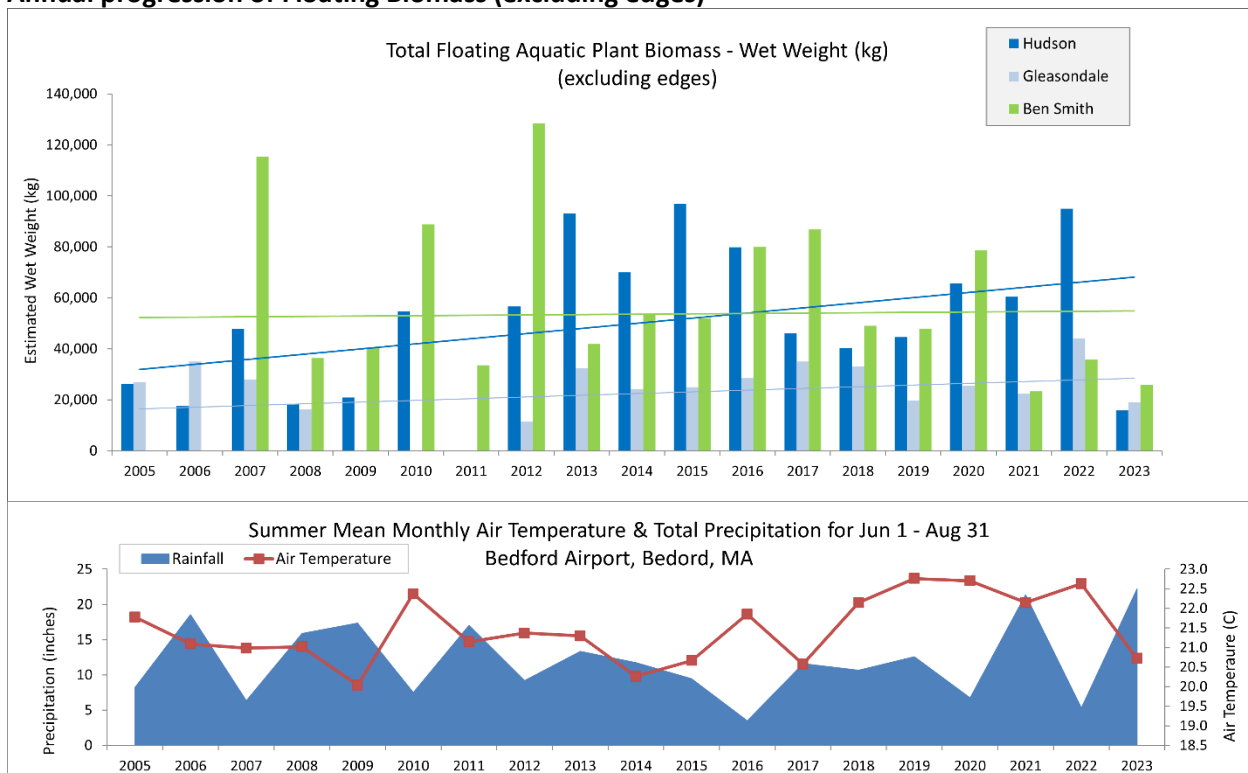


OARS Biomass Summary 2023

Published September 6, 2023

OARS has been surveying floating and submerged biomass during August in three impoundments in the Assabet River since 2005. The objectives of the survey are to assess the nature and extent of aquatic plant biomass and to assess progress in achieving the TMDL goal of reducing biomass by at least 50% from July 1999 values¹. The summer of 2023 was characterized by very heavy precipitation. It was the wettest summer since OARS' biomass surveys began, and biomass in all three impoundments was significantly reduced as a result of the high flows. The Hudson impoundment, which has been choked with filamentous green algae (FGA) in recent years, had the lowest biomass levels recorded since this survey began, and FGA was minimal. The Gleasondale and Ben Smith impoundments also had unusually low amounts of floating biomass. The graph below shows trends by impoundment plotted above summer precipitation and temperature data. OARS' survey data show a statistical long-term worsening trend for Hudson, though 2023 was not representative. For Ben Smith, if only peak biomass years are evaluated, there seems to be an improving trend. Gleasondale is not exhibiting any long-term change. Maps of biomass coverage in each impoundment are exhibited in Appendix A. The maps show percent coverage in the main frame and dominant species in the inset. In 2023, there were very few sectors with significant enough coverage to register a dominant species.

