Newfound Lake Watershed Assessment (2007 & 2008)

Prepared for

The People of the Newfound Lake Watershed, The Every Acres Counts Project Team, and The New Hampshire Department of Environmental Services

Prepared by:

UNH CFB

and

University of New Hampshire Cooperative Extension

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ACKNOWLEDGEMENTS

The Newfound Lakes Region Association (NLRA), in conjunction with the University of New Hampshire Center for Freshwater Biology (CFB) and Cooperative Extension Water Resource Program, undertook an extensive two year sampling effort on Newfound Lake and select tributary inlets with the primary goals of better characterizing the current condition of Newfound Lake, identifying potential problem areas around the lake and providing recommendations to minimize future water quality impacts. This report builds upon the findings of a Newfound Lake Tributary Assessment (Craycraft and Schloss, 2008) that characterized the water and phosphorus load into Newfound Lake. The success of this project was the culmination of the assistance and guidance of numerous volunteers highlighted in Table 1. The NLRA, under

Table 1: Newfound Lake Volunteer Monitors (2007 & 2008).

Joe Allison	Ralph Donahue	Jean Fay
Dick Beyer	Lynn Egsgard	Ron West
Nancy Dineen	Bill Fay	

the guidance of Boyd Smith (executive director) and Martha Twombly (program director), undertook the formidable task of coordinating this multi-site sampling effort, assuring that samples and data were transferred to University of New Hampshire staff members on a timely basis and helping coordinate the use of the NLRA pontoon boat during CFB field team visits. We also acknowledge Catherine Callahan, New Hampshire Fish and Game Geographical Information Specialist, who performed the Newfound Lake watershed delineations and Dan Sundquist of the Society for the Protection of New Hampshire Forests who provided the map of topography and lake bathymetry included in this report..

Jillian McCarthy, New Hampshire Department of Environmental Services (DES) Quality Assurance Coordinator, Vincint Perelli, New Hampshire DES Quality Assurance Manager, and Charles Porfert, Environmental Protection Agency (EPA) New England Quality Assurance Officer, provided technical support and reviewed the Quality Assurance Project Plan (QAPP) that outlined the standard operating procedures used in this study. Steve Landry, New Hampshire DES Merrimack Watershed Supervisor, provided guidance and assistance with the development and implementation of the Newfound Watershed Master Plan (WMP) initiative that will utilize the water quality data contained in this report in a watershed wide planning effort.

Laboratory space was provided by the University of New Hampshire College of Life Sciences and Agriculture while administrative support was provided by University of New Hampshire Cooperative Extension. Members of the University of New Hampshire CFB laboratory and field team, who assisted in the collection and analysis of water quality samples include: Robert Craycraft, Erin Cubly, William Finley, Benjamin Ho, Gabrielle Hodgman, Lejla Kadic, Jennifer Thompson and Susan Wilderman.

Jeff Schloss, University of New Hampshire Cooperative Extension water resources specialist, provided guidance during the two year study period and provided editorial review of the summary report. Michelle Daley, University of New Hampshire Water Resource Research Center, reviewed and provided constructive comments regarding the sodium and chloride data collected through this project.

EXECUTIVE SUMMARY

Purpose and Objectives

The Newfound Lake watershed is located in the Towns of Alexandria, Bristol, Bridgewater, Danbury, Dorchester, Groton, Hebron, Plymouth and Orange. With continued development pressures facing local decision-makers in the nine towns, the need exists for scientifically-based information that will provide support for proactive natural resource based planning within the Newfound Lake watershed.

The Newfound Lake watershed assessment is the second of two summary reports prepared by the University of New Hampshire Center for Freshwater Biology as part of the Watershed Master Plan that focuses on the Newfound Lake watershed, the current status of Newfound Lake and its tributaries, and discusses measures that can be employed to minimize future water quality impacts. This report largely focuses on in-lake water quality. However, data from select stream inlets are also discussed and information from the previous Newfound Lake water/phosphorus budget (Craycraft and Schloss, 2008) including more extensive analysis and interpretation of the steam water quality and quantity with an emphasis on the phosphorus load into Newfound Lake, is also referenced in this report when appropriate.

This intensive water quality monitoring project is a component of the larger watershed master planning initiative that relies on expertise in land-use and watershed planning, survey design and interpretation, education and outreach. The collective expertise of the professionals involved in this project will help educate local municipal officials and will foster informed land-use planning decisions that will benefit future generations.

The core project team members for the Watershed Master Plan Project include:

- Robert Craycraft – University of New Hampshire Cooperative Extension and UNH Center for Freshwater Biology (water quality monitoring)
- Dr. Brian Eisenhauer – Plymouth State University Center for the Environment (social survey design and interpretation)
- Chris Duggan – Newfound Area School District (curriculum development and student engagement)
- Steve Landry – New Hampshire Department of Environmental Services Merrimack River Watershed Coordinator (development of watershed management plans)
- Boyd Smith – Newfound Lake Region Association Executive Director (project manager)
- Steve Whittman – Jeffrey H. Taylor and Associates (professional planner)

Scope

The Newfound Lake watershed assessment, conducted between July 23, 2007 and September 25, 2008, was designed to complete a series of independent, but interrelated objectives that will provide local decision makers and the public with a better understanding of the impacts of development, population growth, and land use change on the Newfound Lake and its drainage basin (watershed). The Newfound Lake Watershed Master Plan and Implementation Grant includes the following tasks that are being integrated into the WMP to allow local officials to make decisions based upon sound scientific data:

- Completed an 18-month Newfound Lake Water/Phosphorus Budget: completed and summarized in a complimentary report (Craycraft and Schloss, 2008)
- Conducted water quality sampling at seven “deep” sampling stations.
- Conducted near-shore water quality sampling at thirty shallow sampling stations.
- Conducted artificial substrate sampling, that mimics growth on rocks and lake bottom debris, at three in-lake sampling stations and one site located in the Fowler River.
- Conducted bottom sediment (benthic) core sampling at twenty three lake and stream sampling stations
- Conducted paired watershed sampling in twelve selected stream inlets.

Lake Aging (Eutrophication) Overview

A common concern among New Hampshire lakefront property owners is a perceived increase in the density and abundance of aquatic plants in the shallows, increases in the amount of microscopic plant “algae” growth (detected as greener water), and water transparency decreases collectively known as eutrophication. Eutrophication is a natural process that takes place on a geological time frame of thousands of years, during which lakes progress from clear pristine lakes to green, nutrient enriched lakes. Much like the fertilizers applied to our lawns, nutrients that enter our lakes stimulate plant growth and culminate in greener (and in turn, less clear) waters. Some lakes age at a faster rate than others due to naturally occurring attributes: watershed area relative to lake area, slope of the land surrounding the lake, soil type, mean lake depth, etc. Since our New Hampshire lakes were created during the last ice-age, which ended about 12,000 years ago, we should have a natural continuum of lakes ranging from pristine to nutrient enriched.

Deep Sampling Site Water Quality Assessment

The overall condition of each of the Newfound Lake deep sampling stations is excellent based on a review of the 2007 and 2008 water quality data. The water transparency ranged from 18.0 to 37.1 feet during the study period while the amount of microscopic plant growth was generally low and well below nuisance concentrations. Total phosphorus (nutrient) concentrations were also low while the dissolved oxygen concentrations (necessary for a self-sustaining cold water fishery) were high throughout the water column for all but the southernmost sampling location, Site 2 Mayhew, located south of Mayhew Island (Appendix C). The overall condition of Newfound Lake remained excellent and was characteristic of a relatively young, oligotrophic lake, although there was a clear difference between the Mayhew sampling station and the remaining Newfound Lake sites.

The Mayhew Site, the only site located south of Mayhew Island, was characterized by the lowest dissolved oxygen concentrations near the lake bottom (Appendix C). This likely restricted the cold water fishery to other areas of Newfound Lake during the summer and fall months. Likewise, the water clarity was shallower (Figure 7), the amount of algal (microscopic plant) growth was higher (Figure 6) and the total phosphorus (nutrient) concentrations were higher (Appendix B). The Mayhew site is located in the most developed segment of Newfound Lake and might be reflecting localized nutrient inputs associated with a more intense level of residential development (Figure 1). As indicated above, the overall water quality is excellent but the Mayhew sampling site is exhibiting the early symptoms of nutrient enrichment that are not evident at the other Newfound Lake sampling sites.

Shallow Sampling Site Water Quality Assessment

Near-shore Water Quality Sampling

The near-shore water quality was generally excellent and was characterized by low total phosphorus and low levels of *E. coli* bacteria (Appendix D). However, a notable exception existed on September 30, 2008 that included bacteria "spikes" near the major tributary inlets, the Cockermouth River and the Fowler River (Appendix D), following a period of heavy rainfall. *E. coli* spikes near the tributary inlets are a reminder that the large catchments extending well into Alexandria and Groton may act as conduits for pollutant transport that could significantly impact the Newfound Lake water quality.

Total phosphorus concentrations were generally low at the Newfound Lake near-shore sampling sites with the exception of the Hebron Marsh sampling stations where the total phosphorus concentrations tended to be higher (Appendix D). Hebron Marsh is a shallow area characterized by macroscopic plant (weed) growth and a finer and more organic lake bottom composition. Hebron Marsh is an example of a localized region of Newfound Lake that appears to have naturally transitioned into a more nutrient enriched state.

Artificial Substrate (Periphyton) Sampling

The near-shore periphyton sampling, which integrates multi-week water quality, indicated the forested "reference" site exhibited the least amount of algae growth among sampling stations. On the other hand, the Hebron Site, near the Hebron brook tributary, included the highest measured periphyton concentration following a heavy storm event period (Figure 15). The periphyton data are a reminder that short-term nutrient loading can locally stimulate near-shore algal growth and that water quality threats exist and could be exacerbated by poorly thought out land use conversions that increase the sediment and phosphorus load into Newfound Lake.

Near-rshore Bottom Sediment (Benthic) Core Sampling

Benthic sediment sampling indicates the more organic sediments generally contained more phosphorus (Figure 19). Visual observation suggested that the more organic sediments in and around Hebron Marsh, The Newfound Marina channel and Georges Brook (Figure 18 and Table 10), were associated with areas of increased aquatic plant growth. Erosion of fertile upland soils (forest soils, agricultural soils or duff layer from disturbed sites) may stimulate aquatic plant growth if they reach Newfound Lake. The displacement of upland soils will not only adversely impact the Newfound Lake water quality, but will also result in the loss of soil fertility and reduce the capacity to regenerate the forest and promote the growth of agricultural crops in the watershed.

Paired Watershed (Stream Assessment)

The paired watershed (stream) total phosphorus and turbidity concentrations spiked during an August 11, 2008 storm event and suggest storm water management and erosion control measures are important to protecting in-lake and in-stream water quality (Appendix H). Soluble reactive phosphorus (the dissolved phosphorus fraction) was low on all sampling dates and suggests that significant phosphorus is associated with particulate debris (i.e. sediment and vegetation) that enters the lake during high flow and storm event periods. Cashman Brook and Black Brook were characterized by sodium and chloride (constituents of road salt) concentrations that were significantly higher than the concentrations documented at the other sampling locations (Figure 21). Dick Brown Brook and Tilton Brook are also characterized by elevated salt concentrations relative to abutting streams, drained by similarly sized watersheds (Figure 21 and Table 11). Elevated sodium and chloride concentrations have been correlated to the amount of paved roadway (Daley et al, submitted) and may be associated with local road salt applications.

Long-Term Water Quality Trends

A review of twenty three years of water quality sampling in Pasquaney Bay indicates a long-term trend of decreasing water clarity since 1986 (Figure 28). The amount of algal (microscopic plant) growth exhibits a trend of increasing concentrations in both Pasquaney Bay and south of Mayhew Island since 1986 (Figures 29 and 30). Thus, while the overall water quality remained excellent in Newfound Lake, there are signs that the water quality has been degraded over time (even at the deep centrally located reference stations) and may be influenced by land use changes within the Newfound Lake watershed.

Conclusions and Recommendations

One may consider the saying, “a lake is a reflection of its watershed,” which ties lake and stream quality to watershed wide land use patterns. A watershed-wide effort is essential to the preservation of the exceptional Newfound Lake and tributary water quality that is characteristic of the region. Short-term and localized water quality variations, identified through the extensive Newfound Lake and tributary sampling and discussed previously, are a reminder that threats exist within the watershed. If these threats are ignored, they will ultimately have an adverse impact on the Newfound Lake and stream quality.

Many Newfound Lake tributary inlets are characterized by extensive bank-undercutting associated with the erosive force of stream flow. Elevated turbidity and total phosphorus concentrations documented during intense storm events reflect the displacement of sediments from the stream bank and upland sources. On a more positive note, extensive streamside (riparian) forests extend along most of the tributary inlets which help stabilize the stream banks, prevent excessive erosion and in turn protect water quality and critical fishery habitat. Healthy riparian buffers can also serve as travel corridors for upland wildlife species. Streamside vegetative buffer requirements, that fall under the jurisdiction of the comprehensive shoreland protection act (CSPA), are currently limited to the lower reaches of the Cockermouth and Fowler Rivers (DES, November 2008). Municipalities should consider establishing local vegetative buffer requirements for the other streams in the watershed to foster environmentally friendly development.

Future land-use planning efforts should consider minimizing the percentage of impervious surfaces, such as roads and out-buildings, that tend to concentrate and accelerate overland water flow and thus increase the potential for erosion. Much of the Newfound Lake watershed is steep sloped and is particularly susceptible to water quality problems due to the rapid runoff. Increases in impervious cover and the removal of natural forest canopy, associated with home site development, can alter the natural hydrology and can increase the discharge velocities of streams and the erosion potential of overland water flow. Rainwater that runs over the impervious surface and the associated developed areas can also pick up pollutants such as pet waste and lawn fertilizers that may enter water courses and adversely impact water quality. Impervious surfaces also reduce groundwater recharge and can result in atypically low in-stream water levels during summer low-flow (summer base flow) periods. The lack of in-stream flow can have adverse impacts on the local fishery and may also coincide with atypically low or dry dug wells for local residents. Municipalities might consider incorporating low impact development (LID) principals into their subdivision, site plan and zoning ordinances that will help retain natural hydrology and that will protect water quality. Recent publications by the DES, New Hampshire Stormwater Manual Volume 2: Post-Construction Best Management Practices Selection and Design (DES, 2008) and Innovative Land Use Planning Handbook (DES, 2008) discuss LID principles and provide model ordinances and regulations that can assist communities in their environmental planning efforts.

Municipalities might want to consider creating, reviewing or amending their storm water management regulations that provide temporary and permanent storm water management requirements. Strong stormwater management requirements can simultaneously protect water quality and reduce highway maintenance costs associated with inadequately engineered storm water management measures. Municipalities might also consider measures such as conservation subdivision design standards, which direct growth to areas of a land parcel most suitable for development and direct growth away from more environmentally sensitive areas (i.e. lakes and ponds, rivers, wetlands and steep slopes).

The Watershed Master Plan is a good source of land use planning suggestions for those seeking further land use planning suggestions. The Watershed Master Plan was developed with a mind towards balancing the protection of natural resources, fostering the retention of rural character, promoting economic vitality and meeting the needs of changing demographics and increasing population.

NEWFOUND LAKE AND ITS WATERSHED

Introduction

The Newfound Lake Watershed, the geographic area in which all water drains into Newfound Lake, is closely tied to water quality and quantity in Newfound Lake. Stated another way, a lake is a reflection of its watershed; what occurs in the watershed can have significant impacts on whether the water quality improves, degrades or remains the same. As population growth occurs in our region and the resulting pressures from development and recreational use ensue, there is growing concern over the potential for degradation of lake water quality. The resulting symptoms of these impacts can include algal blooms, establishment of nuisance aquatic weeds, shoreline scums, declining fishery (as well as a decline in the lake's overall ecological integrity) and increased sedimentation. Of primary concern are the impacts of increased nutrient loading caused by human activities in the watershed that result in accelerated plant growth (submerged and emergent vascular plants and algae) within the lake. Nutrients can come from many sources and include surface runoff resulting from precipitation upon the natural and developed areas of the lake's watershed (drainage basin). Additional nutrients are transported into the lake through stream inflow, groundwater, septic system effluent that leaches into groundwater and even from precipitation and dry fallout (dust particles). Activities within the watershed, such as the construction of residential subdivisions, result in removing or damaging vegetation, duff layers (leaf litter) and soils that, when left in an undisturbed and natural state, trap nutrients before they reach wetlands, streams, lakes and ponds. Roads, driveways and drainage ways increase channelized flow that tends to transport more runoff and nutrient laden materials through the watershed. Improper and unneeded fertilizer applications for agriculture and homeowner landscaping can also add to the nutrient load that reaches the lake.

Of the two nutrients most important to the growth of aquatic plants, nitrogen and phosphorus, it is generally observed that phosphorus is the more limiting to plant growth in lakes, and therefore the more important to monitor and control. Phosphorus is generally present in lower concentrations than nitrogen, and its sources arise primarily through human activity in a watershed. The total phosphorus discussed in this report includes dissolved phosphorus as well as phosphorus contained in or adhered to suspended particles such as sediment and plankton.

As little as 10 parts per billion of phosphorus in a lake can cause an algal bloom. Using a full Olympic swimming pool as an example, it would take 10 drops of water added to the approximately 130,000 gallons of water to equal 10 parts per billion. Extensive blooms will block sunlight and can depress oxygen levels in the water due to the death and subsequent microbial decomposition of plant and algal matter. Reduced oxygen concentrations can be detrimental to fish, plants and wildlife of the lake and can also result in the degradation of aesthetic quality due to events such as fish kills and accumulations of decaying material (muck) along the lake bottom. When the oxygen, dissolved in the water over the sediments, becomes reduced below two milligrams per liter, phosphorus, the majority of which usually binds to the lake sediments and remains unreactive, can be released. Thus, it is important to obtain an understanding of the sources and amounts of phosphorus supplied to a lake from its watershed in order to control its input to the surface waters. The best method to achieve this is to conduct field sampling and derive a water and phosphorus budget which has been reported in a previous report (Craycraft and Schloss, 2008). The information summarized in this report builds upon the Newfound Lake water and phosphorus budget and characterizes the water quality conditions within Newfound Lake, and also includes supplemental stream sampling that will help better characterize the condition of select Newfound Lake sub-watersheds. The 2007 and 2008 water quality monitoring continued to emphasize the collection of total phosphorus measurements while additional measurements, highlighted and discussed in Table 2, were also collected to better assess current conditions.

The comprehensive water quality sampling approach outlined in this report is a component of a larger Watershed Master Planning project that will facilitate natural resource management at the watershed scale. Educational outreach efforts that evolve as part of this effort will involve numerous entities that include the NLRA, Jeffrey Taylor and Associates, Plymouth State University, NH DES, the University of New Hampshire and UNH Cooperative Extension, the Newfound Area School District, the watershed community, concerned citizens, and local decision-makers.

Table 2: Primary sampling parameters and sampling rationale

Sampling Parameters	Rationale
Total Phosphorus	Phosphorus (P) tends to be the limiting nutrient in lakes. Total phosphorus is the sum of phosphorus in all its forms (dissolved or particulate) and can be used to determine a lake's trophic (nutrient enrichment) state. Quantifying the phosphorus load is of paramount importance in lake management and is highly correlated to the amount of microscopic plant growth that can be measured as chlorophyll *a*.
Soluble Reactive Phosphorus	Soluble reactive phosphorus (SRP) is a dissolved fraction of the total phosphorus and the SRP is readily available for algal growth. Soluble reactive phosphorus is formed naturally through the decomposition of organic matter but can also be associated with fertilizer applications and septic system effluent.
Turbidity	Turbidity reflects the amount of particulate matter suspended in the water column and can also help determine the areas within the Newfound watershed where sediment erosion is the greatest concern. Turbidity can also be used as a surrogate for "total phosphorus" loading into Newfound Lake since phosphorus tends to attach to sediment particles and is also part of organic debris that enter Newfound Lake. Turbidity will also serve as an indicator of areas within the watershed where sediment erosion is of the greatest concern.
Temperature	Temperature is correlated to what types of aquatic organisms can survive in the lake and the streams. Temperature variations can also reflect differences in the amount of (shoreside) riparian cover in the Newfound Lake sub-watersheds and may also be correlated with the amount of impervious surface (surfaces that do not allow water infiltration such as roofs, roads, etc.
Light	Sunlight is a necessary component to the photosynthetic activity of both aquatic and terrestrial plants. The amount of light penetration can influence the amount of aquatic vascular plant and algal growth. Much like terrestrial plants, many aquatic species require high light levels to successfully grow, reproduce and flourish.
Specific Conductivity	Specific Conductivity, the capacity of water to carry an electrical current, provides insight into local geological variations among the sampling stations, as well as provides insight into regions where road salt runoff, nutrient runoff, etc. might be impacting the water quality. Specific conductivity is highly correlated with sodium and chloride concentrations and thus is a good surrogate measurement of road salt runoff.

Sampling Parameters	Rationale
Total Alkalinity	Alkalinity is a measure of the water's capacity to neutralize acids. The alkalinity is generally low in New Hampshire Lakes and provides insight into the susceptibility of Newfound Lake to acid precipitation.
pH	pH is an indicator of the acidity of the lakewater, influences nutrient availability from the sediments and impacts the fitness and distribution of aquatic organisms.
Dissolved Oxygen	Dissolved oxygen concentrations are essential for a healthy fishery and are also associated with the eutrophication (lake aging) process. During the summer months, deep north temperate lakes stratify into three distinct zones; an upper warm water zone (epilimnion), a zone of rapid temperature decrease (thermocline/metalimnion) and a deep cold water zone (hypolimnion). During the summer months, the zones are partitioned and oxygen is not readily replenished to the bottom waters. Oxygen deprived (anoxic) conditions, near the lake bottom, are commonly associated with more nutrient enriched lake that may also be experiencing internal nutrient loading, a process by which nutrients are "released" from the sediments into the water column.
Carbon Dioxide	Carbon Dioxide is a by-product of microbial decomposition and can build-up in the deeper areas of Newfound Lake during the summer stratification period. When dissolved in the water, carbon dioxide is in equilibrium with carbonic acid which can naturally impact the lake acidity (pH) during the course of the day as well as among the thermal layers in the water column.
Secchi Disk Transparency	Water transparency integrates the impacts of sediments, microscpic plant "algal" cells, colored water and detrital (decomposing) debris that are flushed into the lake. The Secchi Disk transparency measurements provide water transparency data that can be compared among sampling locations and among years to assess the spatial and temporal variation.
Chlorophyll *a*	Chlorophyll a serves as a good estimator of microscopic plant "algal" biomass. Generally speaking, the greener the water, the more microscopic plant/chlorophyll *a* in the water column. The collection and analysis of chlorophyll samples are relatively simple and provide insight into the trophic condition of Newfound Lake.

Sampling Parameters	Rationale
True Color	True color is a measure of the natural color of the water after particulate debris has been filtered out. For instance, wetland systems tend to be darkly stained and when they enter the lake can also result in more tea stained waters can have a significant impact on the water clarity, particularly in localized areas of the Newfound Lake watershed where considerable wetland drainage exists. True color measurements provide insight into the causes of water transparency variations as well as insight into the seasonal variations in the amount of wetland drainage into Newfound Lake.
Escerichia coli (E. coli)	*E. coli* is an indicator bacteria that is used to screen for fecal contamination in lake and streams. *E. coli* samples were collected in this project to screen for problem near-shore areas around the periphery of Newfound Lake.
Sodium and Chloride	Sodium and Chloride are constituents of road salt and can become elevated in more developed watersheds where increased salt applications occur. Sodium and chloride are closely correlated with Specific Conductivity measurements and this study will examine those relationships within the Newfound Lake watershed.
Nitrate	Nitrates are commonly associated with septic effluent and fertilizer applications. Assessment of nitrate concentrations will assist in the screening for potential problem areas in select Newfound Lake tributary inlets.
Percent Organic Matter	The amount, or percent, of organic matter along the lakebottom can have an impact on whether aquatic vascular plants can successfully colonize and flourish in a particular area of the lake. A more organic rich benthos can also be associated with elevated phosphorus concentrations that can become available to stimulate algal and aquatic vascular plant growth.
Periphyton Chlorophyll *a*	Chorophyll *a* is the photosynthetic pigment found in plants and algae. Aquatic plant and algal growth are limited by the amount of in-lake nutrients, most notably phosphorus, and thus the chlorophyll *a* pigment concentrations can serve a surrogate for nutrient inputs over time as chlorophyll is the response parameter to nutrient condition. Many New Hampshire residents have expressed a concern that the amount of attached algae (periphyton) growth has increased on rocks around the periphery of New Hampshire’s lakes and ponds.

BACKGROUND DATA

Newfound Lake Watershed

The Newfound Lake watershed encompasses all or part of the towns of Alexandria, Bristol, Bridgewater, Danbury, Dorchester, Groton, Hebron, Plymouth and Orange. Newfound Lake is located south of Plymouth and east of Mount Cardigan at a mean elevation of 179 meters (586 feet) above sea level. The Newfound River, which drains the lake, flows southerly through the Town of Bristol to the Pemigewasset River that forms the Merrimack River at its confluence with the Winnipesaukee River in Franklin (Table 3). In the 1930s, Newfound Lake was artificially raised by a dam that is currently operated by the New Hampshire DES Dam Bureau. Newfound Lake is considered the deepest lake in New Hampshire with a maximum recorded depth of 55.5 meters (182 feet) and ranks fifth among the largest New Hampshire Lakes. The watershed is predominantly forested and includes two larger wetland complexes that drain into two of the larger streams: Georges Brook to the north and Bog Brook to the west. The watershed, delineated to the Newfound Lake Dam (outlet) at the Newfound River, totals 56,825 acres (Table 3 and Figure 1).

Table 3. Newfound Lake Summary Data

Latitude	43°39'46"
Longitude	71°46'31"
Lake Elevation	586 feet
Lake Area	4,451 acres
Maximum Depth	182 feet
Watershed Area	56,825 acres
Lake type	Natural with Dam
River Basin	Merrimack

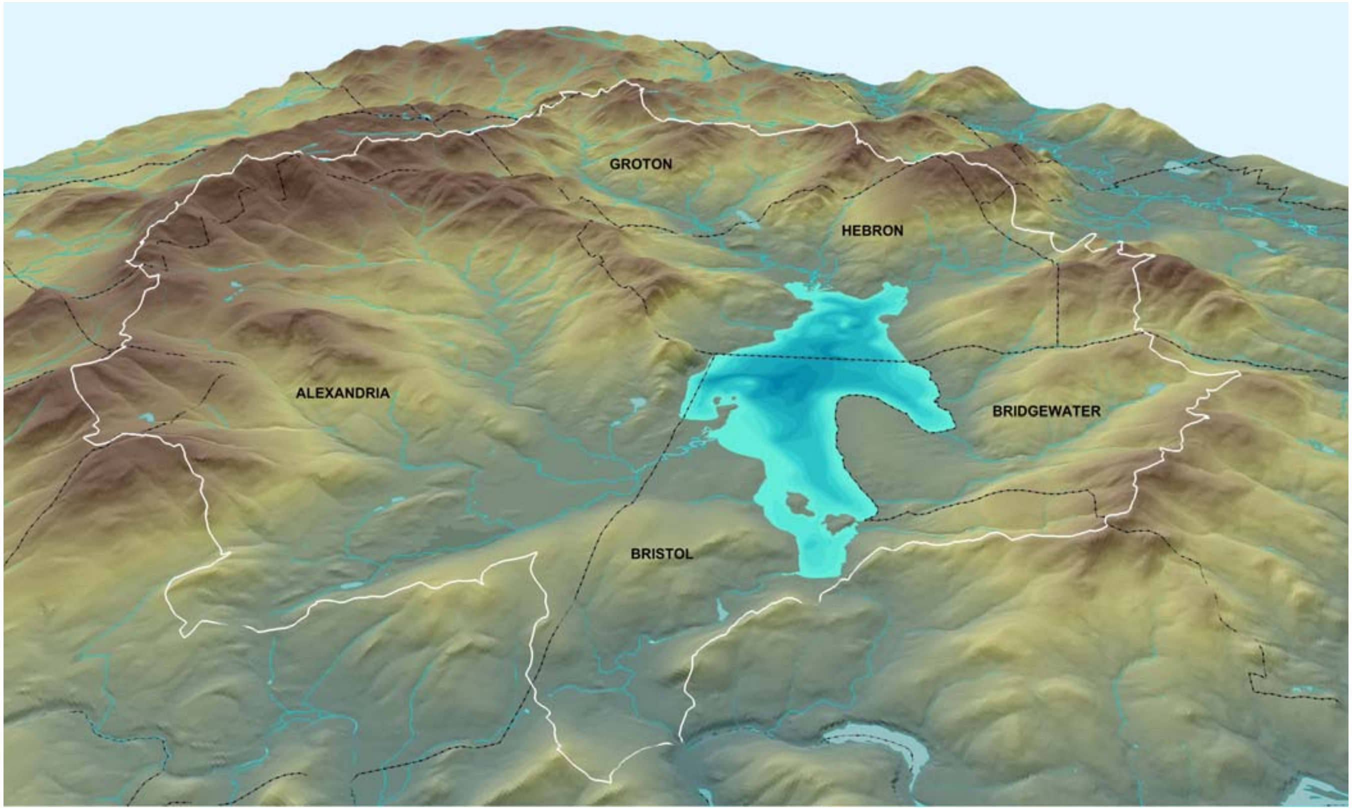
Newfound Lake surface area and Watershed area were derived from 7.5 minute US Geological Survey mapping data that was digitized into a Geological Information System.

Geology and Topography

The bedrock geology of the Newfound Lake watershed, as typical of most New Hampshire watersheds, is predominantly granite and metamorphic rocks. Its topography is highly variable, with some of the flatter land located adjacent to the main stems of the Cockermouth and Fowler Rivers (Figure 1), and the Bog Brook tributary that is fed by a large meandering wetland complex. There is also flatter land around the perimeter of Newfound Lake, although steep sloped regions are interspersed and include "the Ledges" located northwest of Wellington State Park. Viewing the surrounding landscape, one sees hills and mountains in the distance that delineate the headwaters of Newfound Lake and the watershed divide with Mount Cardigan forming the highest land elevation of 3155 feet along the westerly watershed boundary. The bedrock geology and thin soils that do not retain much water, coupled with relatively steep slopes, cause the tributaries to experience rapid runoff during storm and snowmelt events.

During these short-duration and high intensity runoff periods, rainfall and/or melt-waters tend to rapidly flow off the landscape and concentrate to form well-defined stream channels. The channels of many Newfound Lake tributary inlets are characterized by cobble and boulders as is expected in steep-sloped watersheds where finer materials are flushed downstream due to the erosive force of the water.

Figure 1. Shaded Relief map of the Newfound Lake Watershed



Source: Society for the Protection of NH Forests

Newfound Lake Bathymetry

The Newfound Lake bathymetry refers to the depth contours characteristic of the lake, much like the topographic contours of the Newfound Lake watershed. The deepest point of the lake is located east of “the Ledges” well away from the shoreline while a second deep basin, over 120 feet deep, is located in the more northerly section of Newfound Lake (Figure 1). Some of the larger areas of continuous shallow water are located in Hebron Marsh and near the outflows of the two largest tributary inlets: the Cockermouth and Fowler Rivers. A shallow, and relatively sandy strip, runs from the Fowler River south to Mayhew Island on the southwest side of the lake. While shallower than the other deep basins, a third basin of approximately 60 feet is located south of Mayhew Island. The Newfound bathymetry, coupled with coves and bays, partitions the lake in such a way that local watershed influences (i.e. differences in the amount of development or forest-cover) may influence water quality differently among sampling locations.

UNDERSTANDING LAKE AGING (EUTROPHICATION)

A common concern among New Hampshire lakefront property owners is a perceived increase in the density and abundance of aquatic plants in the shallows, increases in the amount of microscopic plant “algae” growth (detected as greener water), and water transparency decreases; what is known as **eutrophication**. Eutrophication is a natural process by which all lakes age and progress from clear pristine lakes to green, nutrient enriched lakes on a geological time frame of thousands of years. Much like the fertilizers applied to our lawns, nutrients that enter our lakes stimulate plant growth and culminate in greener (and in turn less clear) waters. Some lakes age at a faster rate than others due to naturally occurring attributes: watershed area relative to lake area, slope of the land surrounding the lake, soil type, mean lake depth, etc. Since our New Hampshire lakes were created during the last ice-age, which ended about 10,000 years ago, we should have a natural continuum of lakes ranging from extremely pristine to very enriched.

Classification criteria are often used to categorize lakes into what are known as **trophic states**, in other words, levels of lake plant and algae productivity or “greenness” Refer to Table 4 below for a summary eutrophication parameters used to assess water quality through the CFB.

Table 4: Eutrophication Parameters and Trophic Categorization

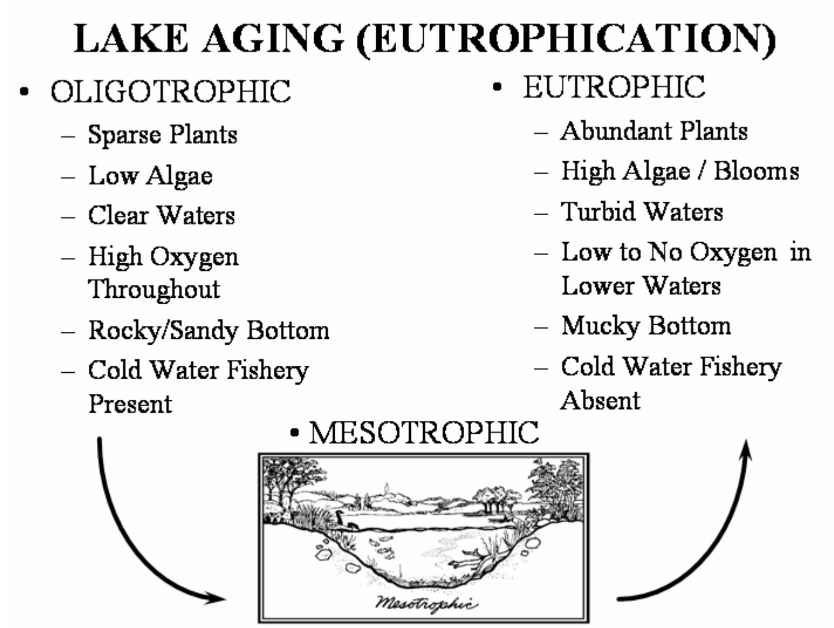
Parameter	Oligotrophic “pristine”	Mesotrophic “transitional”	Eutrophic “enriched”
Chlorophyll a (*ug*/l) *	<3.0	3.0-7.0	>7.0
Water Transparency (meters) *	>4.0	2.5-4.0	<2.5
Total Phosphorus (*ug*/l) *	<15.0	15.0-25.0	>25.0
Dissolved Oxygen (saturation) #	high to moderate	moderate to low	low to zero
Macroscopic Plant (Weed) Abundance	low	moderate	high

*** Denotes classification criteria employed by Forsberg and Ryding (1980).**
 # Denotes dissolved oxygen concentrations near the lake bottom.

Oligotrophic lakes are considered "unproductive" pristine systems and are characterized by high water clarities, low nutrient concentrations, low algae concentrations, minimal levels of aquatic plant "weed" growth, and high dissolved oxygen concentrations near the lake bottom. **Eutrophic** lakes are considered "highly productive" enriched systems characterized by low water transparencies, high nutrient concentrations, high algae concentrations, large stands of aquatic plants and very low dissolved oxygen concentrations near the lake bottom. **Mesotrophic** lakes have qualities between those of oligotrophic and eutrophic lakes and are characterized by moderate water transparencies, moderate nutrient concentrations, moderate algae growth, moderate aquatic plant "weed" growth and decreasing dissolved oxygen concentrations near the lake bottom (Figure 2).

Is a pristine, oligotrophic, lake "better than" an enriched, eutrophic, lake? Not necessarily! As indicated above, lakes will naturally exhibit varying degrees of productivity. Some lakes will naturally be more susceptible to eutrophication than others due to their

Figure 2



natural attributes and in turn have aged more rapidly. This is not necessarily a bad thing as our best bass fishing lakes tend to be more mesotrophic to eutrophic than oligotrophic; an ultra-oligotrophic lake (extremely pristine) will not support a very healthy cold water fishery. However, human related activities can augment the aging process (what is known as cultural eutrophication) and result in a transition from a pristine system to an enriched system in tens of years rather than the natural transitional period that should take thousands of years. Cultural eutrophication is particularly a concern for northern New England lakes where large tracts of once forested and agricultural lands are being developed.

The DES is currently working on formalizing aquatic life use nutrient criteria to determine whether lakes are impaired based upon the ability to support aquatic life. The draft

DES criteria for an oligotrophic lake are < 8.0 micrograms per liter (*u*g/l) for total phosphorus and < 3.3 *u*g/l for chlorophyll *a*. Data collected through the Newfound Lake Watershed Assessment (2007 & 2008) and collected by the Newfound Lake volunteer monitors and CFB (1986-2006), indicate Newfound Lake is best classified as an Oligotrophic Lake based upon the draft DES aquatic life use nutrient criteria.

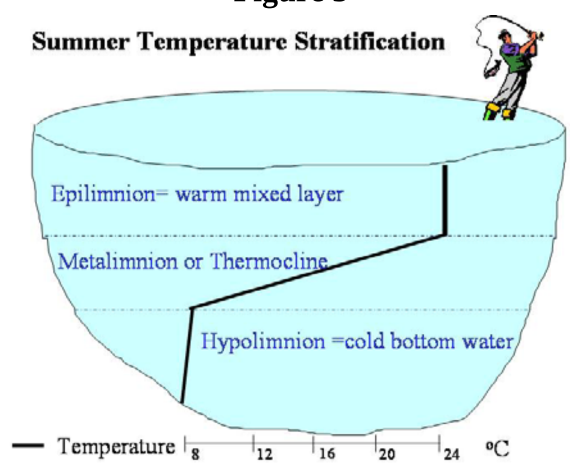
DISCUSSION OF LAKE AND STREAM MONITORING MEASUREMENTS

The section below details the important concepts involved for the various testing procedures used in the **New Hampshire Lakes Lay Monitoring Program**. Certain tests or sampling performed at the time of the optional **Center for Freshwater Biology** field trip are indicated by an asterisk (*).

Thermal Stratification in the Deep Water Sites

Lakes in New Hampshire display distinct patterns of temperature stratification, that develop as the summer months progress, where a layer of warmer water (the **epilimnion**) overlies a deeper layer of cold water (**hypolimnion**). The layer that separates the two regions characterized by a sharp drop in temperature with depth is called the **thermocline** or **metalimnion** (Figure 3). Some shallow lakes may be continually mixed by wind action and will never stratify. Other lakes may only contain a developed epilimnion and metalimnion.

Figure 3



Water Transparency

Secchi Disk depth is a measure of the water transparency. The deeper the depth of Secchi Disk disappearance, the more transparent the lake water; light penetrates deeper if there is little dissolved and/or particulate matter (which includes both living and non-living particles) to absorb and scatter it.

In the shallow areas of many lakes, the Secchi Disk will hit bottom before it is able to disappear from view (what is referred to as a "Bottom Out" condition). Thus, Secchi Disk measurements are generally taken over the deepest sites of a lake. Transparency values greater than 4 meters are typical of clear, unproductive lakes while transparency values less than 2.5 meters are generally an indication of highly productive lakes. Water transparency values between 2.5 meters and 4 meters are generally considered indicative of moderately productive lakes.

Chlorophyll *a*

The chlorophyll *a* concentration is a measurement of the standing crop of phytoplankton and is often used to classify lakes into categories of productivity called trophic states. **Eutrophic** lakes are highly productive with large concentrations of algae and aquatic plants due to nutrient enrichment. Characteristics include accumulated organic matter in the lake basin and lower dissolved oxygen in the bottom waters. Summer chlorophyll *a* concentrations average above 7 mg m^3 (7 milligrams per cubic meter; 7 parts per billion). **Oligotrophic** lakes have low productivity and low nutrient levels and average summer chlorophyll *a* concentrations that are generally less than 3 mg m^3. These lakes generally have cleaner bottoms and high dissolved oxygen levels throughout. **Mesotrophic** lakes are intermediate in productivity with concentrations of chlorophyll *a* generally between 3 mg m^3 and 7 mg m^3. Testing is sometimes done to check for **metalimnetic algal populations**, algae that layer out at the thermocline and generally go undetected if only epilimnetic (point or integrated) sampling is undertaken. Chlorophyll concentrations of a water sample collected in the thermocline is compared to the integrated epilimnetic sample. Greater chlorophyll levels of the point sample, in conjunction with microscopic examination of the samples (see Phytoplankton section below), confirm the presence of such a population of algae. These populations should be monitored as they may be an early indication of increased nutrient loading into the lake.

Turbidity

Turbidity is a measure of suspended material in the water column such as sediments and planktonic organisms. The greater the turbidity of a given water body the lower the Secchi Disk transparency and the greater the amount of particulate matter present. Turbidity is measured as nephelometric turbidity units (NTU), a standardized method among researchers. Turbidity levels are generally low in New Hampshire reflecting the pristine condition of the majority of our lakes and ponds. Increasing turbidity values can be an indication of increasing lake productivity or can reflect improper land use practices within the watershed which destabilize the surrounding landscape and allow sediment runoff into the lake.

While Secchi Disk measurements will integrate the clarity of the water column from the surface waters down to the depth of disappearance, turbidity measurements are collected at discrete depths from the surface down to the lake bottom. Such discrete sampling can identify layering algal populations (previously discussed) that are undetectable when measuring Secchi Disk transparency alone.

Dissolved Color

The dissolved color of lakes is generally due to dissolved organic matter from **humic substances**, which are naturally-occurring polyphenolic compounds leached from decayed vegetation. Highly colored or "stained" lakes have a "tea" color. Such substances generally do not threaten water quality except as they diminish sunlight penetration into deep waters.

Increases in dissolved watercolor can be an indication of increased development within the watershed as many land clearing activities (construction, deforestation, and the resulting increased run-off) add additional organic material to lakes. Natural fluctuations of dissolved color occur when storm events increase drainage from wetlands areas within the watershed. As suspended sediment is a difficult and expensive test to undertake, both dissolved color and chlorophyll information are important when interpreting the Secchi Disk transparency

Dissolved color is measured on a comparative scale that uses standard chloroplatinate dyes and is designated as a color unit or ptu. Lakes with color below 10 ptu are very clear, 10 to 20 ptu are slightly colored, 20 to 40 ptu are lightly tea colored, 40 to 80 ptu are tea colored and greater than 80 ptu indicates highly colored waters. Generally the majority of New Hampshire lakes have color between 20 to 30 ptu.

Total Phosphorus (TP)

Of the two "nutrients" most important to the growth of aquatic plants, nitrogen and phosphorus, it is generally observed that phosphorus is the more limiting to plant growth, and therefore the more important to monitor and control. Phosphorus is generally present in lower concentrations, and its sources arise primarily through human related activity in a watershed. Nitrogen can be fixed from the atmosphere by many bloom-forming blue-green bacteria, and thus it is difficult to control. The total phosphorus includes all dissolved phosphorus as well as phosphorus contained in or adhered to suspended particulates such as sediment and plankton. As little as 10 parts per billion of phosphorus in a lake can cause an algal bloom.

Generally, in the more pristine lakes, phosphorus values are higher after spring melt when the lake receives the majority of runoff from its surrounding watershed. The nutrient is used by the algae and plants which in turn die and sink to the lake bottom causing surface water phosphorus concentrations to decrease as the summer progresses. Lakes with nutrient loading from human activities and sources (agriculture, logging, sediment erosion, septic systems, etc.) will show greater concentrations of nutrients as the summer progresses or after major storm events.

Soluble Reactive Phosphorus (SRP) *

Soluble reactive phosphorus is a fraction of the (total) phosphorus that consists largely of orthophosphate, the form of phosphorus that is directly taken up by algae and that stimulates growth. Soluble reactive phosphorus is obtained by filtering a water sample through a fine mesh filter, generally a 0.45 micron membrane filter, which effectively removes the particulate matter from the sample. Soluble reactive phosphorus concentrations are thus less than, or equal to, the measured total phosphorus concentrations for a water sample.

Soluble reactive phosphorus typically occurs in trace concentrations while applications of fertilizers as well as septic system effluent can be associated with elevated concentrations. Knowledge of both the total phosphorus and the soluble reactive phosphorus is important to understanding the sources of phosphorus into a lake and to understanding the lake's response to the phosphorus loading. For instance, a lake experiencing soluble reactive phosphorus runoff from a fertilized field may exhibit immediate water quality decline (i.e. increased algal growth) while lakes experiencing elevated total phosphorus concentrations associated with sediment washout may not exhibit clear symptoms of increased nutrient loading for years.

Streamflow *

Streamflow, when collected in conjunction with stream cross-section information, is a measure of the volume of water traversing a given stream stretch over a period of time and is often expressed as cubic meters per second. Knowledge of the streamflow is important when determining the amount of nutrients and other pollutants that enter a lake. Knowledge of the streamflow in conjunction with nutrient concentrations, for instance, will provide the information necessary to calculate phosphorus loading values and will in turn be useful in discerning the more impacted areas within a watershed.

pH *

The pH is a way of expressing the acidic level of lake water, and is generally measured with an electrical probe sensitive to hydrogen ion activity. The pH scale has a range of 1 (very acidic) to 14 (very "basic" or alkaline) and is logarithmic (i.e.: changes in 1 pH unit reflect a ten times difference in hydrogen ion concentration). Most aquatic organisms tolerate a limited range of pH and most fish species require a pH of 5.5 or higher for successful growth and reproduction.

Alkalinity

Alkalinity is a measure of the buffering capacity of the lake water. The higher the alkalinity value, the more acid that can be neutralized. Typically lakes in New Hampshire have low alkalinities due to the absence of carbonates and other natural buffering minerals in the bedrock and soils of lake watersheds.

Decreasing alkalinity over a period of a few years can have serious effects on the lake ecosystem. In a study on an experimental acidified lake in Canada by Schindler, gradual lowering of the pH from 6.8 to 5.0 in an 8-year period resulted in the disappearance of some aquatic species, an increase in nuisance species of algae and a decline in the condition and reproduction rate of fish. During the first year of Schindler's study the pH remained unchanged while the alkalinity declined to 20 percent of the pre-treatment value. The decline in alkalinity was sufficient to trigger the disappearance of zooplankton species, which in turn caused a decline in the "condition" of fish species that fed on the zooplankton.

The analysis of alkalinity employed by the **CFB** includes use of a dilute titrant allowing an order of magnitude greater sensitivity and precision than the standard method. Two endpoints are recorded during each analysis. The first endpoint (gray color of dye; pH endpoint of 5.1) approximates low level alkalinity values, while the second endpoint (pink dye color; pH endpoint of 4.6) approximates the alkalinity values recorded historically, such as NH Fish and Game data, with the methyl-orange endpoint method.

The average alkalinity of lakes throughout New Hampshire is low, approximately 6.5 mg per liter (calcium carbonate alkalinity). When alkalinity falls below 2 mg per liter the pH of waters can greatly fluctuate. Alkalinity levels are most critical in the spring when acid loadings from snowmelt and run-off are high, and many aquatic species are in their early, and most susceptible, stages of their life cycle.

Specific Conductivity *

The specific conductance of a water sample indicates concentrations of dissolved salts. Leaking septic systems and deicing salt runoff from highways can cause high conductivity values. Fertilizers and other pollutants can also increase the conductivity of the water. Conductivity is measured in **micromhos** (the opposite of the measurement of resistance **ohms**) per centimeter, more commonly referred to as micro-Siemans (*u*S). Specific conductivity implies the measurements are standardized to the equivalent room temperature reading as conductivity will increase with increasing temperature.

Sodium and Chloride *

Low levels of sodium and chloride are found naturally in some freshwater and groundwater systems while high sodium and chloride concentrations are characteristic of the open ocean and are elevated in estuarine systems as well. Elevated sodium and chloride concentrations in freshwater or groundwater systems, that exceed the natural baseline concentrations, are commonly associated with the application of road salt. Sodium and particularly chloride are highly mobile and, relatively speaking, move into the surface and groundwater relatively unimpeded. Sodium and chloride concentrations can become elevated during periods of heavy snow pack melt when the salts are flushed into surface waters and have also been observed in elevated concentrations during the summer months when low flow conditions concentrate the sodium and chloride.

Road salt runoff is known to adversely impact roadside vegetation as is oftentimes evidenced by bleached (discolored) leaves and needles and in more extreme instances dead trees and shrubs. The United States Environmental Protection Agency (EPA) has set the standard for protection of aquatic life, both plants and animals, at 230 milligrams per liter (mg/l). The EPA has also established a secondary maximum contaminant level of 250 mg/l for both sodium and chloride, predominantly for taste, while the sodium advisory limit for persons with hypertention is 20 mg/l

Dissolved Oxygen and Free Carbon Dioxide *

Oxygen is an essential component for the survival of aquatic life. Submergent plants and algae take in carbon dioxide and create oxygen through **photosynthesis** by day. **Respiration** by both animals and plants uses up oxygen continually and creates **carbon dioxide**. Dissolved oxygen profiles determine the extent of declining oxygen concentrations in the lower waters. High carbon dioxide values are indicative of low oxygen conditions and accumulating organic matter. For both gases, as the temperature of the water decreases, more gas can be dissolved in the water.

The typical pattern of clear, unproductive lakes is a slight decline in hypolimnetic oxygen as the summer progresses. Oxygen in the lower waters is important for maintaining a fit, reproducing, cold water fishery. Trout and salmon generally require oxygen concentrations above 5 mg per liter (parts per million) in the cool deep waters. On the other hand, carp and catfish can survive very low oxygen conditions. Oxygen above the lake bottom is important in limiting the release of nutrients from the sediments and minimizing the collection of undecomposed organic matter.

Bacteria, fungi and other **decomposers** in the bottom waters break down organic matter originating from the watershed or generated by the lake. This process uses up oxygen and produces carbon dioxide. In lakes where organic matter accumulation is high, oxygen depletion can occur. In highly stratified eutrophic lakes the entire hypolimnion can remain unoxygenated or **anaerobic** until fall mixing occurs.

The oxygen peaks occurring at surface and mid-lake depths during the day are quite common in many lakes. These characteristic **heterograde oxygen curves** are the result of the large amounts of oxygen, the by-product of photosynthesis, collecting in regions of high algal concentrations. If the peak occurs in the thermocline of the lake, metalimnetic algal populations (discussed above) may be present.

Indicator Bacteria *

Certain disease causing organisms, pathogenic bacteria, viruses and parasites, can be spread through contact with polluted waters. Faulty septic systems, sewer leaks, combined sewer overflows and the illegal dumping of wastes from boats can contribute fecal material containing these pathogens. Typical water testing for pathogens involves the use of detecting coliform bacteria. These bacteria are not usually considered harmful themselves but they are relatively easy to detect and can be screened for quickly. Thus, they make good surrogates for the more difficult to detect pathogens.

Total coliform includes all coliform bacteria that arise from the gut of animals or from vegetative materials. **Fecal coliform** are those specific organisms that inhabit the gut of warm blooded animals. Another indicator organism **Fecal streptococcus** (sometimes referred to as **enterococcus**) also can be monitored. The ratio of fecal coliform to fecal strep may be useful in suggesting the type of animal source responsible for the contamination. In 1991, the State of

New Hampshire changed the indicator organism of preference to *E. coli* which is a specific type of fecal coliform bacteria thought to be a better indicator of human contamination. The new state standard requires Class A “bathing waters” to be under 88 organisms (referred to as colony forming units; cfu) per 100 milliliters of lakewater.

Ducks and geese are often a common cause of high coliform concentrations at specific lake sites. While waterfowl are important components to the natural and aesthetic qualities of lakes that we all enjoy, it is poor management practice to encourage these birds by feeding them. The lake and surrounding area provides enough healthy and natural food for the birds and feeding them stale bread or crackers does nothing more than import additional nutrients into the lake and allows for increased plant growth. As birds also are a host to the parasite that causes "swimmers itch", waterfowl roosting areas offer a greater chance for infestation to occur. Thus while leaving offerings for our feathered friends is enticing, the results can prove to be detrimental to the lake system and to human health.

NEWFOUND LAKE WATER QUALITY MONITORING: 2007 AND 2008

The WMP project is part of a pro-active effort dedicated to assisting local decision makers in their long-term planning efforts. The in-lake and tributary monitoring components of this project provide the watershed communities with quantitative baseline data that have identified potential problems and areas of concern that can be mitigated through education/outreach efforts in combination with long-term land use planning initiative directed at controlling pollutant runoff into Newfound Lake. The primary pollutant of concern is phosphorus (the lake stressor variable) in the context of how it will impact lake productivity as measured by chlorophyll concentration (lake reaction variable) while supplemental near-shore bacteria sampling will provide insight into public health concerns. Supplemental anion and cation data (i.e. sodium and chloride) will augment the assessment of impaired tributary reaches. All data collected through this project will assist in the creation of the Watershed Management Plan.

The water quality monitoring effort is designed to complete a series of independent, but interrelated objectives that will provide a better understanding of the impacts of development, population growth, and land use change on the Newfound Lake watershed. Water quality monitoring results are discussed by task in the following section:

- 18-month Newfound Lake Water/Phosphorus Budget - completed and summarized in a companion report (Craycraft and Schloss, 2008)
- Conduct In-lake water quality sampling to assist in trend detection and water quality assessment.
- Conduct Near-shore water quality surveys to screen for potential problem areas and assess near-shore water quality conditions.
- Implement periphyton (attached algae) sampling to integrate water quality impacts over time and help determine whether localized water quality variations exist.
- Conduct benthic (lake sediment) core sampling to determine the extent of sediment phosphorus variations among sampling locations.
- Perform a paired watershed study of select tributary inlets to characterize land-use impacts on minimally developed watersheds

Extensive details of the project's sampling design and methods can be found in the Newfound Lake Watershed Assessment Quality Assurance Project Plan (Schloss and Craycraft, 2006).

In-Lake (Reference) Sampling Sites

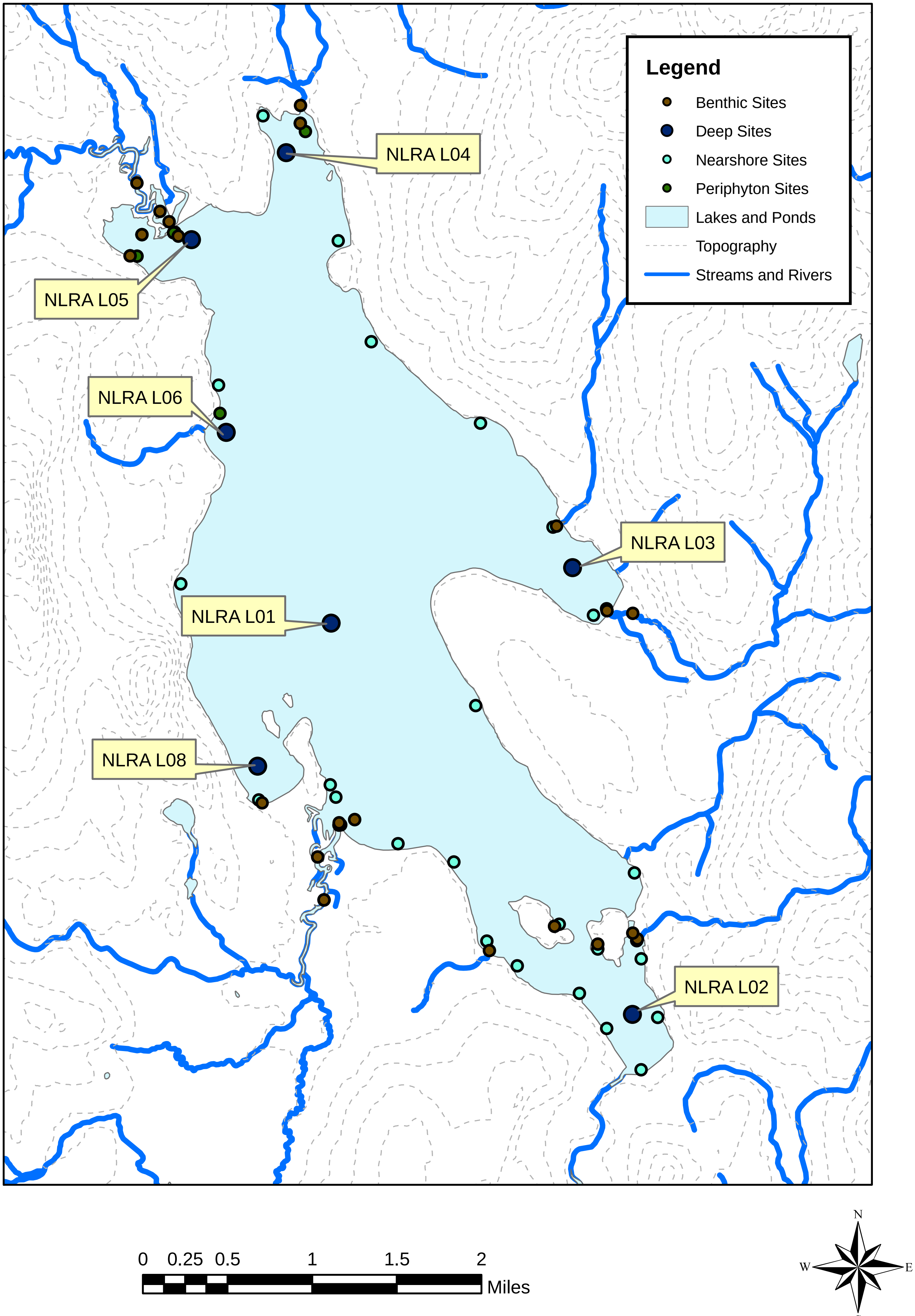
Choice Of Deep In-Lake Sampling Stations

Seven in-lake sampling locations were selected that had been included in past sampling efforts for Newfound Lake undertaken by the CFB and the NH LLMP (LLMP). Historical data have been documented in the annual volunteer monitoring reports provided since 1986 (LLMP, 1986-2006). The seven sampling sites are positioned at deeper points around Newfound Lake and reflect localized water quality variations found among the more centrally located sampling stations in both the open waters, and more confined basins (Table 5 and Figure 4). The monitoring of the seven in-lake sampling locations will also provide for insight into the differences and similarities among the sites that could be important when considering future remedial actions for the lake, as well as, the susceptibility of the seven Newfound Lake sampling stations to water quality degradation. Furthermore, during the period of thermal stratification, sampling locations such as L01 Deep and L02 Mayhew can effectively function as two "independent lakes" where the chemical, physical and biological characteristics vary between sampling locations.

Table 5. Newfound Lake Study Sites

Lake Sites	Site ID	Location: Latitude Longitude	Sampling Site Description / Rationale
Deep	NLRA L01	43°39'24.7" 71°46'24.5"	Near the deepest point in Newfound Lake, reflects the overall condition of Newfound Lake
Mayhew	NLRA L02	43°37'24.5" 71°44'16.5"	Southern Lake basin with heavy first-tier lakeshore development that might impact water quality.
Pasquaney Bay	NLRA L03	43°39'41.8" 71°44'42.1"	Sampling station located in Pasquaney Bay where watershed runoff might impact local water quality.
Loon Island	NLRA L04	43°41'49.3" 71°46'43.8"	Sampling station located in the northeasterly bay. Water quality will reflect sub-watershed inputs.
Cockermouth	NLRA L05	43°41'22.5" 71°47'24.0"	Sampling station located in the northwesterly bay that is "fed" by the Cockermouth River. Water quality will reflect the Cockermouth River drainage and other local watershed inputs.
Beachwood	NLRA L06	43°40'23.3" 71°47'09.1"	Sampling station located along the westerly shoreline.
Follansbee Cove	NLRA L08	43°38'40.7" 71°46'55.6"	Sampling location located in a westerly basin located near Wellington state park. Water quality reflects the sub-watershed inputs.

Figure 4. Newfound Lake Deep Sites



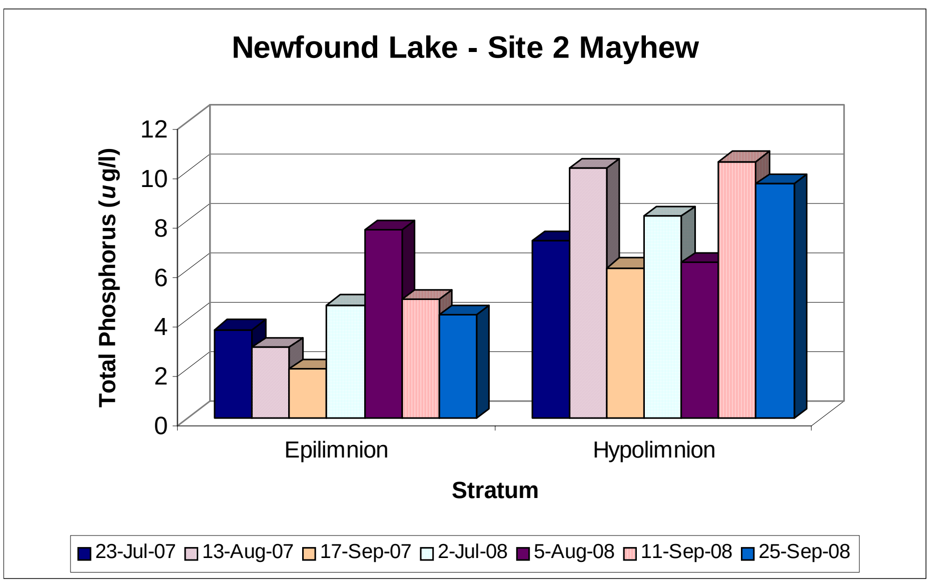
In-Lake Sampling Results

The Newfound Lake water quality data were variable among sampling locations as well as variable among sampling dates. The following section reports on the July 23, 2007 through September 25, 2008 water quality data that were collected by the UNH CFB field team. This section includes a brief discussion of the water quality monitoring results for each analytical water quality parameter followed by a summary of the water quality results.

Total Phosphorus

Total phosphorus concentrations were low at all sampling sites and the composite epilimnetic samples ranged from 2.0 to 7.6 micrograms per liter (*u*g/l) among seven sampling dates during the summers of 2007 and 2008 (Appendix B). Deep water (hypolimnetic) phosphorus samples were also low and ranged from 2.2 to 10.4 *u*g/l among the seven sampling locations (Appendix B). The hypolimnetic total phosphorus concentrations documented at Site L02 Mayhew were generally higher than the corresponding surface water (composite) samples (Figure 5). All epilimnetic total phosphorus concentrations were below 8 *u*g/l that is considered the DES aquatic life threshold for an oligotrphic lake.

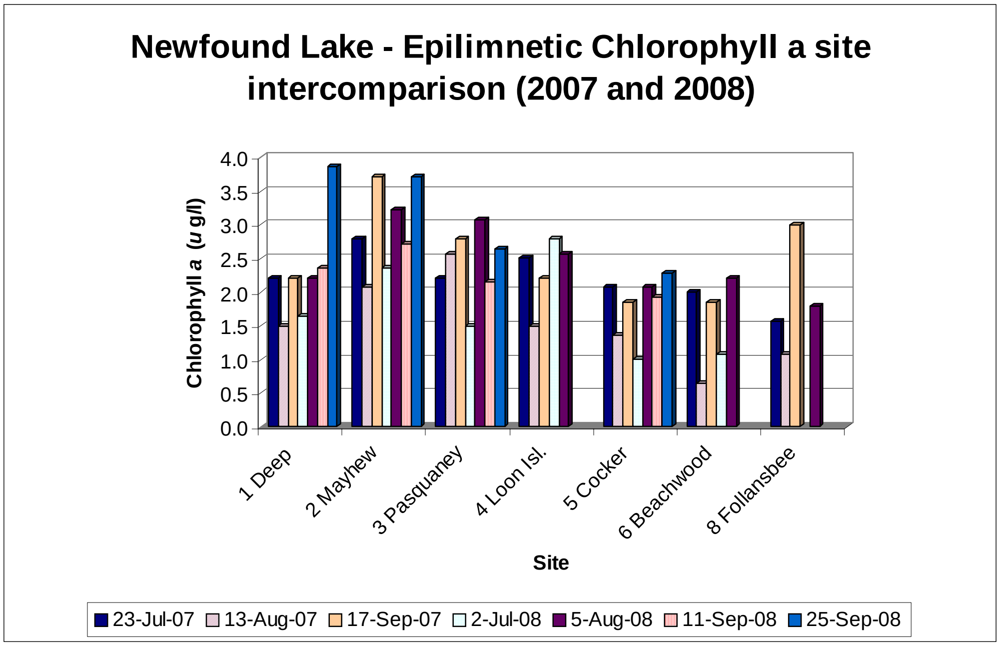
Figure 5.



Chlorophyll *a*

Chlorophyll *a* concentrations were variable among sampling dates and ranged from 0.6 to 3.9 micrograms per liter (*u*g/l) while most values remained below 3.0 *u*g/l (Figure 6). The chlorophyll *a* concentrations documented at Site L02 Mayhew were generally the highest concentrations measured among the sampling stations (Figure 6). The chlorophyll *a* concentrations generally fell below 3.3 *u*g/l that is considered the DES aquatic life threshold for an oligotrophic lake. Chlorophyll *a* concentrations sometimes exceeded the concentration of 3.3 *u*g/l at Site L02 Mayhew (Figure 6).

Figure 6.



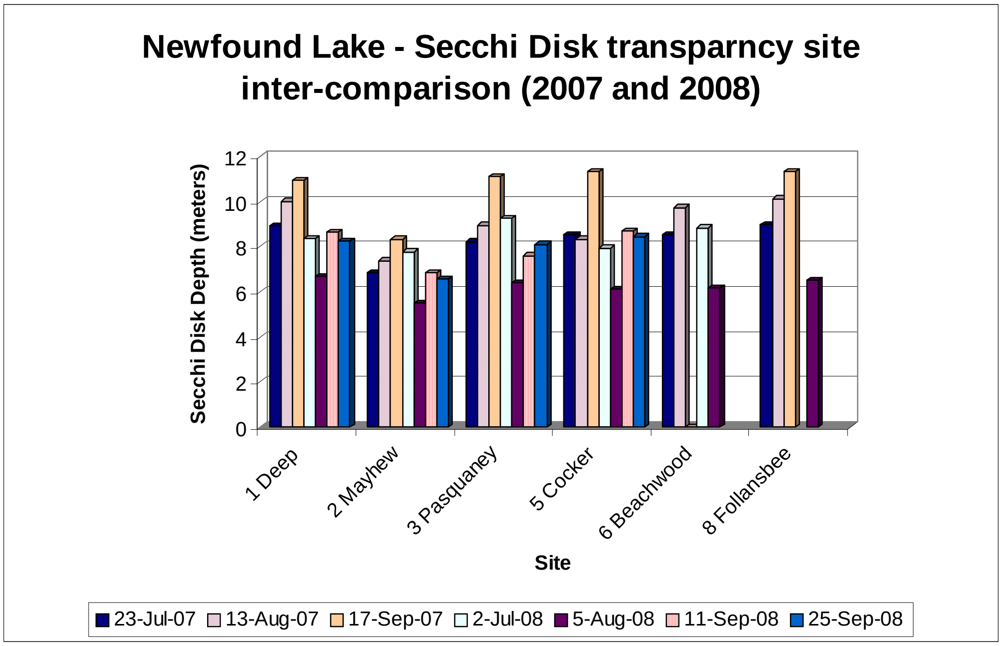
Secchi Disk Transparency

Secchi Disk transparency ranged from 18.0 feet (5.5 meters) to 37.1 feet (11.3 meters) and varied among sampling dates (Figure 7). The shallowest water transparency measurements were documented at Site L02 Mayhew on all sampling dates. *Note: Site 4 Loon Island was removed from the Secchi Disk transparency comparison due to the shallowness of the site and the Secchi Disk resting on the lakebottom before disappearing from view.*

Dissolved Oxygen

The dissolved oxygen concentrations generally remained above 5 milligrams per liter (mg/l) which is commonly considered the minimum oxygen concentrations required for the successful growth and reproduction of the coldwater fishery (Appendix C). The single exception was documented at Site L02 Mayhew where the bottom water (hypolimnetic) oxygen concentrations were near or below 5 mg/l by August 13, 2007 and near or below 5 mg/l by August 5, 2008. Sampling in September (2007 and 2008) revealed that the L02 Mayhew dissolved oxygen concentrations became reduced below 5 mg/l in the hypolimnion and that the dissolved oxygen concentrations were decreasing in the metalimnion as well (Appendix C).

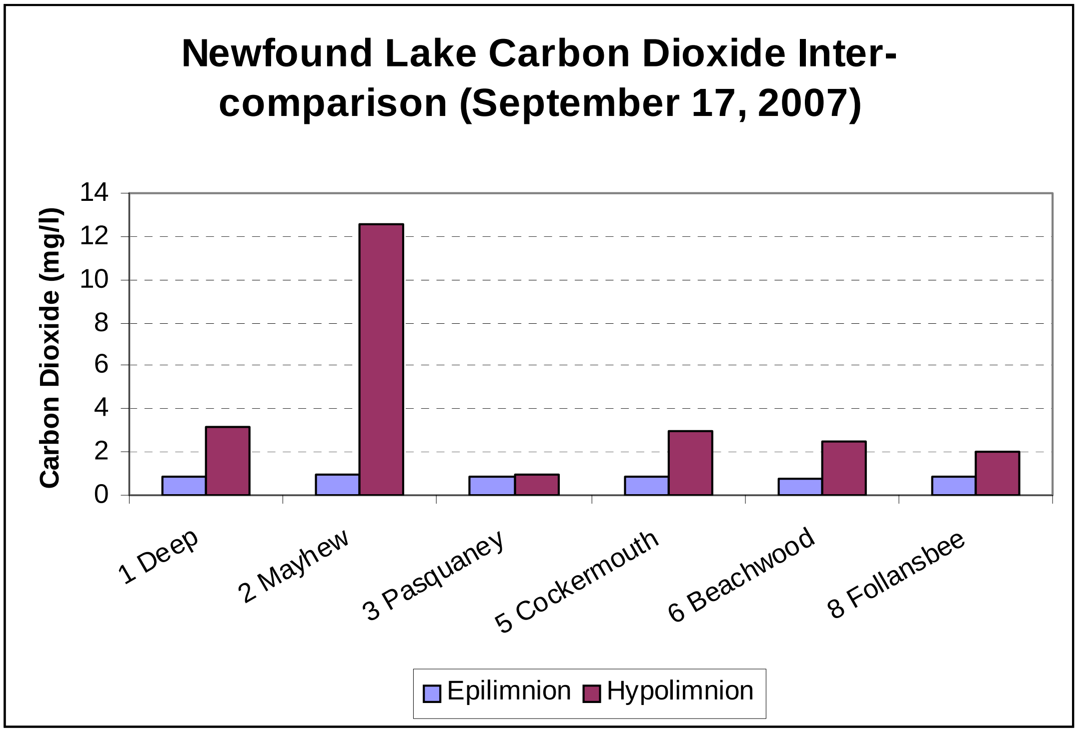
Figure 7.



Carbon Dioxide

Carbon dioxide concentrations were consistently low in the surface waters and increased with depth as one would expect. Higher carbon dioxide concentrations near the lake bottom are commonly associated with the decomposition of organic matter by microbes and the corresponding respiration (production of the carbon dioxide by-product). The highest carbon dioxide concentrations were consistently documented near the lake bottom of Site L02 Mayhew and correspond to the lower dissolved oxygen concentrations in the southerly basin. Figure 8 provides a visual representation of the late season (late August – early October) pattern of carbon dioxide concentrations among sampling stations.

Figure 8.



Total Alkalinity

Total alkalinity measurements ranged from 2.0 to 4.6 and averaged 3.3 milligrams per liter (mg/l). While low, the Newfound Lake alkalinity remained capable of neutralizing acid inputs and avoiding large pH (acidity) swings that can be toxic to aquatic organisms.

pH

The pH measurements varied from 5.9 to 7.4 in the surface waters (epilimnion) during the study period and generally exhibited a decrease in pH with depth. The most acidic water was documented near the lake bottom, in the hypolimnion, where a pH minimum of 5.5 units was logged. Carbonic acid, a natural acid that forms when carbon dioxide dissolved in the lake water, is common among New Hampshire lakes.

Specific Conductivity

Specific conductivity measurements were low and ranged from 32.0 to 43.0 micro-Siemans per centimeter (*u*S/cm) among the six sampling stations and among sampling dates. The highest specific conductivity measurement of 43.0 *u*S/cm was documented near the lakebottom of Site L02 Mayhew on September 25, 2008 and was most likely caused by some nutrient flux off of the sediments. The elevated elevated specific conductivity corresponded to low dissolved oxygen concentrations near the lake bottom.

Water Quality Summary

The water quality remained high at all Newfound Lake sampling Stations in both 2007 and 2008 and the data were characteristic of a high quality water body. A comparison among the seven Newfound Lake sampling stations indicates that the southerly sampling station, Site L02 Mayhew, is characterized by lower water transparency, higher chlorophyll *a*, higher total phosphorus concentrations as well as declining late season dissolved oxygen concentrations in the deep, hypolimnetic and metalimnetic, waters. The data indicate that the southern sampling station is more nutrient enriched than the sampling stations to the north and may reflect the influence of a higher level of watershed development in the southern segment of Newfound Lake. While the L02 Mayhew sampling station was clearly the most nutrient enriched amount the deep sampling locations, the water quality conditions were characteristic of an oligotrophic lake that is approaching more nutrient enriched, mesotrophic, status. Continued water quality monitoring of the Newfound Lake deep sites is recommended to continue to track both short-term and longer-term trends. Future sampling should include:

- Continued weekly to bi-weekly epilimnetic chlorophyll *a* and dissolved color sampling at the seven historical sampling stations. Secchi Disk transparency measurements should also be collected during each site visit.
- Implementation of bi-weekly epilimnetic total phosphorus sampling at each of the seven historical sampling stations.
- Implementation of hypolimnetic total phosphorus sampling at Site L02 Mayhew during the months of July, August and September.
- Continued collection of late season (mid-August/September) dissolved oxygen and metalimnetic chlorophyll *a* samples at each of the historical sampling sites.

Near-shore Water Quality Survey Data

Choice of Near-shore Sampling Stations

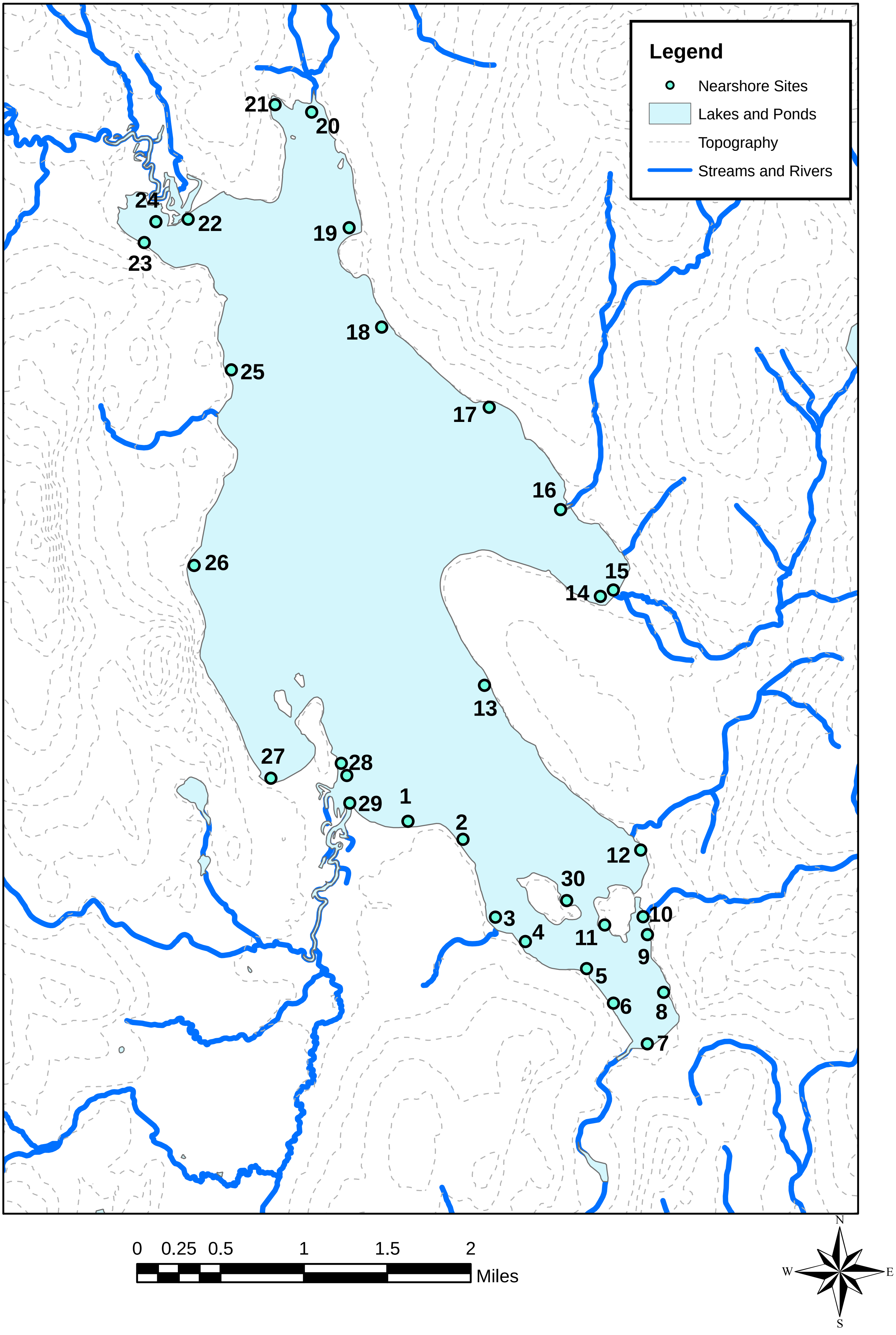
Thirty near-shore sampling stations were selected to correspond to locations that are most susceptible to water quality variations, such as areas proximal to tributary inlets and areas near more intensive land use, as well as a series of reference sampling locations that reflect minimal levels of human (anthropogenic) influence (Table 6 and Figure 9). The near-shore sampling approach included the collection of samples during the spring, summer and fall as well as a pair of samples collected before and after the Fourth of July weekend. The near-shore sampling locations were positioned approximately 150 to 300 feet offshore to provide an assessment of the collective influence of watershed inputs and to identify general variations that were evident around Newfound Lake such as differences between sites in Hebron Marsh, sites south of Mayhew Island and sites located in Pasquaney Bay. While the near-shore samples may provide insight into the influence of localized land use practices, the data were not designed to single out the influence of septic effluent, fertilizer application, tributary runoff, etc.

