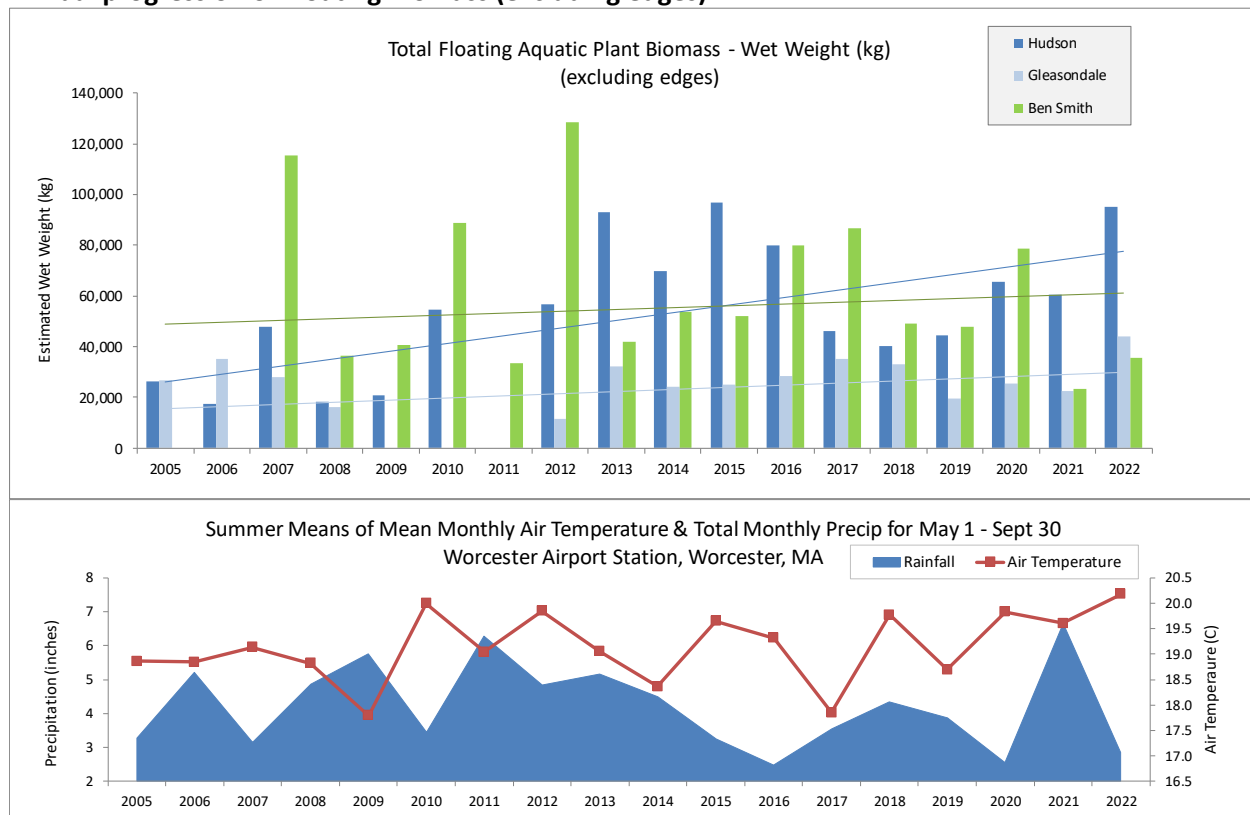


OARS Biomass Summary 2022

B. Wetherill August 30, 2022

2022 was characterized by severe drought and very warm temperatures. It was one of the three driest years since these surveys began, and average temperature was higher than any year since the surveys began. The three impoundments reacted quite differently to the extreme conditions. The Hudson impoundment was more than 60% covered on average with filamentous green algae (FGA). The Hudson impoundment is usually dominated by FGA on the surface and coontail below the surface, and conditions have been steadily getting worse since 2018. The Gleasondale impoundment also had much more floating biomass than previous years, more than it has ever had in these surveys, but it was not dominated by a single species. It had a mixture of FGA, duckweed, watermeal, and lily. The Ben Smith impoundment had much less floating biomass than previous years – surprisingly little. It looked like it might have even been treated with an herbicide. The graph below shows a continuing significant upward trend in biomass for Hudson and minimal to zero trend for Gleasondale and Ben Smith. Maps of biomass coverage in each impoundment are exhibited in Appendix A.