Annual progression of Floating Biomass (excluding edges)



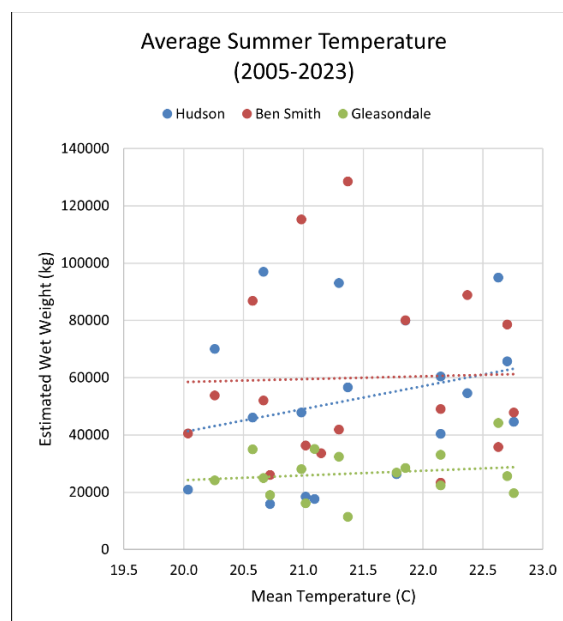
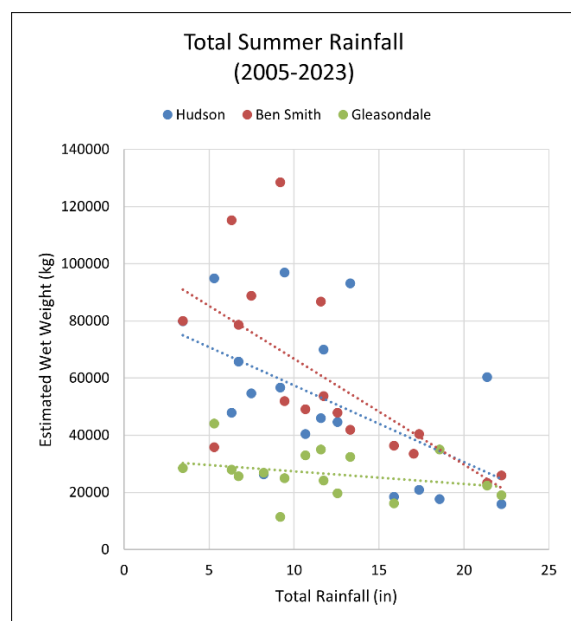
¹ MA DEP, 2004, "Assabet River Total Maximum Daily Load for Total Phosphorus", Report Number: MA82B-01-2004-01, Control Number CN 201.0.

Climate Correlation

A statistical review of the data reveals a strong inverse correlation between biomass and precipitation (low significance in Gleasondale). Lower precipitation results in slow-moving stagnating waters which promote biomass growth, especially FGA and duckweed. High precipitation produces high flows which carry duckweed and other floating algae downstream much faster. Hudson is the shallowest of the three impoundments, which explains why it has the strongest correlation with temperature, but the temperature correlation is not significant in any of the impoundments.

Total Floating Biomass Correlations (2005-2023):

Pearson Corr.	Hudson	Gleasondale	Ben Smith
Temperature	0.26	0.16	0.03
Precipitation	-0.54	-0.30	-0.65