The near-shore water quality sampling effort emphasized the collection of three primary parameters to address the amount nutrient (total phosphorus), fecal contamination (*E. coli*) and salts (Specific Conductivity).

Table 6: Newfound Lake near-shore sampling stations

Site ID	Location: Latitude dd:mm:ss	Location: Longitude dd:mm:ss	Sampling Site Description
NLRA-S01	43 38 16.9	71 45 56.0	Approximately 150 feet offshore near Camp Wallomut. Old camps are located near the shoreline.
NLRA-S02	43 38 11.3	71 45 32.3	Approximately 200 feet offshore near numerous camps.
NLRA-S03	43 37 47.0	71 45 18.3	Approximately 300 feet offshore near the Black Brook tributary inlet. Numerous shoreline cottages exist.
NLRA-S04	43 37 39.4	71 45 05.4	Approximately 300 feet from the shore near Manor Estates Beach.
NLRA-S05	43 37 31.0	71 44 39.0	Approximately 150 feet from Cummings Beach and "Bungalow" Village.
NLRA-S06	43 37 20.2	71 44 27.4	Approximately 100 feet offshore with houses along the shoreline.
NLRA-S07	43 37 07.5	71 44 12.8	Approximately 100 feet offshore east of the outlet near the southern beach.
NLRA-S08	43 37 23.6	71 44 05.8	Approximately 150 feet offshore near Lakeshore Road and a dense cluster of shoreline cottages.
NLRA-S09	43 37 41.6	71 44 12.8	Approximately 150 feet offshore and receiving drainage from the Red Fox condominiums.
NLRA-S10	43 37 47.2	71 44 14.7	Approximately 75 feet from the mouth of Hemlock Brook.
NLRA-S11	43 37 44.6	71 44 31.2	Pikes Point at the mouth of the cove. Several cottages are located in the cove with a fairly well vegetated shoreline.
NLRA-S12	43 38 08.0	71 44 15.7	Approximately 100 feet from a forested shoreline with scattered near-shore cottages.
NLRA-S13	43 38 59.4	71 45 23.1	Approximately 100 feet from the shore and northwest of a community beach.
NLRA-S14	43 39 27.2	71 44 33.2	Near a beach and some cottages that include some older "second tier" (across the street) cottages.
NLRA-S15	43 39 29.2	71 44 27.6	Approximately 75 feet from the Whittemore Brook tributary inlet.
NLRA-S16	43 39 54.3	71 44 50.4	Off Paradise Pint, mouth of the tributary with numerous cottages and a community beach just north of the inlet.
NLRA-S17	43 40 26.2	71 45 21.2	Approximately 200 feet from shore and near the Whipowill condominiums.
NLRA-S18	43 40 51.2	71 46 07.6	Approximately 200 feet from shore between the Pasquaney and Moglis Camps. The shoreline is predominantly forested and is a “reference” site.
NLRA-S19	43 41 22.2	71 46 21.7	Some shorefront residential development north of Onaway Point.
NLRA-S20	43 41 58.3	71 46 37.9	Central location in Sanborn Bay cove that includes a beach and residential development. The site is in the middle of a *Sparganium* bed and is influenced by Georges Brook.
NLRA-S21	43 42 00.6	71 46 53.7	Approximately 200 feet offshore of Sleepy Hollow.
NLRA-S22	43 41 24.8	71 47 31.1	Approximately 100 feet from the mouth of the Cockermouth River
NLRA-S23	43 41 17.5	71 47 50.0	Approximately 250 feet offshore on the southern side of Hebron Marsh
NLRA-S24	43 41 24.0	71 47 45.0	Approximately 200 feet offshore on the northern side of Hebron Marsh
NLRA-S25	43 40 37.8	71 47 12.4	Approximately 150 feet from the shore. A forested “reference” site with a couple of scattered cottages.
NLRA-S26	43 39 36.7	71 47 28.3	Approximately 200 feet from the Ledges tributary inlet and approximately 40 feet from the Ledges beach.
NLRA-S27	43 38 30.3	71 46 55.1	Approximately 100 feet from the culvert and 200 feet from Wellington Beach. The site represents a composite influence of the inlet, beach and nearby cottages.
NLRA-S28	43 38 35.0	71 46 24.8	Approximately 100 feet offshore from the public boat launch ramp.
NLRA-S29	43 38 22.6	71 46 21.1	Mouth of the Fowler River.
NLRA-S30	43 37 52.2	71 44 47.6	Approximately 75 feet offshore of the Mayhew Island beach.

Figure 9. Newfound Lake Near-Shore Sites



Near-shore Sampling Results

The Newfound Lake water quality data were oftentimes similar among sampling locations as well as variable among sampling dates although some notable differences (discussed below) were documented. The following section reports on the September 13, 2007 through September 30, 2008 water quality data that were collected by the UNH CFB field team.

Total Phosphorus

Total phosphorus concentrations ranged from < 2.0 micrograms per liter (*u*g/l) to 15.7 *u*g/l during the study period. The total phosphorus concentrations were generally highest at the Hebron Marsh sampling stations, Sites NLRA S23 and NLRA S24, and likely reflect the natural conditions of this shallower region of Newfound Lake. Short-term phosphorus spikes were also documented at a sampling site off the Fowler River tributary inlet (S29) on June 10, 2008 and September 30, 2008 and likely reflect the influence of the Fowler River during higher discharge periods. Visual observations made by the CFB field team indicated that aquatic vegetation, the genus *Sparganium*, was matted down for hundreds of yards south of the Fowler River indicating the flow path of the Fowler River. Based upon visual observations, one could deduce the influence of the Fowler River extends well into Newfound Lake during high discharge periods. The near-shore total phosphorus concentrations documented in Newfound Lake in 2007 and 2008 were generally similar to the deep, open water samples measured during that time span.

Escerichia coli (E. coli)

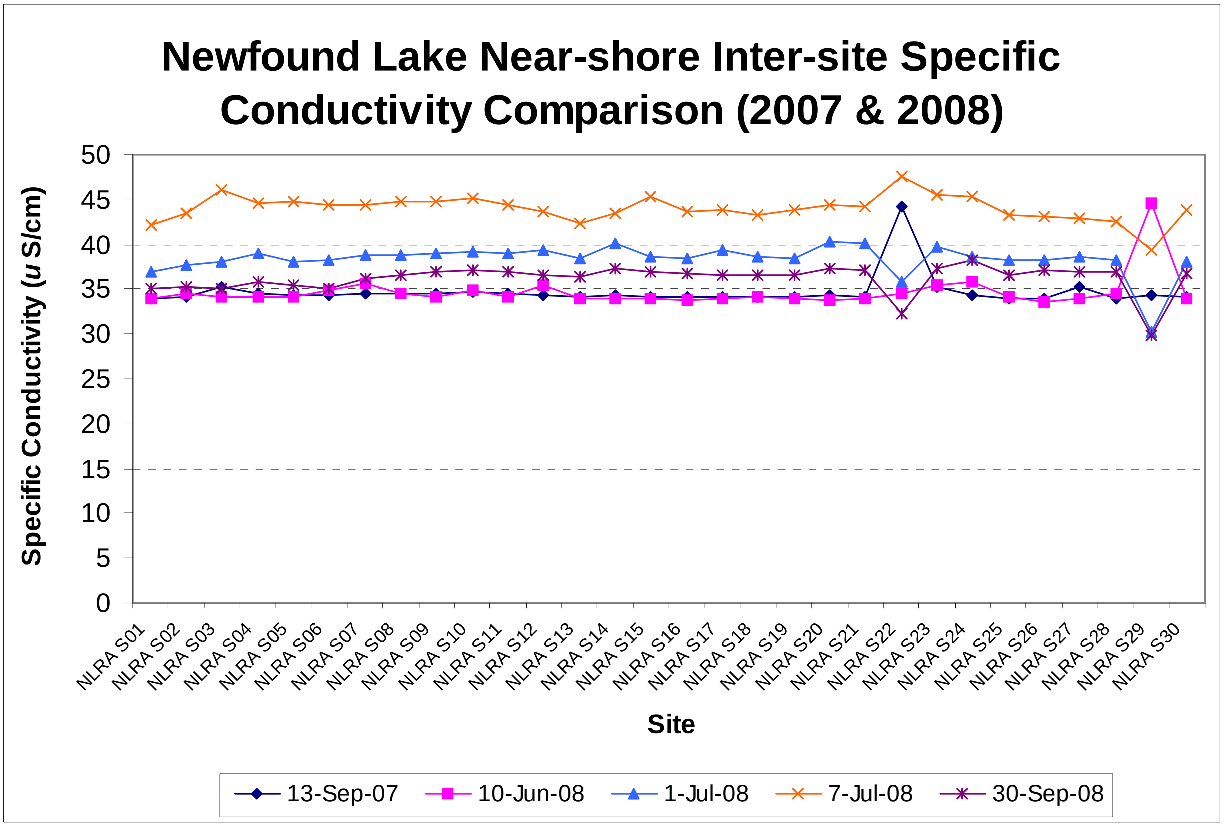
Escherichia coli data ranged from < 1 to 86 colony forming units per 100 milliliters (CFU/100 ml) during the study period. Furthermore, the *E. coli* counts were consistently below the New Hampshire DES threshold of 88 CFU/100 ml considered the state standard for contact recreation. The *E. coli* counts were highly variable among sampling dates and among sampling sites (Appendix D). The lowest bacteria counts were documented on July 7, 2008, after the fourth of July weekend, while the July 1, 2008 (pre July 4 weekend) were also some of the lower values documented during the study period. Water quality sampling on September 13, 2007, following a period of heavy rainfall the previous week (Appendix E), included *E. coli* “spikes” at sites near the mouths of the Cockermouth River (Site NLRA S22) and the Fowler River (Site NLRA S29). *E. coli* counts documented along the southwesterly shoreline were also elevated on September 13, 2007 relative to most sampling sites. Site NLRA S29 also experienced *E. coli* spikes on June 10, 2008 and September 30, 2008 while site NLRA S22 spiked on September 30, 2008. The September 30 sampling date followed a three day period of heavy rainfall (Appendix E) and included the two highest *E.*

coli measurements of 86 CFU/100ml (NLRA S22) and 72 CFU/100ml (NLRA S29) that were documented during the 2007/2008 study period.

<u>Specific Conductivity</u>

Specific Conductivity measurements ranged from 29.9 to 47.5 microsiemans per centimeter (*u*S/cm) during the study periods. Specific conductivity measurements were highest at all but Site NLRA S29 (the mouth of the Fowler River) on July 7, 2008 and tended to be lowest at most sampling locations on June 10, 2008 (Figure 10). The sampling locations near the mouths of the Cockermouth (NLRA S22) and the Fowler River (NLRA S29) tended to exhibit the greatest deviation relative to measurements recorded at the other sampling locations on a particular sampling date.

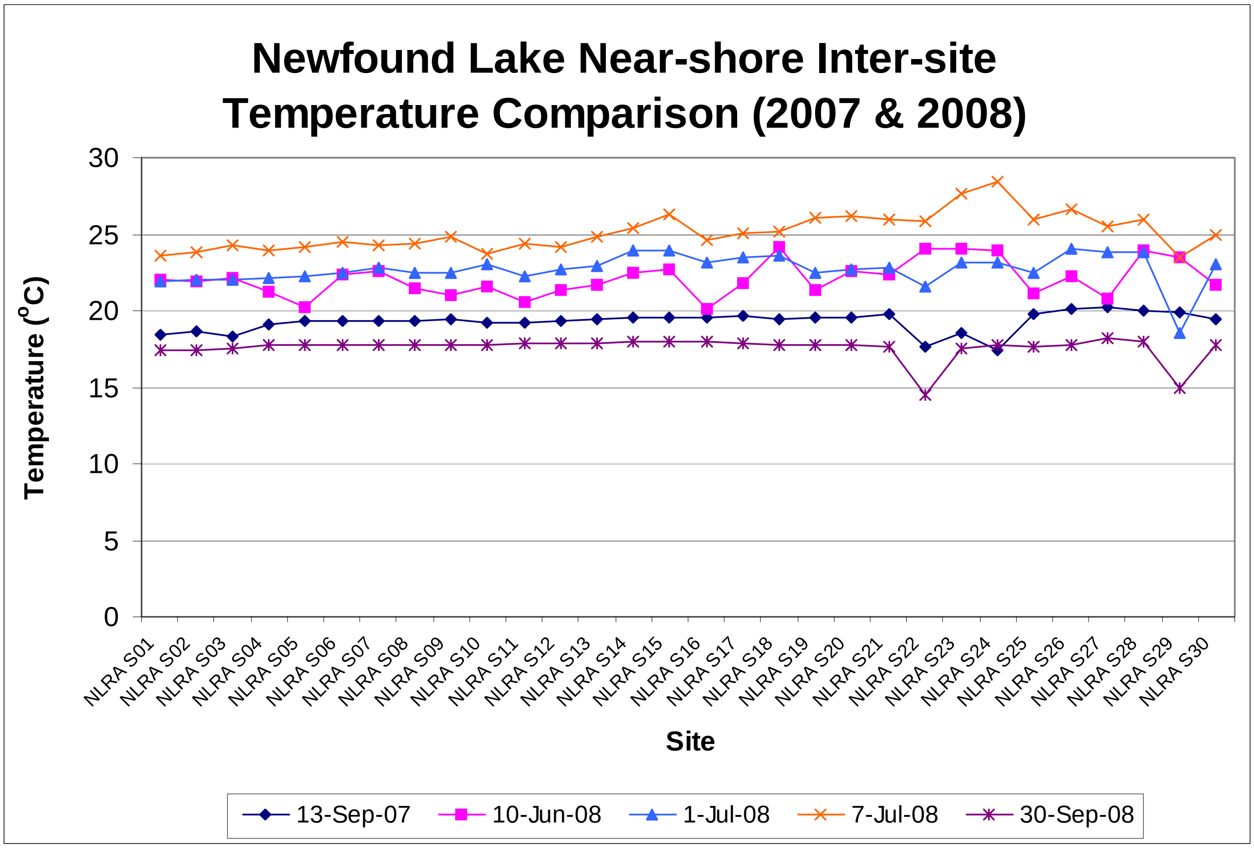
Figure 10



Temperature

Temperature measurements ranged from 14.5°C to 28.4°C during the study period. The temperature measurements were generally highest at each of the sampling stations on July 7, 2008 and were generally lowest on September 30, 2008 (Figure 11). The sites located at the outflows of the Cockermouth (NLRA S22) and the Fowler (NLRA S29) Rivers exhibited some of the larger discrepancies relative to temperature measurements documented at the other sampling locations. The highest temperature measurements were documented at the shallow and embayed Hebron Marsh sampling sites (NLRA S23 and S24) on July 7, 2008.

Figure 11



Water Quality Summary

Ambient water quality data collected as part of the near-shore sampling component of the project generally exhibited excellent water quality among the thirty sampling stations. Water quality variations were documented among sampling dates and some of the higher *E. coli* measurements were documented on September 30, 2008 following a period of heavy rainfall and indicate that the tributary inlets, particularly the Fowler and Cockermouth Rivers, serve as a conduit for pollutants (in this case *E. coli*) to make their way into Newfound Lake. Data collected as part of the previous Newfound Lake phosphorus/water budget (Craycraft and Schloss, 2008) and during the tributary sampling component of this report, reaffirm that short-term pollutant pulses occur and illustrate the linkage between the watershed area that extends miles away from the lake, and the quality of Newfound Lake.

Water quality data collected both before and after the July 4 weekend (July 1, 2008 and July 7, 2008) did not document short-term water quality impacts that are sometimes associated with periods of heavy use. The post-July 4 weekend data collected on July 7, 2008 included lower *E. coli* concentrations relative to the concentrations collected on July 1, 2008.

Water quality data collected along the more densely populated shoreline, south of Mayhew Island, were high and were generally similar to the water quality measurements documented in other areas of Newfound Lake. Total phosphorus concentrations remained low on all occasions south of Mayhew Island while short term *E. coli* spikes were documented but did not exhibit a general pattern among sampling dates and remained well below problematic levels.

Total phosphorus samples were typically higher in the shallow Hebron Marsh (sites NLRA S23 and S24) relative to the other near-shore sampling sites and reflected the progression of this localized region of Newfound Lake to a more nutrient enriched, meso/eutrophic, state. The Hebron Marsh is a good example of an area of Newfound Lake where a more organic rich (mucky) lakebottom has been colonized by aquatic vascular plants that flourish late in the summer months. To a lesser extent, one may observe some increased aquatic vegetation in the shallows near the inlet of Georges Brook although the near-shore phosphorus samples collected near Georges Brook (NLRA S20) were significantly lower than those documented in Hebron Marsh.

Periphyton (Attached Algae) Sampling

Choice of Periphyton Sampling Locations

Near-shore periphyton samples (Figures 12 & 13 and Appendix G) were positioned at seven sampling locations around the periphery of Newfound Lake (Table 7 and Figure 14) to provide a highly sensitive means to investigate Newfound Lake's productivity response to near-shore nutrient loading during the summer months. Unlike water column samples that represent a "snapshot" of the lake conditions, the periphyton samplers integrate the longer-term (two week to one month periods) over which attached algal growth responds to nutrient inputs and physical fluctuations such as temperature variations and light penetration. Many residents have expressed concerns that the amount of slimy coating one finds on rocks around the periphery of the lake has increased over time and the periphyton samplers provide a standardized method to quantify growth variations both spatially and temporally.

Figure 12. Periphyton Samplers pending deployment (June 16, 2008)

Figure 13. Periphyton Sampler deployed near Hemlock Brook (June 16, 2008)

Periphyton samplers were positioned near major tributary inlets that include the Cockermouth River, Fowler River, Georges Brook and Hemlock Brook while additional samplers were positioned in the more nutrient enriched Hebron Marsh as well as in a "reference" location along a predominantly forested shoreline, P-03 Beachwood (Table 7). The in-lake Cockermouth River, Fowler River and the Georges Brook samplers were vandalized during the study period and the results discussed in this report will be limited to the remaining sampling locations.

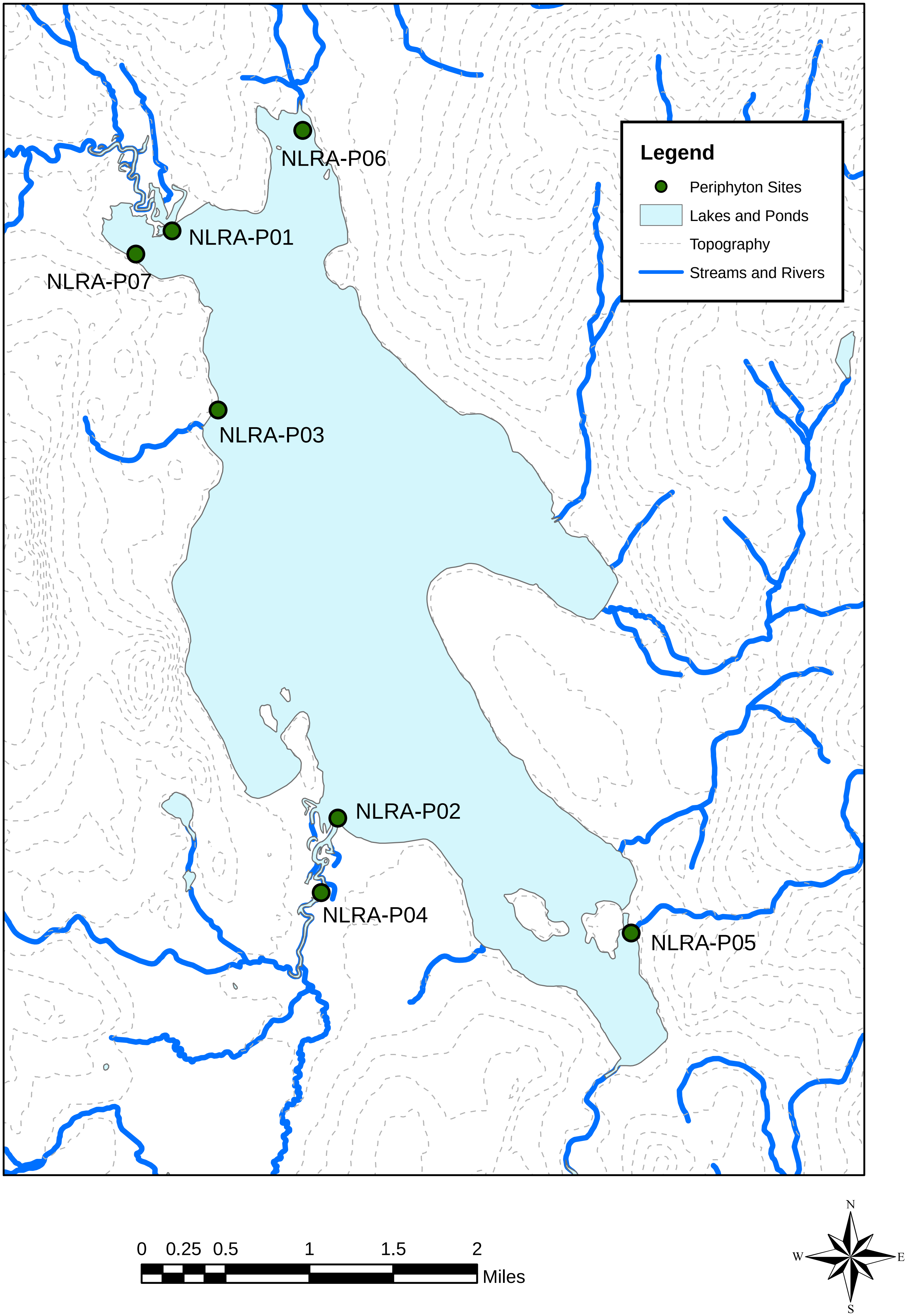
The functional (non-vandalized) periphyton samplers were initially deployed on June 12, 2008 (Site P-04 Fowler) and on June 16, 2008 (Sites P-03 Beachwood, P-05 Hebron and P-07 Hemlock) and were first sampled on July 22, 2008 following the formation of a natural biofilm and subsequent periphyton growth. Samplers were submersed to depths of approximately 4.5 feet

(P-04), 3.0 feet (P-05) and 4.5 feet (P-3 and P-07). Absolute sample depth varied based on lake level fluctuations that were characteristic of the summer months. A combination Onset temperature/light logger collected data at 15 minute increments that was used to determine the impact of light and temperature variation on the amount of periphyton growth.

Table 7. Near-shore Periphyton Sampling Locations and Sampling Rationale.

Site ID	Latitude dd:mm:ss	Longitude dd:mm:ss	Sampling site description / Rationale
NLRA-P01	43 41 24.6	71 47 31.6	Site located at the mouth of the Cockermouth River to assess the response to nutrient loading from the Cockermouth River sub-watershed. *Sampler vandalized.*
NLRA-P02	43 38 22.7	71 46 20.3	Site located at the mouth of the Fowler River to assess the response to nutrient loading from the Fowler River sub-watershed. *Sampler vandalized.*
NLRA-P03	43 40 29.1	71 47 11.8	Near-shore site north of the Beachwood development that is drained by a forested, near-reference, watershed.
NLRA-P04	43 37 59.6	71 46 27.4	Fowler River (approximately 1000 yards upstream) to document the difference in water quality in the embayed region, relative to the mouth of the River. The upstream sampling will help assess the potential for short-term nutrient loading during heavy storm events.
NLRA-P05	43 37 47.2	71 44 14.7	Site located near the mouth of Hemlock Brook to assess the response to nutrient loading from the Hemlock Brook sub-watershed.
NLRA-P06	43 41 55.8	71 46 35.7	Site located approximately 500 yards from the mouth of Georges Brook to assess the response to nutrient loading from the Georges Brook sub-watershed. The site is characterized by some macrophyte growth including patches of Sparganium. *Sampler vandalized.*
NLRA-P07	43 41 47.1	71 47 47.1	Site located in Hebron Marsh to document the periphyton response to the more nutrient enriched (relatively speaking) section of Newfound Lake. Hebron March is characterized by emergent vegetation and Eutricularia along the lake bottom.

Figure 14. Newfound Lake Periphyton Sites



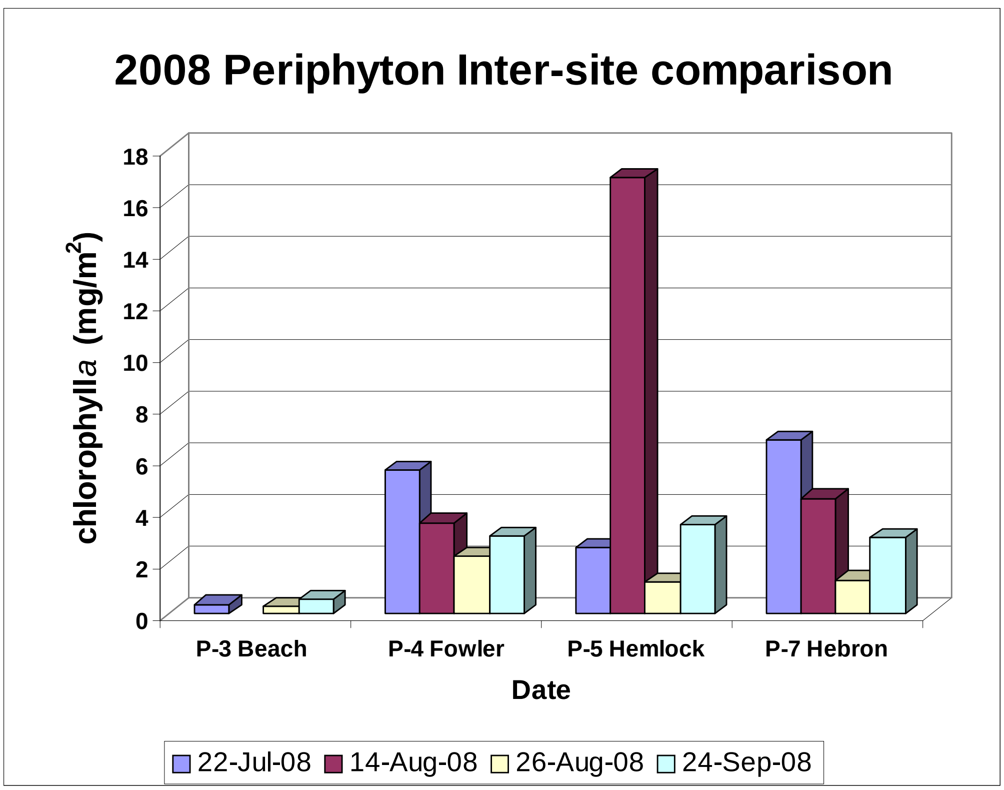
Periphyton Sampling Results

Periphyton Chloropyll *a*

Periphyton chlorophyll *a* was used to determine the amount of growth on each of the four intact periphyton samplers and the results are reported as milligrams per square meter (mg/m^2). The periphyton chlorophyll *a* results were obtained for July 22, 2008, August 14, 2008, August 26, 2008 and September 24, 2008 by scraping a known area of the periphyton sampler and retaining the growth for subsequent analysis. Appendix F provides images of the growth visually observed on each of the four samplers on the four sampling dates. Note: the P-03 Beachwood sampler was damaged and no data were collected for that site on August 14, 2008.

The P-03 Beachwood "reference" sampling site consistently exhibited the least amount of algal growth when compared to the other sampling sites (Figure 15). The site exhibiting the maximum amount of growth was variable among sampling dates with each of the Upper Fowler, P-04, Hemlock, P-05, and Hebron, P-07, exhibiting the maximum amount of growth on a given sampling date (Figure 15). The single greatest amount of periphyton growth was documented at site P-05 Hemlock on August 14, 2008 at which time the amount of periphyton growth reached 16.88 mg/m^2. The August 14 sampling date followed a period of intense rainfall and the Hemlock periphyton sampler included visible sediment depositional materials that were likely flushed into Newfound Lake during the high flow period.

Figure 15



Temperature

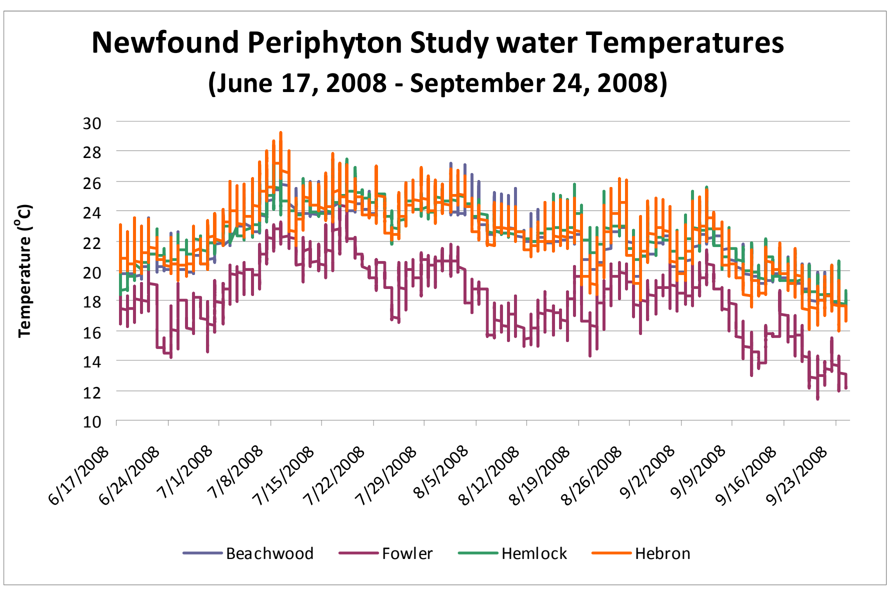
Water temperatures loggers attached to each of the periphyton samplers recorded temperature data at 15 minute increments. Water temperatures ranged from 11.4 ^{o}C to 29.3^{o}C between June 17 and September 24, 2008. The temperature measurements documented at Site P-04 Fowler were significantly lower than the temperature measurements documented at the remaining sampling stations, Sites P-03 Beachwood, P-05 Hebron and P-07 Hemlock (Figure 16). Median temperature values were calculated for each deployment period (i.e. the period during which the periphyton growth occurred) and the results indicated that the warmest temperature for a given sampling period varied among Sites P-3 Beachwood, P-5 Hebron and P-7 Hemlock which were all characterized by warm water relative to the P-3 Fowler River sampling station (Table 8).

Table 8: 2008 Peripyton Sampler Water Temperature Summary Statistics by Sampling Period: mean, (median), minimum and maximum

Sample Period	P-3 Beachwood	P-4 Fowler	P-5 Hebron	P-7 Hemlock
June 17 – July 22	22.9^{o}C (23.4^{o}C) (range: 19.5 – 28.3)	19.3^{o}C (19.5^{o}C) (range: 14.2 – 24.9)	23.1^{o}C (23.5^{o}C) (range: 18.4– 28.0)	23.3^{o}C (23.5^{o}C) (range: 19.4 – 29.3)
July 22 – Aug 14	-------	18.3 ^{o}C (18.4^{o}C) (range: 15.0 – 21.8)	23.7^{o}C (23.8^{o}C) (range: 21.7– 26.7)	23.7^{o}C (23.8^{o}C) (range: 20.9 – 27.0)
Aug 14 – Aug 26	22.2^{o}C (22.1^{o}C) (range: 19.9 – 25.4)	17.8^{o}C (17.9^{o}C) (range: 14.3 – 20.5)	22.9^{o}C (22.8^{o}C) (range: 21.0– 25.8)	22.3^{o}C (22.4^{o}C) (range: 18.4 – 26.2)
Aug 26 – Sept 24	20.5^{o}C (20.3^{o}C) (range: 17.6 – 25.2)	16.5^{o}C (16.5^{o}C) (range: 11.4 – 21.4)	20.7^{o}C (20.8^{o}C) (range: 17.7– 25.6)	20.5^{o}C (20.2^{o}C) (range: 16.0 – 25.4)

Note: P-3 Beachwood sampler not deployed between July 22 and July 31, 2008.

Figure 16.



Light

Light measurements, documented between June 17, 2008 and September 24, 2008, were collected to discern relative differences in light penetration among sampling locations (Table 9). The light measurements documented during the study period were most intense at Site P-3 Beachwood followed by Site P-5 Hebron while the measurements documented at P-7 Hemlock Brook and P-4 Fowler were less intense and were similar over the course of the study period (Table 9).

Table 9: 2008 Periphyton Sampler Light Intensity Summary Statistics

# reading in respective categories	Site P-3 Beachwood	Site P-4 Fowler	Site P-5 Hebron	Site P-7 Hemlock
> 1000 LUX	4385	4100	4299	4174
> 5000 LUX	2965	2417	2942	2607
> 10000 LUX	2112	1694	2040	1632
Median LUX	2411	1679	1970	1905
# Measurements	8621	8626	8625	8624

Note: the data summary data were collected at 15 minute intervals between June 17, 2008 (00:00 hr) and July 22, 2008 (10:15hr) and between August 1, 2008 (00:00 hr) and September 24, 2008 (10:00 hr). The P-3 Beachwood sampler was out of service between July 22 August 1, 2008. Samples logged during the periphyton sample collection period, when the sampler was out of the water, were selectively removed from the analysis. Thus, the minor discrepancy in sample size among sampling location.

Water Quality Summary

The "reference" Beachwood periphyton samples exhibited the least amount of algal growth even though the Beachwood periphyton sampler was exposed to some of the higher temperatures and higher light intensity that would favor increased periphyton growth. On the other hand, the lowest temperature and light intensity was documented at the Fowler River sampling site where the amount of periphyton growth was significantly higher than at the Beachwood site. The Hemlock and Hebron sampling stations exhibited, generally speaking, similar temperatures relative to the Beachwood site and light levels near or below that of the Beachwood site. Based purely on the physical, light and temperature data, one would expect the growth at both the Hemlock and Hebron sites to be near or below that of Beachwood. However, both Hemlock and Hebron were characterized by significantly more periphyton growth than was documented at the Beachwood Site.

The data suggest that localized and short-term and longer-term nutrient fluxes are impacting the periphyton growth at the Hemlock and Hebron sampling stations. The greatest amount of periphyton growth was documented at the Hemlock site (located approximately 75 feet from the Mouth of Hemlock Brook) on August 14, 2008 following a period of atypical rainfall and heavy watershed runoff. The growth response, documented at Hemlock Brook, suggests a significant amount of short-term nutrient loading stimulated the growth. Silt and coarser sand grains were also clearly visible on the Hemlock periphyton sampler that suggested an atypically heavy sediment load that was associated with the storm event. Interestingly, total phosphorus samples collected in Newfound Lake at or near the Hemlock site, during the study period of 2007 and 2008, were consistently low and near the concentrations documented at or near the Beachwood sampling site.

The results suggest that the Hemlock periphyton sampler growth responded to short-duration nutrient loading events that were not captured during standard ambient water quality sampling. Current and previous total phosphorus sampling at and near the Hebron (Hebron Marsh) and the Fowler (Fowler River) sampling sites have typically been higher that those documented at the Beachwood sampling site. Thus, the elevated periphyton growth at the latter sampling sites, relative to the Beachwood site, is not surprising.

Benthic (Bottom Sediment) Core Sampling

Choice of Benthic Core Sampling Stations

Benthic substrate composition can reflect sediment and organic matter loading from watershed sources and may be correlated to the ability of aquatic vascular plants, including nuisance exotic species such as variable water milfoil, to colonize locations around Newfound Lake. The benthos can serve as a nutrient sink and, under some conditions, a source of internal nutrient loading. The collection of benthic sediment samples and the characterization of the substrate composition was undertaken to provide a better understanding of the potential for future aquatic plant growth and to help ascertain whether particular areas of the lake are more susceptible to water quality problems, having been exposed to a greater degree of sediment and nutrient loading. Sediment cores were collected at 22 locations around the periphery of Newfound Lake and in the channels of the larger tributary inlets (Table 10 and Figure 17). The sampling locations collectively represent areas influenced by major tributary inlets, shallow marshy areas such as Hebron Marsh and locations distant from channelized nutrient runoff that are characterized by a forested shoreline (Table 10). Benthic sampling locations were positioned in close proximity to existing near-shore and tributary sampling sites where water chemistry and biology data were being collected.

Benthic Sampling Results

Benthic Phosphorus

Summer 2008 (July 29, August 14 and August 26) benthic phosphorus (dry weight) concentrations were highly variable among sampling sites and ranged from .010 grams phosphorus to Kilogram substrate (g/Kg) to 1.22 g/Kg. The lower phosphorus concentrations, such as those documented in a sandy Wellington Beach (Site NLRA-B22, 0.01 g/Kg) area and in the Fowler River south of West Shore Road (Site NLRA-B01, 0.015 g/Kg), were associated with sandier bottom substrates (Table 10 and Figure 18). On the other hand, finer benthic substrate composition typical of the Hebron Marsh sampling sites, that tended to be characterized by the highest phosphorus concentrations, ranged from 1.05 to 1.22 g/Kg (Table 10 and Figure 18).

Table 10: Benthic Core-sampling Locations

Site ID	Latitude dd:mm:ss	Longitude dd:mm:ss	Visual Assessment of Bottom Substrate Composition	Sampling Site Description
NLRA-B01	43 37 59.6	71 46 27.4	Predominantly sand	Site sampled in the Fowler River near the periphyton sampler located approximately 200 feet downstream of West Shore Road.
NLRA-B02	43 38 12.8	71 46 30.1	Predominantly sand	Site sampled in the Fowler River at the juntion of the marina and the Fowler River channel. Core collected in the center of the Fowler River channel.
NLRA-B03	43 38 23.3	71 46 21.0	Predominantly sand and some fine grained material	Site located in Newfound Lake approximately 100 feet from the river's mouth. Some scatter *Sparganium* in the immediate vicinity.
NLRA-B04	43 38 24.3	71 46 14.4	Predominantly sand	Site located approximately 500 feet from the mouth of the Fowler River southwest of the channel with the sand bar to the north.
NLRA-B05	43 37 44.1	71 45 17.2	Predominantly sand	Site located near the Black Brook tributary inlet.
NLRA-B06	43 37 47.7	71 44 14.4	Predominantly sand and fine grained material	Site located approximately 50 feet from the mouth of Hemlock Brook.
NLRA-B07	43 37 49.5	71 44 16.4	Predominantly sand and fine grained material	Site located approximately 100 feet from Hemlock Brook in an embayed area that has minimal Hemlock Brook influence.
NLRA-B08	43 37 46.1	71 44 31.2	Sand and fine grained material	Cove Site near NLRA-S11. Sample taken in a bed of Eriocolon.
NLRA-B09	43 37 51.6	71 44 49.6	Predominantly sand	Core collected at NLRA-S30 in the middle of a sandy beach.
NLRA-B10	43 39 27.8	71 44 16.5	Predominantly sand	Core collected in Dick Brown Brook immediately downstream of Route 3A.
NLRA-B11	43 39 28.6	71 44 27.4	Predominantly sand	Core collected at the mouth of Dick Brown Brook
NLRA-B12	43 39 54.6	71 44 48.9	Predominantly sand	Core collected at the mouth of Whittemore Brook approximately 50 feet from offshore of the tributary channel.
NLRA-B13	43 41 58.3	71 46 37.9	Predominantly sand with fine grained material	Core collected at Site NLRA-S20. Macrophytes, including *Sparganium*, were visible around the sampling site.
NLRA-B14	43 42 03.8	71 46 37.8	Fine grained material	Core collected at a more organic site in the Georges Brook channel between North Shore Road and Newfound Lake.
NLRA-B15	43 41 23.6	71 47 29.6	Predominantly sand	Core collected approximately 200 feet into Newfound Lake in the Cockermouth River Channel (between the navigation bouy markers).
NLRA-B16	43 41 28.0	71 47 33.5	Predominantly fine grained material	Core collected at the junction of the Cockermouth River and the Marina approximately 25 feet into the marina channel. Emergent and submergent vegetation characterized the sampling area.
NLRA-B17	43 41 31.2	71 47 37.4	Predominantly sand	Core collected in the Cockermouth River upstream of the intersection of the marina channel and the Cockermouth River channel.
NLRA-B18	43 41 39.9	71 47 47.2	Predominantly sand	Core collected at tributary site NLRA-S11 at North Shore Road.
NLRA-B19	43 41 17.5	71 47 50.0	Fine grained material	Core collected near the Hebron Marsh periphyton sampler (NLRA-P07) in the southern portion of the marsh. Emergent and submergent vegetation characterized the sampling area.
NLRA-B20	43 41 24.0	71 47 45.0	Fine grained material	Core collected in Hebron Marsh near the northern shoreline. Emergent and submergent aquatic vegetation characterized the sampling area.
NLRA-B21	43 37 51.6	71 44 49.6	Boulders, cobble and sand	Core collected in the vicinity of the Beachwood periphyton sampler and approximately 20-25 feet offshore.
NLRA-B22	43 38 29.4	71 46 53.7	Predominantly sand	Core collected in close proximity to the mouth of the Wellington Brook.

Figure 17. Newfound Lake Benthic Sites

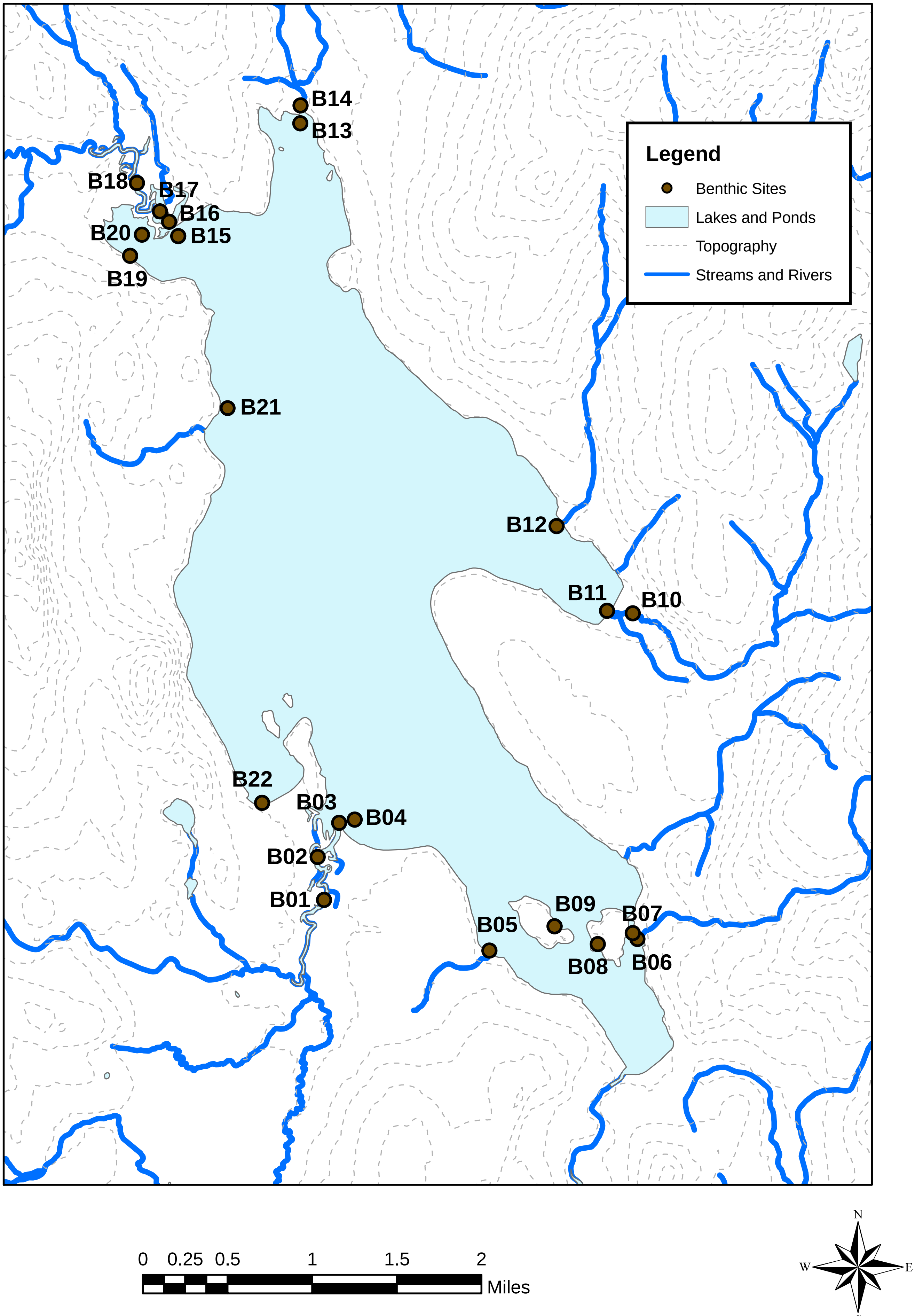
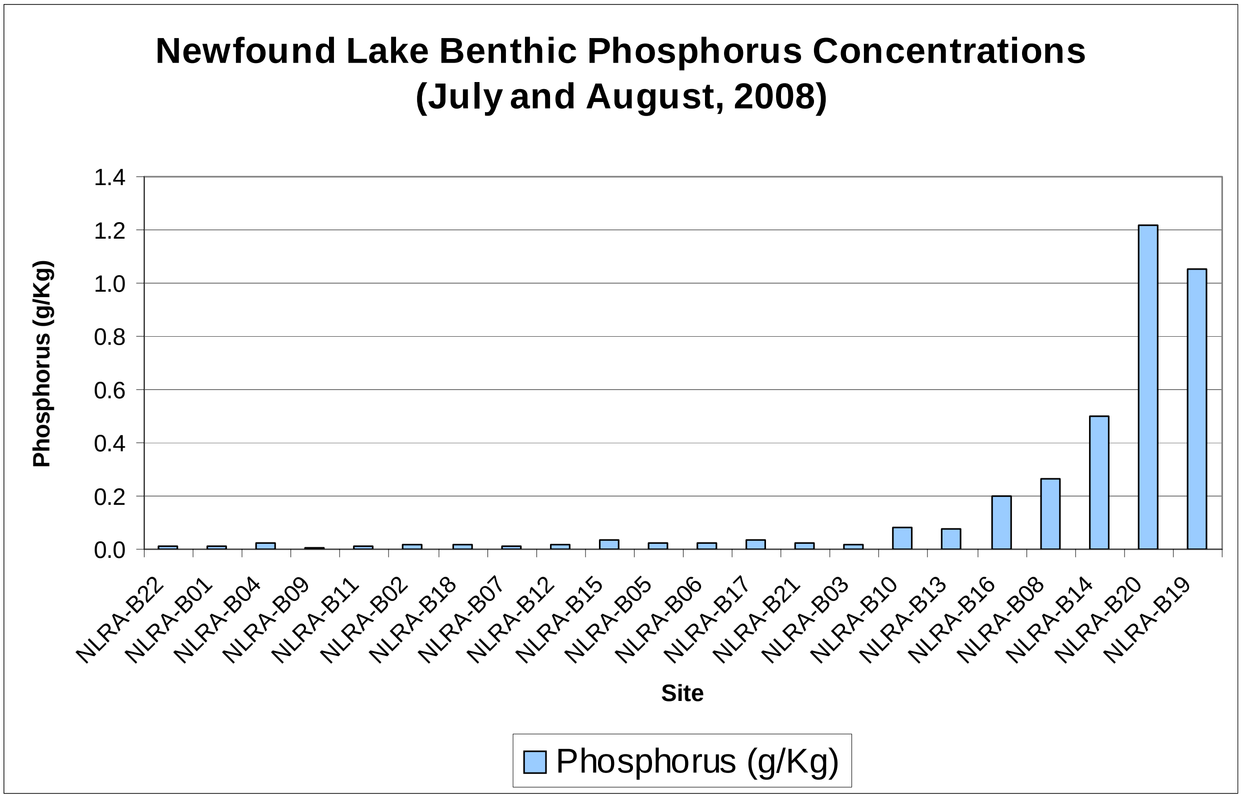


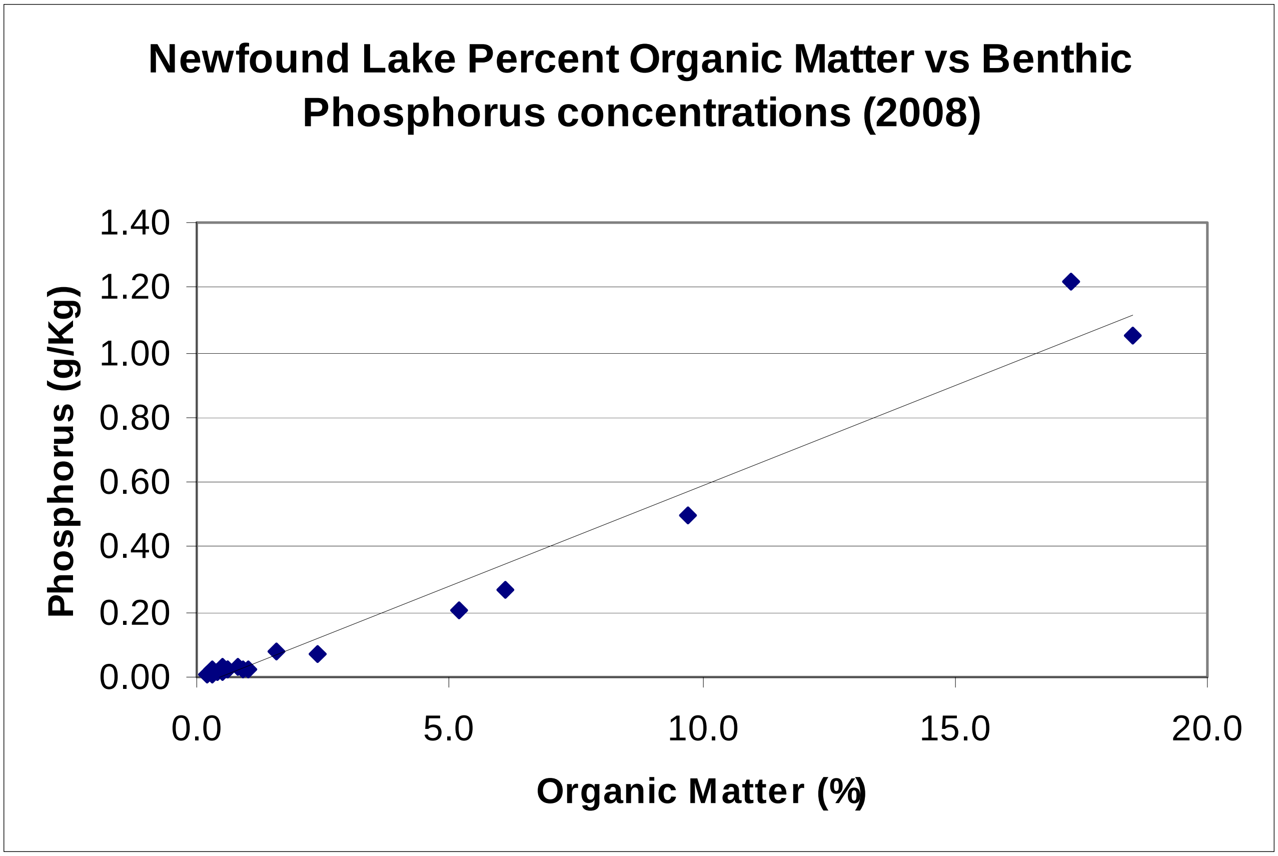
Figure 18



<u>Benthic Percent Organic Matter</u>

The composition of the benthic substrate was also highly variable in terms of the percent composition of organic matter. Organic matter collectively includes the decomposing and living debris that accumulates along the lake bottom including aquatic vascular plants, algal cells, twigs, leaves, decomposing animal remains, etc. The percent organic matter of the benthic substrate ranged from 0.2% to 18.5% among the twenty-two sampling sites. The organic composition of the benthic substrate tended to be lowest (<1%) in sandy shoreline areas and tended to be highest in the Hebron Marsh cove (17.3% - 18.5%). Based on visual observations, one tended to observe a decrease in the grain size of benthic materials as the percentage of organic matter increased. A simple relationship between the percent organic matter and benthic phosphorus concentration (Figure 19) indicates the pattern of increasing phosphorus contentration with increasing organic matter and, as was observed visually, with decreasing benthic grain size.

Figure 19



<u>Water Quality Summary</u>

The benthic sampling results, as indicated above, documented a clear correlation between the percent organic matter and the phosphorus content of the sediments. The more organic rich and phosphorus rich sediments were also the areas where aquatic vascular plants were sighted in greater abundance (i.e. B19 & B20 Hebron Marsh, B14 Georges Brook Channel and B16 Junction of Cockermouth River and Marina). The benthic sediment samples provide insight into the potential impacts of poorly planed development and land use activities in the uplands that could potentially destabilize the soils and result in additional sediment and the associated phosphorus loading. It is also worth noting that the finer soil particles, that tend to have the higher phosphorus content, are more likely to be displaced into the lake. Much like in the upland landscape, a host of aquatic plants take advantage of the finer and more organic sediments that are capable of supporting the colonization by both native and exotic aquatic plants.

Paired-watershed (Tributary Inlet) Study

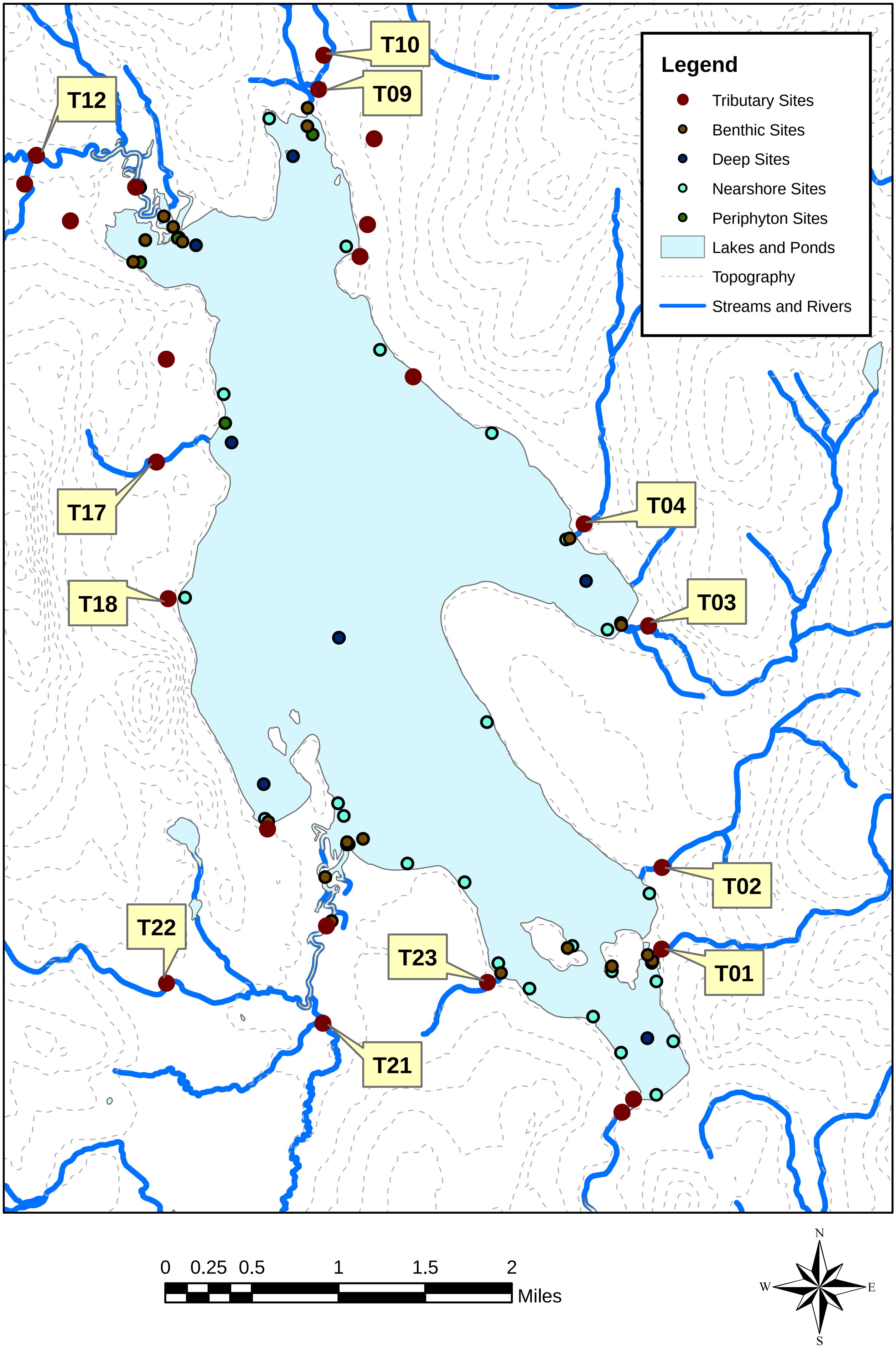
Choice of Paired-watershed Sampling Locations

Twelve stream sampling sites were selected for the paired-watershed sampling component of this study (Table 11 and Figure 20). The paired watershed approach involves sampling of both reference (minimally impaired) and impacted watersheds that that were selected based upon available land use data and previously collected water quality data (Craycraft and Schloss, 2008). The sites were selected from among twenty three stream inlet sites previously assessed during the Newfound Lake water/phosphorus budget (Craycraft and Schloss, 2008) and the selected streams represent a gradient of developed land use, 0.5 to 10.2%, based upon pre-existing geographical information system Thermatic Mapper land classification data (New Hampshire GRANIT, 2001). Some study streams were also selected based upon elevated specific conductivity (a surrogate for sodium and chloride runoff) values (Table 11). Rural communities, such as the Newfound Lake watershed community, can experience subtle water quality variations that are associated with differences in land use patterns. Knowledge of the relationships between land use and water quality interactions can be instrumental in helping local decision makers better understand the impacts of localized land use practices. The paired-watershed study expands upon the data collected as part of the Newfound Lake water/nutrient budget and includes the direct measurement of sodium and chloride (road salt constituents) concentrations and soluble reactive phosphorus concentrations which are readily available to stimulate algal plant growth. Nitrate and soluble reactive phosphorus concentrations were also measured to provide insight into potential variations in the application of local fertilizers, agricultural runoff and septic effluent. Total phosphorus, which includes both dissolved and particulate forms, was measured to track variations among watersheds and to provide additional insight into whether the phosphorus transported to the Newfound Stream network is in a dissolved or particulate form. Dissolved phosphorus may be an indication of septic effluent or excessive fertilizer application that are discharge into the surface waters while the total phosphorus can also be associated with periods of erosion that can transport nutrient laden soils into the Newfound tributaries and subsequently into Newfound Lake.

Table 11. Newfound Lake Study Streams.

Study Streams	Site ID	Location: Latitude Longitude	Sampling Location	Watershed Area (acres)	Developed (%)	Rationale for water quality monitoring and assessment
Hemlock Brook	NLRA T01	43°37’51.4” 71°44’09.3”	Junction of Sunset Drive and Route 3A.	894.5	0.7	Reference watershed located adjacent to the similarly sized Tilton Brook watershed.
Tilton Brook	NLRA T02	43°38’15.8” 71°44’09.1”	Near Junction of Route 3A & Whittemore Pt. Road South.	785.5	6.2	“degraded” watershed based on elevated conductivity
Dick Brown Brook	NLRA T03	43°39’28.4” 71°44’14.7”	Near Junction of Route 3A & Whittemore Pt. Road North.	2095.6	0.8	“degraded” watershed based on elevated conductivity
Whittemore Brook	NLRA T04	43°39’58.8” 71°44’41.8”	Near Junction of Route 3A, Paradise Road and Brook Road	2058.8	0.5	Reference watershed located adjacent to the similarly sized Dick Brown Brook watershed.
Cashman Brook	NLRA T09	43°42’09.3” 71°46’31.8”	At junction of Cooper Road and Stony Brook Road	230.2	2.0	“degraded” watershed based on elevated conductivity
Georges Brook	NLRA T10	43°42’19” 71°46’30”	At the junction of Cooper Road and Georges Brook	3031.9	1.4	Watershed fed by a large wetland complex..
Cockermouth River	NLRA T12	43°41’49.4” 71°48’28.8”	At the intersection of Braley Road and the Cockermouth River	16213.3	1.0	Extensively forested large watershed with scattered residential lots and fields.
Mason Brook	NLRA T17	43°40’17.7” 71°47’38.2”	At Camp Wicosutta off of West Shore Road	505.8	1.7	Predominantly forested watershed with a summer camp and grass field immediately upstream.
The Ledges	NLRA T18	43°39’36.1” 71°47’33.7”	At the Ledges condominium development off of West Shore Road	461.8	10.8	Predominantly forested watershed with a dense condominium development.
Bog Brook	NLRA T21	43°37’28.5” 71°46’29.0”	At the intersection of Fowler River Road and Bog Brook	7954.1	1.4	Watershed drained by an extensive wetland complex with scattered development
Fowler River	NLRA T22	43°37’41.0” 71°47’34.4”	As the Fowler River intersects Fowler River Road	12929.1	0.8	Extensively forested large watershed with scattered residential lots and cleared fields.
Black Brook	NLRA T23	43°37’40.2” 71°45’22.7”	Junction of Brown’s Beach Road & West Shore Road	581.7	7.2	“degraded” watershed with elevated conductivity and turbidity spikes.

Figure 20. Newfound Lake Paired Watershed Sites



Paired Watershed Sampling Results

Rainfall

Rainfall totals were reviewed from the National Climatic Data Center climatological sampling station, Alexandria 4, located within the Newfound Lake watershed (latitude: 43:38, longitude: 71:48, elevation: 1160.1 feet). Rainfall quantities can be correlated to periods of heavy runoff and concurrent periods of heavy sediment erosion and are thus important to the interpretation of water quality data. The five tributary sampling dates included dry periods, minimal rainfall periods and a period of heavy rainfall and runoff (Table 12). Daily rainfall totals are reported for a two day period that captures the precipitation documented immediately prior to and during the sampling event. Rainfall data were collected at 7:00 AM each day and thus the best indicator of rainfall could be obtained by a review of the two day rainfall totals since most samples were collected in the later morning through the mid-afternoon.

Table 12. Alexandria 4 Climatological Sampling Station daily rainfall totals

Date *	Rainfall (Inches)	Sampling Date / Comments
4/9/2008	0.00	The April 9, 2008 sampling date is representative of the spring runoff period. Deep snowpack, a foot or more, remained on the ground on April 9, 2008.
4/10/2008	0.00	
5/22/2008	0.03	The May 22, 2008 sampling date is representative of the spring base flow period that followed periods of heavy runoff during the months of March and April.
5/23/2008	0.00	
8/11/2008	0.52	The August 11, 2008 sampling date is representative of an intense storm event. The sampling was conducted as the storm subsided and stream discharge was cresting at Black Brook, Fowler River, Cockermouth River, the Ledges and Mason Brook.
8/12/2008	1.48	
8/18/2008	0.00	The August 18, 2008 sampling date is representative of a return to base flow conditions following the intense August 11, 2008 storm event.
8/19/2008	0.43	
10/21/2008	0.00	The October 21, 2008 sampling date is representative of base flow conditions. Samples were collected prior to the rainfall event.
10/22/2008	0.93	

* Water quality samples were collected on the dates denoted by the **bold font**.

Total Phosphorus

Total phosphorus concentrations were variable among sampling dates and among sampling locations. The highest total phosphorus concentrations were consistenly measured at the sampling locations on August 11, 2008 during a high flow sampling period and reached a maximum concentration of 308.1 micrograms per liter (*u*g/l) in the Fowler River (Appendix H). Total phosphorus concentrations were significantly lower during both baseflow periods and spring runoff periods (April 9, 2008).

Soluble Reactive Phosphorus

Soluble reactive phosphorus concentrations were low during the study period and ranged from < 1.0 to 4.4 micrograms per liter (*u*g/l). Most sites were characterized by the highest soluble reactive phosphorus concentrations during the August 11, 2008 stormwater runoff period.

Turbidity

Turbidity measurements were generally low and were generally below one nephlometric turbidity unit (NTU). The highest turbidity measurements were consistently documented on August 11, 2008 for the sampling locations and included a maximum turbidity of 33.6 NTU measured at the Cockermouth River (NLRA T12) sampling station (Appendix H).

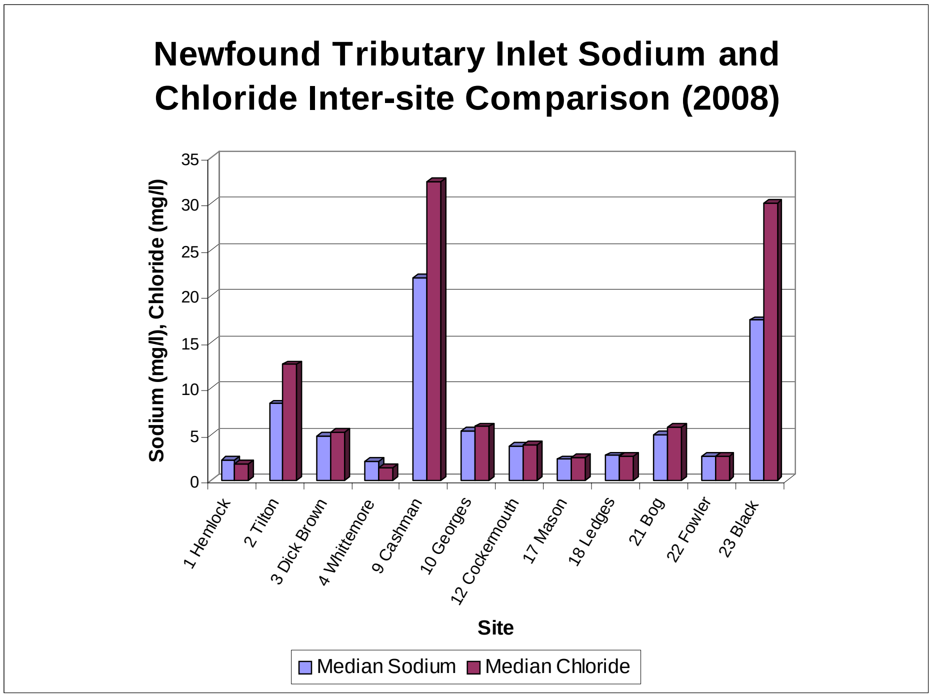
Discharge

Stream discharge volume was highest on August 11, 2008 and coincided with an intense period of rainfall the previous 24 hours. Discharge volumes were also elevated on April 9, 2008 and corresponded to a period of snow pack melt that recharged the tributary inlets (Appendix H). Discharge volumes were significantly lower during the dry sampling dates: May 22, August 18, 2008 and October 21, 2008 (Appendix H).

Sodium and Chloride

Sodium and chloride measurements were highly variable among sampling locations and among sampling dates (Appendix H). The median 2008 sodium and chloride concentrations documented in Cashman Brook and Black Brook were appreciably higher than values documented at the other sampling locations (Figure 21). An examination of similarly sized and adjacent watersheds indicated that the sodium and chloride concentrations in Dick Brown Brook and Tilton Brook were noticeably higher than levels documented in the less developed and adjacent Whittemore Brook and Hemlock Brooks (Table 11 and Figure 21). The sodium and chloride concentrations documented during the August 11, 2008 storm event were lowest at each of the sampling stations while sodium and chloride measurements documented during base flow (low flow) conditions in May tended to be appreciably higher.

Figure 21



Specific Conductivity

The specific conductivity results were highly correlated to the sodium and chloride concentrations (Figures 22 and 23) and followed the general pattern described for the

Figure 22

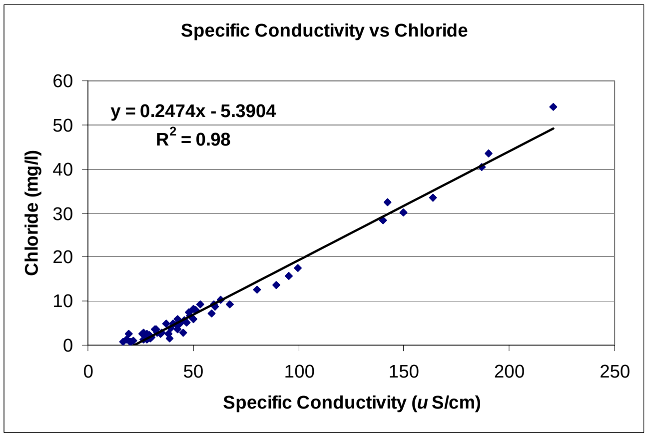
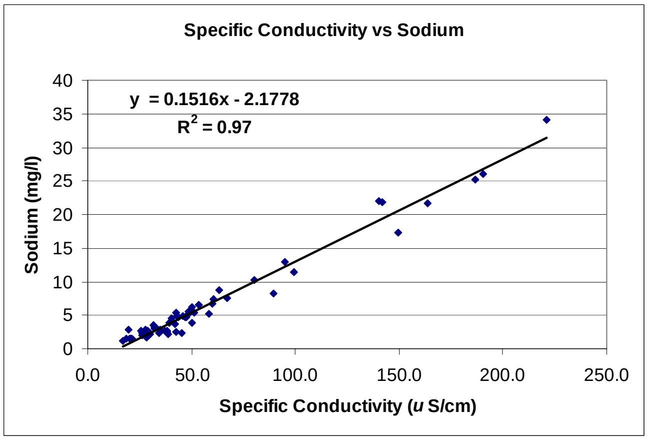


Figure 23

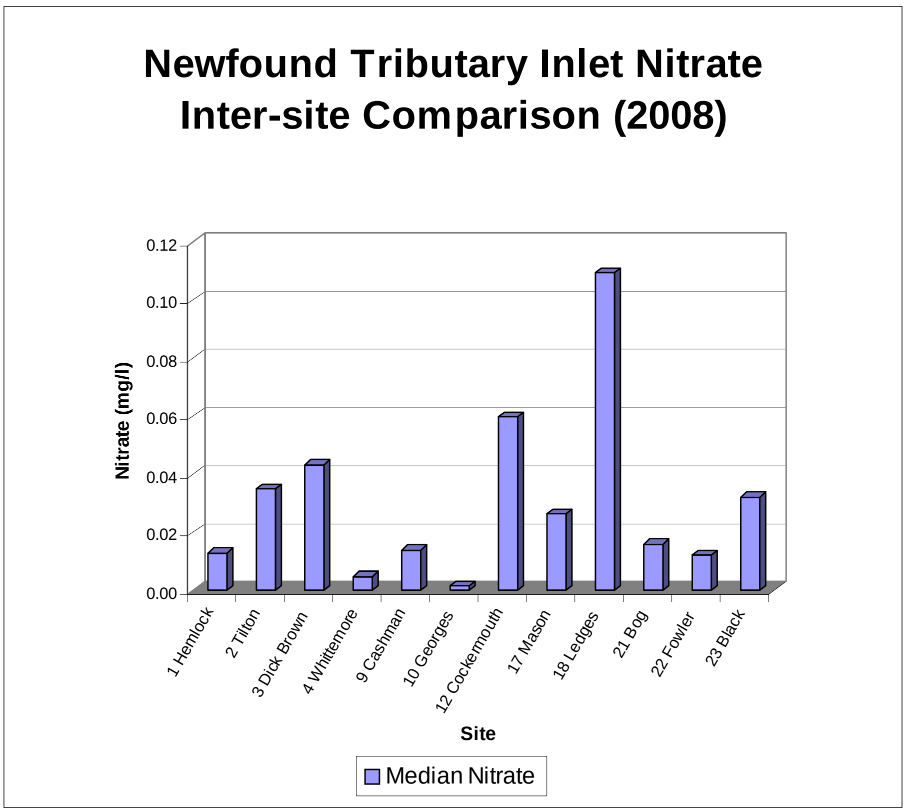


sodium and chloride data. The specific conductivity measurements exhibited a range of 16.7 micro-Siemans per centimeter (*u*S/cm) to 221.1 *u*S/cm during the study period.

Nitrate

To provide some general insight into the nitrate variation among sites, nitrate concentrations were compared and ranged from less than 0.03 milligrams per liter (mg/l) to 0.14 mg/l (Figure 24). Median nitrate concentrations were calculated for each sampling location and a comparison among sampling locations indicated that the highest median nitrate concentration occurred at the Ledges while the Cockermouth river also exhibited elevated nitrate concentrations. On the other hand, the median nitrate concentration documented at Georges Brook was the lowest documented among the sampling stations and was near detection limits. Nitrate concentrations documented at Tilton Brook and Dick Brown Brook were also higher than the corresponding values documented at the less developed, and adjacent, Hemlock Brook and Whittemore Brook watersheds.

Figure 24.



Water Quality Summary

While the Newfound Tributary water quality is generally excellent, storm event sampling during this study reaffirms the threat of phosphorus and sediment loading from upland sources. The August 11, 2008 sampling included turbidity and total phosphorus spikes that exceeded baseline levels by one to two orders of magnitude (Appendix H). Coupled with the high volume of water during the storm event sampling period, significant sediment and nutrient (phosphorus) entered the lake. The data suggest that the majority of the phosphorus entering Newfound Lake through the tributary network is in the form of particulate-bound phosphorus. Thus, measures that stabilize the uplands (i.e. retention of riparian buffers, minimizing impervious surfaces) will help minimize future water quality problems associated with runoff and nutrient loading.

The tributary inlets sampled during this study represent low density development patterns with the level of development ranging from 0.5 to 10.2 %. Sodium and chloride sampling conducted during the study period documented concentrations at the Cashman Brook, Black Brook, Tilton Brook and Dick Brown Brook that exceeded baseline levels. While this study did not identify a clear relationship between percent development and salt concentrations, Black Brook and Tilton Brook exhibit some of the higher levels of developed land in the watershed, 7.2 and 6.2% respectively, and they may be exhibiting the early signs of increased sodium and chloride loading associated with road salt applications. Research conducted through the University of New Hampshire Water Resource Research Center in the Lamprey River (coastal) watershed and the Ossipee River watershed has found a close relationship between percent road pavement or percent impervious surfaces as a predictor of spatial variation in both sodium and chloride (Daley et, al. submitted April 2009). Elevated sodium and chloride concentrations during base flow periods suggests that private well monitoring might be worth conducting in the future to quantify the salt concentrations in drinking water. Sampling of shallow wells may also provide soluble reactive phosphorus and nitrate information that will provide insight into nutrient loading associated with septic system effluent.

DETERMINING WATER QUALITY CHANGES AND TRENDS

Box and Whisker Plots

Quick Overview

A trend analysis for the L02 Mayhew and L03 Pasquaney sampling sites is included in this section using *box-and-whisker* plots that provide a visual representation of how the data are spread out and how much variation exists on an annual basis. The *box-and-whisker* plots also provide a summary of how your data have varied among years and a trendline has been inserted into the graphs to visualize the long-term water quality trend.