Annual progression of Floating Biomass (excluding edges)

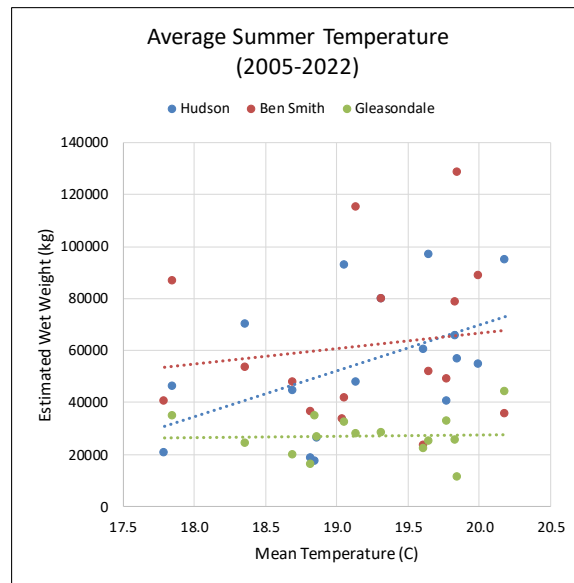
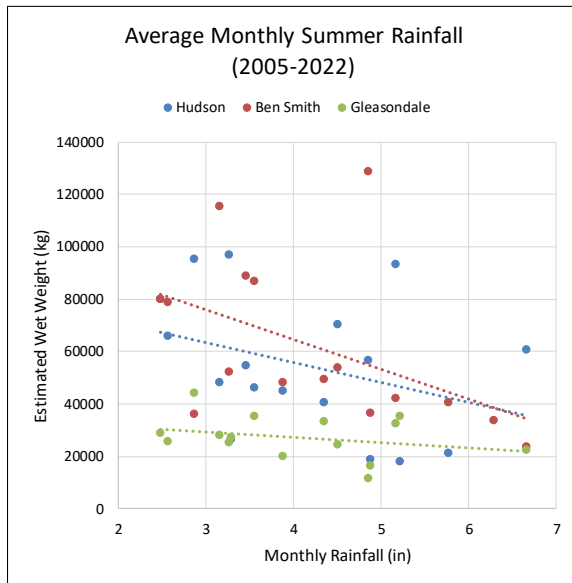


A statistical review of the data reveals a strong positive correlation between biomass and temperature in Hudson and a strong inverse correlation between biomass and precipitation in Ben Smith (though the Ben Smith correlation did not play out in 2022). Hudson is the shallowest of the three impoundments, which can explain the stronger effect of temperature. Gleasondale has the lowest correlations with both indicators, but there is some inverse correlation with precipitation in all three impoundments.

Lower precipitation results in slow-moving stagnating waters which promote biomass growth, especially FGA and duckweed.

Total Floating Biomass Correlations:

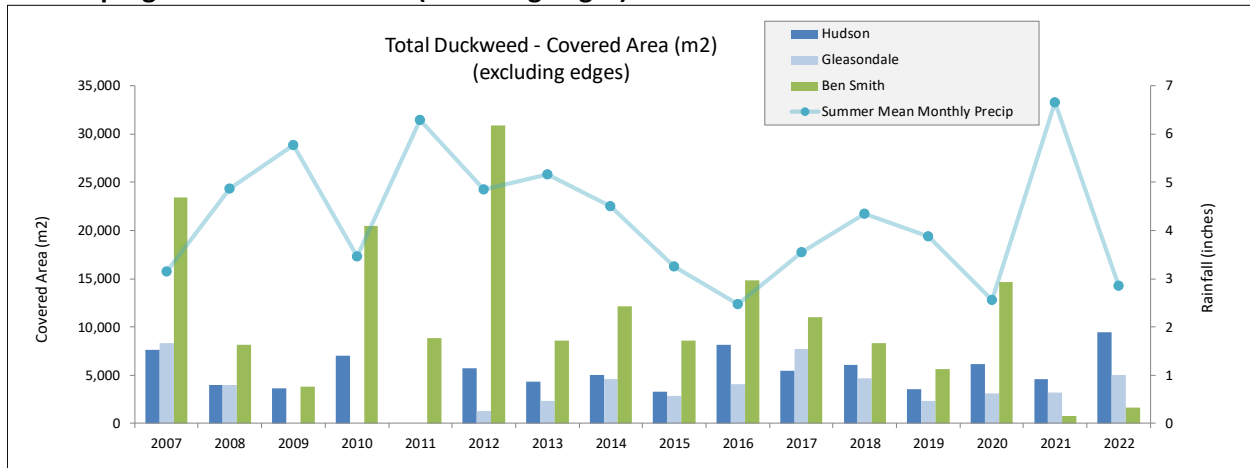
Pearson Corr.	Hudson	Gleasondale	Ben Smith
Temperature	0.49	0.03	0.14
Precipitation	-0.35	-0.30	-0.48