TMDL Goal

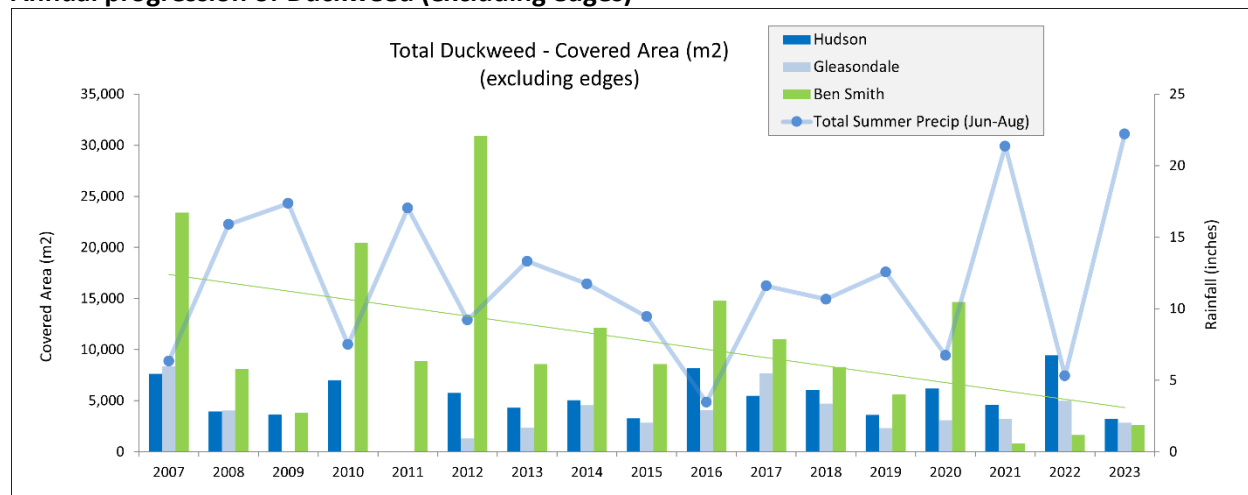
The goal of achieving a 50% reduction in floating biomass from July 1999 values would correspond to maximum wet weights of 46,800 kg in Ben Smith, 41,500 kg in Gleasondale, and 59,000 kg in Hudson². Biomass levels in all impoundments were well below these goals in 2023, but this was due to the high precipitation levels. Otherwise, only Gleasondale is meeting the goal on a consistent basis. Gleasondale has achieved the goal in all years except 2022, which was especially dry. Ben Smith and Hudson have not yet achieved it in most years. The median amount of floating biomass since 2013 has been 49,000 kg (52%) in Ben Smith and 66,000 kg (56%) in Hudson.

² ENSR, 2001, "SuAsCo Watershed Assabet River TMDL Study: Phase One – Assessment Final Report", ENSR International, Document # 9000-259-100.

Duckweed

A similar analysis of duckweed doesn't show any obvious trends other than Ben Smith. In Ben Smith, there has been a noticeable lack of duckweed over the past three years, which has pulled the trend down dramatically. Low levels in Ben Smith in 2021 and 2023 were attributed to the high rainfall, but there is no clear explanation for 2022. In all three impoundments, correlations with temperature and precipitation generally match those for total floating biomass.

Annual progression of Duckweed (excluding edges)



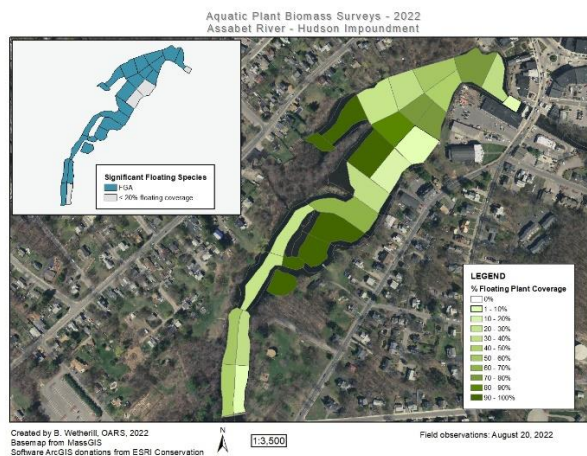
Duckweed Correlations:

Pearson Corr.	Hudson	Gleasondale	Ben Smith
Temperature	0.46	-0.27	0.00
Precipitation	-0.77	-0.29	-0.56

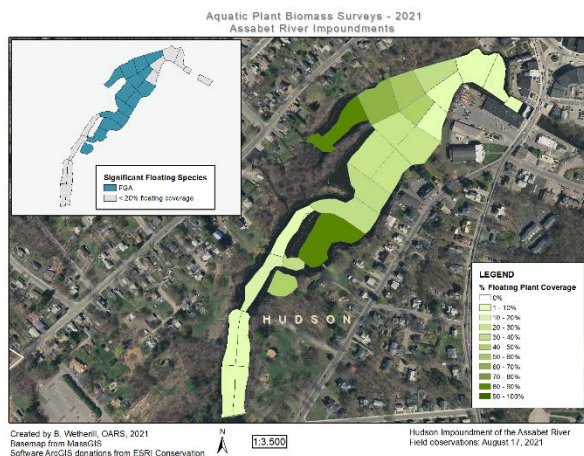
Hudson Eutrophication

One big takeaway from this survey has been the eutrophication of the Hudson impoundment. This was not evident in 2023 due to the heavy precipitation, but floating biomass was extreme in 2022 due to the drought and warm weather and seems to have been worsening over the previous four years. The following four images show percent coverage by sector for each of those four years. They show how much coverage increased from 2019 to 2022. 2018 (not shown) had even lower floating biomass levels.

