* (EWM) concentration in Lake Holcombe were surveyed in response to a pilot project by Lake Holcombe Improvement and Protection Association to use milfoil weevils, *Euhrychiopsis lecontei,* as a bio-control agent of EWM. Surveys were conducted in Pine Lake twice in 2011 and 2012. Surveys were conducted in Goose Bay and Goat Island twice in 2012. Surveys will be conducted twice annually for the next three to five years.

Summary of Findings

The percent coverage of aquatic vegetation was low in all three areas as was the maximum rooting depth. Lake Holcombe is characterized by dark tannin stained water causing decreased light penetration which may be limiting EWM distribution as well as aquatic plant growth in general.

At this time, EWM has shown increases over time, however, this was impacted by a delayed growing season in 2011 and an accelerated growing season in 2012. At this time, it is too early in the project to determine success or failure of the weevils based on EWM distribution.

No weevils were found during any in-lake visual inspection of plants or during laboratory inspections in 2011. Weevils were present in the spring 2012 surveys (i.e. prior to 2012 stocking activities) indicating that the 2011 stocked weevils were successful at overwintering. Both the number of total EWM apical meristems and the average number of meristems per stem decreased by from May 2021 to August 2012 while the average number of weevils increased. Weevils were found far from areas stocked in either year indicating the weevils are moving substantial distances to find EWM in suitable habitat.

Introduction

Eurasian watermilfoil *Myriophyllum spicatum* L. (EWM) was first documented in Lake Holcombe, Chippewa County, Wisconsin in 2005. At that time it was limited to Pine Lake, a small back-water area adjacent to the Lake Holcombe Flowage. Since the original discovery it territory has expanded to include areas of the main portion of Lake Holcombe.

The milfoil weevil *Euhrychiopsis lecontei* Dietz is a native specialist herbivore that preferentially feeds on EWM (Marko et al 2005) and has been shown to suppress EWM populations in laboratory and whole-lake experiments (e.g. Sheldon and Creed 1995; Creed and Sheldon 1995; Creed 1998; Newman and Beisboer 2000; Jester et al. 2000). In 2010 the Lake Holcombe Improvement Association (LHIA) applied for and received a Natural Resources Fund Grant to implement the use of milfoil weevils for the purpose of biological control of EWM on Lake Holcombe. The following interim report details in-lake EWM and weevil monitoring activities performed by water resources staff at the Wisconsin Department of Natural Resources.

Methods

Study areas

The aquatic plant communities of three distinct areas of EWM concentration in Lake Holcombe were surveyed for EWM frequency and density (Figure 1). Pine Lake is minimally connected to the main flowage and can be considered an autonomous body of water. The entirety of Pine Lake was surveyed. Goose Bay and Goat Island occur in the main flowage area of Lake Holcombe. The edges of the surveyed areas Goose Bay and Goat Island were determined by the extent of EWM. The areas surrounding the survey areas were visually surveyed to ensure EWM did not extended beyond the edges of the designated survey area.

Myriophyllum spicatum

EWM was surveyed using a Point-Intercept (PI) method. Using GIS, a 42 meter grid was placed over the survey area. At each PI site, one plant sample was collected using a steel thatching rake. The presence and density of EWM was recorded for each point. EWM was given a density rating based on the total coverage of the rake (1 – sparse, 2 – moderate, 3 – abundant). Depth was recorded at each sample site and classified into four zones: zone 1 = 0 – 1.5 ft; zone 2 = 2– 5 ft; zone 3 = 5.5 – 10 ft; zone 4 = >10.5.

Euhrychiopsis lecontei

To determine the presence or absence of weevils prior to stocking activities, during the June 2011 sampling period, three random plants were collected from four areas within each survey area, showing the densest EWM growth based on data collected in the aquatic plant survey and historic records. In September 2011 we increased the number of randomly selected plants from each area to five. During both surveys in 2012, the top 50 cm of two EWM stems were collected at every site where EWM occurred.

Stems were preserved in 75% ethanol. Laboratory examination of EWM stems was done using a dissecting microscope. Data collected were: the total number of apical meristems (tips of stems) per site, total number of weevil eggs, larvae, pupae and adults per site and evidence of weevil feeding damage (i.e. darkened apical meristems, pupal blast holes).

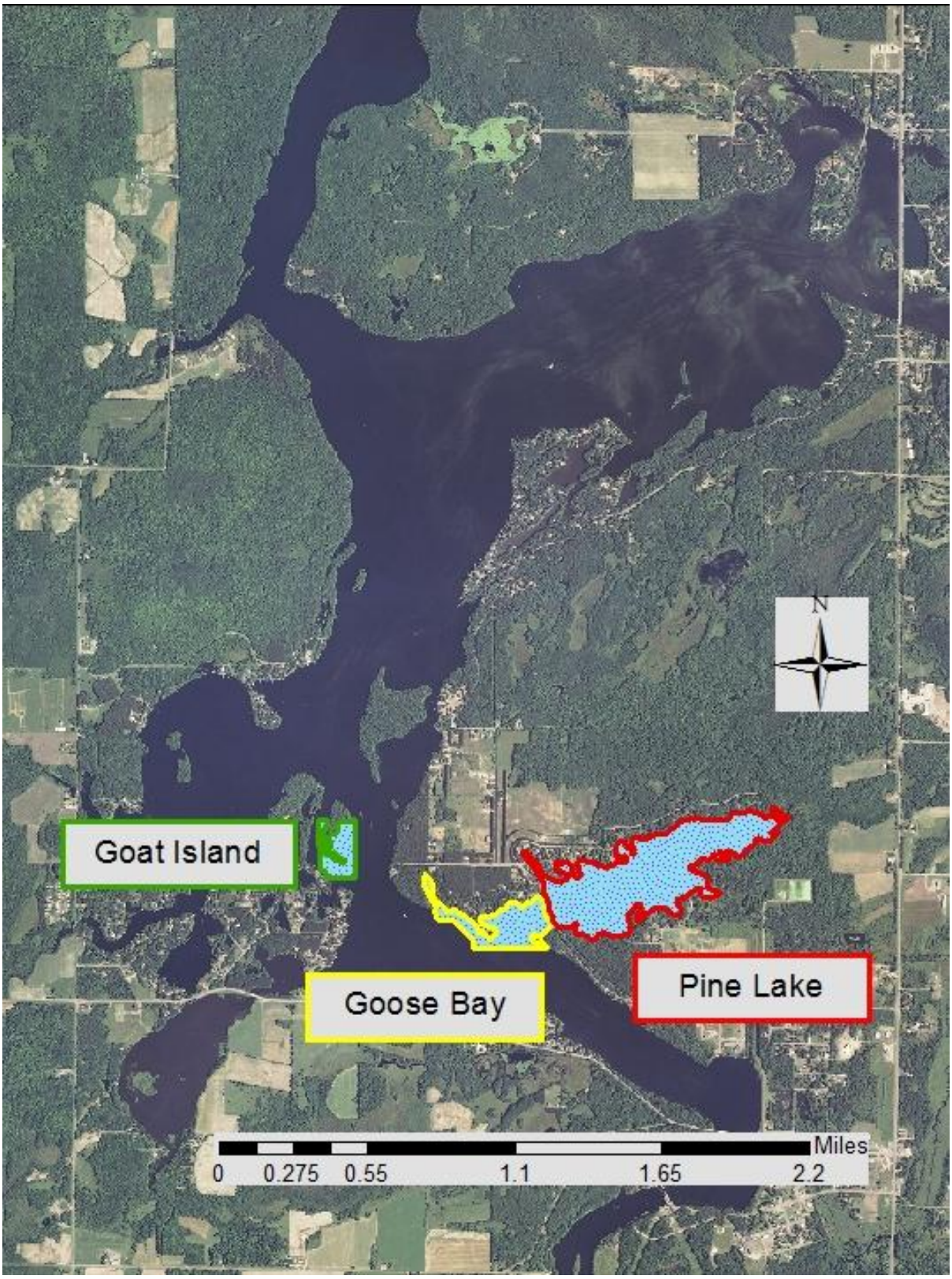

Figure 1. Lake Holcombe Flowage highlighting survey areas

Description of Pine Lake

Pine Lake is 120 acres with 4.5 miles of shoreline and a maximum depth of 17 feet. A 42 meter sampling grid consisting of 334 points was developed for plant survey use on Pine Lake. Of the original 334 points, 43 sites in June 2011, Sept 2011 and May 2012 and 46 sites in Aug 2012 were not sampled because they occurred on land or shallow depths and/or dense plant growth prevented access (Figure 2). EWM surveys were conducted in June 2011, September 2011, May 2012 and August 2012. Weevils were stocked in Pine Lake in July 2011 and July 2012 with stock raised by LHIA (see Figure 13 for weevil stocking sites)