Duckweed

A similar analysis of duckweed doesn't show any noticeable trends, though the lack of duckweed this year in Ben Smith is noticeable. Low levels in Ben Smith in 2021 were attributed to the high rainfall, but there is no clear explanation for 2022. Correlations with temperature and precipitation generally match those for total floating biomass.

Annual progression of Duckweed (excluding edges)



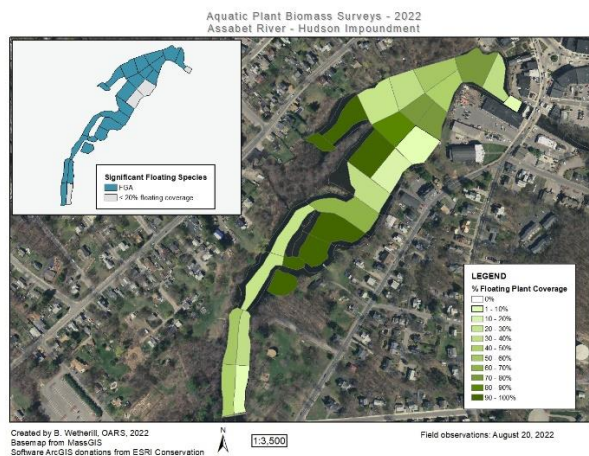
Duckweed Correlations:

Pearson Corr.	Hudson	Gleasondale	Ben Smith
Temperature	0.49	-0.39	0.23
Precipitation	-0.60	-0.34	-0.31

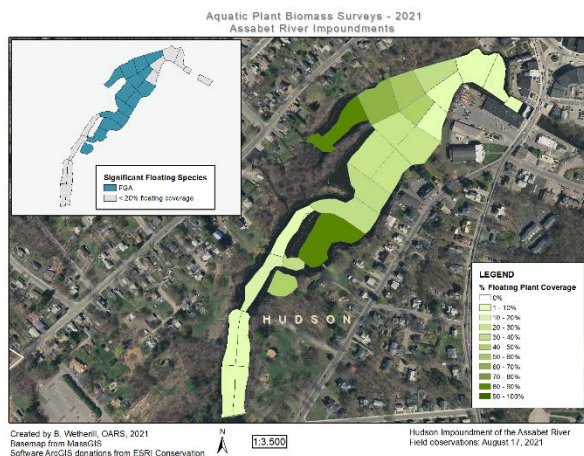
Biomass Key Message

The big takeaway from this survey is the deterioration of the Hudson impoundment. Floating biomass was extreme in 2022 due to the drought and warm weather, but it also highlighted the worsening conditions. The following four images show percent coverage by sector for each of the last four years. They show how much coverage has increased from 2019 to 2022. 2018 (not shown) had even lower floating biomass levels.

