

Assessing river herring habitat after aquatic herbicide application

Master's thesis by Caroline Reusch





Fanwort



Eurasian Watermilfoil



Hydrilla



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Aquatic Herbicide Management



**DMF Recommendations: TOY restrictions
4/1 - 6/30 and no full pond treatment**



Existing information on impacts of aquatic herbicide on diadromous fish?

What about larval and juvenile river herring?

How does mass plant die off impact river herring habitat?

Are there any indirect impacts to substrate or water quality?
Changes to food abundance?

Goal: Investigate the potential indirect impacts of herbicide treatment on river herring habitat, focusing on variations in zooplankton abundance, spawning substrate, and water quality.

- Is the primary food source for juvenile river herring (zooplankton), impacted by herbicide treatment?
- Does herbicide treatment alter benthic spawning substrata?
- How does water quality change during herbicide treatment?

Field Work

Monitored eight lakes in Southeastern MA and Cape Cod over a month

- All river herring runs
- Infested with invasive aquatic plants
- Four **untreated** lakes
- Four **treated** lakes

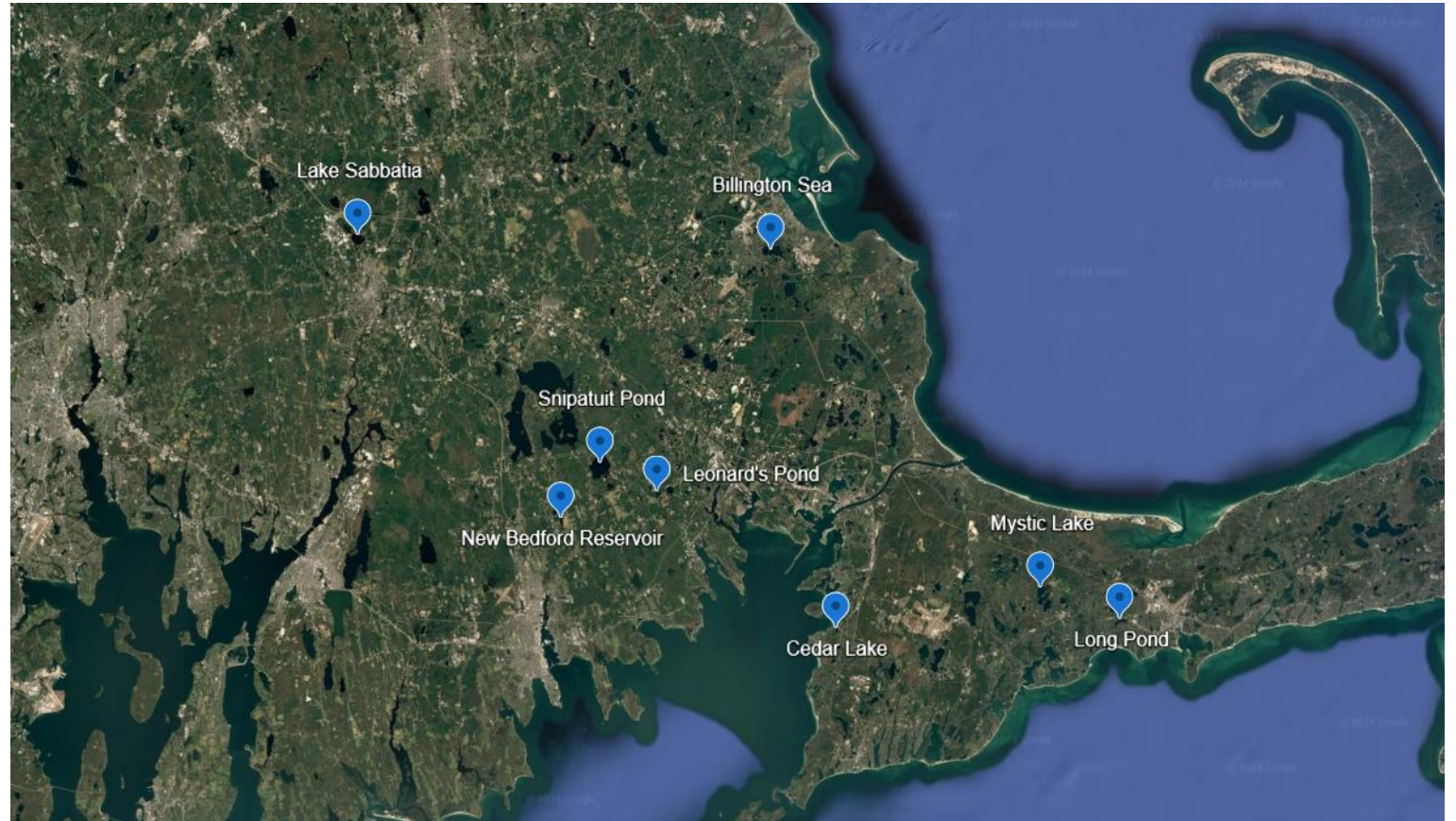
Six sampling sites at each lake

- Zooplankton tow
- Water quality measurements
- Substrate grab
- Max depth measurement