These plots illustrate how the data group together for a given year. The line in the "box" represents the sample median, the extent of the "box" represents a statistical range for comparison to another year, the "whiskers" show the boundaries of what could be considered the representative range of all the samples, and any points above or below the whiskers show atypical readings or "outliers" that represent an extreme condition or difference from that year's data range. An algae bloom event may cause this type of outlier to occur in the chlorophyll data (high point) or Secchi disk clarity (low point).

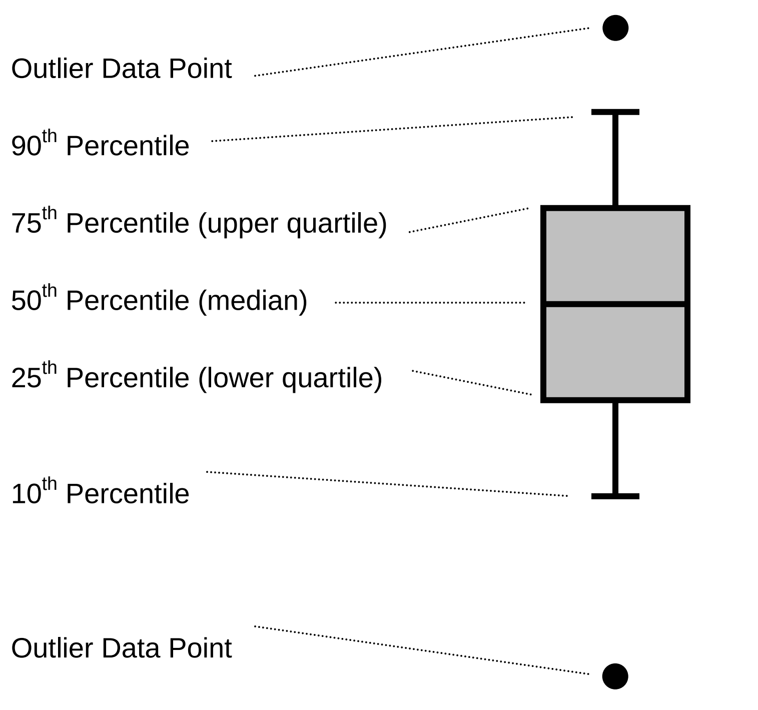
We recommend that each **NH LLMP** participating group plan on collecting weekly or biweekly measurements throughout the sampling season to ensure that enough data are available for this type of statistical analysis. We suggest that at least 8 data collections per year occur and generally set 10 measurements per year as a sampling effort goal per site.

The Details

In the sections below we further describe the use of the box and whisker plot for those that are interested on how they are determined and how they are interpreted:

The **box-and-whisker plot** is good at showing the **extreme values** and the range of middle values of your data (Figure 25). The box depicts the middle values of a variable, while the **whiskers** stretch to demonstrate the values between which 80% of the data points will fall. The filled circles then reflect the "outlier" data points that fall outside of the whiskers and reflect values that are atypically high or atypically low relative to the other data measured for a given year.

Figure 25. Sample Box and Whisker Plot



The box-and-whisker plots can be summarized as a graphic that displays the following important features of the data when they are arranged in order from least to greatest:

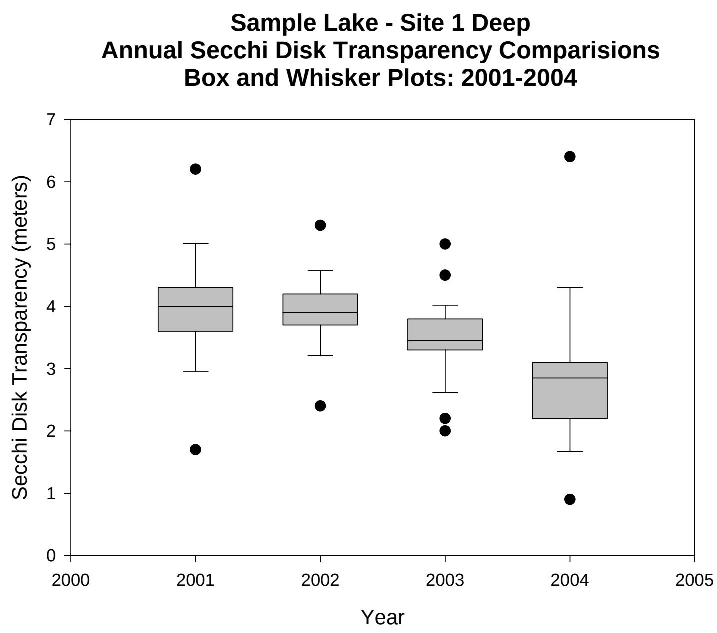
- Median (50th percentile) – the middle of the data
- Lower Quartile (25th percentile) – the point below which 25% of the data points are located.
- Upper Quartile (75th percentile) – the point below which 75% of the data points are located.
- 90th Percentile – the point below which 90% of the data points are located.
- 10th Percentile – the point below which 10% of the data points are located.
- Outlier Data points – data points that represent the upper 10% or the lowest 10% of the data collected for a specific year.

Note: A minimum number of data points is required to compute each feature documented above. At least three points are required to compute the Lower and the Upper Quartiles, five points are needed to compute the 10th percentile, and six points are needed to compute the 90th percentile. In the event that insufficient data points have been collected features will not be graphed due to the inability to reliably calculate the respective attribute.

Sample Box-and-Whisker Plot Interpretation

A sample *box-and-whisker* plot is depicted in Figure 26 and it provides an opportunity to assess the usefulness of this type of plot at interpreting water quality monitoring data. The imaginary data depicted in Figure 26 reflect the annual water transparency measurements between the years 2001 and 2004. As you can glean from Figure 26, the distribution of the water clarity measurements have shifted to less clear conditions between 2001 and 2004. The median values, as well as the upper and lower quartiles (what is represented by the gray shaded box) have gradually shifted to less clear conditions over the four year span. The data points that lie between the upper and lower quartiles reflect 50% of the data collected for a given year and can provide insight into whether or not the water quality data are varying significantly between or among years. In extreme cases, when the gray shaded regions do not overlap between successive years or among years, one can quickly determine that the data distribution is significantly different for those years where the middle data (gray shading) does not overlap. Such differences can reflect long-term trends or can be a reflection of extreme climatic conditions for a given year such as atypically wet or atypically dry conditions that can have a profound impact on water quality.

Figure 26.



Note: The number of outlier data points is dependant on the size of the dataset.

Additional evaluation of the data can include a review of the 10^{th} and the 90^{th} percentiles (the whiskers) that provide additional insight into the distribution of the data. In this case, the trends exhibited by the 10^{th} and the 90^{th} percentiles are following the pattern of decreasing Secchi Disk Transparency as is exhibited by boxes (gray shaded regions). Outlier data points that fall outside of the "whiskers" can also be insightful. Such extreme values can be an early indicator of coming trends or can be an early warning sign of potential water quality problems. For instance, when Secchi Disk transparency measurements occasionally become significantly reduced (i.e. shallower water) such phenomenon can be an indication of short-term water quality problems such as excessive sediment or an algal bloom. If such problems are not contended with, but are instead left unattended, the longer-term impact could result in an increase in the magnitude and frequency of the water transparency reductions that, in turn, would result in a decreasing trend as evidenced by a shift of the "Boxes" to shallower water transparencies. There might also be occasions when the Secchi Disk transparency outliers reflect atypically clear water clarity. Such outliers can be a sign that conditions are improving or, as is often the case, the water quality is responding to short-term climatic variations that can have a profound impact on the water quality data. For instance, the outlier data point of 6.4 meters that was documented in 2004 (Figure 26) is counter intuitive to the long term trend of decreasing water quality. Plausible explanations for such an anomaly could be due to short term overgrazing of algae by zooplankton (typical for moderate to highly productive lakes), an abrupt shift in climate that might have favored clearer water (cloudy days or cooler water) or perhaps there was some sort of human intervention, such as a fish stocking or lake treatment that would have resulted in clearer water claries.

Newfound Lake Long-term Trends

Newfound Lake Data

Water quality data have been collected annually at the L02 Mayhew and the L03 Pasquaney sampling sites since 1986 during which samples have been collected as early as May 22 and as late as October 21. The majority of the data have been collected between June 1 and September 15, among year, and the following trend analysis is based upon the June 1 – September 15 sampling period to ensure the results reflect variations among years rather than variations introduced by the timing of data collection. For instance, measurements collected in the spring and fall oftentimes differ appreciably from the summer samples. If the samples are not consistently collected during the same time period among years, the results might reflect the impact of seasonal water quality fluctuations that can mask the actual long-term trends. Samples have not been consistently collected prior to June or after September 15 in Newfound Lake. The long-term trend graphs are based on volunteer monitor data (1986-2008) and the 2007 and 2008 CFB data.

Newfound Secchi Disk Trends

The 23 year long-term Secchi Disk trend is stable for data collected at L02 Mayhew although significant variations are evident among years (Figure 27). On the other hand, the Secchi Disk transparency documented at L03 Pasquaney Bay (Figure 28) has decreased over the past 22 years (no data were collected in 1995). The Pasquaney Bay sampling site is located in a relatively isolated segment of Newfound Lake and may reflect localized land-use alterations along the shoreline or extending further into the watershed. Similar to the Mayhew Site, the Pasquaney Bay water quality has varied significantly among years. Such water transparency variations can be an indication of annual variations in rainfall that tend to have an impact on water quality. Many lakes experience less water clarity during heavy rainfall years relative to years with below average rainfall. Water transparency reductions during heavy rainfall years would tend to be exacerbated when land clearing and construction activities within the watershed do not follow proper erosion control practices and when development occurs on environmentally sensitive areas such as on steep slopes, immediately adjacent to Newfound Lake and adjacent to the stream inlets.

Figure 27.

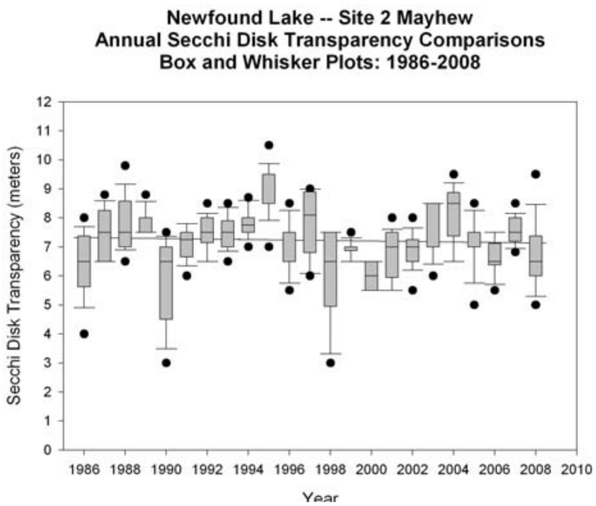
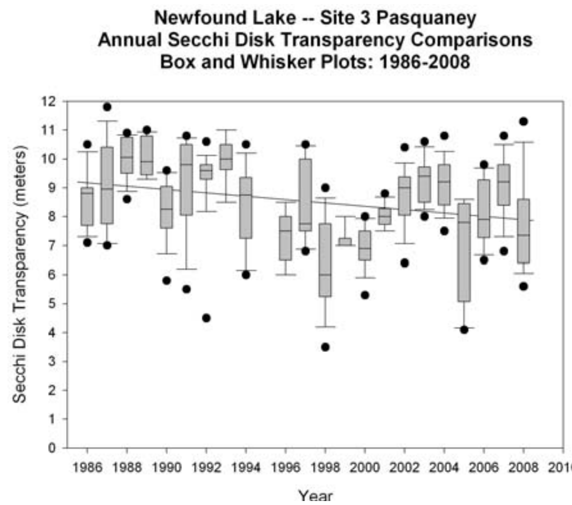


Figure 28.



<u>Newfound Lake Chlorophyll *a* Trends</u>

Sites L02 Mayhew and L03 Pasquaney both exhibit a gradual trend of increasing chlorophyll *a* concentrations over the 23 and 22 year periods, respectively (Figures 29 and 30). Similar to the annual Secchi Disk transparency graphs, the chlorophyll *a* graphs indicate a large degree of annual variation that may reflect fluctuations in rainfall among years, as well as, the influence of development that has the potential to increase the sediment and nutrient runoff into Newfound Lake.

Figure 29

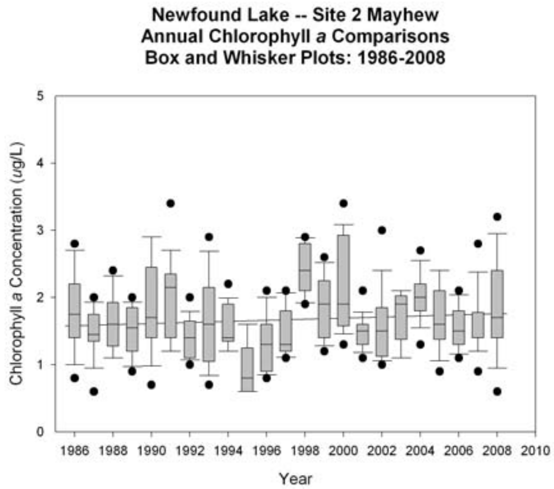
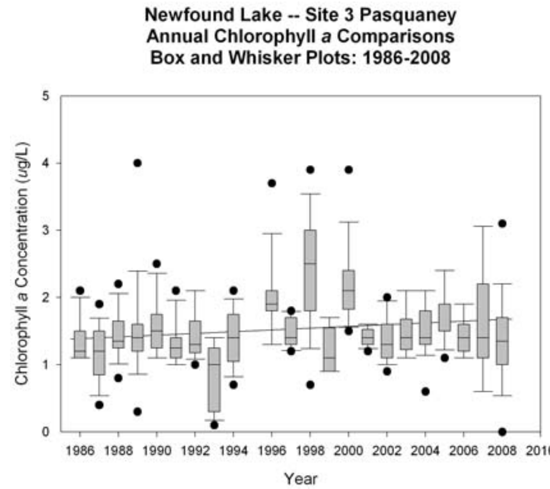


Figure 30



CONCLUSIONS AND RECOMMENDATIONS

Everyone in the watershed has a stake in Newfound Lake. Some enjoy the lake and tributaries directly by participating in recreational opportunities including swimming, boating and fishing while others benefit indirectly through increased revenues associated with tourism and an expanded tax base associated with waterfront property. This report highlights threats to the lake as well as action that can be taken by municipal officials and members of the public who are stewards of the lake and the surrounding uplands.

The overall condition of Newfound Lake, measured at open water deep sampling sites, is excellent and the lake is characterized by some of the clearer water in New Hampshire. However, upon closer examination, one will observe a gradient of clearer water north of Mayhew Island and less clear, greener and more nutrient enriched water south of Mayhew Island. Such variations in water quality can be naturally occurring but can also be a reflection of human activities. In the case of Newfound Lake, the more developed region is located south of Mayhew Island where the poorest (relatively speaking) water quality was documented.

Esherichia coli (E. coli)

Supplemental near-shore water quality sampling also documented localized water quality variations that were not evident from standard deep site sampling described above. Short-term *E. coli* bacteria spikes, an indicator of fecal contamination, were documented near the mouths of the Cockermouth and Fowler Rivers following periods of heavy rainfall. The larger stream inlets act as conduits that transport pollutants from the uplands into Newfound Lake and thus are areas where protective measures are warranted to maintain the high water quality. Sources of fecal contamination could be associated with natural wildlife activities near the stream channel or they may reflect fecal contamination from upland sources associated with septic effluent, livestock, pets, etc. While this study did not distinguish between the different sources, it is clear that poorly thought out land use alterations may have an adverse impact on the in-lake water quality through channelized and augmented watershed runoff.

Total Phosphorus

Total phosphorus (nutrient) concentrations were generally low around the lake periphery but did include periodic spikes near the major tributary inlets (Cockermouth and Fowler Rivers). Total phosphorus concentrations were also elevated at the Hebron Marsh sites and reflect a higher level of localized lake productivity. The Hebron Marsh is at a later stage of lake aging (eutrophication) relative to the remainder of Newfound Lake and is characterized by greater accumulations of organic matter along the lake bottom and elevated macroscopic plant growth. While Hebron Marsh represents a natural progression from a young to an older water body it is a reminder that shallow areas in Newfound Lake, particularly around the periphery of the lake, are susceptible to localized water quality degradation.

Periphyton (Attatched Algae)

Artificial substrate samplers reaffirm that Newfound Lake is susceptible to localized nutrient inputs and is characterized by water quality variations reflecting land cover and land use around the periphery of the lake. These periphyton substrate samplers integrate the longer-term impacts of nutrient runoff (2 week – 4 week periods) that can be overlooked when more typical "snapshot" water quality sampling is undertaken at a particular day and time. For instance, a reference sampling station located along a forested shoreline (P-3 Beachwood) was consistently characterized by less algal growth (a response to less nutrient loading) than the corresponding sampling location located near the Hemlock Brook (P-5) tributary inlet (Figures 31 and 32 and Appendix F).

Sediments

Sediment (benthic) core samples collected along the Newfound Lake bottom varied among sampling locations and exhibited a gradient of increasing phosphorus content as the sediments became more organic. It was also noted that aquatic plant growth tended to be more abundant in areas characterized by more organic and finer sediment relative to areas characterized by coarser grained material (i.e. sand) that is also low in phosphorus. The relationship between phosphorus content and organic matter should be a reminder of the threats associated with erosion of upland soils, both adjacent to the lake and that extend miles away, which can be channelized into the lake through its tributaries. The finer, nutrient laden organic sediments tend to settle out around the lake perimeter and favor the colonization of the shallows by aquatic plants. The loss of upland soils reduces soil fertility which has long-term implications related to agricultural and forest productivity in the watershed.

Figure 31. Site P-3 Beachwood (September 24, 2008)

Figure 32. Site P-5 Hemlock (September 24, 2008)

The greatest amount of tributary phosphorus loading documented among five sampling dates in 2008 occurred during an intense rainfall event on August 11. Such short-term nutrient loading events may be associated with increased periphyton growth, discussed above, around the periphery of Newfound Lake. The total phosphorus and turbidity spikes during high flow periods are a reminder that stormwater management and proper erosion control measures are important to protecting both the in-stream (tributary) and lake water quality. Consideration should be given to both short-term (during construction) and permanent stormwater management options that are capable of attenuating sediment, phosphorus and other pollutants before they discharge into the streams and subsequently into Newfound Lake.

Road Salt

Road salt constituents, sodium and chloride, were elevated above baseline levels in both Cashman Brook and Black Brook, suggesting anthropogenic (human) impacts. Data collected in the adjacent streams of the similarly sized Hemlock Brook and Tilton Brook watersheds, as well as the adjacent streams of the similarly sized Dick Brown Brook and Whittemore Brook watersheds, revealed differences in sodium and chloride concentrations. Interestingly, a recent analysis of data through the University of New Hampshire Water Resource Research Center has found a close relationship between percent road pavement and both sodium and chloride (Daley et, al. in Prep). Thus, it is possible that some variation in salt concentrations are associated with the quantity of paved surfaces in the stream catchments that receive road salt applications during the winter months. The United States Environmental Protection Agency (EPA) has set a chronic chloride threshold of 230 milligrams per liter (mg/l) for aquatic life impacts. While the current study did not include private well water sampling it is worth noting that the EPA recognizes the threat of sodium to patients with hypertension and requires public water suppliers to report sodium levels above 20 mg/l so physicians can advise patients with hypertension. Data collected through this study found a close correlation between both sodium and chloride and field specific conductivity measurements. Future specific conductivity measurements might serve as a low cost surrogate for documenting variations in salt concentrations among sampling locations both spatially and temporally.

Based on data collected as part of this study and data collected through the previous Newfound Lake water/phosphorus budget (Craycraft and Schloss, 2008), developmental pressures continue to pose a threat to our New Hampshire lakes and may coincide with degraded water quality. The Towns of Alexandria, Bristol, Bridgewater, Danbury, Dorchester, Groton, Hebron, Plymouth and Orange might consider proactively adopting zoning and regulations that foster natural resource conservation and that concurrently minimize water quality degradation.

Some General Considerations Include:

Steep Slopes create increased runoff water velocities, which cause increased sediment (and concurrent phosphorus) mobilization. Shoreline areas, such as the area near Follansbee Cove, are characterized by steep sloped terrain while the Newfound Lake watershed is comprised of an extensive network of feeder streams that are largely characterized by relatively steep-sloped sub-watersheds highly susceptible to perturbation. Future land use management efforts should be directed towards maximizing riparian (shoreline) vegetation, which will reduce the water velocity and will both physically (i.e. filter) and chemically (i.e. plant uptake) remove nutrients. Slopes of 15% and greater compose 56.2% of the Newfound Lake watershed and characterize the headwaters of most tributary inlets (Craycraft and Schloss, 2008). Steep sloped regions should be carefully managed to preserve vegetation and prevent soil erosion.

Riparian (shoreside) Buffers provide many natural functions that include the protection of water quality and the preservation and enhancement of in-stream and in-lake fishery and wildlife habitat. The New Hampshire Comprehensive Shoreland Protection Act (CSPA) regulates land clearing, development and fertilization activities within a 250 foot jurisdictional area adjacent to Newfound Lake and Spectacle Pond, as well as, specified segments of the Cockermouth and Fowler Rivers. The CSPA should be consulted prior to removing any shoreside vegetation within 250 feet of the aforementioned water bodies. However, most of the steep sloped regions are not regulated by the CSPA and thus it falls upon local municipalities and landowners to minimize unintended environmental impacts in steep-sloped terrain.

When construction is undertaken, riparian cover should be maintained and diverted stormwater runoff should be directed towards vegetated regions where water will infiltrate the ground and minimize water quality impacts. Foresight should also be given to ensure that any implemented Best Management Practices (BMPs) are properly designed for the site-specific conditions and that a long-term maintenance plan, that includes regular inspections and corrective actions (when necessary), is followed.

Impervious Surfaces such as roads, driveways, houses and out-buildings tend to concentrate, and accelerate overland waterflow, and thus increase the potential for sediment and phosphorus loading. Roads, homes and other structures cover the soil with impenetrable materials that reduce the natural infiltration and purification of water. Instead, the water often flows directly to the lake and tributaries as channelized and/or sheet runoff which can carry with it a significant phosphorus and sediment load. Homeowners should consider implementing erosion control measures including check dams, plunge pools, water bars and vegetated buffers that will attenuate stormwater runoff from impervious surfaces. Any existing pipes and culverts that bring concentrated flow directly to the shore should be daylighted and the water diverted or infiltrated. An inspection and long-term maintenance plan is a critical component of ensuring the long-term effectiveness of all erosion control measures. Again, the CSPA contains regulations that are in effect within 250 feet of the shorelines of Newfound Lake and the lower reaches of the Cockermouth and the Fowler Rivers.

Town officials should consider adopting a strategy to minimize water quality impacts associated with road construction. As the population grows, the road network will likely be improved. Improvements to existing roads and construction of new roads requires implementation of proper erosion control measures to minimize the adverse impacts to surface water and to minimize the expenses associated with long-term road maintenance. Drainage systems that were adequate for rough and semi-pervious gravel roads will not be able to handle the increased velocities and water volumes of paved roads; many more water turnouts and diversions will be required when roads are paved. The size of culverts may need to be increased to carry heavier storm flows. Road runoff should never go directly into the lake or any tributary but instead should be directed to a vegetated area that can reduce the velocity and increase infiltration.

Wetland Complexes are found within the Newfound watershed and include extensive wetland complexes in the Georges Brook and in the Bog Brook sub-watersheds. Wetland systems play a large role in mitigating flow and shunting nutrients but can also be highly susceptible to perturbation. Care needs to be taken when roads and driveways are improved so they do not interrupt these networks nor create excessive water loadings or sedimentation into these systems that can greatly reduce the wetland functionality as well as destroy critical wildlife habitat.

Septic System effluent is laden with phosphorus and is thought to constitute a significant portion of the phosphorus reaching many of our New Hampshire lakes. Aging septic systems, along with the conversion of homes from seasonal to year round use (which increases the annual load), often exacerbate the problems. While the scope of this study did not measure the impacts of septic systems bordering the lake shore and the tributaries, direct measurements of groundwater seepage in Mendums Pond (Schloss et al., 2009) identified septic systems as one of the major phosphorus sources that occur during the dry summer months. For the Newfound watershed, any marginal systems will continue to pose a threat due to the well to excessively-drained soils around the lake and the close proximity of lakeshore homes to the lake. Septic systems have been shown to contribute a significant phosphorus load to Flint Pond (Hollis) where a combination of sandy soils, aging septic systems and conversions from seasonal to year round use existed. Even a well functioning septic system can contribute significant phosphorus load to the lake (Conner and Bowser, 1997). Thus, residents within the Newfound Lake watershed might consider installing low volume fixtures to limit the water used and thus reduce the phosphorus load. Local building codes could be amended to incorporate water-conserving appliances and fixtures. The NLRA might consider working with interested Towns to facilitate a timely septic tank inspection and pumping schedule that will facilitate a bulk-rate discount for watershed residents.

Stream Bank Undercutting and Destabilization (Watershed-wide Erosion Concerns) The Newfound watershed, as previously discussed, is characterized by steep slopes that accelerate water flow and in extreme cases scour substrate materials such as cobble and boulders during high flow periods. Evidence of extensive bank undercutting was observed in numerous tributaries (Figures 33 - 35). The figures also reflect the stabilizing capacity of the riparian vegetation and root systems that are prevalent along most stream channels. Some might consider the root systems as natural "re-bar" that effectively stabilizes the shoreline and minimizes erosion into our New Hampshire streams and lakes. As previously discussed, the majority of the Newfound Lake watershed is forested and includes extensive riparian vegetation along the tributary network. Future conservation efforts should foster the retention of riparian vegetation and, when possible, the reestablishment of riparian vegetation in regions where it has been removed. Riparian cover not only minimizes the phosphorus and sediment loading into surface waters but it also enhances fishery habitat and provides travel corridors for wildlife species.

Figure 33. Whittemore Brook bank undercutting
(August 30, 2007)

The following pages contain some more generic recommendations for maintaining healthy lakes that can be copied and distributed to watershed residents to let them know what can be done to protect their valued water resources.

Figure 34. Cockermouth River (Site 12 Cockermouth)
bank undercutting (Photographed August 17, 2007)

Figure 35. Fowler River (Site 22 Fowler)
bank undercutting (Photographed August 17, 2007)

Recommendations for Healthy Lakeshore and Streamside Living

- Encourage shoreside vegetation and protect wetlands - shoreside vegetation (what is also known as **riparian vegetation**) and wetlands provide a protective buffer that "traps" pollutants before reaching the lake. These buffers remove materials both chemically (through biological uptake) and physically (settling materials out). As riparian buffers are removed and wetlands lost, pollutant materials are more likely to enter the lake and in turn, favor declining water quality. Shoreline vegetation grown tall will also discourage geese and shade the water reducing the possibility of aquatic weed recruitment.

- Limit fertilizer applications - fertilizers entering the lake can stimulate aquatic plant and algal growth and in extreme cases result in noxious algal blooms. Increases in algal growth tend to diminish water transparency and under extreme cases culminate in surface "scums" that can wash up on the shoreline and can also produce unpleasant smells as the material decomposes. Excessive nutrient concentrations also favor algal forms known to produce toxins which irritate the skin and under extreme conditions, are dangerous when ingested. Use low maintenance grasses such as fescues that require less nutrients and water to grow. After a lawn is established a single application of fertilizer in the late fall is generally more than adequate to maintain a healthy growth. Oftentimes a simple pH adjustment will do more good and release nutrients already in the soils.

- Limit organic matter loading - organic matter (leaves, grass clippings, etc.) are a major source of nutrients in the aquatic environment. As the vegetative matter decomposes nutrients are "freed up" and can become available for aquatic plant and algal growth. In general, we are not concerned with this material entering the lake naturally (leaf senescence in the fall) but rather excessive loading of this material as occurs when residents dump or rake leaf litter and grass clippings into the lake. This material not only provides large nutrient reserves which can stimulate aquatic plant and algal growth but also makes great habitat for leaches and other potentially undesirable organisms in swimming areas.

- Limit the loss of vegetative cover and the creation of impervious surfaces - A forested watershed offers the best protection against pollutant runoff. Trees and tall vegetation intercept heavy rains that can erode soils and surface materials. The roots of these plants keep the soils in place, process nutrients and absorb moisture so the soils do not wash out. Impervious surfaces (paved roads, parking lots, building roofs, etc.) reduce the water's capacity to infiltrate into the ground, and in turn, go through nature's water purification system. As water seeps into the soil, pollutants are removed from the runoff through absorption onto soil particles. Biological processes detoxify substances and/or immobilize substances. Surface water runoff over impervious surfaces also increases water velocities which favor the transport of a greater load of suspended and dissolved pollutants into your lake.

- Discourage the feeding ducks and geese – ducks and geese that are locally fed tend to concentrate around the known food source and can result in localized water quality problems. Waterfowl quickly process food into nutrients that are capable of stimulate microscopic plant "algal" growth. Ducks and Geese are also host to the parasite responsible for swimmers itch. While not a health threat, swimmers itch is very uncomfortable.

- Maintain Septic Systems - faulty septic systems are a big concern as they can be a primary source of water pollution around our lakes in the summer. Septic systems are loaded with nutrients and can also be a health threat when not functioning properly. Inspect your system on a timely basis and pump out the septic tank every three to five years depending on tank capacity and household water use.

Note: Consult materials such as those listed below, for further guidance on assessing and implementing corrective actions that can maintain or improve the quality of surface and subsurface (septic) runoff that may otherwise impact water quality.

- Pipeline: Summer 2008 Vol. 19, No. 1. Septic Systems and Source Water Protection: Homeowners can help improved community water quality. http://www.nesc.wvu.edu/pdf/WW/publications/pipline/PL_SU08.pdf
- Landscaping at the Water's Edge: an Ecological Approach. $20.00/ea University of New Hampshire Cooperative Extension Publications Center, Nesmith Hall, 131 Main Street, Durham NH 03824. www.extension.unh.edu/publications
- Integrated Landscaping: Following Nature's Lead. $20.00/ea University of New Hampshire Cooperative Extension Publications Center, Nesmith Hall, 131 Main Street, Durham NH 03824 www.extension.unh.edu/publications
- New Hampshire Department of Environmental Services fact sheet series (all topics) http://des.nh.gov/organization/commissioner/pip/factsheets/index.htm

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New Hampshire Department of Environmental Services. December 2008. New Hampshire Stormwater Manual Volume 3: Erosion and Sediment Controls During Construction. http://des.nh.gov/organization/divisions/water/stormwater/manual.htm

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Schloss, Jeffrey A., Robert C. Craycraft and Susan E. Wilderman. 2009. Final Report: Nutrient and Water Budget Mendums Pond Watershed Assessment. February 2009. UNH Center for Freshwater Biology, UNH Cooperative Extension. University of New Hampshire. Durham, NH. CFB Report # 2009-2-001.

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Start Time (hh:mm)	Finish Time (hh:mm)	Stratum	pH (std units)	Carbon Dioxide (mg/l)	Carbon Dioxide (replicate) (mg/l)	Alkalinity gray end pt. @ pH 5.1 (mg/l)	Alkalinity gray end pt. @ pH 5.1 (replicate) (mg/l)
1 Deep	7/23/2007	0.5	9:18	10:13	epilimnion	-----	1.1	-----	3.8	-----
1 Deep	7/23/2007	3.5	9:18	10:13	epilimnion	-----	-----	-----	-----	-----
1 Deep	7/23/2007	9.5	9:18	10:13	metalimnion	-----	1.0	-----	3.5	-----
1 Deep	7/23/2007	28.0	9:18	10:13	hypolimnion	-----	3.2	3.7	3.2	3.4
1 Deep	7/23/2007	0-7.0	9:18	10:13	epilimnion (composite "hose" sample)	-----	-----	-----	3.8	-----
1 Deep	8/13/2007	0.5	9:35	10:15	epilimnion	-----	1.0	-----	2.7	-----
1 Deep	8/13/2007	4.0	9:35	10:15	epilimnion	-----	1.1	-----	2.1	-----
1 Deep	8/13/2007	8.5	9:35	10:15	metalimnion	-----	0.9	-----	2.1	-----
1 Deep	8/13/2007	29.0	9:35	10:15	hypolimnion	-----	3.5	3.4	1.6	-----
1 Deep	8/13/2007	0-7.0	9:35	10:15	epilimnion (composite "hose" sample)	-----	-----	-----	2.0	-----
1 Deep	9/17/2007	0.5	9:40	10:30	epilimnion	-----	0.9	-----	3.4	-----
1 Deep	9/17/2007	6.0	9:40	10:30	epilimnion	-----	0.9	-----	3.4	-----
1 Deep	9/17/2007	13.5	9:40	10:30	metalimnion	-----	2.2	-----	2.9	-----
1 Deep	9/17/2007	29.0	9:40	10:30	hypolimnion	-----	3.2	-----	3.1	-----
1 Deep	9/17/2007	0-8.0	9:40	10:30	epilimnion (composite "hose" sample)	-----	-----	-----	3.0	-----
2 Mayhew	7/23/2007	0.5	14:16	14:55	epilimnion	-----	1.3	-----	3.8	-----
2 Mayhew	7/23/2007	3.5	14:16	14:55	epilimnion	-----	1.1	-----	3.5	-----
2 Mayhew	7/23/2007	7.0	14:16	14:55	metalimnion	-----	1.4	-----	-----	-----
2 Mayhew	7/23/2007	12.0	14:16	14:55	hypolimnion	-----	6.8	7.2	3.6	3.7
2 Mayhew	7/23/2007	0-6.0	14:16	14:55	epilimnion (composite "hose" sample)	-----	-----	-----	-----	-----
2 Mayhew	8/13/2007	0.5	17:55	18:20	epilimnion	-----	0.7	-----	2.2	-----
2 Mayhew	8/13/2007	3.0	17:55	18:20	epilimnion	-----	1.3	-----	2.3	-----
2 Mayhew	8/13/2007	8.5	17:55	18:20	metalimnion	-----	0.6	-----	2.4	-----
2 Mayhew	8/13/2007	15.5	17:55	18:20	hypolimnion	-----	11.3	-----	3.2	-----
2 Mayhew	8/13/2007	0-6	17:55	18:20	epilimnion (composite "hose" sample)	-----	-----	-----	2.7	-----
2 Mayhew	9/17/2007	0.5	14:30	15:00	epilimnion	-----	1.0	-----	3.3	-----
2 Mayhew	9/17/2007	5.0	14:30	15:00	epilimnion	-----	0.9	-----	3.4	-----
2 Mayhew	9/17/2007	11.0	14:30	15:00	metalimnion	-----	8.3	-----	4.3	-----
2 Mayhew	9/17/2007	14.5	14:30	15:00	hypolimnion	-----	12.6	12.2	5.0	-----
2 Mayhew	9/17/2007	0-8.0	14:30	15:00	epilimnion (composite "hose" sample)	-----	-----	-----	3.5	-----
3 Pasquaney	7/23/2007	0.5	13:13	13:53	epilimnion	-----	1.1	-----	3.5	-----
3 Pasquaney	7/23/2007	3.0	13:13	13:53	epilimnion	-----	1.0	-----	3.7	-----
3 Pasquaney	7/23/2007	6.5	13:13	13:53	metalimnion	-----	1.1	-----	3.3	-----
3 Pasquaney	7/23/2007	13.0	13:13	13:53	hypolimnion	-----	1.1	1.3	3.4	3.6
3 Pasquaney	7/23/2007	0-4.5	13:13	13:53	epilimnion (composite "hose" sample)	-----	-----	-----	3.8	-----
3 Pasquaney	8/13/2007	0.5	10:35	11:10	epilimnion	-----	0.7	-----	3.0	-----
3 Pasquaney	8/13/2007	4.0	10:35	11:10	epilimnion	-----	< 0.5	-----	3.1	-----
3 Pasquaney	8/13/2007	8.5	10:35	11:10	metalimnion	-----	0.6	-----	2.7	-----

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Site	Date	Depth (meters)	Start Time (hh:mm)	Finish Time (hh:mm)	Stratum	pH (std units)	Carbon Dioxide (mg/l)	Carbon Dioxide (replicate) (mg/l)	Alkalinity gray end pt. @ pH 5.1 (mg/l)	Alkalinity gray end pt. @ pH 5.1 (replicate) (mg/l)
3 Pasquaney	8/13/2007	12.3	10:35	11:10	hypolimnion	-----	0.7	-----	2.5	-----
3 Pasquaney	8/13/2007	0-7.0	10:35	11:10	epilimnion (composite "hose" sample)	-----	-----	-----	3.0	-----
3 Pasquaney	9/17/2007	0.5	13:30	13:50	epilimnion	-----	0.9	-----	3.3	-----
3 Pasquaney	9/17/2007	5.0	13:30	13:50	epilimnion	-----	1.0	-----	3.4	-----
3 Pasquaney	9/17/2007	12.0	13:30	13:50	hypolimnion	-----	1.0	-----	3.3	-----
3 Pasquaney	9/17/2007	0-8.0	13:30	13:50	epilimnion (composite "hose" sample)	-----	-----	-----	3.3	-----
4 Loon Island	7/23/2007	0.5	12:35	12:57	epilimnion	-----	1.1	-----	3.6	-----
4 Loon Island	7/23/2007	0-5.5	12:35	12:57	epilimnion (composite "hose" sample)	-----	-----	-----	3.4	-----
4 Loon Island	8/13/2007	0.5	15:25	15:55	epilimnion	-----	0.6	-----	2.8	-----
4 Loon Island	8/13/2007	3.0	15:25	15:55	epilimnion	-----	0.6	-----	2.5	-----
4 Loon Island	8/13/2007	5.5	15:25	15:55	metalimnion	-----	0.6	-----	2.6	-----
4 Loon Island	8/13/2007	0-6.0	15:25	15:55	epilimnion (composite "hose" sample)	-----	-----	-----	2.5	-----
4 Loon Island	9/17/2007	0.5	13:05	13:20	epilimnion	-----	1.2	-----	3.4	-----
4 Loon Island	9/17/2007	0-8.0	13:05	13:20	epilimnion (composite "hose" sample)	-----	-----	-----	3.3	-----
5 Cockermouth	7/23/2007	0.5	11:57	12:25	epilimnion	-----	1.1	-----	3.7	-----
5 Cockermouth	7/23/2007	0-6.0	11:57	12:25	epilimnion (composite "hose" sample)	-----	-----	-----	3.4	-----
5 Cockermouth	8/13/2007	0.5	14:20	15:15	epilimnion	-----	0.9	-----	4.0	-----
5 Cockermouth	8/13/2007	3.0	14:20	15:15	epilimnion	-----	0.8	-----	2.0	-----
5 Cockermouth	8/13/2007	9.0	14:20	15:15	metalimnion	-----	0.7	-----	3.0	-----
5 Cockermouth	8/13/2007	19.0	14:20	15:15	hypolimnion	-----	3.1	3.2	2.3	2.6
5 Cockermouth	8/13/2007	0-6.0	14:20	15:15	epilimnion (composite "hose" sample)	-----	-----	-----	3.0	-----
5 Cockermouth	9/17/2007	0.5	12:25	12:45	epilimnion	-----	0.9	-----	3.3	-----
5 Cockermouth	9/17/2007	5.0	12:25	12:45	epilimnion	-----	1.0	-----	3.3	-----
5 Cockermouth	9/17/2007	14.5	12:25	12:45	hypolimnion	-----	3.0	-----	3.2	-----
5 Cockermouth	9/17/2007	0-8.0	12:25	12:45	epilimnion (composite "hose" sample)	-----	-----	-----	3.3	-----
6 Beachwood	7/23/2007	0.5	11:10	11:47	epilimnion	-----	0.9	-----	3.7	-----
6 Beachwood	7/23/2007	9.0	11:10	11:47	metalimnion	-----	1.1	-----	3.6	-----
6 Beachwood	7/23/2007	15.5	11:10	11:47	hypolimnion	-----	2.8	-----	3.5	-----
6 Beachwood	7/23/2007	0-8.0	11:10	11:47	epilimnion (composite "hose" sample)	-----	-----	-----	3.6	-----
6 Beachwood	8/13/2007	0.5	16:10	16:40	epilimnion	-----	0.7	-----	2.6	-----
6 Beachwood	8/13/2007	3.0	16:10	16:40	epilimnion	-----	0.7	-----	2.7	-----
6 Beachwood	8/13/2007	8.0	16:10	16:40	metalimnion	-----	0.7	-----	3.1	-----
6 Beachwood	8/13/2007	16.5	16:10	16:40	hypolimnion	-----	1.0	-----	2.8	2.9
6 Beachwood	8/13/2007	0-6.0	16:10	16:40	epilimnion (composite "hose" sample)	-----	-----	-----	2.6	-----
6 Beachwood	9/17/2007	0.5	11:45	12:10	epilimnion	-----	0.8	-----	3.3	-----
6 Beachwood	9/17/2007	6.0	11:45	12:10	epilimnion	-----	0.7	-----	3.3	-----
6 Beachwood	9/17/2007	13.0	11:45	12:10	metalimnion	-----	1.4	-----	3.4	3.1
6 Beachwood	9/17/2007	14.5	11:45	12:10	hypolimnion	-----	2.5	-----	3.1	-----

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Site	Date	Depth (meters)	Start Time (hh:mm)	Finish Time (hh:mm)	Stratum	pH (std units)	Carbon Dioxide (mg/l)	Carbon Dioxide (replicate) (mg/l)	Alkalinity gray end pt. @ pH 5.1 (mg/l)	Alkalinity gray end pt. @ pH 5.1 (replicate) (mg/l)
6 Beachwood	9/17/2007	0-8.0	11:45	12:10	epilimnion (composite "hose" sample)	-----	-----	-----	3.3	-----
7 Fowler	7/23/2007	0.5	15:31	15:33	epilimnion	-----	-----	-----	-----	-----
7 Fowler	8/13/2007	0.5	17:40	17:41	epilimnion	-----	-----	-----	2.7	-----
8 Follensbee	7/23/2007	0.5	10:20	10:55	epilimnion	-----	0.9	-----	3.6	-----
8 Follensbee	7/23/2007	8.0	10:20	10:55	metalimnion	-----	1.1	-----	3.4	-----
8 Follensbee	7/23/2007	13.0	10:20	10:55	hypolimnion	-----	2.9	-----	3.3	-----
8 Follensbee	7/23/2007	0-6.5	10:20	10:55	epilimnion (composite "hose" sample)	-----	-----	-----	4.1	-----
8 Follensbee	8/13/2007	0.5	17:00	17:30	epilimnion	-----	0.7	-----	2.6	-----
8 Follensbee	8/13/2007	4.0	17:00	17:30	epilimnion	-----	1.1	-----	2.8	-----
8 Follensbee	8/13/2007	9.5	17:00	17:30	metalimnion	-----	0.9	-----	2.6	-----
8 Follensbee	8/13/2007	12.5	17:00	17:30	hypolimnion	-----	1.6	-----	2.2	-----
8 Follensbee	8/13/2007	0-7.5	17:00	17:30	epilimnion (composite "hose" sample)	-----	-----	-----	3.2	-----
8 Follensbee	9/17/2007	0.5	11:00	11:31	epilimnion	-----	0.9	-----	3.4	3.4
8 Follensbee	9/17/2007	6.0	11:00	11:31	epilimnion	-----	0.7	-----	3.2	-----
8 Follensbee	9/17/2007	13.5	11:00	11:31	hypolimnion	-----	2.0	-----	3.3	-----
8 Follensbee	9/17/2007	0-8.0	11:00	11:31	epilimnion (composite "hose" sample)	-----	-----	-----	3.3	-----
1 Deep	6/11/2008	0.5	12:30	13:29	epilimnion	------	------	-----	-----	-----
1 Deep	6/11/2008	4.5	12:30	13:29	metalimnion	------	------	-----	-----	-----
1 Deep	6/11/2008	30.0	12:30	13:29	hypolimnion	------	------	-----	-----	-----
1 Deep	6/11/2008	0-3.0	12:30	13:29	epilimnion (composite "hose" sample)	------	------	-----	-----	-----
2 Mayhew	6/11/2008	0.5	10:30	11:45	epilimnion	------	------	-----	-----	-----
2 Mayhew	6/11/2008	1.5	10:30	11:45	epilimnion	------	------	-----	-----	-----
2 Mayhew	6/11/2008	4.5	10:30	11:45	metalimnion	------	------	-----	-----	-----
2 Mayhew	6/11/2008	13.5	10:30	11:45	hypolimnion	------	------	-----	-----	-----
2 Mayhew	6/11/2008	0-3.0	10:30	11:45	epilimnion (composite "hose" sample)	------	------	-----	-----	-----
1 Deep	7/2/2008	0.5	10:48	11:36	epilimnion	------	1.5	1.2	2.9	3.1
1 Deep	7/2/2008	7.0	10:48	11:36	metalimnion	------	1.2	1.3	3.0	-----
1 Deep	7/2/2008	30.0	10:48	11:36	hypolimnion	------	3.9	3.5	2.9	3.0
1 Deep	7/2/2008	0-4.0	10:48	11:36	epilimnion (composite "hose" sample)	------	------	-----	3.0	-----
2 Mayhew	7/2/2008	0.5	9:45	10:28	epilimnion	------	1.1	-----	3.1	-----
2 Mayhew	7/2/2008	5.5	9:45	10:28	metalimnion	------	1.4	1.2	3.0	3.2
2 Mayhew	7/2/2008	13.0	9:45	10:28	hypolimnion	------	4.4	4.9	2.9	3.0
2 Mayhew	7/2/2008	0-3.5	9:45	10:28	epilimnion (composite "hose" sample)	------	------	-----	3.6	-----
3 Pasquaney	7/2/2008	0.5	11:50	12:24	epilimnion	------	1.2	-----	2.9	-----
3 Pasquaney	7/2/2008	7.5	11:50	12:24	metalimnion	------	1.5	1.6	2.7	3.2
3 Pasquaney	7/2/2008	13.5	11:50	12:24	hypolimnion	------	3.2	3.2	3.0	3.0
3 Pasquaney	7/2/2008	0-4.0	11:50	12:24	epilimnion (composite "hose" sample)	------	------	-----	2.9	-----
4 Loon Reef	7/2/2008	0.5	12:42	13:11	epilimnion	------	1.0	-----	3.2	-----

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Start Time (hh:mm)	Finish Time (hh:mm)	Stratum	pH (std units)	Carbon Dioxide (mg/l)	Carbon Dioxide (replicate) (mg/l)	Alkalinity gray end pt. @ pH 5.1 (mg/l)	Alkalinity gray end pt. @ pH 5.1 (replicate) (mg/l)
4 Loon Reef	7/2/2008	5.5	12:42	13:11	metalimnion	------	1.3	1.4	3.1	3.2
4 Loon Reef	7/2/2008	8.0	12:42	13:11	hypolimnion	------	1.8	1.9	3.1	3.1
4 Loon Reef	7/2/2008	0-3.5	12:42	13:11	epilimnion (composite "hose" sample)	------	------	-----	3.2	-----
5 Cockermouth	7/2/2008	0.5	13:25	14:10	epilimnion	------	1.1	-----	3.0	-----
5 Cockermouth	7/2/2008	6.0	13:25	14:10	metalimnion	------	2.0	1.9	3.4	3.2
5 Cockermouth	7/2/2008	17.5	13:25	14:10	hypolimnion	------	3.6	3.4	2.4	3.0
5 Cockermouth	7/2/2008	0-3.0	13:25	14:10	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
6 Beachwood	7/2/2008	0.5	14:32	15:00	epilimnion	------	1.0	-----	3.5	-----
6 Beachwood	7/2/2008	6.0	14:32	15:00	metalimnion	------	2.1	1.8	2.8	3.0
6 Beachwood	7/2/2008	16.5	14:32	15:00	hypolimnion	------	4.1	-----	2.9	-----
6 Beachwood	7/2/2008	0-3.0	14:32	15:00	epilimnion (composite "hose" sample)	------	------	-----	2.9	-----
1 Deep	8/5/2008	0.5	10:50	11:19	epilimnion	7.2	0.5	-----	3.2	-----
1 Deep	8/5/2008	8.5	10:50	11:19	metalimnion	7.1	1.0	-----	3.3	-----
1 Deep	8/5/2008	30.0	10:50	11:19	hypolimnion	6.4	2.5	-----	3.0	-----
1 Deep	8/5/2008	0-5.0	10:50	11:19	epilimnion (composite "hose" sample)	------	------	-----	3.4	-----
2 Mayhew	8/5/2008	0.5	10:00	10:31	epilimnion	7.1	0.5	-----	3.4	-----
2 Mayhew	8/5/2008	3.0	10:00	10:31	epilimnion	------	0.7	-----	3.3	-----
2 Mayhew	8/5/2008	8.5	10:00	10:31	metalimnion	6.5	3.5	-----	3.5	-----
2 Mayhew	8/5/2008	12.0	10:00	10:31	hypolimnion	6.2	6.0	-----	3.5	-----
2 Mayhew	8/5/2008	0-5.0	10:00	10:31	epilimnion (composite "hose" sample)	------	------	-----	3.2	-----
3 Pasquaney	8/5/2008	0.5	14:38	14:59	epilimnion	7.2	0.7	-----	3.0	-----
3 Pasquaney	8/5/2008	8.5	14:38	14:59	metalimnion	6.9	0.8	-----	3.3	-----
3 Pasquaney	8/5/2008	14.8	14:38	14:59	hypolimnion	5.5	3.9	-----	3.0	-----
3 Pasquaney	8/5/2008	0-6.5	14:38	14:59	epilimnion (composite "hose" sample)	------	------	-----	2.8	-----
4 Loon Reef	8/5/2008	0.5	13:47	14:17	epilimnion	7.1	0.7	-----	3.2	-----
4 Loon Reef	8/5/2008	6.8	13:47	14:17	epilimnion	6.9	0.8	1.0	3.4	3.3
4 Loon Reef	8/5/2008	0-7.0	13:47	14:17	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
5 Cockermouth	8/5/2008	0.5	13:12	13:37	epilimnion	------	0.6	-----	3.1	-----
5 Cockermouth	8/5/2008	9.0	13:12	13:37	metalimnion	6.8	1.1	-----	3.3	-----
5 Cockermouth	8/5/2008	15.0	13:12	13:37	hypolimnion	6.5	2.0	-----	3.0	-----
5 Cockermouth	8/5/2008	0-7.0	13:12	13:37	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
6 Beachwood	8/5/2008	0.5	12:09	12:33	epilimnion	7.2	1.1	-----	3.4	-----
6 Beachwood	8/5/2008	9.0	12:09	12:33	metalimnion	6.8	1.2	-----	3.2	-----
6 Beachwood	8/5/2008	13.8	12:09	12:33	hypolimnion	6.6	2.3	-----	3.1	-----
6 Beachwood	8/5/2008	0-7.0	12:09	12:33	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
8 Fallansbee	8/5/2008	0.5	11:28	11:55	epilimnion	7.1	0.8	-----	3.7	-----
8 Fallansbee	8/5/2008	8.5	11:28	11:55	metalimnion	6.9	1.1	-----	3.5	-----
8 Fallansbee	8/5/2008	14.0	11:28	11:55	hypolimnion	6.5	2.5	-----	3.5	-----

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Start Time (hh:mm)	Finish Time (hh:mm)	Stratum	pH (std units)	Carbon Dioxide (mg/l)	Carbon Dioxide (replicate) (mg/l)	Alkalinity gray end pt. @ pH 5.1 (mg/l)	Alkalinity gray end pt. @ pH 5.1 (replicate) (mg/l)
8 Fallansbee	8/5/2008	0-5.0	11:28	11:55	epilimnion (composite "hose" sample)	------	------	-----	4.0	-----
1 Deep	9/11/2008	0.5	12:08	13:16	epilimnion	6.8	1.2	-----	3.4	-----
1 Deep	9/11/2008	4.0	12:08	13:16	epilimnion	6.8	1.2	1.2	3.5	3.5
1 Deep	9/11/2008	11.0	12:08	13:16	metalimnion	6.7	2.6	-----	3.1	-----
1 Deep	9/11/2008	29.0	12:08	13:16	hypolimnion	6.3	4.1	3.8	3.2	-----
1 Deep	9/11/2008	0-9.0	12:08	13:16	epilimnion (composite "hose" sample)	------	------	-----	3.1	-----
2 Mayhew	9/11/2008	0.5	10:30	11:32	epilimnion	6.7	1.6	-----	3.5	-----
2 Mayhew	9/11/2008	3.0	10:30	11:32	epilimnion	6.7	1.5	-----	3.4	3.3
2 Mayhew	9/11/2008	9.0	10:30	11:32	metalimnion	6.7	1.4	-----	3.3	-----
2 Mayhew	9/11/2008	16.5	10:30	11:32	hypolimnion	6.0	13.0	-----	5.0	-----
2 Mayhew	9/11/2008	0-7.0	10:30	11:32	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
3 Pasquaney	9/11/2008	13.0	14:51	15:27	hypolimnion	6.4	2.8	-----	3.2	-----
3 Pasquaney	9/11/2008	0-9.0	14:51	15:27	epilimnion (composite "hose" sample)	------	------	-----	4.6	-----
5 Cockermouth	9/11/2008	0.5	13:33	14:32	epilimnion	6.8	1.1	-----	3.3	-----
5 Cockermouth	9/11/2008	5.0	13:33	14:32	epilimnion	6.9	1.1	-----	3.3	-----
5 Cockermouth	9/11/2008	11.0	13:33	14:32	metalimnion	6.6	2.3	-----	3.1	-----
5 Cockermouth	9/11/2008	19.0	13:33	14:32	hypolimnion	6.3	4.4	-----	3.5	-----
5 Cockermouth	9/11/2008	0-9.0	13:33	14:32	epilimnion (composite "hose" sample)	------	------	-----	3.8	-----
1 Deep	9/25/2008	13.0	13:35	14:32	metalimnion	6.5	4.7	-----	2.9	-----
1 Deep	9/25/2008	29.0	13:35	14:32	hypolimnion	6.2	5.4	-----	2.8	-----
1 Deep	9/25/2008	0-8.0	13:35	14:32	epilimnion (composite "hose" sample)	------	------	-----	3.0	-----
2 Mayhew	9/25/2008	0.5	12:13	13:06	epilimnion	7.1	1.1	-----	3.3	-----
2 Mayhew	9/25/2008	12.0	12:13	13:06	metalimnion	6.2	13.2	-----	4.1	-----
2 Mayhew	9/25/2008	15.0	12:13	13:06	hypolimnion	6.1	16.2	-----	4.8	-----
2 Mayhew	9/25/2008	0-8.0	12:13	13:06	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----
3 Pasquaney	9/25/2008	12.0	15:59	16:43	metalimnion	6.5	3.7	-----	3.1	-----
3 Pasquaney	9/25/2008	13.5	15:59	16:43	hypolimnion	6.2	4.5	4.7	3.2	3.1
3 Pasquaney	9/25/2008	0-8.0	15:59	16:43	epilimnion (composite "hose" sample)	------	------	-----	3.2	-----
5 Cockermouth	9/25/2008	12.0	14:48	15:44	metalimnion	6.6	2.2	-----	3.1	-----
5 Cockermouth	9/25/2008	14.5	14:48	15:44	hypolimnion	6.5	3.5	-----	3.0	-----
5 Cockermouth	9/25/2008	0-8.0	14:48	15:44	epilimnion (composite "hose" sample)	------	------	-----	3.3	-----

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Alkalinity pink end pt. @ pH 4.6 (mg/l)	Alkalinity pink end pt. @ pH 4.6 (replicate) (mg/l)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Turbidity (NTU)	Turbidity (replicate) (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Chlorophyll *a* (*u* g/l)
1 Deep	7/23/2007	0.5	4.5	-----	-----	-----	0.5	0.6	-----	-----	1.6
1 Deep	7/23/2007	3.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
1 Deep	7/23/2007	9.5	4.4	-----	3.1	-----	0.5	0.5	-----	-----	3.2
1 Deep	7/23/2007	28.0	4.1	4.2	2.7	-----	0.5	0.4	-----	-----	-----
1 Deep	7/23/2007	0-7.0	4.5	-----	3.2	-----	0.7	0.7	-----	-----	2.2
1 Deep	8/13/2007	0.5	3.2	-----	-----	-----	0.5	0.5	8.0	-----	1.0
1 Deep	8/13/2007	4.0	2.8	-----	-----	-----	0.2	0.3	-----	-----	-----
1 Deep	8/13/2007	8.5	2.6	-----	2.9	-----	1.3	0.6	-----	-----	3.0
1 Deep	8/13/2007	29.0	2.3	-----	4.1	-----	0.3	0.4	10.2	-----	-----
1 Deep	8/13/2007	0-7.0	2.2	-----	4.0	-----	0.4	0.4	-----	-----	1.5
1 Deep	9/17/2007	0.5	3.9	-----	-----	-----	0.2	0.2	-----	-----	2.1
1 Deep	9/17/2007	6.0	3.8	-----	-----	-----	0.4	0.7	-----	-----	-----
1 Deep	9/17/2007	13.5	3.5	-----	2.0	-----	0.2	0.3	-----	-----	3.3
1 Deep	9/17/2007	29.0	3.6	-----	2.2	-----	<0.2	0.2	8.2	-----	-----
1 Deep	9/17/2007	0-8.0	3.5	-----	3.9	-----	0.2	<0.2	-----	-----	2.2
2 Mayhew	7/23/2007	0.5	4.2	-----	-----	-----	1.0	0.8	-----	-----	2.8
2 Mayhew	7/23/2007	3.5	4.2	-----	-----	-----	1.2	1.0	-----	-----	-----
2 Mayhew	7/23/2007	7.0	-----	-----	4.6	-----	-----	-----	-----	-----	4.1
2 Mayhew	7/23/2007	12.0	4.2	4.2	7.2	6.5	1.0	1.3	-----	-----	-----
2 Mayhew	7/23/2007	0-6.0	-----	-----	3.6	3.4	-----	-----	-----	-----	2.8
2 Mayhew	8/13/2007	0.5	2.8	-----	-----	-----	0.4	0.3	7.9	-----	2.2
2 Mayhew	8/13/2007	3.0	2.9	-----	-----	-----	0.5	0.4	-----	-----	-----
2 Mayhew	8/13/2007	8.5	3.1	-----	5.4	-----	0.6	0.5	-----	-----	3.1
2 Mayhew	8/13/2007	15.5	3.8	-----	10.1	-----	-----	-----	2.3	-----	-----
2 Mayhew	8/13/2007	0-6	3.5	-----	2.9	-----	-----	-----	-----	-----	2.1
2 Mayhew	9/17/2007	0.5	3.9	-----	-----	-----	0.4	0.5	-----	-----	2.6
2 Mayhew	9/17/2007	5.0	3.9	-----	-----	-----	0.4	0.4	-----	-----	-----
2 Mayhew	9/17/2007	11.0	4.8	-----	5.7	-----	1.1	1.1	-----	-----	3.4
2 Mayhew	9/17/2007	14.5	5.6	-----	6.1	6.9	2.4	2.3	0.8	-----	-----
2 Mayhew	9/17/2007	0-8.0	4.0	-----	2.0	3.3	0.6	0.5	-----	-----	3.7
3 Pasquaney	7/23/2007	0.5	4.3	-----	-----	-----	1.0	0.8	-----	-----	1.9
3 Pasquaney	7/23/2007	3.0	4.3	-----	-----	-----	0.9	1.0	-----	-----	-----
3 Pasquaney	7/23/2007	6.5	4.1	-----	4.3	-----	0.6	0.6	-----	-----	3.1
3 Pasquaney	7/23/2007	13.0	4.6	4.5	3.5	-----	0.9	0.9	-----	-----	-----
3 Pasquaney	7/23/2007	0-4.5	4.8	-----	2.9	-----	0.4	0.2	-----	-----	2.2
3 Pasquaney	8/13/2007	0.5	3.6	-----	-----	-----	0.4	0.4	8.8	-----	1.3
3 Pasquaney	8/13/2007	4.0	3.6	-----	-----	-----	0.8	0.3	-----	-----	-----
3 Pasquaney	8/13/2007	8.5	3.2	-----	4.1	4.3	0.5	0.4	-----	-----	2.4

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Alkalinity pink end pt. @ pH 4.6 (mg/l)	Alkalinity pink end pt. @ pH 4.6 (replicate) (mg/l)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Turbidity (NTU)	Turbidity (replicate) (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Chlorophyll *a* (*u* g/l)
3 Pasquaney	8/13/2007	12.3	2.9	-----	6.1	-----	0.5	0.6	10.2	-----	-----
3 Pasquaney	8/13/2007	0-7.0	3.7	-----	2.7	2.9	0.3	0.2	-----	-----	2.6
3 Pasquaney	9/17/2007	0.5	3.9	-----	-----	-----	0.2	0.3	8.4	-----	1.7
3 Pasquaney	9/17/2007	5.0	3.8	-----	-----	-----	0.4	0.6	-----	-----	-----
3 Pasquaney	9/17/2007	12.0	3.6	-----	3.1	-----	0.4	0.3	7.2	-----	2.3
3 Pasquaney	9/17/2007	0-8.0	3.7	-----	3.3	-----	0.3	0.6	-----	-----	2.8
4 Loon Island	7/23/2007	0.5	4.1	-----	-----	-----	0.6	0.6	-----	-----	2.7
4 Loon Island	7/23/2007	0-5.5	4.4	-----	3.4	-----	0.3	0.4	-----	-----	2.5
4 Loon Island	8/13/2007	0.5	3.3	-----	-----	-----	0.4	0.5	8.5	-----	1.4
4 Loon Island	8/13/2007	3.0	3.0	-----	-----	-----	0.6	0.6	-----	-----	-----
4 Loon Island	8/13/2007	5.5	3.0	-----	4.1	-----	0.6	0.5	8.4	-----	2.2
4 Loon Island	8/13/2007	0-6.0	3.2	-----	3.5	-----	0.3	0.3	-----	-----	1.5
4 Loon Island	9/17/2007	0.5	3.9	-----	-----	-----	0.3	0.4	-----	-----	2.6
4 Loon Island	9/17/2007	0-8.0	3.8	-----	2.0	-----	0.3	0.3	-----	-----	2.2
5 Cockermouth	7/23/2007	0.5	4.3	-----	-----	-----	0.4	0.4	-----	-----	1.9
5 Cockermouth	7/23/2007	0-6.0	4.3	-----	3.0	-----	0.3	0.2	-----	-----	2.1
5 Cockermouth	8/13/2007	0.5	4.4	-----	-----	-----	0.4	0.4	8.3	-----	1.1
5 Cockermouth	8/13/2007	3.0	2.7	-----	-----	-----	0.3	0.6	-----	-----	-----
5 Cockermouth	8/13/2007	9.0	3.5	-----	3.7	-----	0.5	0.5	-----	-----	2.6
5 Cockermouth	8/13/2007	19.0	2.7	3.2	4.4	-----	0.5	0.3	10.1	-----	-----
5 Cockermouth	8/13/2007	0-6.0	3.6	-----	3.7	-----	0.3	0.5	-----	-----	1.4
5 Cockermouth	9/17/2007	0.5	3.9	-----	-----	-----	<0.2	<0.2	-----	-----	1.6
5 Cockermouth	9/17/2007	5.0	3.8	-----	-----	-----	0.2	0.2	-----	-----	-----
5 Cockermouth	9/17/2007	14.5	3.6	-----	3.8	-----	0.5	0.4	9.4	-----	3.2
5 Cockermouth	9/17/2007	0-8.0	3.8	-----	< 2.0	-----	0.2	0.3	-----	-----	1.9
6 Beachwood	7/23/2007	0.5	4.1	-----	-----	-----	0.4	0.4	-----	-----	1.8
6 Beachwood	7/23/2007	9.0	4.3	-----	4.7	-----	0.6	0.6	-----	-----	4.2
6 Beachwood	7/23/2007	15.5	4.3	-----	3.7	-----	0.6	0.6	-----	-----	-----
6 Beachwood	7/23/2007	0-8.0	4.4	-----	4.5	-----	0.3	0.5	-----	-----	2.0
6 Beachwood	8/13/2007	0.5	3.5	-----	-----	-----	0.4	0.2	8.1	-----	0.9
6 Beachwood	8/13/2007	3.0	3.2	-----	-----	-----	0.4	0.2	-----	-----	-----
6 Beachwood	8/13/2007	8.0	3.7	-----	3.0	-----	0.3	0.4	-----	-----	0.3
6 Beachwood	8/13/2007	16.5	3.3	3.3	4.5	-----	0.4	0.4	10.2	10.2	-----
6 Beachwood	8/13/2007	0-6.0	3.1	-----	3.6	-----	0.2	0.3	-----	-----	0.6
6 Beachwood	9/17/2007	0.5	3.8	-----	-----	-----	<0.2	<0.2	8.2	-----	1.7
6 Beachwood	9/17/2007	6.0	3.8	-----	-----	-----	0.3	0.3	-----	-----	-----
6 Beachwood	9/17/2007	13.0	3.9	3.6	3.1	-----	0.8	0.5	-----	-----	3.5
6 Beachwood	9/17/2007	14.5	3.6	-----	2.4	-----	0.2	0.2	12.4	-----	-----

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Site	Date	Depth (meters)	Alkalinity pink end pt. @ pH 4.6 (mg/l)	Alkalinity pink end pt. @ pH 4.6 (replicate) (mg/l)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Turbidity (NTU)	Turbidity (replicate) (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Chlorophyll *a* (*u* g/l)
6 Beachwood	9/17/2007	0-8.0	3.6	-----	3.2	-----	<0.2	0.2	-----	-----	1.9
7 Fowler	7/23/2007	0.5	-----	-----	4.5	-----	-----	-----	-----	-----	-----
7 Fowler	8/13/2007	0.5	3.2	-----	4.7	-----	0.6	0.5	-----	-----	1.8
8 Follensbee	7/23/2007	0.5	4.5	-----	-----	-----	0.6	0.4	-----	-----	2.1
8 Follensbee	7/23/2007	8.0	4.4	-----	2.7	-----	0.5	1.1	-----	-----	2.3
8 Follensbee	7/23/2007	13.0	4.2	-----	5.6	-----	0.5	0.8	-----	-----	-----
8 Follensbee	7/23/2007	0-6.5	4.9	-----	3.1	-----	0.4	0.5	-----	-----	1.6
8 Follensbee	8/13/2007	0.5	3.2	-----	-----	-----	0.3	0.3	7.9	8.0	0.8
8 Follensbee	8/13/2007	4.0	3.4	-----	-----	-----	0.3	0.3	-----	-----	-----
8 Follensbee	8/13/2007	9.5	3.3	-----	3.6	-----	0.4	0.4	-----	-----	2.7
8 Follensbee	8/13/2007	12.5	3.0	-----	4.3	-----	0.4	0.4	10.2	-----	-----
8 Follensbee	8/13/2007	0-7.5	3.6	-----	3.6	-----	0.2	0.2	-----	-----	1.1
8 Follensbee	9/17/2007	0.5	4.0	3.9	-----	-----	0.2	0.2	8.8	-----	2.9
8 Follensbee	9/17/2007	6.0	3.8	-----	-----	-----	0.4	0.3	-----	-----	-----
8 Follensbee	9/17/2007	13.5	3.6	-----	2.4	-----	0.6	0.5	11.6	-----	3.4
8 Follensbee	9/17/2007	0-8.0	4.0	-----	< 2.0	-----	0.2	0.2	-----	-----	3.0
1 Deep	6/11/2008	0.5	-----	-----	------	-----	------	------	------	-----	0.9
1 Deep	6/11/2008	4.5	-----	-----	2.6	-----	------	------	------	-----	0.9
1 Deep	6/11/2008	30.0	-----	-----	4.0	-----	------	------	------	-----	-----
1 Deep	6/11/2008	0-3.0	-----	-----	3.2	-----	------	------	------	-----	0.5
2 Mayhew	6/11/2008	0.5	-----	-----	------	-----	------	------	------	-----	1.1
2 Mayhew	6/11/2008	1.5	-----	-----	------	-----	------	------	------	-----	-----
2 Mayhew	6/11/2008	4.5	-----	-----	4.1	-----	------	------	------	-----	1.3
2 Mayhew	6/11/2008	13.5	-----	-----	6.8	-----	------	------	------	-----	-----
2 Mayhew	6/11/2008	0-3.0	-----	-----	7.1	-----	------	------	------	-----	1.1
1 Deep	7/2/2008	0.5	3.5	3.8	------	-----	0.2	0.2	8.2	8.4	1.1
1 Deep	7/2/2008	7.0	3.7	-----	7.0	-----	0.3	0.3	------	-----	1.7
1 Deep	7/2/2008	30.0	3.4	3.4	4.6	-----	0.3	0.3	10.8	-----	-----
1 Deep	7/2/2008	0-4.0	3.7	-----	4.0	4.4	0.4	0.2	------	-----	1.6
2 Mayhew	7/2/2008	0.5	3.6	-----	5.1	-----	<0.2	0.2	8.6	-----	2.6
2 Mayhew	7/2/2008	5.5	3.8	3.6	6.5	-----	0.4	0.4	------	-----	2.0
2 Mayhew	7/2/2008	13.0	3.4	3.6	8.2	-----	0.3	0.4	8.0	-----	
2 Mayhew	7/2/2008	0-3.5	4.4	-----	4.6	-----	0.3	0.3	------	-----	2.4
3 Pasquaney	7/2/2008	0.5	3.7	-----	------	-----	0.2	0.2	9.0	-----	1.1
3 Pasquaney	7/2/2008	7.5	3.5	3.7	5.3	-----	0.4	0.3	------	-----	1.6
3 Pasquaney	7/2/2008	13.5	3.4	3.5	8.6	-----	0.2	0.2	10.4	-----	-----
3 Pasquaney	7/2/2008	0-4.0	3.6	-----	5.0	-----	0.2	0.2	------	-----	1.5
4 Loon Reef	7/2/2008	0.5	3.7	-----	------	-----	0.2	0.3	8.6	-----	3.0

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Alkalinity pink end pt. @ pH 4.6 (mg/l)	Alkalinity pink end pt. @ pH 4.6 (replicate) (mg/l)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Turbidity (NTU)	Turbidity (replicate) (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Chlorophyll *a* (*u* g/l)
4 Loon Reef	7/2/2008	5.5	3.9	3.9	4.6	-----	0.3	0.3	------	-----	3.1
4 Loon Reef	7/2/2008	8.0	4.0	3.8	3.9	-----	0.4	0.3	9.4	-----	-----
4 Loon Reef	7/2/2008	0-3.5	4.0	-----	3.8	-----	0.3	0.2	------	-----	2.8
5 Cockermouth	7/2/2008	0.5	3.7	-----	------	-----	0.2	0.3	8.8	-----	0.9
5 Cockermouth	7/2/2008	6.0	3.9	3.6	5.7	-----	0.3	0.5	------	-----	1.3
5 Cockermouth	7/2/2008	17.5	3.4	3.6	3.1	-----	0.2	<0.2	10.4	-----	-----
5 Cockermouth	7/2/2008	0-3.0	3.9	-----	3.4	-----	<0.2	0.2	------	-----	1.0
6 Beachwood	7/2/2008	0.5	4.0	-----	------	-----	0.2	0.2	8.4	-----	1.3
6 Beachwood	7/2/2008	6.0	3.6	3.8	5.2	-----	0.4	0.3	------	-----	2.2
6 Beachwood	7/2/2008	16.5	3.6	-----	4.0	-----	0.4	0.4	10.4	-----	-----
6 Beachwood	7/2/2008	0-3.0	3.6	-----	3.3	-----	0.2	0.2	------	-----	1.1
1 Deep	8/5/2008	0.5	4.2	-----	------	-----	0.3	0.3	8.2	-----	3.7
1 Deep	8/5/2008	8.5	4.1	-----	10.3	-----	0.6	0.5	------	-----	4.6
1 Deep	8/5/2008	30.0	3.9	-----	3.3	-----	<0.2	<0.2	11.0	-----	------
1 Deep	8/5/2008	0-5.0	4.1	-----	3.8	-----	0.5	0.3	------	-----	2.2
2 Mayhew	8/5/2008	0.5	4.2	-----	------	-----	0.5	0.3	8.0	-----	1.7
2 Mayhew	8/5/2008	3.0	4.2	-----	------	-----	0.3	0.3	------	-----	-----
2 Mayhew	8/5/2008	8.5	4.3	-----	------	-----	0.7	0.6	------	-----	6.6
2 Mayhew	8/5/2008	12.0	4.4	-----	6.3	-----	0.5	0.5	6.0	-----	-----
2 Mayhew	8/5/2008	0-5.0	4.0	-----	7.6	-----	0.4	0.4	------	-----	3.2
3 Pasquaney	8/5/2008	0.5	3.9	-----	------	-----	0.2	<0.2	8.6	-----	2.5
3 Pasquaney	8/5/2008	8.5	4.0	-----	5.4	-----	0.3	0.4	------	-----	2.6
3 Pasquaney	8/5/2008	14.8	3.9	-----	6.4	-----	0.3	0.4	10.8	-----	-----
3 Pasquaney	8/5/2008	0-6.5	3.9	-----	7.3	-----	1.3	1.5	------	-----	3.1
4 Loon Reef	8/5/2008	0.5	4.0	-----	------	-----	0.3	0.3	9.0	-----	1.6
4 Loon Reef	8/5/2008	6.8	4.2	4.0	6.3	5.5	0.5	0.5	8.0	-----	1.4
4 Loon Reef	8/5/2008	0-7.0	4.2	-----	5.8	8.7	0.3	0.3	------	-----	2.6
5 Cockermouth	8/5/2008	0.5	3.9	-----	------	-----	0.4	0.3	8.0	-----	2.4
5 Cockermouth	8/5/2008	9.0	4.0	-----	8.9	-----	0.5	0.5	------	-----	3.1
5 Cockermouth	8/5/2008	15.0	4.2	-----	7.1	-----	0.4	0.4	10.2	-----	-----
5 Cockermouth	8/5/2008	0-7.0	4.1	-----	5.4	-----	0.3	0.3	------	-----	2.1
6 Beachwood	8/5/2008	0.5	4.3	-----	------	-----	0.4	0.4	8.2	-----	1.4
6 Beachwood	8/5/2008	9.0	4.0	-----	7.9	-----	0.4	0.3	------	-----	2.4
6 Beachwood	8/5/2008	13.8	3.8	-----	8.2	-----	0.4	0.4	10.0	-----	-----
6 Beachwood	8/5/2008	0-7.0	4.2	-----	6.1	-----	0.3	0.4	-----	-----	2.2
8 Fallansbee	8/5/2008	0.5	4.6	-----	------	-----	0.4	0.3	8.0	-----	1.9
8 Fallansbee	8/5/2008	8.5	4.3	-----	5.8	-----	0.5	0.4	-----	-----	4.4
8 Fallansbee	8/5/2008	14.0	4.5	-----	4.7	-----	0.5	0.4	10.2	-----	-----