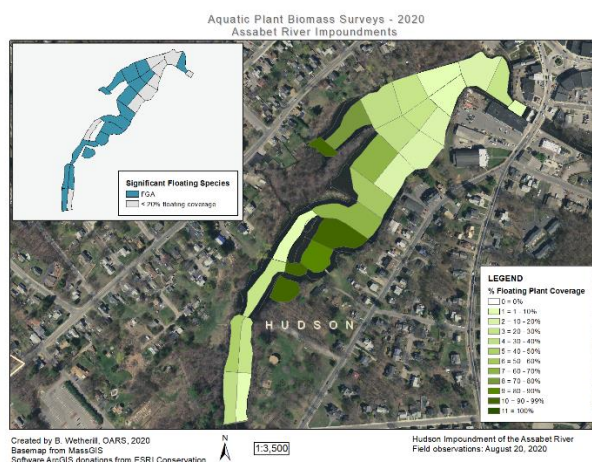
Hudson – 2022



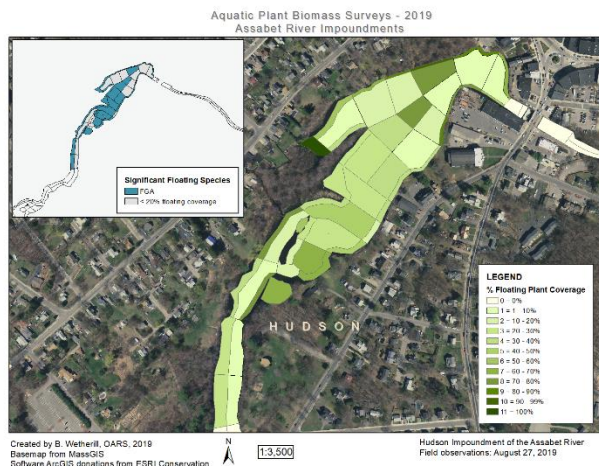
Hudson – 2021



Hudson – 2020



Hudson – 2019

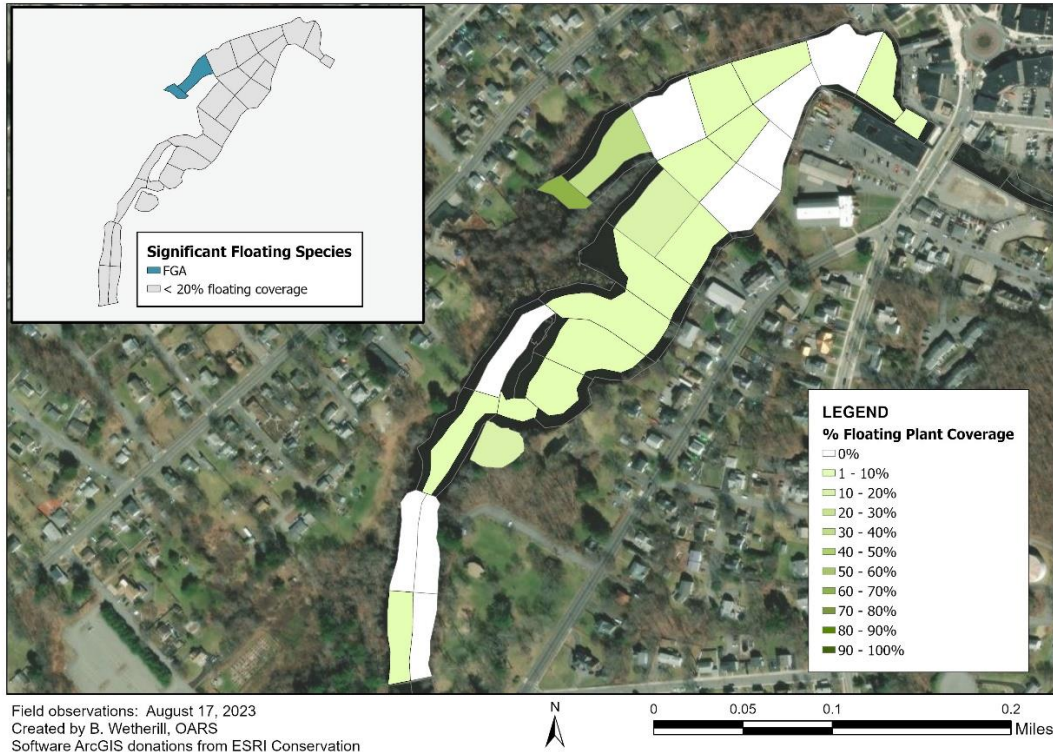


Hudson Biomass 2022 -