One deep water quality station at each lake

Eight HOBO loggers

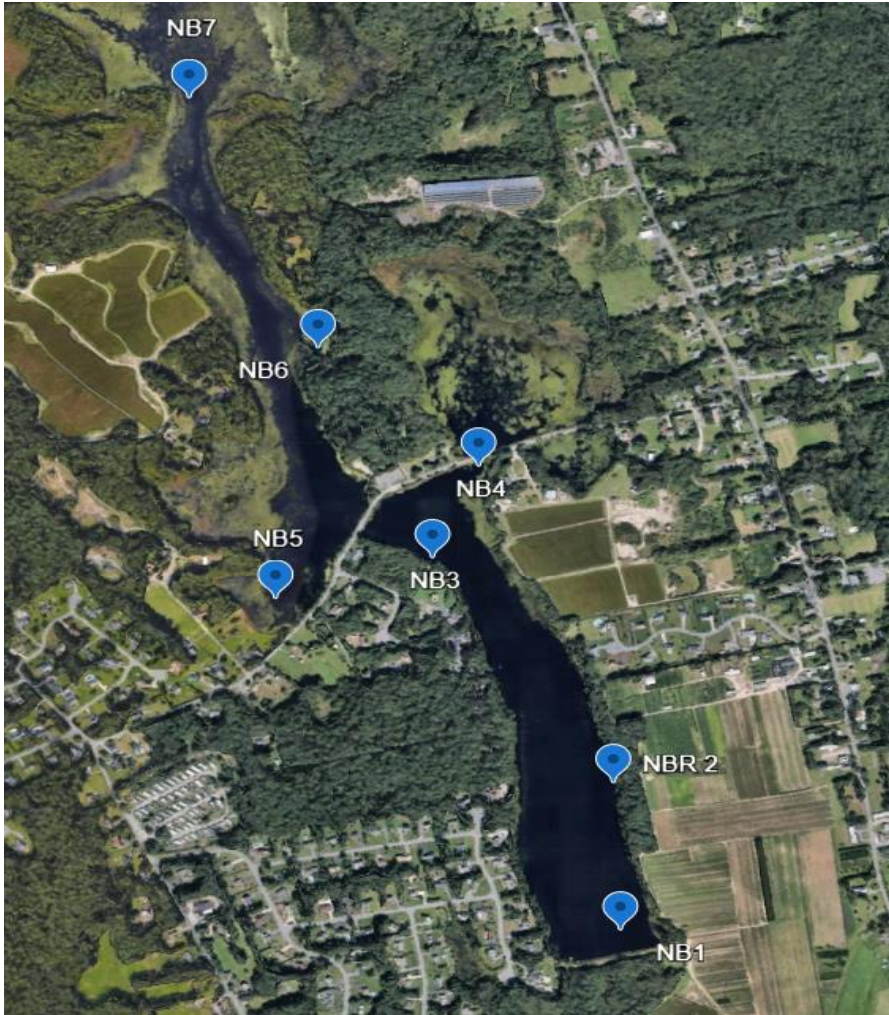
- 0.3m
- Log temp every 30 mins



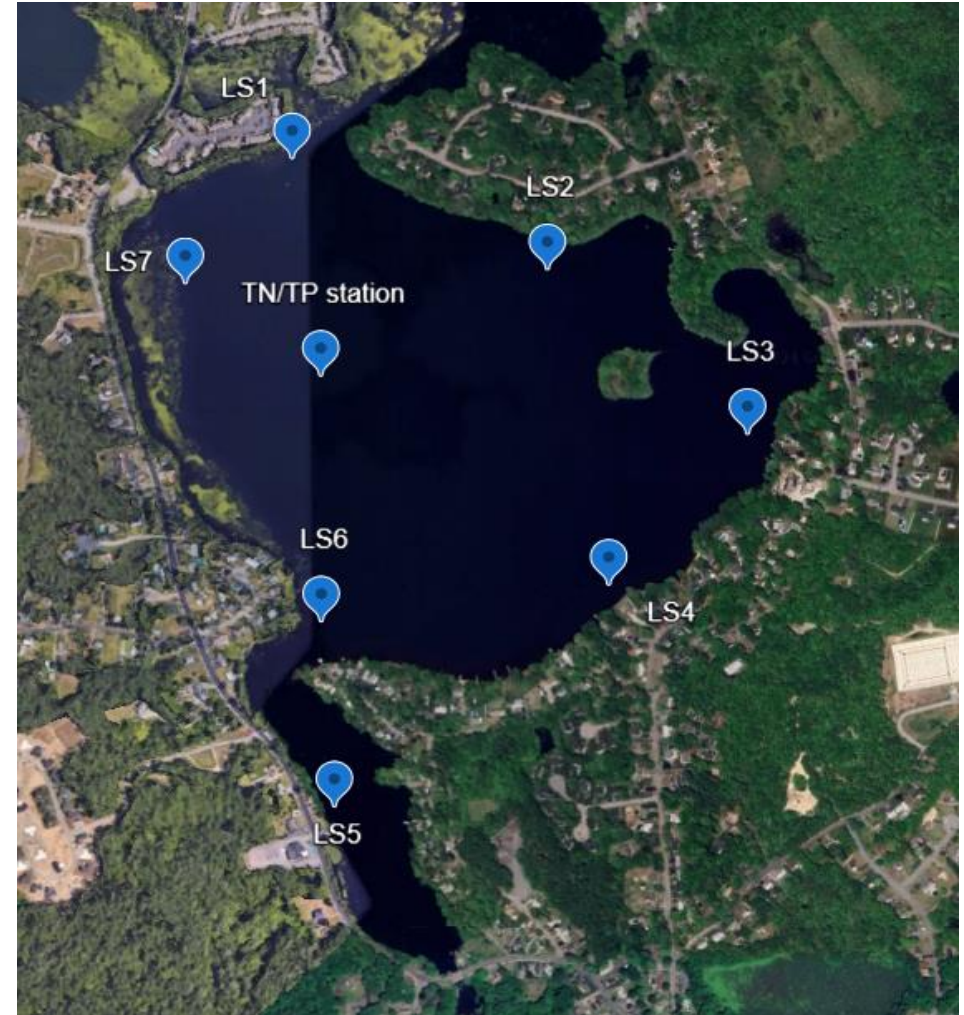
Untreated: Snipatuit Pond, Leonard's Pond, New Bedford Reservoir, Billington Sea

Treated: Lake Sabbatia, Cedar Lake, Mystic Lake, Long Pond

New Bedford Reservoir, Acushnet, MA, untreated



Lake Sabbatia, Taunton, MA, treated with herbicide



Treated lakes: 24hr pre, 24hr post, 48hrs post, 7 days, 14, days, 21 days, and 28 days post

Untreated lakes: Once a week for a month

Zooplankton tows

Gear: 153-micron Wisconsin Plankton Net, rope marked with 0.5m and 1m intervals, spray bottle, plastic jar, 50 ml conical sampling tubes, 53-micron sieve, Alca Zelter tablets, Lugol's solution, 70% ethanol.

Protocol:

Vertical tow, 1-2m in depth

Dip net three times

Spray down net and chamber

Release contents into container

Drop ¼ Alca Zelter tab, wait 5 minutes