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Depth (meters)	Alkalinity pink end pt. @ pH 4.6 (mg/l)	Alkalinity pink end pt. @ pH 4.6 (replicate) (mg/l)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Turbidity (NTU)	Turbidity (replicate) (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Chlorophyll *a* (*u* g/l)
8 Fallansbee	8/5/2008	0-5.0	4.8	-----	5.1	-----	0.5	0.5	-----	-----	1.8
1 Deep	9/11/2008	0.5	4.1	-----	------	-----	0.2	<0.2	8.4	-----	1.4
1 Deep	9/11/2008	4.0	4.3	4.0	------	-----	0.4	0.3	-----	-----	-----
1 Deep	9/11/2008	11.0	3.7	-----	5.1	-----	0.2	<0.2	-----	-----	1.6
1 Deep	9/11/2008	29.0	3.8	-----	3.5	-----	0.2	0.2	9.5	-----	-----
1 Deep	9/11/2008	0-9.0	3.8	-----	7.4	-----	0.2	0.2	-----	-----	2.4
2 Mayhew	9/11/2008	0.5	4.3	-----	------	-----	0.3	0.3	7.9	-----	2.4
2 Mayhew	9/11/2008	3.0	4.0	3.9	------	-----	0.3	0.5	-----	-----	-----
2 Mayhew	9/11/2008	9.0	3.8	-----	6.3	-----	0.4	0.3	-----	-----	2.1
2 Mayhew	9/11/2008	16.5	5.8	-----	10.4	-----	1.3	1.4	0.9	-----	-----
2 Mayhew	9/11/2008	0-7.0	4.0	-----	4.8	5.1	0.4	0.3	-----	-----	2.7
3 Pasquaney	9/11/2008	13.0	3.9	-----	6.7	-----	------	------	9.0	-----	-----
3 Pasquaney	9/11/2008	0-9.0	5.2	-----	4.5	-----	0.3	0.3	-----	-----	2.1
5 Cockermouth	9/11/2008	0.5	4.0	-----	------	-----	0.3	0.2	9.0	-----	1.6
5 Cockermouth	9/11/2008	5.0	4.0	-----	------	-----	<0.2	<0.2	-----	-----	-----
5 Cockermouth	9/11/2008	11.0	3.8	-----	3.5	-----	0.4	0.4	-----	-----	2.1
5 Cockermouth	9/11/2008	19.0	4.0	-----	------	-----	0.2	0.3	9.0	-----	-----
5 Cockermouth	9/11/2008	0-9.0	4.4	-----	3.4	-----	0.4	0.3	-----	-----	1.9
1 Deep	9/25/2008	13.0	3.4	-----	4.6	-----	<0.2	<0.2	-----	-----	1.1
1 Deep	9/25/2008	29.0	3.5	-----	3.8	-----	<0.2	0.2	9.4	-----	-----
1 Deep	9/25/2008	0-8.0	3.9	-----	4.2	-----	0.2	0.3	-----	-----	3.9
2 Mayhew	9/25/2008	0.5	3.7	-----	------	-----	0.2	0.3	9.4	-----	2.4
2 Mayhew	9/25/2008	12.0	4.8	-----	7.5	-----	1.1	1.2	-----	-----	1.4
2 Mayhew	9/25/2008	15.0	5.4	-----	9.5	8.3	1.6	1.7	0.8	-----	-----
2 Mayhew	9/25/2008	0-8.0	4.0	-----	4.2	3.9	0.3	0.3	-----	-----	3.7
3 Pasquaney	9/25/2008	12.0	3.8	-----	5.3	-----	0.2	0.2	-----	-----	1.8
3 Pasquaney	9/25/2008	13.5	3.7	3.6	4.3	-----	0.3	0.3	-----	-----	-----
3 Pasquaney	9/25/2008	0-8.0	3.7	-----	3.0	-----	0.2	0.3	-----	-----	2.6
5 Cockermouth	9/25/2008	12.0	3.7	-----	3.6	-----	0.4	0.3	-----	-----	1.8
5 Cockermouth	9/25/2008	14.5	3.8	-----	4.4	-----	0.3	0.3	9.2	-----	-----
5 Cockermouth	9/25/2008	0-8.0	3.9	-----	3.8	-----	0.2	0.2	-----	-----	2.3

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Start Time (hh:mm)	Stop Time (hh:mm)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #2 (meters)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #2 (meters)
1 Deep	7/23/2007	9:18	10:13	6.45	6.70	6.63	8.82	9.10
2 Mayhew	7/23/2007	14:16	14:55	4.90	5.00	5.20	6.80	6.80
3 Pasquaney	7/23/2007	13:13	13:53	5.70	5.80	5.75	8.25	8.30
4 Loon Island	7/23/2007	12:35	12:57	5.50	5.45	5.42	6.60	6.60
5 Cockermouth	7/23/2007	11:57	12:25	5.45	5.50	5.49	8.50	8.42
6 Beachwood	7/23/2007	11:10	11:47	5.97	6.10	5.95	8.61	8.49
8 Follansbee	7/23/2007	10:20	10:55	5.71	6.00	6.10	8.90	9.10
1 Deep	8/13/2007	9:35	10:15	7.80	7.75	7.70	10.05	9.95
2 Mayhew	8/13/2007	17:55	18:20	5.20	5.30	5.05	7.50	7.45
3 Pasquaney	8/13/2007	10:35	11:10	5.30	6.00	6.40	9.10	9.00
4 Loon Island	8/13/2007	15:25	15:55	7.15	6.70	6.35	8.60	8.60
5 Cockermouth	8/13/2007	14:30	15:15	5.60	6.40	5.95	8.20	7.95
6 Beachwood	8/13/2007	16:10	16:40	7.60	7.60	7.70	9.70	9.80
8 Follansbee	8/13/2007	17:00	17:30	6.80	6.85	6.90	10.20	10.15
1 Deep	9/17/2007	9:40	10:30	-----	-----	-----	10.80	11.00
2 Mayhew	9/17/2007	14:30	15:00	-----	-----	-----	8.30	8.40
3 Pasquaney	9/17/2007	13:30	13:50	-----	-----	-----	11.10	11.20
4 Loon Island	9/17/2007	13:05	13:20	-----	-----	-----	9.30	9.30
5 Cockermouth	9/17/2007	12:25	12:45	-----	-----	-----	11.30	11.30
6 Beachwood	9/17/2007	11:45	12:10	-----	-----	-----	-----	-----
8 Follansbee	9/17/2007	11:00	11:31	-----	-----	-----	11.30	11.30
2 Mayhew	6/11/2008	10:30	11:45	4.85	5.30	5.00	7.80	7.80
1 Deep	7/2/2008	10:48	11:36	6.20	6.15	6.10	8.50	8.30
2 Mayhew	7/2/2008	9:45	10:28	7.00	6.00	6.20	8.00	7.70
3 Pasquaney	7/2/2008	11:50	12:24				9.30	9.40
4 Loon Reef	7/2/2008	12:42	13:11				8.20	8.10
5 Cockermouth	7/2/2008	13:25	14:10				7.90	8.10
6 Beachwood	7/2/2008	14:32	15:00				8.50	8.90
1 Deep	8/5/2008	10:50	11:19	4.30	4.17	4.32	6.70	6.60
2 Mayhew	8/5/2008	10:00	10:31	4.65	4.70	4.75	5.60	5.35
3 Pasquaney	8/5/2008	14:38	14:59				6.30	6.60
4 Loon Reef	8/5/2008	13:47	14:17				6.00	6.10
5 Cockermouth	8/5/2008	13:12	13:37	4.20	4.25	4.30	6.10	6.09
6 Beachwood	8/5/2008	12:09	12:33				6.25	6.10
8 Fallansbee	8/5/2008	11:28	11:55	4.15	4.10	3.95	6.35	6.55

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Start Time (hh:mm)	Stop Time (hh:mm)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #2 (meters)	Secchi Disk Transparency Shady Side w/o Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #2 (meters)
1 Deep	9/11/2008	12:08	13:16				8.62	8.63
2 Mayhew	9/11/2008	10:30	11:32				6.85	6.80
3 Pasquaney	9/11/2008	14:51	15:27				7.46	7.81
5 Cockermouth	9/11/2008	13:33	14:32				8.52	8.74
1 Deep	9/25/2008	13:35	14:32				8.20	8.20
2 Mayhew	9/25/2008	12:13	13:06				6.70	6.40
3 Pasquaney	9/25/2008	15:59	16:43				8.00	8.10
5 Cockermouth	9/25/2008	14:48	15:44				8.60	8.30

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #2 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #2 (meters)
1 Deep	7/23/2007	8.80	6.03	6.05	5.99	8.20	8.50
2 Mayhew	7/23/2007	6.87	4.83	5.10	5.00	6.95	7.00
3 Pasquaney	7/23/2007	8.10	5.35	5.42	5.27	8.13	8.10
4 Loon Island	7/23/2007	6.60	5.90	6.20	6.10	6.80	6.80
5 Cockermouth	7/23/2007	8.61	4.74	4.82	4.71	7.65	7.52
6 Beachwood	7/23/2007	8.52	5.55	5.56	5.70	8.90	8.85
8 Follansbee	7/23/2007	8.90	5.92	5.93	5.91	8.25	8.26
1 Deep	8/13/2007	10.05	6.80	7.85	7.43	9.40	9.55
2 Mayhew	8/13/2007	7.20	4.80	5.00	5.00	6.40	6.30
3 Pasquaney	8/13/2007	8.70	6.65	6.80	6.90	8.75	8.85
4 Loon Island	8/13/2007	7.95	6.70	6.60	6.30	6.3 BO	6.3 BO
5 Cockermouth	8/13/2007	8.80	6.05	6.00	5.95	8.35	8.30
6 Beachwood	8/13/2007	9.70	5.95	6.50	7.10	8.50	8.69
8 Follansbee	8/13/2007	10.00	6.80	6.70	6.70	8.30	8.60
1 Deep	9/17/2007	11.00	-----	-----	-----	-----	-----
2 Mayhew	9/17/2007	8.30	-----	-----	-----	-----	-----
3 Pasquaney	9/17/2007	11.00	-----	-----	-----	-----	-----
4 Loon Island	9/17/2007	9.30	-----	-----	-----	-----	-----
5 Cockermouth	9/17/2007	11.40	-----	-----	-----	-----	-----
6 Beachwood	9/17/2007	-----	-----	-----	-----	10.60	10.50
8 Follansbee	9/17/2007	11.40	-----	-----	-----	-----	-----
2 Mayhew	6/11/2008	7.50	6.10	5.65	6.25	7.45	7.40
1 Deep	7/2/2008	8.25	7.40	7.50	7.30	8.50	8.55
2 Mayhew	7/2/2008	7.60	6.40	6.50	6.40	8.10	8.00
3 Pasquaney	7/2/2008	9.00				9.60	10.10
4 Loon Reef	7/2/2008	7.80				7.90	8.30
5 Cockermouth	7/2/2008	7.80				7.70	8.10
6 Beachwood	7/2/2008	9.10				8.00	8.20
1 Deep	8/5/2008	6.70	4.30	4.60	4.55	6.60	6.35
2 Mayhew	8/5/2008	5.55	4.10	3.70	3.90	5.20	5.35
3 Pasquaney	8/5/2008	6.30				5.75	5.85
4 Loon Reef	8/5/2008	6.35				6.80	6.15
5 Cockermouth	8/5/2008	6.15	4.70	4.60	4.30	5.70	5.90
6 Beachwood	8/5/2008	6.20				5.90	5.70
8 Fallansbee	8/5/2008	6.60	4.10	4.70	4.45	6.45	6.84

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Secchi Disk Transparency Shady Side with Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #2 (meters)	Secchi Disk Transparency Sunny Side w/o Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #2 (meters)
1 Deep	9/11/2008	8.60				7.75	7.61
2 Mayhew	9/11/2008	6.85				5.40	5.80
3 Pasquaney	9/11/2008	7.52				6.80	6.98
5 Cockermouth	9/11/2008	8.76				7.62	7.46
1 Deep	9/25/2008	8.30				7.80	7.70
2 Mayhew	9/25/2008	6.60				6.60	6.60
3 Pasquaney	9/25/2008	8.20				7.50	7.70
5 Cockermouth	9/25/2008	8.40				7.70	7.80

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #2 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #3 (meters)	Sky Condition	Lake Surface Condition	Wind Condition
1 Deep	7/23/2007	8.32	4.03	4.06	4.15	Cloudy	Ripples	Calm
2 Mayhew	7/23/2007	7.07	3.20	3.30	3.26	Cloudy	Ripples	Breezy
3 Pasquaney	7/23/2007	8.15	4.20	4.20	4.10	Cloudy	Waves	Breezy
4 Loon Island	7/23/2007	6.80	3.49	3.45	3.55	Cloudy	Ripples	Breezy
5 Cockermouth	7/23/2007	7.60	4.41	4.45	4.37	Cloudy	Waves	Breezy
6 Beachwood	7/23/2007	8.90	4.43	4.30	4.41	Cloudy	Waves	Breezy
8 Follansbee	7/23/2007	8.40	4.57	4.43	4.46	Cloudy	Waves	Breezy
1 Deep	8/13/2007	9.35	5.10	4.90	5.05	Cloudy	Ripples	Breezy
2 Mayhew	8/13/2007	6.70	4.00	3.70	3.65	Clear	Ripples	Breezy
3 Pasquaney	8/13/2007	9.15	4.50	4.90	4.51	Clear	Ripples	Breezy
4 Loon Island	8/13/2007	6.3 BO	4.20	4.40	4.45	Clear	Ripples	Gusty
5 Cockermouth	8/13/2007	8.30	4.15	4.00	4.20	Hazy	Ripples	Gusty
6 Beachwood	8/13/2007	8.45	5.20	5.40	5.20	Clear	Ripples	Gusty
8 Follansbee	8/13/2007	8.50	4.10	4.20	4.40	Clear	Waves	Windy
1 Deep	9/17/2007	-----	-----	-----	-----	Clear	Calm	Calm
2 Mayhew	9/17/2007	-----	-----	-----	-----	Clear	Ripples	Breezy
3 Pasquaney	9/17/2007	-----	-----	-----	-----	Clear	Ripples	Gusty
4 Loon Island	9/17/2007	-----	-----	-----	-----	Clear	Calm	Calm
5 Cockermouth	9/17/2007	-----	-----	-----	-----	Clear	Calm	Calm
6 Beachwood	9/17/2007	10.60	-----	-----	-----	Clear	Calm	Calm
8 Follansbee	9/17/2007	-----	-----	-----	-----	Clear	Calm	Calm
2 Mayhew	6/11/2008	7.35	2.90	3.00	3.80	Cloudy	Waves	Windy
1 Deep	7/2/2008	8.70	5.50	5.30	5.35	Clear	Ripples	Calm
2 Mayhew	7/2/2008	7.95	4.50	4.30	4.60	Overcast	Ripples	Calm
3 Pasquaney	7/2/2008	9.70				Cloudy	Ripples	Calm
4 Loon Reef	7/2/2008	8.40				Cloudy	Ripples	Calm
5 Cockermouth	7/2/2008	8.40				Cloudy	Ripples	Breezy
6 Beachwood	7/2/2008	8.40				Clear	Ripples	Breezy
1 Deep	8/5/2008	6.67	2.75	2.50	2.65	Cloudy	Ripples	Breezy
2 Mayhew	8/5/2008	5.34	2.30	2.20	2.25	Cloudy	Ripples	Breezy
3 Pasquaney	8/5/2008	6.05				Cloudy	Ripples	Breezy
4 Loon Reef	8/5/2008	6.30				Cloudy	Waves	Breezy
5 Cockermouth	8/5/2008	5.90	2.40	2.55	2.70	Cloudy	Waves	Breezy
6 Beachwood	8/5/2008	5.80				Cloudy	Ripples	Breezy
8 Fallansbee	8/5/2008	6.70	2.65	3.05	2.80	Cloudy	Ripples	Calm

APPENDIX A. Newfound In-lake Water Quality Sampling Data Summary: 2007 and 2008 (Task 6)

Site	Date	Secchi Disk Transparency Sunny Side with Scope black/white disk Reading #3 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #1 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #2 (meters)	Secchi Disk Transparency Sunny Side with Scope black disk Reading #3 (meters)	Sky Condition	Lake Surface Condition	Wind Condition
1 Deep	9/11/2008	7.64				Clear	Calm	Calm
2 Mayhew	9/11/2008	5.80				Clear	Calm	Calm
3 Pasquaney	9/11/2008	6.63				Clear	Calm	Calm
5 Cockermouth	9/11/2008	7.63				Clear	Ripples	Calm
1 Deep	9/25/2008	7.80				Hazy	Ripples	Breezy
2 Mayhew	9/25/2008	6.50				Overcast	Ripples	Breezy
3 Pasquaney	9/25/2008	7.90				Hazy	Ripples	Breezy
5 Cockermouth	9/25/2008	7.90				Hazy	Ripples	Breezy

APPENDIX A. Newfound Lake Near-Shore Sampling Data Summary: 2007 and 2008 (Task 7)

Site	Date	Time (hh:mm)	Depth (meters)	Total Phosphorus (u g/l)	Total Phosphorus (replicate) (u g/l)	E *coli* (CFU/100ml)	E *coli* (replicate) (CFU/100ml)	Temperature (°C)	Temperature (replicate) (°C)	Specific Conductivity (u S/cm)	Specific Conductivity (replicate) (u S/cm)
NLRA S01	9/13/2007	9:20	0.5	2.7	3.7	23	16	18.4	18.4	34.0	34.1
NLRA S02	9/13/2007	9:25	0.5	2.1	------	10	------	18.7	18.7	34.2	34.2
NLRA S03	9/13/2007	9:30	0.5	2.5	------	23	------	18.3	18.3	35.3	35.3
NLRA S04	9/13/2007	9:35	0.5	2.9	------	16	------	19.1	19.1	34.6	34.5
NLRA S05	9/13/2007	9:39	0.5	2.9	------	9	------	19.3	19.3	34.3	34.3
NLRA S06	9/13/2007	9:43	0.5	2.8	------	2	------	19.3	19.3	34.3	34.3
NLRA S07	9/13/2007	9:46	0.5	2.6	------	5	------	19.3	19.3	34.5	34.8
NLRA S08	9/13/2007	9:50	0.5	2.5	------	10	------	19.3	19.3	34.6	34.6
NLRA S09	9/13/2007	9:55	0.5	2.5	------	9	------	19.4	19.4	34.6	34.6
NLRA S10	9/13/2007	10:02	0.5	2.9	------	1	------	19.2	19.3	34.7	34.7
NLRA S11	9/13/2007	10:08	0.5	------	------	2	------	19.2	19.3	34.5	34.6
NLRA S12	9/13/2007	10:23	0.5	2.0	------	2	------	19.3	19.3	34.3	34.3
NLRA S13	9/13/2007	10:35	0.5	1.7	2.5	8	9	19.4	19.4	34.1	34.0
NLRA S14	9/13/2007	10:45	0.5	2.5	------	3	------	19.6	19.5	34.3	34.2
NLRA S15	9/13/2007	10:48	0.5	2.7	------	9	------	19.5	19.6	34.2	34.2
NLRA S16	9/13/2007	10:55	0.5	2.1	------	1	------	19.5	19.5	34.2	34.1
NLRA S17	9/13/2007	11:00	0.5	1.7	------	3	------	19.7	19.7	34.1	34.1
NLRA S18	9/13/2007	11:10	0.5	3.3	------	<1	------	19.4	19.5	34.2	34.2
NLRA S19	9/13/2007	11:15	0.5	1.9	------	3	------	19.5	19.6	34.2	34.2
NLRA S20	9/13/2007	11:24	0.5	2.0	------	5	------	19.6	19.7	34.4	34.6
NLRA S21	9/13/2007	11:29	0.5	2.5	------	2	------	19.8	19.8	34.2	34.2
NLRA S22	9/13/2007	11:40	0.5	2.7	------	18	------	17.6	17.4	44.3	46.0
NLRA S23	9/13/2007	11:47	0.5	5.8	------	5	------	18.5	18.5	35.3	35.3
NLRA S24	9/13/2007	11:52	0.5	10.6	------	2	------	17.4	17.4	34.3	34.3
NLRA S25	9/13/2007	12:00	0.5	2.1	------	2	------	19.8	19.8	34.0	34.0
NLRA S26	9/13/2007	12:16	0.5	2.2	------	3	------	20.1	20.1	34.0	33.9
NLRA S27	9/13/2007	12:24	0.5	1.7	------	1	------	20.2	20.2	35.2	35.1
NLRA S28	9/13/2007	12:35	0.5	2.0	------	<1	------	20.0	20.0	34.0	34.0
NLRA S29	9/13/2007	12:39	0.5	2.5	------	22	------	19.9	19.9	34.3	34.2
NLRA S30	9/13/2007	10:15	0.5	2.9	------	3	------	19.4	19.4	34.1	34.1
NLRA S01	6/10/2008	10:07	0.5	3.0	------	1	------	22.0	21.4	34.0	33.9
NLRA S02	6/10/2008	10:15	0.5	2.7	------	10	------	21.9	21.8	34.5	34.5
NLRA S03	6/10/2008	10:21	0.5	5.3	------	<1	------	22.1	22.1	34.1	34.1
NLRA S04	6/10/2008	10:27	0.5	5.0	------	9	------	21.2	21.4	34.2	34.5
NLRA S05	6/10/2008	10:35	0.5	3.0	------	17	------	20.2	20.6	34.2	34.6
NLRA S06	6/10/2008	10:43	0.5	2.9	------	32	------	22.4	22.3	34.9	34.9
NLRA S07	6/10/2008	10:47	0.5	2.4	------	6	------	22.6	22.7	35.7	35.1

APPENDIX A. Newfound Lake Near-Shore Sampling Data Summary: 2007 and 2008 (Task 7)

Site	Date	Time (hh:mm)	Depth (meters)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	E *coli* (CFU/100ml)	E *coli* (replicate) (CFU/100ml)	Temperature (^oC)	Temperature (replicate) (^oC)	Specific Conductivity (*u* S/cm)	Specific Conductivity (replicate) (*u* S/cm)
NLRA S08	6/10/2008	10:54	0.5	2.5	2.6	2	6	21.5	21.4	34.5	34.7
NLRA S09	6/10/2008	11:01	0.5	2.1	------	5	------	21.0	20.9	34.2	34.6
NLRA S10	6/10/2008	11:08	0.5	3.7	------	1	------	21.6	21.4	34.9	34.9
NLRA S11	6/10/2008	11:32	0.5	5.3	------	<1	------	20.6	20.5	34.1	34.1
NLRA S12	6/10/2008	11:44	0.5	2.6	------	1	------	21.4	21.6	35.5	35.7
NLRA S13	6/10/2008	11:53	0.5	3.1	------	3	------	21.7	21.9	33.9	34.2
NLRA S14	6/10/2008	12:08	0.5	1.9	------	<1	------	22.5	22.6	34.0	33.9
NLRA S15	6/10/2008	12:15	0.5	3.2	------	<1	------	22.7	22.8	33.9	34.0
NLRA S16	6/10/2008	12:21	0.5	4.3	------	1	------	20.1	20.0	33.7	33.9
NLRA S17	6/10/2008	12:30	0.5	5.2	------	<1	------	21.8	21.6	33.9	34.5
NLRA S18	6/10/2008	12:37	0.5	3.3	------	<1	------	24.2	23.9	34.1	34.3
NLRA S19	6/10/2008	12:47	0.5	2.1	------	<1	------	21.4	21.5	33.9	34.0
NLRA S20	6/10/2008	12:56	0.5	2.4	------	<1	------	22.6	22.5	33.8	33.8
NLRA S21	6/10/2008	13:02	0.5	3.9	------	<1	------	22.4	22.3	33.9	33.3
NLRA S22	6/10/2008	13:10	0.5	2.2	------	2	------	24.0	23.8	34.5	34.6
NLRA S23	6/10/2008	13:22	0.5	4.7	------	<1	------	24.0	23.7	35.5	35.2
NLRA S24	6/10/2008	13:27	0.5	5.3	------	3	------	23.9	23.7	35.8	35.6
NLRA S25	6/10/2008	13:39	0.5	3.2	4.7	<1	<1	21.1	------	34.1	34.6
NLRA S26	6/10/2008	13:50	0.5	5.4	------	<1	------	22.3	22.4	33.5	33.9
NLRA S27	6/10/2008	13:57	0.5	3.8	------	<1	------	20.8	20.8	33.9	33.5
NLRA S28	6/10/2008	14:12	0.5	3.2	------	2	------	23.9	23.6	34.6	33.9
NLRA S29	6/10/2008	14:33	0.5	10.9	------	29	------	23.5	23.4	44.5	44.9
NLRA S30	6/10/2008	11:23	0.5	3.2	------	15	------	21.7	21.6	34.0	33.7
NLRA S01	7/1/2008	10:06	0.5	4.3	------	1	------	21.9	21.9	37.0	37.2
NLRA S02	7/1/2008	10:14	0.5	4.7	------	4	------	22.0	22.0	37.7	37.6
NLRA S03	7/1/2008	10:19	0.5	5.5	------	<1	------	22.0	22.0	38.1	38.2
NLRA S04	7/1/2008	10:25	0.5	6.1	------	5	------	22.1	22.0	39.0	39.5
NLRA S05	7/1/2008	10:38	0.5	3.5	------	1	------	22.2	22.1	38.0	38.0
NLRA S06	7/1/2008	10:42	0.5	6.4	5.0	3	4	22.5	22.4	38.2	38.5
NLRA S07	7/1/2008	10:47	0.5	3.5	------	1	------	22.8	22.8	38.8	38.7
NLRA S08	7/1/2008	10:57	0.5	4.2	------	3	------	22.5	22.4	38.8	38.8
NLRA S09	7/1/2008	11:04	0.5	4.3	------	1	------	22.5	22.6	38.9	39.0
NLRA S10	7/1/2008	11:09	0.5	4.0	------	<1	------	23.0	23.1	39.1	39.3
NLRA S11	7/1/2008	11:18	0.5	4.2	------	<1	------	22.3	22.2	38.9	39.0
NLRA S12	7/1/2008	11:32	0.5	4.8	------	1	------	22.7	22.7	39.3	39.2
NLRA S13	7/1/2008	11:43	0.5	5.5	------	1	------	22.9	23.1	38.4	38.5
NLRA S14	7/1/2008	11:56	0.5	4.2	------	5	------	23.9	23.9	40.1	40.6

APPENDIX A. Newfound Lake Near-Shore Sampling Data Summary: 2007 and 2008 (Task 7)

Site	Date	Time (hh:mm)	Depth (meters)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	E *coli* (CFU/100ml)	E *coli* (replicate) (CFU/100ml)	Temperature (^oC)	Temperature (replicate) (^oC)	Specific Conductivity (*u* S/cm)	Specific Conductivity (replicate) (*u* S/cm)
NLRA S15	7/1/2008	12:00	0.5	4.1	------	2	------	23.9	23.9	38.6	38.8
NLRA S16	7/1/2008	12:07	0.5	5.6	------	2	------	23.1	23.1	38.5	38.6
NLRA S17	7/1/2008	12:12	0.5	4.8	------	2	------	23.5	23.4	39.4	40.0
NLRA S18	7/1/2008	12:21	0.5	4.2	------	<1	------	23.6	23.6	38.7	38.5
NLRA S19	7/1/2008	12:26	0.5	3.7	------	3	------	22.5	22.4	38.5	38.6
NLRA S20	7/1/2008	12:32	0.5	5.4	------	10	------	22.7	22.8	40.3	40.3
NLRA S21	7/1/2008	12:44	0.5	4.8	------	6	------	22.8	22.9	40.1	40.0
NLRA S22	7/1/2008	12:53	0.5	5.5	------	23	------	21.6	21.6	35.8	38.3
NLRA S23	7/1/2008	13:04	0.5	6.5	------	6	------	23.1	23.0	39.7	39.6
NLRA S24	7/1/2008	13:13	0.5	7.5	------	4	------	23.1	23.0	38.7	38.8
NLRA S25	7/1/2008	13:25	0.5	4.4	4.3	<1	<1	22.5	22.5	38.2	38.2
NLRA S26	7/1/2008	13:40	0.5	5.3	------	1	------	24.0	24.0	38.2	38.3
NLRA S27	7/1/2008	13:50	0.5	5.2	------	1	------	23.8	23.8	38.6	38.2
NLRA S28	7/1/2008	13:59	0.5	4.8	------	<1	------	23.8	23.9	38.3	38.3
NLRA S29	7/1/2008	14:07	0.5	4.0	------	3	------	18.5	18.5	30.3	31.2
NLRA S30	7/1/2008	11:27	0.5	4.4	------	8	------	23.0	23.1	38.1	38.1
NLRA S01	7/7/2008	10:20	0.5	6.7	------	<1	------	23.6	23.5	42.2	42.5
NLRA S02	7/7/2008	10:28	0.5	4.9	------	1	------	23.8	23.7	43.5	43.6
NLRA S03	7/7/2008	10:35	0.5	4.3	------	<1	------	24.3	24.3	46.0	45.8
NLRA S04	7/7/2008	10:43	0.5	4.0	------	1	------	23.9	23.8	44.5	44.6
NLRA S05	7/7/2008	10:50	0.5	4.5	------	<1	------	24.2	24.1	44.8	44.5
NLRA S06	7/7/2008	10:57	0.5	4.7	------	<1	------	24.5	24.4	44.4	44.5
NLRA S07	7/7/2008	11:04	0.5	3.7	------	<1	------	24.3	24.3	44.4	44.4
NLRA S08	7/7/2008	11:10	0.5	4.6	------	<1	------	24.4	24.4	44.8	44.5
NLRA S09	7/7/2008	11:18	0.5	6.0	------	<1	------	24.8	24.8	44.8	44.6
NLRA S10	7/7/2008	11:30	0.5	4.1	------	<1	------	23.7	23.6	45.1	45.2
NLRA S11	7/7/2008	11:40	0.5	4.7	------	2	------	24.4	24.5	44.4	44.2
NLRA S12	7/7/2008	12:01	0.5	3.9	------	2	------	24.2	24.2	43.6	43.5
NLRA S13	7/7/2008	13:21	0.5	3.6	------	<1	------	24.8	24.7	42.3	42.6
NLRA S14	7/7/2008	13:29	0.5	3.6	------	<1	------	25.4	25.5	43.5	43.6
NLRA S15	7/7/2008	13:35	0.5	4.3	------	5	------	26.3	26.2	45.4	44.9
NLRA S16	7/7/2008	13:43	0.5	6.0	4.3	1	1	24.6	24.5	43.6	43.7
NLRA S17	7/7/2008	13:51	0.5	4.6	------	7	------	25.1	25.1	43.8	43.8
NLRA S18	7/7/2008	14:01	0.5	3.9	------	<1	------	25.2	25.3	43.2	43.4
NLRA S19	7/7/2008	14:09	0.5	4.3	------	1	------	26.1	26.0	43.8	43.8
NLRA S20	7/7/2008	14:17	0.5	7.4	------	1	------	26.2	26.2	44.4	45.4
NLRA S21	7/7/2008	14:25	0.5	4.7	------	<1	------	26.0	26.1	44.2	44.1

APPENDIX A. Newfound Lake Near-Shore Sampling Data Summary: 2007 and 2008 (Task 7)

Site	Date	Time (hh:mm)	Depth (meters)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	E *coli* (CFU/100ml)	E *coli* (replicate) (CFU/100ml)	Temperature (^{o}C)	Temperature (replicate) (^{o}C)	Specific Conductivity (*u* S/cm)	Specific Conductivity (replicate) (*u* S/cm)
NLRA S22	7/7/2008	14:38	0.5	5.7	------	<1	------	25.8	25.7	47.5	47.2
NLRA S23	7/7/2008	14:58	0.5	10.8	------	<1	------	27.6	27.6	45.5	45.4
NLRA S24	7/7/2008	15:04	0.5	9.4	9.3	<1	------	28.4	28.3	45.3	45.2
NLRA S25	7/7/2008	15:18	0.5	4.6	------	1	------	25.9	25.9	43.2	43.1
NLRA S26	7/7/2008	15:30	0.5	4.1	------	<1	------	26.6	26.5	43.1	43.0
NLRA S27	7/7/2008	15:41	0.5	4.3	------	<1	------	25.5	25.4	43.0	43.0
NLRA S28	7/7/2008	15:54	0.5	6.0	------	<1	------	25.9	26.0	42.6	42.6
NLRA S29	7/7/2008	10:11	0.5	5.3	------	2	------	23.5	23.5	39.4	41.0
NLRA S30	7/7/2008	11:49	0.5	3.8	------	<1	------	24.9	25.0	43.9	43.5
NLRA S01	9/1/2008	10:25	0.5	15.7	------	------	------	19.7	19.6	34.8	34.9
NLRA S02	9/1/2008	10:32	0.5	10.0	------	------	------	18.4	18.4	34.2	34.3
NLRA S03	9/1/2008	10:43	0.5	11.9	------	------	------	18.6	18.6	36.4	36.3
NLRA S04	9/1/2008	10:53	0.5	5.8	5.6	------	------	19.2	19.3	36.1	36.1
NLRA S05	9/1/2008	11:05	0.5	3.8	------	------	------	19.7	19.8	36.0	36.0
NLRA S06	9/1/2008	11:16	0.5	4.0	------	------	------	19.8	19.9	35.9	35.8
NLRA S07	9/1/2008	11:26	0.5	3.8	------	------	------	19.8	19.9	36.5	36.4
NLRA S08	9/1/2008	11:35	0.5	3.8	------	------	------	20.0	20.0	36.0	35.9
NLRA S09	9/1/2008	11:43	0.5	4.3	------	------	------	20.1	20.1	36.1	36.1
NLRA S10	9/1/2008	11:51	0.5	5.1	------	------	------	20.1	20.1	36.1	36.1
NLRA S11	9/1/2008	12:03	0.5	4.2	------	------	------	20.5	20.6	35.2	35.9
NLRA S12	9/1/2008	12:26	0.5	6.1	------	------	------	20.5	20.5	36.5	36.6
NLRA S13	9/1/2008	12:43	0.5	3.4	------	------	------	19.8	19.9	35.2	35.2
NLRA S14	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S15	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S16	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S17	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S18	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S19	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S20	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S21	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S22	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S23	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S24	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S25	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S26	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S27	9/1/2008	------		------	------	------	------	------	------	------	------
NLRA S28	9/1/2008	13:02	0.5	3.9	------	------	------	20.3	20.4	35.2	35.2

APPENDIX A. Newfound Lake Near-Shore Sampling Data Summary: 2007 and 2008 (Task 7)

Site	Date	Time (hh:mm)	Depth (meters)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	E *coli* (CFU/100ml)	E *coli* (replicate) (CFU/100ml)	Temperature (°C)	Temperature (replicate) (°C)	Specific Conductivity (*u* S/cm)	Specific Conductivity (replicate) (*u* S/cm)
NLRA S29	9/1/2008	13:15	0.5	11.6	------	------	------	16.7	17.7	32.8	32.9
NLRA S30	9/1/2008	12:16	0.5	3.4	------	------	------	20.1	20.2	35.2	35.3
NLRA S01	9/30/2008	9:52	0.5	3.7	4.5	3	7	17.4	17.4	35.0	35.0
NLRA S02	9/30/2008	10:08	0.5	3.2	------	6	------	17.4	17.4	35.2	35.3
NLRA S03	9/30/2008	10:16	0.5	3.8	------	11	------	17.5	17.5	35.0	34.9
NLRA S04	9/30/2008	10:22	0.5	3.9	------	5	------	17.8	17.8	35.8	35.7
NLRA S05	9/30/2008	10:28	0.5	3.5	------	7	------	17.7	17.7	35.4	35.4
NLRA S06	9/30/2008	10:33	0.5	4.8	------	10	------	17.7	17.7	35.0	35.0
NLRA S07	9/30/2008	10:39	0.5	4.4	------	8	------	17.8	17.8	36.2	36.2
NLRA S08	9/30/2008	10:46	0.5	3.4	------	10	------	17.8	17.8	36.6	36.6
NLRA S09	9/30/2008	10:53	0.5	4.7	------	8	------	17.8	17.8	36.9	36.9
NLRA S10	9/30/2008	10:59	0.5	3.8	------	8	------	17.8	17.9	37.1	37.1
NLRA S11	9/30/2008	11:07	0.5	3.2	------	6	------	17.9	17.9	37.0	37.0
NLRA S12	9/30/2008	11:22	0.5	4.5	------	6	------	17.9	17.9	36.6	36.8
NLRA S13	9/30/2008	11:33	0.5	2.7	------	3	------	17.9	17.9	36.4	36.4
NLRA S14	9/30/2008	11:47	0.5	3.8	------	17	------	18.0	18.0	37.4	37.3
NLRA S15	9/30/2008	11:51	0.5	3.9	------	14	------	18.0	18.1	37.0	37.0
NLRA S16	9/30/2008	12:00	0.5	3.2	------	5	------	18.0	18.0	36.7	36.8
NLRA S17	9/30/2008	12:09	0.5	2.9	------	4	------	17.9	17.9	36.6	36.6
NLRA S18	9/30/2008	12:16	0.5	3.6	------	6	------	17.7	17.7	36.5	36.5
NLRA S19	9/30/2008	12:23	0.5	3.1	------	8	------	17.7	17.7	36.6	36.6
NLRA S20	9/30/2008	12:30	0.5	4.3	------	20	------	17.7	17.7	37.3	37.3
NLRA S21	9/30/2008	12:38	0.5	3.6	------	15	------	17.6	17.6	37.2	37.2
NLRA S22	9/30/2008	12:49	0.5	5.4	------	86	------	14.5	14.5	32.3	32.6
NLRA S23	9/30/2008	13:03	0.5	6.3	------	13	------	17.5	17.5	37.4	37.4
NLRA S24	9/30/2008	13:10	0.5	8.8	9.4	17	19	17.7	17.7	38.2	38.1
NLRA S25	9/30/2008	13:25	0.5	4.9	------	12	------	17.6	17.6	36.6	36.9
NLRA S26	9/30/2008	13:34	0.5	4.0	------	2	------	17.8	17.8	37.1	37.1
NLRA S27	9/30/2008	13:45	0.5	------	------	3	------	18.2	18.2	36.9	36.9
NLRA S28	9/30/2008	13:55	0.5	4.6	------	<1	------	18.0	18.0	37.0	37.0
NLRA S29	9/30/2008	14:07	0.5	7.6	------	72	------	14.9	14.8	29.9	29.9
NLRA S30	9/30/2008	11:15	0.5	3.6	3.9	6	------	17.8	17.8	36.7	36.2

APPENDIX A. Newfound Watershed Periphyton (attatched algae) Data Summary: 2008 (Task 9)

Site ID	Date	Start Time (hh:mm)	Stop Time (hh:mm)	Chlorophyll *a* periphyton (mg/m^2)	Chlorophyll *a* periphyton (replicate) (mg/m^2)	Temperature (^oC)	Temperature (replicate) (^oC)	Specific Conductivity @ 25^{o}C (*u* S/cm)	Specific Conductivity @ 25^{o}C (replicate) (*u* S/cm)
P-1 Cockermouth	7/22/2008	10:41	11:11	1.349	------	------	------	------	------
P-3 Beachwood	7/22/2008	11:33	12:04	0.372	------	24.6	24.6	39.6	39.6
P-4 Fowler	7/22/2008	15:10	15:32	5.567	5.618	20.0	20.0	49.1	49.3
P-5 Hemlock	7/22/2008	13:55	14:23	2.582	------	25.3	25.3	41.5	41.4
P-7 Hebron	7/22/2008	10:20	10:40	6.708	------	23.5	23.4	37.8	39.0
P-1 Cockermouth	8/14/2008	13:01	13:05	------	------	------	------	------	------
P-3 Beachwood	8/14/2008	11:25	11:40	------	------	22.5	22.5	35.3	35.4
P-4 Fowler	8/14/2008	15:08	15:30	3.538	------	17.9	17.8	30.0	30.1
P-5 Hemlock	8/14/2008	10:15	10:40	16.882	------	22.4	22.4	35.5	35.6
P-7 Hebron	8/14/2008	11:55	12:20	4.483	2.891	22.0	22.3	37.2	36.6
P-3 Beachwood	8/26/2008	10:37	10:55	0.301	------	20.9	20.9	35.4	35.3
P-4 Fowler	8/26/2008	15:55	16:17	2.224	2.018	18.3	18.3	48.7	48.7
P-5 Hemlock	8/26/2008	14:07	14:31	1.218	------	20.9	20.9	36.4	36.4
P-7 Hebron	8/26/2008	11:09	11:32	1.316	------	19.2	19.2	37.2	36.9
P-3 Beachwood	9/24/2008	11:09	11:33	0.566	------	18.2	18.2	35.6	35.6
P-4 Fowler	9/24/2008	14:17	14:39	2.986	------	14.0	14.0	49.3	49.2
P-5 Hemlock	9/24/2008	10:20	10:45	3.433	3.711	18.1	18.1	36.3	36.1
P-7 Hebron	9/24/2008	11:51	12:18	2.967	------	17.7	17.7	37.3	37.2

With the exception of the periphyton chlorophyll *a* samples, the data were collected at a standard sampling depth of 0.5 meters.

APPENDIX A. Newfound Watershed Periphyton (attatched algae) Data Summary: 2008 (Task 9)

Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Dissolved Oxygen (% saturation)	Dissolved Oxygen (replicate) (% saturation)	Total Phosphorus (*u* g/l)	Total Phosphorus (replicate) (*u* g/l)	Chlorophyll *a* (*u* g/l)	Chlorophyll *a* (replicate) (*u* g/l)
------	------	------	------	3.8	------	1.6	------
8.5	8.4	101.6	101.2	2.9	------	1.3	------
8.0	8.1	88.2	88.6	10.4	10.3	2.6	------
8.5	8.4	103.0	102.6	3.2	------	1.4	------
8.6	8.6	101.1	101.4	7.4	------	2.6	------
------	------	------	------	6.0	------	------	------
------	------	------	------	3.5	------	1.8	------
------	------	------	------	16.8	------	0.5	------
------	------	------	------	6.1	------	1.3	------
------	------	------	------	7.2	------	1.8	------
------	------	------	------	2.9	------	3.6	------
------	------	------	------	11.1	------	1.6	------
------	------	------	------	5.8	------	4.5	------
------	------	------	------	8.7	------	4.9	------
------	------	------	------	4.1	------	1.9	------
------	------	------	------	8.7	------	1.6	1.1
------	------	------	------	4.1	------	1.9	------
------	------	------	------	5.9	------	2.1	------

APPENDIX A. Newfound Lake Benthic (lake sediment) Data Summary: 2008 (Task 10)

Site ID	Date	Time (hh:mm)	Depth (meters)	Temperature (^oC)	Temperature (replicate) (^oC)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (replicate) (mg/l)	Dissolved Oxygen (% saturation)	Dissolved Oxygen (replicate) (% saturation)
NLRA-B01	7/31/2008	14:17	0.5	------	------	------	------	------	------
NLRA-B02	7/31/2008	13:01	0.5	------	------	------	------	------	------
NLRA-B03	7/31/2008	11:55	0.5	------	------	------	------	------	------
NLRA-B04	7/31/2008	10:25	0.5	------	------	------	------	------	------
NLRA-B05	8/26/2008	9:45	0.1	21.1	21.1	8.8	8.8	98.4	99.1
NLRA-B06	8/14/2008	10:09	0.5	------	------	------	------	------	------
NLRA-B07	8/26/2008	10:25	0.5	21.2	21.2	8.9	8.8	99.7	99.4
NLRA-B08	8/26/2008	10:57	0.5	21.5	21.5	8.9	8.9	100.2	100.7
NLRA-B09	8/26/2008	11:25	0.5	21.3	21.4	8.8	8.7	99.1	98.4
NLRA-B10	8/26/2008	17:14	0.1	15.6	15.6	9.8	9.8	98.9	98.8
NLRA-B11	8/26/2008	12:17	0.5	21.4	21.5	8.9	8.8	101.6	99.6
NLRA-B12	8/26/2008	12:55	0.5	21.2	21.3	9.1	9.0	102.0	101.6
NLRA-B13	8/26/2008	13:35	0.5	19.5	19.5	9.1	9.1	98.8	99.1
NLRA-B14	8/26/2008	14:06	0.5	19.2	19.0	7.1	7.1	77.1	76.6
NLRA-B15	8/14/2008	13:30	0.5	19.7	19.7	------	------	------	------
NLRA-B16	8/14/2008	14:59	0.5	18.5	18.7	------	------	------	------
NLRA-B17	8/14/2008	14:17	0.5	15.9	15.9	------	------	------	------
NLRA-B18	8/26/2008	16:30	0.5	16.9	16.8	9.2	9.2	94.6	94.9
NLRA-B19	8/14/2008	12:17	0.5	22.0	22.3	------	------	------	------
NLRA-B20	8/14/2008	12:45	0.5	23.0	23.3	------	------	------	------
NLRA-B21	8/14/2008	11:25	0.5	20.9	20.9	8.9	8.9	99.7	100.0
NLRA-B22	8/26/2008	15:01	0.5	21.2	21.4	8.9	8.9	99.6	100.1

APPENDIX A. Newfound Lake Benthic (lake sediment) Data Summary: 2008 (Task 10)

Specific Conductivity @ 25^{o}C (*u* S/cm)	Specific Conductivity @ 25^{o}C (replicate) (*u* S/cm)	Total Phosphorus (*u* g/l)	Percent Organic mater (%)	Percent Organic matter (replicate) (%)	Benthic Total Phosphorus (g/Kg)	Benthic Total Phosphorus (replicate) (g/Kg)
------	------	11.8	0.3	------	0.01465	------
------	------	11.6	0.4	------	0.01944	------
------	------	4.6	1.0	------	0.02028	------
------	------	3.7	0.3	------	0.02372	------
36.7	36.8	9.5	0.6	------	0.02119	------
------	------	------	0.6	------	0.02089	------
36.6	36.6	5.8	0.5	------	0.01455	------
36.3	36.3	6.2	6.1	------	0.26630	------
35.9	35.8	5.2	0.3	------	0.00549	------
69.0	68.8	7.1	1.6	------	0.08122	------
36.0	36.0	11.2	0.3	------	0.01239	------
37.5	36.5	------	0.5	------	0.02013	------
35.1	35.4	5.1	2.4	------	0.07511	------
56.2	56.8	18.4	9.7	------	0.49936	------
31.3	31.1	19.4	0.5	------	0.03357	------
33.8	34.0	9.3	5.2	------	0.20270	------
28.6	28.8	7.0	0.8	------	0.03296	------
52.7	52.7	4.5	0.4	------	0.01797	------
37.2	36.6	6.1	18.5	------	1.05166	------
39.2	37.5	7.2	17.3	17.0	1.21625	1.20808
35.4	35.3	2.9	0.9	------	0.02411	------
35.4	35.2	------	0.2	------	0.01024	------

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Depth (meters)	Chloride (mg Cl/l)	Chloride replicate (mg Cl/l)	Nitrate (mg NO^3/l)	Nitrate replicate (mg NO^3/l)	Sulfate (mg S/l)	Sulfate replicate (mg S/l)	Sodium (mg Na/l)	Sodium replicate (mg Na/l)	Potassium (mg K/l)	Potassium replicate (mg K/l)	Magnesium (mg Mg/l)
1 Hemlock Brook	09-Apr-08	11:50	0.1	1.73	------	0.05	------	1.44	------	2.09	------	0.31	------	0.47
1 Hemlock Brook	22-May-08	14:23	0.1	2.85	------	0.01	------	1.49	------	2.92	------	0.49	------	0.68
1 Hemlock Brook	11-Aug-08	14:54	0.1	0.96	------	0.01	------	1.06	------	1.59	------	0.33	------	0.25
1 Hemlock Brook	18-Aug-08	15:31	0.1	1.46	------	0.02	------	1.19	------	2.23	------	0.45	------	0.57
1 Hemlock Brook	21-Oct-08	15:01	0.1	4.88	------	<.003	------	1.43	------	2.62	------	0.55	------	0.75
2 Tilton Brook	09-Apr-08	12:22	0.1	12.56	------	0.04	------	1.58	------	10.28	------	0.60	------	0.63
2 Tilton Brook	22-May-08	14:03	0.1	17.62	------	0.03	------	2.69	------	11.43	------	0.75	------	1.02
2 Tilton Brook	11-Aug-08	14:45	0.1	6.35	------	0.01	------	1.29	------	5.54	------	0.51	------	0.53
2 Tilton Brook	18-Aug-08	15:18	0.1	9.16	------	0.08	------	1.65	------	7.58	------	0.62	------	0.66
2 Tilton Brook	21-Oct-08	14:43	0.1	13.53	------	<.003	------	2.53	------	8.31	------	0.77	------	1.15
3 Dick Brown Brook	09-Apr-08	12:50	0.1	4.82	4.70	0.07	0.05	1.32	1.41	4.68	4.66	0.34	0.33	0.50
3 Dick Brown Brook	22-May-08	13:38	0.1	9.26	------	0.04	------	1.45	------	6.71	------	0.56	------	0.74
3 Dick Brown Brook	11-Aug-08	14:18	0.1	2.79	------	0.02	------	1.16	------	3.15	------	0.43	------	0.45
3 Dick Brown Brook	18-Aug-08	14:46	0.1	5.19	------	0.06	------	1.23	------	4.77	------	0.49	------	0.61
3 Dick Brown Brook	21-Oct-08	14:15	0.1	7.10	------	0.02	------	1.32	------	5.19	------	0.62	------	0.85
4 Whittemore Brook	09-Apr-08	13:08	0.1	0.87	------	0.03	------	1.15	------	1.44	------	0.25	------	0.38
4 Whittemore Brook	22-May-08	13:19	0.1	2.06	------	<.003	------	0.95	------	2.20	------	0.41	------	0.47
4 Whittemore Brook	11-Aug-08	14:02	0.1	0.86	------	<.003	------	0.90	------	1.53	------	0.37	------	0.40
4 Whittemore Brook	18-Aug-08	14:28	0.1	1.32	------	0.02	------	0.91	------	2.07	------	0.45	------	0.49
4 Whittemore Brook	21-Oct-08	13:47	0.1	1.90	------	<.003	------	0.89	------	2.13	------	0.52	------	0.67
9 Cashman Brook	09-Apr-08	13:33	0.1	28.20	------	<.003	------	1.30	------	21.97	------	0.45	------	0.58
9 Cashman Brook	22-May-08	12:27	0.1	54.18	------	0.09	------	1.57	------	34.20	------	0.91	------	1.04
9 Cashman Brook	11-Aug-08	13:39	0.1	10.18	------	0.01	------	0.82	------	8.81	------	0.42	------	0.43
9 Cashman Brook	18-Aug-08	13:34	0.1	32.36	------	0.05	------	1.05	------	21.81	------	0.74	------	0.75
9 Cashman Brook	21-Oct-08	13:25	0.1	43.47	------	0.01	------	1.12	------	26.13	------	1.05	------	1.02
10 Georges Brook	09-Apr-08	13:55	0.1	5.82	------	<.003	------	1.12	------	5.32	------	0.23	------	0.34
10 Georges Brook	22-May-08	12:48	0.1	8.23	------	0.01	------	0.83	------	6.16	------	0.30	------	0.60
10 Georges Brook	11-Aug-08	13:25	0.1	3.52	------	<.003	------	0.77	------	3.58	------	0.28	------	0.30
10 Georges Brook	18-Aug-08	13:52	0.1	4.91	------	<.003	------	0.65	------	4.61	------	0.30	------	0.35
10 Georges Brook	21-Oct-08	13:01	0.1	8.02	------	0.01	------	0.78	------	5.46	------	0.42	------	0.55
12 Cockermouth River	09-Apr-08	14:25	0.1	2.29	------	0.06	------	1.03	------	2.65	------	0.25	------	0.34
12 Cockermouth River	22-May-08	11:49	0.1	6.80	------	0.10	------	1.23	------	5.18	------	0.54	------	0.54
12 Cockermouth River	11-Aug-08	12:30	0.1	0.66	------	0.02	------	0.74	------	1.11	------	0.50	------	0.19
12 Cockermouth River	18-Aug-08	12:36	0.1	3.89	------	0.11	------	1.01	------	3.83	------	0.49	------	0.42
12 Cockermouth River	21-Oct-08	12:33	0.1	4.61	------	0.05	------	1.12	------	3.72	------	0.50	------	0.58
17 Mason Brook	09-Apr-08	14:59	0.1	2.51	------	0.06	------	1.69	------	2.28	------	0.38	------	0.58
17 Mason Brook	22-May-08	11:28	0.1	2.61	------	0.02	------	1.14	------	2.60	------	0.46	------	0.76

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Depth (meters)	Chloride (mg Cl/l)	Chloride replicate (mg Cl/l)	Nitrate (mg NO^3/l)	Nitrate replicate (mg NO^3/l)	Sulfate (mg S/l)	Sulfate replicate (mg S/l)	Sodium (mg Na/l)	Sodium replicate (mg Na/l)	Potassium (mg K/l)	Potassium replicate (mg K/l)	Magnesium (mg Mg/l)
17 Mason Brook	11-Aug-08	12:03	0.1	1.50	------	0.03	------	1.00	------	1.76	------	0.44	------	0.58
17 Mason Brook	18-Aug-08	12:15	0.1	1.62	------	0.03	------	1.00	------	2.12	------	0.47	------	0.67
17 Mason Brook	21-Oct-08	12:14	0.1	2.73	------	<.003	------	1.12	------	2.32	------	0.55	------	1.06
18 The Ledges	09-Apr-08	15:25	0.1	1.32	------	0.05	------	1.14	------	1.77	------	0.26	------	0.53
18 The Ledges	22-May-08	11:01	0.1	5.99	------	0.14	------	1.52	------	3.79	------	0.49	------	0.90
18 The Ledges	11-Aug-08	11:44	0.1	2.63	------	0.03	------	1.05	------	2.82	------	0.39	------	0.57
18 The Ledges	18-Aug-08	11:55	0.1	2.65	------	0.12	------	1.37	------	2.67	------	0.41	------	0.75
18 The Ledges	21-Oct-08	11:52	0.1	3.52	------	0.11	------	1.39	------	2.59	------	0.45	------	0.97
21 Bog Brook	09-Apr-08	16:24	0.1	5.12	------	0.02	------	0.94	------	4.94	------	0.38	------	0.41
21 Bog Brook	22-May-08	10:00	0.1	9.33	------	0.01	------	1.03	------	6.56	------	0.49	------	0.57
21 Bog Brook	11-Aug-08	11:07	0.1	3.55	------	0.02	------	0.82	------	3.20	------	0.57	------	0.30
21 Bog Brook	18-Aug-08	10:45	0.1	5.79	------	0.02	------	0.77	------	4.89	------	0.61	------	0.44
21 Bog Brook	21-Oct-08	10:48	0.1	7.42	------	0.01	------	1.00	------	4.78	------	0.57	------	0.60
22 Fowler River	09-Apr-08	17:06	0.1	2.61	------	0.05	------	1.10	------	2.80	------	0.25	------	0.25
22 Fowler River	22-May-08	10:29	0.1	3.69	------	0.01	------	0.99	------	3.05	------	0.35	------	0.33
22 Fowler River	11-Aug-08	10:41	0.1	1.24	------	0.02	------	0.75	------	1.53	------	0.49	------	0.13
22 Fowler River	18-Aug-08	11:18	0.1	2.62	------	0.01	------	0.99	------	2.66	------	0.34	------	0.38
22 Fowler River	21-Oct-08	11:13	0.1	2.83	------	<.003	------	1.12	------	2.37	------	0.36	------	0.43
23 Black Brook	09-Apr-08	15:39	0.1	15.81	15.68	0.11	0.06	1.44	1.27	12.87	12.86	0.57	0.56	0.56
23 Black Brook	22-May-08	9:05	0.1	40.47	40.31	0.04	0.04	1.19	1.17	25.19	25.39	0.86	0.90	1.06
23 Black Brook	11-Aug-08	9:55	0.1	8.71	8.82	0.02	0.04	0.89	0.91	7.35	7.29	0.62	0.61	0.51
23 Black Brook	18-Aug-08	10:05	0.1	33.43	34.14	0.03	0.08	0.83	0.88	21.64	21.86	0.58	0.94	0.73
23 Black Brook	21-Oct-08	10:09	0.1	30.09	30.58	0.03	0.03	0.93	0.92	17.36	17.54	1.10	1.06	1.30

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Magnesium replicate (mg Mg/l)	Calcium (mg Ca/l)	Calcium replicate (mg Ca/l)	Soluble Reactive Phosphorus (*u* g/l)	Soluble Reactive Phosphorus replicate (*u* g/l)	Total Phosphorus (*u* g/l)	Total Phosphorus replicate (*u* g/l)	Temperature (^{o}C)	Temperature replicate (^{o}C)	Specific Conductivity @ 25^{o}C (*u* S/cm)
1 Hemlock Brook	09-Apr-08	11:50	------	2.56	------	1.0	------	3.2	------	2.7	2.7	27.6
1 Hemlock Brook	22-May-08	14:23	------	4.26	------	< 1.0	------	2.9	------	9.9	9.8	35.1
1 Hemlock Brook	11-Aug-08	14:54	------	2.44	------	1.3	------	18.5	------	15.2	15.2	21.3
1 Hemlock Brook	18-Aug-08	15:31	------	4.04	------	1.5	------	6.1	------	16.8	16.8	29.5
1 Hemlock Brook	21-Oct-08	15:01	------	4.53	------	3.0	------	6.1	------	7.5	7.4	37.2
2 Tilton Brook	09-Apr-08	12:22	------	4.55	------	< 1.0	------	3.7	------	3.1	3.1	80.2
2 Tilton Brook	22-May-08	14:03	------	6.33	------	< 1.0	------	7.2	------	9.6	9.5	99.6
2 Tilton Brook	11-Aug-08	14:45	------	4.25	------	1.4	------	13.3	------	15.2	15.2	48.8
2 Tilton Brook	18-Aug-08	15:18	------	5.41	------	1.2	------	6.3	------	16.4	16.4	67.4
2 Tilton Brook	21-Oct-08	14:43	------	7.16	------	< 1.0	------	3.1	------	8.4	8.4	89.5
3 Dick Brown Brook	09-Apr-08	12:50	0.49	3.73	3.60	< 1.0	------	4.9	------	3.2	3.2	43.7
3 Dick Brown Brook	22-May-08	13:38	------	4.40	------	1.0	------	4.0	------	10.4	10.3	60.0
3 Dick Brown Brook	11-Aug-08	14:18	------	3.89	------	1.4	------	18.7	------	15.7	15.7	32.6
3 Dick Brown Brook	18-Aug-08	14:46	------	4.28	------	1.1	------	6.7	------	17.4	17.3	46.9
3 Dick Brown Brook	21-Oct-08	14:15	------	5.63	------	1.5	------	5.2	------	7.8	7.8	58.5
4 Whittemore Brook	09-Apr-08	13:08	------	2.31	------	1.5	------	4.5	------	3.6	3.6	20.2
4 Whittemore Brook	22-May-08	13:19	------	2.82	------	< 1.0	------	5.3	------	9.8	9.8	29.7
4 Whittemore Brook	11-Aug-08	14:02	------	3.57	------	2.3	------	10.7	------	15.5	15.5	20.7
4 Whittemore Brook	18-Aug-08	14:28	------	3.63	------	1.9	------	8.8	------	17.4	17.4	26.3
4 Whittemore Brook	21-Oct-08	13:47	------	4.35	------	2.0	------	5.2	------	7.7	7.7	30.2
9 Cashman Brook	09-Apr-08	13:33	------	4.52	------	1.0	------	4.0	------	4.0	3.9	140.3
9 Cashman Brook	22-May-08	12:27	------	6.13	------	1.6	------	3.8	------	10.0	9.9	221.1
9 Cashman Brook	11-Aug-08	13:39	------	3.83	------	2.2	------	21.1	------	15.9	15.8	63.1
9 Cashman Brook	18-Aug-08	13:34	------	5.41	------	2.0	------	5.1	------	17.2	17.2	142.1
9 Cashman Brook	21-Oct-08	13:25	------	6.87	------	1.4	------	4.3	------	8.4	8.4	190.4
10 Georges Brook	09-Apr-08	13:55	------	2.61	------	< 1.0	------	4.1	------	1.6	1.5	42.8
10 Georges Brook	22-May-08	12:48	------	4.42	------	2.0	------	15.3	------	13.5	13.5	50.3
10 Georges Brook	11-Aug-08	13:25	------	3.48	------	1.3	------	12.8	------	16.3	16.3	31.6
10 Georges Brook	18-Aug-08	13:52	------	4.21	------	< 1.0	------	11.7	------	20.3	20.2	40.4
10 Georges Brook	21-Oct-08	13:01	------	4.48	------	1.2	------	7.8	------	7.8	7.8	51.1
12 Cockermouth River	09-Apr-08	14:25	------	2.42	------	< 1.0	------	5.5	------	4.2	4.2	29.1
12 Cockermouth River	22-May-08	11:49	------	4.11	------	1.1	------	3.6	------	10.2	10.2	48.4
12 Cockermouth River	11-Aug-08	12:30	------	2.80	------	2.7	------	258.1	------	15.0	14.9	16.7
12 Cockermouth River	18-Aug-08	12:36	------	4.23	------	< 1.0	------	3.5	------	17.2	17.1	39.1
12 Cockermouth River	21-Oct-08	12:33	------	4.54	------	< 1.0	------	2.9	------	8.4	8.3	42.1
17 Mason Brook	09-Apr-08	14:59	------	4.39	------	< 1.0	------	4.3	------	4.1	4.1	34.5
17 Mason Brook	22-May-08	11:28	------	5.02	------	1.6	------	6.7	------	9.6	9.6	38.4

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Magnesium replicate (mg Mg/l)	Calcium (mg Ca/l)	Calcium replicate (mg Ca/l)	Soluble Reactive Phosphorus (*u* g/l)	Soluble Reactive Phosphorus replicate (*u* g/l)	Total Phosphorus (*u* g/l)	Total Phosphorus replicate (*u* g/l)	Temperature (^oC)	Temperature replicate (^oC)	Specific Conductivity @ 25^oC (*u* S/cm)
17 Mason Brook	11-Aug-08	12:03	------	4.68	------	1.7	------	38.3	------	15.6	15.5	28.6
17 Mason Brook	18-Aug-08	12:15	------	5.53	------	1.1	------	4.9	------	17.0	17.0	38.8
17 Mason Brook	21-Oct-08	12:14	------	6.36	------	1.1	------	4.0	------	8.9	8.9	45.4
18 The Ledges	09-Apr-08	15:25	------	3.35	------	< 1.0	------	3.2	------	4.2	4.2	28.0
18 The Ledges	22-May-08	11:01	------	4.90	------	1.2	------	3.4	------	10.4	10.4	50.1
18 The Ledges	11-Aug-08	11:44	------	4.08	------	1.5	------	34.8	------	15.3	15.3	19.6
18 The Ledges	18-Aug-08	11:55	------	4.82	------	< 1.0	------	2.1	------	17.7	17.7	38.4
18 The Ledges	21-Oct-08	11:52	------	5.66	------	< 1.0	------	2.5	------	9.1	9.1	42.8
21 Bog Brook	09-Apr-08	16:24	------	3.10	------	1.4	------	8.9	------	3.9	3.9	42.9
21 Bog Brook	22-May-08	10:00	------	4.06	------	1.4	------	9.8	------	12.4	12.5	53.5
21 Bog Brook	11-Aug-08	11:07	------	3.48	------	4.4	------	98.1	------	15.5	15.5	32.1
21 Bog Brook	18-Aug-08	10:45	------	4.11	------	1.0	------	13.7	------	17.5	17.5	45.9
21 Bog Brook	21-Oct-08	10:48	------	4.34	------	1.2	------	6.9	------	6.9	6.8	47.7
22 Fowler River	09-Apr-08	17:06	------	1.46	------	< 1.0	------	6.9	------	4.5	4.4	28.1
22 Fowler River	22-May-08	10:29	------	2.69	------	1.1	------	3.5	------	10.5	10.6	32.1
22 Fowler River	11-Aug-08	10:41	------	2.11	------	3.5	------	308.1	------	14.9	14.9	18.3
22 Fowler River	18-Aug-08	11:18	------	2.22	------	1.0	------	4.5	------	17.1	17.1	25.7
22 Fowler River	21-Oct-08	11:13	------	3.02	------	1.2	------	4.5	------	6.8	6.7	26.2
23 Black Brook	09-Apr-08	15:39	0.56	5.05	5.14	2.0	------	18.2	18.6	4.5	4.4	95.2
23 Black Brook	22-May-08	9:05	1.15	9.00	8.92	2.0	2.6	8.6	9.7	9.8	9.7	186.9
23 Black Brook	11-Aug-08	9:55	0.51	5.02	5.29	3.5	3.6	182.6	160.6	15.7	15.6	60.4
23 Black Brook	18-Aug-08	10:05	0.93	8.85	9.10	2.2	2.0	10.2	10.1	16.0	15.9	163.6
23 Black Brook	21-Oct-08	10:09	1.26	8.50	8.28	1.7	1.8	8.4	8.6	6.7	6.7	149.7

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Specific Conductivity @ 25°C replicate (u S/cm)	Turbidity (NTU)	Turbidity replicate (NTU)	pH (std units)	pH replicate (std units)	Gauge Height (feet)	Gauge Height (feet)	Discharge (m^3/sec)
1 Hemlock Brook	09-Apr-08	11:50	27.7	0.2	0.4	6.5	6.6	0.78	0.78	0.422
1 Hemlock Brook	22-May-08	14:23	35.2	< 0.2	< 0.2	7.1	7.1	0.28	0.28	0.012
1 Hemlock Brook	11-Aug-08	14:54	21.2	1.1	1.2	-----	-----	0.98	0.98	0.589
1 Hemlock Brook	18-Aug-08	15:31	29.6	0.2	0.2	6.7	6.8	------	------	------
1 Hemlock Brook	21-Oct-08	15:01	37.3	0.2	< 0.2	7.0	7.0	0.26	0.26	0.011
2 Tilton Brook	09-Apr-08	12:22	80.1	0.2	< 0.2	6.6	6.6	1.08	1.08	0.219
2 Tilton Brook	22-May-08	14:03	100.1	< 0.2	< 0.2	7.0	7.1	0.58	0.58	0.013
2 Tilton Brook	11-Aug-08	14:45	49.1	0.9	0.8	-----	-----	1.24	1.24	0.336
2 Tilton Brook	18-Aug-08	15:18	67.2	0.2	0.2	6.8	6.9	0.78	0.78	0.067
2 Tilton Brook	21-Oct-08	14:43	89.2	< 0.2	< 0.2	6.9	6.9	0.66	0.66	0.030
3 Dick Brown Brook	09-Apr-08	12:50	43.9	0.4	0.4	6.6	6.6	1.28	1.28	0.658
3 Dick Brown Brook	22-May-08	13:38	61.4	0.2	0.5	6.8	6.9	0.78	0.78	0.074
3 Dick Brown Brook	11-Aug-08	14:18	32.6	1.9	1.6	-----	-----	1.96	2.00	0.889
3 Dick Brown Brook	18-Aug-08	14:46	46.4	0.7	0.5	6.9	6.9	------	------	0.195
3 Dick Brown Brook	21-Oct-08	14:15	58.4	0.2	0.2	6.9	6.9	0.66	0.66	0.074
4 Whittemore Brook	09-Apr-08	13:08	20.2	0.4	0.3	6.5	6.5	1.20	1.18	0.646
4 Whittemore Brook	22-May-08	13:19	29.9	0.2	< 0.2	6.9	6.8	0.64	0.64	0.073
4 Whittemore Brook	11-Aug-08	14:02	20.7	0.5	0.4	-----	-----	1.32	1.32	0.873
4 Whittemore Brook	18-Aug-08	14:28	26.3	0.7	0.6	6.9	6.9	0.82	0.82	0.192
4 Whittemore Brook	21-Oct-08	13:47	30.2	< 0.2	< 0.2	6.9	7.0	0.64	0.64	0.073
9 Cashman Brook	09-Apr-08	13:33	138.3	< 0.2	0.2	6.6	6.6	1.20	1.20	0.208
9 Cashman Brook	22-May-08	12:27	221.2	< 0.2	0.3	6.8	6.8	0.58	0.58	0.004
9 Cashman Brook	11-Aug-08	13:39	64.5	0.4	0.3	-----	-----	1.34	1.35	0.328
9 Cashman Brook	18-Aug-08	13:34	142.0	< 0.2	< 0.2	6.9	6.9	0.74	0.74	0.009
9 Cashman Brook	21-Oct-08	13:25	190.6	< 0.2	< 0.2	6.8	6.8	0.80	0.80	0.020
10 Georges Brook	09-Apr-08	13:55	42.8	0.2	0.3	6.3	6.3	4.59	4.59	1.505
10 Georges Brook	22-May-08	12:48	50.3	0.7	0.7	6.9	7.0	5.02	5.02	0.049
10 Georges Brook	11-Aug-08	13:25	32.0	1.2	0.7	-----	-----	4.44	4.45	2.738
10 Georges Brook	18-Aug-08	13:52	40.6	0.7	0.6	6.8	6.9	4.93	4.93	0.059
10 Georges Brook	21-Oct-08	13:01	51.2	0.4	0.4	6.7	6.8	4.93	4.94	0.067
12 Cockermouth River	09-Apr-08	14:25	29.3	1.0	1.1	6.3	6.3	2.74	2.75	2.875
12 Cockermouth River	22-May-08	11:49	48.4	0.2	0.2	6.6	6.6	3.30	3.30	0.070
12 Cockermouth River	11-Aug-08	12:30	16.6	33.6	34.2	-----	-----	1.48	1.46	30.748
12 Cockermouth River	18-Aug-08	12:36	39.2	0.2	< 0.2	6.6	6.6	3.23	3.23	0.112
12 Cockermouth River	21-Oct-08	12:33	42.1	0.2	< 0.2	6.6	6.6	3.30	3.30	0.070
17 Mason Brook	09-Apr-08	14:59	34.3	0.2	0.3	6.6	6.6	0.56	0.58	0.092
17 Mason Brook	22-May-08	11:28	38.5	0.3	0.3	6.9	6.9	0.22	0.22	0.005

APPENDIX A. Newfound Watershed Tributary (Paired-Watershed) Data Summary: 2008 (Task 5)

Sample Name	Sampling Date	Collection Time (hh:mm)	Specific Conductivity @ 25°C replicate (*u* S/cm)	Turbidity (NTU)	Turbidity replicate (NTU)	pH (std units)	pH replicate (std units)	Gauge Height (feet)	Gauge Height (feet)	Discharge (m^3/sec)
17 Mason Brook	11-Aug-08	12:03	26.1	2.4	2.3	-----	-----	0.98	0.98	0.371
17 Mason Brook	18-Aug-08	12:15	38.7	0.3	0.3	7.1	7.2	0.26	0.26	0.008
17 Mason Brook	21-Oct-08	12:14	45.5	0.2	< 0.2	7.0	7.0	0.24	0.24	0.006
18 The Ledges	09-Apr-08	15:25	27.9	0.5	0.4	6.7	6.7	0.92	0.92	0.418
18 The Ledges	22-May-08	11:01	50.1	< 0.2	0.2	7.0	7.0	0.31	0.31	0.007
18 The Ledges	11-Aug-08	11:44	19.7	2.1	1.9	-----	-----	1.30	1.28	1.135
18 The Ledges	18-Aug-08	11:55	38.5	0.4	0.3	7.1	7.1	0.40	0.40	0.011
18 The Ledges	21-Oct-08	11:52	42.8	< 0.2	< 0.2	7.2	7.2	0.36	0.36	0.009
21 Bog Brook	09-Apr-08	16:24	43.0	0.6	0.7	6.1	6.1	2.34	2.35	2.975
21 Bog Brook	22-May-08	10:00	53.6	0.7	0.7	6.6	6.6	2.83	2.83	0.390
21 Bog Brook	11-Aug-08	11:07	32.2	19.1	19.8	-----	-----	1.89	1.89	6.849
21 Bog Brook	18-Aug-08	10:45	45.9	0.7	0.6	6.4	6.4	2.78	2.78	0.583
21 Bog Brook	21-Oct-08	10:48	47.8	0.2	0.2	6.5	6.5	2.30	2.31	3.259
22 Fowler River	09-Apr-08	17:06	28.1	0.6	0.7	6.1	6.1	3.67	3.66	5.561
22 Fowler River	22-May-08	10:29	32.0	< 0.2	0.2	6.5	6.5	4.08	4.08	0.650
22 Fowler River	11-Aug-08	10:41	18.0	29.1	27.4	-----	-----	2.73	2.73	------
22 Fowler River	18-Aug-08	11:18	25.8	0.3	0.2	6.5	6.5	4.03	4.03	0.859
22 Fowler River	21-Oct-08	11:13	26.3	< 0.2	< 0.2	6.9	6.7	4.07	4.07	0.691
23 Black Brook	09-Apr-08	15:39	95.4	1.9	1.7	6.5	6.5	1.16	1.16	0.275
23 Black Brook	22-May-08	9:05	187.8	0.9	1.0	6.8	6.9	0.40	0.40	0.008
23 Black Brook	11-Aug-08	9:55	60.4	10.2	10.2	-----	-----	1.60	1.60	0.383
23 Black Brook	18-Aug-08	10:05	163.8	1.0	0.9	6.8	6.8	0.54	0.54	------
23 Black Brook	21-Oct-08	10:09	149.8	0.7	0.7	6.6	6.6	0.46	0.46	0.007