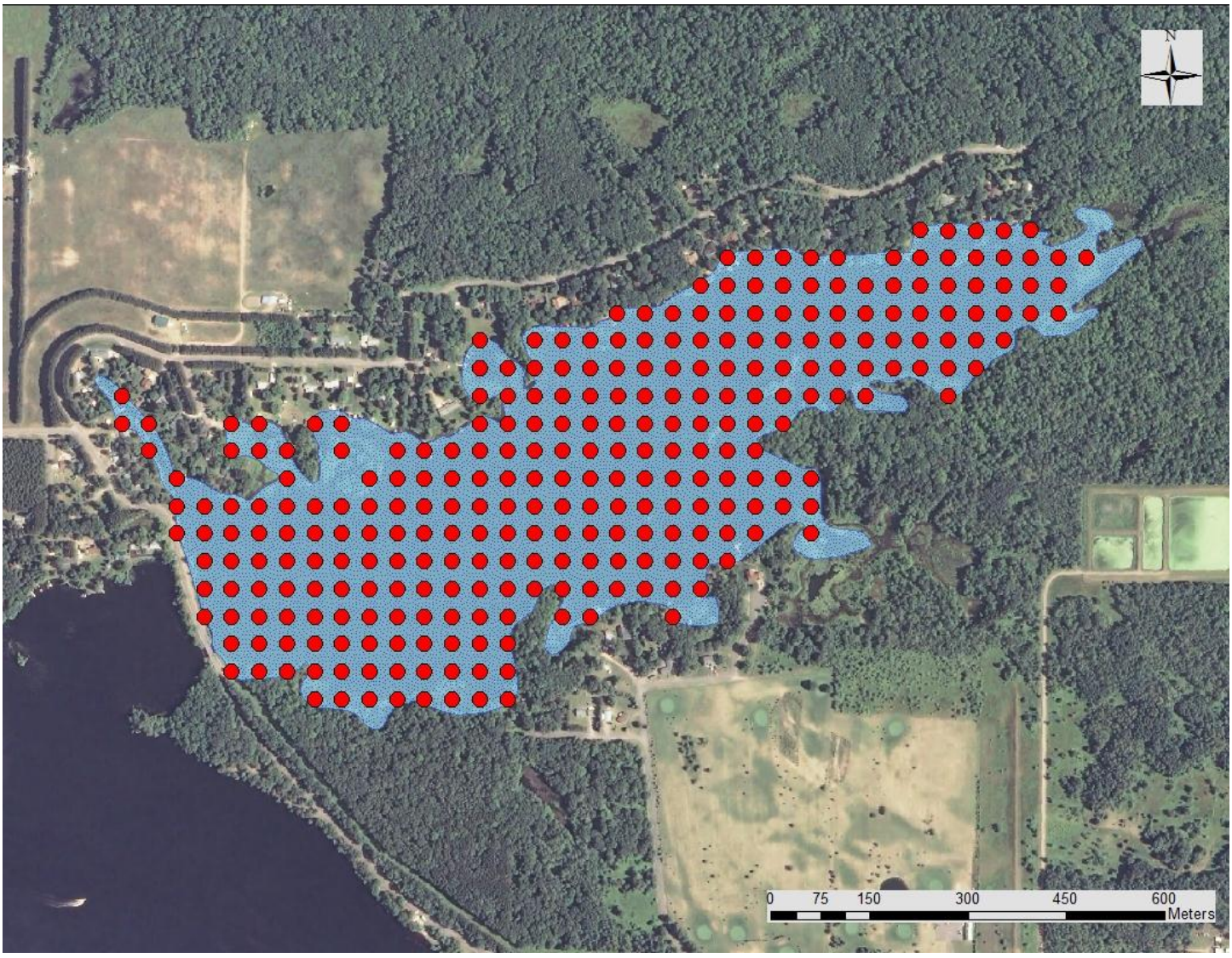

Figure 2. Sampled sites in Pine Lake

Pine Lake Results

Vegetation

Aquatic vegetation was found at between 31% and 34% of all sites over all sample periods. Sites in depth zone 1 had the highest percentage of vegetation (Figure 3 and 4). Zone 3 was rarely vegetated and there was no vegetation found at sites deeper than 10 feet.

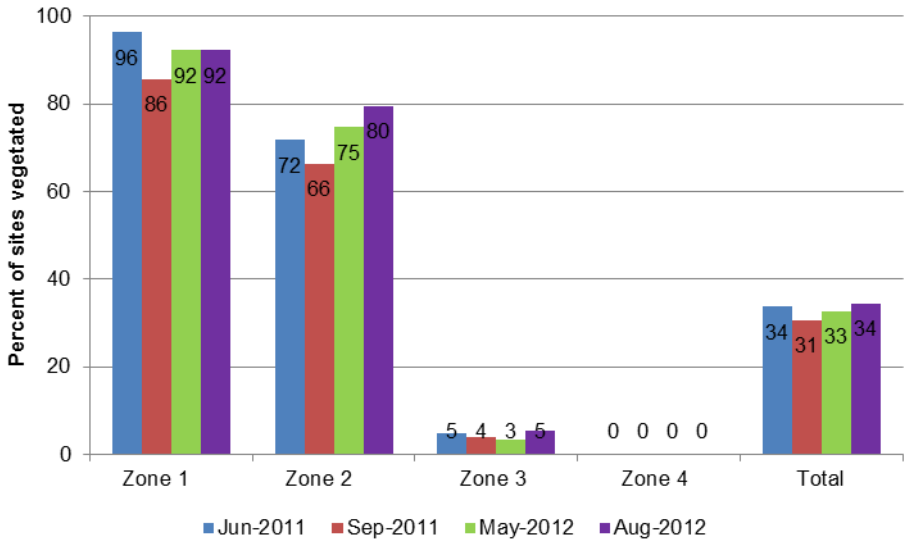

Figure 3. Percent of sampled sites with vegetation by depth zone in Pine Lake

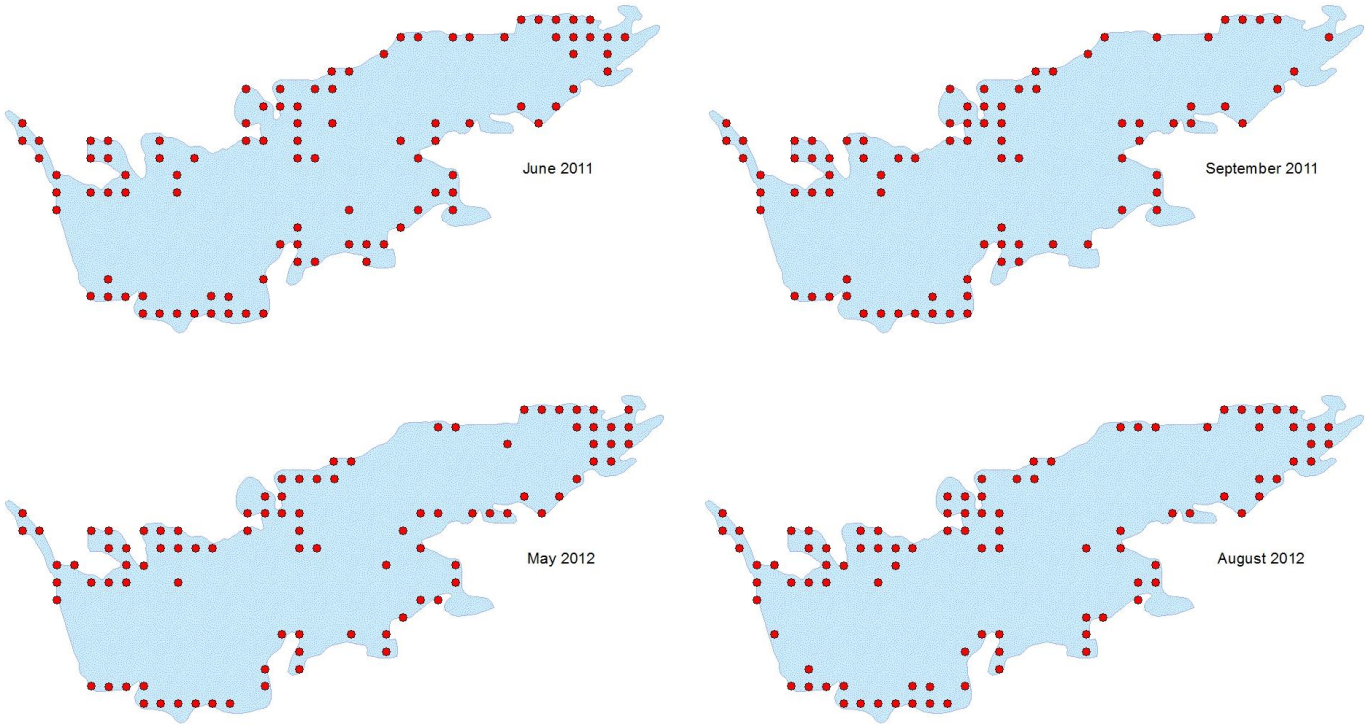

Figure 4. Sampled sites with vegetation in Pine Lake

Myriophyllum spicatum

Total coverage of EWM was between 10% and 21% of the entire survey area (Figure 5 and 10). Total coverage increased from spring to summer sampling periods during both years. EWM was most frequently found in zones 1 and 2. At sites shallower than 10 feet (the maximum rooting depth) the percent total coverage was 14% to 36% (Figure 6). At sites which had any vegetation, coverage was 31% to 71% (Figure 7). EWM was found at average densities between 1 and 2. Average densities increased from 2011 to 2012 (Figure 8). The average number of apical meristems per EWM stem decreased from nine in May 2012 to three in August 2012 (Figure 9).

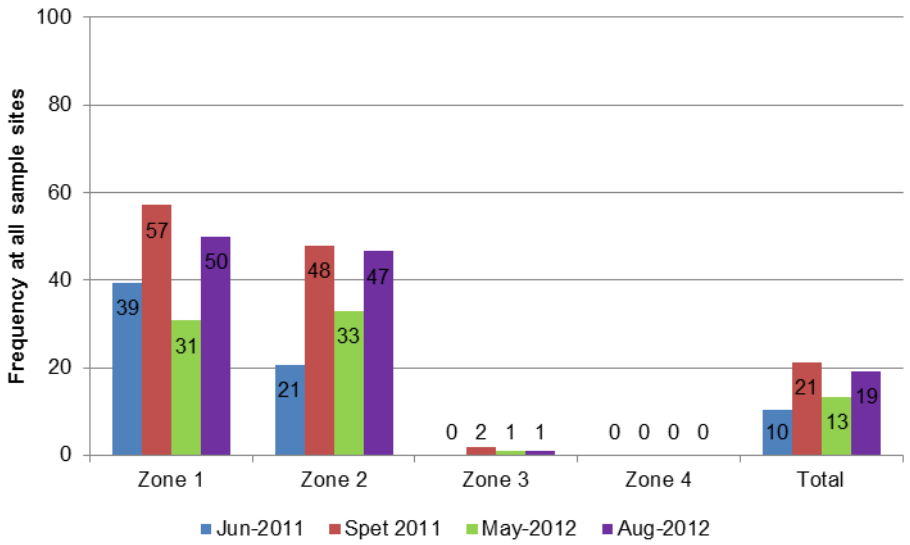

Figure 5. Frequency of EWM at all sample sites in Pine Lake

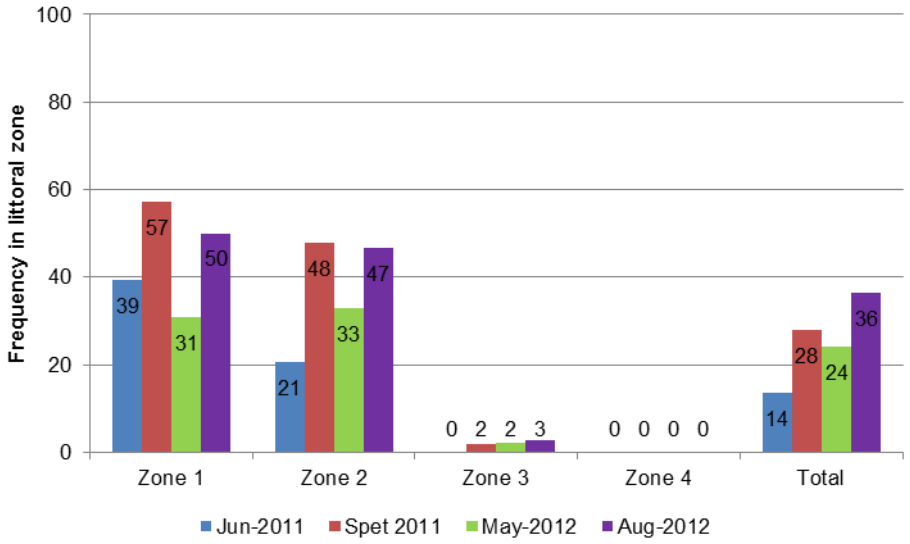

Figure 6. Frequency of EWM at sample sites shallower than the maximum depth of vegetation (10 ft) in Pine Lake