Sieve contents

Spray into 50 ml conical tubes

Pour 40-50ml ethanol

7-8 drops of Lugol's solution

Store in cooler

Wash/spray down in between lakes



Water quality measurements

temperature, DO (% mg/L), pH, and specific conductivity

WATER CHEMISTRY

Station	Time	Depth (M)	Water Temp. (°C)	Water Sp. Cond. (mS/cm)	Water pH	Water Turbidity (NTU)	Water D.O. (% sat.)	Water D.O. (mg/l)	Secchi Disc (m)
CL1	2:47	1.0	22.9	360.0	6.07		44.7	3.76	
CL1	2:52	0.3	27.8	340.8	7.08		106.6	8.39	
CL2	3:02	1.5	19.4	362.6	5.93		5.4	0.49	
CL2	3:07	0.6	27.4	340.8	6.84		102.1	8.13	
CL2	3:12	0.3	27.5	340.6	7.22		108.1	8.55	
CL3	3:33	1.0	25.7	345.3	6.06		6.5	0.53	
CL3	3:27	0.3	27.5	341.3	7.17		108.7	8.60	
CL4	3:50	1.0	22.2	352.0	6.02		63.8	5.52	
CL4	3:55	0.3	27.2	343.3	6.65		95.5	7.57	
CL5	4:09	0.3	25.6	331.4	6.13		65.8	5.23	
CL5	4:17	1.0	23.0	340	5.97		-0.4	-0.02	
CL6	4:30	0.3	27.2	338.5	7.07		124.4	9.76	
CL6	4:35	1.0	22.9	381.6	5.92		0.6	0.07	



