

Lubberland Creek Fish Survey Final Report



Submitted to The Nature Conservancy
by Alyson Eberhardt
NH Sea Grant/UNH Cooperative Extension
22 December 2015



Table of Contents

PROJECT GOAL.....	3
OVERVIEW	3
METHODS.....	3
RESULTS	5
WATER QUALITY	5
NEKTON OF LUBBERLAND CREEK.....	6
<i>Species Captured Upstream of Culvert.....</i>	<i>6</i>
<i>Species Captured Downstream of Culvert.....</i>	<i>7</i>
CITIZEN ENGAGEMENT	7
RESTORATION RECCOMENDATIONS	7
APPENDICES	9
A. PERMITS.....	9
B. FISH AND SAMPLING SITE DATA.....	11
1. <i>Fish abundance and site data.....</i>	<i>11</i>
2. <i>Mean fish length (mm)</i>	<i>13</i>
C. VOLUNTEER MATCH	15
1. <i>Volunteer hours</i>	<i>15</i>
2. <i>Volunteer mileage</i>	<i>16</i>

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Title page photo credits: upper pictures, Haley Andreozzi (UNH Cooperative Extension); lower pictures, Pete Steckler (TNC)

PROJECT GOAL

To understand fish community composition and abundance in Lubberland Creek, both upstream and downstream of Bay Road in Newmarket, NH.

OVERVIEW

A perched, 3' pipe culvert under Bay Road connects the upstream and downstream sections of Lubberland Creek in Newmarket, NH. This project will document the fish species captured upstream and downstream of the culvert.

METHODS

Prior to fish sampling, required permits for fish capture and handling were obtained from NH Fish and Game and the University of New Hampshire Institutional Animal Care and Use Committee (see Appendix A).

Fish sampling occurred in spring (May 19), summer (August 13) and fall (October 8) of 2015 to capture seasonal changes in fish species and life stages. Fish were captured using two methods to sample the diversity of habitats present in Lubberland Creek and account for gear-bias: seine nets (May 19 and October 8 sampling efforts) and minnow traps (August 13 and October 8). Seine net width was adjusted to account for the creek width at each sampling site; seine nets were towed for a length of ten meters. Minnow traps were set for less than 24 hours to minimize escape rates. Sampling effort varied on each date dependent on the gear used and site permission. Thirteen sampling sites were fished for a total of 21 samples (figure 1). Captured nekton were immediately transferred to buckets of creek water equipped with aerators to ensure adequate oxygen levels. Fish and crustaceans were identified, counted, measured for length (a subset were measured when over 50 individuals were collected; Appendix B) and returned to the site from which they were captured. Water quality data were collected at each sampling site using a refractometer and a YSI 85 (May) or YSI Pro 2030 (August and October). Data were collected for dissolved oxygen, temperature and salinity.

Volunteers were engaged in the data collection efforts. Prior to each fish sampling effort, an overview of the project goals was provided and the methods were reviewed. Volunteers were trained in fish and water quality data collection methods in situ. All data were recorded on field data sheets.