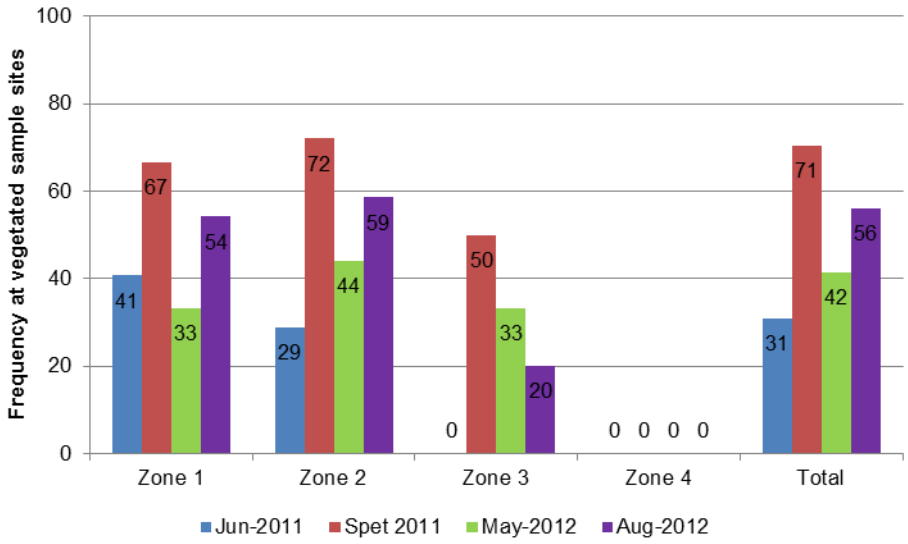

Figure 7. Frequency of EWM at sample sites that had vegetation in Pine Lake

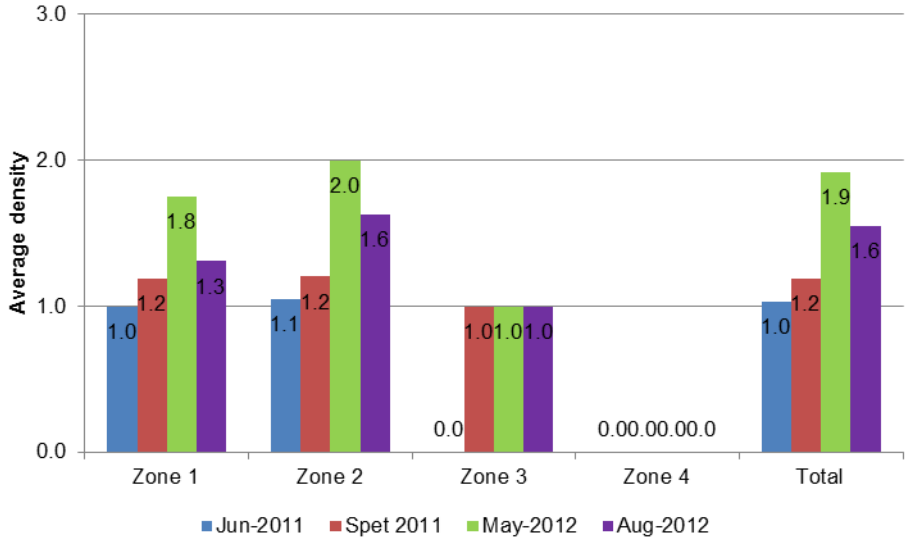

Figure 8. Average density of EWM in Pine Lake

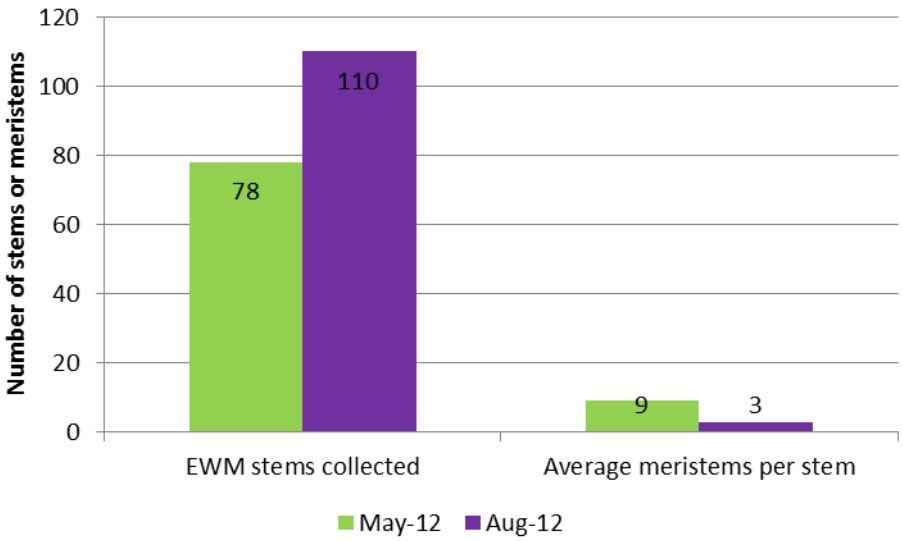

Figure 9. Number of EWM stems collected and average number of apical meristems per EWM stem in Pine Lake

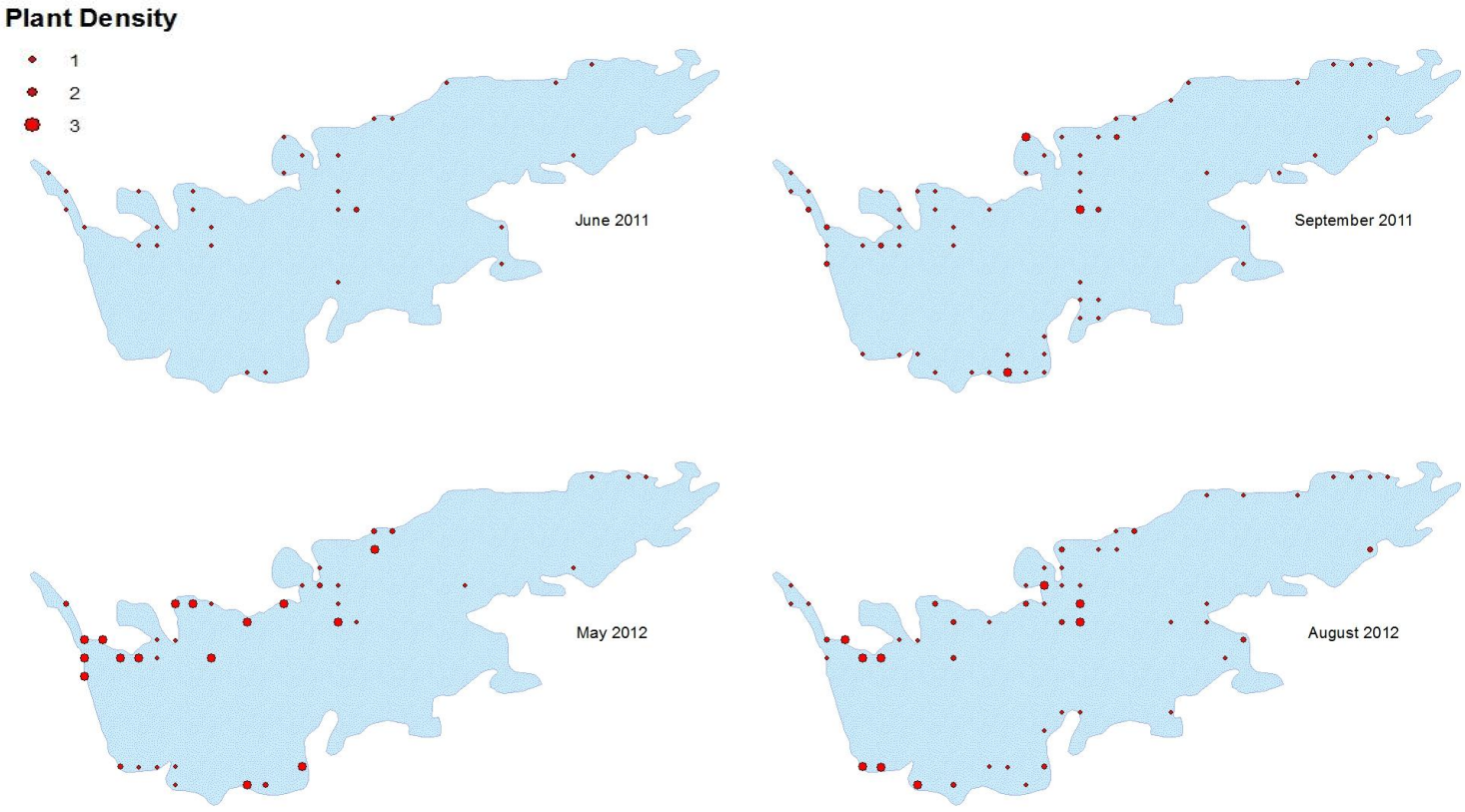

Figure 10. Sampled sites with EWM in Pine Lake

Euhrychiopsis lecontei

No weevils or feeding damage were found during any pre-stocking in-lake visual inspection of plants or during laboratory inspections of samples from the June 2011 survey. During the September 2011 survey, many of the plants in the stocked areas displayed damage characteristic with weevil feeding damage (i.e. plants were shredded and lacked buoyancy). During laboratory inspections in September 2011, three stems were found from the stocked area with apparent pupal damage though no weevils were found. During the May 2012 survey, 28% of EWM sites had at least one life stage of weevil present. This increased to 73% in August 2012. When sites that showed signs of weevil damage but without any weevils present (evidence) were included, that increased to 93% (Figure 11). Weevil density increased from 0.4 individuals per stem in May 2012 to 1.6 in August 2012 (any life stage) (Figure 12). Weevils were found beyond the July 2011 stocking area in May 2012 and beyond the June 2012 stocking area in August 2012 (Figure 13).