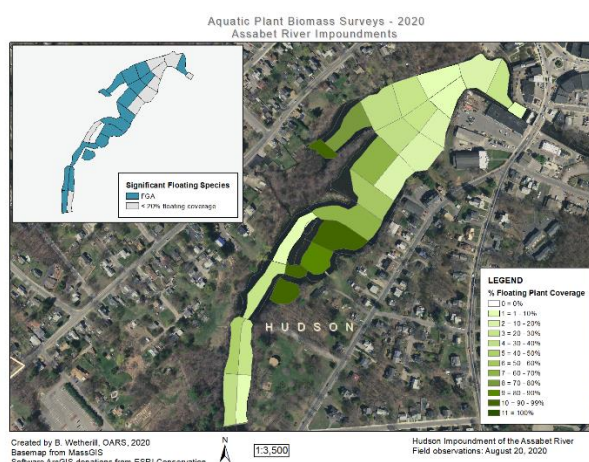
Hudson – 2022



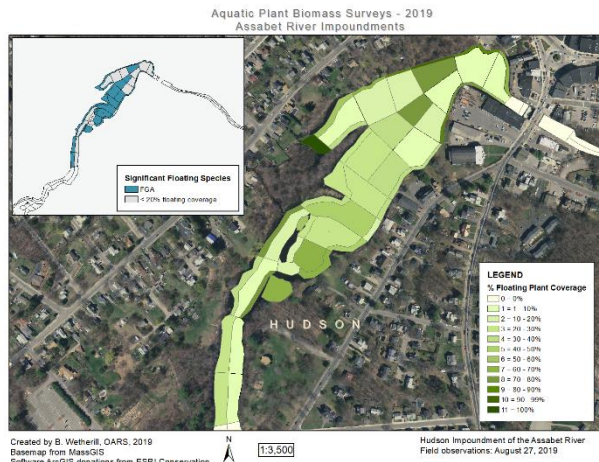
Hudson – 2021



Hudson – 2020



Hudson – 2019

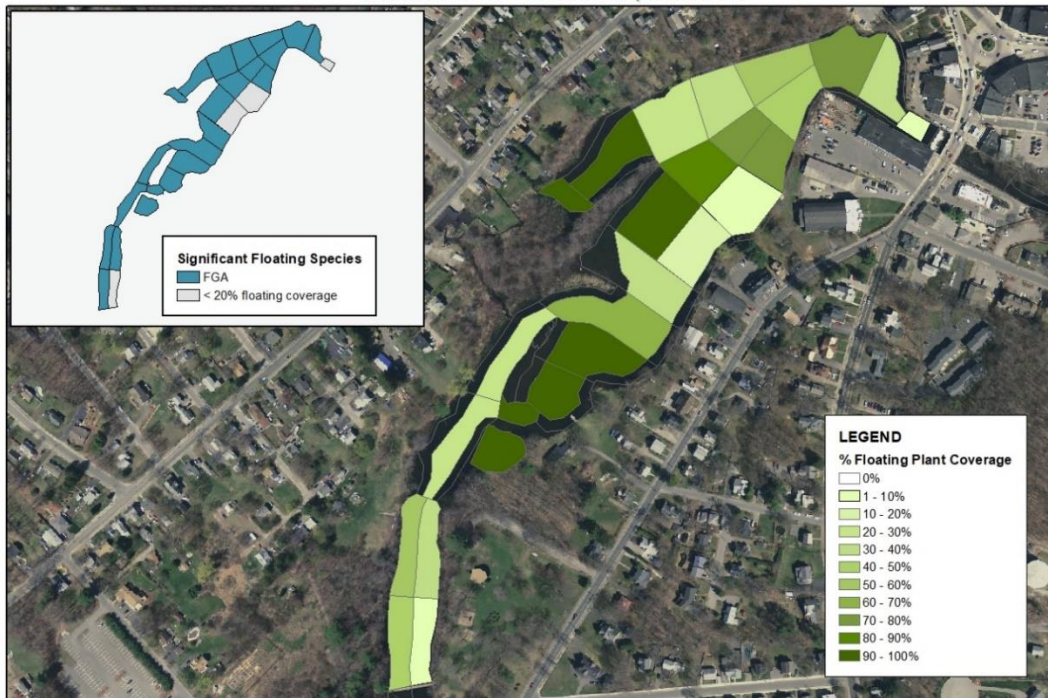


Hudson Biomass 2022 -



Appendix A – Maps of 2022 percent coverage and dominant species

Aquatic Plant Biomass Surveys - 2022
Assabet River - Hudson Impoundment



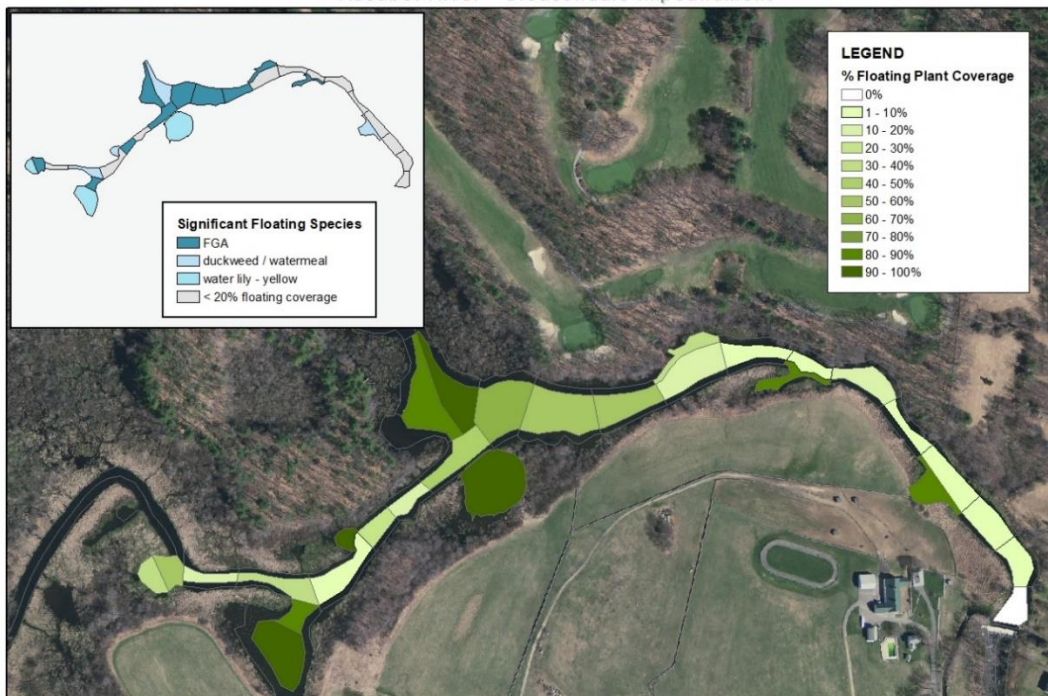