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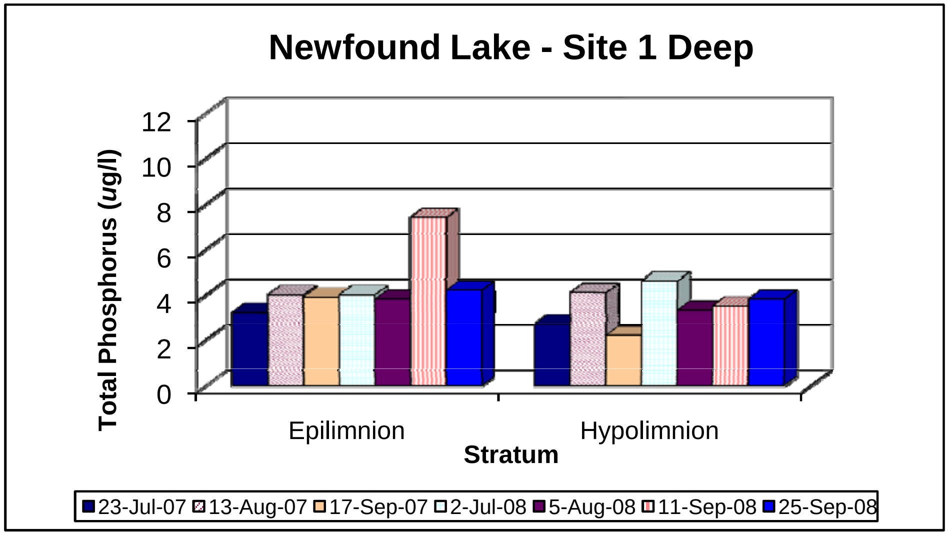
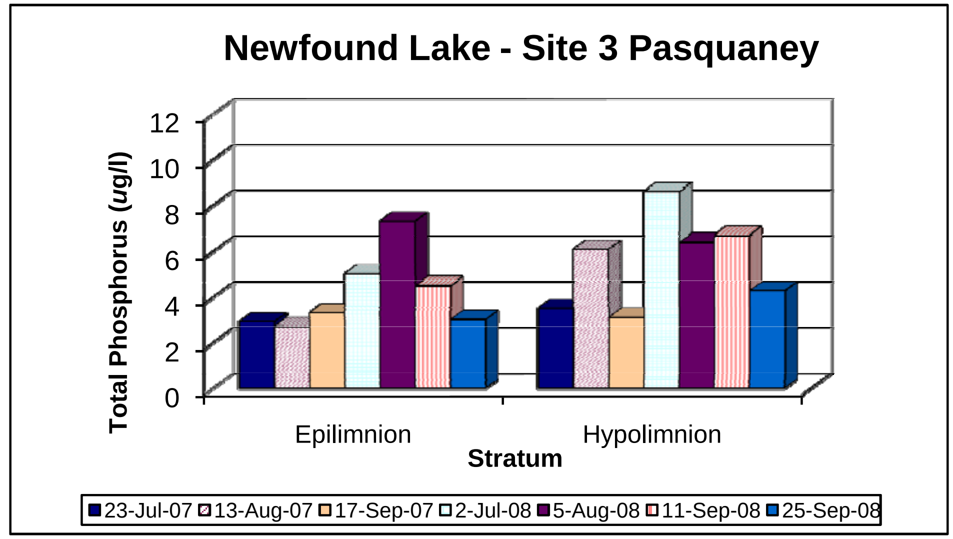
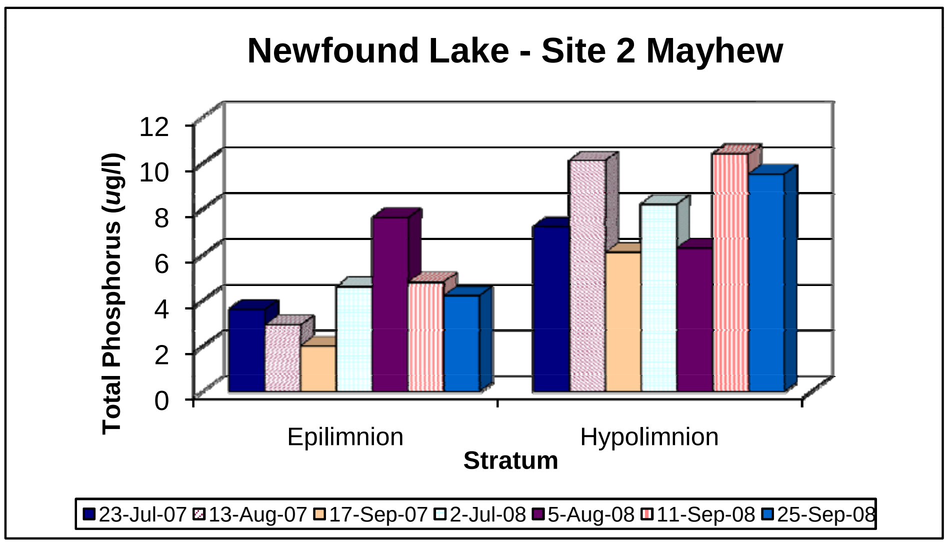
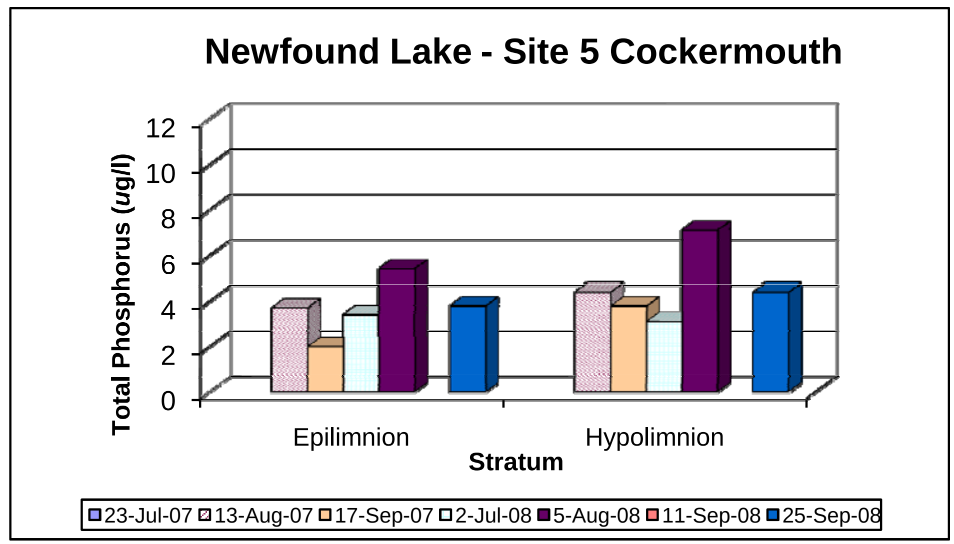
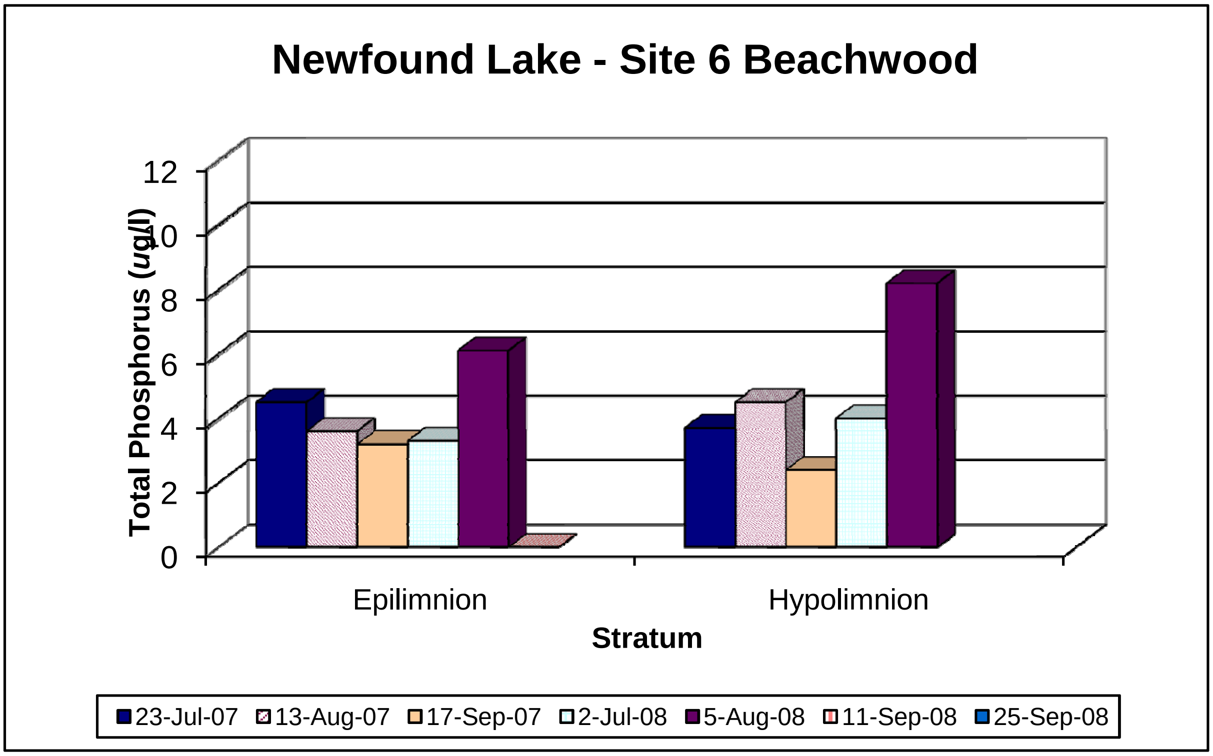
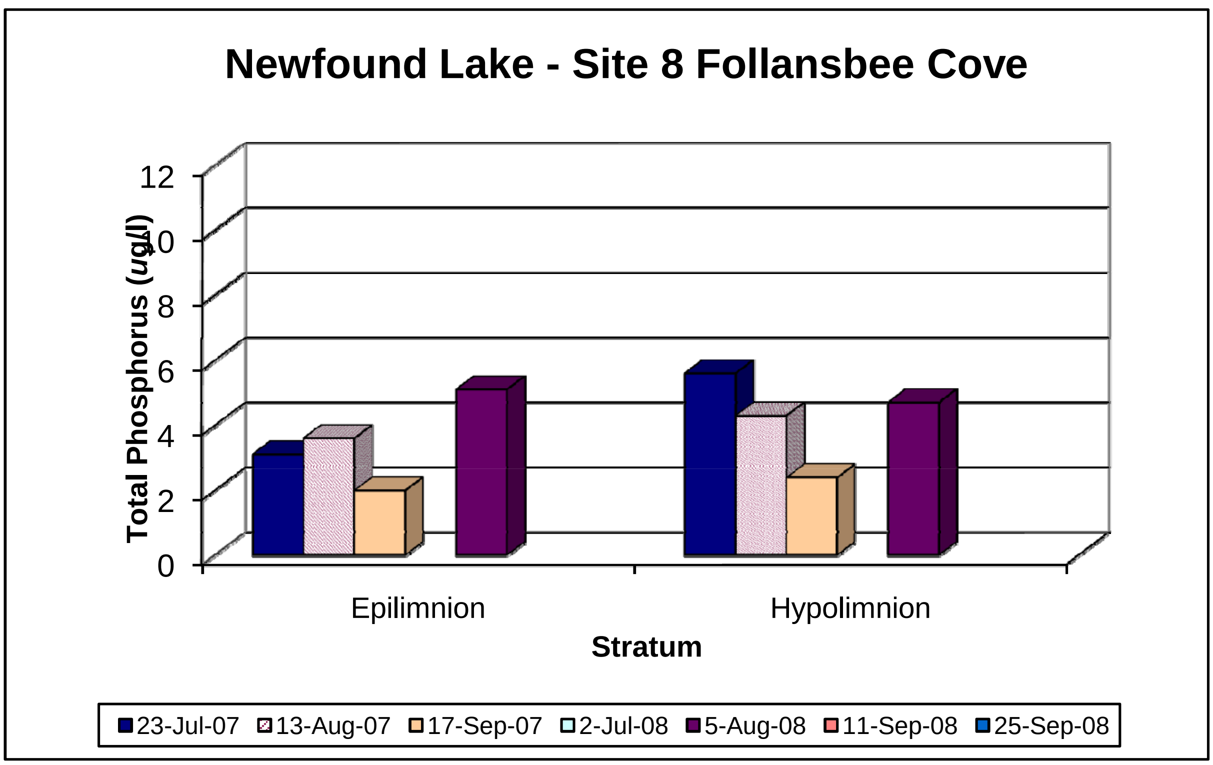

Newfound Lake - Site 1 Deep
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08


Newfound Lake - Site 3 Pasquaney
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08


Newfound Lake - Site 2 Mayhew
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08

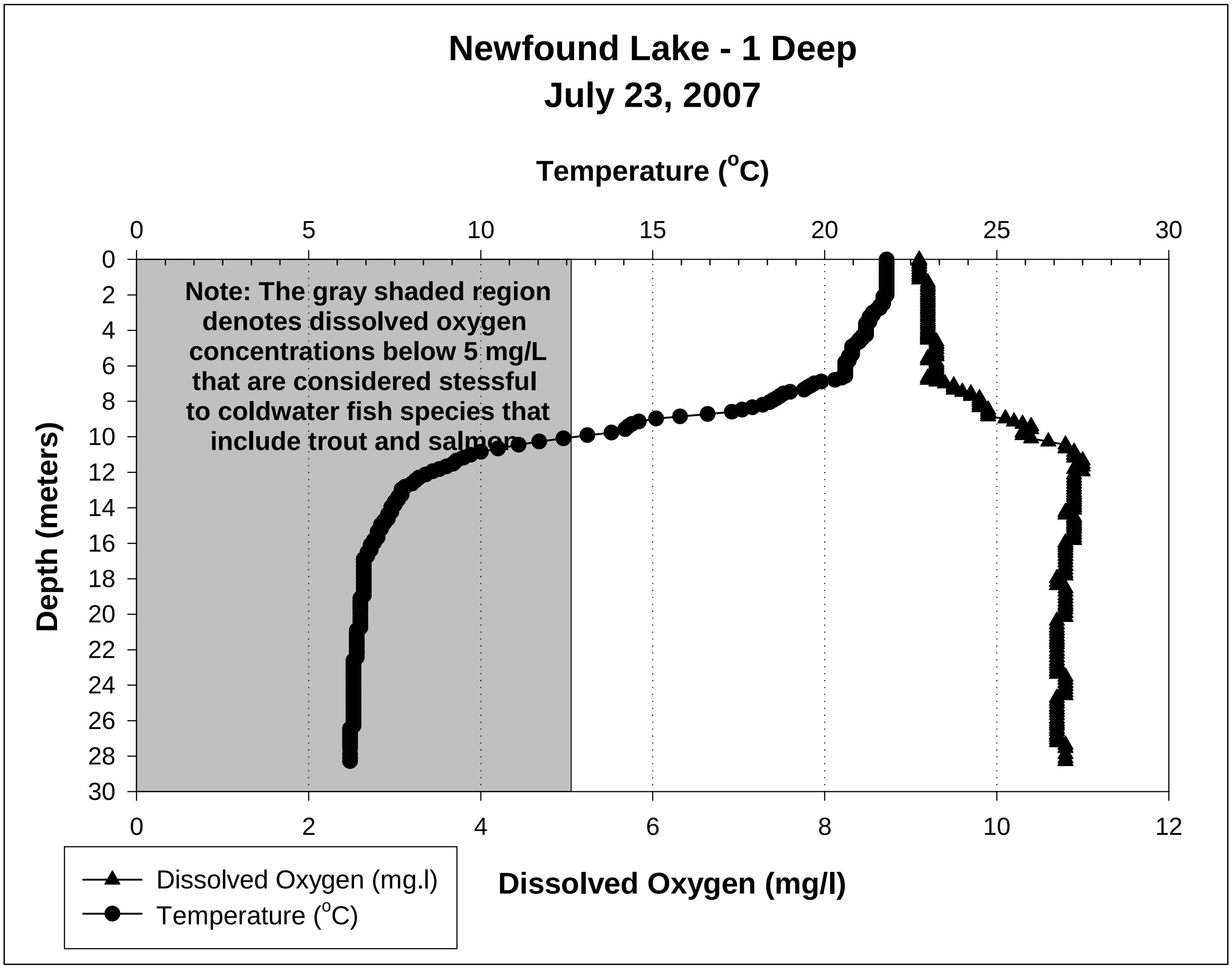

Newfound Lake - Site 5 Cockermouth
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08

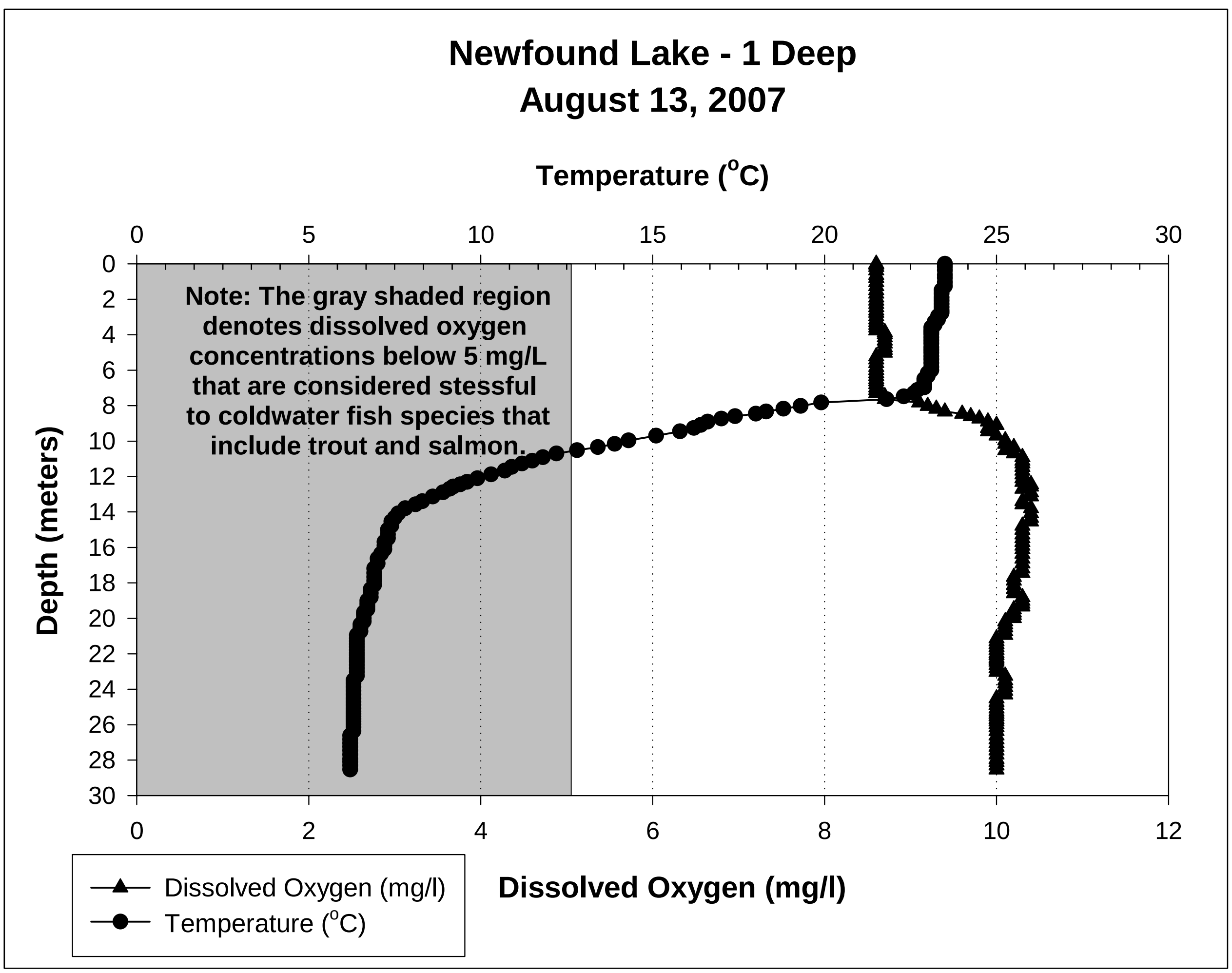

Newfound Lake - Site 6 Beachwood
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08

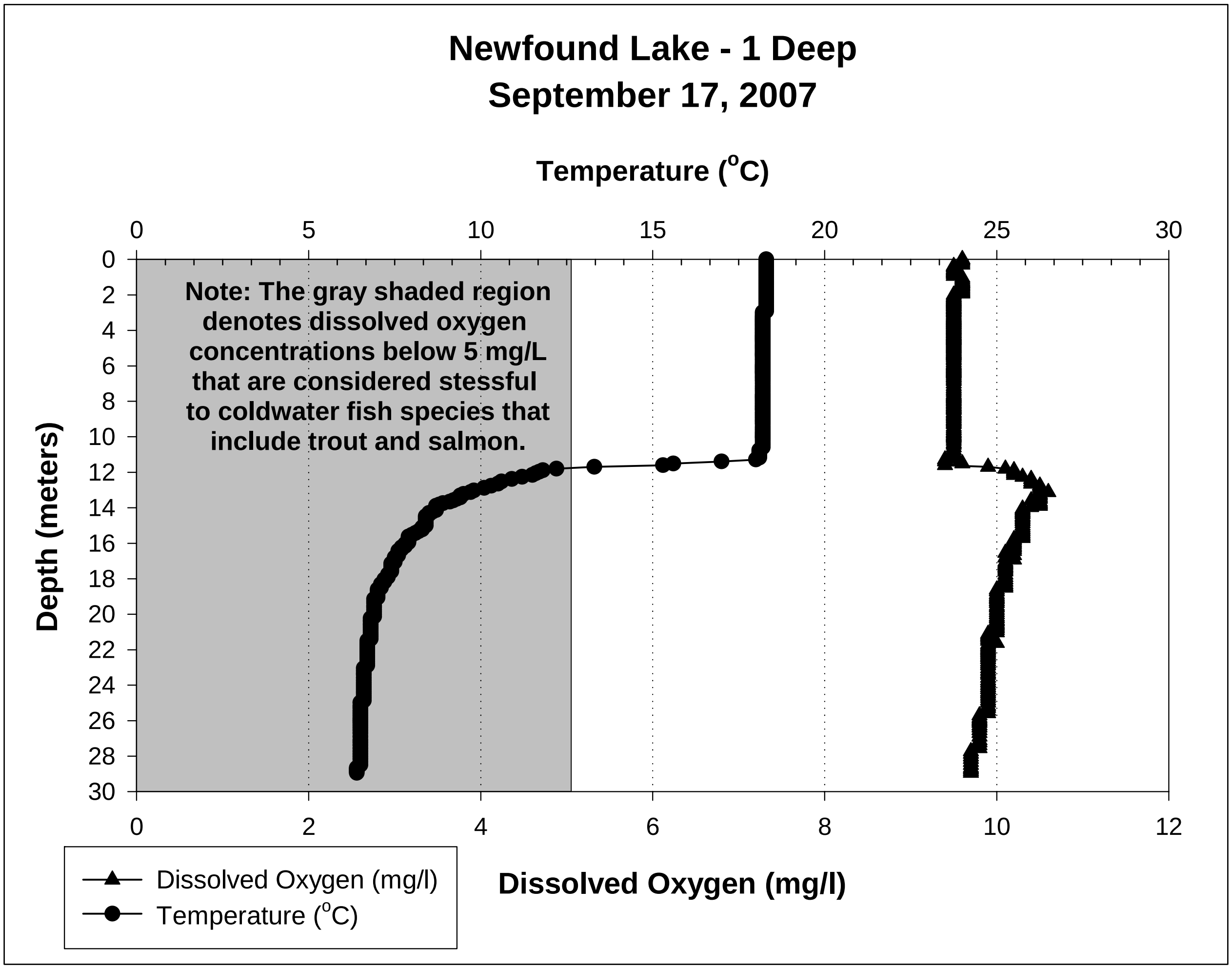

Newfound Lake - Site 8 Follansbee Cove
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
Epilimnion
Hypolimnion
Stratum
23-Jul-07
13-Aug-07
17-Sep-07
2-Jul-08
5-Aug-08
11-Sep-08
25-Sep-08

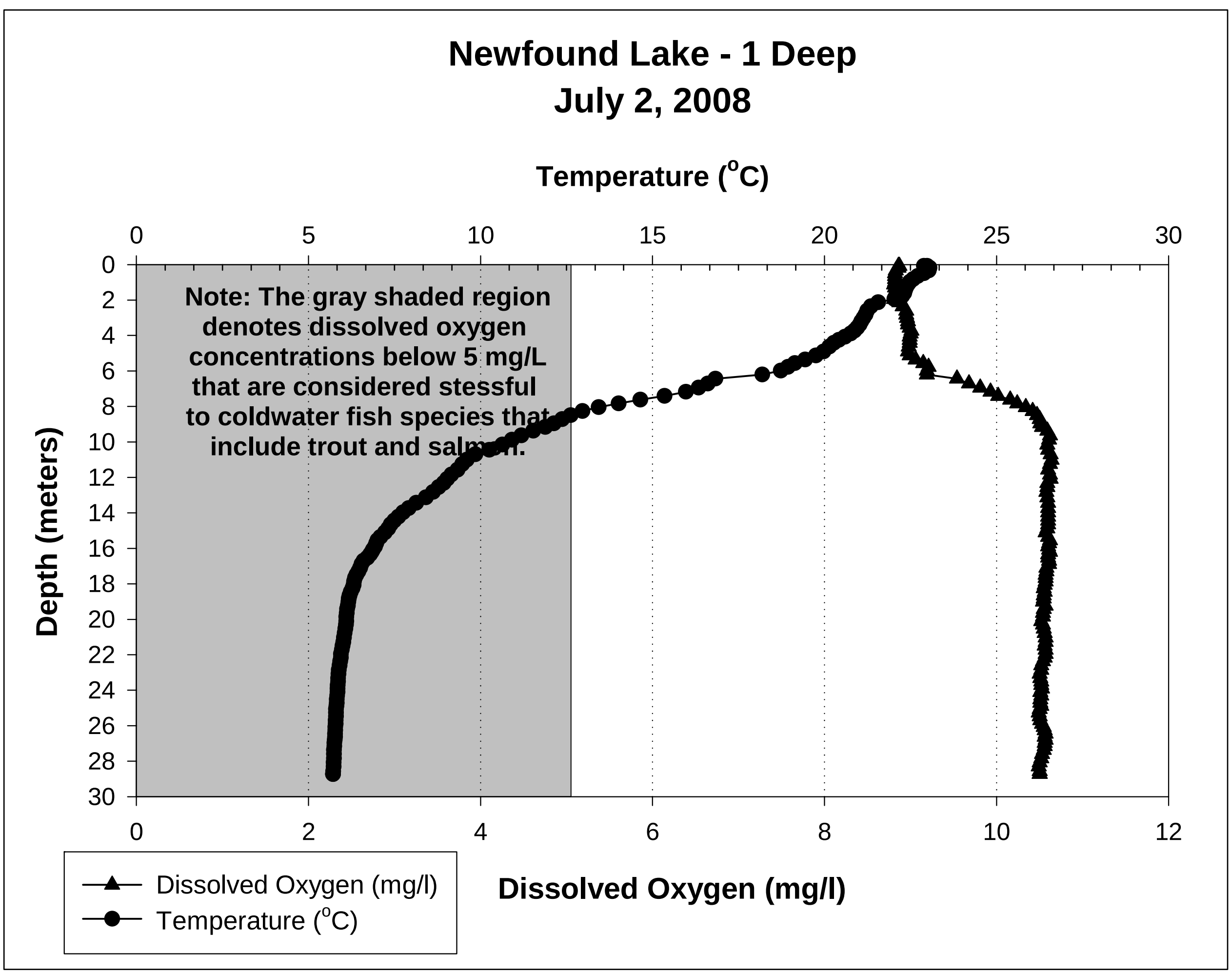
APPENDIX C

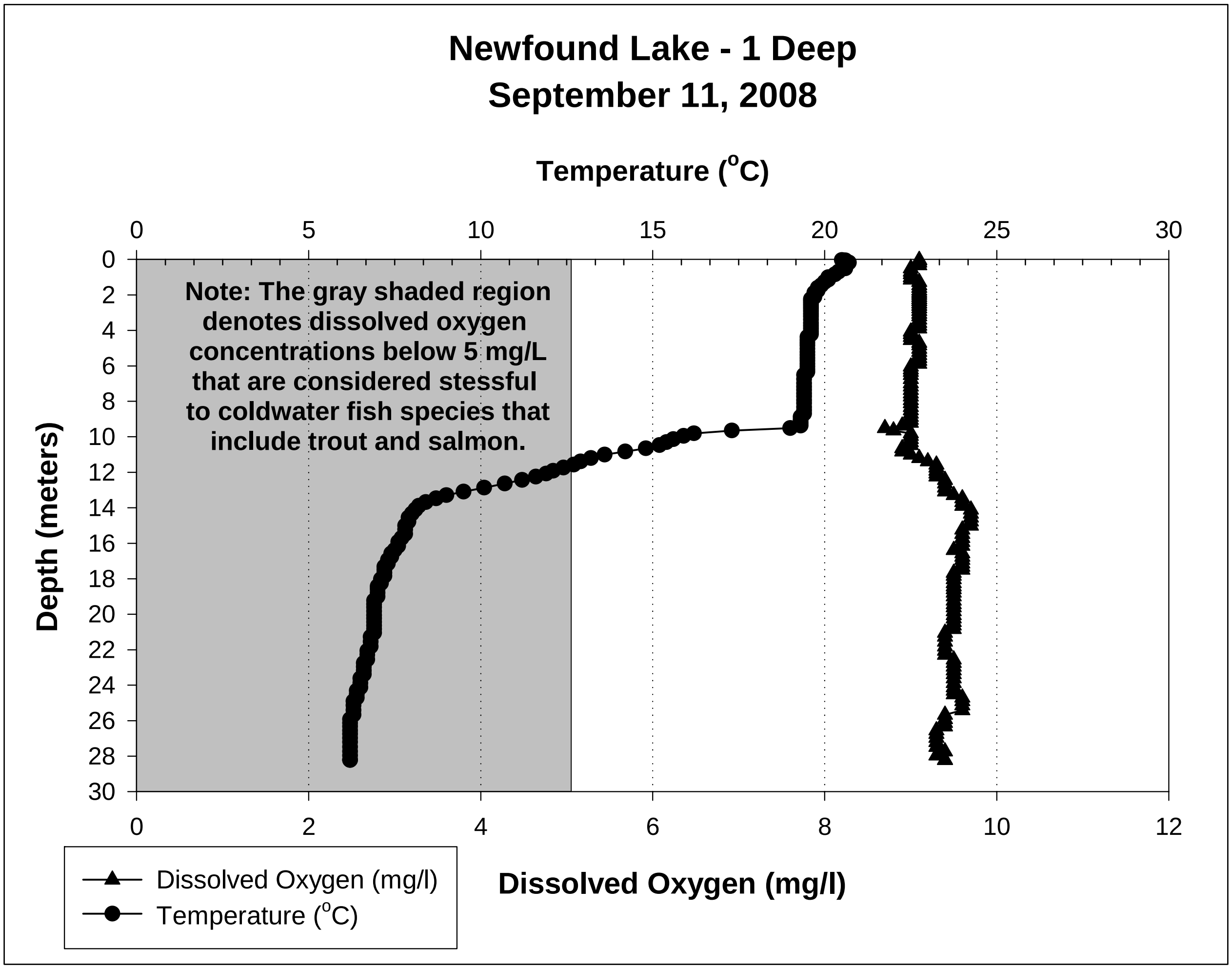
The following graphs illustrate the dissolved oxygen and temperature data collected at the Newfound Lake deep sampling stations between July 23, 2007 and September 25, 2008. Temperature and dissolved oxygen data were generally collected at twenty centimeter (0.2 meter) intervals from the surface down to the lake bottom. The temperature units are degrees Celsius (^{o}C) while the dissolved oxygen units are milligrams per liter (mg/l). The gray shaded region on the graphs represent dissolved oxygen concentrations stressful to coldwater fish species (dissolved oxygen concentrations less than 5 parts per million). *Notice the low dissolved oxygen concentrations near the lake bottom at Site L02 (2 Mayhew).*

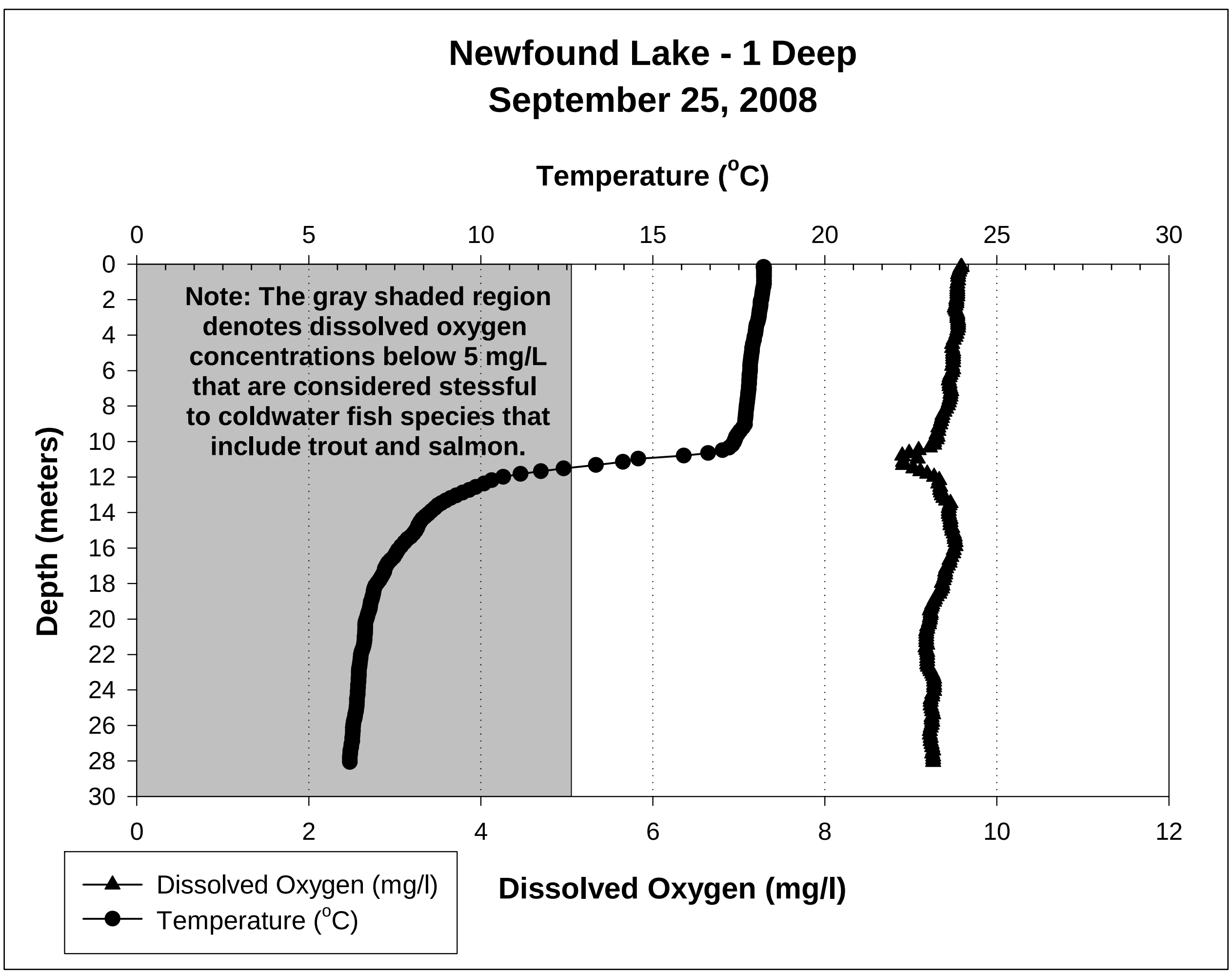

Newfound Lake - 1 Deep
July 23, 2007
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
0
2
4
6
8
10
12
Dissolved Oxygen (mg.l)
Temperature (°C)
Dissolved Oxygen (mg/l)

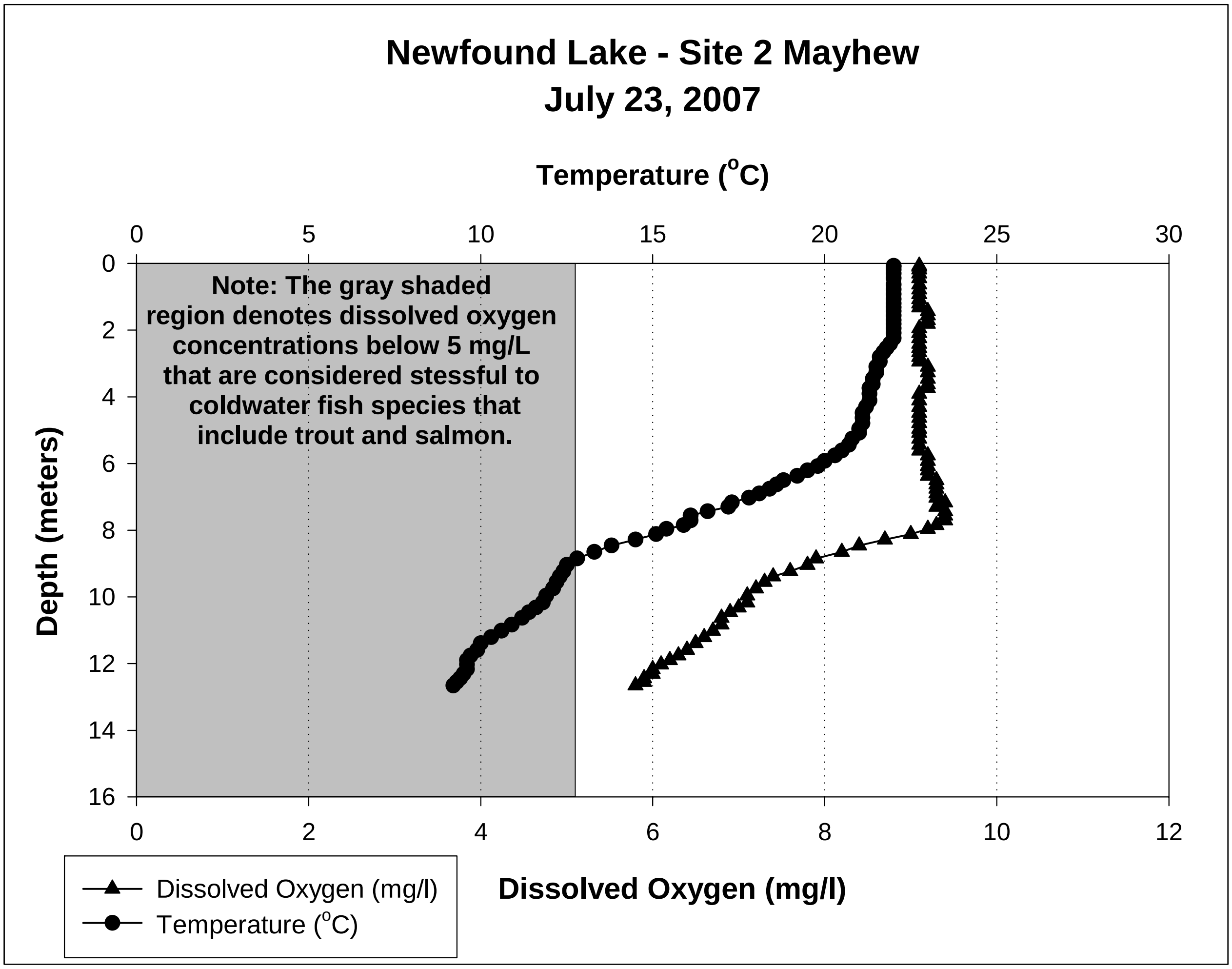

Newfound Lake - 1 Deep
August 13, 2007
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

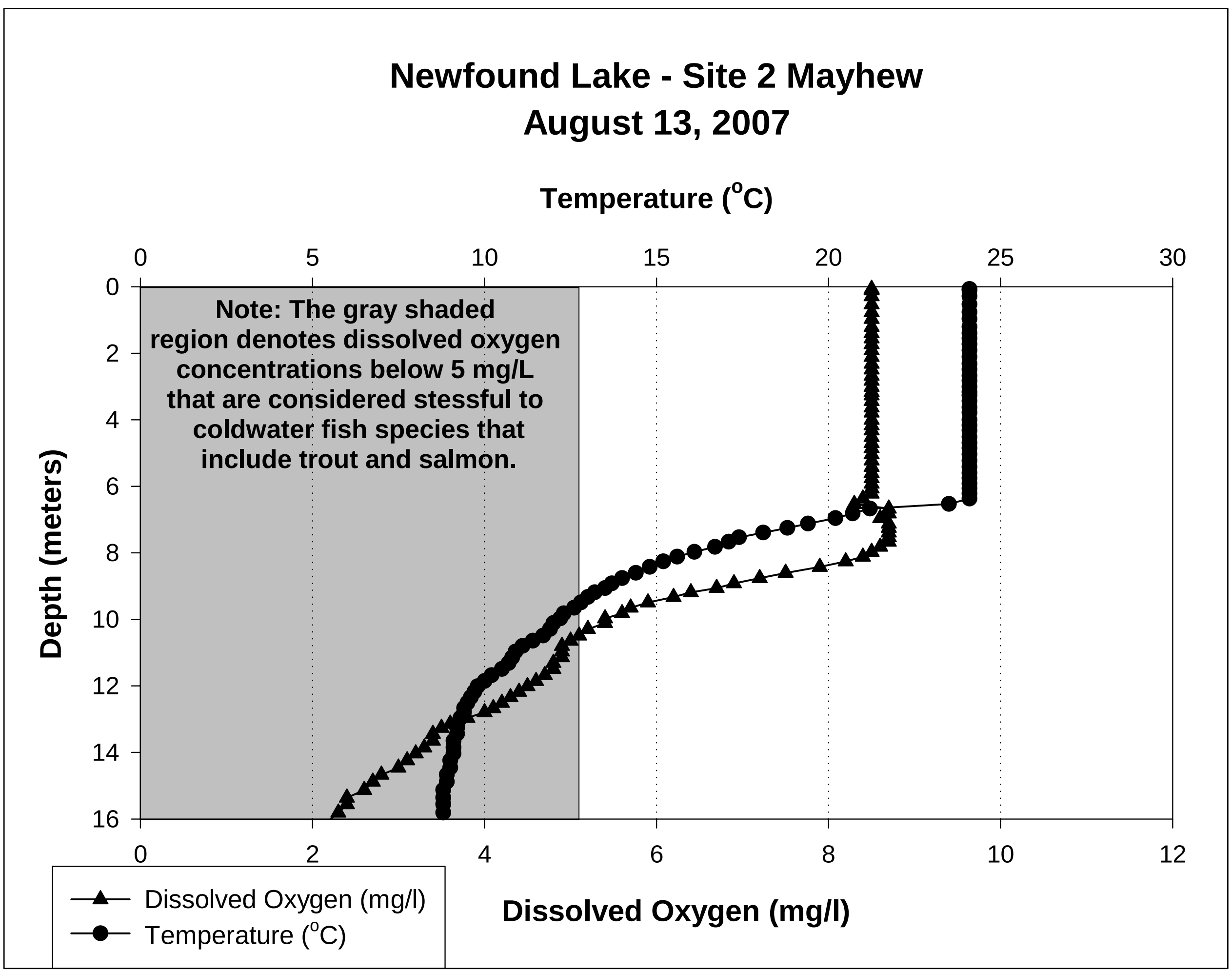

Newfound Lake - 1 Deep
September 17, 2007
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)

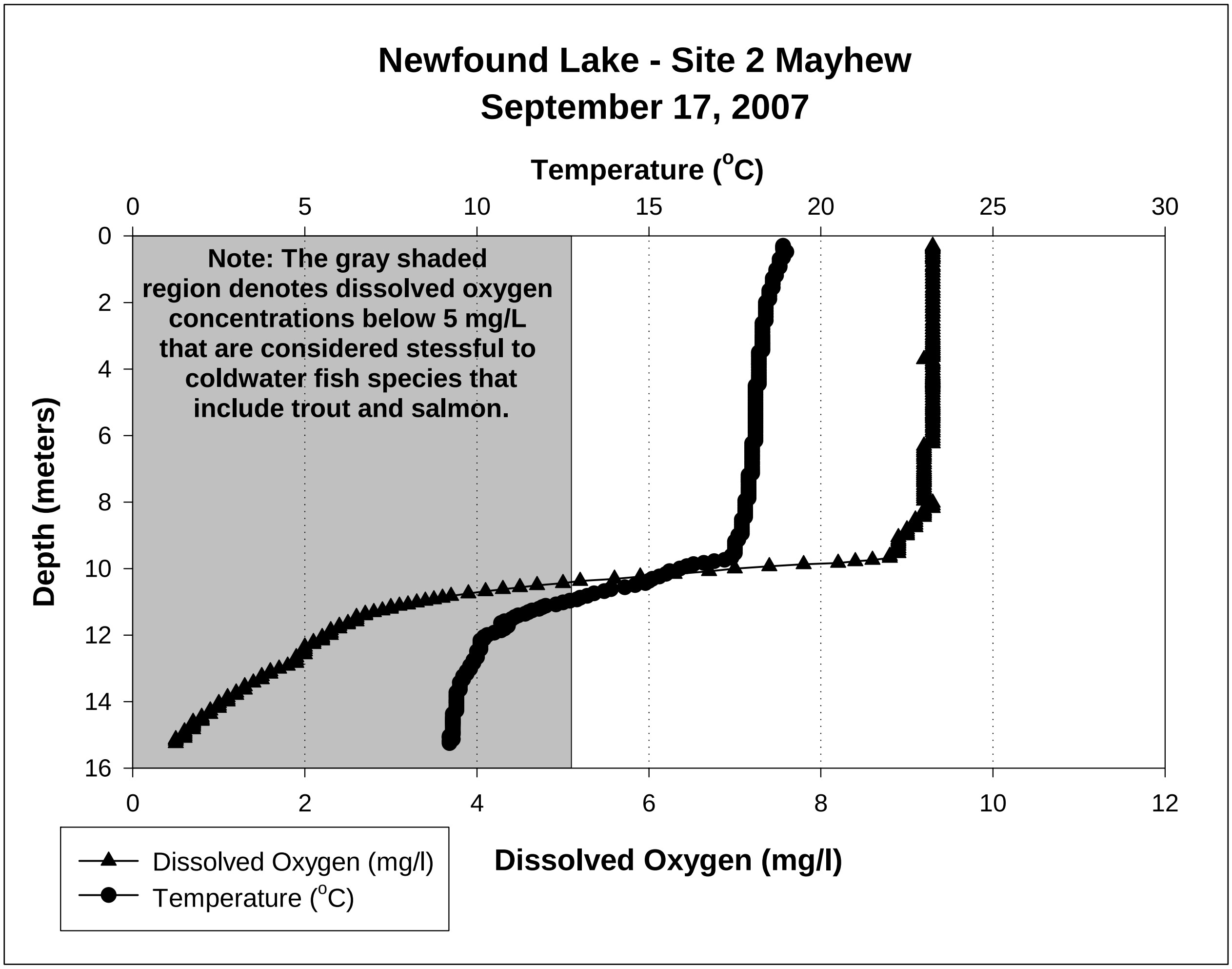

Newfound Lake - 1 Deep
July 2, 2008
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)


Newfound Lake - 1 Deep
September 11, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

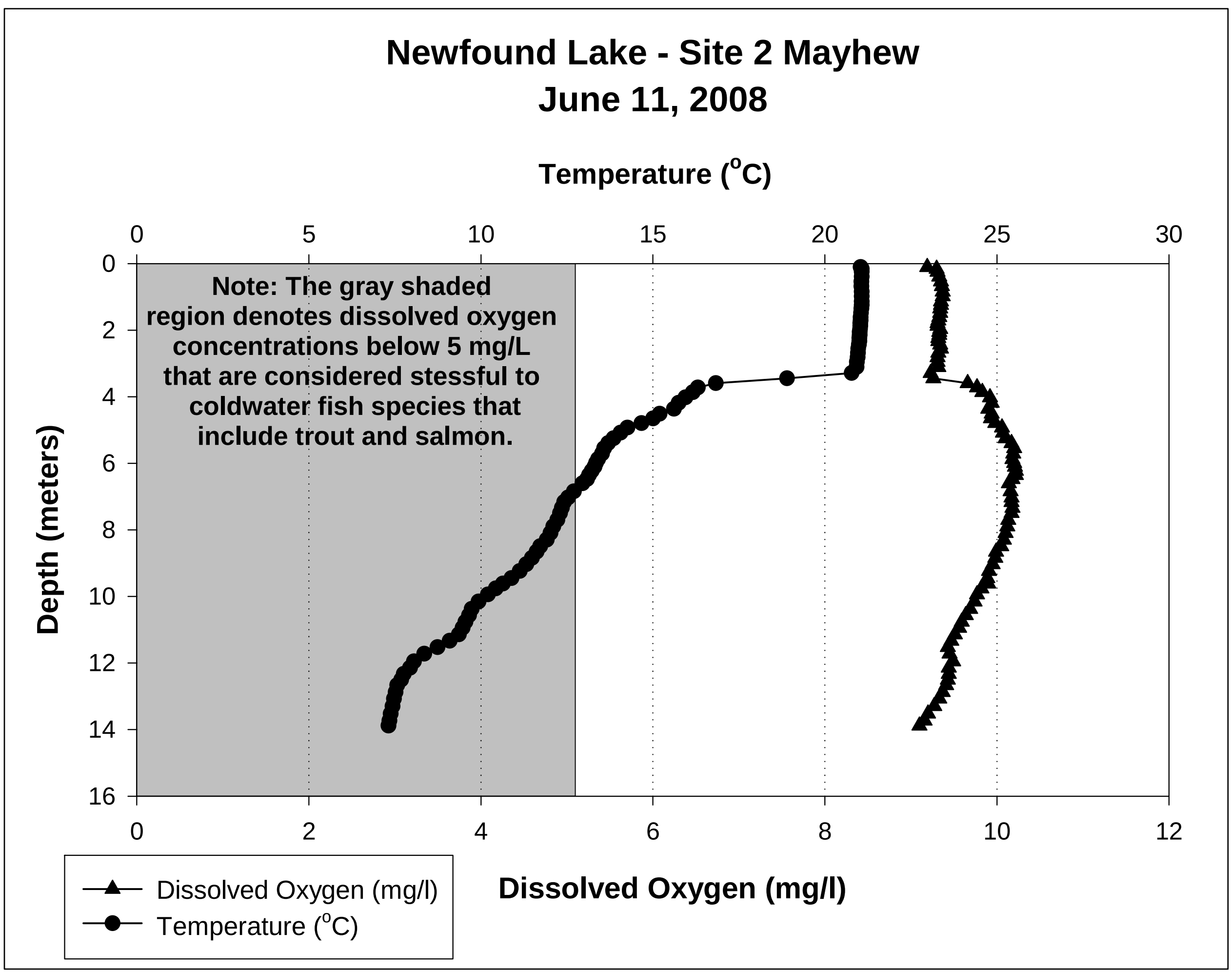

Newfound Lake - 1 Deep
September 25, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)


Newfound Lake - Site 2 Mayhew
July 23, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

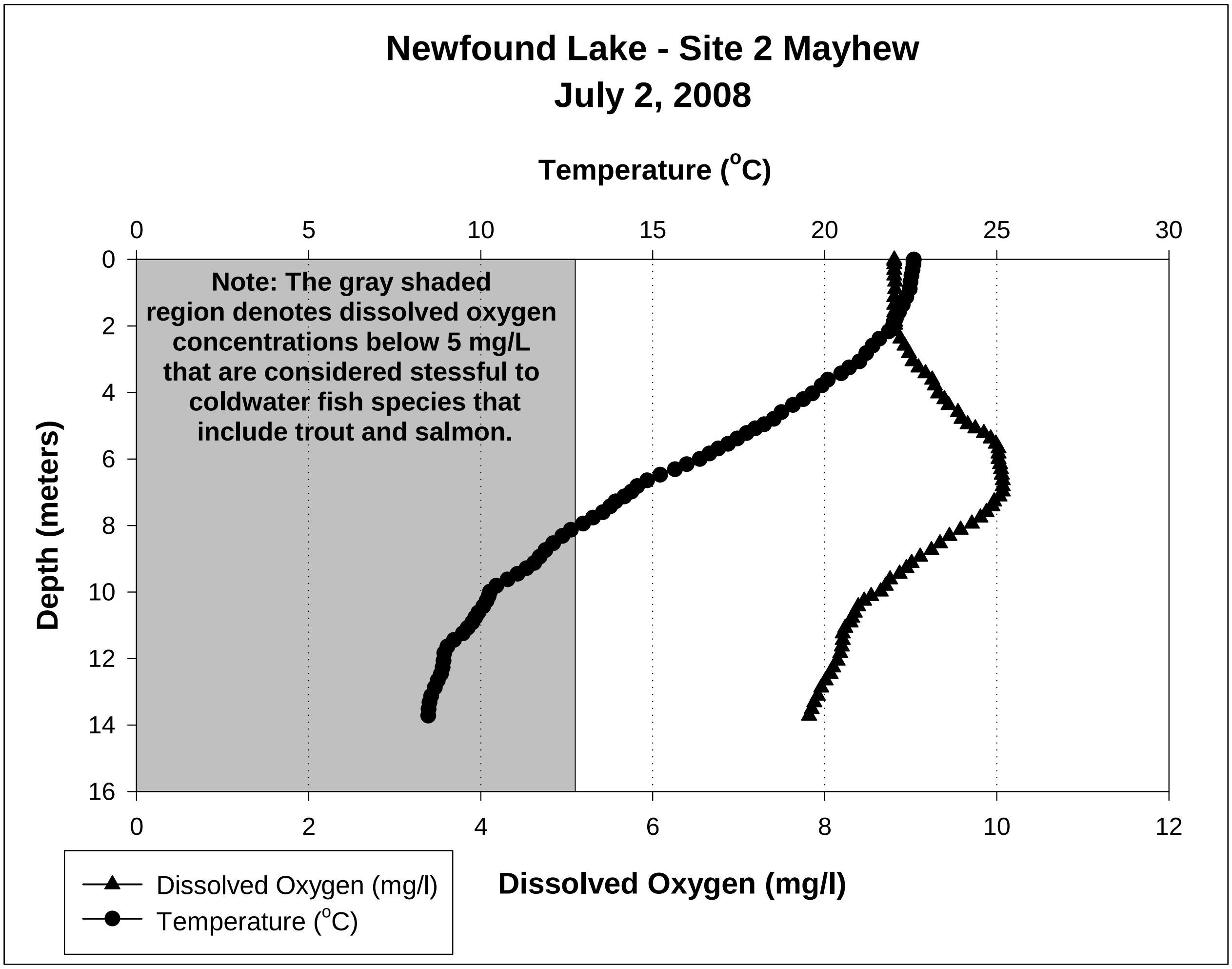

Newfound Lake - Site 2 Mayhew
August 13, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

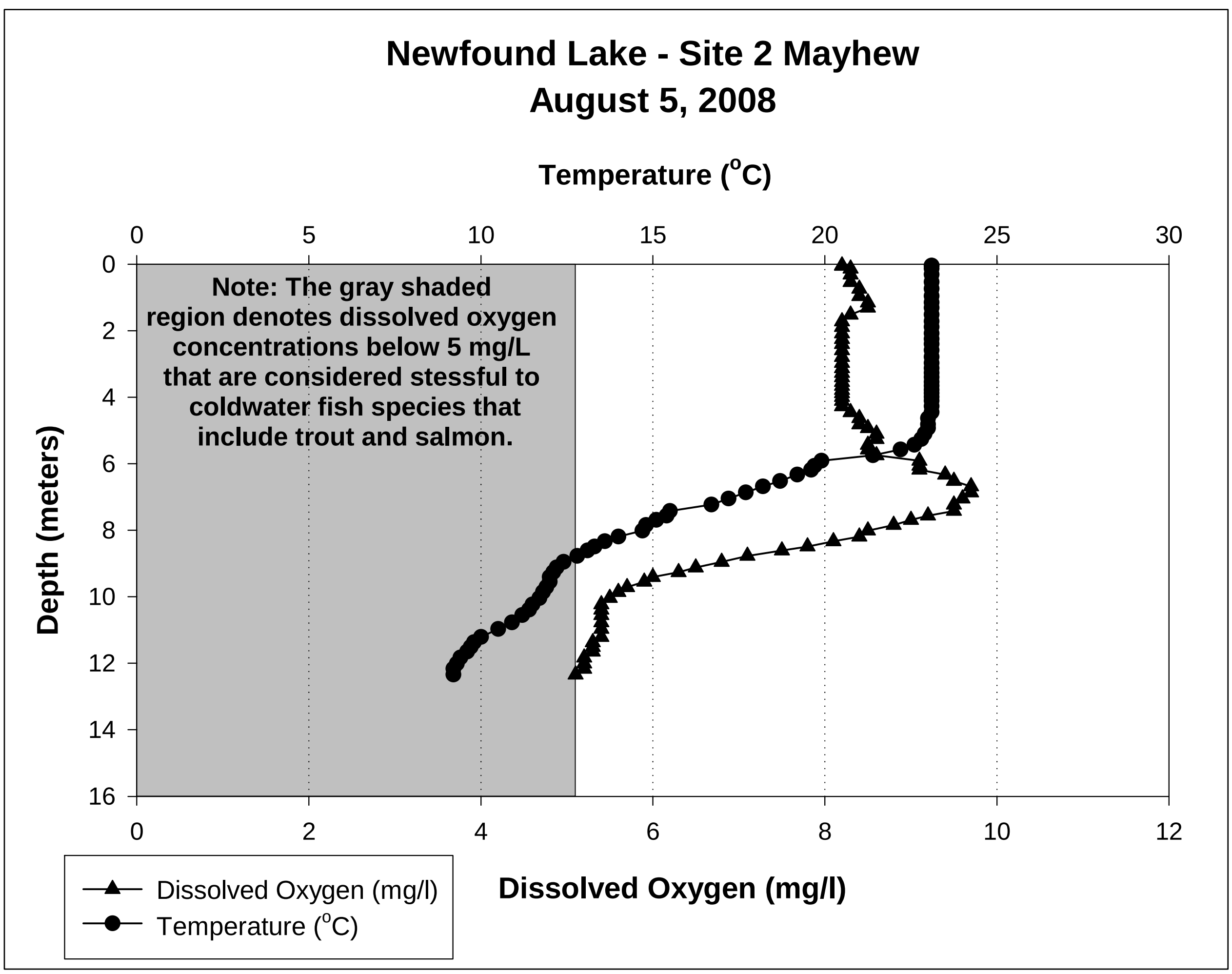


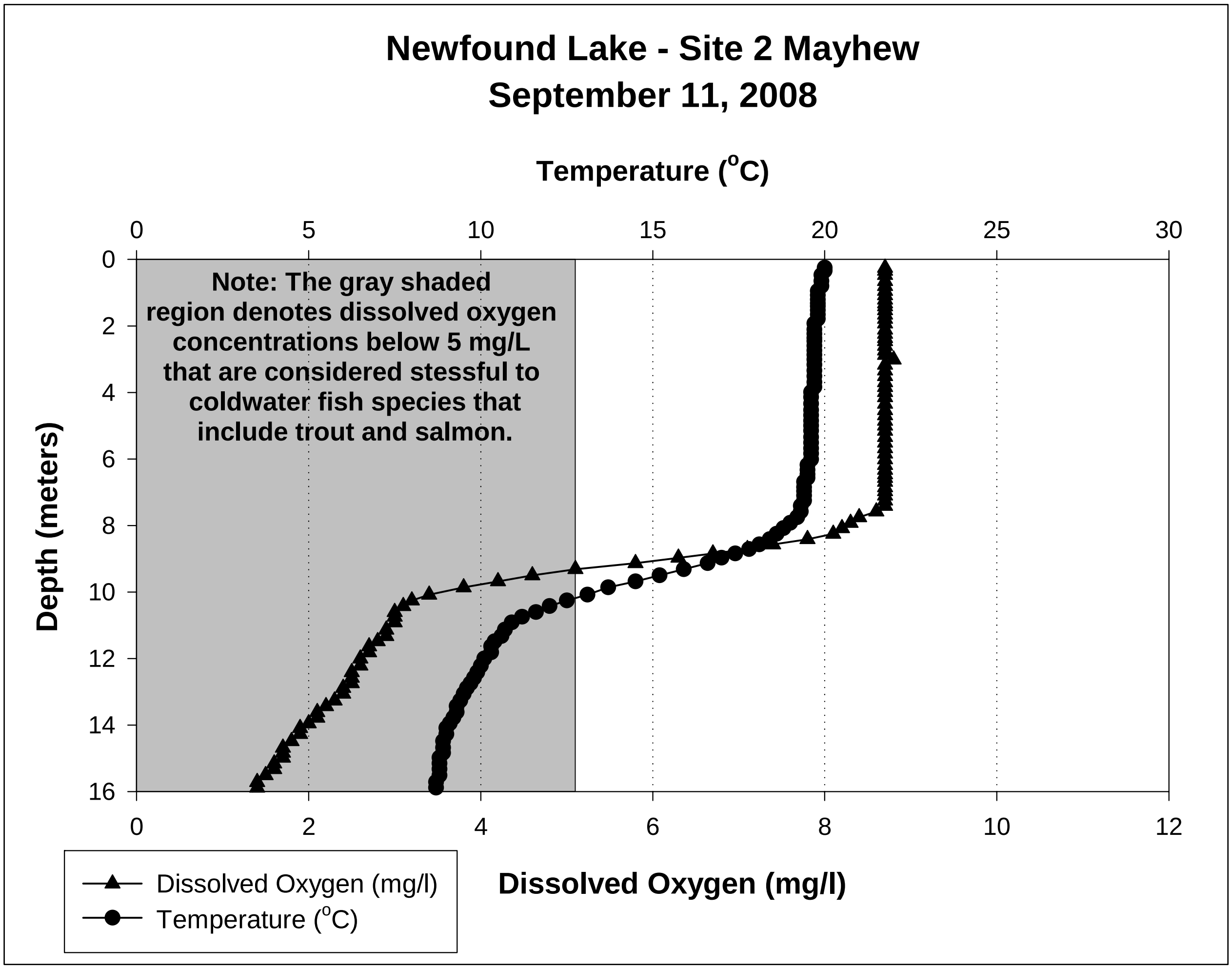
Newfound Lake - Site 2 Mayhew
September 17, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

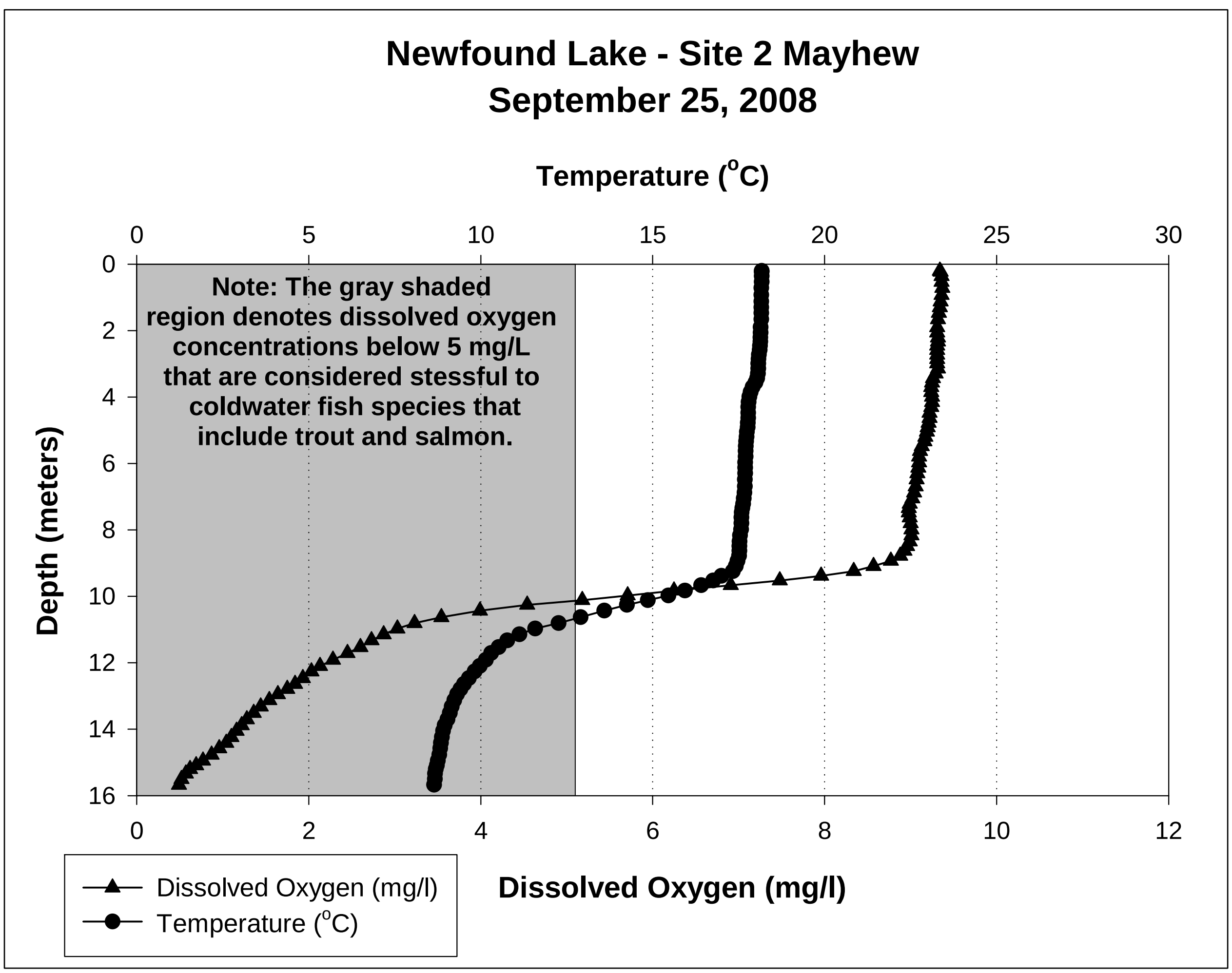


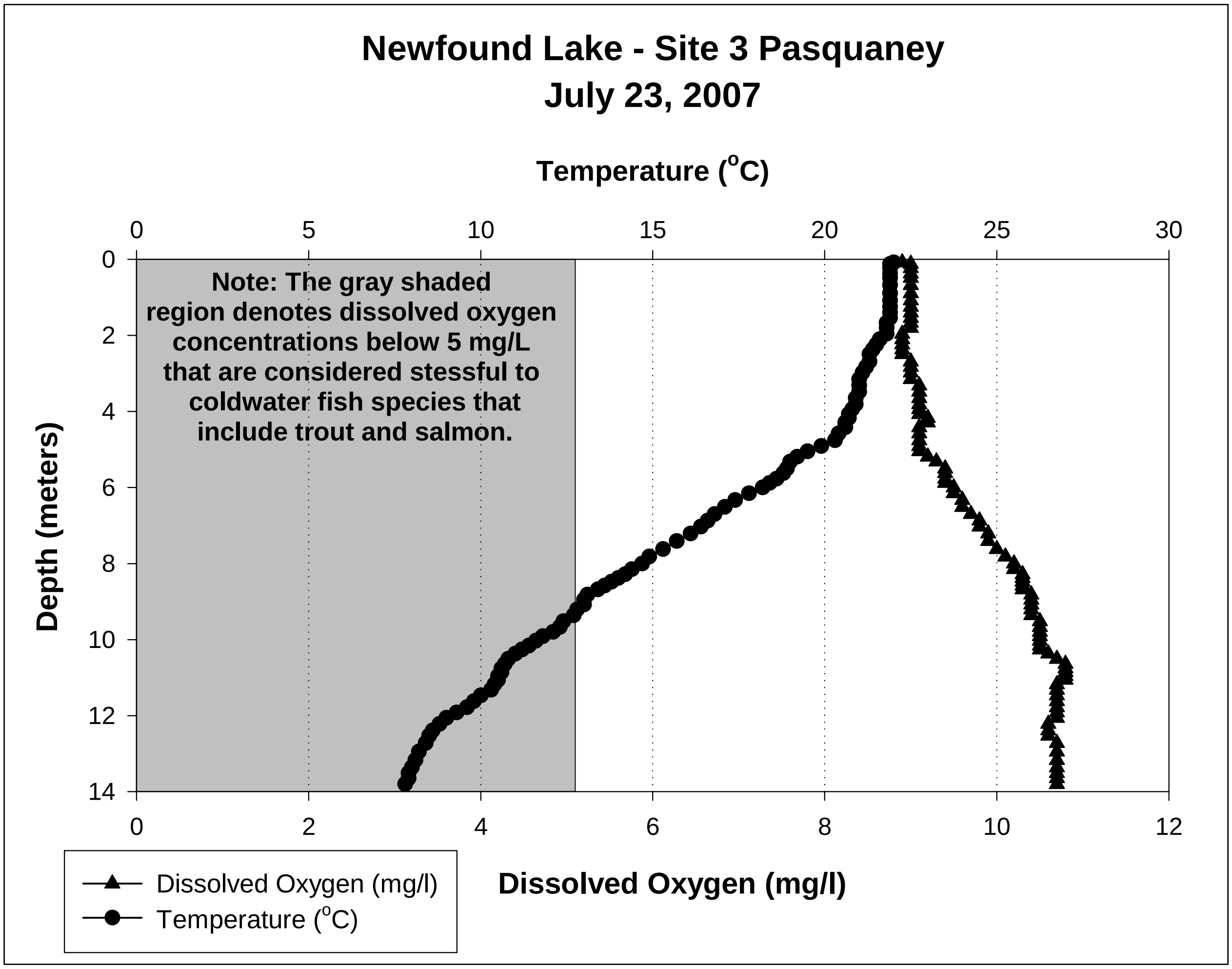
Newfound Lake - Site 2 Mayhew
June 11, 2008
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

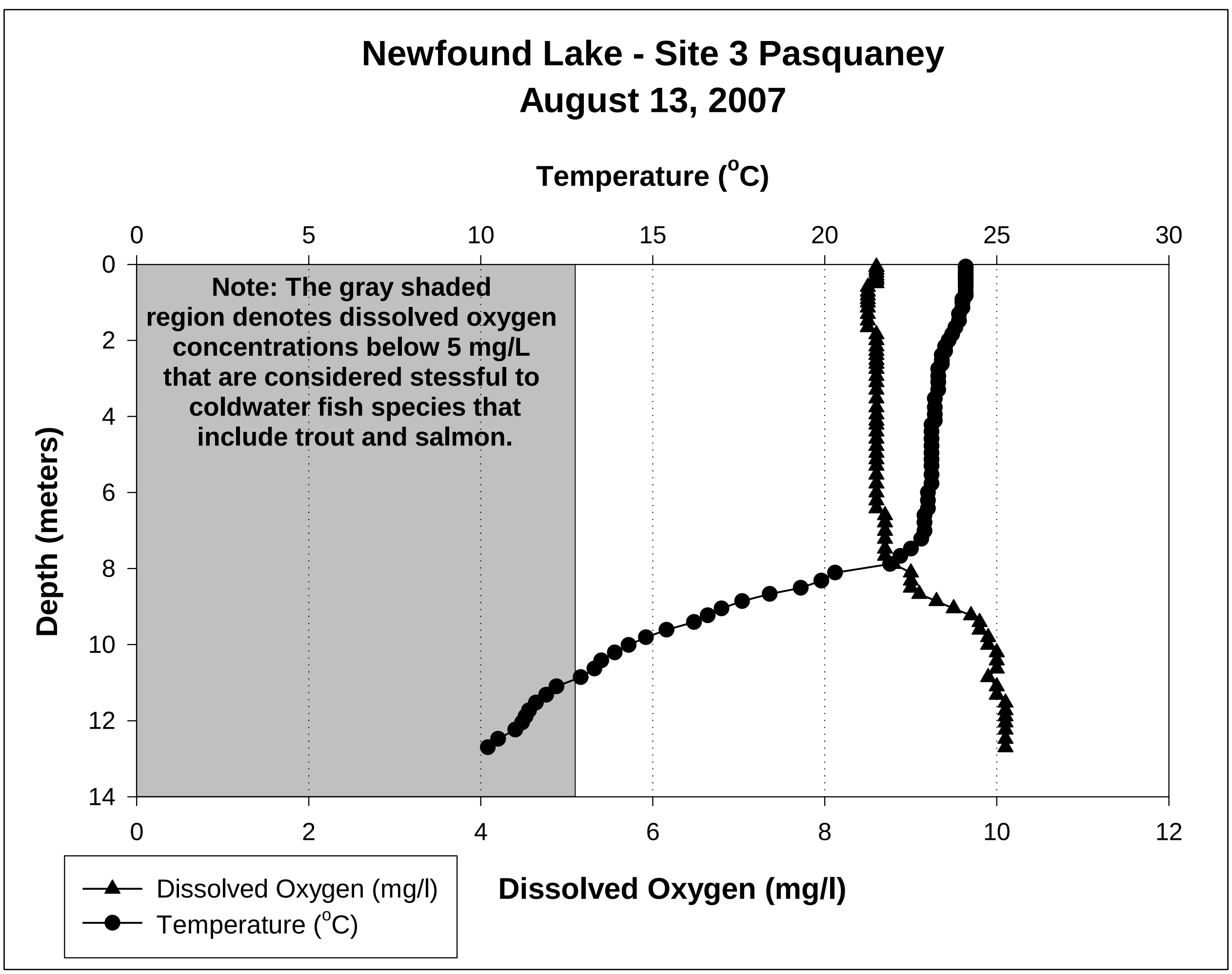

Newfound Lake - Site 2 Mayhew
July 2, 2008
Temperature (^{o}C)
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (^{o}C)

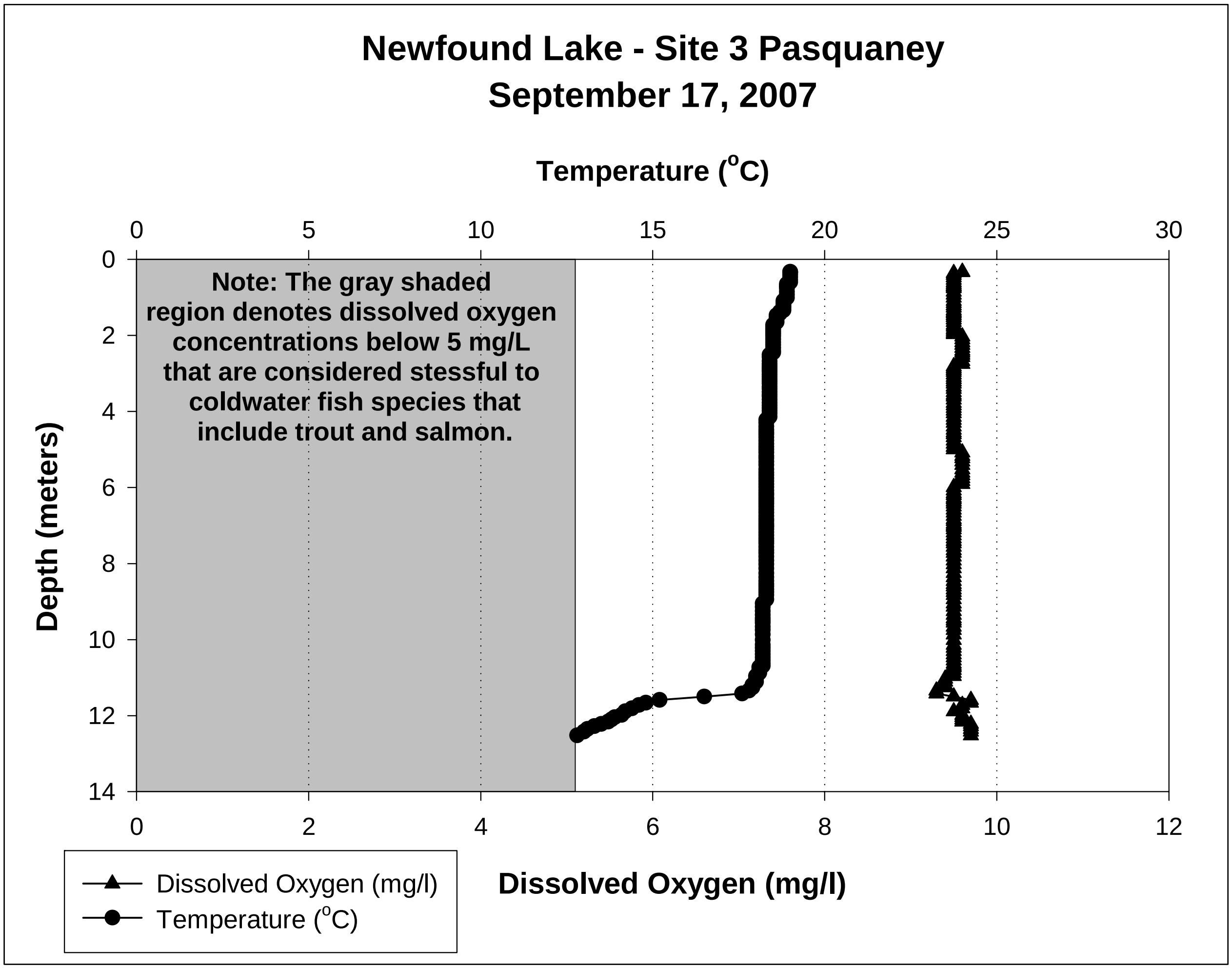

Newfound Lake - Site 2 Mayhew
August 5, 2008
Temperature (^{o}C)
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (^{o}C)


Newfound Lake - Site 2 Mayhew
September 11, 2008
Temperature (oC)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

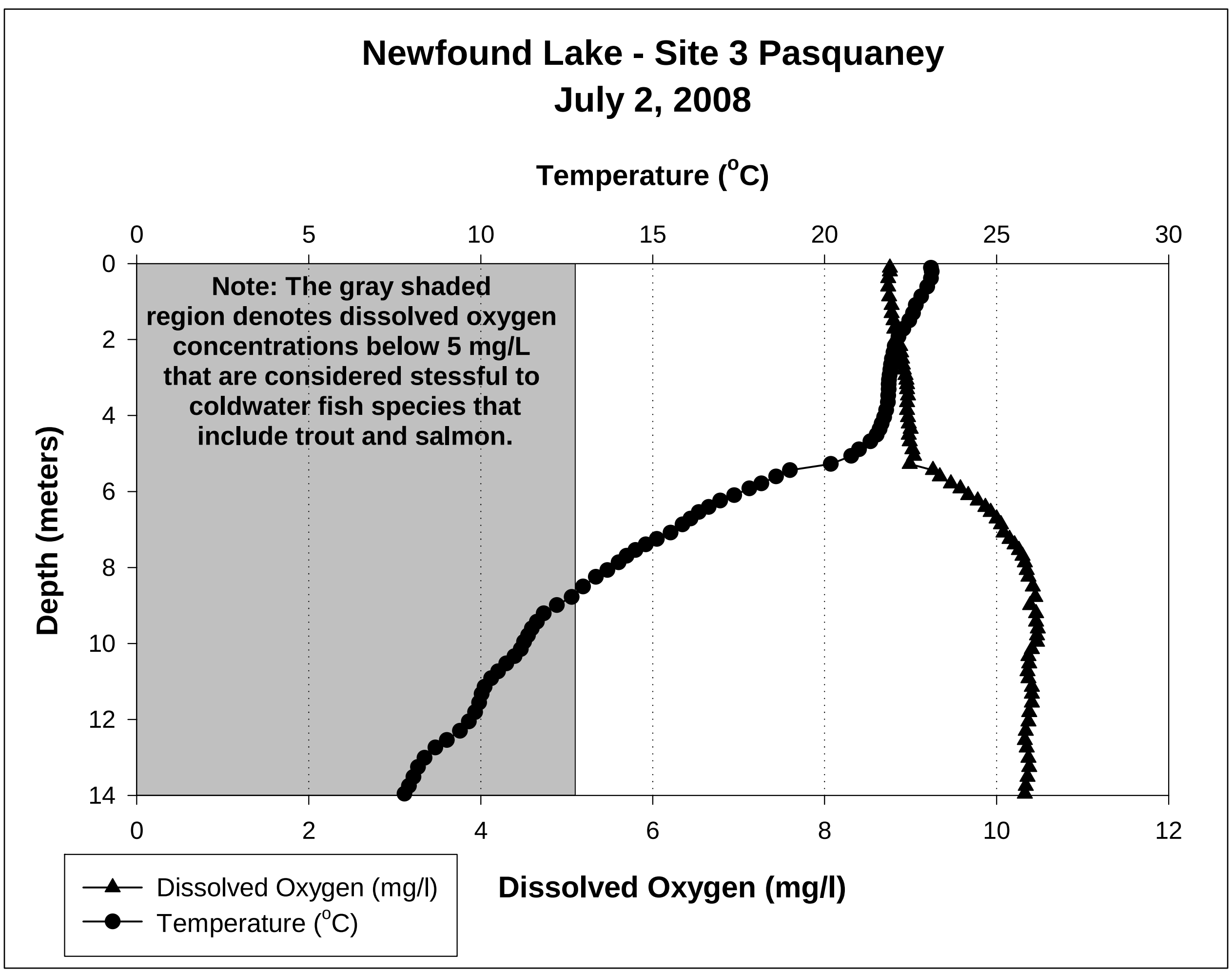

Newfound Lake - Site 2 Mayhew
September 25, 2008
Temperature (oC)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)