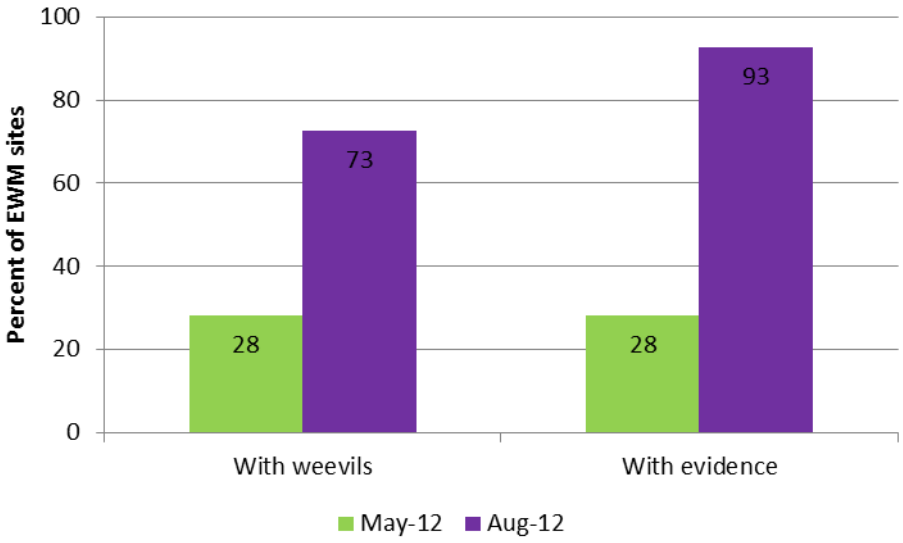

Figure 11. Percent of EWM stems with weevils or evidence of weevil activity in Pine Lake

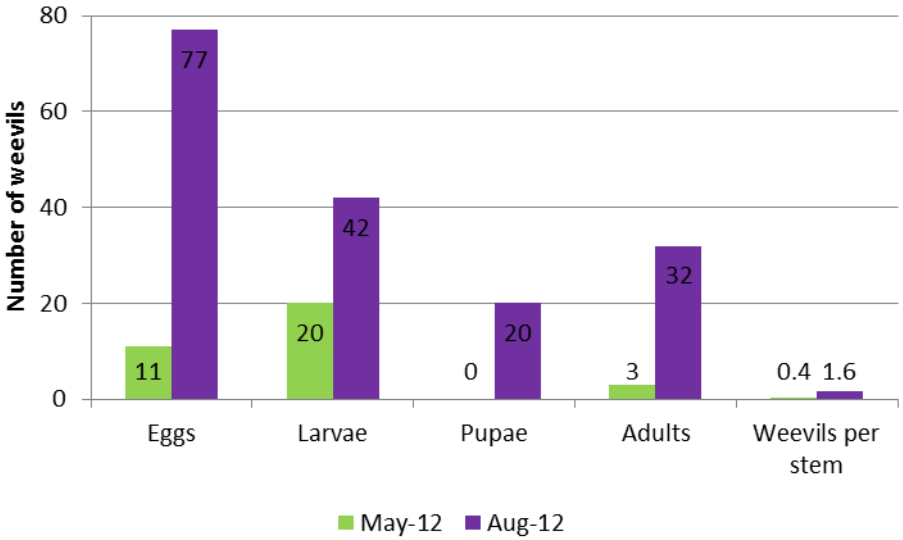

Figure 12. Number of weevil life forms found in Pine Lake

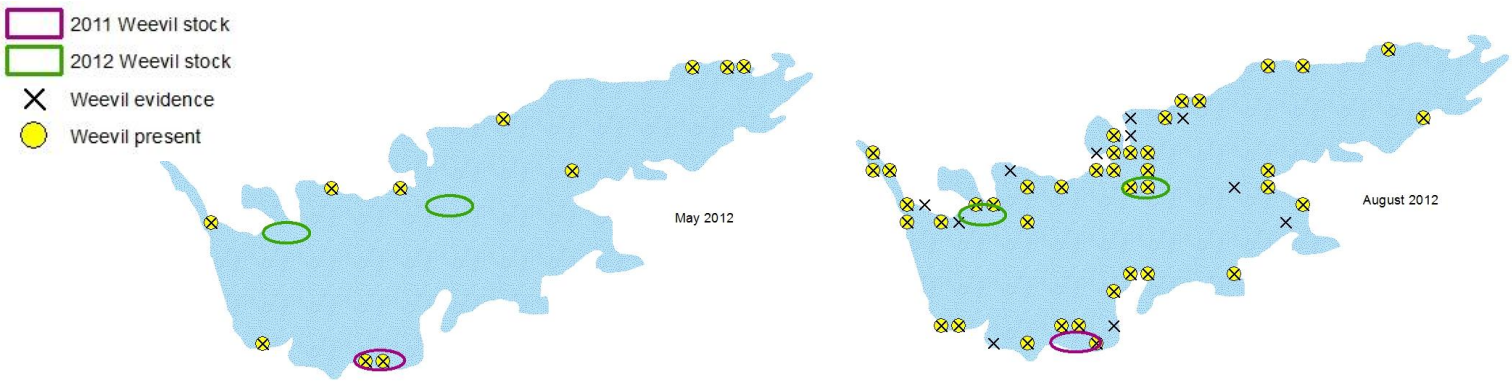

Figure 13**.** Sampled sites with EWM and weevil presence or evidence in Pine Lake

Description of Goose Bay

Goose Bay is approximately 30 acres with a maximum depth of 27 feet. This area of Lake Holcombe is located east of Pine Lake and wraps around a large area of cultivated lawn often inhabited by several Canada Geese. The west side of the survey area runs along the channel of the main flowage and has a steep slope. The east side of the sample area is a small bay connecting the main flowage to Pine Lake. A 42 meter grid of 82 points was used to survey Goose Bay. Four points were terrestrial and not sampled leaving 79 sample points (Figure 14). Weevils were stocked in Goose Bay in July 2011 by EnviroScience (Figure 25).

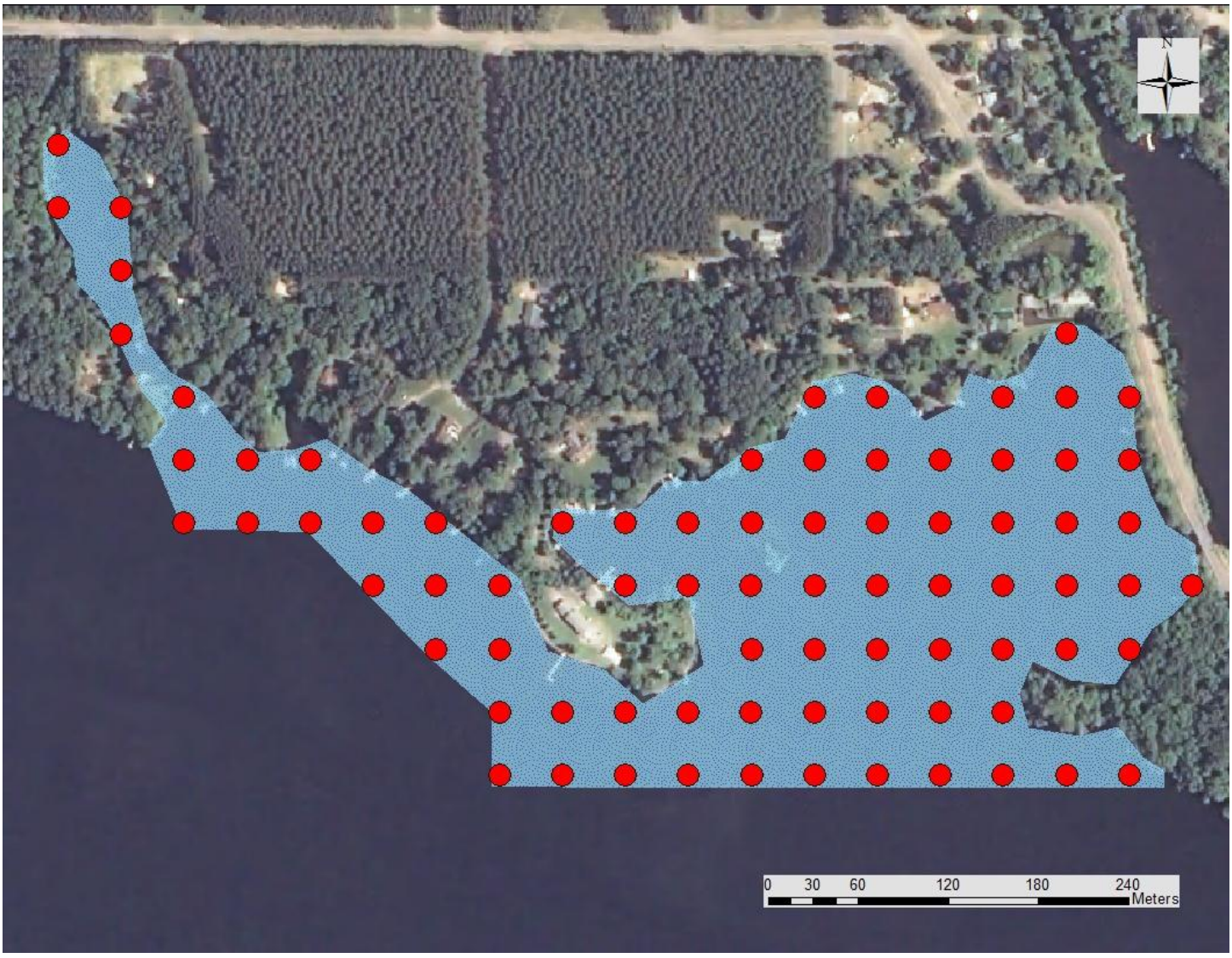

Figure 14. Sampled sites in Goose Bay

Goose Bay Results

Vegetation

Aquatic vegetation was found at 41% of sampled sites during both surveys. The majority of vegetation was found in zones 1 and 2. Few sites in zone 3 had vegetation and no vegetation was found at depths greater than 6 feet (Figures 15 and 16).