Created by B. Wetherill, OARS, 2022
Basemap from MassGIS
Software ArcGIS donations from ESRI Conservation



1:3,500

Field observations: August 20, 2022

Aquatic Plant Biomass Surveys - 2022
Assabet River - Gleasondale Impoundment



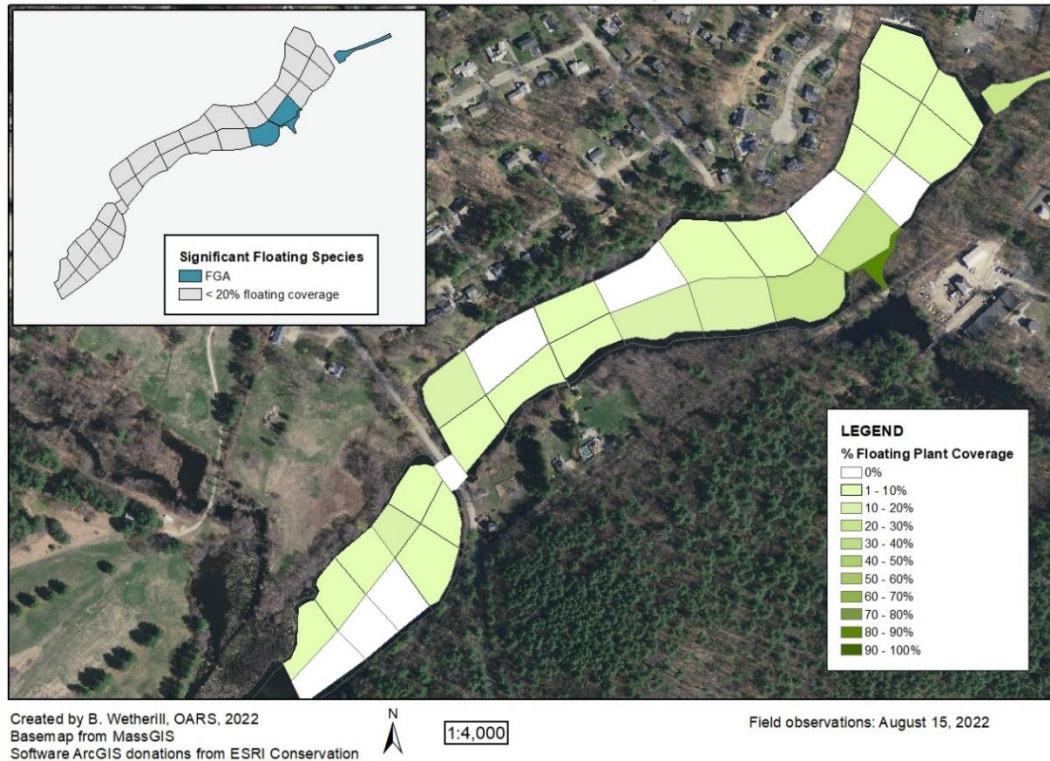
Created by B. Wetherill, OARS, 2022
Basemap from MassGIS
Software ArcGIS donations from ESRI Conservation