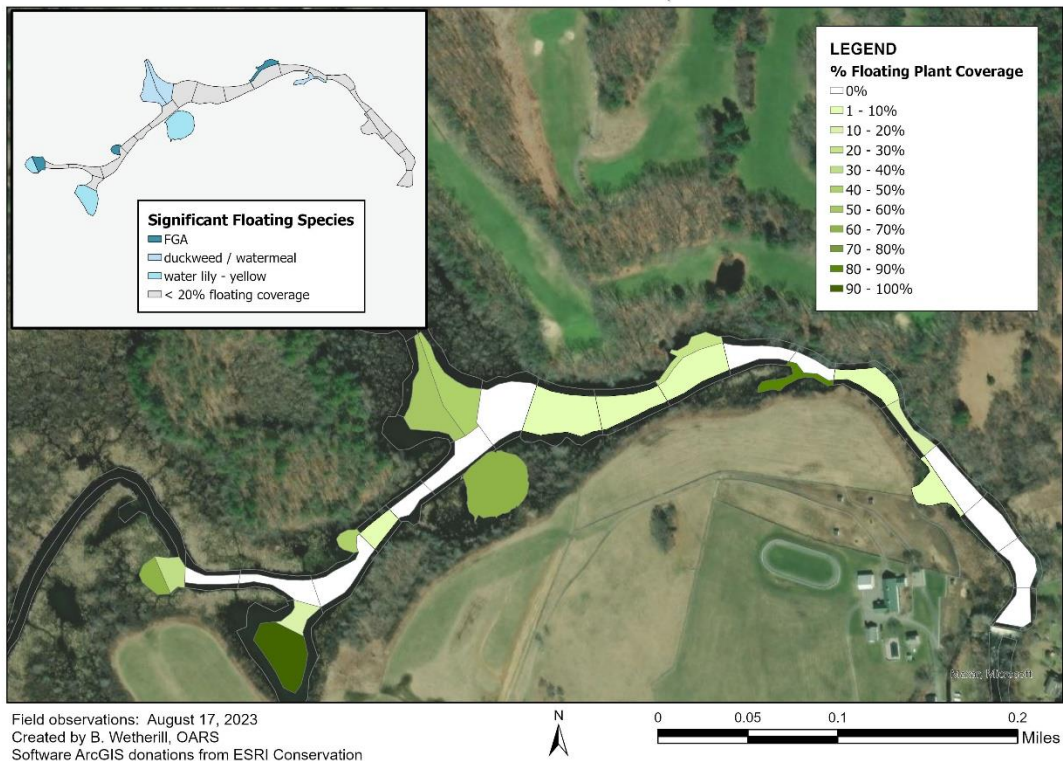


Appendix A – Maps of 2023 percent coverage and dominant species

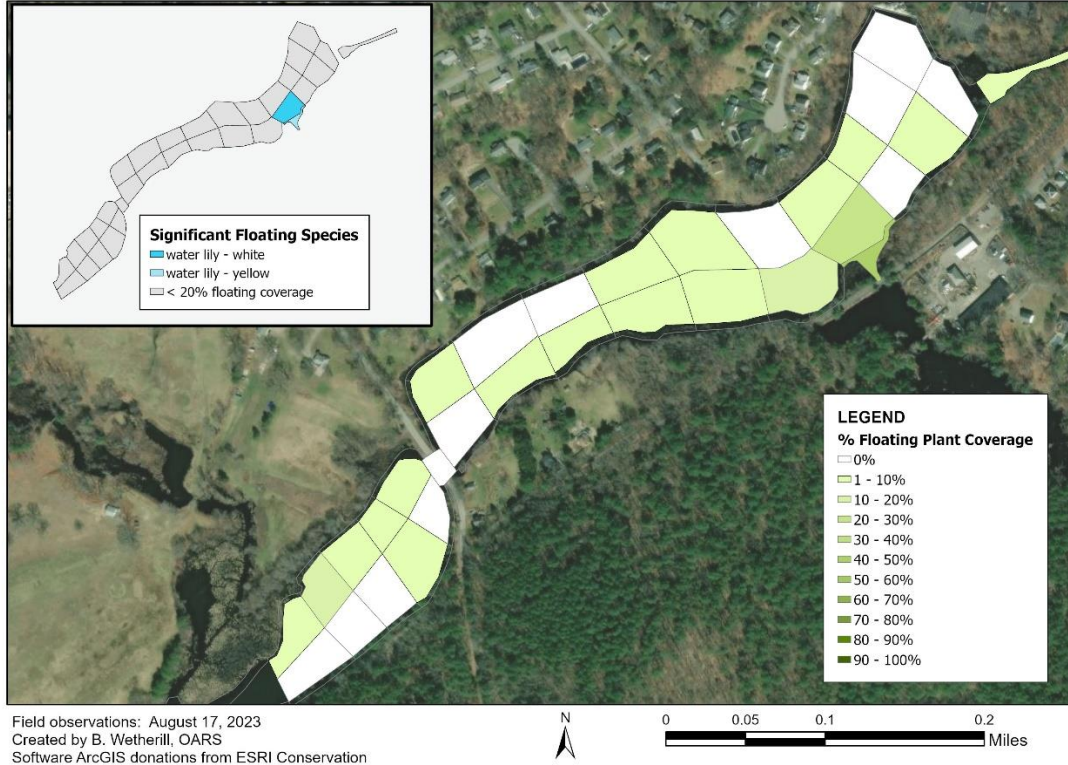
Aquatic Plant Biomass Surveys - 2023
Assabet River - Hudson Impoundment