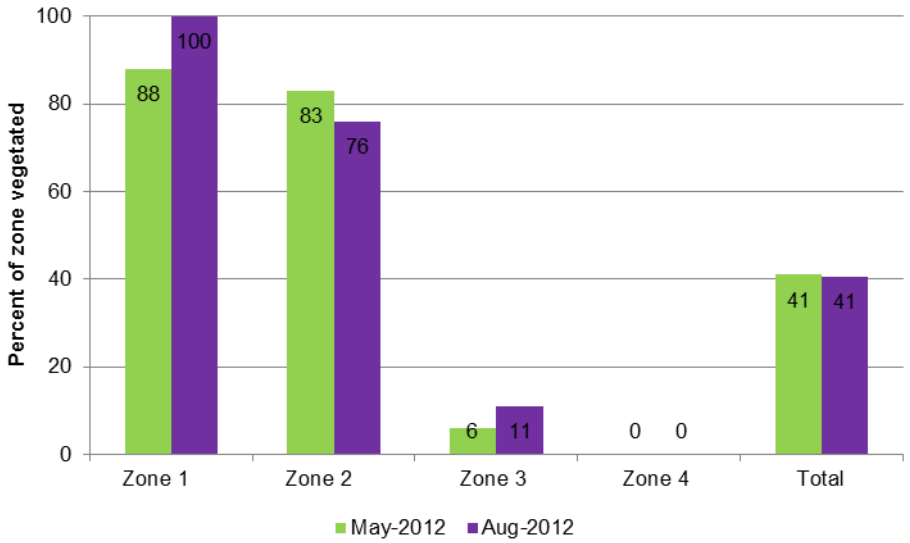

Figure 15. Percent of sampled sites with vegetation by depth zone in Goose Bay

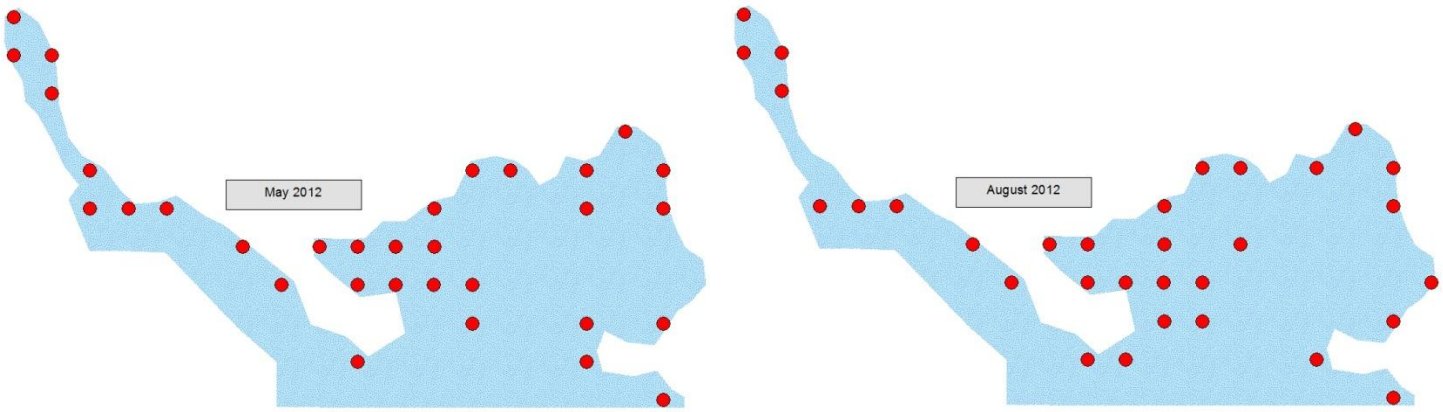

Figure 16. Sampled sites with vegetation in Goose Bay

Myriophyllum spicatum

Total coverage of EWM was 24% and 25% of the entire survey area (Figure 17 and 22). Total coverage increased slightly from spring to summer sampling periods. EWM was most frequently found in zones 1 and 2. At sites shallower than six feet (the maximum rooting depth) the percent total coverage was 43% to 46% (Figure 18). At sites which had any vegetation, coverage was 59% to 63% (Figure 19). EWM was found at average densities between 1 and 2 except for zone 3 in August 2012 where average density was 3. Average densities decreased from 2011 to 2012 (Figure 20). The average number of apical meristems per EWM stem decreased from 8.3 to 1.9 (Figure 21).

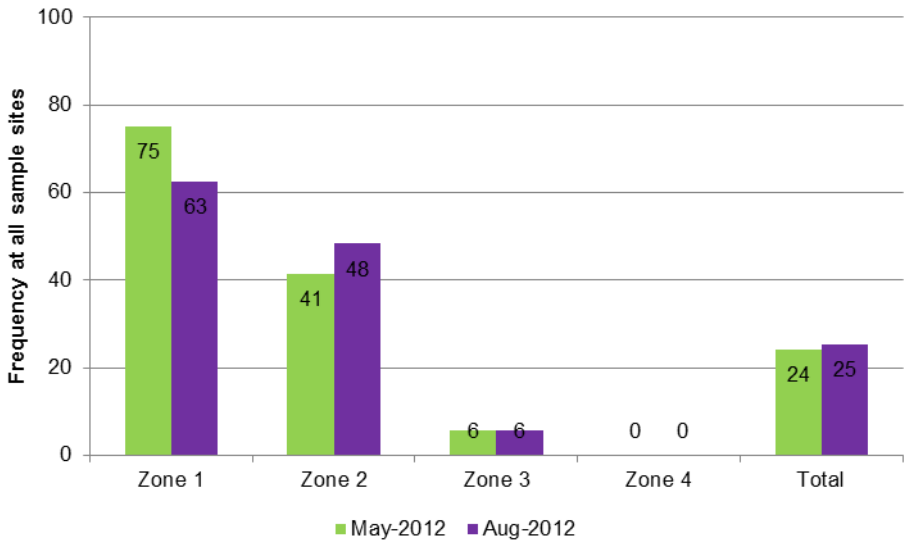

Figure 17. Frequency of EWM at all sample sites in Goose Bay

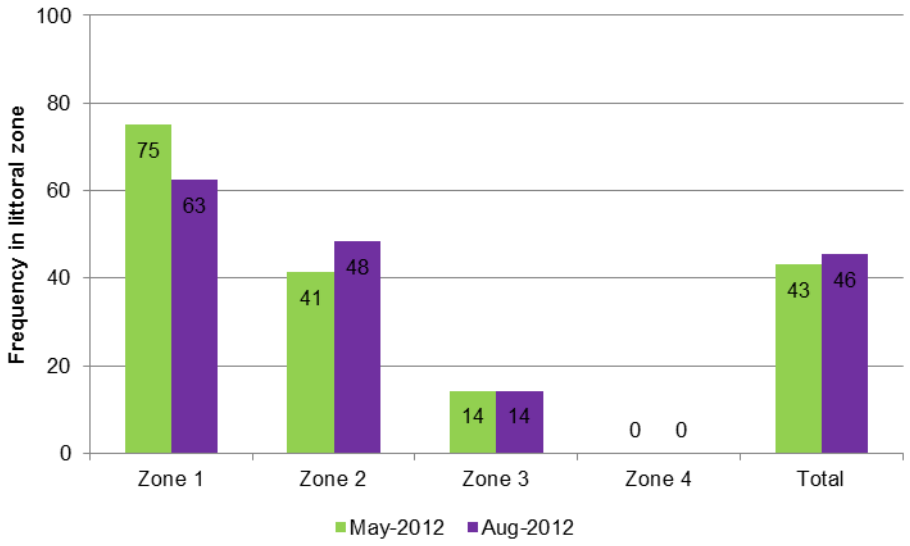

Figure 18. Frequency of EWM at sample sites shallower than the maximum depth of vegetation (6 ft) in Goose Bay

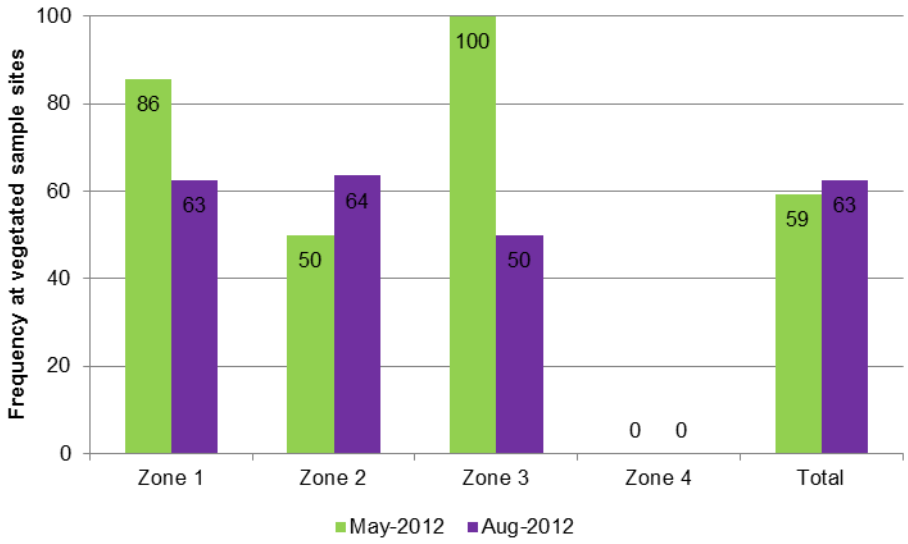

Figure 19. Frequency of EWM at sample sites that had vegetation in Goose Bay

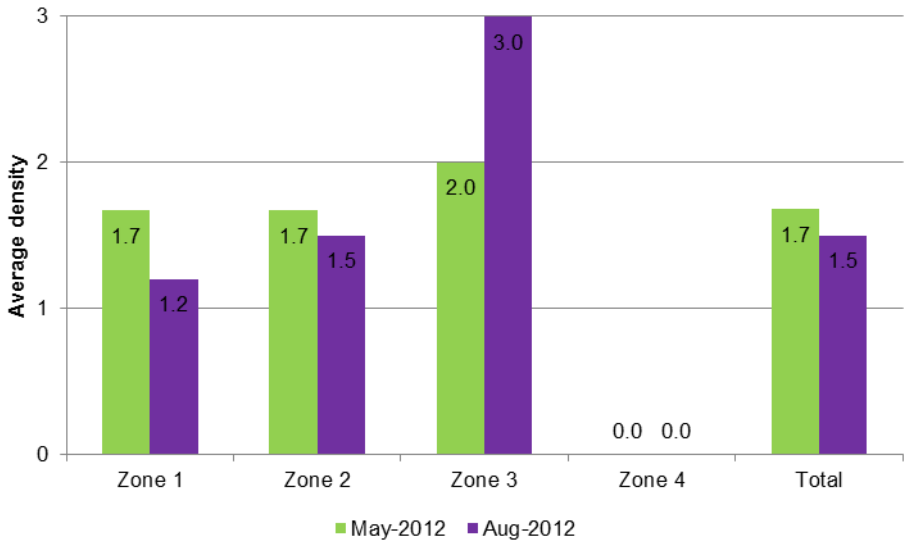

Figure 20. Average density of EWM in Goose Bay

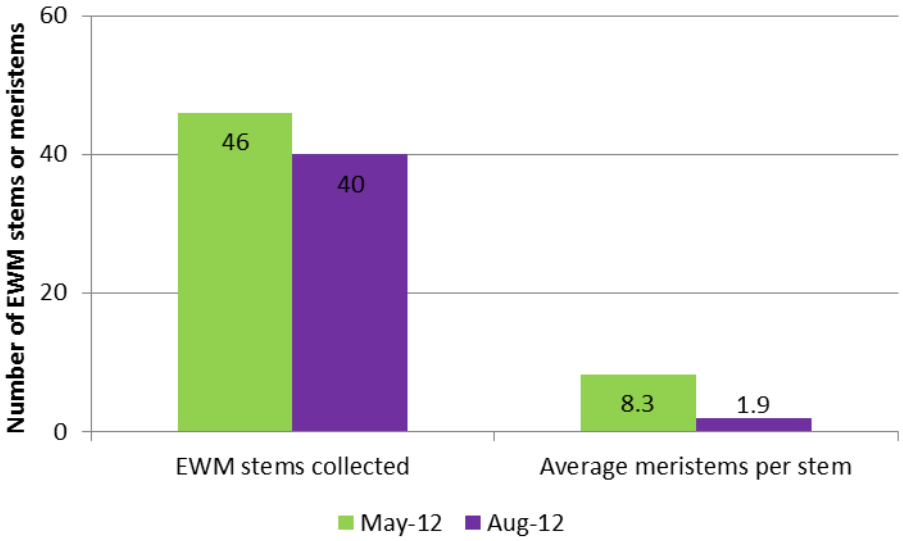

Figure 21. Number of EWM stems collected and average number of apical meristems per EWM stem in Goose Bay