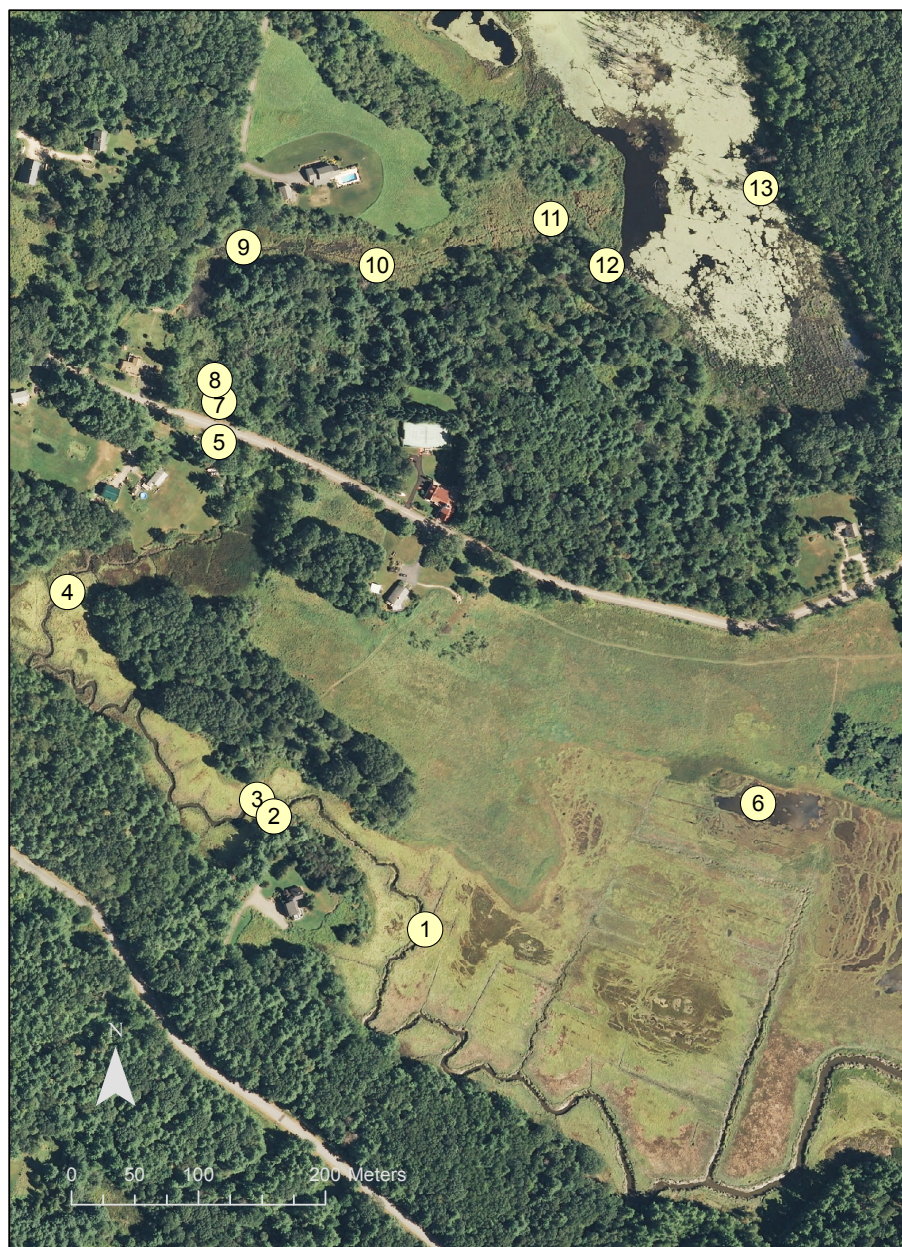


Figure 1. Lubberland Creek fish survey sites

RESULTS

Water quality

Low dissolved oxygen was recorded at multiple sites throughout the creek (table 1). Violations of New Hampshire Class A (6 mg/L) or class B (5 mg/L) water quality standards for dissolved oxygen were recorded on each sampling date. It should be noted that dissolved oxygen data are not averages but records of dissolved oxygen conditions at one point in time.

Salinity values recorded at the upstream sampling sites (sites 7-13) were 0.1 practical salinity units (psu) or less, typical of freshwater systems. Salinity recorded downstream of the culvert was variable; freshwater values (0-0.1 psu) were recorded immediately downstream of the culvert (site 5), and mesohaline salinity levels (3.5-12.0 psu) were recorded at the remaining downstream creek sites (sites 1-4). It is typical for salt marsh creek salinity values to vary greatly according to location in the creek (i.e, proximity to the estuary), tidal stage, and the amount of fresh water inflow. A salinity of 27 psu was recorded in the panne; it is typical for salt marsh panne salinity to also vary greatly from freshwater to polyhaline (observed here) to hypersaline conditions.

Table 1. Lubberland Creek water quality data

Site		1	2	3	4	5	6	7	8	9	10	12	13
Waterbody type		creek	creek	creek	creek	scour pool	panne	scour pool	creek	creek	creek	beaver pond	beaver pond
Location		downstream						upstream					
Dissolved oxygen (mg/L)	May	3.9	4.6	7.2		7.4			5.4	5.7	3.6		
	Aug			6.7		6.4	10.4	4.6				2.3	0.4
	Oct	7.7		8.3	6.7	8.4	11.3	7.3				5.1	5.9
Dissolved oxygen (% saturation)	May	42.0	51.0	72.0		78.4			54.3	57.4	35.9		
	Aug			78.8		64.9		47.5				27.0	3.9
	Oct	72.2		78.4	63.1	75.0	111.0	67.3				50.3	53.2
Salinity	May	10.1	7.4	3.5		0.1			0.1	0.1	0.1		
	Aug			12.0		0.0	27.0					0.0	0.0
	Oct												
Temperature (deg C)	May	16.6	16.5	15.7		17.8			15.4	15.4	15.5		
	Aug			23.1		17.5	27.9	16.5				22.6	20.3
	Oct			13.0	12.7	10.4	14.5	11.4				15.2	10.7

Violation of class A standard

Violation of class B standard

Nekton of Lubberland Creek

Twenty samples were collected over the course of 3 sampling events, resulting in a total of 3710 fish, shrimp and crabs captured from Lubberland Creek (table 2). The majority of fish (n=3114) were two species captured downstream of the culvert: the common salt marsh resident, the mummichog (*Fundulus heteroclitus*) as well as a migratory run of young of the year American eel (*Anguilla rostrata*.) The remaining 595 individuals comprised 11 different species, of which 4 were crustaceans. Catch data for each sampling site can be found in Appendix B.