Aquatic Plant Biomass Surveys - 2023
Assabet River - Gleasondale Impoundment



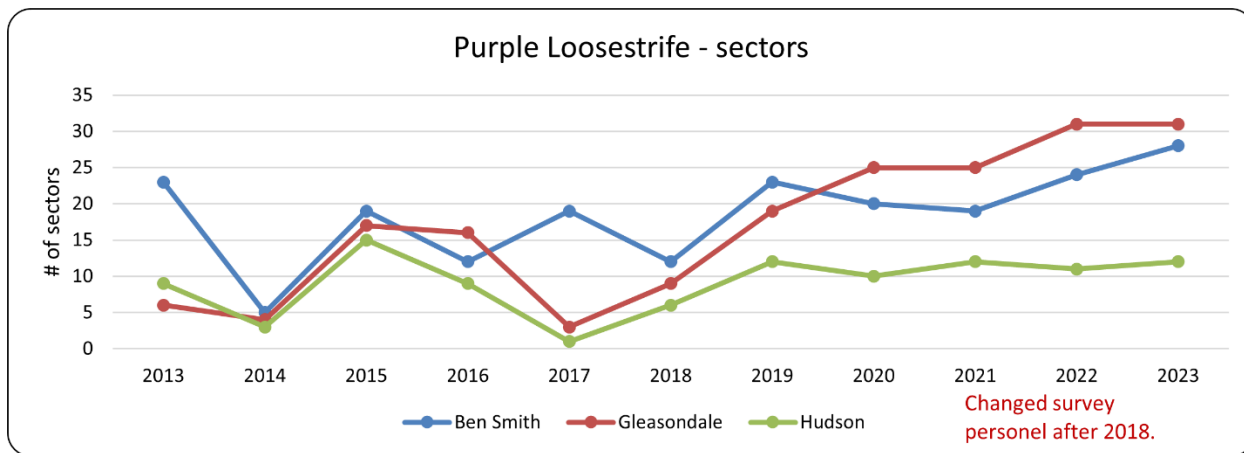
Aquatic Plant Biomass Surveys - 2023
Assabet River - Ben Smith Impoundment