Substrate grabs

- Percent coverage at site
 - Iron rake used for grabs
 - Rake – 1.5m x 0.8m
 - Two 2 m wide grabs
- Plant decomposition scale
- Observations and pictures



PLANT DECOMPOSITION SCALE

- 1- fresh, no discoloration or signs of detritivore feeding
- 2-3- early decomposition, yellow discoloration, plant fragmentation and evidence of detritivore feeding;
- 4-5- advanced decomposition, little to no plant structure left, breakdown of plant into sediment.

SPAWNING SUBSTRATE

Station No.

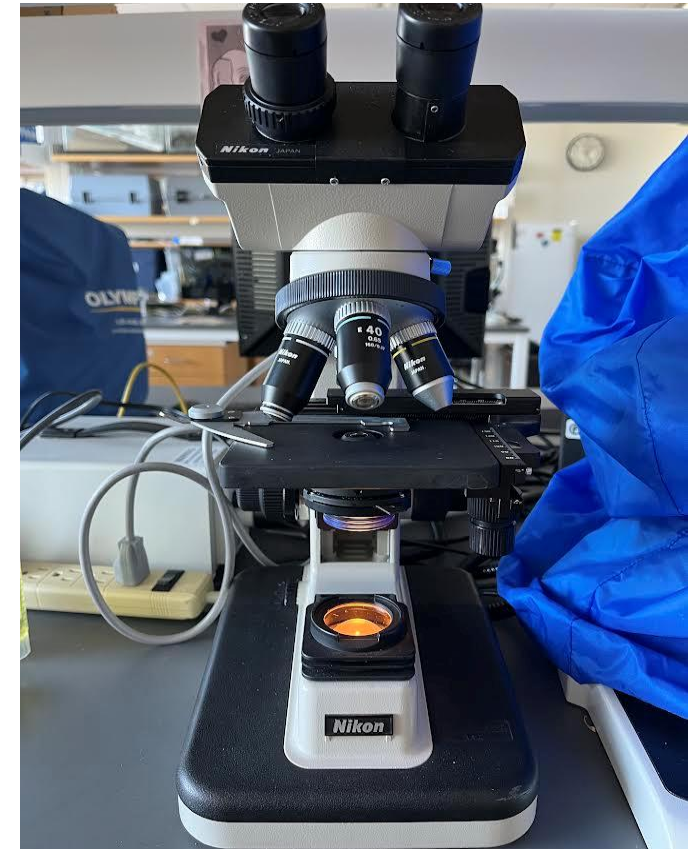
	1	2	3	4	5	6
Gravel/cobble	65	50	30			
Sand						
Silt/detritus	10			10	10	75
Periphyton	25	50	20	15		
Vascular plant			50	75	90	25
Notes						

LS2: decaying plants covered in periphyton, possible pondweed species. Decomp 2-3
 LS3: Decaying pondweed, Milfoil present/uprooted possible frozen decay, cobble/gravel bottom w/, Decomp: 1
 LS4: Native lily pads, possible bladder wort, Milfoil present. No presence of decay. Medium density silt mixed w/ cobbles, periphyton on top
 LS5: Thick layer of plants (Milfoil/lily pads), dense detritus layer, decaying Milfoil: Decomp: 2

Lab Work

Plankton identification

- Three subsamples
- Hensen Stempel pipette 1ml
- Sedgewick-rafter counting cell
 - Holds 1ml of sample
- Nikon microscope
- Scan and ID plankton
 - ID to family
- Tally plankton