Table 2. Summary of fish and crustaceans captured in Lubberland Creek

	Downstream	Upstream
Freshwater fishes		
redfin pickerel <i>Esox americanus</i>	0	6
golden shiner <i>Notemigonus crysoleucas</i>	3	1
pumpkinseed <i>Lepomis gibbosus</i>	2	1
common shiner <i>Luxilus cornutus</i>	10	0
Estuarine fishes		
ninespine stickleback <i>Pungitius pungitius</i>	1	0
fourpine stickleback <i>Apeltes quadracus</i>	59	0
mummichog <i>Fundulus heteroclitus</i>	1114	0
Migratory fishes		
white perch <i>Morone americana</i>	3	0
American eel (glass) <i>Anguilla rostrata</i>	2000	0
American eel (yellow) <i>Anguilla rostrata</i>	2	0
Crustaceans		
Asian shore crab <i>Hemigrapsus sanguineus</i>	4	0
Sand shrimp <i>Crangon septemspinosa</i>	14	0
Grass shrimp <i>Paleomon spp.</i>	470	0
Mud crab <i>Panopeus herbstii</i>	20	0
TOTAL	3702	8

Species Captured Upstream of Culvert

Upstream of the culvert, Lubberland Creek is a small freshwater stream with beaver activity present. Habitats sampled include scrub-shrub swamp, graminoid marsh and beaver ponds (details on site characteristics can be found in Appendix B). Three fish species (a total of 8 individuals) were collected upstream of the culvert: redfin pickerel (*Esox americanus*), golden shiner (*Notemigonus cryoleucas*) and pumpkinseed (*Lepomis*

gibbosus). These species are native to NH, typical of the slow moving, vegetated habitats sampled and adapted to the low dissolved oxygen conditions recorded at these sites.

Species Captured Downstream of Culvert

Downstream of the culvert, Lubberland Creek transitions from freshwater to brackish; habitats sampled include the pooled area of the creek immediately downstream of the culvert, salt marsh creeks, and a salt marsh panne.

The majority of nekton captured in the salt marsh (sites 1-4) were native species typical of estuarine systems, and include: mummichogs, grass shrimp (*Paleomon* spp.), white perch (*Morone americana*), fourspine stickleback (*Apeltes quadracus*), ninespine stickleback (*Pungitius pungitius*), sand shrimp (*Crangon septemspinosa*), American eel and the mud crab (*Panopeus herbstii*). One non-native crustacean species, the Asian shore crab (*Hemigrapsus sanguineus*) was captured within the salt marsh.

Seven fish species were captured in the pooled area of the creek immediately downstream of the culvert (site 5). Three species typical of freshwater systems were captured at this site: golden shiner, pumpkinseed and common shiner (*Luxilis cornutus*). In addition, two estuarine species were captured (fourspine stickleback and mummichog) as well as two migratory species, American eel and white perch. Approximately 2000 glass eels were captured at site 5 in May during the spring ingress of young of the year eels from coastal waters into freshwater. One eel captured at site 5 was a sub-adult yellow eel.

Citizen engagement

A total of 16 volunteers were engaged and contributed 97.5 hours toward the project. Data for volunteer match (effort and mileage) can be found in Appendix C.

RESTORATION RECCOMENDATIONS

The approximately 2000 glass eels captured downstream of the culvert during the May sampling event indicate that Lubberland Creek could serve as an important waterbody for American eel populations, a species of special concern in New Hampshire. However given that no eels were captured upstream, the culvert under Bay Road appears to be restricting eel access to upstream habitats. Restoring connectivity to Lubberland Creek is recommended to provide eels access to valuable upstream resources for feeding and growth.

In addition, white perch are semi-anadromous and can exploit upstream freshwater habitats in the spring to spawn. Given the lack of white perch observed upstream in the May sampling effort, the perched culvert may also restrict the ability of white perch to access the upstream habitats of Lubberland Creek.