Newfound Lake - Site 3 Pasquaney
July 23, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

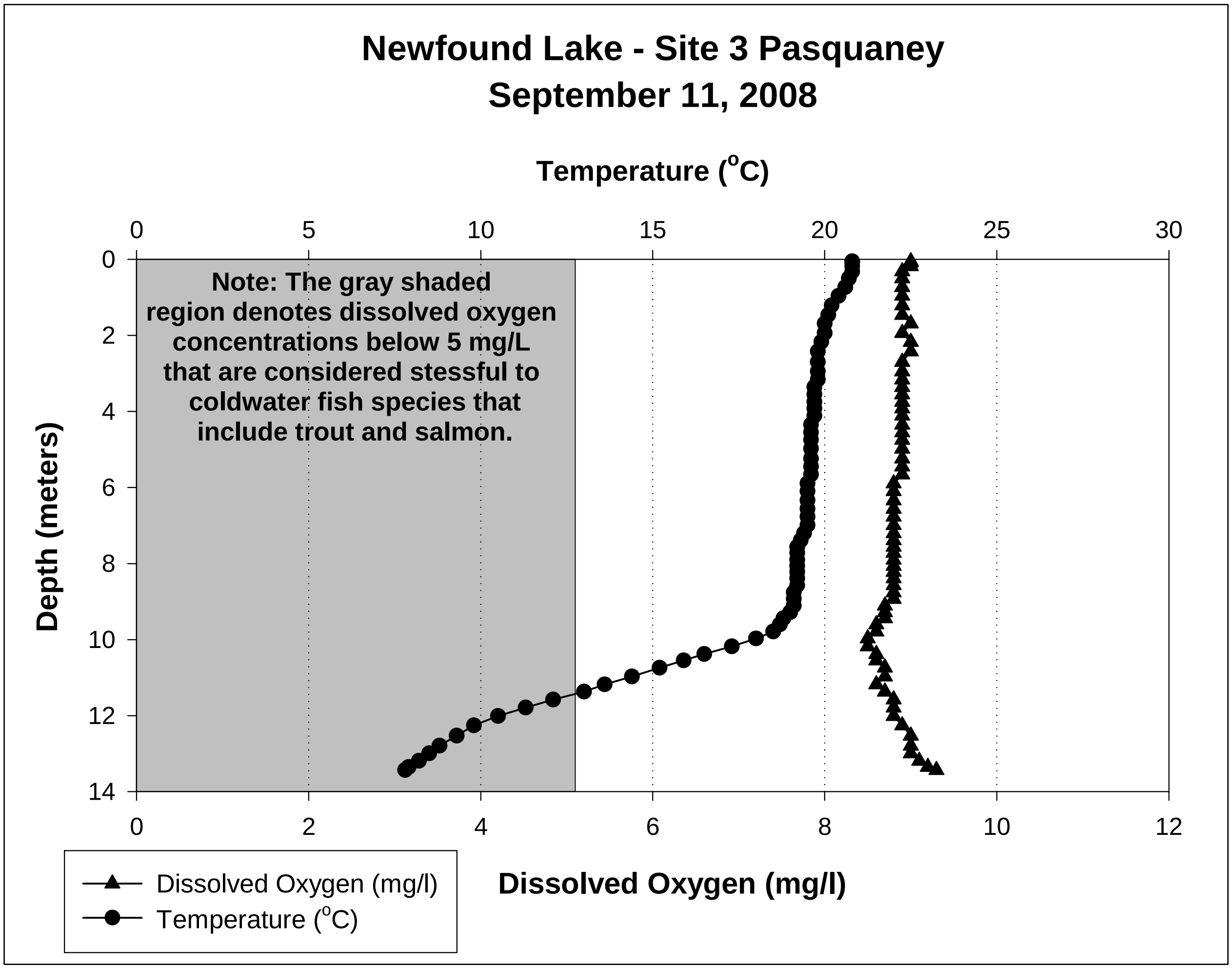

Newfound Lake - Site 3 Pasquaney
August 13, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

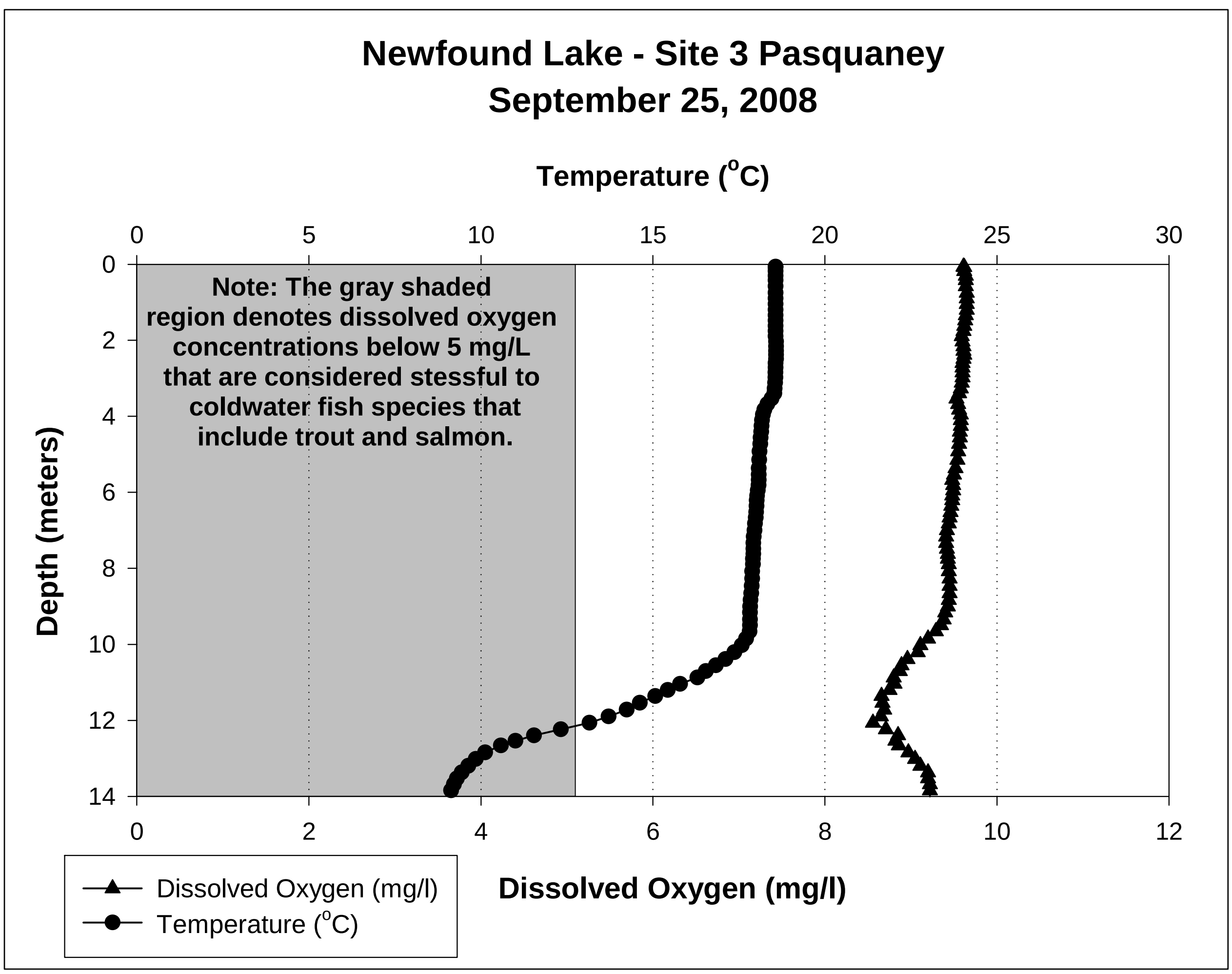


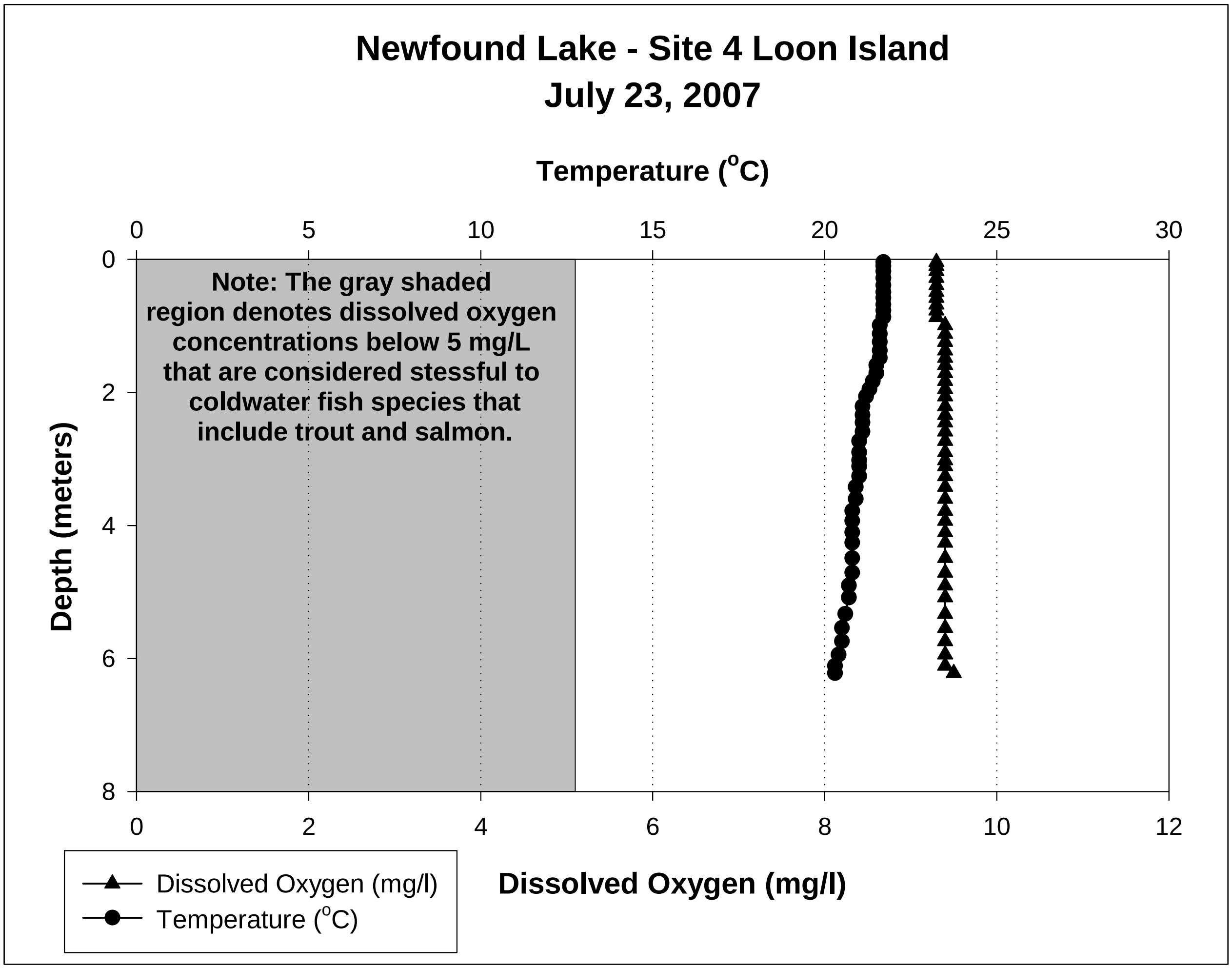
Newfound Lake - Site 3 Pasquaney
September 17, 2007
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

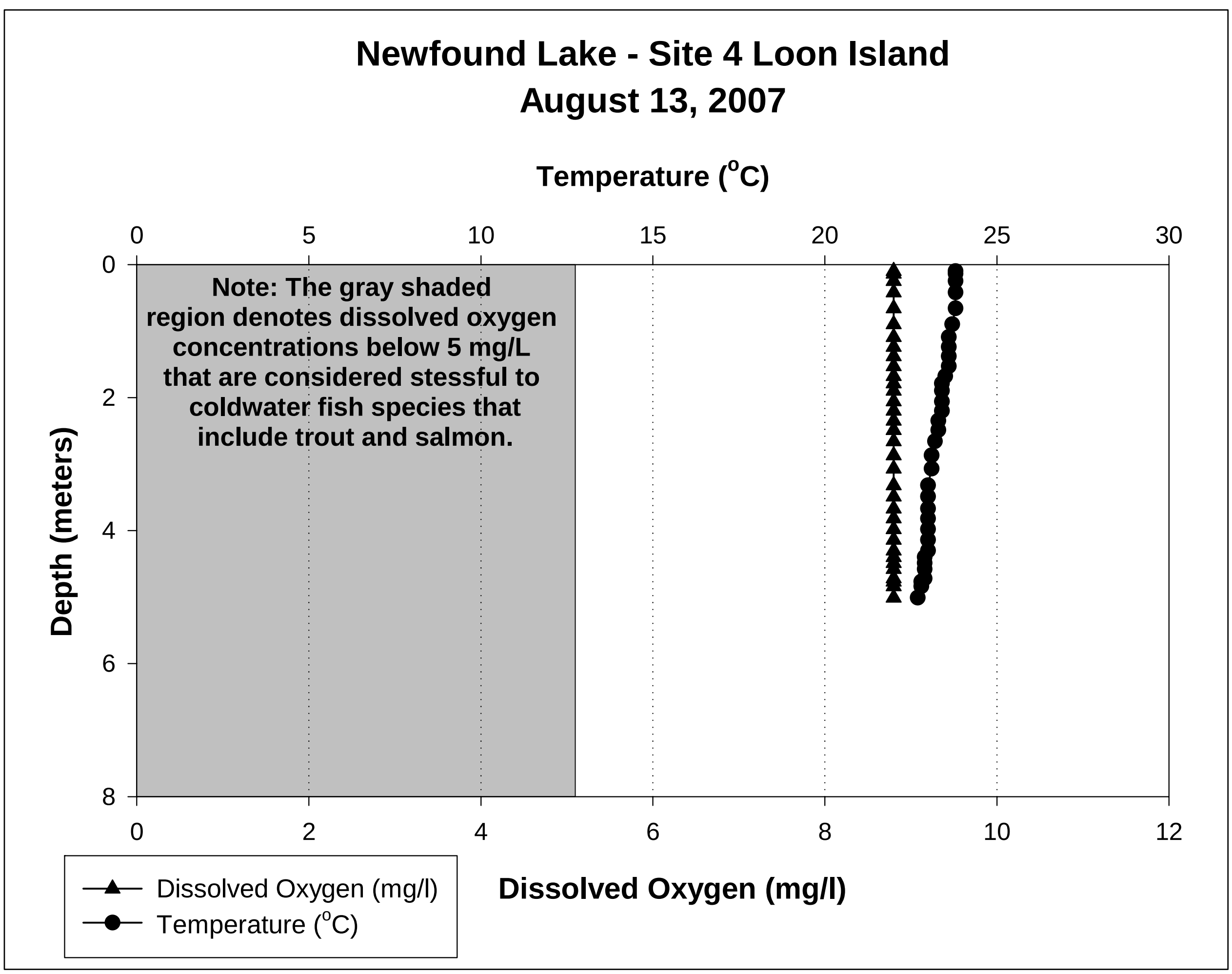


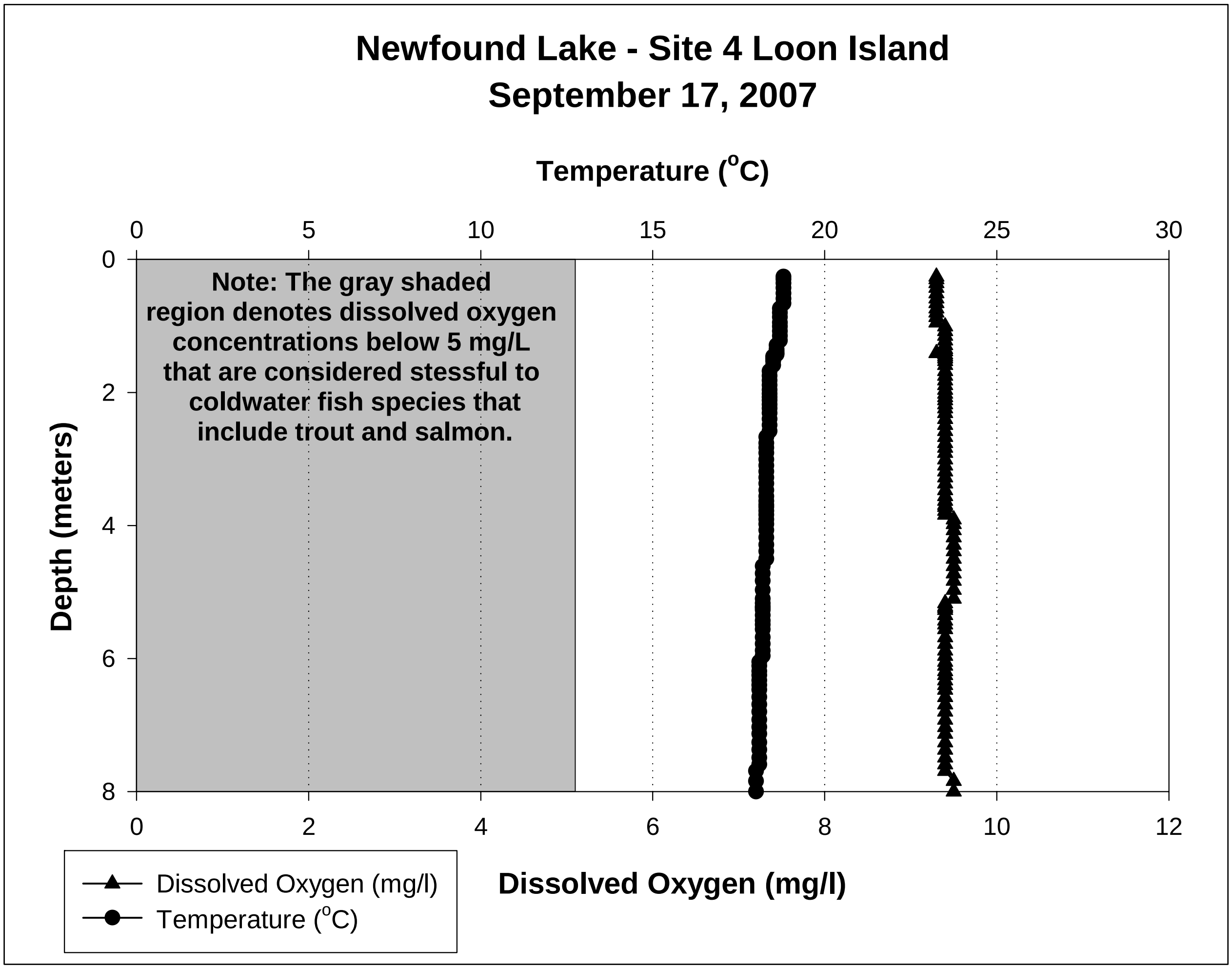
Newfound Lake - Site 3 Pasquaney
July 2, 2008
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

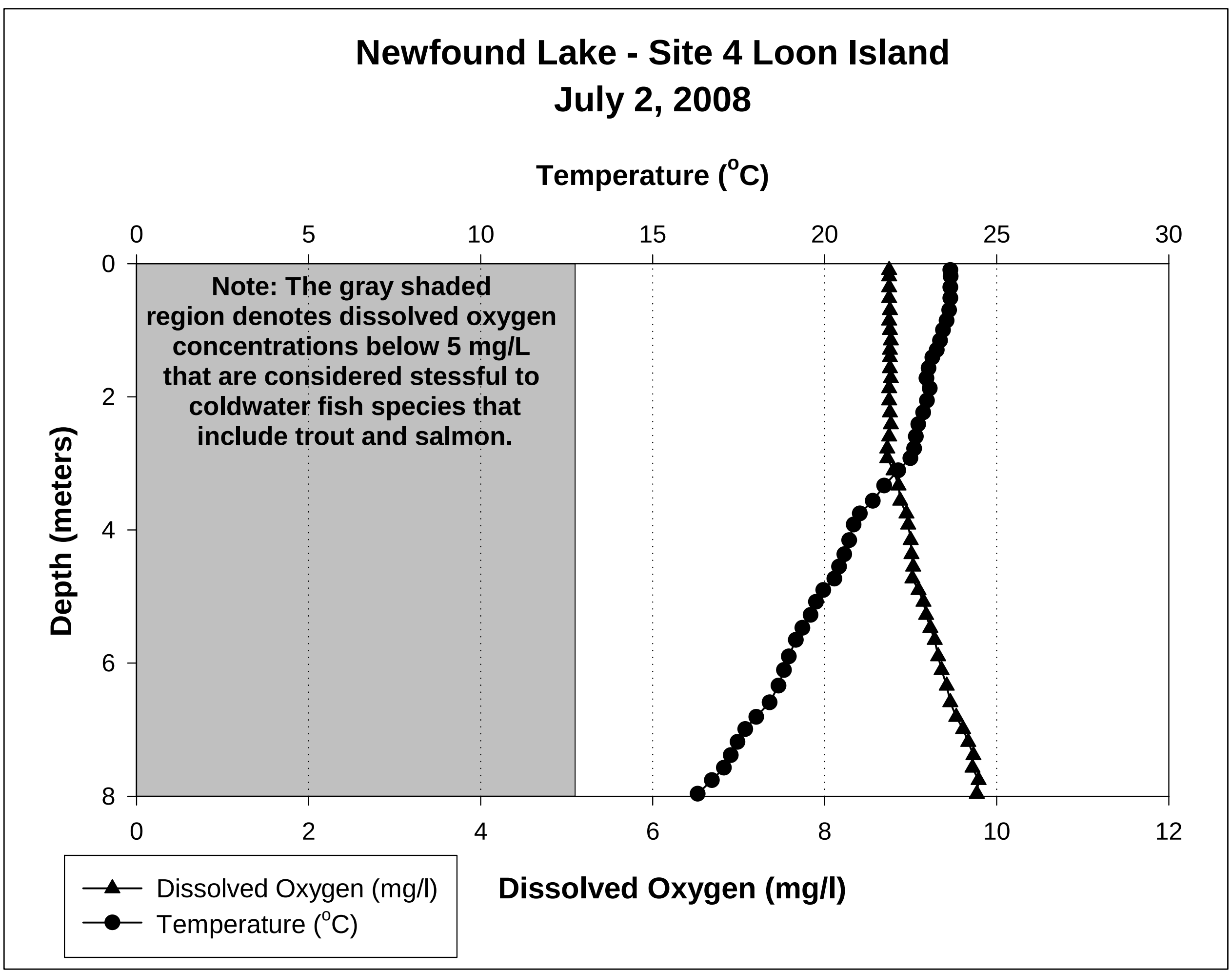

Newfound Lake - Site 3 Pasquaney
September 11, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

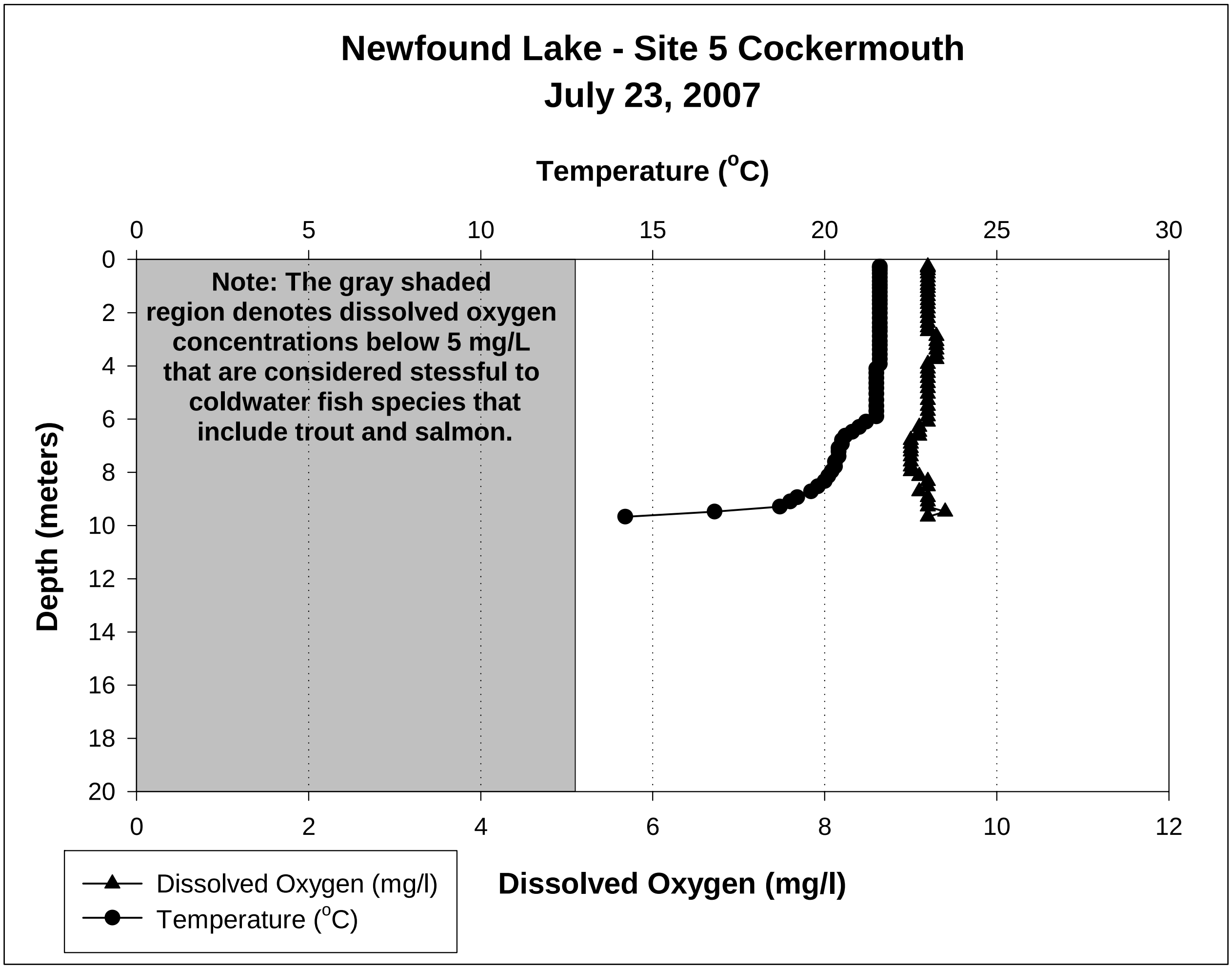

Newfound Lake - Site 3 Pasquaney
September 25, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

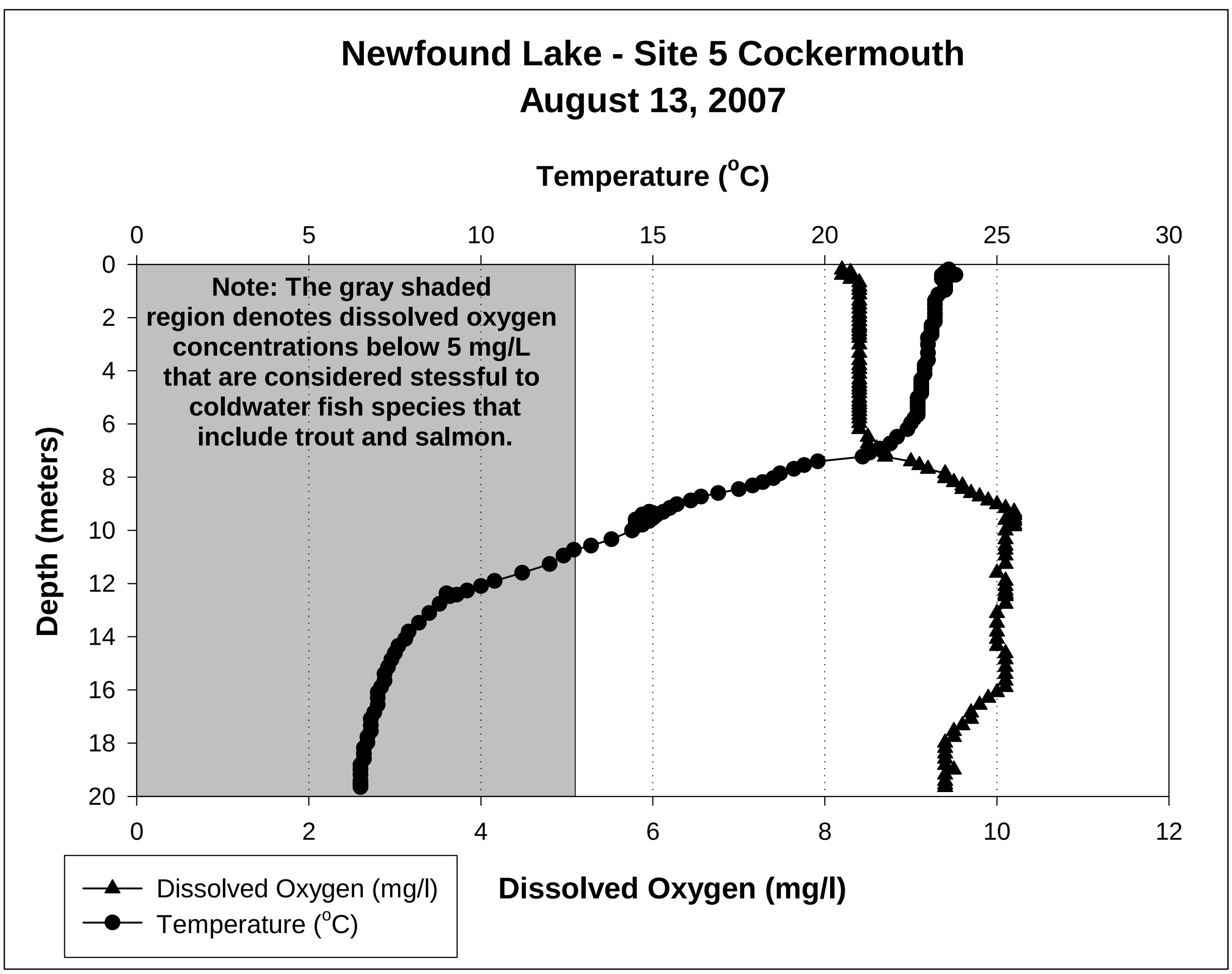

Newfound Lake - Site 4 Loon Island
July 23, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

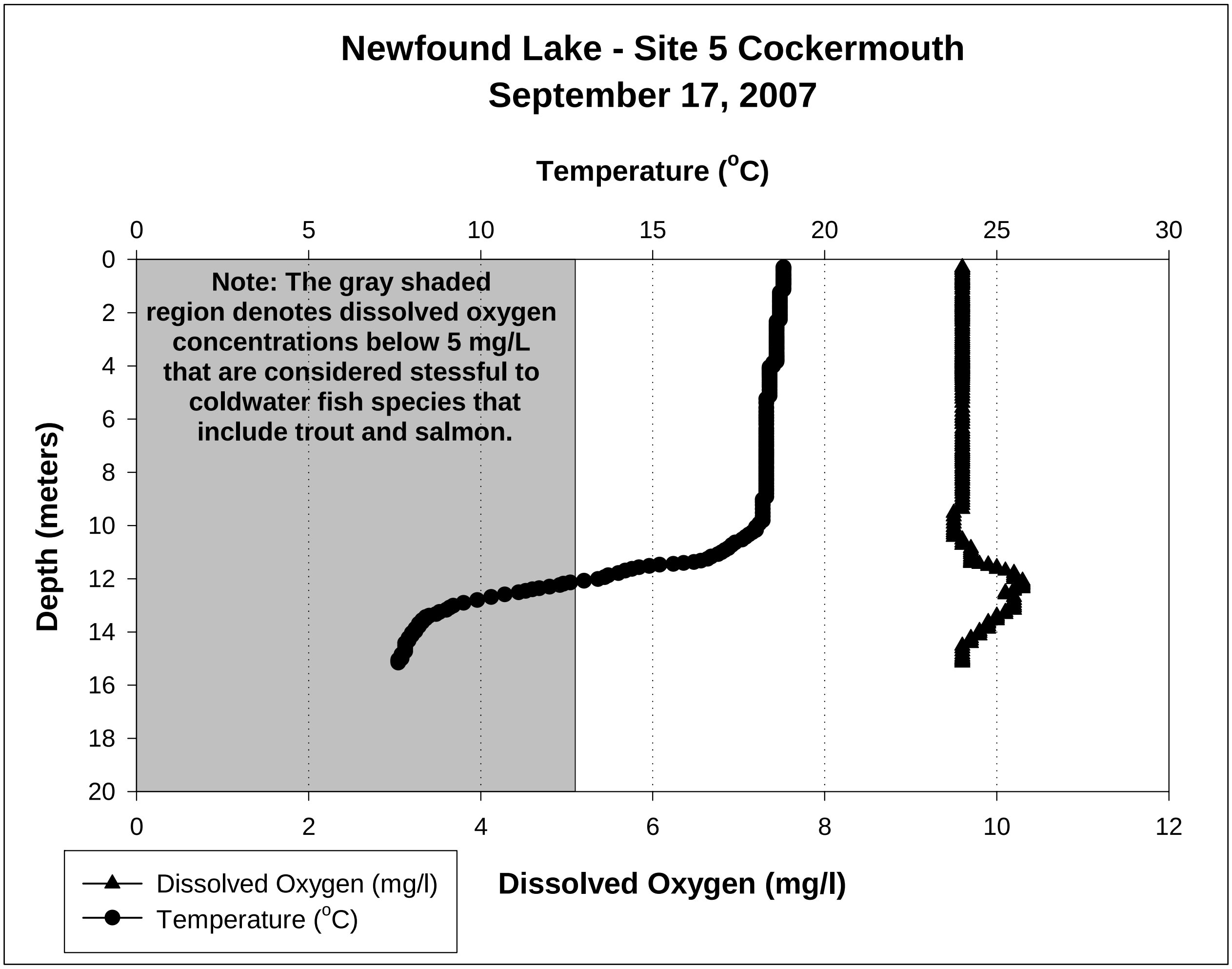

Newfound Lake - Site 4 Loon Island
August 13, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

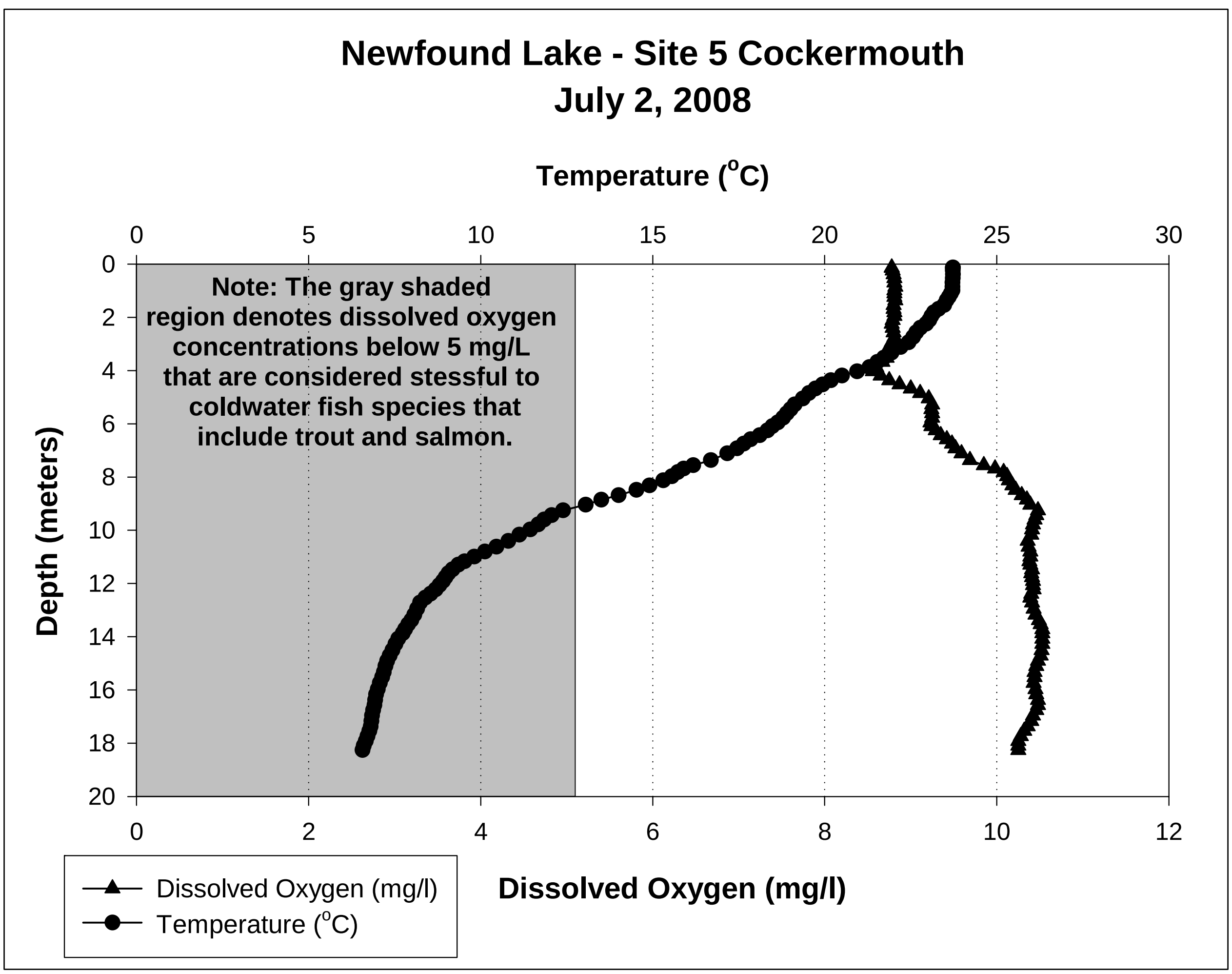

Newfound Lake - Site 4 Loon Island
September 17, 2007
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)

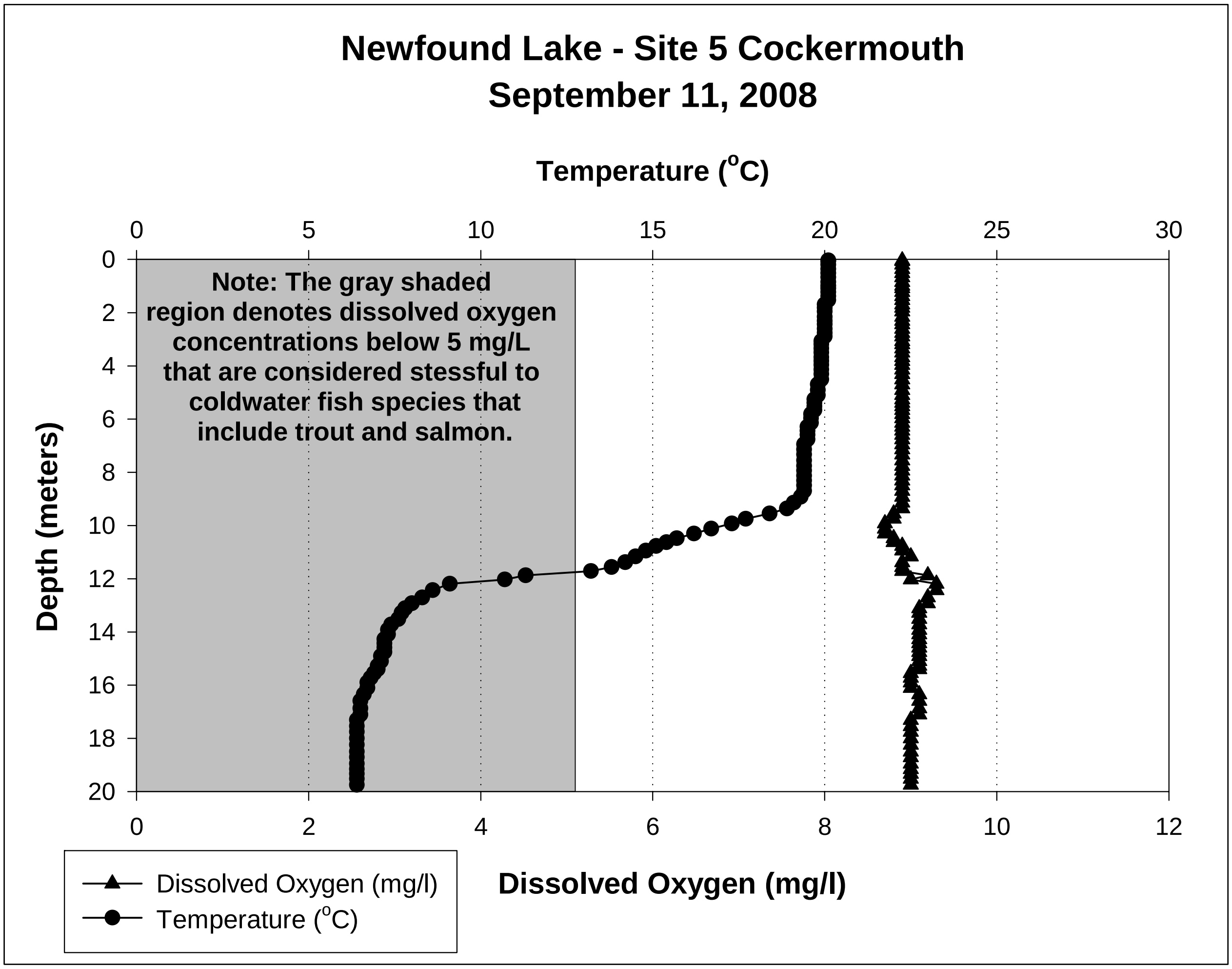

Newfound Lake - Site 4 Loon Island
July 2, 2008
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)

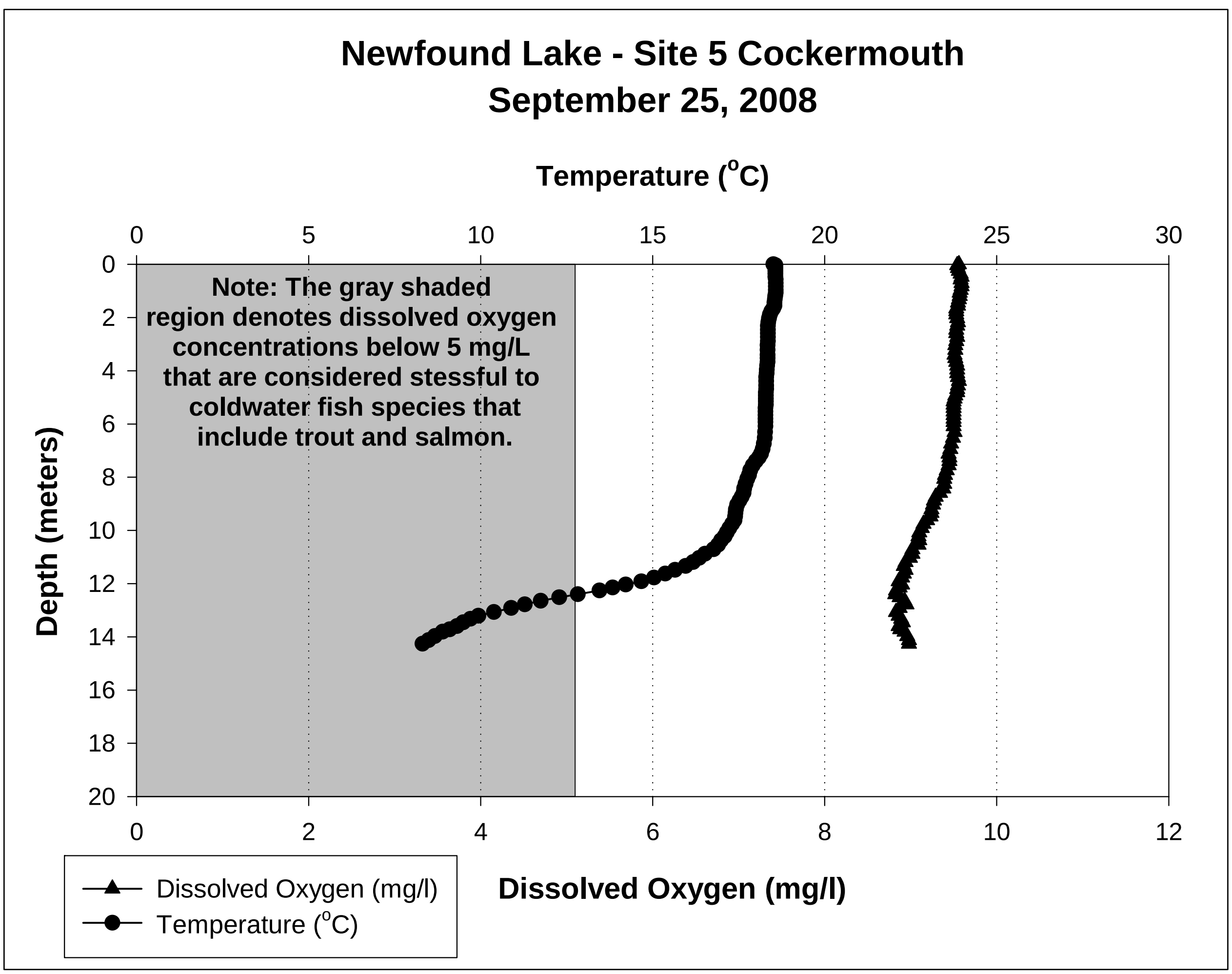

Newfound Lake - Site 5 Cockermouth
July 23, 2007
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)

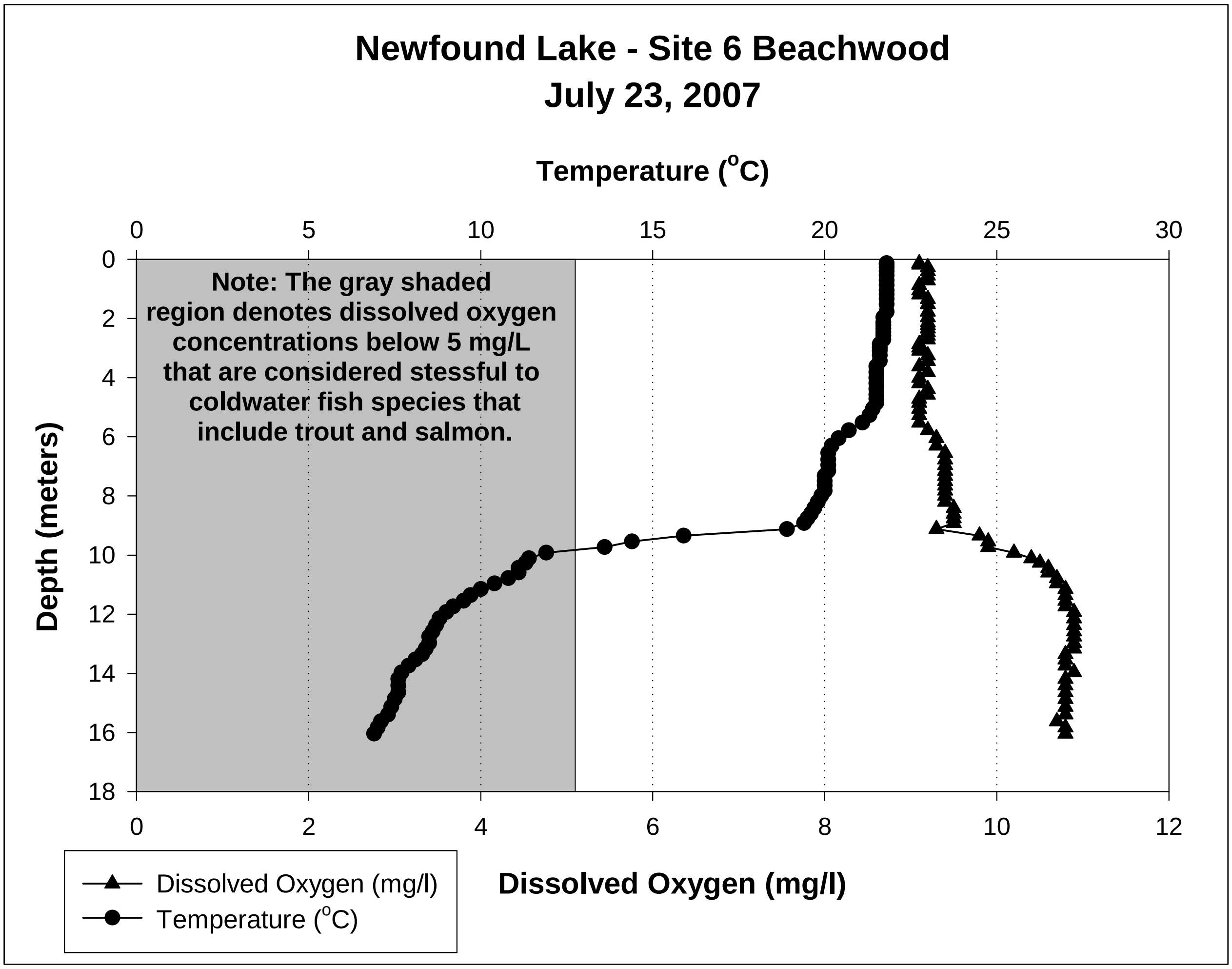

Newfound Lake - Site 5 Cockermouth
August 13, 2007
Temperature (°C)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Dissolved Oxygen (mg/l)
Temperature (°C)

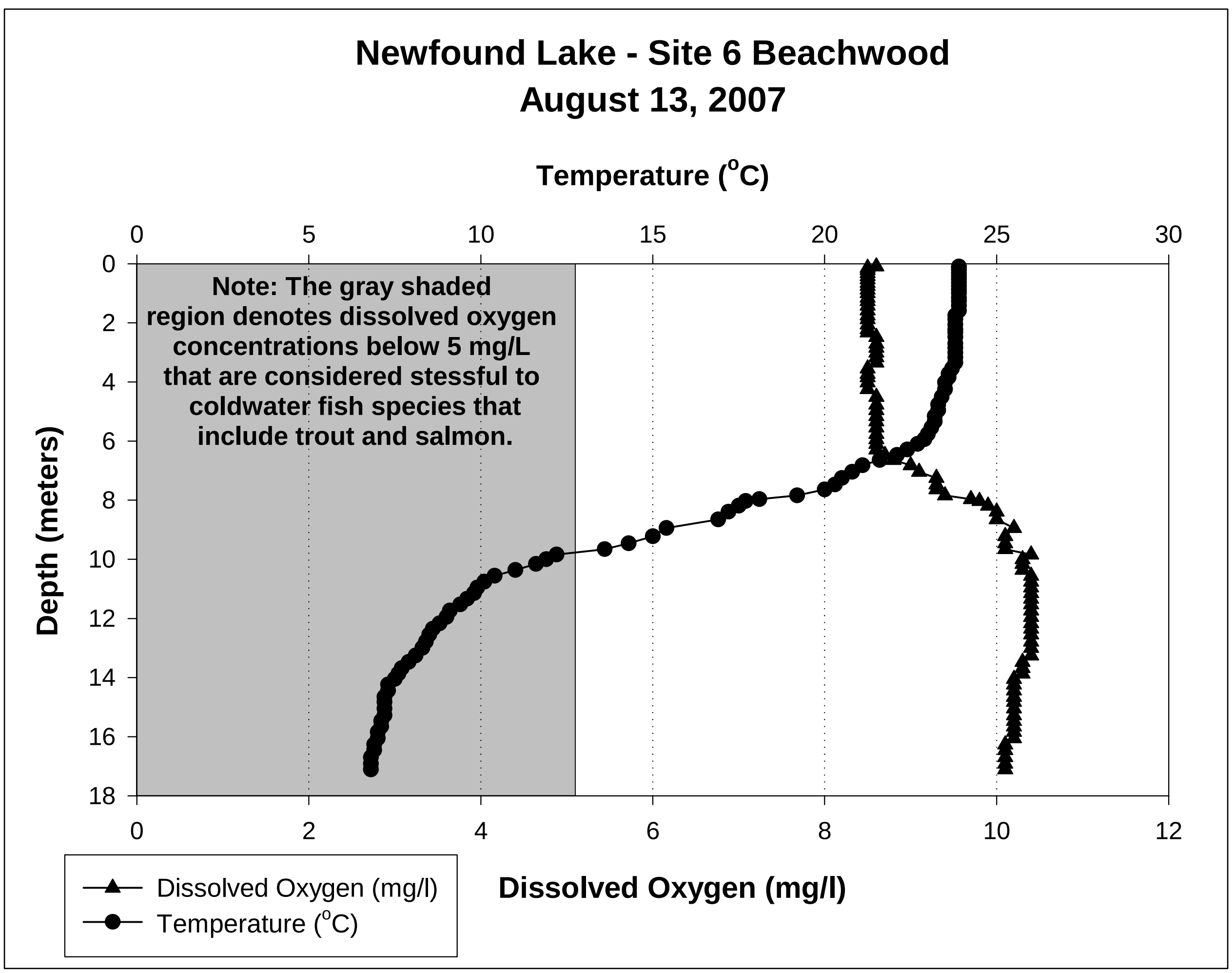

Newfound Lake - Site 5 Cockermouth
September 17, 2007
Temperature (°C)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16 18 20
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

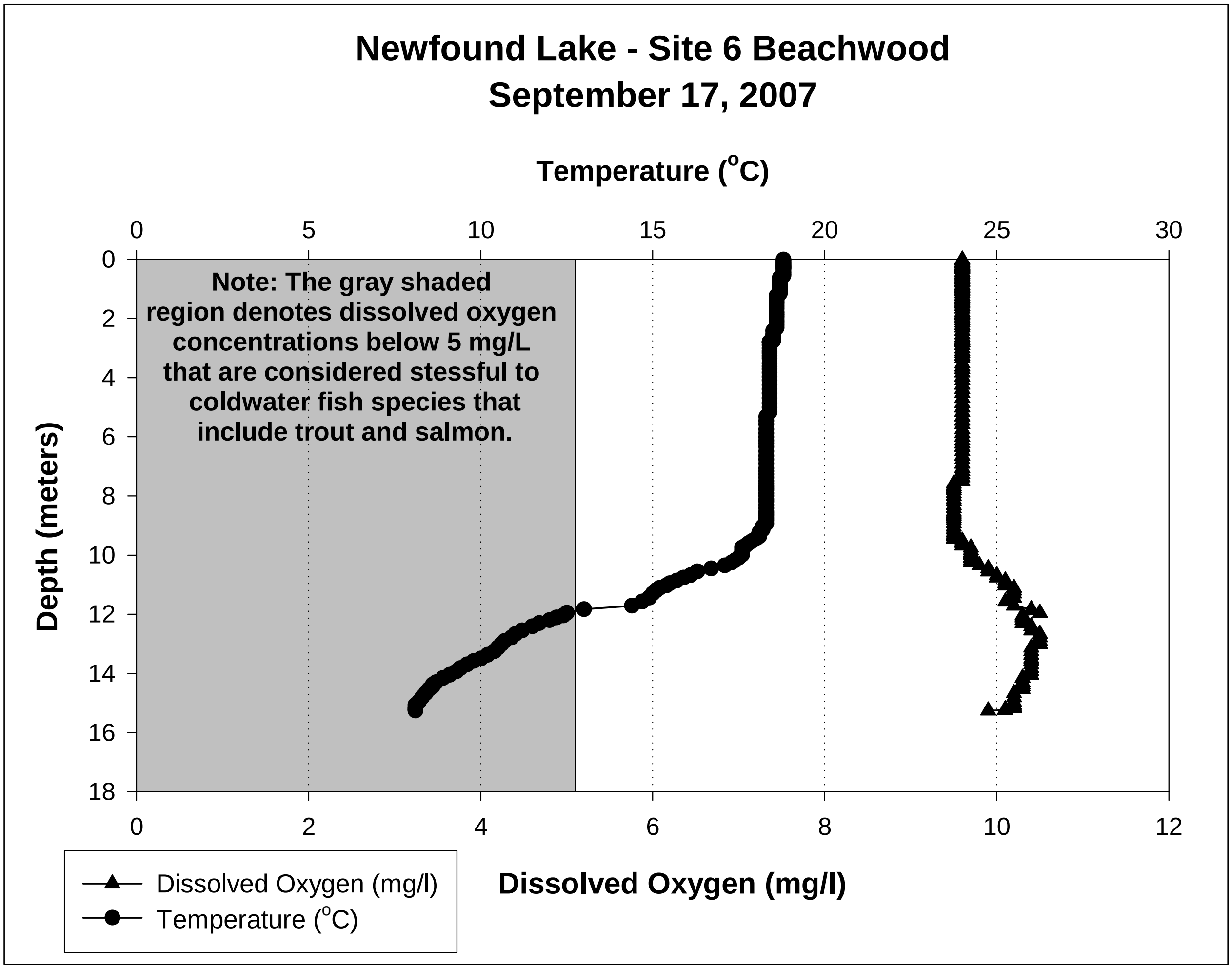

Newfound Lake - Site 5 Cockermouth
July 2, 2008
Temperature (°C)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16 18 20
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)


Newfound Lake - Site 5 Cockermouth
September 11, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

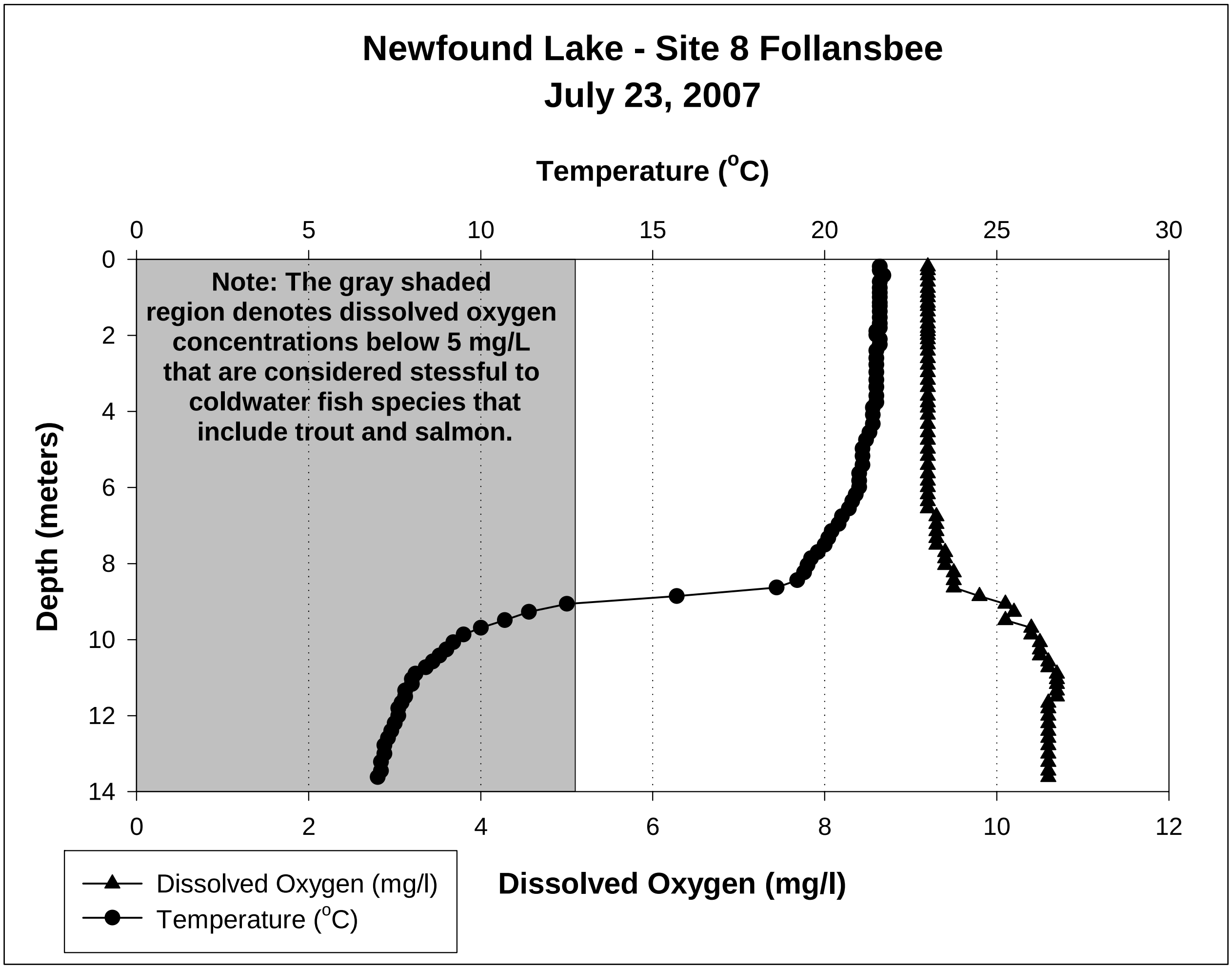

Newfound Lake - Site 5 Cockermouth
September 25, 2008
Temperature (oC)
0
5
10
15
20
25
30
Depth (meters)
0
2
4
6
8
10
12
14
16
18
20
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

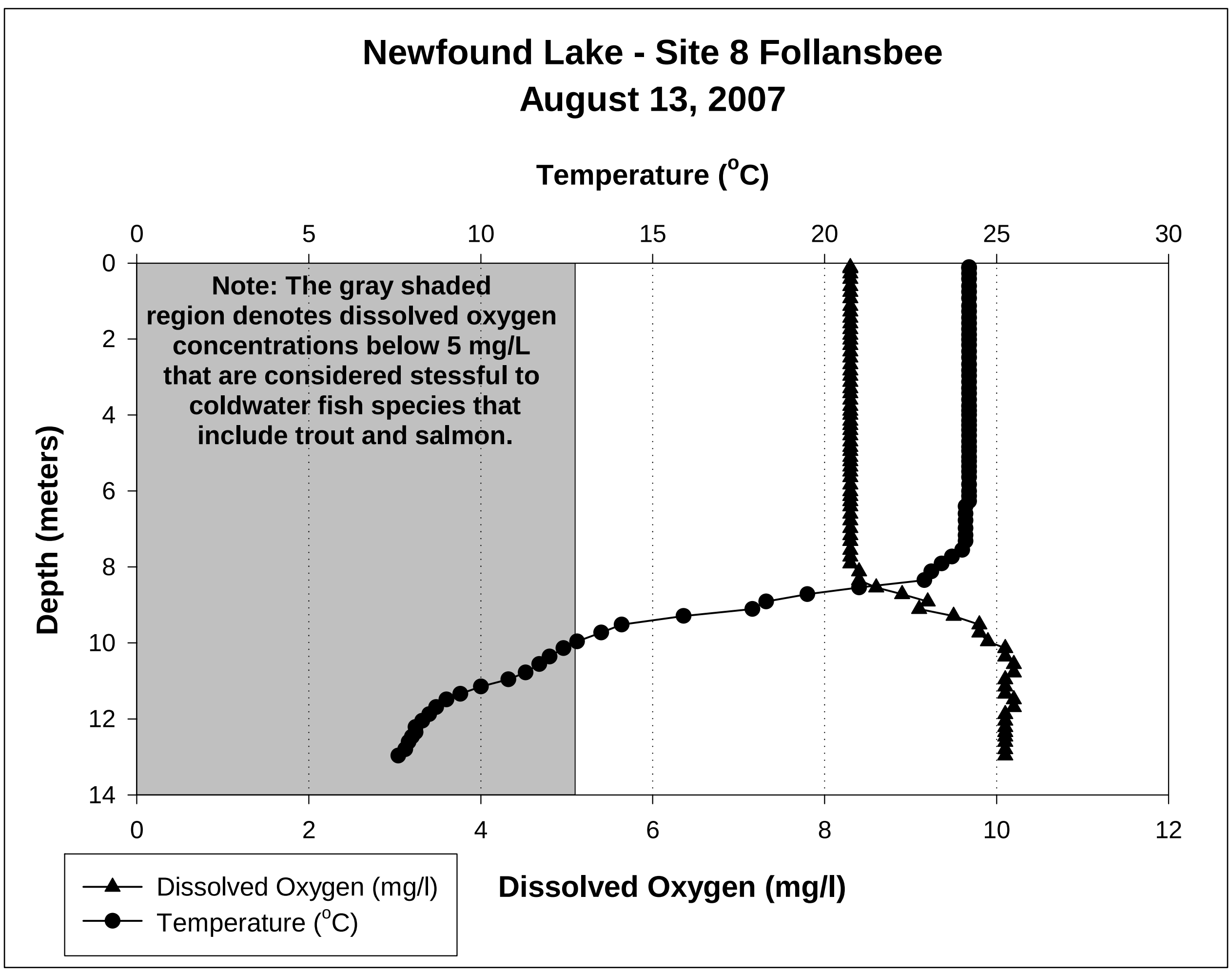

Newfound Lake - Site 6 Beachwood
July 23, 2007
Temperature (°C)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16 18
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

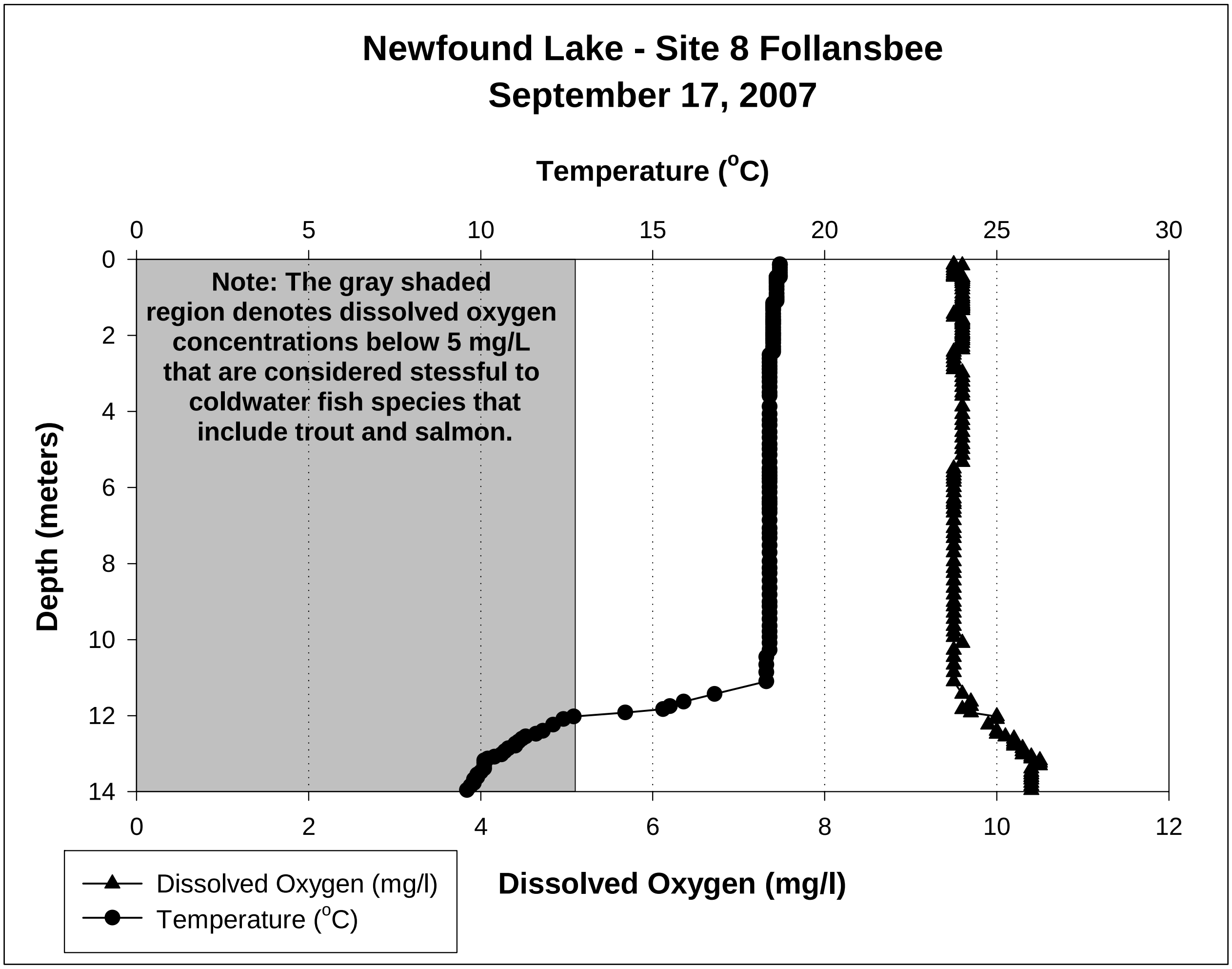

Newfound Lake - Site 6 Beachwood
August 13, 2007
Temperature (°C)
0 5 10 15 20 25 30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0 2 4 6 8 10 12 14 16 18
0 2 4 6 8 10 12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

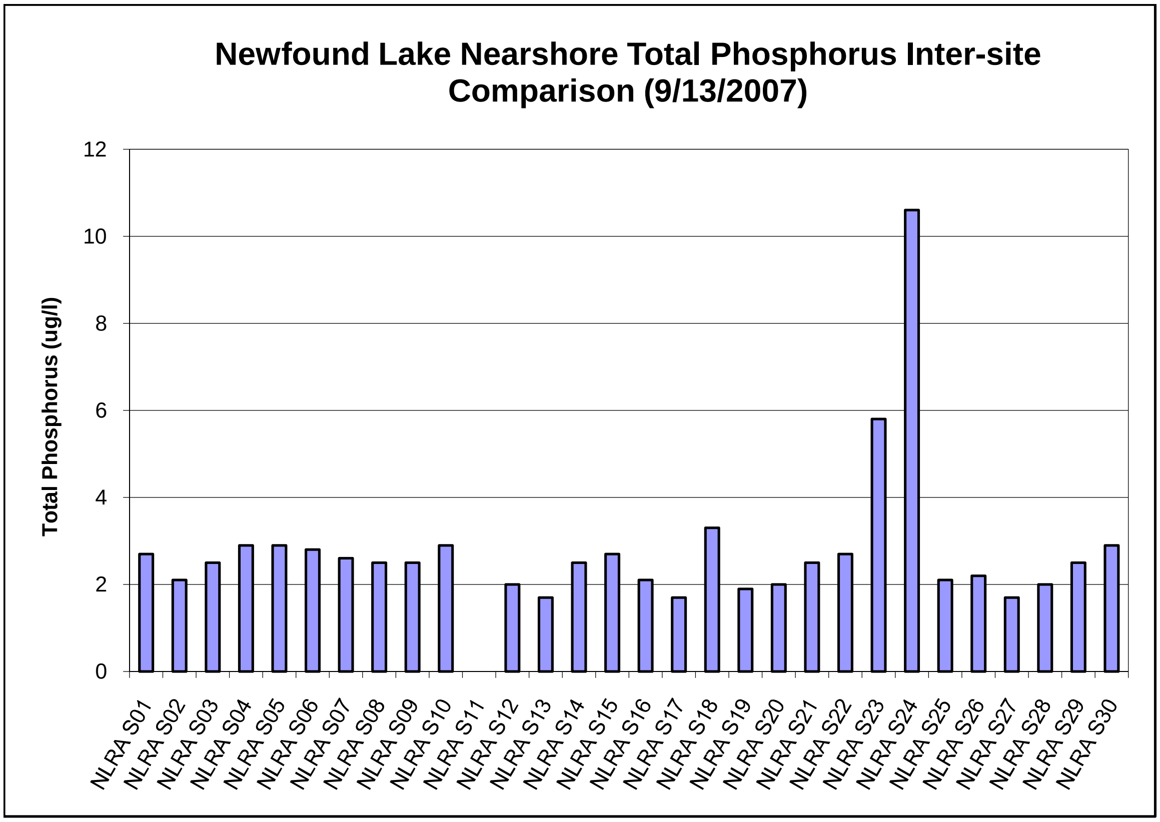


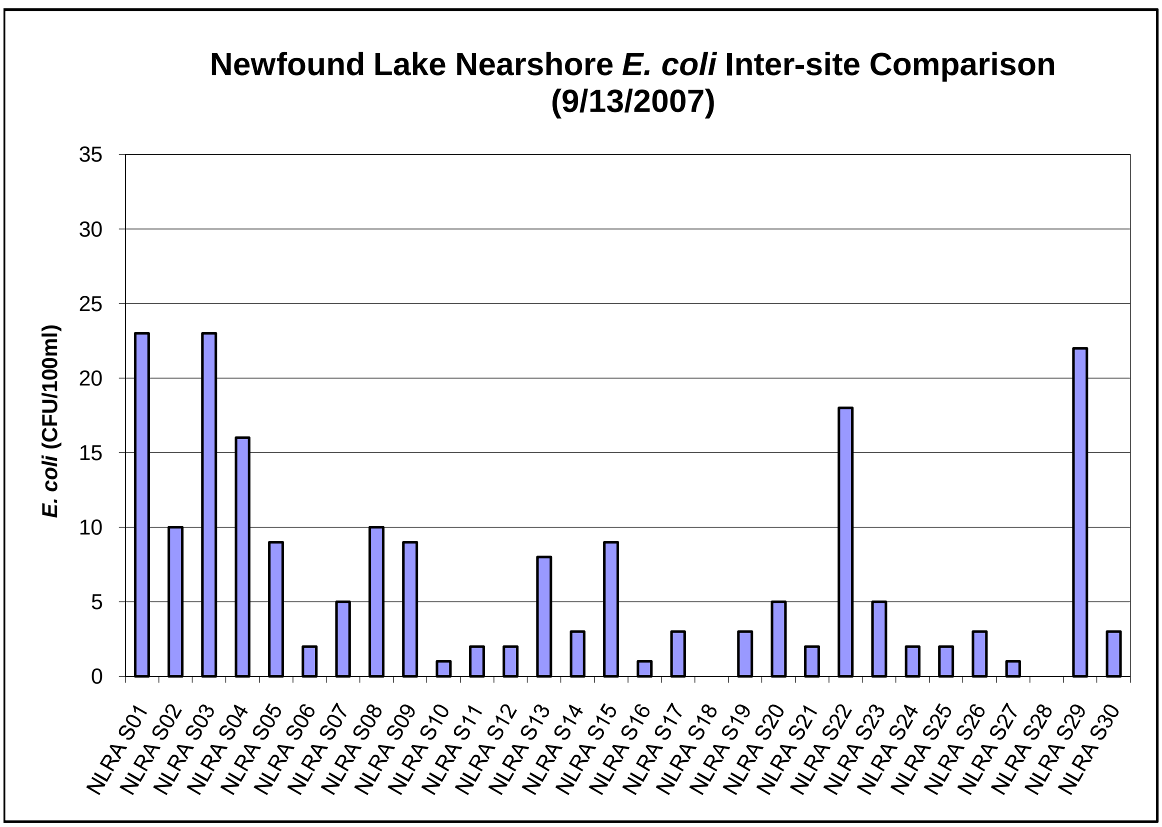
Newfound Lake - Site 6 Beachwood
September 17, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
16
18
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

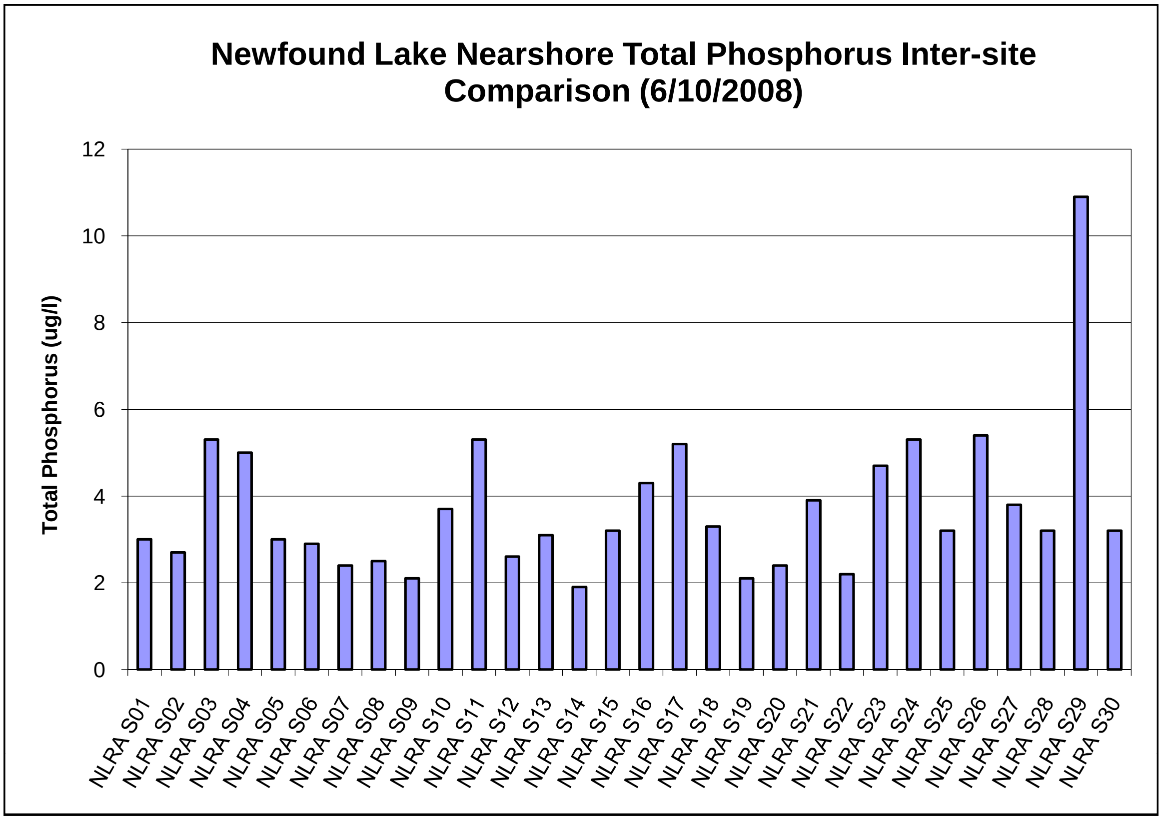

Newfound Lake - Site 8 Follansbee
July 23, 2007
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

