SLUICE POND GEOPHYSICAL SUB-BOTTOM SURVEY, LYNN, MASSACHUSETTS
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Salem
S T A T E | C O L L E G E

Abstract

Holocene climate changes are preserved in lakes all across the world, and geophysical surveys can provide groundwork information about these sediments to assist in coring work. In this study, a sub-bottom survey was conducted in Sluice Pond, a publicly accessed pond located about two miles south of Lynn Center, Lynn, Massachusetts. This work was assembled in order to improve our understanding of the pond's preserved sediment characteristics. The survey was conducted using the Edge Tech 3100-P portable sub-bottom profiling system and SB-424 tow-fish. We totaled ten surveyed lines at CHIRP frequencies in the range of 4 to 24 kHz. The pond's sediment thickness, depth to Pleistocene acoustic basement, and unusual acoustic features were analyzed. An isopach map and depth to acoustic basement map were produced to exhibit the data. Data reveal a maximum thickness of Holocene sediment of about 5 meters. This unit pinches out in shallow water, and is underlain by an impenetrable unit, most likely Pleistocene in age (Ritch and Hubeny, 2008). A second acoustically impenetrable area on the southwest side of the main basin was observed in the Holocene unit. The characteristics of this area, we believe, are a result of ground water flowing into the pond along local bedrock fractures. These results will assist in future coring studies of Sluice Pond, Lynn, Massachusetts, and may help our understanding of local groundwater flow into the pond.

Field Methods

Edge Tech 3100-P portable sub-bottom profiling system and SB-424 tow-fish. With range of 4 to 24 kHz. The system pulled along side the boat in the water at a depth of about one meter. The seismic waves provide an image of the sub-bottom characteristics of the pond. Using start and stop positions, lines of the data are produced, and are used to create isopach maps and useful data for future research.
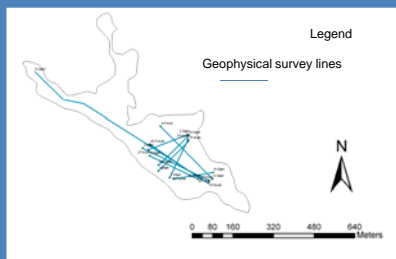
Professor Doug Allen putting the system together.

Professor Brad Hubeny lowering the fish into the water along side the boat.
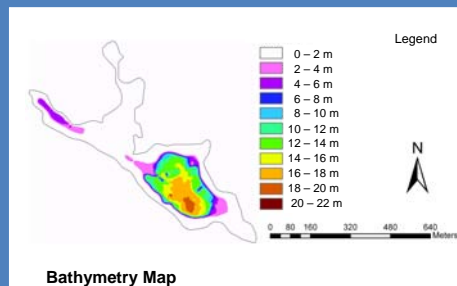
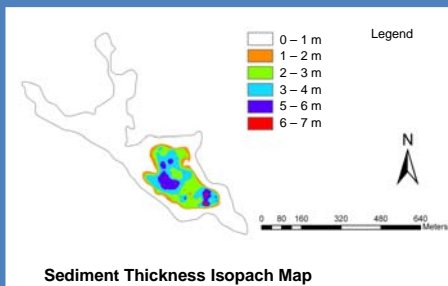Professor Neil Tibert and I record one of the lines.
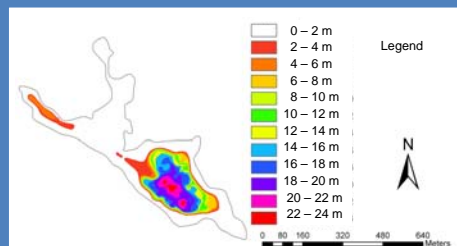
Legend

Geophysical survey lines

N

Geophysical Survey Lines, November 4, 2007

Results

Legend
0 – 2 m
2 – 4 m
4 – 6 m
6 – 8 m
8 – 10 m
10 – 12 m
12 – 14 m
14 – 16 m
16 – 18 m
18 – 20 m
20 – 22 m

N

0 80 160 320 480 640 Meters

Bathymetry Map

Legend
0 – 1 m
1 – 2 m
2 – 3 m
3 – 4 m
4 – 5 m
5 – 6 m
6 – 7 m

N

0 80 160 320 480 640 Meters

Sediment Thickness Isopach Map

Legend
0 – 2 m
2 – 4 m
4 – 6 m
6 – 8 m
8 – 10 m
10 – 12 m
12 – 14 m
14 – 16 m
16 – 18 m
18 – 20 m
20 – 22 m
22 – 24 m

N

0 80 160 320 480 640 Meters

Depth to Acoustic Basement Map

Dots are regions of full acoustic penetration
Red areas are zones of groundwater or gas
(see example profile images below)

Unknown Extent

Unknown Extent

N

0 80 160 320 480 640 Meters
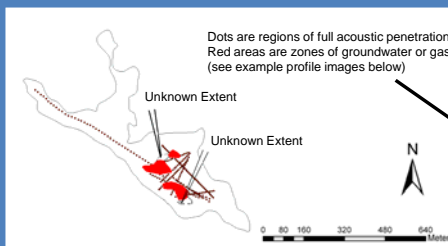
Map of Acoustically Diffuse Regions

- Maximum thickness of Holocene sediment is about 5 meters. This unit pinches out in shallow water, and is underlain by an impenetrable unit, most likely Pleistocene in age (Ritch and Hubeny, 2008; Poster #23-1).

- Acoustically diffuse regions may be a result of ground water flowing into the pond along local bedrock fractures.

- These findings provide knowledge and understanding of Sluice Pond, Lynn, Massachusetts that will assist in future studies of the pond.

Acknowledgements

Study Site

Sluice Pond is a publicly accessed, city-owned natural pond, that allows boat access from a paved ramp located on the northwestern cove, just off Route 129. The Pond is a deep, 50-acre natural pond located about two miles south of Lynn Center. Maximum depth is about 65 feet. The pond is connected to several other ponds, the formation is known as the" strawberry necklace." The shoreline is heavily developed with year round homes.

Sluice Pond, Lynn MA

Lab Methods

Ten geophysical lines were analyzed for sediment acoustic properties and thicknesses using a Gerber variable scale rule and hard copies of the lines. Representative lines are shown below.

SW   NE
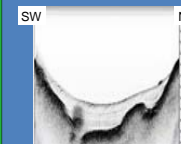
SP07_SB01: Note sediment pinching out at sides of pond. Line is through deep hole. Acoustically diffuse region is seen in the southwest portion of line.

NE   SW

SP07_SB02: Two regions of acoustically diffuse sediment are noted in the northeast and southwest.

E   W

SP07_SB06: Deep area of lake with diffuse region in west.

Georeferenced data were imported to ArcGIS software and converted to raster data sets using the Spatial Analyst Inverse Distance Weighted Interpolation Technique.