Resident species would also benefit from restored connectivity in Lubberland Creek. For instance, multiple freshwater fish species were observed at site 5 below the culvert. While the site in which they were captured was fresh, the salinity increases within a short distance downstream of the site. Although the freshwater species captured at site 5 can tolerate low salinity levels, it is not optimal and may induce osmoregulatory stress. Given the increasing salinity downstream and the perched culvert upstream, the freshwater fishes found at site 5 are restricted to a small area of optimal habitat.

Redfin pickerel, also a species of concern in NH, were captured upstream at multiple sampling sites within habitats typical of this species i.e., small streams with emergent and submerged aquatic vegetation. Redfin pickerel are also tolerant of brackish water. As such, connectivity to lower reaches of Lubberland Creek will likely expand the available habitat for this species.

It is recommended that adequate hydrology and connectivity be restored to Lubberland Creek to allow for the unrestricted movements of resident and migratory fishes between upstream and downstream habitats. Restored connectivity will provide increased habitat availability and access to important foraging, growth and spawning habitat.

APPENDICES

A. PERMITS



New Hampshire Fish and Game Department

HEADQUARTERS: 11 Hazen Drive, Concord, NH 03301-6500
(603) 271-3421
FAX (603) 271-1438

www.WildNH.com
e-mail: info@wildlife.nh.gov
TDD Access: Relay NH 1-800-735-2964

Permit No. MFD 1526
May 14, 2015

TO WHOM IT MAY CONCERN:

Under the authority contained in RSA 214:29, permission is hereby granted to **Alyson Eberhardt, UNH Cooperative Extension, 122 Mast Road, Lee, N.H., 03861**, to catch and possess for educational purposes, several fish and invertebrate species native to Lubberland Creek, Newmarket, N.H.

This permit is subject to the following conditions:

- 1) The fish and invertebrates may be collected by use of ¼ mesh minnow traps and hand drawn 20 ft. shore seine and by hand.
- 2) The area of collection shall be within Lubberland Creek, above and below a road crossing of Bay Rd., Newmarket, N.H. Sampling shall be conducted between May and November 2015.
- 3) The fish and invertebrates collected may be identified, measured and immediately released.
- 4) No specimens collected as authorized by this permit may be sold or consumed.
- 5) Volunteers may assist the permittee. Copies of this permit shall be carried by those engaged in this permitted activity.

The permittee shall furnish the Executive Director, by January 31, 2016, a brief written report containing the approximate number and species taken and released.

This permit shall expire December 31, 2015 unless sooner revoked or rescinded. No importation or possession of fish is permitted after December 31, 2015, without renewal of this permit.


Glenn Normandeau
Executive Director

GN/BWS/vjb

cc: Evan Mulholland, Legal Coordinator
Marine Fisheries Division
Law Enforcement
Lt. Michael G. Eastman

REGION 1
629B Main Street
Lancaster, NH 03584-3612
(603) 788-3164
FAX (603) 788-4823
email: reg1@wildlife.nh.gov

REGION 2
PO Box 417
New Hampton, NH 03256
(603) 744-5470
FAX (603) 744-6302
email: reg2@wildlife.nh.gov

REGION 3
225 Main Street
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(603) 868-1095
FAX (603) 868-3305
email: reg3@wildlife.nh.gov

REGION 4
15 Ash Brook Court
Keene, NH 03431
(603) 352-9669
FAX (603) 352-8798
email: reg4@wildlife.nh.gov

University of New Hampshire

Research Integrity Services, Service Building
51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

18-May-2015

Eberhardt, Alyson
UNHCE/NH Sea Grant
122 Mast Road
Lee, NH 03861

IACUC #: 150404

Project: Lubberland Creek Fish Survey

Category: C

Approval Date: 14-May-2015

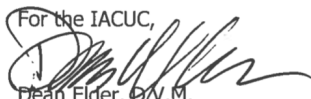
The Institutional Animal Care and Use Committee (IACUC) reviewed and approved the protocol submitted for this study under Category D on Page 5 of the Application for Review of Vertebrate Animal Use in Research or Instruction - *Animal use activities that involve accompanying pain or distress to the animals for which appropriate anesthetic, analgesic, tranquilizing drugs or other methods for relieving pain or distress are used.*

Approval is granted for a period of three years from the approval date above. Continued approval throughout the three year period is contingent upon completion of annual reports on the use of animals. At the end of the three year approval period you may submit a new application and request for extension to continue this project. Requests for extension must be filed prior to the expiration of the original approval.