1:3,500

Field observations: August 22, 2022

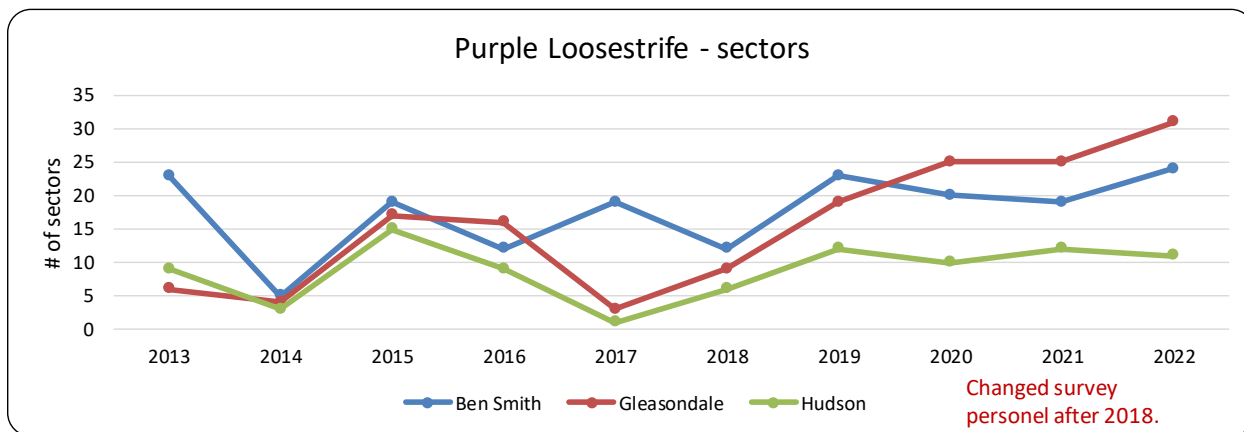
Aquatic Plant Biomass Surveys - 2022
Assabet River - Ben Smith Impoundment



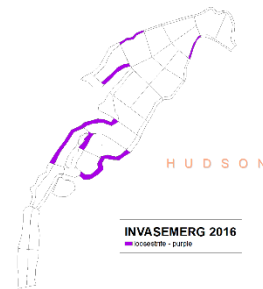
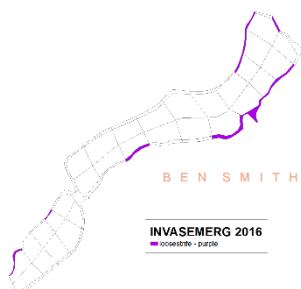
Note: Starting in 2020, the survey was conducted on the central areas of the impoundments only. Edges were excluded to save time. It was proposed that the real objective of the survey should be biomass in the central portion of the impoundments, not biomass that has collected along the shore. Also, the edge sectors, as drawn, included large portions of exposed land, so percent coverage was somewhat misleading. All years have been adjusted accordingly in the data. The excluded edges can be seen as a faint gray line in the maps above.