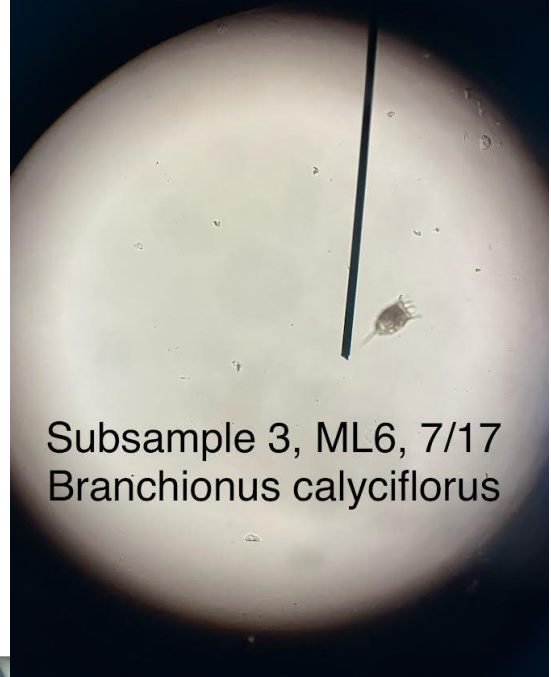


Date	Site	Concentration factor (ml)	Organism	Subsample 1 (1 ml)	Subsample 2 (1 ml)	Subsample 3 (1 ml)	Total	Avg. Count per 1 ml	Number per liter of lake water
7/2/2024	CL3	1047.2	Mayfly				1	1	0.954927426
7/16/2024	BS1	1178.1	Copepoda Cyclopoid nauplius	2			2	2	1.69768756
7/16/2024	BS1	1178.1	Copepoda Cyclopidae		1		1	1.5	1.273296567
7/16/2024	BS1	1178.1	Clad. Diaph. Ceratodaphnia		1		1	1	0.848824378
7/16/2024	BS1	1178.1	Cladocera Bosminidae			1	1	1	0.848824378
7/16/2024	BS1	1178.1	Rotifera Conochilidae conochiloides	1			1	1	0.848824378
7/16/2024	BS1	1178.1	Rotifera Branchiuridae		2		2	2	1.69768756
7/16/2024	BS1	1178.1	Rotifera Branch. Keratella			2	2	2	1.69768756
7/9/2024	NB7	785.4	Copepoda Cyclopoid nauplius	10	3	4	17	5.666666667	7.215007215
7/9/2024	NB7	785.4	Copepoda Cyclopidae	13	14	11	38	12.666666667	16.12766319
7/9/2024	NB7	785.4	Copepoda Diaptomidae		1		1	1	1.273296567
7/9/2024	NB7	785.4	Clad. Diaph. Ceratodaphnia	6	2	12	20	6.666666667	8.488243782
7/9/2024	NB7	785.4	Cladocera Bosminidae	2	10	4	16	5.333333333	6.790595026
7/9/2024	NB7	785.4	Cladocera Chydridae	9	8	9	26	8.666666667	11.03471692
7/9/2024	NB7	785.4	Cladocera Siphidae Diaphanosoma	9	10		19	6.666666667	11.03471692
7/23/2024	NB6	785.4	Copepoda Cyclopoid nauplius		1		1	2	1.273296567
7/23/2024	NB6	785.4	Copepoda Cyclopidae	4	11	4	19	6.333333333	8.963831993
7/23/2024	NB6	785.4	Clad. Diaph. Ceratodaphnia	13	3	14	30	10	12.73296567
7/23/2024	NB6	785.4	Cladocera Bosminidae		1		1	1	1.273296567
7/23/2024	NB6	785.4	Cladocera Chydridae	3	5	13	13	4.333333333	5.517094919
7/23/2024	NB6	785.4	Cladocera Siphidae Diaphanosoma	4	5	3	12	4	5.02946269
7/23/2024	NB6	785.4	Chaoborus		1		1	1	1.273296567
7/2/2024	CL1	1047.2	Copepoda Cyclopoid nauplius			1	1	1	0.954927426
7/2/2024	CL1	1047.2	Copepoda Cyclopidae			7	7	5	4.774637128
7/2/2024	CL1	1047.2	Copepoda Calanoida nauplius	1			1	1	0.954927426
7/2/2024	CL1	1047.2	Copepoda Diaptomidae	3			3	2	1.90984881
7/2/2024	CL1	1047.2	Clad. Diaph. Ceratodaphnia			5	5	2.5	2.387781564
7/2/2024	CL1	1047.2	Cladocera Bosminidae	2			2	2	1.90984881
7/2/2024	CL1	1047.2	Cladocera Chydridae			2	2	2	1.90984881
7/2/2024	CL1	1047.2	Rotifera Planorbis			1	1	1	0.954927426

Subsample 2, CL6, 6/28
Bosminidae



Subsample 3, ML6, 7/17
Branchionus calyciflorus



Subsample 1, LS5, 7/10
Ceriodaphnia



NB7, 7/9, Subsample 2
Diaphansoma



And more plankton ID...



17 out of 252 samples completed.

JOB OPENING AT BRIDGEWATER STATE UNIVERSITY: Graduate student's assistant. Part time, three days a week. Assist with the identification and enumeration of plankton samples
Pay: experience and a good time

Please help



Thank you!