Please Note:

1. All cage, pen, or other animal identification records must include your IACUC # listed above.
2. Use of animals in research and instruction is approved contingent upon participation in the UNH Occupational Health Program for persons handling animals. Participation is mandatory for all principal investigators and their affiliated personnel, employees of the University and students alike. Information about the program, including forms, is available at <http://unh.edu/research/occupational-health-program-animal-handlers>.

If you have any questions, please either me at 862-4629 or Julie Simpson at 862-2003.

For the IACUC,

Dean Elder, D.V.M.
Vice Chair

cc: File

B. Fish and sampling site data

1. Fish abundance and site data

		DOWNSTREAM SITES					UPSTREAM SITES							
		1	2	3	4	5	6	7	8	9	10	11	12	13
Waterbody type		creek	creek	creek	creek	scour pool	panne	scour pool	creek	creek	creek	creek	beaver pond	beaver pond
Habitat		salt marsh	salt marsh	creek	salt marsh		salt marsh	scrub shrub	creek	scrub shrub	graminoid marsh		beaver pond	beaver pond
Gear		seine	seine	seine, minnow trap	seine	seine, minnow trap	minnow trap	minnow trap	seine	seine	seine	minnow trap	minnow trap	minnow trap
Sample dates		May 2015, Oct 2015	May 2015	May 2015, Aug 2015, Oct 2015	Oct 2015	May 2015, Aug 2015, Oct 2015	Aug 2015, Oct 2015	May 2015, Aug 2015	May 2015	May 2015	May 2015	Oct 2015	Aug 2015	Aug 2015, Oct 2015
redfin pickerel	May										3			
	Aug							1					1	
	Oct							1						
Grass shrimp	May	301		167										
	Aug			2										
	Oct													
9 spine stickleback	May	1												
	Aug													
	Oct													
4 spine stickleback	May	26	15	7		6								
	Aug													
	Oct				5									
mummichog	May	50												
	Aug			24			457							
	Oct	1		444	8	10	120							
sand shrimp	May		13											
	Aug													
	Oct	1												
golden shiner	May					3								
	Aug													1
	Oct													
pumpkinseed	May					1								

	Aug					1							1	
	Oct													
white perch	May													
	Aug			2										
	Oct				1									
glass eel	May					2000								
	Aug													
	Oct													
yellow eel	May					1								
	Aug			1										
	Oct													
Asian shore crab	May													
	Aug			4										
	Oct													
common shiner	May													
	Aug													
	Oct					10								
mud crab	May	1		4										
	Aug													
	Oct				15									

Other species captured:

- Site 8: dragonfly larvae, many spider spp, freshwater clams, green frogs (3), leaches, backswimmers, amphipods, red spotted newt
- Site 9: pickerel frog, dragonfly larvae, spiders, amphipods, helgrammite, giant waterbug (eggs on back), caddisfly case, leaches, damselfly larvae, backswimmer
- Site 10: Eastern spotted newt (2), green frog tadpole, crayfish, backswimmer, aquatic beetle, leeches, amphipods, caddisfly

2. Mean fish length (mm)

[illegible]

C. Volunteer match

1. Volunteer hours

First name	Last name	19-May-15	13-Aug-15	8-Oct-15
Mike	Stockdale	6	6	
Dave	Kellam	6		
Stephen	Tobin			
Suzanne	Petersen		5.7	
Brittany	Bivona		5	4.75
Brian	Sullivan		5	
Zac	Karacouzian		5	
Haley	Andreozzi			5.5
Robin	Mose			8
Beth	McGuerty			5.25
Terri	Kershow			5.3
Hal	Weeks			6
Holly	Oliver			6.25
Steve	Luell			6
James	Newsom			6.75
Dave	Hoyler			5
Total hours for each effort		12	26.7	58.8
Total volunteer hours for project		97.5		
Value of volunteer time*		\$22.98		
Total value of volunteer effort		\$2,240.55		

*Value of volunteer time from https://www.independentsector.org/volunteer_time

2. Volunteer mileage

First name	Last name	19-May-15	13-Aug-15	8-Oct-15
Mike	Stockdale	40	40	
Dave	Kellam	16		
Suzanne	Peterson		30	
Zac	Karakouzian		6	
Brian	Sullivan		8	
Brittany	Bivona		10	16
Robin	Mose			160
Beth	McGuerty			30
Terri	Kershow			30
Hal	Weeks			26
Holly	Oliver			80
Steve	Luell			14
James	Newsom			100
Dave	Hoyler			14
Total mileage for each effort		56	94	470
Total volunteer mileage for project		620		
Value of volunteer mileage*		\$0.575		
Total value of volunteer mileage		\$356.50		

* federal 2015 mileage rate