Appendix B - Purple Loosestrife

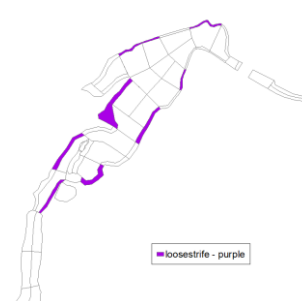
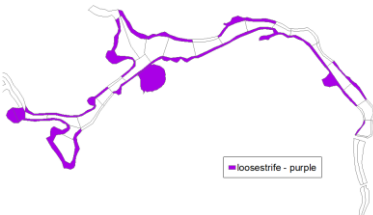
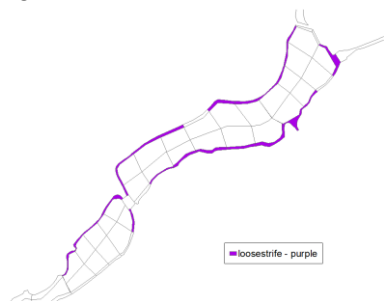
A graph by year of the number of sectors with purple loosestrife shows what seems to be an upward trend, especially in the Gleasondale impoundment. In 2022, almost all of the edge sectors in Ben Smith and Gleasondale had some purple loosestrife. Our records show that CISMA and OARS released *Galerucella* leaf-eating beetles in the Sudbury River area in 2012 (or 2013?), 2014, and 2015, but not in these Assabet impoundments.