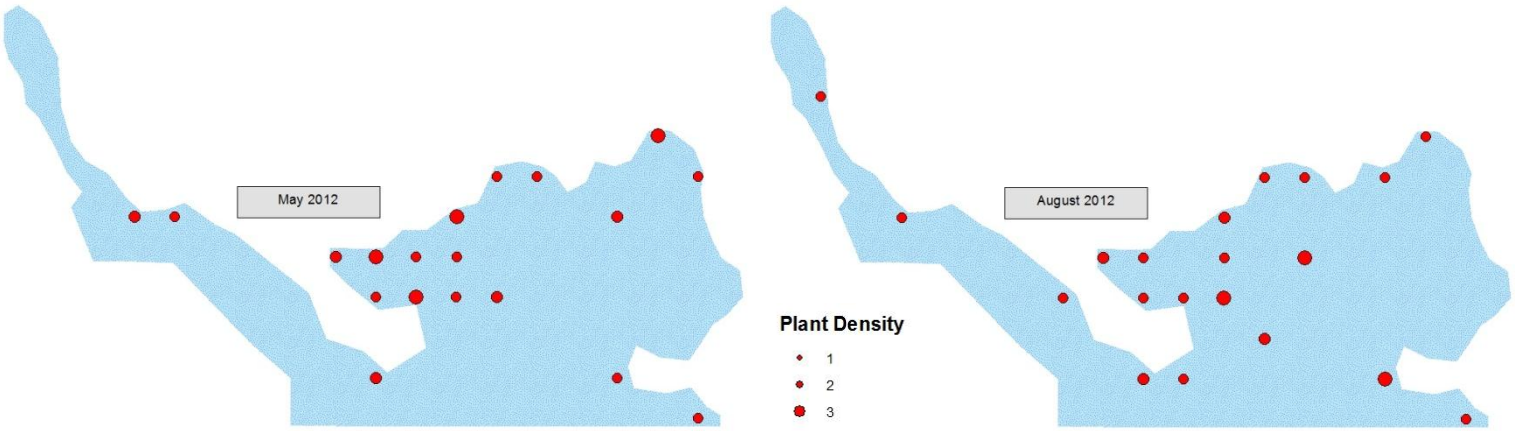

Figure 22. Sampled sites with EWM in Goose Bay

Euhrychiopsis lecontei

No weevils or feeding damage were found during any pre-stocking in-lake visual inspection of plants or during laboratory inspections of samples from the June 2011or September 2011 surveys. Weevils were found at 26% of EWM sites in May 2012 and 40% in August 2012. This increased to 45% when considering sites which showed evidence of weevil presence (Figure 23). Weevil larvae were the most frequently found life stage in May 2012 and eggs were the most frequently found life stage in August 2012. Weevil density increased from 0.33 to 1.1 individuals per stem (any life stage) (Figure 24). Weevils were not frequently found in sites near stocking areas (Figure 25).

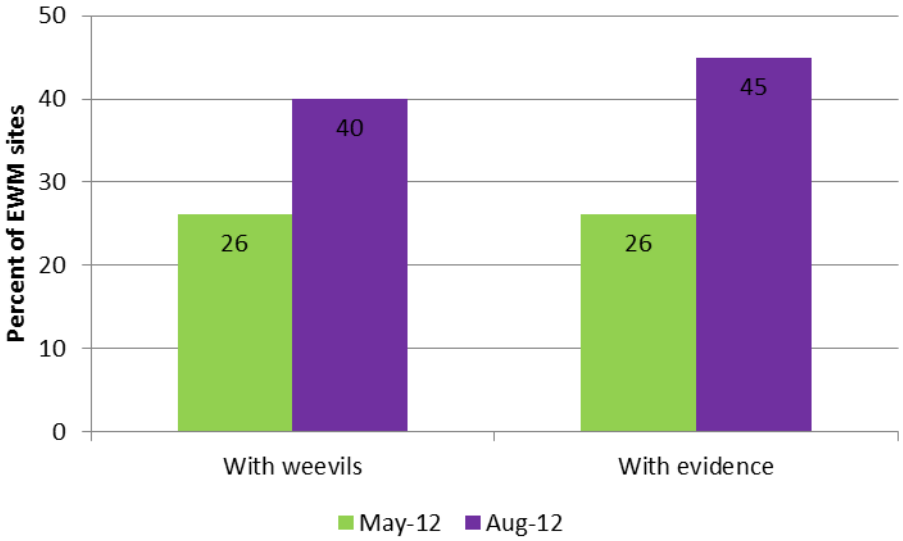

Figure 23. Percent of EWM stems with weevils or evidence of weevil activity in Goose Bay

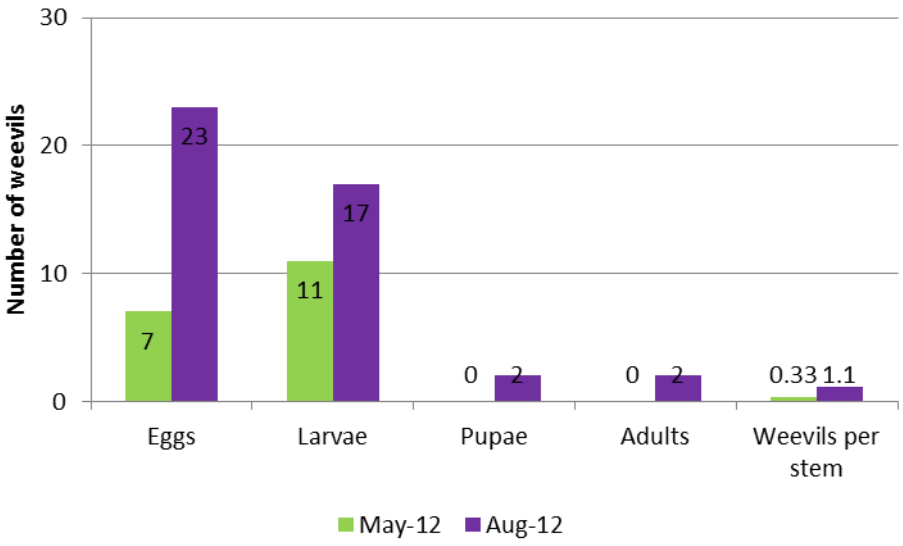

Figure 24. Number of weevil life forms found in Goose Bay

Figure 25. Sampled sites with EWM and weevil presence or evidence in Goose Bay

Description of Goat Island

Goat Island occurs in the middle of Lake Holcombe and is approximately 15 acres with a maximum depth of 30 feet. A small portion of the area occurs in a semi-protected cove while the majority of the area occurs along the edge of the main flowage channel. The edges of the study area have steep slopes and are subjected to heavy wave action from boat traffic. A 42 meter grid of 53 points was used to survey Goat Island. Nine points were terrestrial leaving 44 sampled points (Figures 26). Weevils were stocked in Goat Island in July 2011 and May 2012 by EnviroScience (Figure 37).

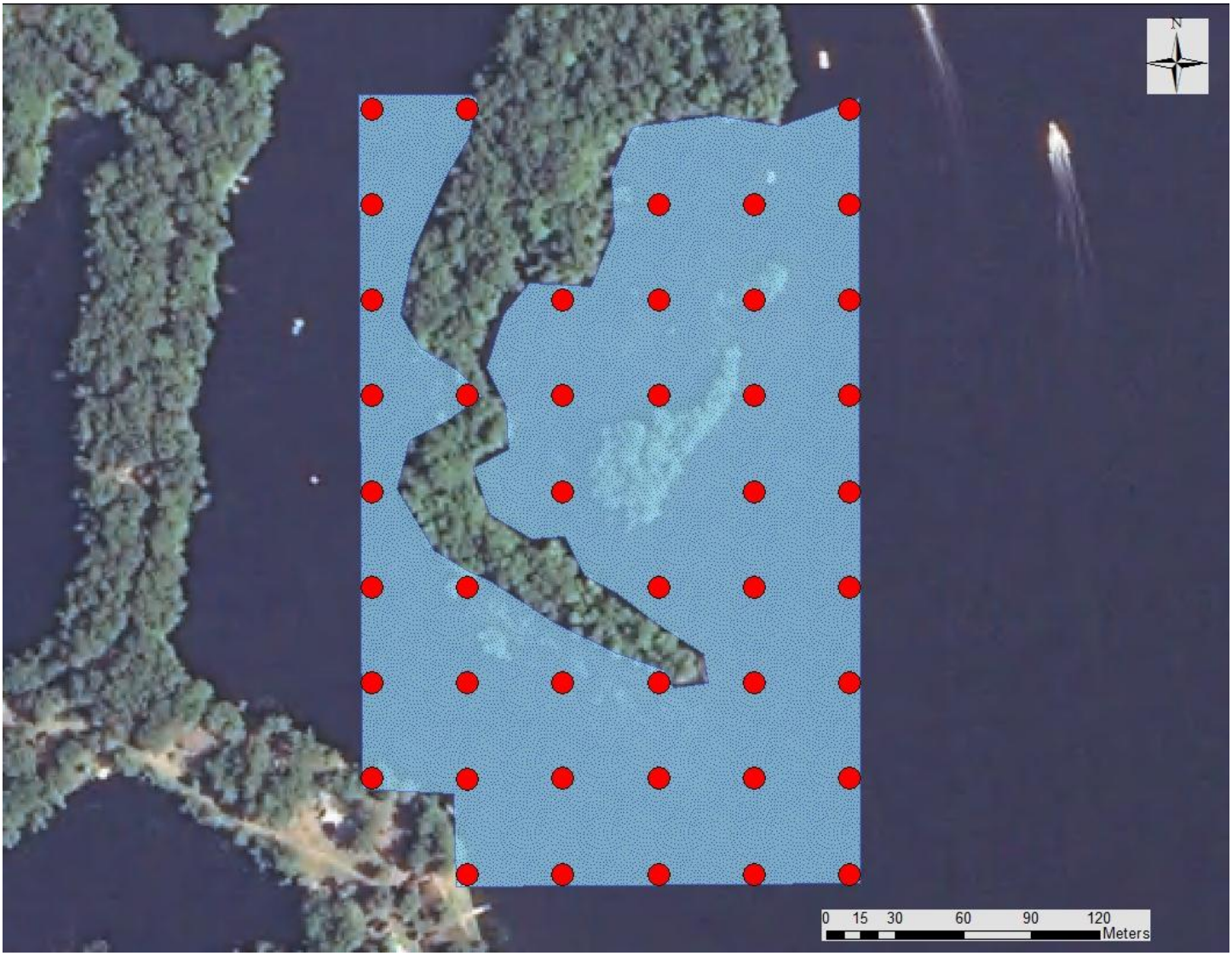

Figure 26. Sampled sites in Goat Island

Goat Island Results

Vegetation

Aquatic vegetation was found at 27% of sampled sites in May 2012. This increased to 32% in August 2012. Vegetation increased in zones 1 and 3 in August 2012 and remained the same in zone 2. There was no vegetation found at depths greater than seven feet (Figures 27 and 28).