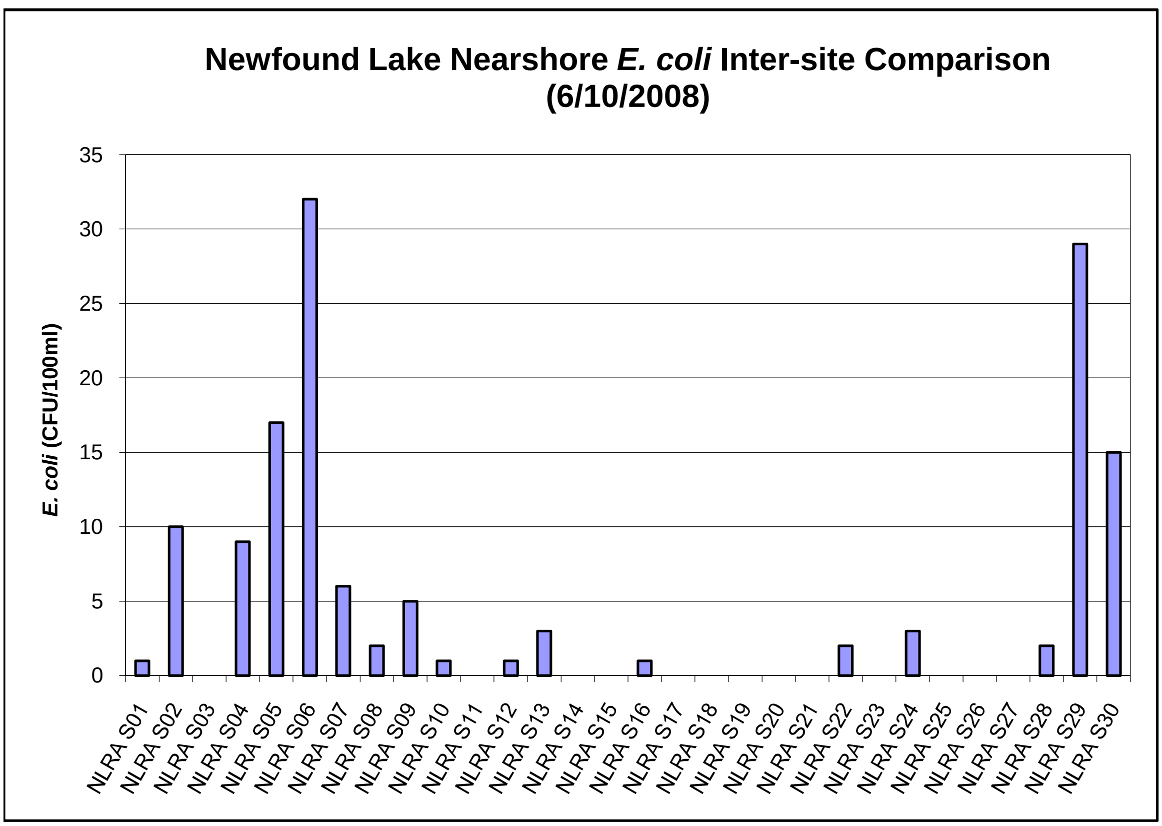

Newfound Lake - Site 8 Follansbee
August 13, 2007
Temperature (°C)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (°C)
Dissolved Oxygen (mg/l)

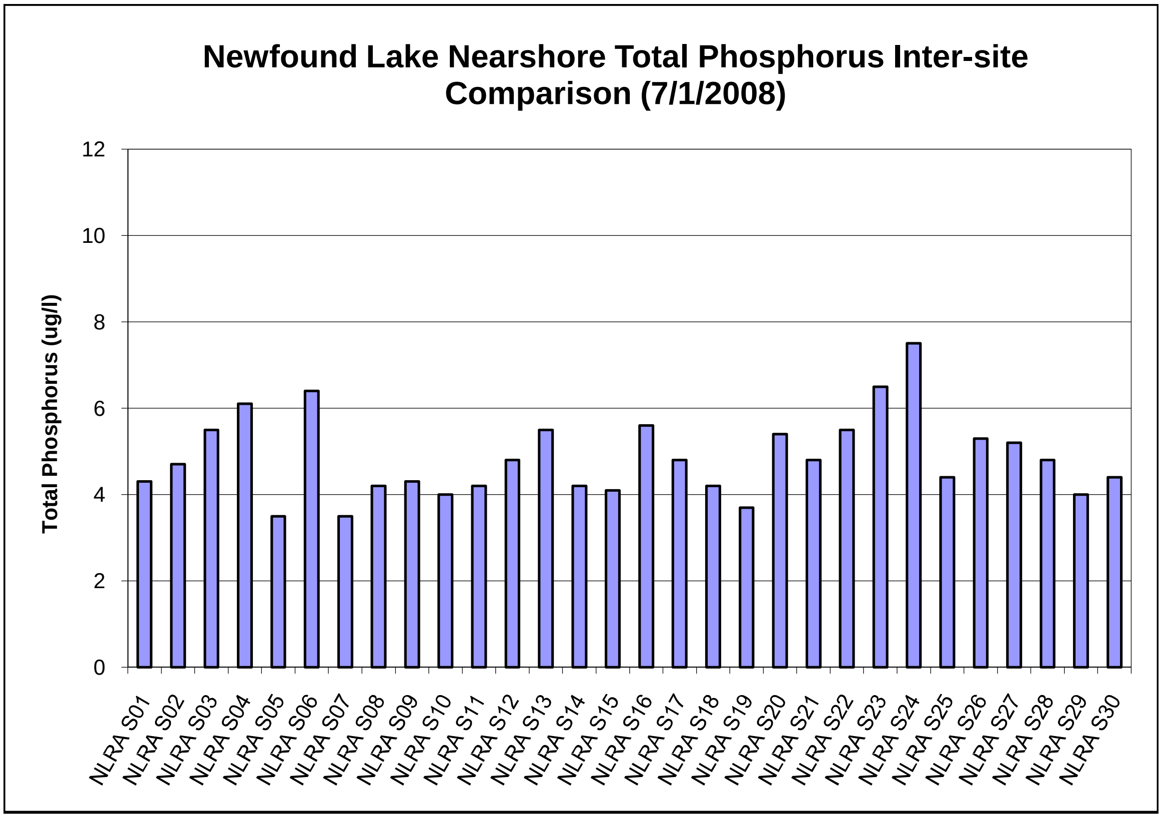

Newfound Lake - Site 8 Follansbee
September 17, 2007
Temperature (oC)
0
5
10
15
20
25
30
Note: The gray shaded region denotes dissolved oxygen concentrations below 5 mg/L that are considered stessful to coldwater fish species that include trout and salmon.
Depth (meters)
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
Dissolved Oxygen (mg/l)
Temperature (oC)
Dissolved Oxygen (mg/l)

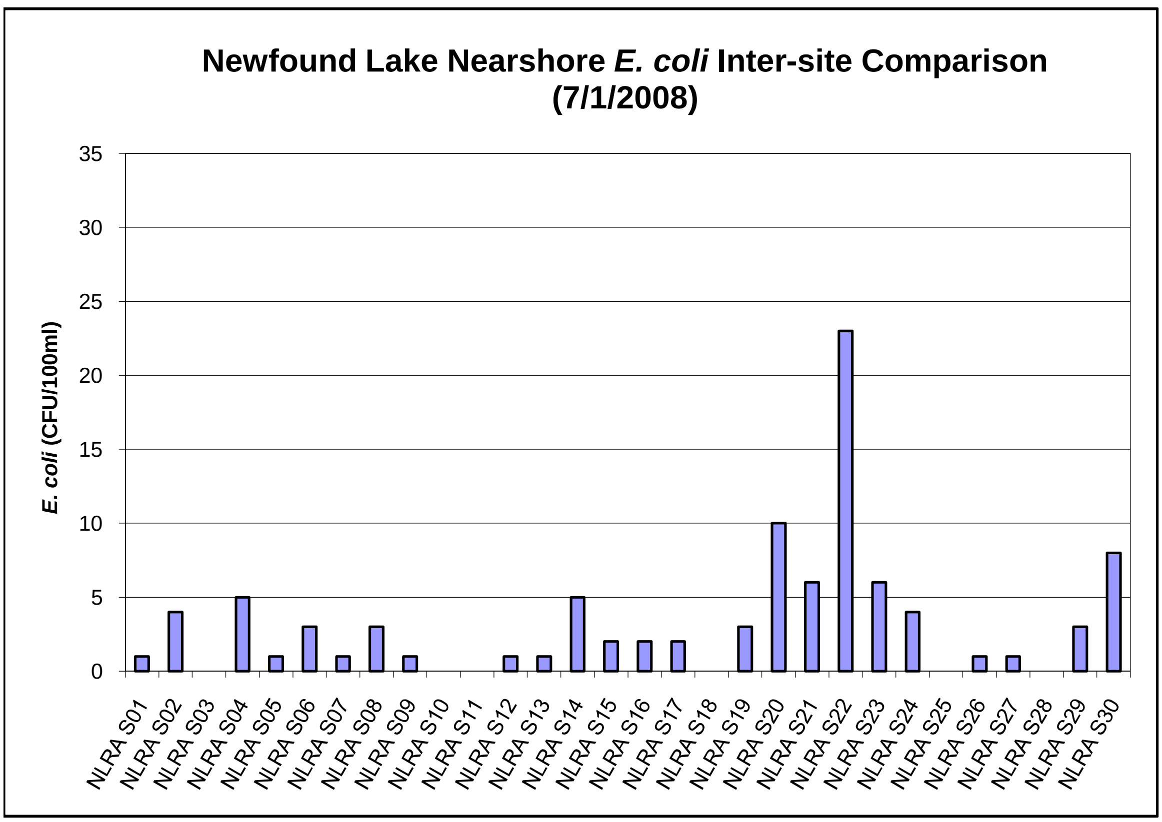

Newfound Lake Nearshore Total Phosphorus Inter-site Comparison (9/13/2007)
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30

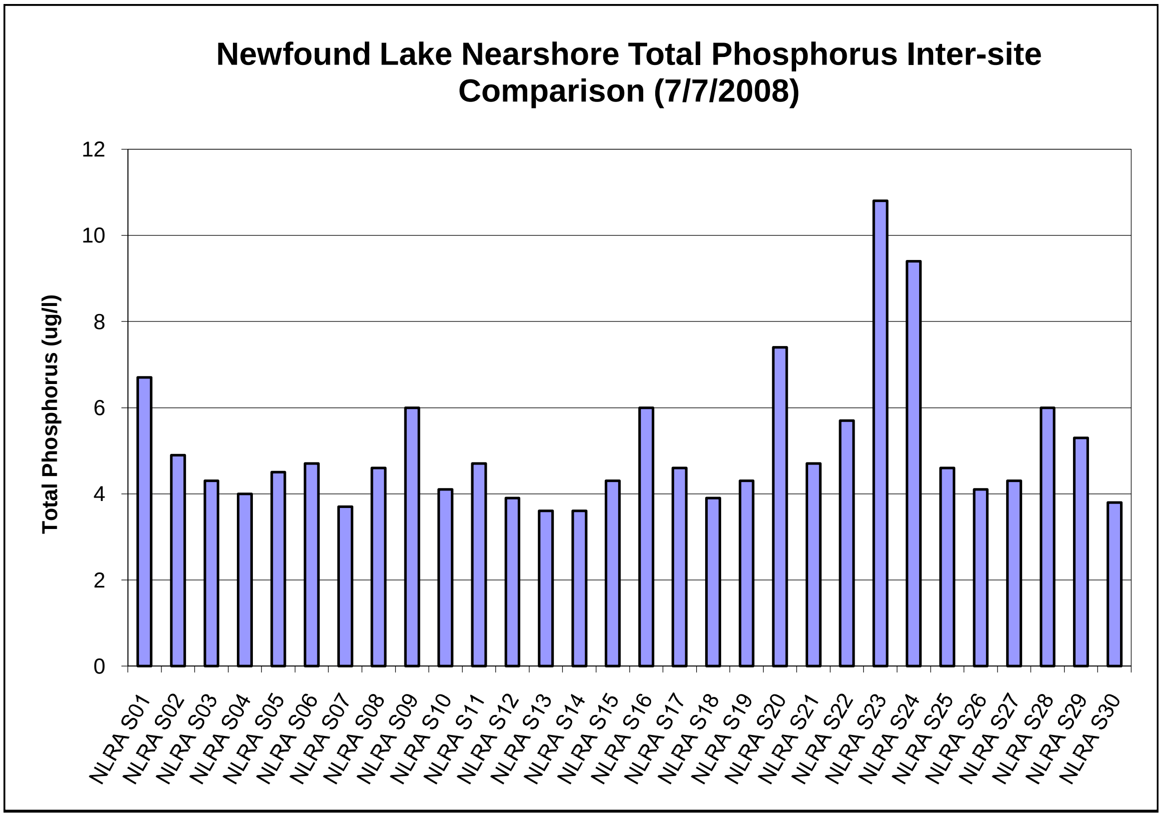

Newfound Lake Nearshore E. coli Inter-site Comparison (9/13/2007)
E. coli (CFU/100ml)
0
5
10
15
20
25
30
35
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30

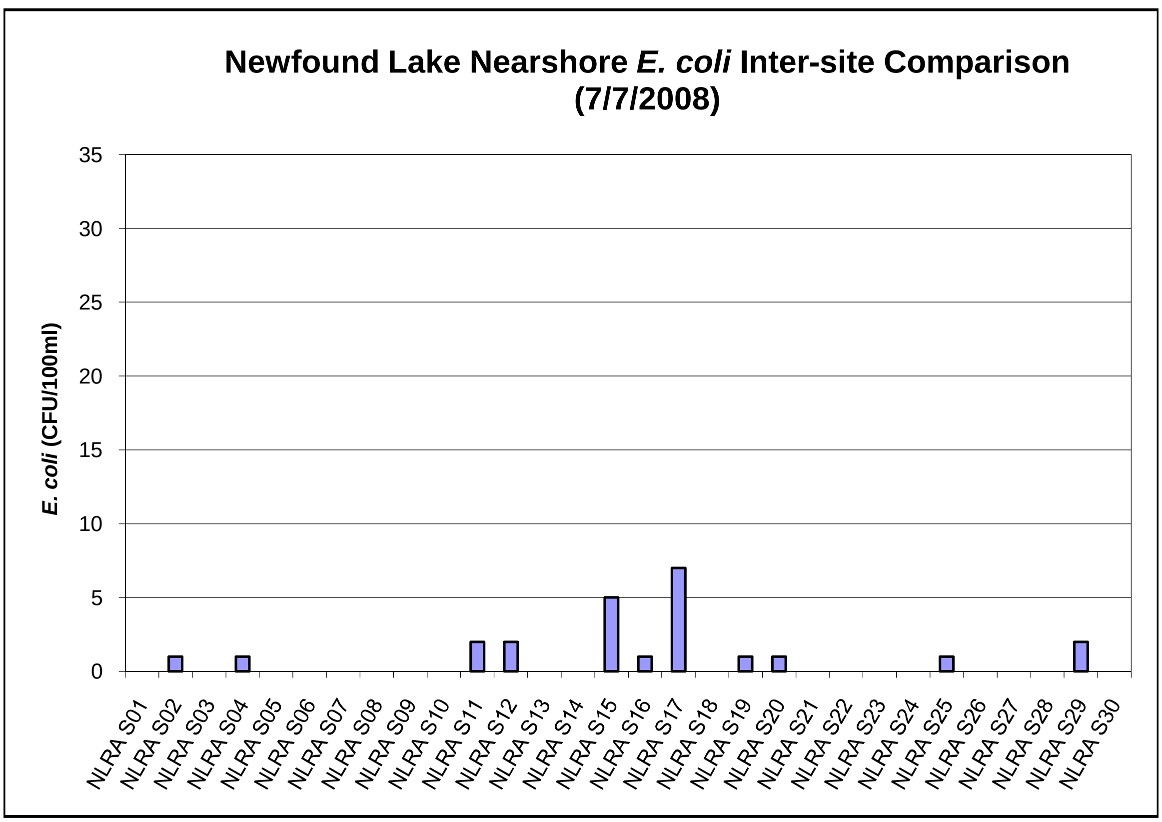

Newfound Lake Nearshore Total Phosphorus Inter-site Comparison (6/10/2008)
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30

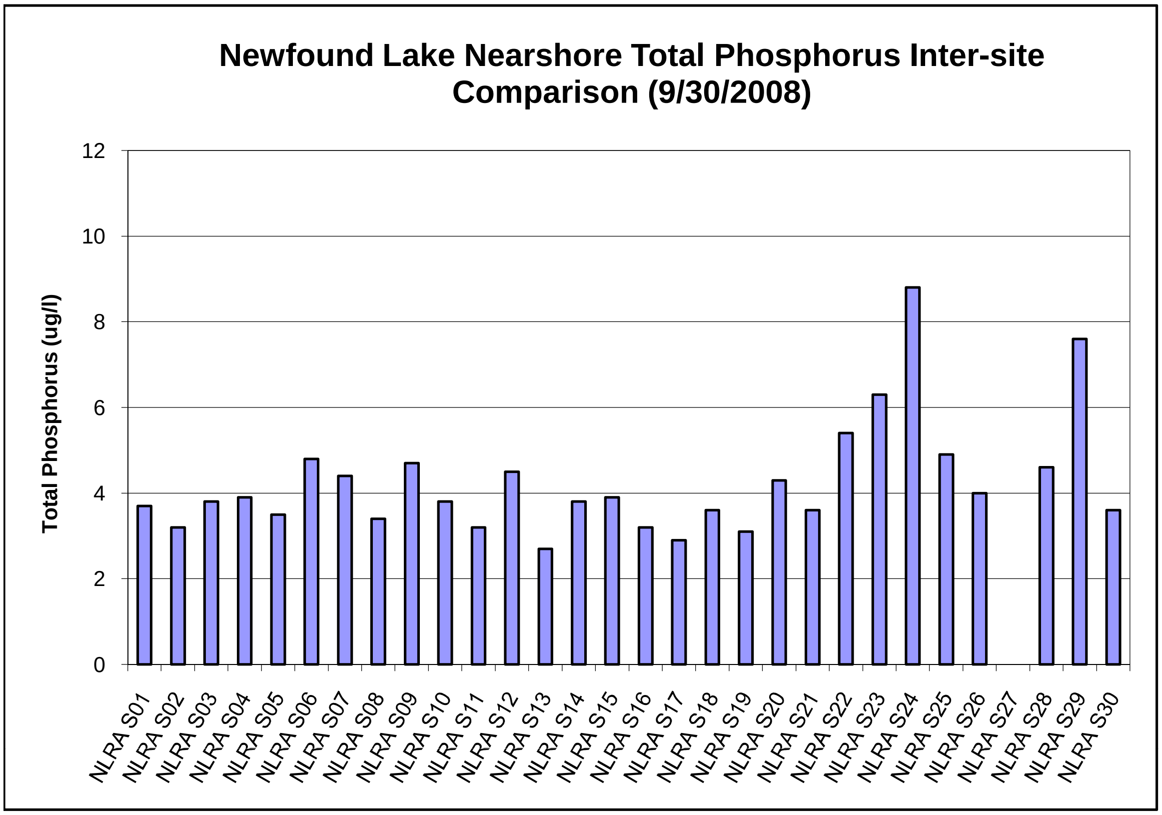

Newfound Lake Nearshore E. coli Inter-site Comparison (6/10/2008)
E. coli (CFU/100ml)
0
5
10
15
20
25
30
35
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30

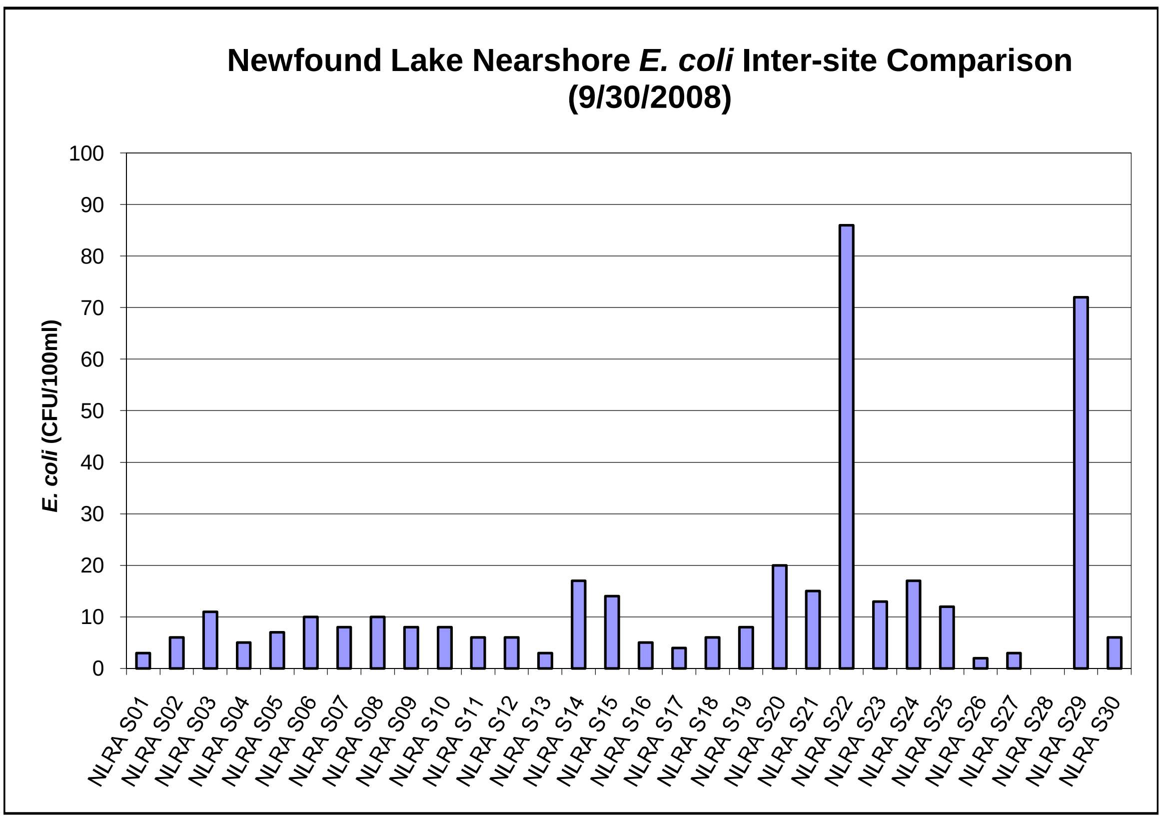

Newfound Lake Nearshore Total Phosphorus Inter-site Comparison (7/1/2008)
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30


Newfound Lake Nearshore *E. coli* Inter-site Comparison (7/1/2008)
E. coli (CFU/100ml)
0
5
10
15
20
25
30
35
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30


Newfound Lake Nearshore Total Phosphorus Inter-site Comparison (7/7/2008)
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30


Newfound Lake Nearshore *E. coli* Inter-site Comparison (7/7/2008)
E. coli (CFU/100ml)
0
5
10
15
20
25
30
35
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30


Newfound Lake Nearshore Total Phosphorus Inter-site Comparison (9/30/2008)
Total Phosphorus (ug/l)
0
2
4
6
8
10
12
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30


Newfound Lake Nearshore E. coli Inter-site Comparison (9/30/2008)
E. coli (CFU/100ml)
0
10
20
30
40
50
60
70
80
90
100
NLRA S01
NLRA S02
NLRA S03
NLRA S04
NLRA S05
NLRA S06
NLRA S07
NLRA S08
NLRA S09
NLRA S10
NLRA S11
NLRA S12
NLRA S13
NLRA S14
NLRA S15
NLRA S16
NLRA S17
NLRA S18
NLRA S19
NLRA S20
NLRA S21
NLRA S22
NLRA S23
NLRA S24
NLRA S25
NLRA S26
NLRA S27
NLRA S28
NLRA S29
NLRA S30

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Appendix E. Alexandria 4 Climatological Sampling Station Precipitation Data (2007 and 2008)

Date	Precipitation (inches)
7/1/2007	0.00
7/2/2007	0.00
7/3/2007	0.00
7/4/2007	0.00
7/5/2007	0.42
7/6/2007	0.00
7/7/2007	0.04
7/8/2007	0.27
7/9/2007	0.24
7/10/2007	0.91
7/11/2007	0.21
7/12/2007	0.50
7/13/2007	0.00
7/14/2007	0.00
7/15/2007	0.00
7/16/2007	0.63
7/17/2007	0.00
7/18/2007	0.57
7/19/2007	0.33
7/20/2007	1.47
7/21/2007	0.00
7/22/2007	0.00
7/23/2007	0.11
7/24/2007	0.00
7/25/2007	0.00
7/26/2007	0.00
7/27/2007	0.00
7/28/2007	0.02
7/29/2007	0.07
7/30/2007	0.00
7/31/2007	0.00
8/1/2007	0.00
8/2/2007	0.00
8/3/2007	0.00
8/4/2007	0.00
8/5/2007	0.00
8/6/2007	0.00

Date	Precipitation (inches)
9/1/2007	0.00
9/2/2007	0.00
9/3/2007	0.00
9/4/2007	0.00
9/5/2007	0.00
9/6/2007	0.00
9/7/2007	0.00
9/8/2007	0.00
9/9/2007	0.07
9/10/2007	1.44
9/11/2007	0.55
9/12/2007	0.62
9/13/2007	0.00
9/14/2007	0.00
9/15/2007	0.72
9/16/2007	0.44
9/17/2007	0.00
9/18/2007	0.00
9/19/2007	0.00
9/20/2007	0.00
9/21/2007	0.00
9/22/2007	0.00
9/23/2007	0.00
9/24/2007	0.00
9/25/2007	0.00
9/26/2007	0.00
9/27/2007	0.00
9/28/2007	0.17
9/29/2007	0.06
9/30/2007	0.00
4/1/2008	0.38
4/2/2008	0.15
4/3/2008	0.00
4/4/2008	0.00
4/5/2008	0.54
4/6/2008	0.01
4/7/2008	0.00

Date	Precipitation (inches)
5/1/2008	0.00
5/2/2008	0.00
5/3/2008	0.04
5/4/2008	0.38
5/5/2008	0.06
5/6/2008	0.00
5/7/2008	0.00
5/8/2008	0.08
5/9/2008	0.00
5/10/2008	0.00
5/11/2008	0.00
5/12/2008	0.00
5/13/2008	0.00
5/14/2008	0.00
5/15/2008	0.00
5/16/2008	0.00
5/17/2008	0.02
5/18/2008	0.01
5/19/2008	0.03
5/20/2008	0.03
5/21/2008	0.00
5/22/2008	0.03
5/23/2008	0.00
5/24/2008	0.03
5/25/2008	0.00
5/26/2008	0.00
5/27/2008	0.00
5/28/2008	0.05
5/29/2008	0.00
5/30/2008	0.00
5/31/2008	0.02
6/1/2008	0.06
6/2/2008	0.00
6/3/2008	0.00
6/4/2008	0.07
6/5/2008	0.11
6/6/2008	0.44

Date	Precipitation (inches)
7/1/2008	0.00
7/2/2008	0.00
7/3/2008	0.00
7/4/2008	0.00
7/5/2008	0.00
7/6/2008	0.00
7/7/2008	0.00
7/8/2008	0.00
7/9/2008	0.00
7/10/2008	0.15
7/11/2008	0.00
7/12/2008	0.00
7/13/2008	0.00
7/14/2008	0.16
7/15/2008	0.00
7/16/2008	0.00
7/17/2008	0.00
7/18/2008	0.00
7/19/2008	0.28
7/20/2008	0.09
7/21/2008	0.54
7/22/2008	0.61
7/23/2008	0.00
7/24/2008	1.09
7/25/2008	1.00
7/26/2008	0.00
7/27/2008	0.23
7/28/2008	0.00
7/29/2008	0.00
7/30/2008	0.00
7/31/2008	0.00
8/1/2008	0.40
8/2/2008	0.09
8/3/2008	1.69
8/4/2008	0.15
8/5/2008	0.00
8/6/2008	0.07

Date	Precipitation (inches)
9/1/2008	0.00
9/2/2008	0.00
9/3/2008	0.00
9/4/2008	0.00
9/5/2008	0.00
9/6/2008	0.03
9/7/2008	3.37
9/8/2008	0.00
9/9/2008	0.00
9/10/2008	0.67
9/11/2008	0.00
9/12/2008	0.00
9/13/2008	0.17
9/14/2008	0.61
9/15/2008	0.41
9/16/2008	0.00
9/17/2008	0.00
9/18/2008	0.00
9/19/2008	0.00
9/20/2008	0.00
9/21/2008	0.00
9/22/2008	0.00
9/23/2008	0.00
9/24/2008	0.00
9/25/2008	0.00
9/26/2008	0.00
9/27/2008	1.63
9/28/2008	1.25
9/29/2008	0.11
9/30/2008	0.00
10/1/2008	0.02
10/2/2008	0.42
10/3/2008	0.07
10/4/2008	0.02
10/5/2008	0.00
10/6/2008	0.00
10/7/2008	0.00

Appendix E. Alexandria 4 Climatological Sampling Station Precipitation Data (2007 and 2008)

Date	Precipitation (inches)
8/7/2007	0.52
8/8/2007	1.21
8/9/2007	0.48
8/10/2007	0.00
8/11/2007	0.00
8/12/2007	0.00
8/13/2007	0.00
8/14/2007	0.00
8/15/2007	0.00
8/16/2007	0.01
8/17/2007	0.29
8/18/2007	0.00
8/19/2007	0.00
8/20/2007	0.00
8/21/2007	0.00
8/22/2007	0.00
8/23/2007	0.00
8/24/2007	0.05
8/25/2007	0.08
8/26/2007	0.51
8/27/2007	0.00
8/28/2007	0.00
8/29/2007	0.00
8/30/2007	0.00
8/31/2007	0.54

Date	Precipitation (inches)
4/8/2008	0.00
4/9/2008	0.00
4/10/2008	0.00
4/11/2008	0.00
4/12/2008	0.59
4/13/2008	0.00
4/14/2008	0.00
4/15/2008	0.00
4/16/2008	0.00
4/17/2008	0.00
4/18/2008	0.00
4/19/2008	0.00
4/20/2008	0.00
4/21/2008	0.00
4/22/2008	0.00
4/23/2008	0.00
4/24/2008	0.05
4/25/2008	0.00
4/26/2008	0.00
4/27/2008	0.01
4/28/2008	0.19
4/29/2008	2.42
4/30/2008	0.83

Date	Precipitation (inches)
6/7/2008	0.57
6/8/2008	0.00
6/9/2008	0.09
6/10/2008	0.00
6/11/2008	0.53
6/12/2008	0.00
6/13/2008	0.00
6/14/2008	0.00
6/15/2008	0.56
6/16/2008	0.06
6/17/2008	0.03
6/18/2008	0.13
6/19/2008	0.00
6/20/2008	0.00
6/21/2008	0.00
6/22/2008	0.00
6/23/2008	2.38
6/24/2008	0.63
6/25/2008	0.05
6/26/2008	0.00
6/27/2008	0.06
6/28/2008	0.18
6/29/2008	1.32
6/30/2008	0.11

Date	Precipitation (inches)
8/7/2008	1.83
8/8/2008	0.18
8/9/2008	0.39
8/10/2008	0.00
8/11/2008	0.52
8/12/2008	1.48
8/13/2008	0.07
8/14/2008	0.00
8/15/2008	0.00
8/16/2008	0.00
8/17/2008	0.38
8/18/2008	0.00
8/19/2008	0.43
8/20/2008	0.00
8/21/2008	0.00
8/22/2008	0.00
8/23/2008	0.00
8/24/2008	0.00
8/25/2008	0.00
8/26/2008	0.00
8/27/2008	0.00
8/28/2008	0.00
8/29/2008	0.00
8/30/2008	0.00
8/31/2008	0.03

Date	Precipitation (inches)
10/8/2008	0.00
10/9/2008	0.16
10/10/2008	0.00
10/11/2008	0.00
10/12/2008	0.00
10/13/2008	0.00
10/14/2008	0.00
10/15/2008	0.00
10/16/2008	0.02
10/17/2008	0.37
10/18/2008	0.00
10/19/2008	0.00
10/20/2008	0.00
10/21/2008	0.00
10/22/2008	0.93
10/23/2008	0.05
10/24/2008	0.00
10/25/2008	0.00
10/26/2008	1.88
10/27/2008	0.00
10/28/2008	0.00
10/29/2008	0.53
10/30/2008	0.00
10/31/2008	0.00

APPENDIX F. Periphyton Substrate Sampler Growth

Figure: P-3 Beachwood July 22, 2008

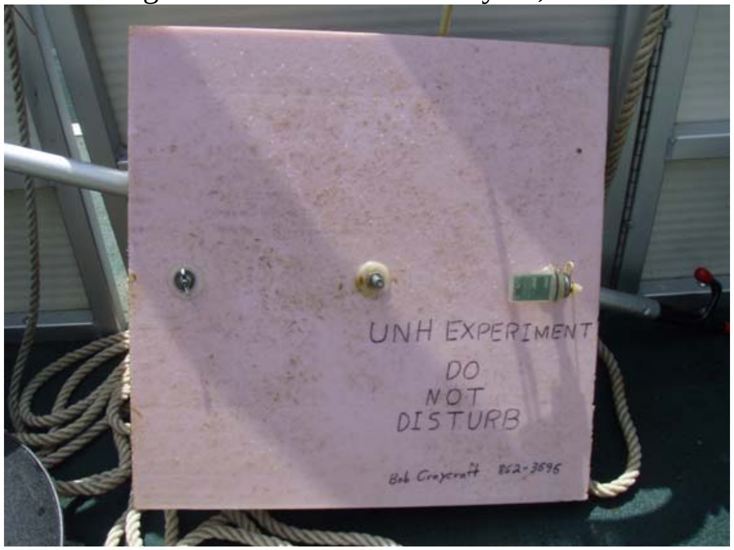


Figure: P-4 Fower July 22, 2008

Figure: P-5 Hemlock July 22, 2008

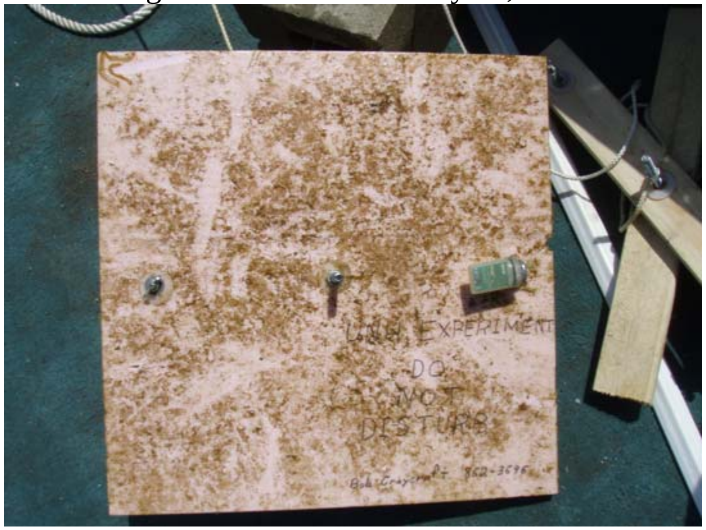


Figure: P-7 Hebron July 22, 2008

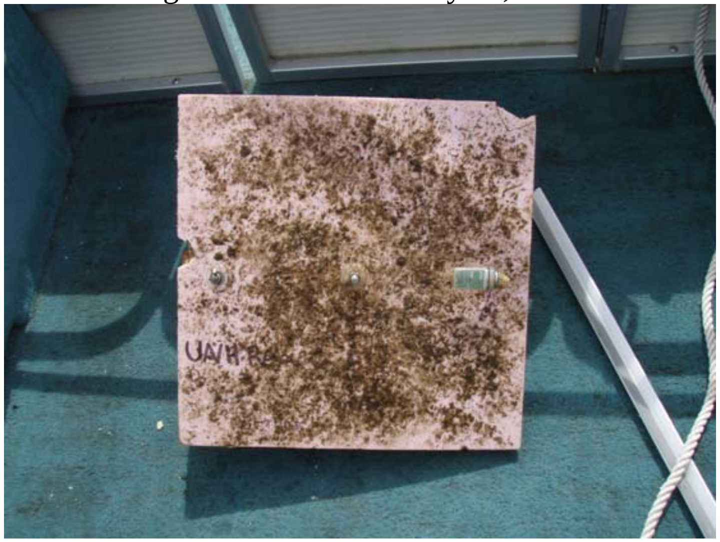


Figure: P-3 Beachwood August 14, 2008

Missing Data: Periphyton sampler damaged during July 22 retrieval and had to re-establish biofilm before reinstituting sampling.

Figure: P-4 Fower August 14, 2008

Figure: P-5 Hemlock August 14, 2008

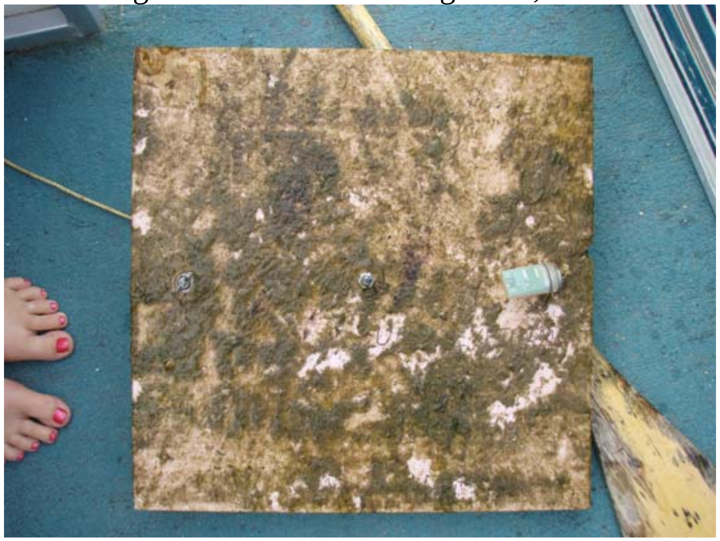


Figure: P-7 Hebron August 14, 2008

APPENDIX F. Periphyton Substrate Sampler Growth

Figure: P-3 Beachwood August 26, 2008

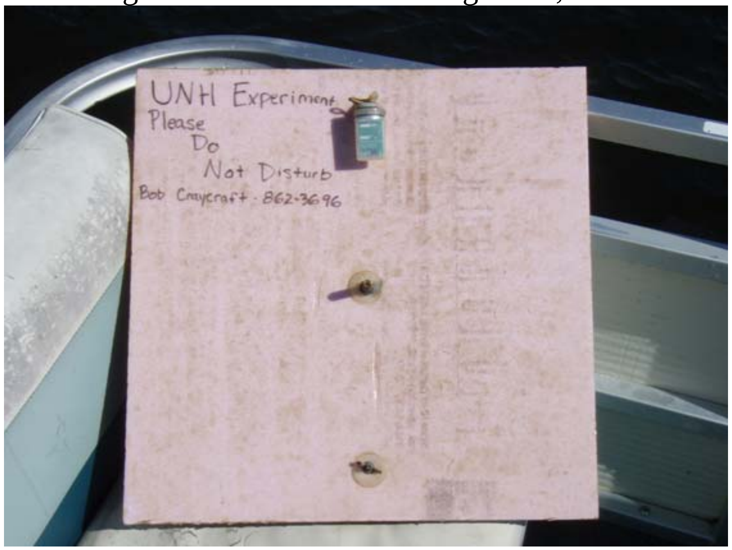


Figure: P-4 Fower August 26, 2008

Figure: P-5 Hemlock August 26, 2008

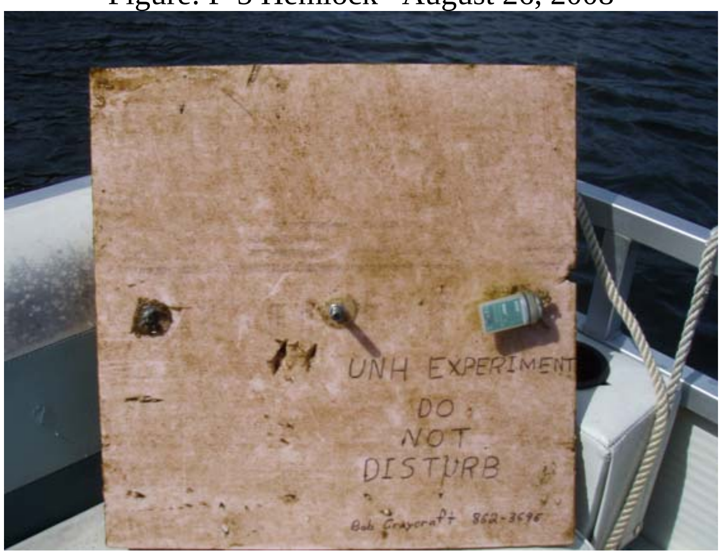


Figure: P-7 Hebron August 26, 2008

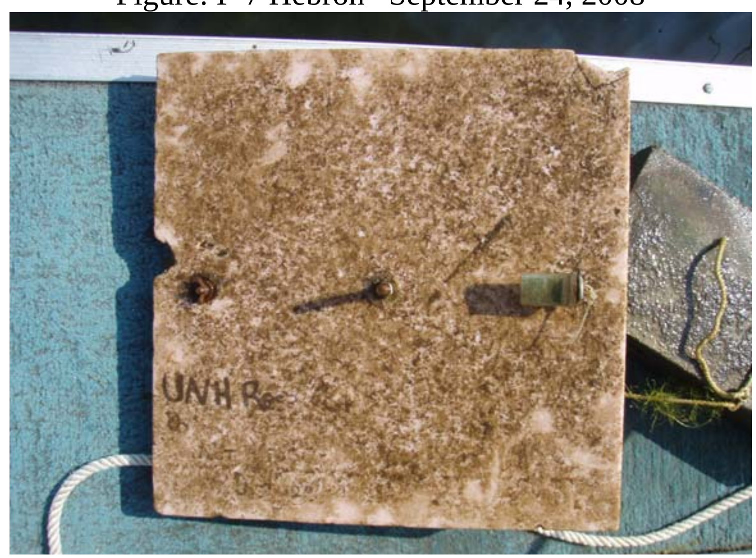
APPENDIX F. Periphyton Substrate Sampler Growth

Figure: P-3 Beachwood   September 24, 2008

Figure: P-4 Fower   September 24, 2008

Figure: P-5 Hemlock   September 24, 2008

Figure: P-7 Hebron   September 24, 2008



Newfound Lake Artificial Substrate (periphyton) Sampler Components

(see photos on the subsequent pages for completed product)

Hardware/Components

- ½" x 3" wood cut to 18" length
- 1" thick (4 x 8 foot) pink Corning insulation cut to 18" x 18" squares
- 3" long ¼" diameter hex head bolts
- ¼" wing nuts
- 5" long x ¼" diameter stainless steel eye bolts (to affix the Hobo Onset light/temperature meters)
- 6" long x 3/8" diameter stainless steel eye bolts (to attach the anchor line to the buoyant samplers)
- nylon washers
- ¼" stainless steel washers
- 8" x 8" x 16" three hole cinder blocks (used as anchor weights)
- 10" x 10" x 10" one hole cinder blocks (used as anchor weights)
- nylon line rated for a 90 pound weight capacity (used as anchor line between the cinder block and the eye bolt)
- 4" zip ties to affix the Hobo Onset meters to the 4" eye bolts and to ensure the meters are positioned in the appropriate orientation (facing up to measure sunlight)
- thin nylon line to tether the Hobo Onset meters to the 4" eye bolts (to ensure that the samplers to not float away should the zip ties break)

General Notes (see photos on the following pages):

- The Corning insulation was attached to the wood frame using thee bolts (the 5" x 1/4" eye bolt, the 6" x 3/8" eye bolt and the 3" x ¼" hex bolt). The 3/8" eye bolt was positioned in the center of the sampler while the two remaining bolts were positioned 2" from the two edges of the sampler (one at each edge).
- A hex nut was recessed into the upper wood cross beam and a nylon washer was positioned between the upper and lower cross beams to avoid stressing the corning insulation when raising the samplers out of the water (the weight of the cinder block anchor is primarily born by the lower wood cross beam.
- The periphyton samplers were highly buoyant and while the three hole cinder blocks would "sink" the samplers, a second weight (cinder block) was generally attached to ensure that the samplers did not "walk" across the lake, due to wave action and turbulence, and end up submersed into deeper waters.
- In-lake periphyton samplers were submersed to depths of 1 to 1.5 meters. Natural lake level fluctuations had an influence on the daily sampler depth and it was important to consider submersing the samples to a sufficient depth that would avoid interference with boat props that may drive over the periphyton samplers.

- Periphyton samplers are retrieved using a standard boat hook that “catches” the anchor line while the wood cross beam frame protects the Corning insulation (growth substrate surface) from damage during sampler retrieval. The buoyancy of the periphyton sampler makes the rising of the sampler to the water surface but care must be taken once the sampler is raised out of the water. It was most effective to place one’s hand under the lower wood beam, by the 3/8” eye bolt, and lift the sampler out of the water and place the sampler on the boat deck. All sampling was undertaken via a pontoon boat that provided a working platform and provided ample maneuvering space.

Figure 1. Front of Sampler with three bolts visible

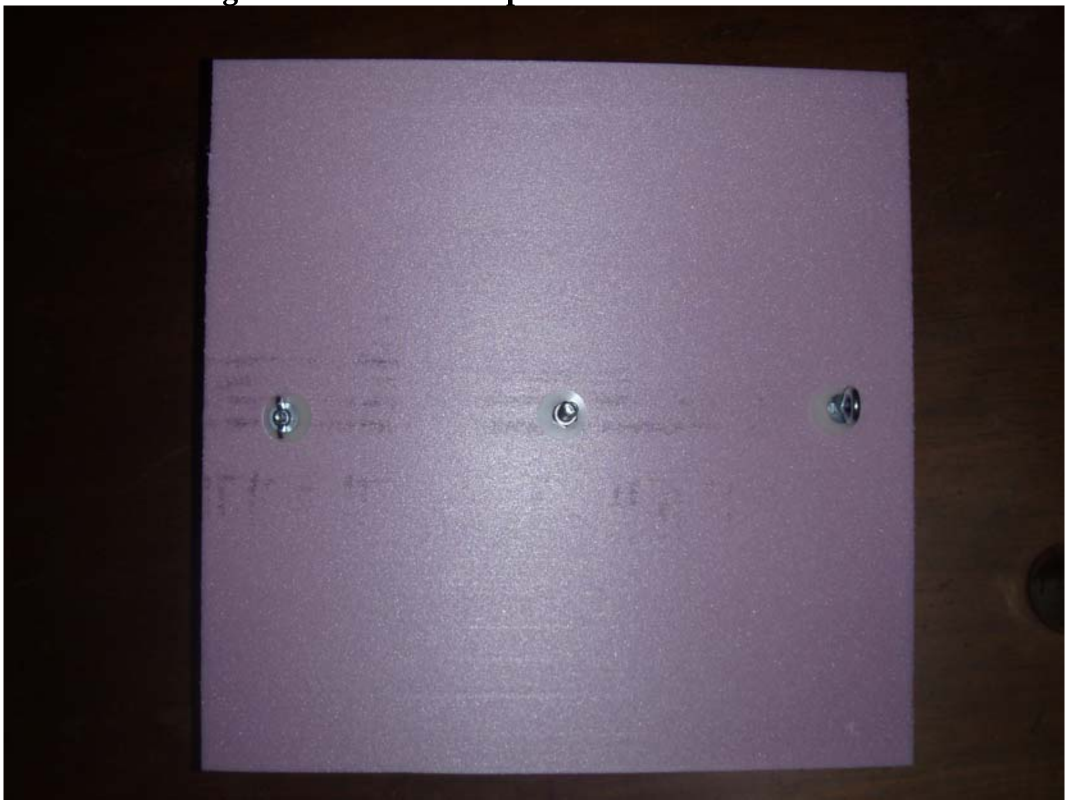


Figure 2. Underside of Sampler with Cross beams visible, eye bolt anchor hole visible and accessory bolts visible.

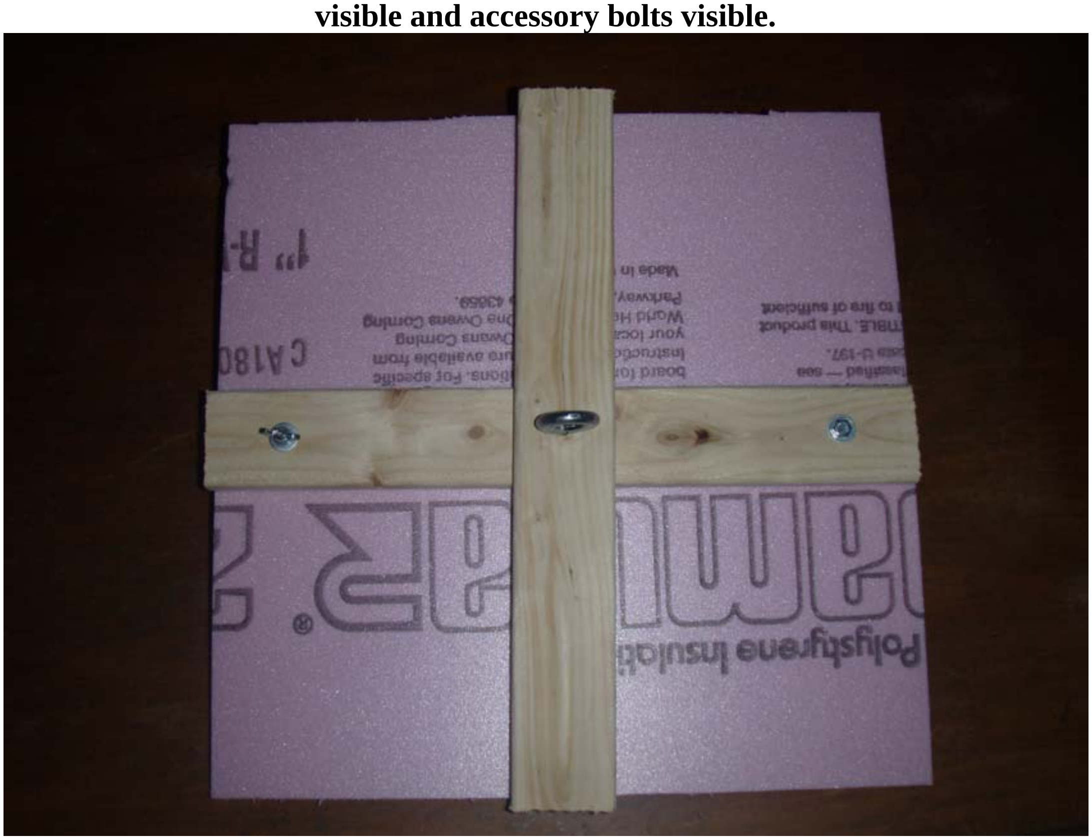
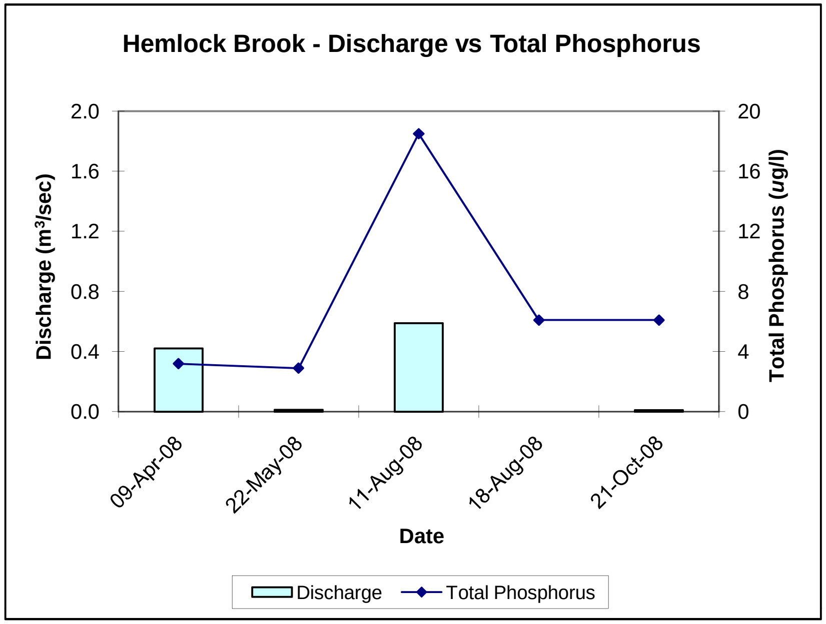
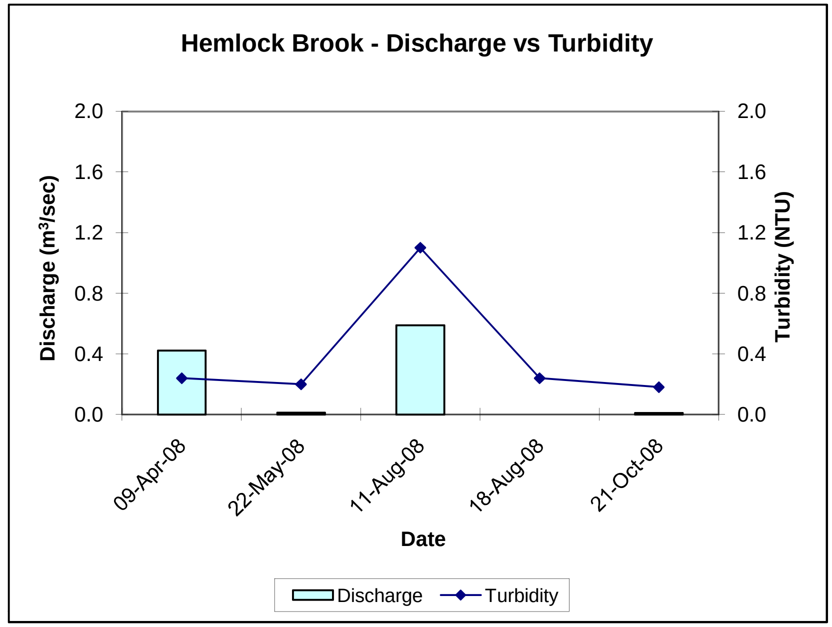
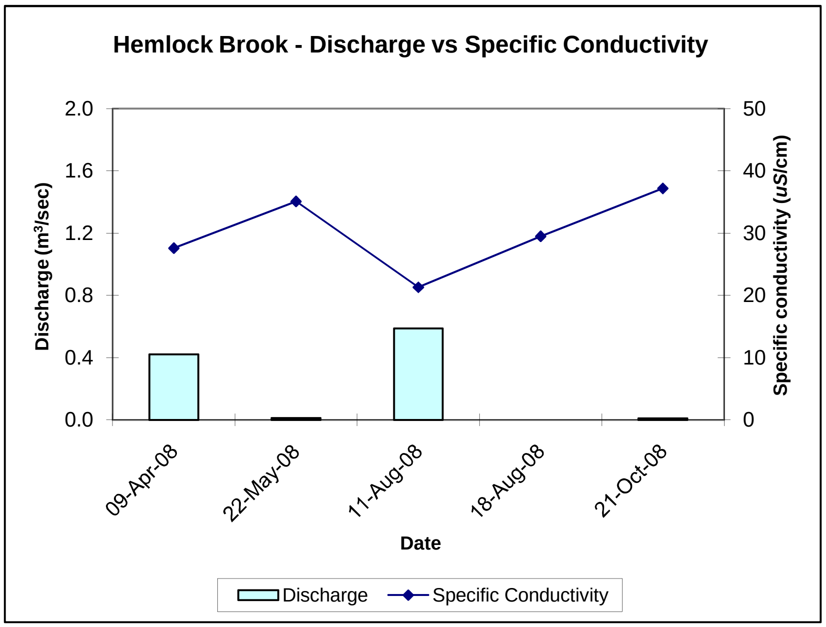


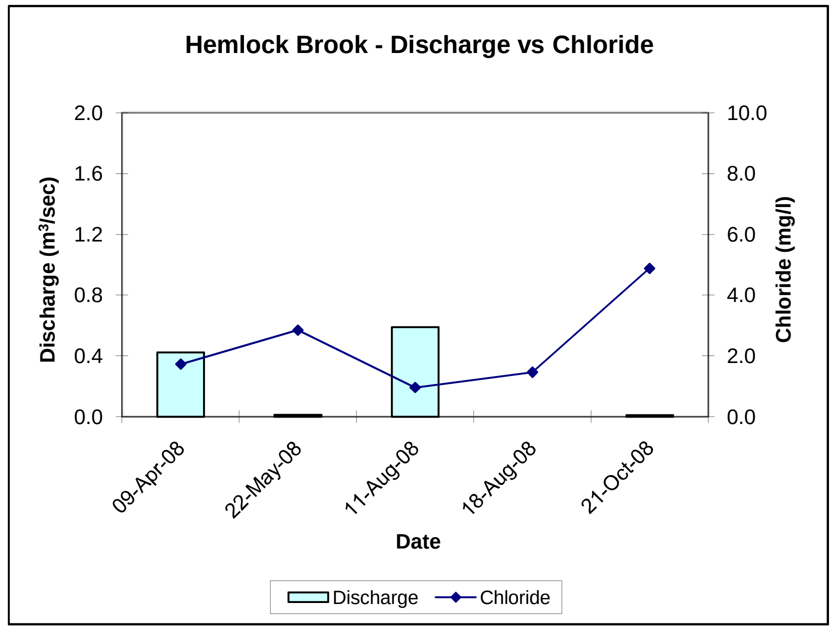
Figure 3. Artificial Substrate sampler being prepared for deployment. Note: the anchor line and cinder block is being attached and the Hobo Onset Temperature/Light meter is affixed to the 5” eye bolt on the right hand side of the sampler.

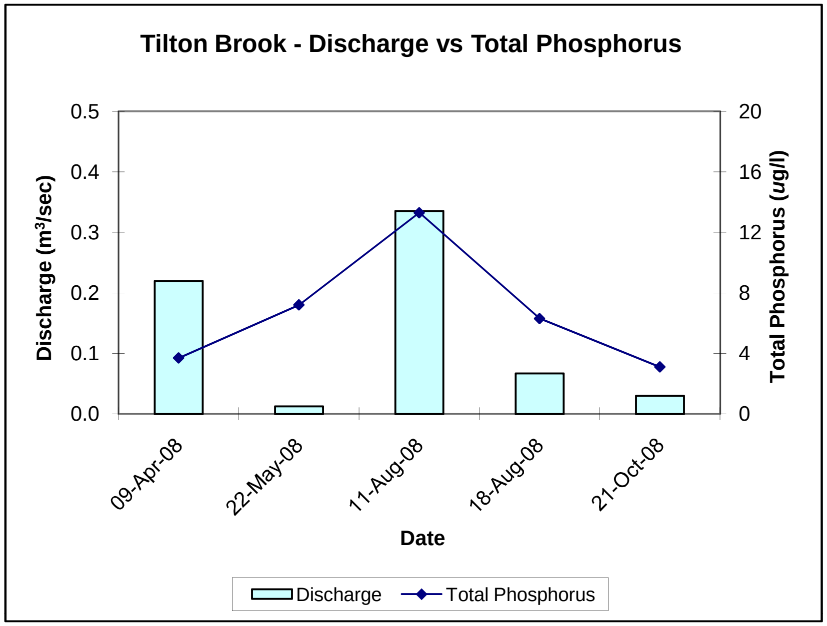
Figure 4. Periphyton Samplers awaiting deployment with Hobo Onset sensors attached.

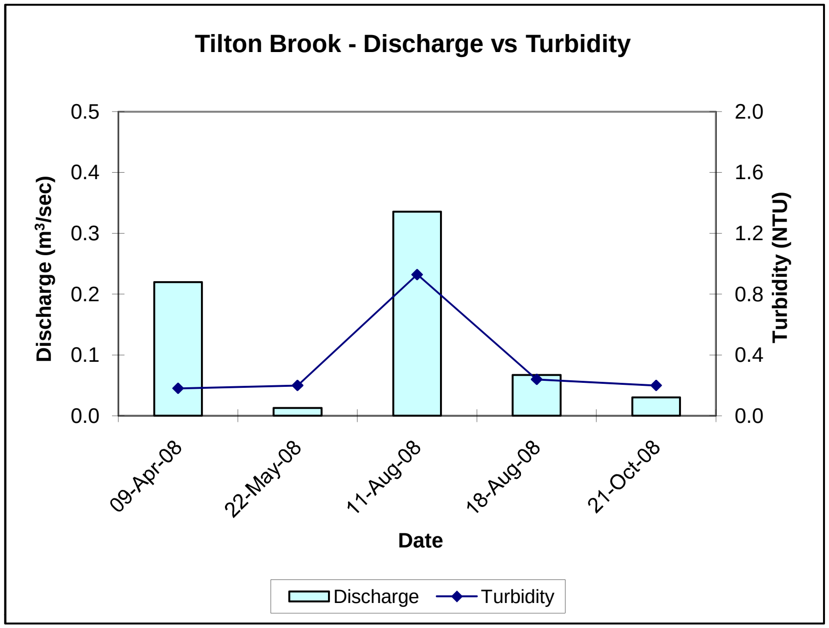

Hemlock Brook - Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
2.0
1.6
1.2
0.8
0.4
0.0
20
16
12
8
4
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

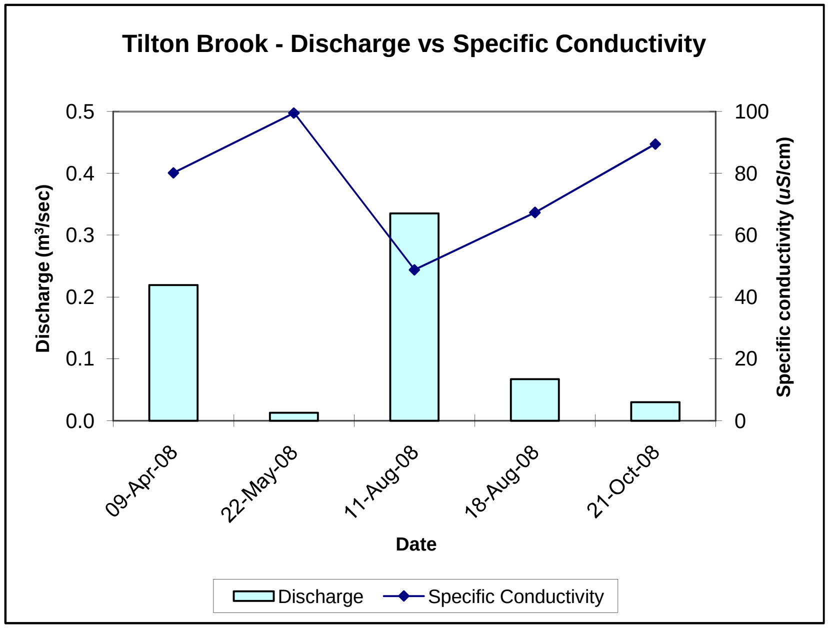

Hemlock Brook - Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
2.0
1.6
1.2
0.8
0.4
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

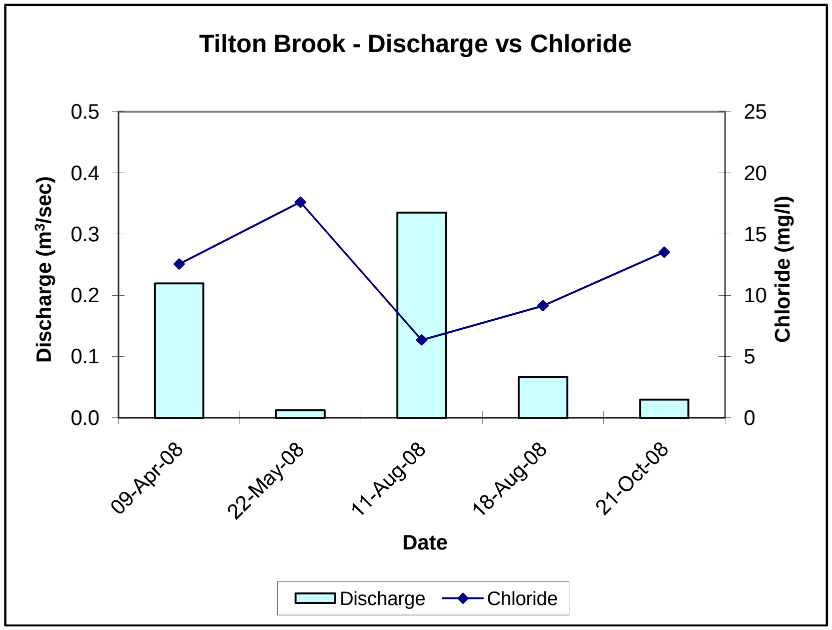

Hemlock Brook - Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
2.0
1.6
1.2
0.8
0.4
0.0
50
40
30
20
10
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

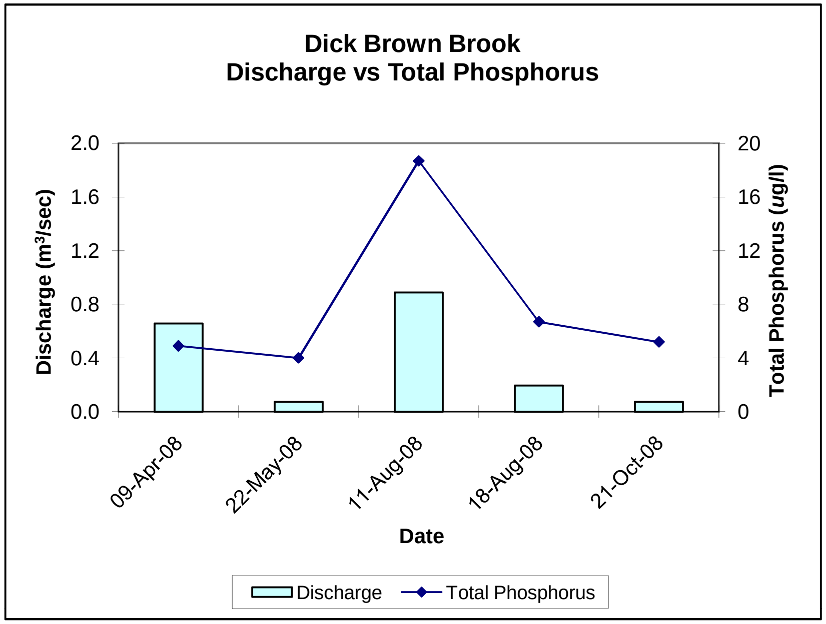

Hemlock Brook - Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
2.0
1.6
1.2
0.8
0.4
0.0
10.0
8.0
6.0
4.0
2.0
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

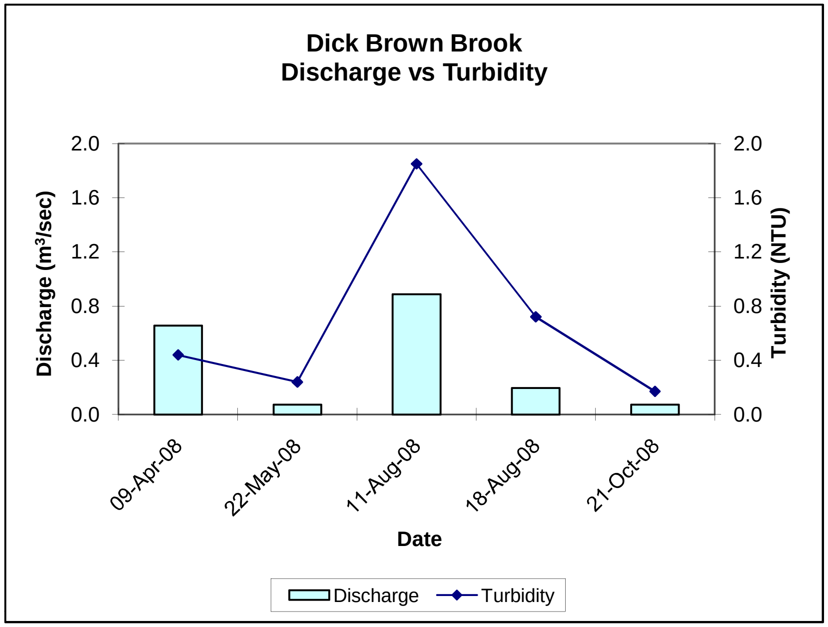

Tilton Brook - Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
0.0
0.1
0.2
0.3
0.4
0.5
0
4
8
12
16
20
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

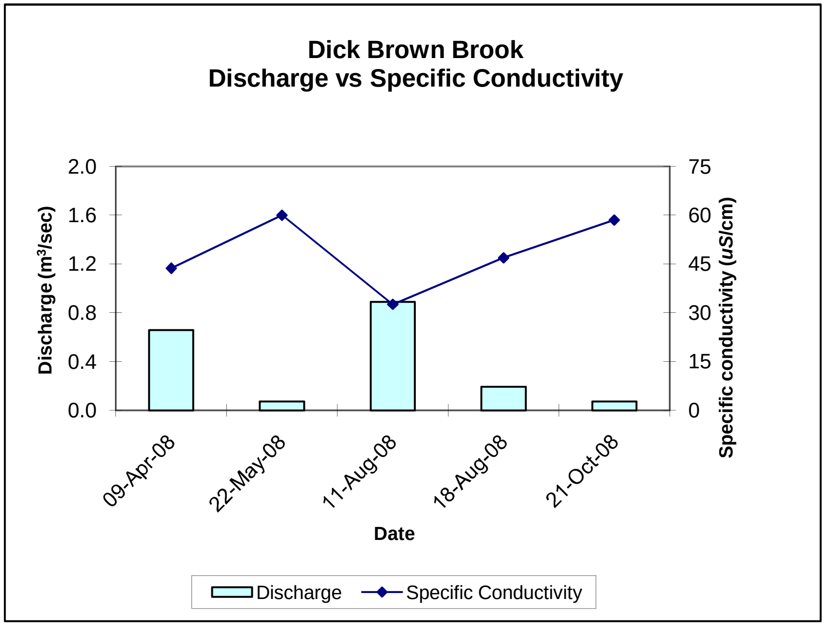

Tilton Brook - Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.4
0.8
1.2
1.6
2.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

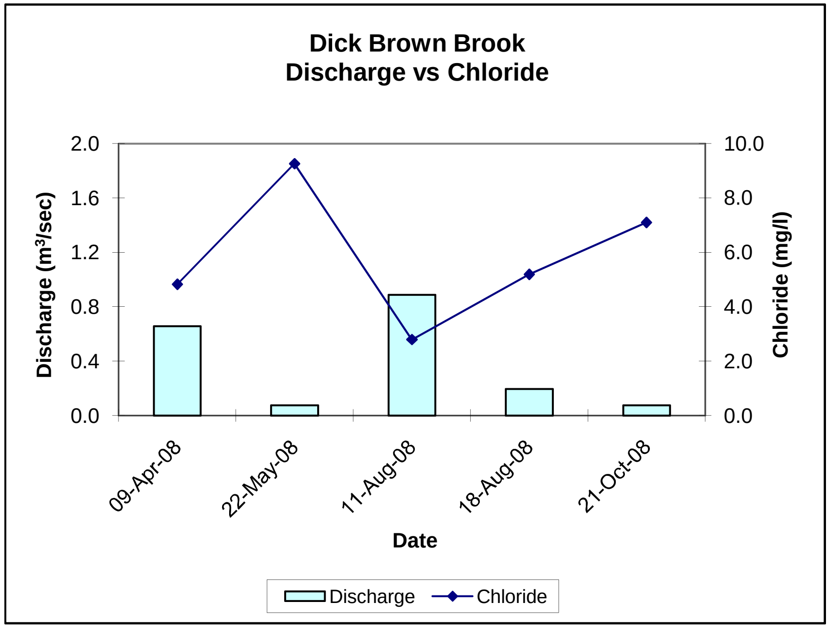

Tilton Brook - Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
0.0
0.1
0.2
0.3
0.4
0.5
0
20
40
60
80
100
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

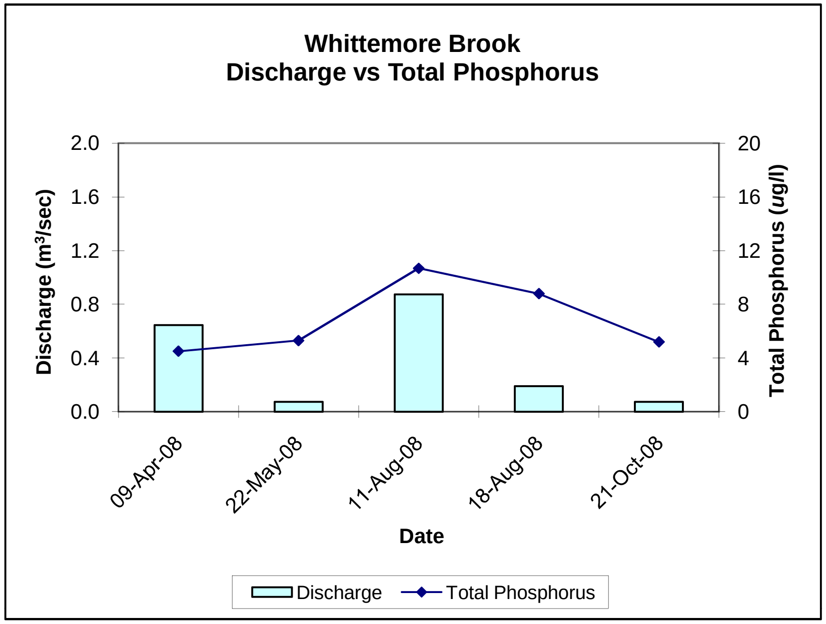

Tilton Brook - Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
0.0
0.1
0.2
0.3
0.4
0.5
0
5
10
15
20
25
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

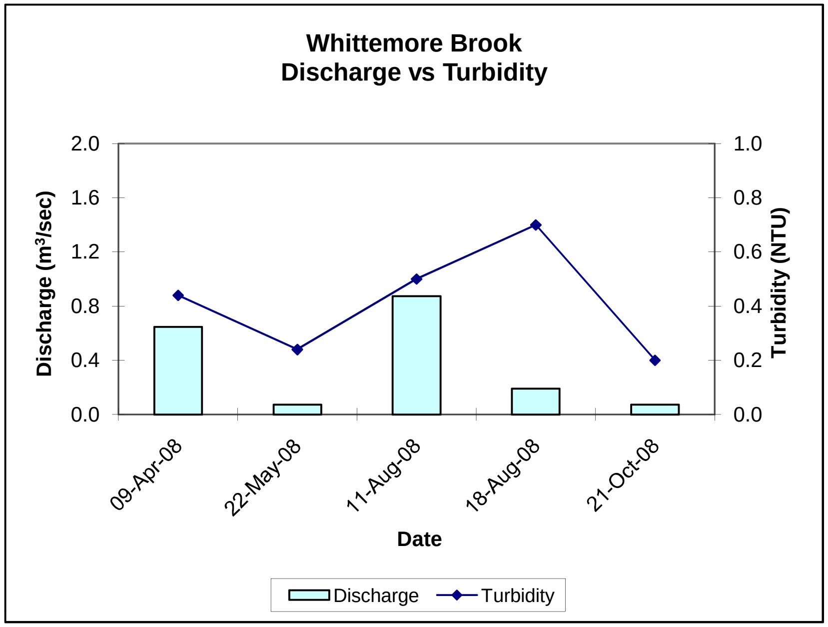

Dick Brown Brook
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
2.0 1.6 1.2 0.8 0.4 0.0
20 16 12 8 4 0
09-Apr-08 22-May-08 11-Aug-08 18-Aug-08 21-Oct-08
Date
Discharge
Total Phosphorus