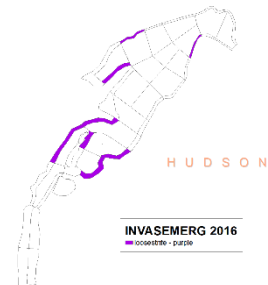
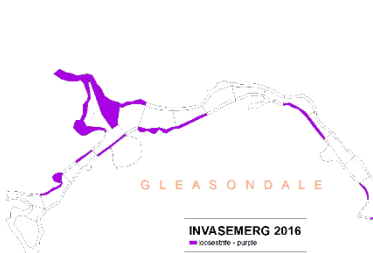
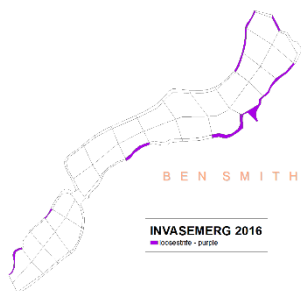
Note: Starting in 2020, the survey was conducted on the central areas of the impoundments only. Edges were excluded to save time. It was proposed that the real objective of the survey should be biomass in the central portion of the impoundments, not biomass that has collected along the shore. Also, the edge sectors, as drawn, included large portions of exposed land so percent coverage was 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

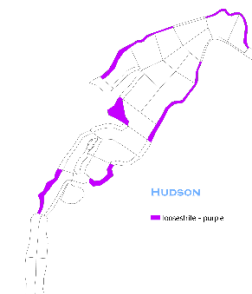
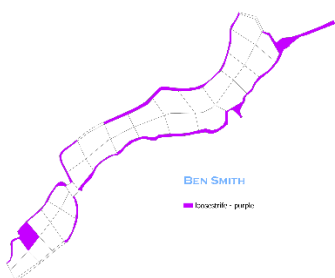
A graph by year of the number of sectors with purple loosestrife shows what seems to be an upward trend, especially in the Gleasondale impoundment. In 2023, almost all of the edge sectors in Ben Smith and Gleasondale had some purple loosestrife. Our records show that Cisma and OARS released Galerucella leaf-eating beetles in the Sudbury River area in 2012 (or 2013?), 2014, and 2015, but not in these Assabet impoundments.