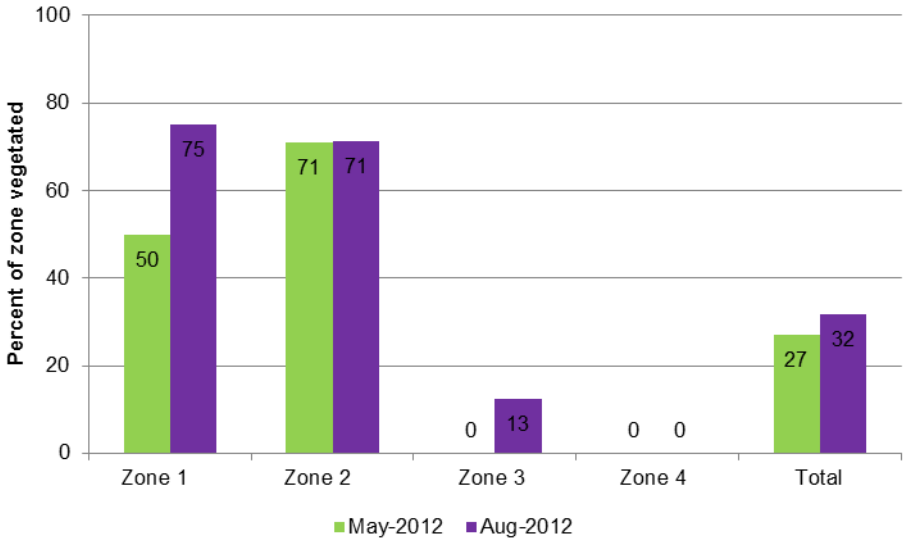

Figure 27. Percent of sampled sites with vegetation by depth zone in Goat Island

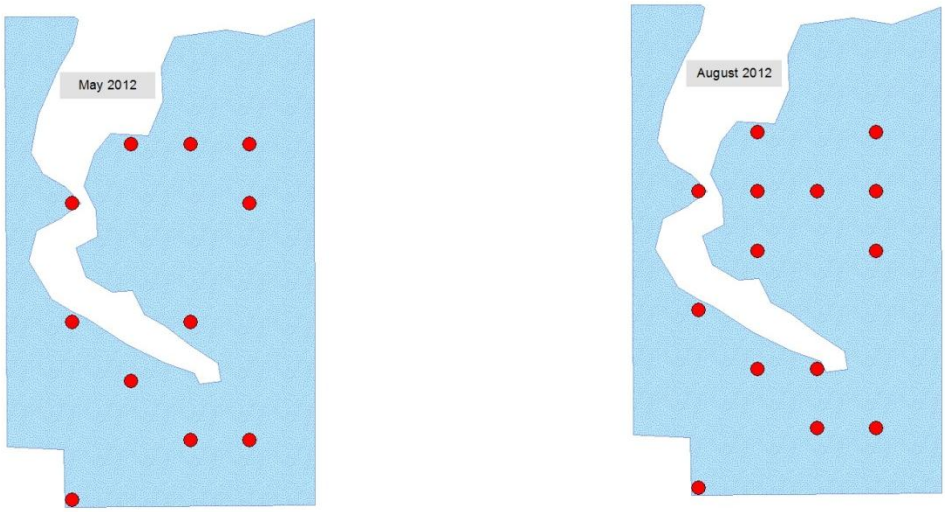

Figure 28. Sampled sites with vegetation in Goat Island

Myriophyllum spicatum

Total coverage of EWM was 16% and 20% of the entire survey area (Figure 29 and 34). Total coverage increased from spring to summer sampling periods. EWM was only found in zones 1 and 2. At sites shallower than seven feet (the maximum rooting depth) the percent total coverage was 39% to 21% (Figure 30). At sites which had any vegetation, coverage was 64% during both sampling periods (Figure 31). EWM was found at average densities between 2 and 3 (Figure 32). The average number of apical meristems per EWM stem decreased from 12.8 to 1.6 (Figure 33)

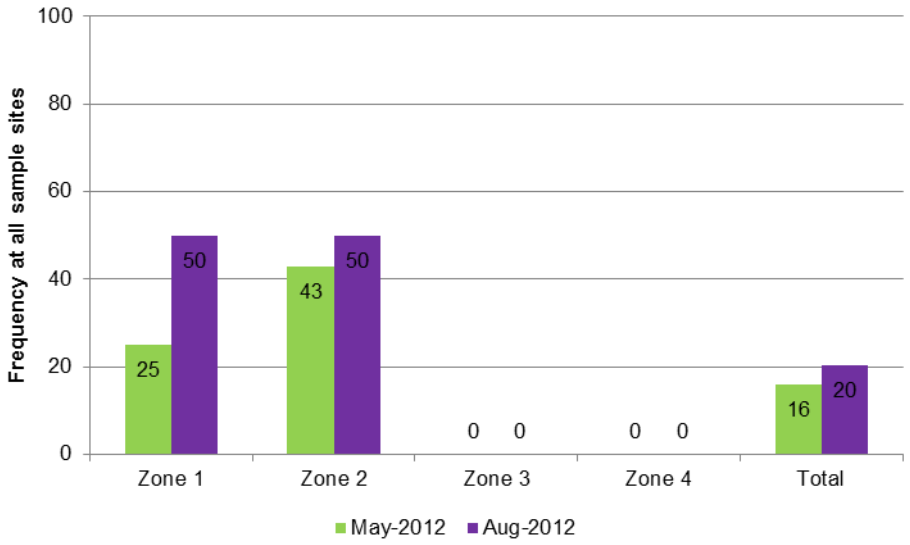

Figure 29. Frequency of EWM at all sample sites in Goat Island

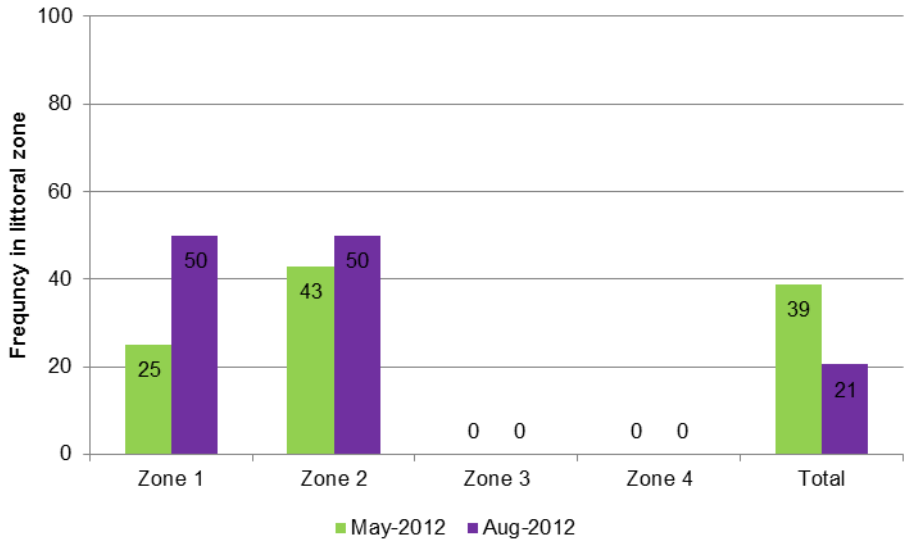

Figure 30. Frequency of EWM at sample sites shallower than the maximum depth of vegetation (7 ft) in Goat Island