2016

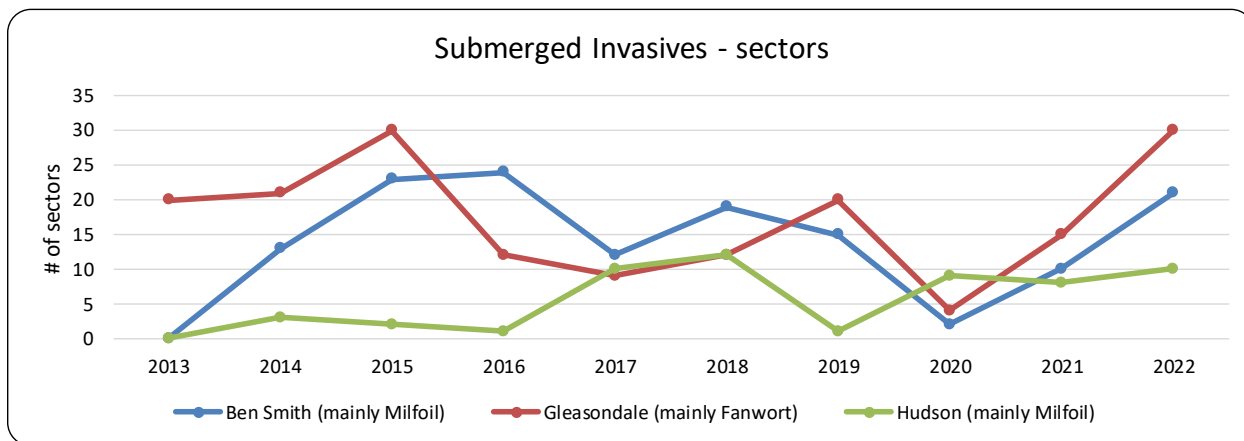


2022

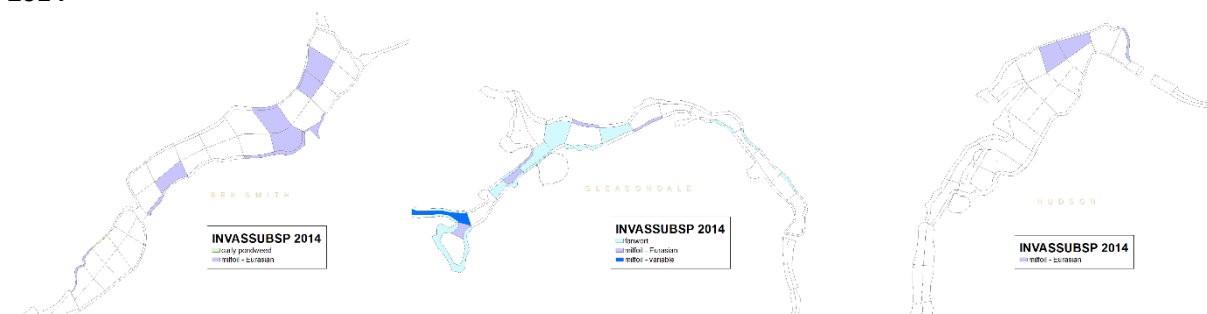


Appendix C - Submerged Invasives

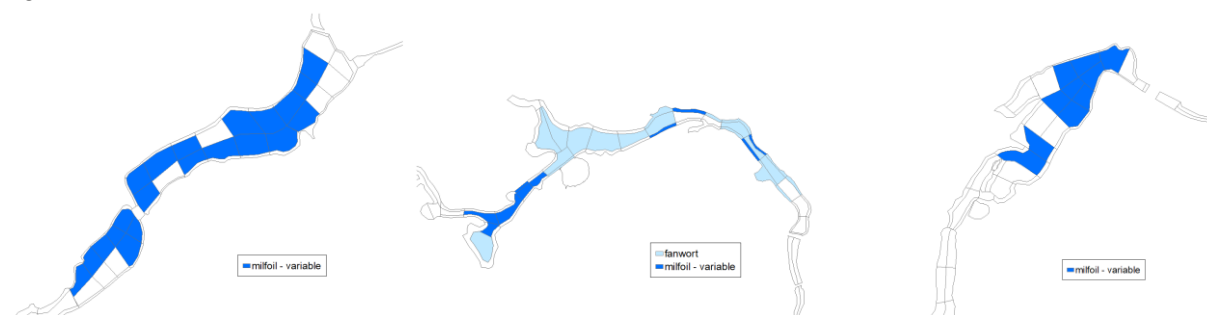
A graph by year of the number of sectors with submerged invasives shows a gradual increase in invasives in Hudson and a large spike of invasives in 2022 in Ben Smith and Gleasondale. Maps of sectors with invasive submerged species from 2014 and 2021 highlight differences between the impoundments. Gleasondale has always been distinguished by the large amount of fanwort, which is rarely seen in the other impoundments.



2014



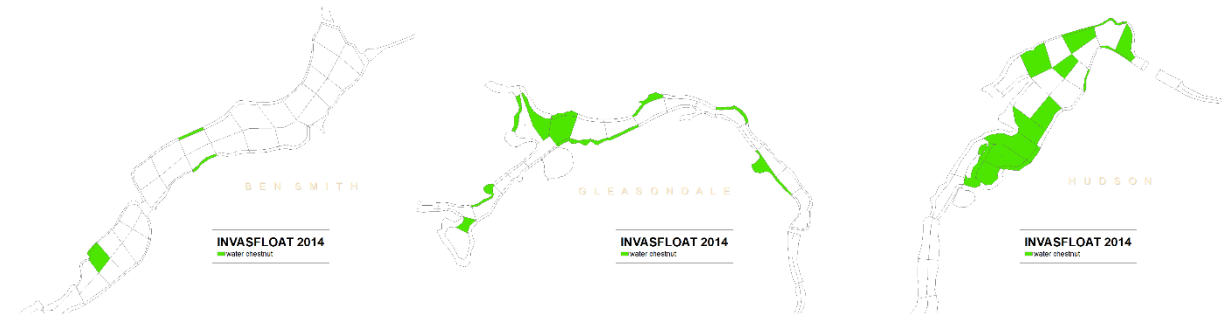
2022



Appendix D - Water Chestnut

Very little water chestnut was found during the 2022 Biomass Surveys, but it is hard to draw any conclusions from the water chestnut data because there is intensive organized removal of water chestnut earlier in the year. Maps of sectors with water chestnut from 2014 and 2022 show less water chestnut in 2022, but this could just be a factor of better pulling in 2022. The lack of water chestnut in the Hudson impoundment is surprising. Could it be crowded out by FGA and coontail?

2014



2022