2016

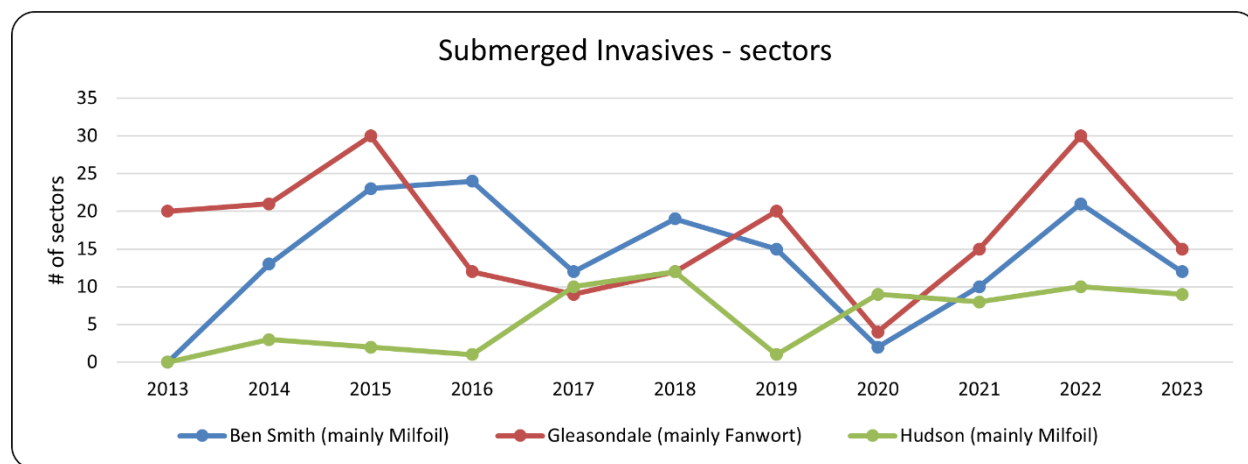


2023

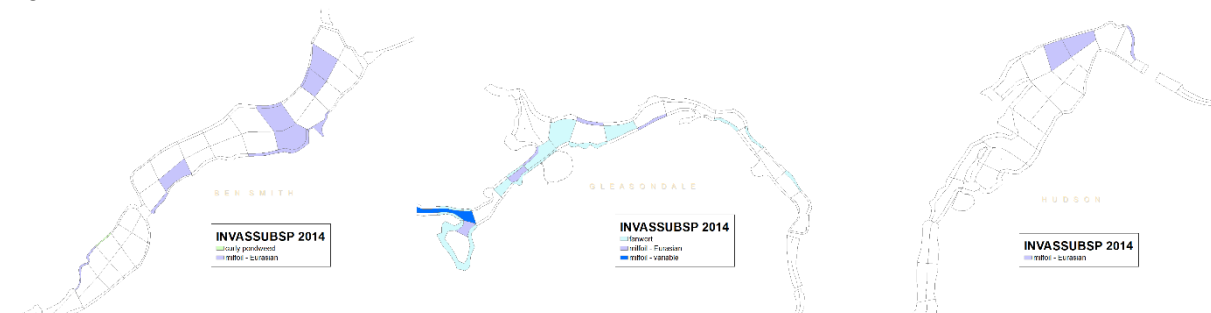


Appendix C - Submerged Invasives

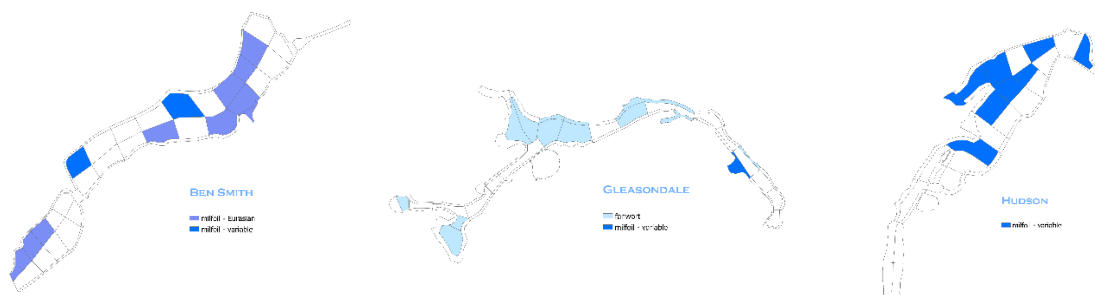
A graph by year of the number of sectors with submerged invasives shows a gradual increase in invasives in Hudson and a large spike of invasives in 2022 in Ben Smith and Gleasondale. Maps of sectors with invasive submerged species from 2014 and 2023 highlight differences between the impoundments. Gleasondale has always been distinguished by the large amount of fanwort, which is rarely seen in the other impoundments. Eurasian and variable milfoil are the primary invasives in the other two impoundments.



2014



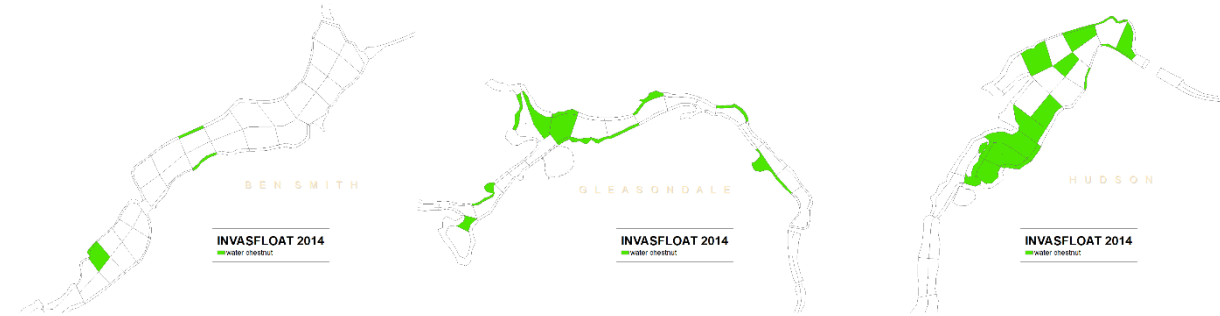
2023



Appendix D - Water Chestnut

No water chestnut was found during the 2023 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 2023 show less water chestnut in 2023, but this could just be a factor of better pulling in 2023.

2014



2023