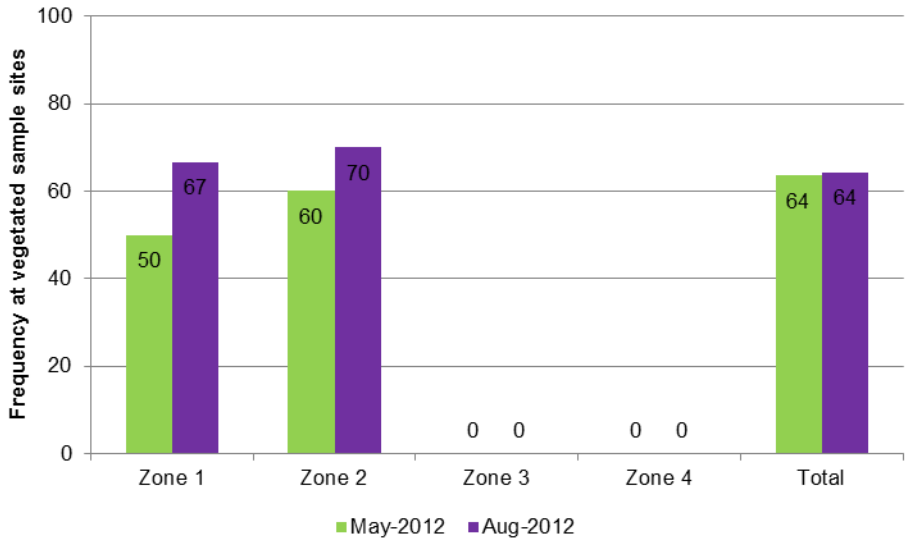

Figure 31. Frequency of EWM at sample sites that had vegetation in Goat Island

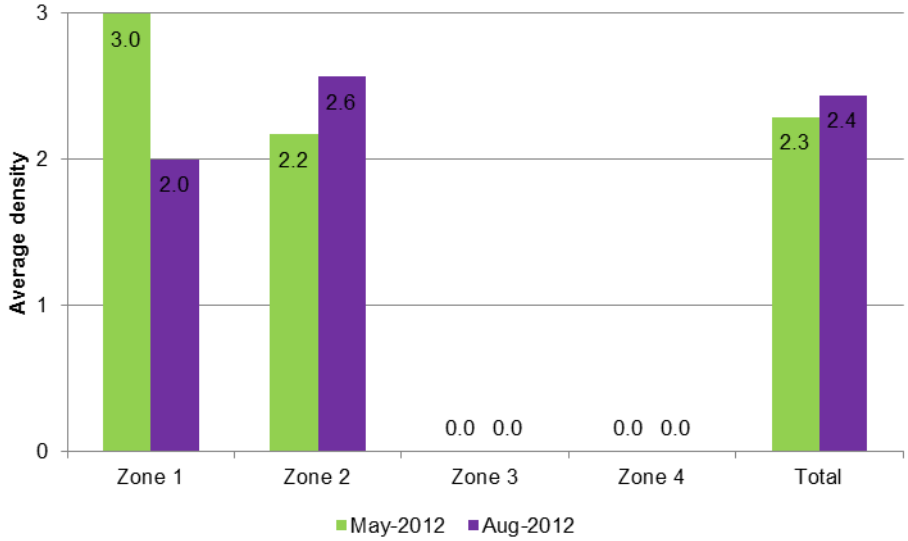

Figure 32. Average density of EWM in Goat Island

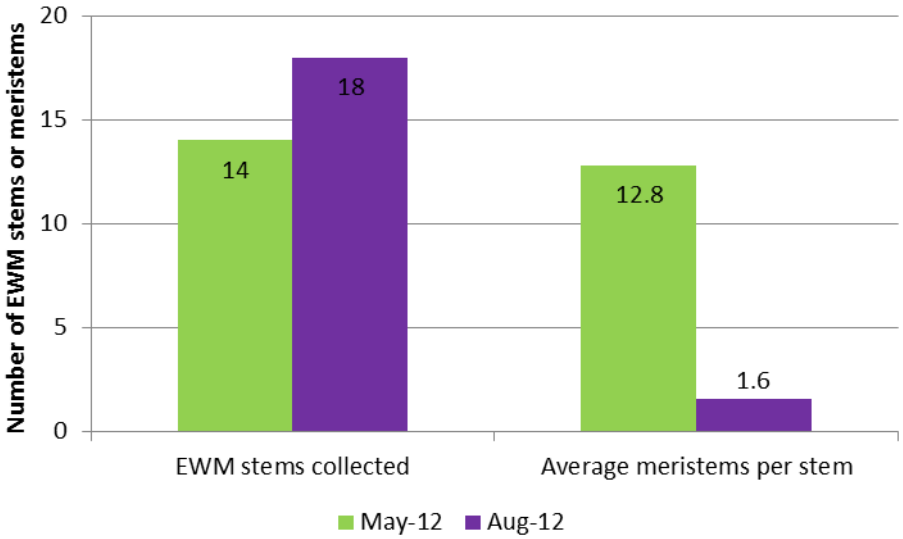

Figure 33. Number of EWM stems collected and average number of apical meristems per EWM stem Goat Island

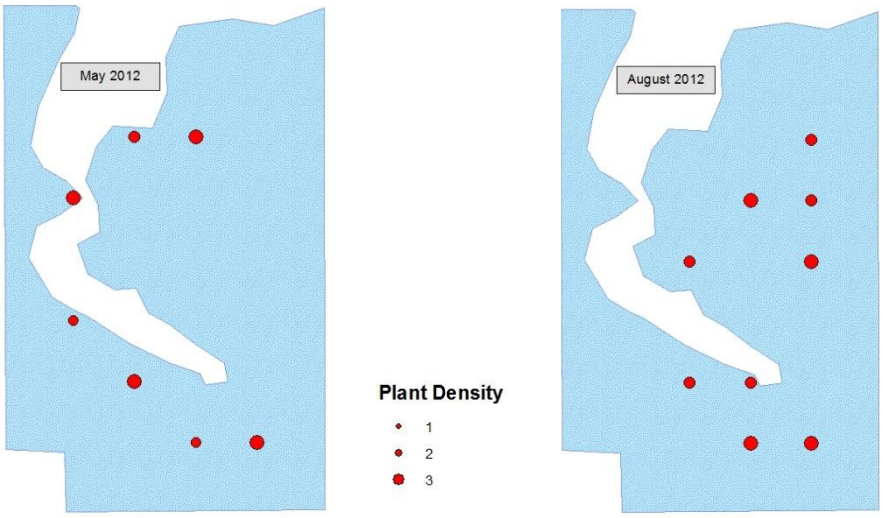

Figure 34. Sampled sites with EWM in Goat Island

Euhrychiopsis lecontei

No weevils or feeding damage were found during any pre-stocking in-lake visual inspection of plants or during laboratory inspections of samples from the June 2011or September 2011 surveys. Weevils were found at 14% of EWM sites in May 2012 and 67% in August. This increased to 78% when considering sites which showed evidence of weevil presence (Figure 35). Weevil larvae were the most frequently found life stage in both sample periods. No adult weevils were found during either survey. Weevil density increased from 0.14 to 1.44 individuals per stem (any life stage) (Figure 36). Weevils were found near to and apart from stocking areas (Figure 37)

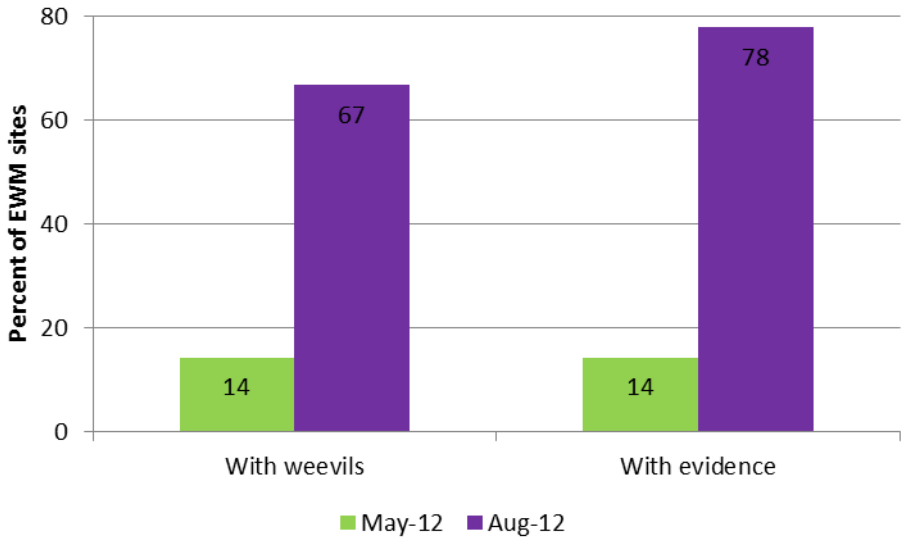

Figure 35. Percent of EWM stems with weevils or evidence of weevil activity in Goat Island

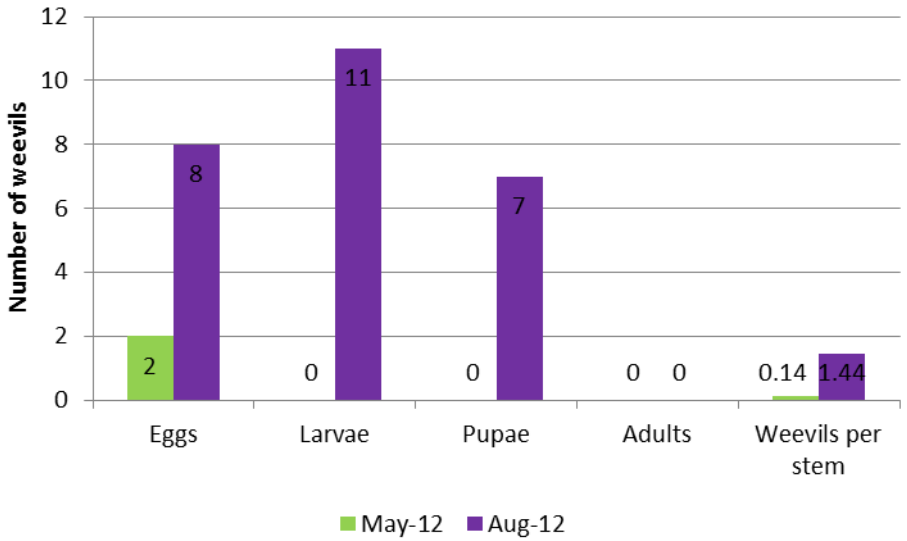

Figure 36. Number of weevil life forms found in Goat Island

Figure 37. Sampled sites with EWM and weevil presence or evidence Goat Island

Discussion

The percent coverage of aquatic vegetation was low in all three survey areas as was the maximum rooting depth. Lake Holcombe is characterized by dark tannin stained water causing decreased light penetration which may be limiting plant growth. The total coverage of EWM was also sparse across all survey areas. Where EWM was found, coverage was rarely dense. The limitations imposed on the aquatic plant community by shallow light penetration may be acting to prevent the widespread dominance of EWM across the entire body of water. The apparent increase of EWM over time was highly influenced by irregular temperature patterns and at this early stage of the weevil project is not indicative of a failure of the project.

Data collected from the aquatic plant survey and from observations of lake residents revealed an unusual growth pattern for EWM in the spring and early summer of 2011 resulting in a regionally observed decline in EWM. This affected the project in several ways. EnviroScience experienced difficulty finding adequate numbers of weevils from the "seed" lakes to establish a parent population from which to rear the stocking population. This led to weevils being stocked later in the season than was ideal (July). In order to retain enough milfoil to feed the stocking tanks used by LHIA and sustain the weevil population once it was placed in the lake, fewer stems were pulled for determination of presence/absence of existing weevil populations than the number pulled after stocking activities. Due to the late stocking of the weevils, assessments of post-stocking populations occurred in September 2011. As weevils fly inland between September and November, this is not an ideal time to conduct these surveys (Newman et al. 2001; Reeves et al 2008). Due to atypical late season growth of EWM, a late season plant survey was conducted in September to collect baseline data that more closely resemble typical coverage of EWM. In 2012, an unusually warm spring led to an accelerated and extended growing season which may account for the relatively higher coverage in August 2012.

No weevils were found during any visual in-lake inspection of plants or during laboratory inspections in 2011. Conclusions that can be drawn from this are that weevils were either not present before the stocking activities or they existed at low enough densities to escape detection. Also, we may infer that the stocked weevils had already migrated to the shoreline for winter by mid-September explaining their absence after 2011 stocking. The presence of weevils in spring 2012 surveys (i.e. prior to 2012 stocking activities) indicates that the 2011 stocked weevils were successful at overwintering. Both the number of total EWM apical meristems and the average number of meristems per stem decreased by from May to August while the average number of weevils increased. Weevils were found far from areas stocked in either year in Pine Lake indicating the weevils are moving substantial distances to find EWM in suitable habitat.

Conclusion

The data presented here are part of a multi-year assessment of the efficacy of milfoil weevils at controlling the EWM population in Lake Holcombe. Aquatic plant surveys will be conducted annually in spring (late May to early June) and summer (August) for the next three to five years. EWM stems will be collected during all plant surveys to determine population and distribution of weevils. Data will continue to be compiled and compared to document changes in the aquatic plant community and weevil populations.

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