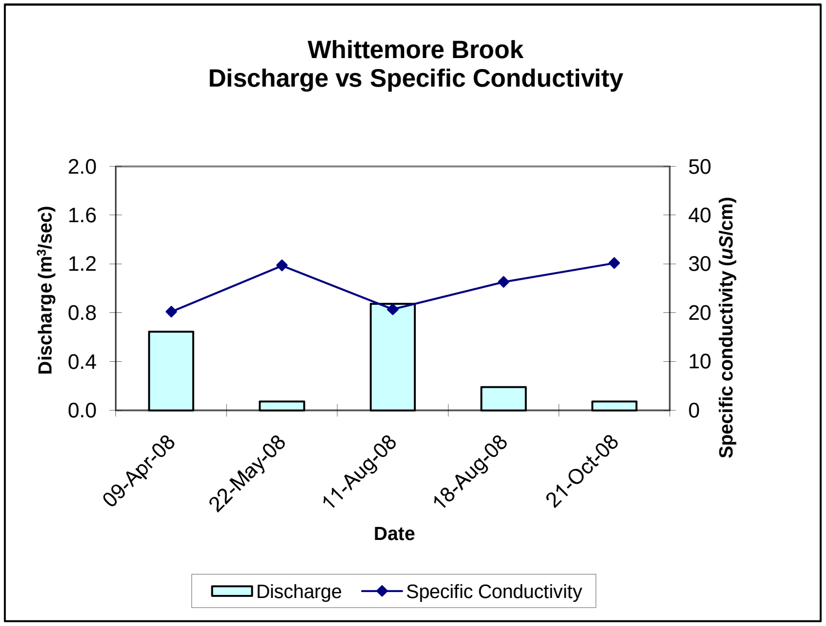

Dick Brown Brook
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
2.0 1.6 1.2 0.8 0.4 0.0
09-Apr-08 22-May-08 11-Aug-08 18-Aug-08 21-Oct-08
Date
Discharge
Turbidity

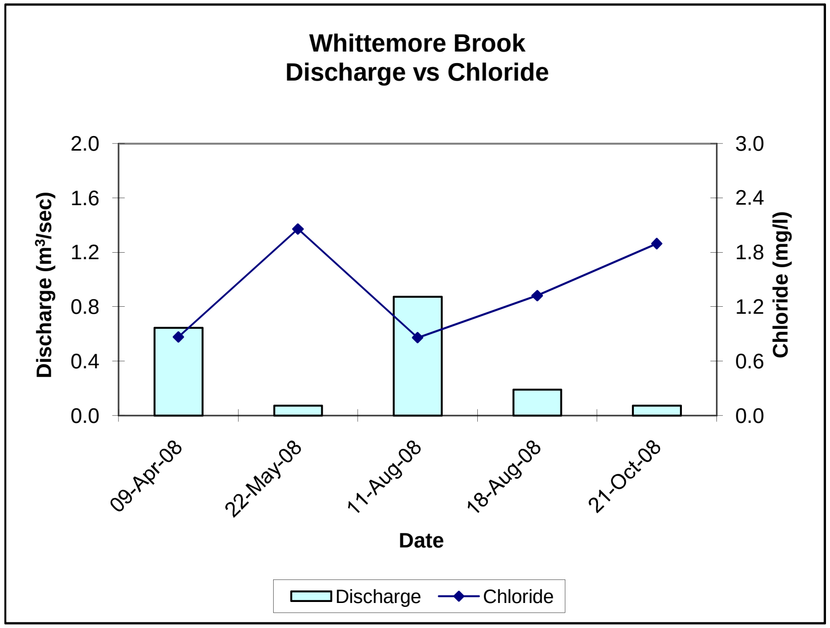

Dick Brown Brook
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
2.0 1.6 1.2 0.8 0.4 0.0
75 60 45 30 15 0
09-Apr-08 22-May-08 11-Aug-08 18-Aug-08 21-Oct-08
Date
Discharge
Specific Conductivity

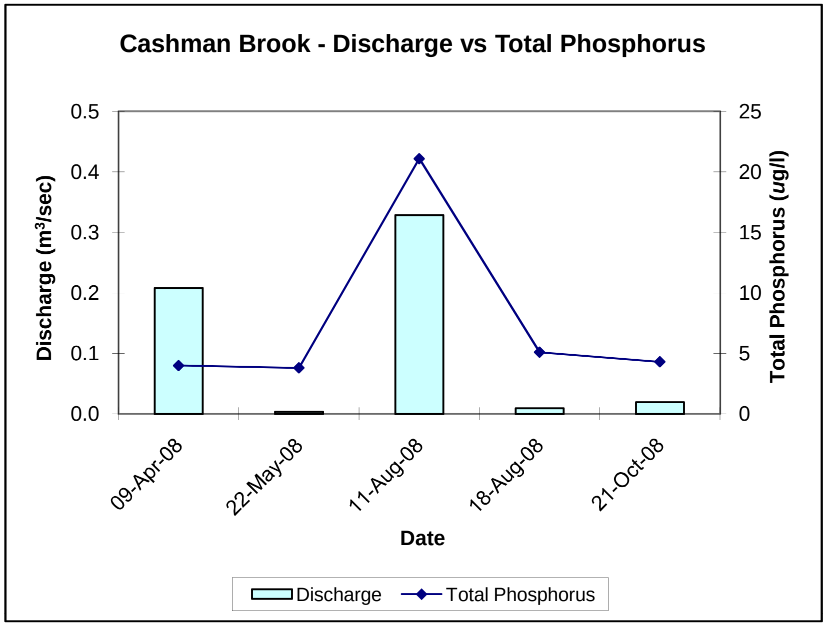

Dick Brown Brook
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
2.0 1.6 1.2 0.8 0.4 0.0
10.0 8.0 6.0 4.0 2.0 0.0
09-Apr-08 22-May-08 11-Aug-08 18-Aug-08 21-Oct-08
Date
Discharge
Chloride

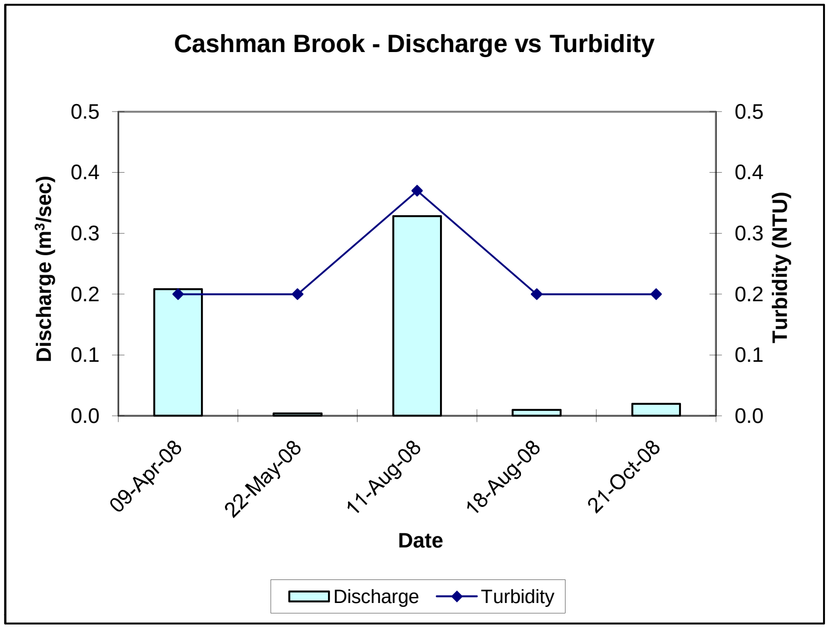

Whittemore Brook
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

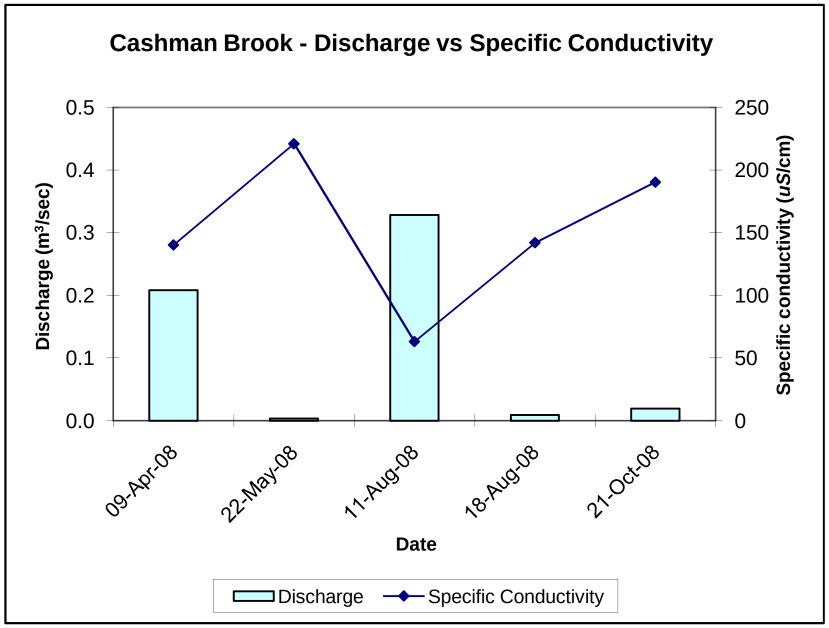

Whittemore Brook
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

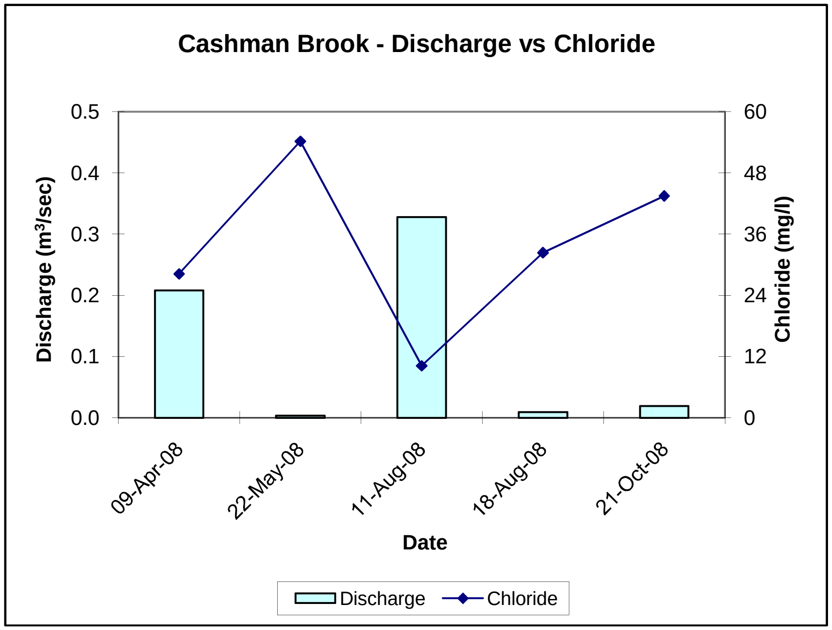

Whittemore Brook
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

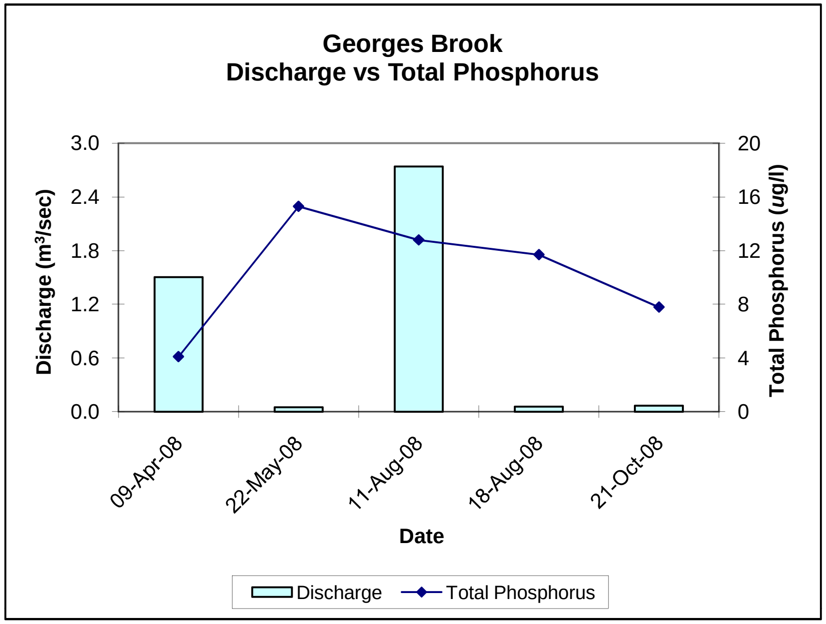

Whittemore Brook
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

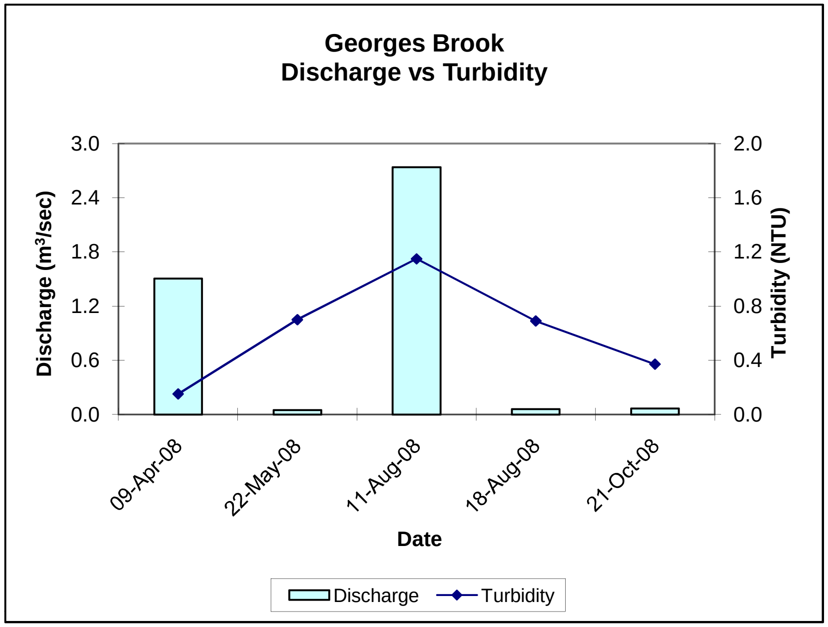

Cashman Brook - Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
0.5
0.4
0.3
0.2
0.1
0.0
25
20
15
10
5
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

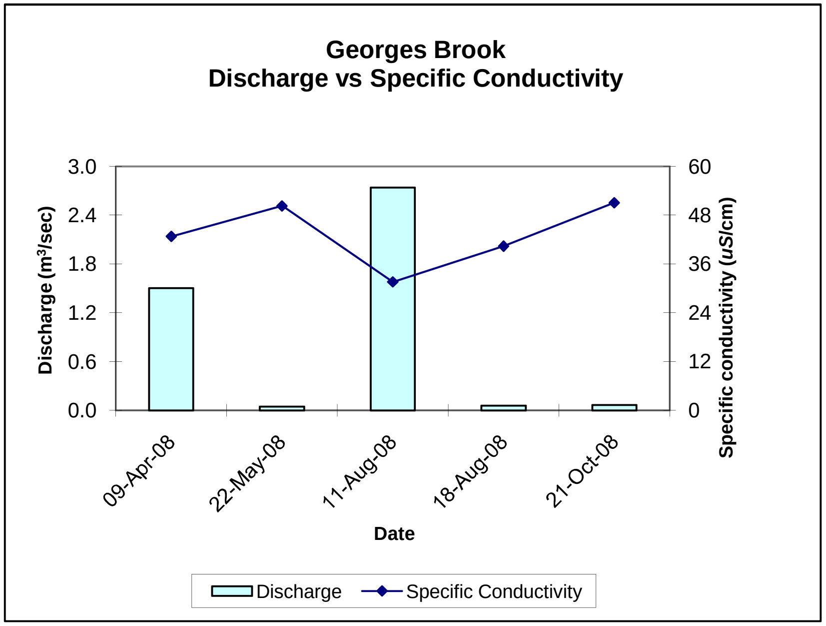

Cashman Brook - Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
0.5
0.4
0.3
0.2
0.1
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

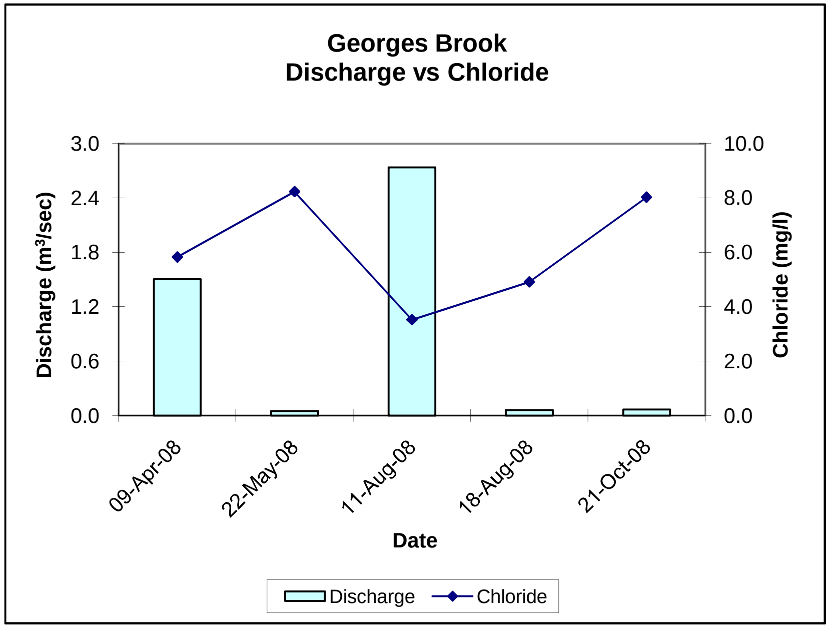

Cashman Brook - Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
0.5
0.4
0.3
0.2
0.1
0.0
250
200
150
100
50
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

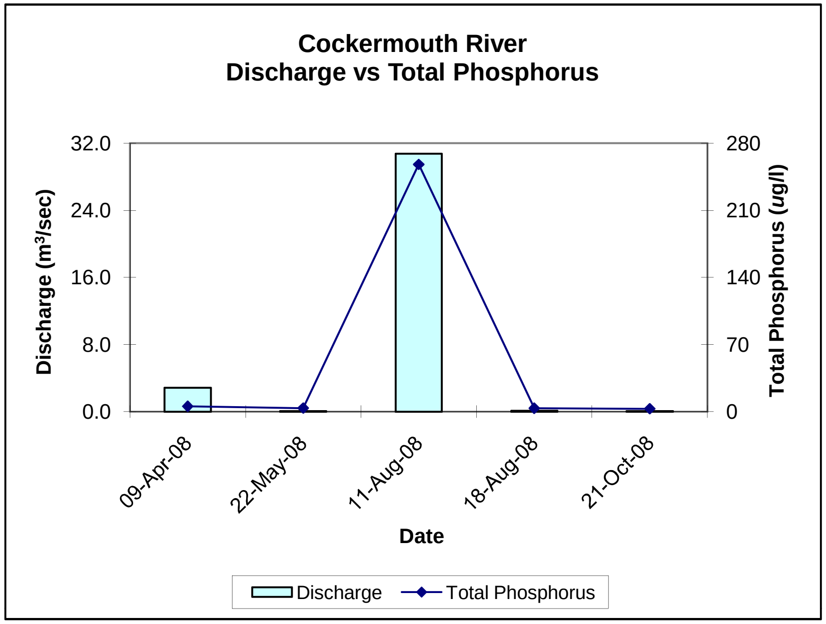

Cashman Brook - Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
0.5
0.4
0.3
0.2
0.1
0.0
60
48
36
24
12
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

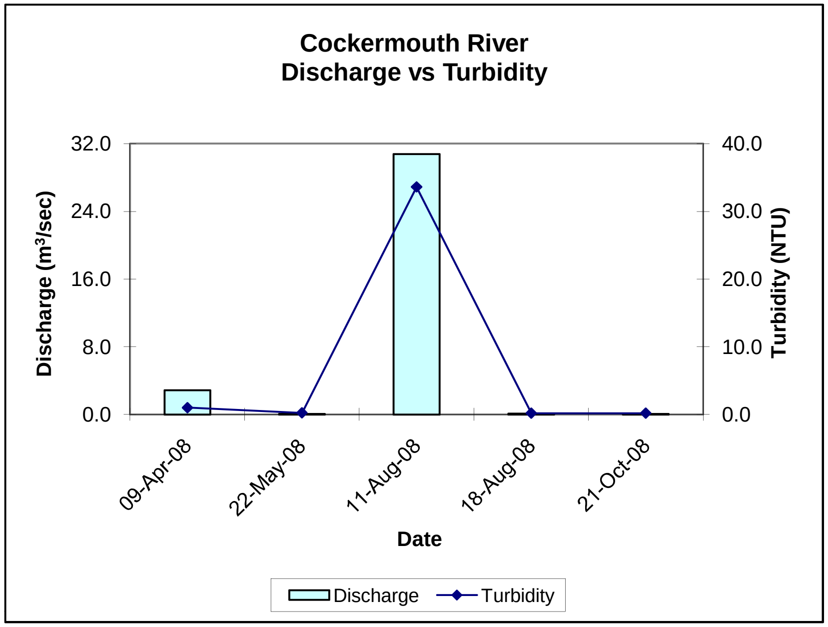

Georges Brook
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
3.0
2.4
1.8
1.2
0.6
0.0
20
16
12
8
4
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

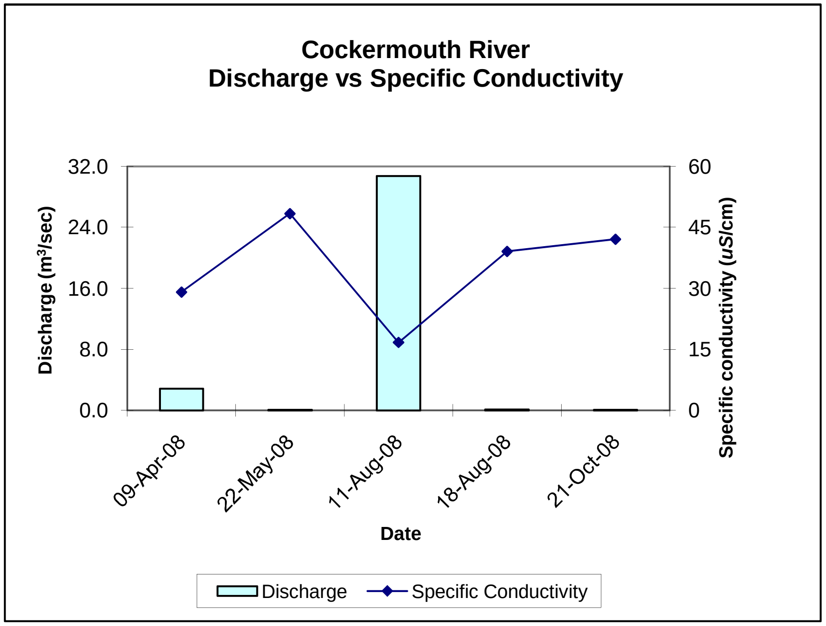

Georges Brook
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
3.0
2.4
1.8
1.2
0.6
0.0
2.0
1.6
1.2
0.8
0.4
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

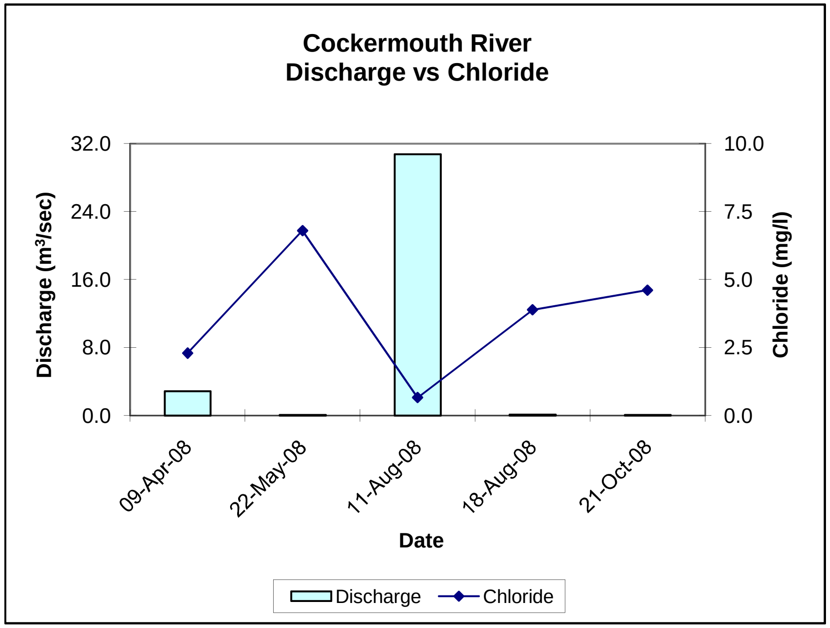

Georges Brook
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
3.0
2.4
1.8
1.2
0.6
0.0
60
48
36
24
12
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

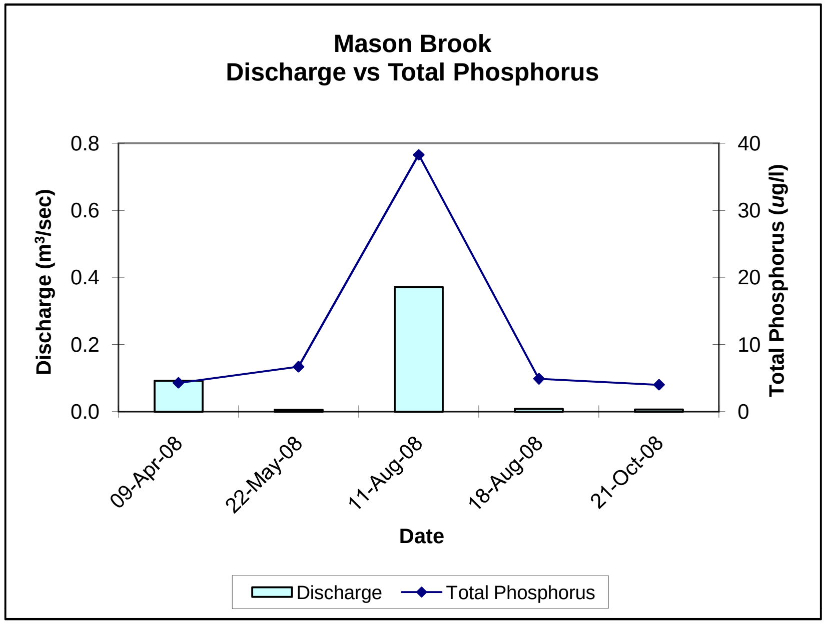

Georges Brook
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
3.0
2.4
1.8
1.2
0.6
0.0
10.0
8.0
6.0
4.0
2.0
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

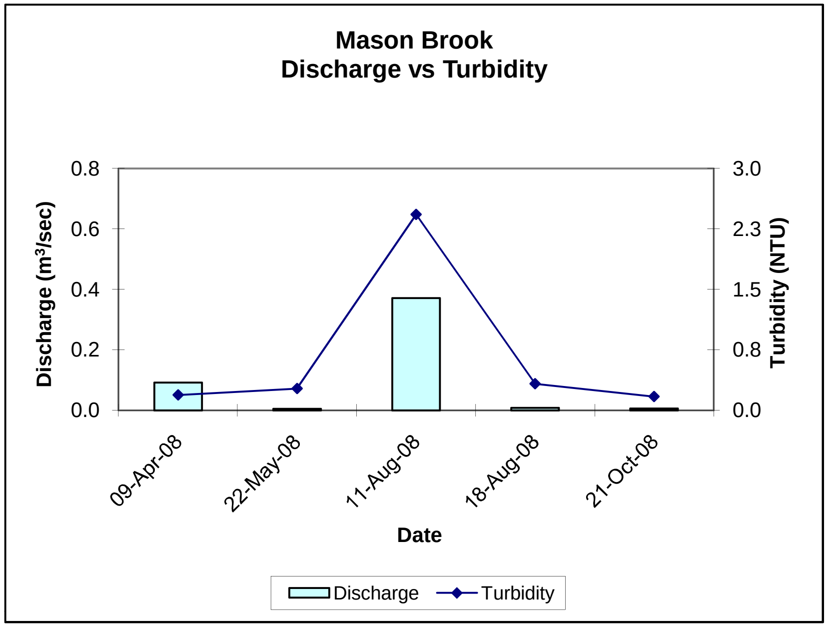

Cockermouth River
Discharge vs Total Phosphorus
32.0
24.0
16.0
8.0
0.0
280
210
140
70
0
Discharge (m³/sec)
Total Phosphorus (ug/l)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

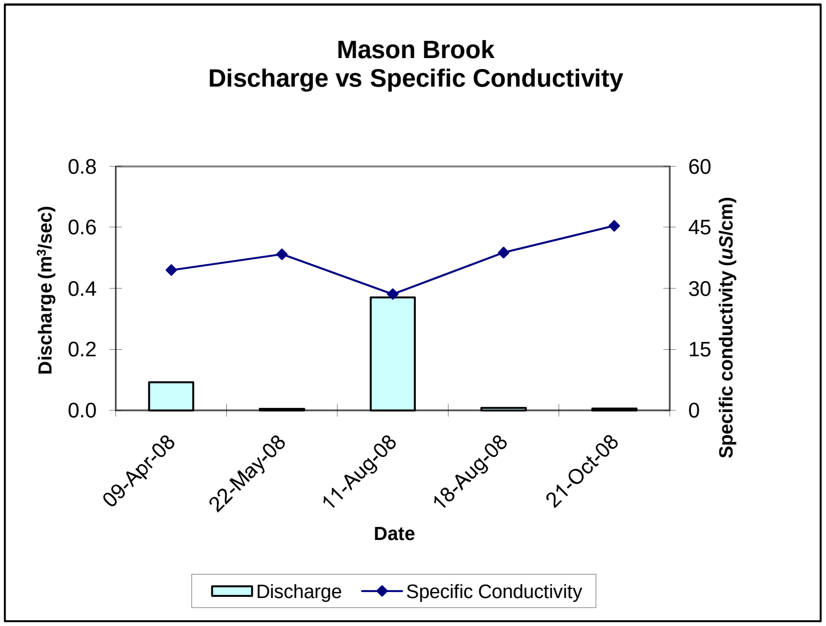

Cockermouth River
Discharge vs Turbidity
32.0
24.0
16.0
8.0
0.0
40.0
30.0
20.0
10.0
0.0
Discharge (m³/sec)
Turbidity (NTU)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

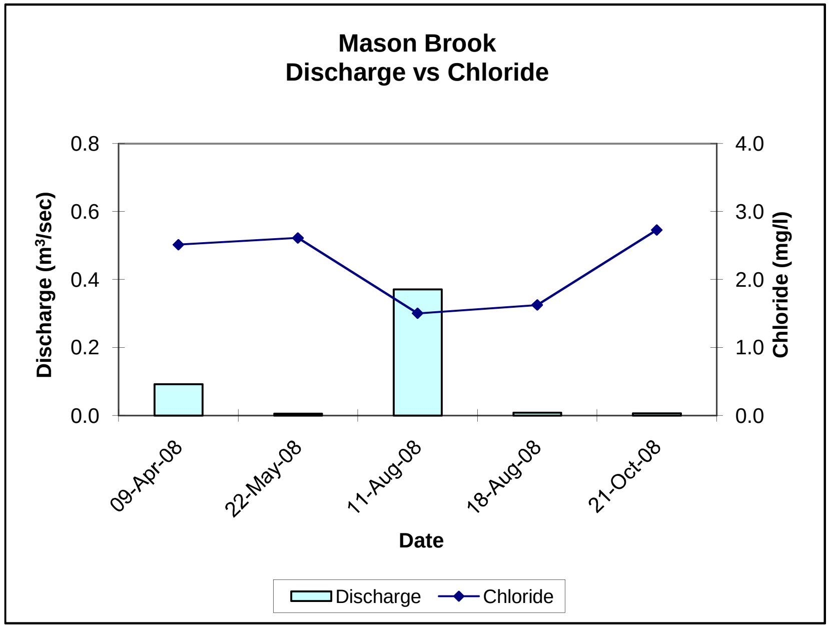

Cockermouth River
Discharge vs Specific Conductivity
32.0
24.0
16.0
8.0
0.0
60
45
30
15
0
Discharge (m³/sec)
Specific conductivity (uS/cm)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

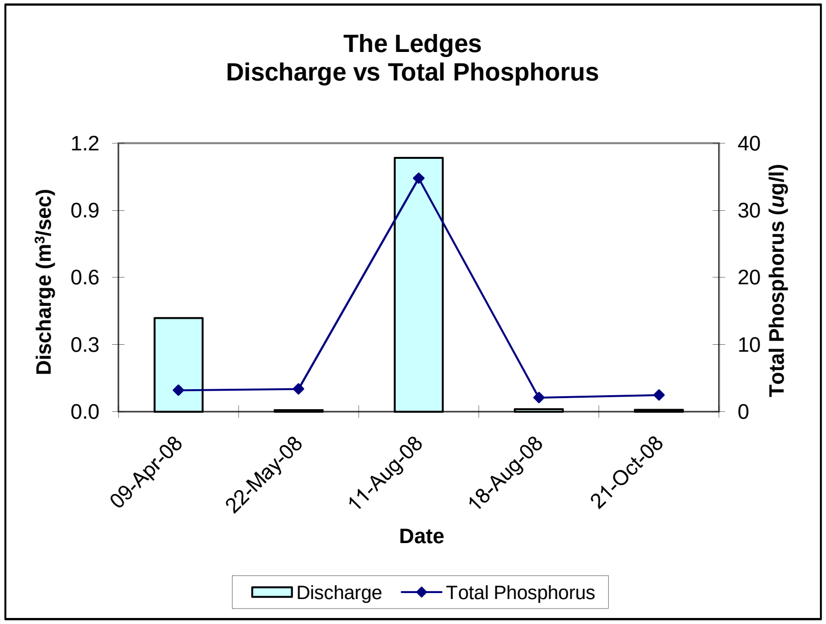

Cockermouth River
Discharge vs Chloride
32.0
24.0
16.0
8.0
0.0
10.0
7.5
5.0
2.5
0.0
Discharge (m³/sec)
Chloride (mg/l)
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

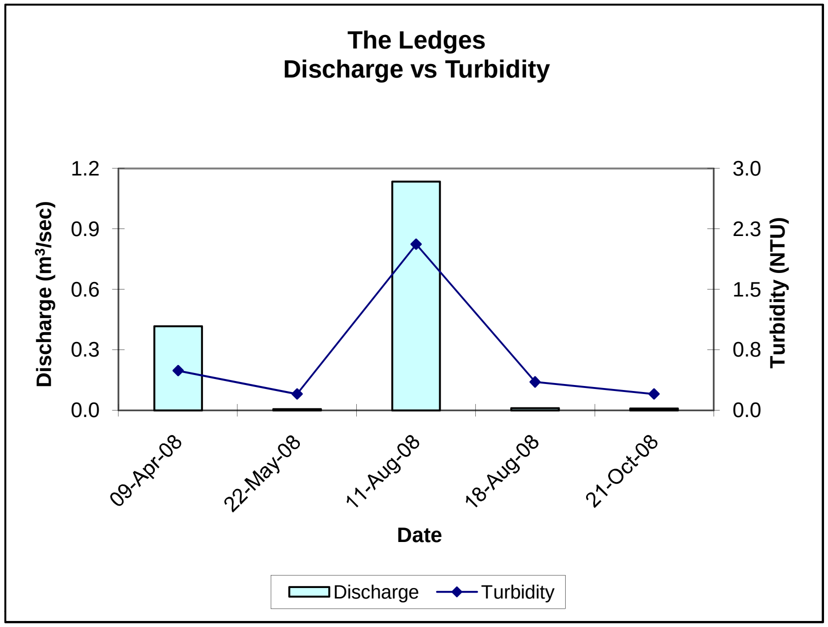

Mason Brook
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
0.0
0.2
0.4
0.6
0.8
0
10
20
30
40
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

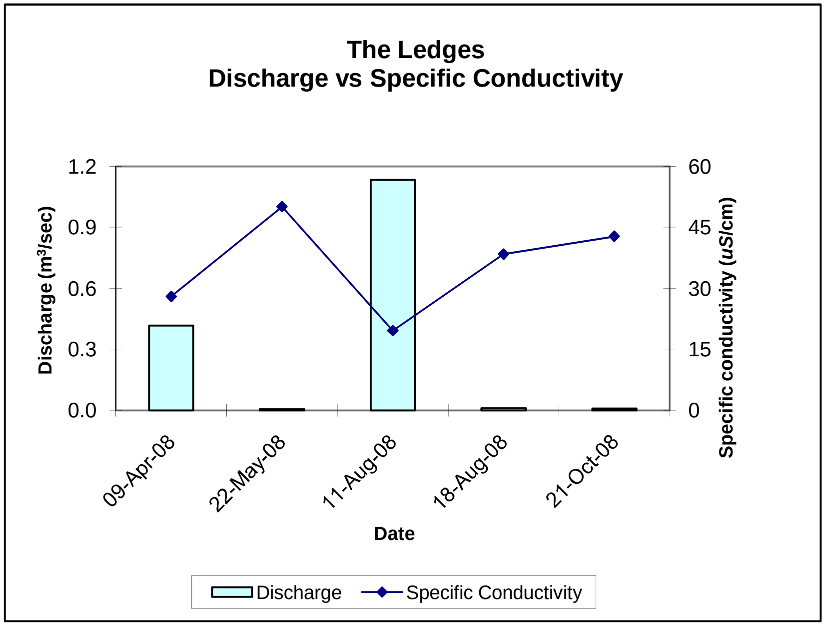

Mason Brook
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
0.0
0.2
0.4
0.6
0.8
0.0
0.8
1.5
2.3
3.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

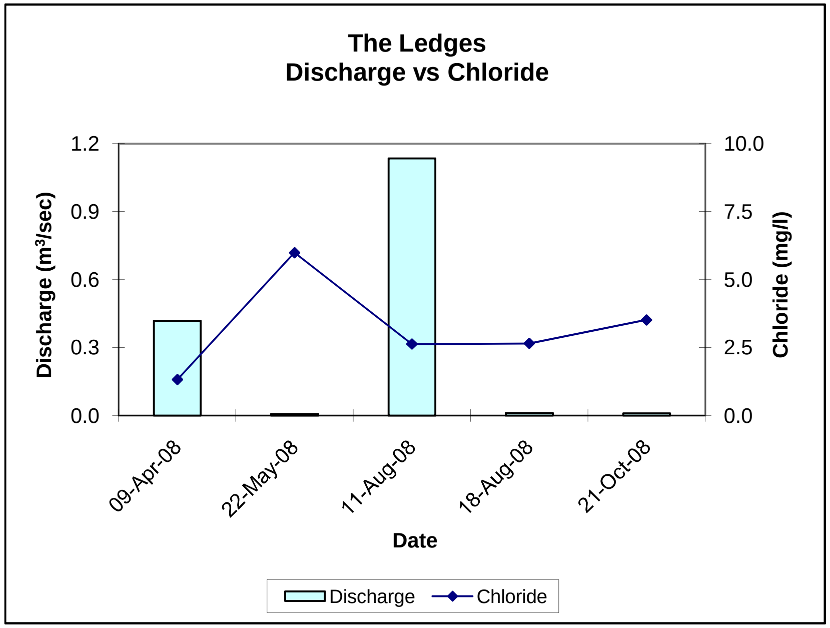

Mason Brook
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
0.0
0.2
0.4
0.6
0.8
0
15
30
45
60
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

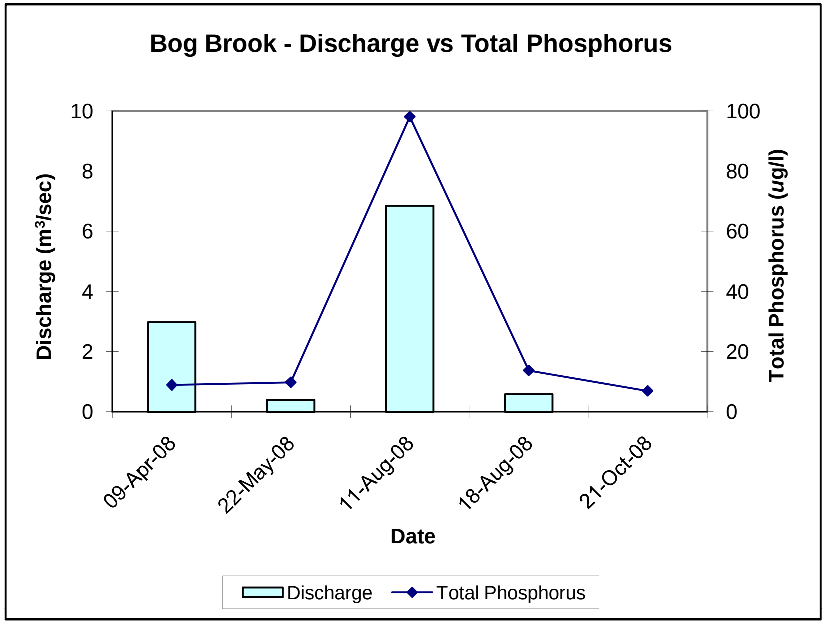

Mason Brook
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
0.0
0.2
0.4
0.6
0.8
0.0
1.0
2.0
3.0
4.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

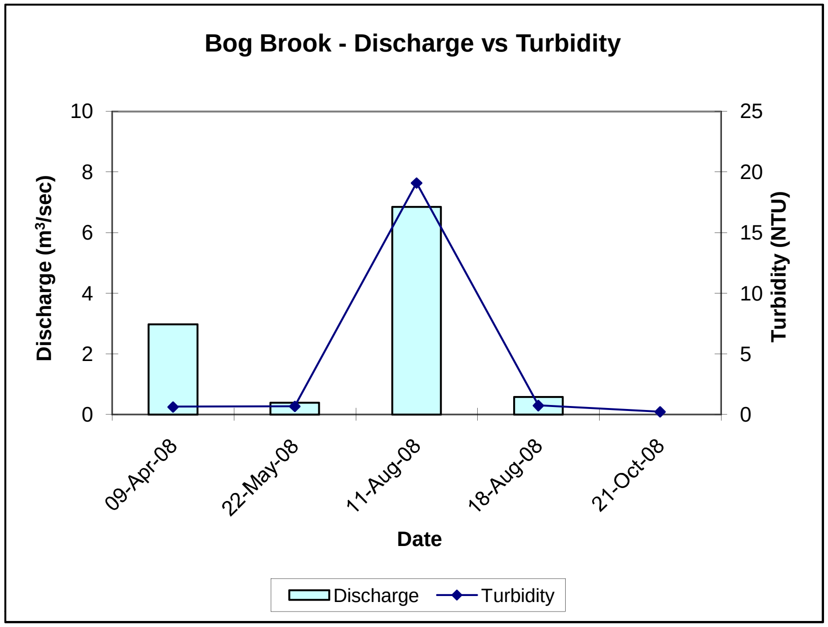

The Ledges
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
1.2
0.9
0.6
0.3
0.0
40
30
20
10
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

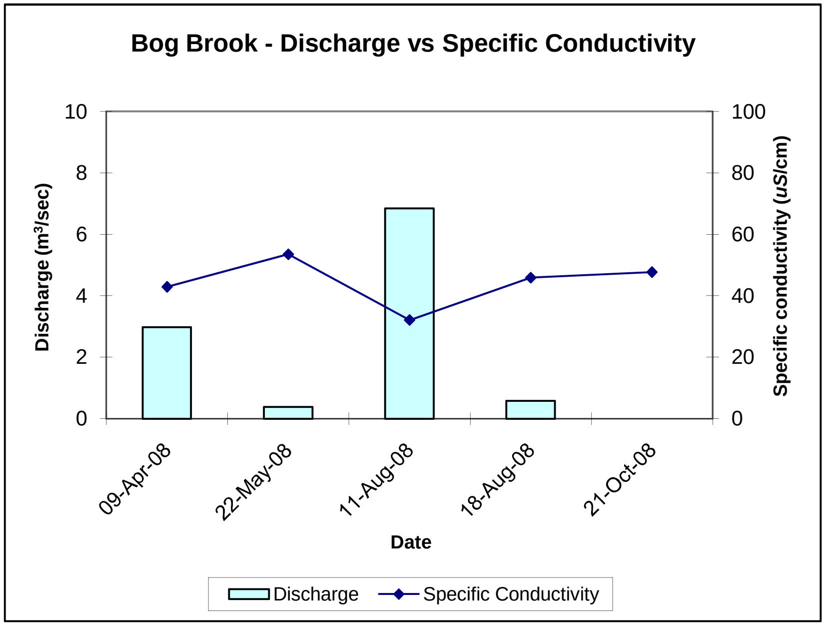

The Ledges
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
1.2
0.9
0.6
0.3
0.0
3.0
2.3
1.5
0.8
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

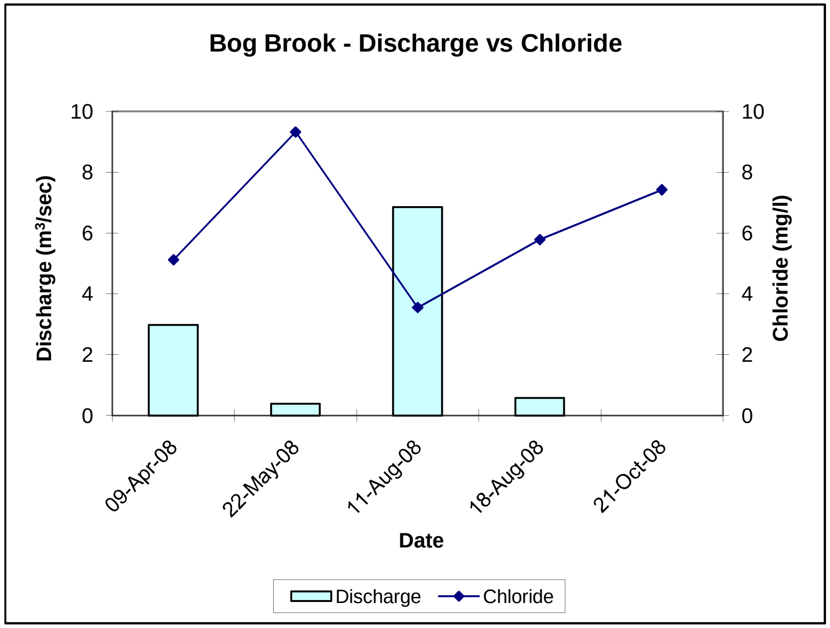

The Ledges
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
1.2
0.9
0.6
0.3
0.0
60
45
30
15
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

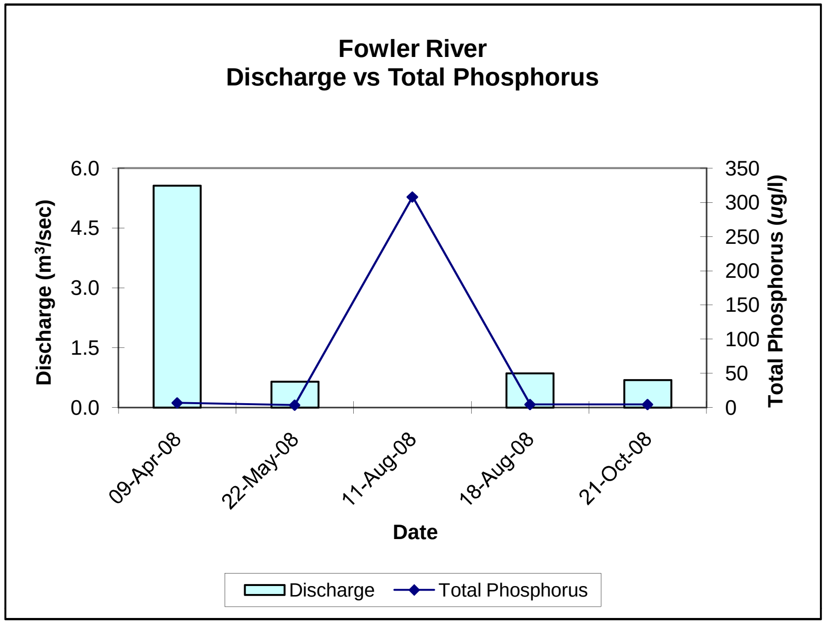

The Ledges
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
1.2
0.9
0.6
0.3
0.0
10.0
7.5
5.0
2.5
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

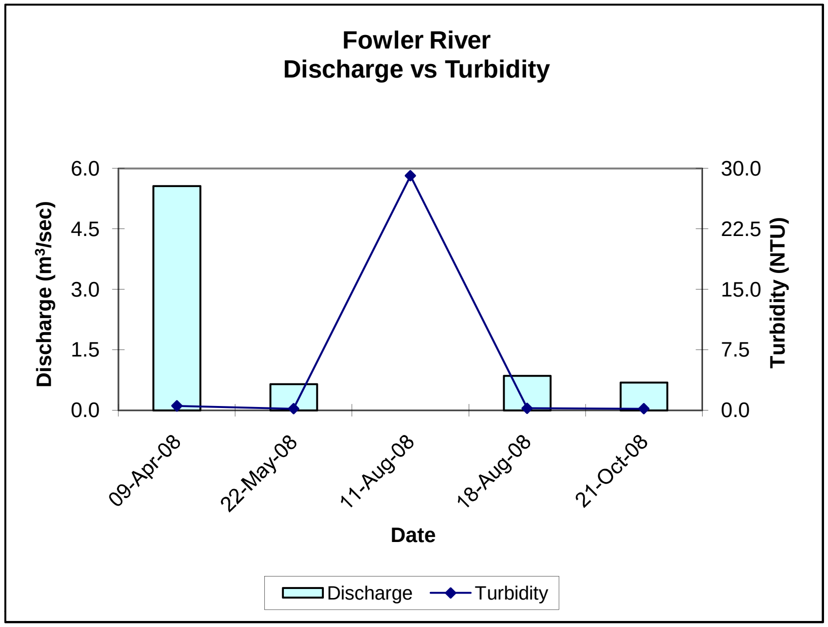

Bog Brook - Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
0
2
4
6
8
10
0
20
40
60
80
100
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

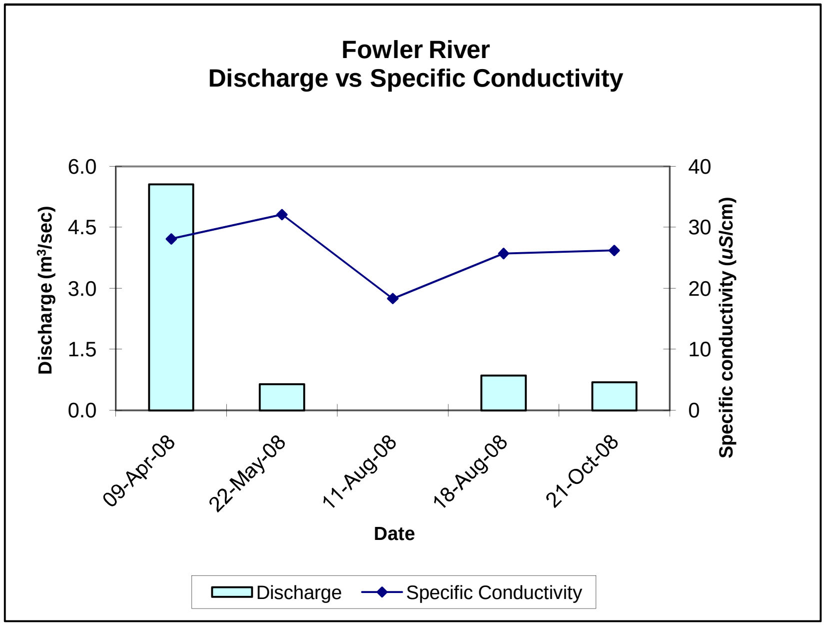

Bog Brook - Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
0
2
4
6
8
10
0
5
10
15
20
25
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

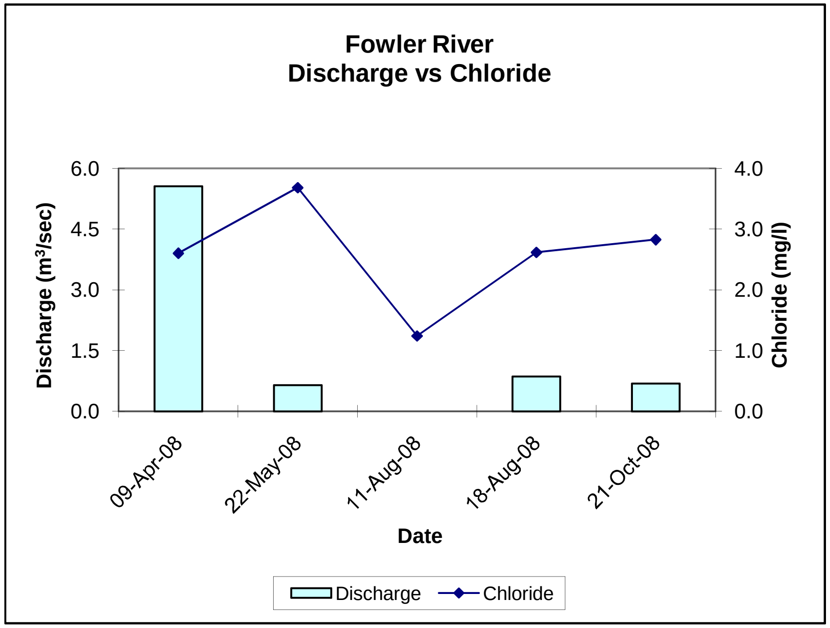

Bog Brook - Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
0
2
4
6
8
10
0
20
40
60
80
100
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity

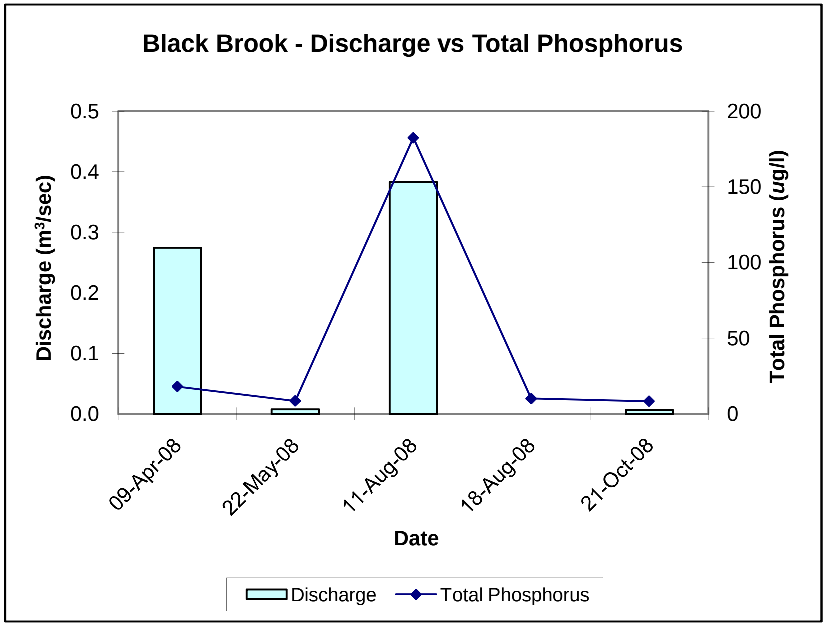

Bog Brook - Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
0
2
4
6
8
10
0
2
4
6
8
10
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

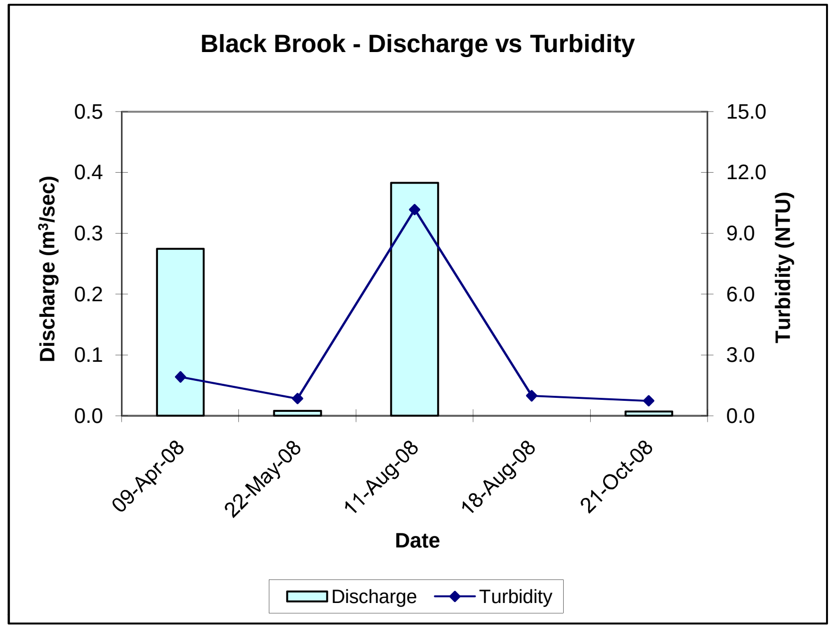

Fowler River
Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
6.0
4.5
3.0
1.5
0.0
350
300
250
200
150
100
50
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus

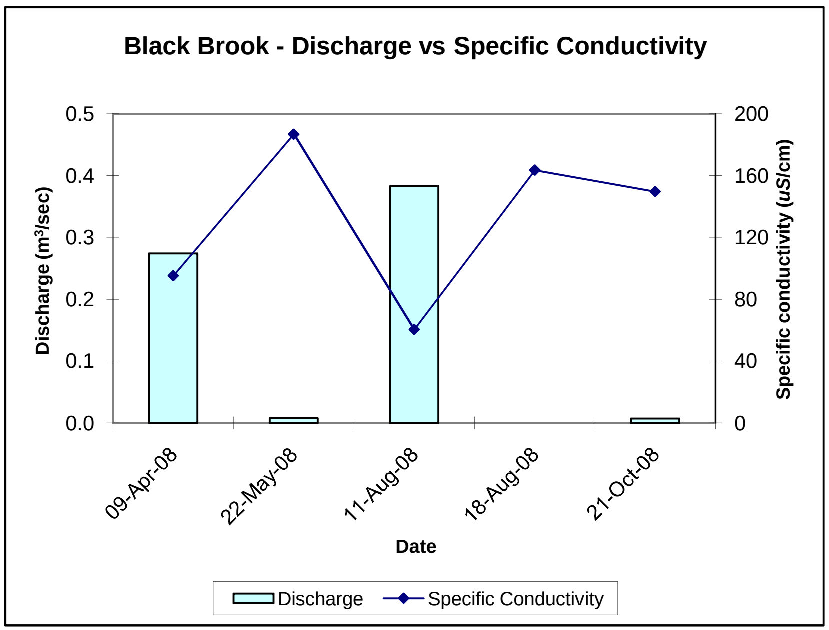

Fowler River
Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
6.0
4.5
3.0
1.5
0.0
30.0
22.5
15.0
7.5
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity

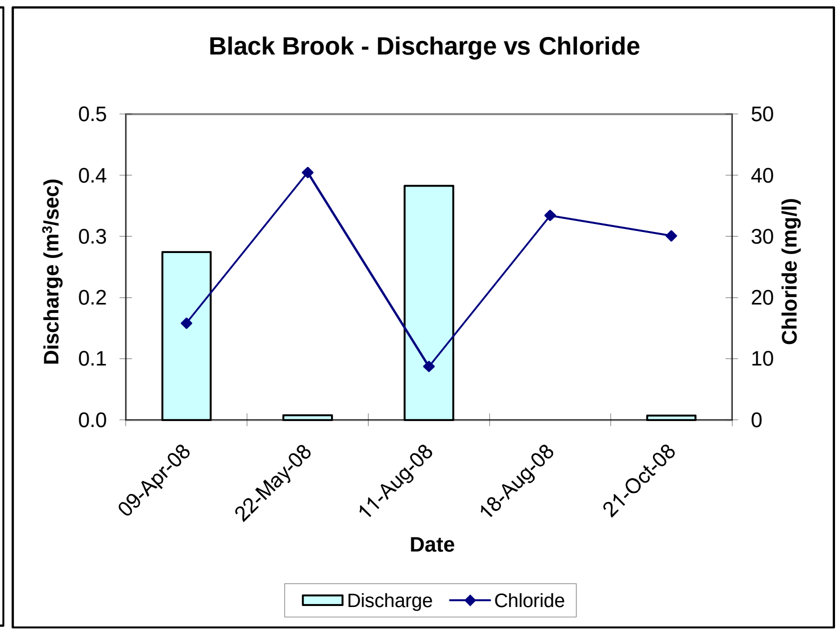

Fowler River
Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
6.0
4.5
3.0
1.5
0.0
40
30
20
10
0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity


Fowler River
Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
6.0
4.5
3.0
1.5
0.0
4.0
3.0
2.0
1.0
0.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride


Black Brook - Discharge vs Total Phosphorus
Discharge (m³/sec)
Total Phosphorus (ug/l)
0.0
0.1
0.2
0.3
0.4
0.5
0
50
100
150
200
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Total Phosphorus


Black Brook - Discharge vs Turbidity
Discharge (m³/sec)
Turbidity (NTU)
0.0
0.1
0.2
0.3
0.4
0.5
0.0
3.0
6.0
9.0
12.0
15.0
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Turbidity


Black Brook - Discharge vs Specific Conductivity
Discharge (m³/sec)
Specific conductivity (uS/cm)
0.0
0.1
0.2
0.3
0.4
0.5
0
40
80
120
160
200
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Specific Conductivity


Black Brook - Discharge vs Chloride
Discharge (m³/sec)
Chloride (mg/l)
0.0
0.1
0.2
0.3
0.4
0.5
0
10
20
30
40
50
09-Apr-08
22-May-08
11-Aug-08
18-Aug-08
21-Oct-08
Date
Discharge
Chloride

APPENDIX I. Newfound Lake Volunteer Monitor Data (1986-2008)

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
2 Mayhew	6/26/86	5.5	2.6
2 Mayhew	7/4/86	6.5	1.8
2 Mayhew	7/8/86	8.0	1.2
2 Mayhew	7/15/86	7.0	2.8
2 Mayhew	7/22/86	7.5	1.4
2 Mayhew	7/29/86	7.5	1.9
2 Mayhew	8/5/86	4.0	2.2
2 Mayhew	8/12/86	6.0	------
2 Mayhew	8/19/86	6.5	1.6
2 Mayhew	8/26/86	5.5	0.8
2 Mayhew	9/2/86	6.0	1.7
2 Mayhew	6/16/87	8.5	1.1
2 Mayhew	6/24/87	6.5	1.4
2 Mayhew	7/1/87	7.5	1.5
2 Mayhew	7/7/87	6.5	2.0
2 Mayhew	7/14/87	7.5	1.9
2 Mayhew	7/21/87	6.5	1.6
2 Mayhew	7/29/87	7.5	1.4
2 Mayhew	8/5/87	6.5	1.9
2 Mayhew	8/12/87	8.0	1.3
2 Mayhew	8/18/87	8.8	0.6
2 Mayhew	8/25/87	7.5	1.4
2 Mayhew	9/1/87	8.5	1.5
2 Mayhew	6/14/88	8.0	1.8
2 Mayhew	6/22/88	7.0	1.2
2 Mayhew	6/28/88	7.5	1.1
2 Mayhew	7/6/88	7.0	1.4
2 Mayhew	7/13/88	8.5	1.1
2 Mayhew	7/20/88	8.8	1.6
2 Mayhew	7/28/88	7.8	1.4
2 Mayhew	8/3/88	9.0	1.3
2 Mayhew	8/11/88	9.8	1.6
2 Mayhew	8/17/88	7.5	1.6
2 Mayhew	8/24/88	7.5	2.3
2 Mayhew	9/1/88	6.5	2.4
2 Mayhew	9/6/88	7.0	2.3
2 Mayhew	6/14/89	8.8	1.0
2 Mayhew	6/20/89	8.0	------
2 Mayhew	6/27/89	8.0	1.1
2 Mayhew	7/4/89	7.5	1.3
2 Mayhew	7/13/89	7.5	1.6
2 Mayhew	7/18/89	7.5	2.0
2 Mayhew	7/25/89	8.0	0.9
2 Mayhew	8/1/89	8.0	1.7
2 Mayhew	8/9/89	8.0	1.3
2 Mayhew	8/15/89	8.0	1.8
2 Mayhew	8/23/89	8.0	1.9
2 Mayhew	8/29/89	7.5	1.5
2 Mayhew	9/5/89	8.5	1.9
2 Mayhew	6/18/90	6.5	1.5
2 Mayhew	6/26/90	7.3	1.3
2 Mayhew	7/5/90	7.0	1.8
2 Mayhew	7/11/90	6.5	2.9
2 Mayhew	7/17/90	7.0	1.5
2 Mayhew	7/24/90	6.5	1.1
2 Mayhew	7/31/90	7.5	0.7
2 Mayhew	8/8/90	3.7	2.9
2 Mayhew	8/15/90	3.0	2.9
2 Mayhew	8/21/90	4.0	1.8

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
3 Pasquaney	7/4/86	8.9	1.9
3 Pasquaney	7/9/86	7.5	1.5
3 Pasquaney	7/16/86	8.0	2.1
3 Pasquaney	7/22/86	10.0	1.1
3 Pasquaney	7/29/86	8.8	1.2
3 Pasquaney	8/6/86	7.1	1.2
3 Pasquaney	8/13/86	7.7	1.1
3 Pasquaney	8/19/86	9.0	1.4
3 Pasquaney	8/26/86	10.5	1.1
3 Pasquaney	9/2/86	8.8	1.2
3 Pasquaney	6/18/87	9.0	0.9
3 Pasquaney	6/23/87	9.0	0.8
3 Pasquaney	7/2/87	7.0	1.6
3 Pasquaney	7/7/87	8.2	1.9
3 Pasquaney	7/14/87	7.1	1.6
3 Pasquaney	7/22/87	7.5	1.4
3 Pasquaney	7/29/87	8.9	1.4
3 Pasquaney	8/6/87	8.0	1.3
3 Pasquaney	8/12/87	10.0	0.4
3 Pasquaney	8/19/87	10.8	0.6
3 Pasquaney	8/27/87	11.8	0.9
3 Pasquaney	9/3/87	11.1	1.1
3 Pasquaney	6/14/88	9.9	0.8
3 Pasquaney	6/24/88	8.6	1.4
3 Pasquaney	6/28/88	9.5	1.2
3 Pasquaney	7/5/88	9.0	1.1
3 Pasquaney	7/12/88	10.2	1.8
3 Pasquaney	7/20/88	10.9	1.5
3 Pasquaney	7/26/88	9.7	1.3
3 Pasquaney	8/3/88	9.5	1.3
3 Pasquaney	8/9/88	10.7	2.0
3 Pasquaney	8/17/88	10.7	1.5
3 Pasquaney	8/23/88	10.8	1.3
3 Pasquaney	9/7/88	10.8	2.2
3 Pasquaney	10/31/88	11.3	------
3 Pasquaney	6/21/89	10.5	1.5
3 Pasquaney	6/30/89	11.0	1.2
3 Pasquaney	7/7/89	9.4	1.1
3 Pasquaney	7/13/89	10.9	1.7
3 Pasquaney	7/19/89	9.9	4.0
3 Pasquaney	7/26/89	9.9	1.4
3 Pasquaney	8/1/89	9.8	1.2
3 Pasquaney	8/9/89	9.3	0.3
3 Pasquaney	8/17/89	9.5	1.4
3 Pasquaney	8/23/89	10.8	1.7
3 Pasquaney	8/30/89	9.3	1.4
3 Pasquaney	9/6/89	10.8	1.5
3 Pasquaney	6/20/90	7.4	1.6
3 Pasquaney	6/27/90	9.0	1.5
3 Pasquaney	7/7/90	7.1	1.3
3 Pasquaney	7/11/90	8.8	1.8
3 Pasquaney	7/20/90	8.4	1.7
3 Pasquaney	7/25/90	9.6	1.1
3 Pasquaney	8/3/90	9.1	1.2
3 Pasquaney	8/10/90	9.5	2.5
3 Pasquaney	8/15/90	5.8	2.3
3 Pasquaney	8/22/90	7.8	1.5
3 Pasquaney	8/30/90	7.8	1.4
3 Pasquaney	9/5/90	8.1	1.1

APPENDIX I. Newfound Lake Volunteer Monitor Data (1986-2008)

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
2 Mayhew	8/28/90	6.0	1.6
2 Mayhew	9/4/90	5.0	2.0
2 Mayhew	6/18/91	7.0	2.4
2 Mayhew	6/26/91	6.5	2.4
2 Mayhew	7/2/91	6.8	1.2
2 Mayhew	7/10/91	7.0	1.8
2 Mayhew	7/16/91	7.5	2.2
2 Mayhew	7/23/91	7.5	1.4
2 Mayhew	7/30/91	7.5	1.4
2 Mayhew	8/7/91	7.8	2.1
2 Mayhew	8/14/91	7.8	1.2
2 Mayhew	8/20/91	6.0	2.2
2 Mayhew	8/27/91	6.5	2.3
2 Mayhew	9/4/91	7.5	3.4
2 Mayhew	6/19/92	7.0	1.1
2 Mayhew	6/24/92	6.5	1.7
2 Mayhew	6/30/92	7.5	1.3
2 Mayhew	7/7/92	8.0	1.4
2 Mayhew	7/16/92	6.5	2.0
2 Mayhew	7/22/92	7.5	1.1
2 Mayhew	7/29/92	7.5	1.0
2 Mayhew	8/4/92	7.3	1.4
2 Mayhew	8/13/92	7.8	1.7
2 Mayhew	8/19/92	8.0	1.4
2 Mayhew	8/25/92	8.5	1.1
2 Mayhew	9/3/92	8.0	1.6
2 Mayhew	6/15/93	6.5	0.7
2 Mayhew	6/22/93	7.5	2.2
2 Mayhew	6/29/93	8.0	1.1
2 Mayhew	7/6/93	7.0	1.0
2 Mayhew	7/12/93	8.3	0.9
2 Mayhew	7/19/93	7.0	1.5
2 Mayhew	7/27/93	8.5	2.6
2 Mayhew	8/3/93	7.8	1.6
2 Mayhew	8/10/93	7.3	2.1
2 Mayhew	8/17/93	7.5	2.9
2 Mayhew	8/24/93	7.0	1.8
2 Mayhew	8/31/93	7.8	1.6
2 Mayhew	6/15/94	8.7	1.2
2 Mayhew	6/21/94	8.0	1.2
2 Mayhew	6/28/94	7.0	1.4
2 Mayhew	7/5/94	8.5	1.3
2 Mayhew	7/13/94	7.5	1.4
2 Mayhew	7/19/94	------	1.7
2 Mayhew	7/27/94	7.5	1.4
2 Mayhew	8/3/94	7.5	1.4
2 Mayhew	8/9/94	------	1.9
2 Mayhew	8/16/94	8.0	1.9
2 Mayhew	8/23/94	7.5	2.2
2 Mayhew	8/30/94	8.0	1.9
2 Mayhew	6/13/95	7.0	1.6
2 Mayhew	6/21/95	8.5	1.6
2 Mayhew	6/28/95	8.5	0.6
2 Mayhew	7/6/95	8.3	0.6
2 Mayhew	7/12/95	9.3	0.7
2 Mayhew	7/20/95	9.6	0.6
2 Mayhew	7/27/95	9.5	0.6
2 Mayhew	7/31/95	8.5	0.7
2 Mayhew	8/9/95	10.5	0.9
3 Pasquaney	6/18/91	7.0	1.9
3 Pasquaney	6/25/91	5.5	1.3
3 Pasquaney	7/3/91	6.5	2.1
3 Pasquaney	7/11/91	------	1.1
3 Pasquaney	7/17/91	9.1	1.1
3 Pasquaney	7/25/91	10.5	1.2
3 Pasquaney	8/1/91	9.6	1.4
3 Pasquaney	8/9/91	10.8	1.1
3 Pasquaney	8/14/91	10.7	1.4
3 Pasquaney	8/20/91	10.0	1.3
3 Pasquaney	8/28/91	9.3	1.0
3 Pasquaney	9/4/91	10.1	1.0
3 Pasquaney	9/9/91	10.5	------
3 Pasquaney	6/19/92	4.5	1.1
3 Pasquaney	6/25/92	9.3	1.0
3 Pasquaney	7/5/92	9.6	2.1
3 Pasquaney	7/8/92	9.5	1.3
3 Pasquaney	7/17/92	9.7	1.5
3 Pasquaney	7/24/92	10.6	1.3
3 Pasquaney	7/29/92	9.1	1.1
3 Pasquaney	8/6/92	9.3	1.8
3 Pasquaney	8/13/92	10.0	1.2
3 Pasquaney	8/19/92	9.8	1.3
3 Pasquaney	8/27/92	9.8	1.2
3 Pasquaney	9/4/92	9.3	2.1
3 Pasquaney	9/11/92	9.7	1.6
3 Pasquaney	6/28/93	8.5	1.3
3 Pasquaney	7/5/93	------	1.4
3 Pasquaney	7/13/93	8.5	1.1
3 Pasquaney	7/19/93	9.5	1.4
3 Pasquaney	7/28/93	11.0	0.3
3 Pasquaney	8/4/93	10.0	0.9
3 Pasquaney	8/11/93	10.5	1.1
3 Pasquaney	8/19/93	10.0	1.2
3 Pasquaney	8/24/93	10.5	0.1
3 Pasquaney	8/30/93	11.0	0.8
3 Pasquaney	9/6/93	10.0	0.2
3 Pasquaney	9/13/93	10.0	0.3
3 Pasquaney	7/5/94	6.5	1.0
3 Pasquaney	7/14/94	6.0	1.3
3 Pasquaney	7/21/94	9.5	0.9
3 Pasquaney	7/29/94	10.5	0.7
3 Pasquaney	8/3/94	9.2	1.2
3 Pasquaney	8/11/94	------	1.8
3 Pasquaney	8/17/94	------	1.4
3 Pasquaney	8/24/94	8.5	1.4
3 Pasquaney	9/1/94	8.0	2.1
3 Pasquaney	9/6/94	9.0	1.6
3 Pasquaney	9/15/94	------	1.9
3 Pasquaney	10/9/94	------	2.1
3 Pasquaney	6/27/96	6.0	3.7
3 Pasquaney	7/3/96	6.8	2.1
3 Pasquaney	7/11/96	------	1.9
3 Pasquaney	7/17/96	6.0	1.8
3 Pasquaney	7/27/96	6.5	2.1
3 Pasquaney	8/3/96	8.0	1.3
3 Pasquaney	8/7/96	7.5	------
3 Pasquaney	8/15/96	7.5	2.2
3 Pasquaney	8/22/96	8.5	1.3

APPENDIX I. Newfound Lake Volunteer Monitor Data (1986-2008)

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
2 Mayhew	8/16/95	9.5	1.1
2 Mayhew	8/29/95	8.5	1.4
2 Mayhew	9/5/95	8.5	1.1
2 Mayhew	6/6/96	7.0	0.9
2 Mayhew	6/12/96	8.5	1.3
2 Mayhew	6/20/96	7.5	0.8
2 Mayhew	7/1/96	7.5	1.6
2 Mayhew	7/8/96	7.5	1.6
2 Mayhew	7/13/96	8.0	1.9
2 Mayhew	7/18/96	5.5	0.9
2 Mayhew	7/26/96	6.0	1.3
2 Mayhew	8/2/96	6.5	2.1
2 Mayhew	8/19/96	7.5	0.9
2 Mayhew	7/18/97	6.8	1.3
2 Mayhew	7/24/97	7.7	1.1
2 Mayhew	7/31/97	8.9	1.3
2 Mayhew	8/6/97	9.0	1.2
2 Mayhew	8/27/97	8.5	1.8
2 Mayhew	9/5/97	6.0	2.1
2 Mayhew	9/17/97	8.0	1.7
2 Mayhew	7/7/98	3.0	2.8
2 Mayhew	7/21/98	4.6	2.4
2 Mayhew	8/3/98	6.0	2.9
2 Mayhew	8/18/98	7.5	1.9
2 Mayhew	9/1/98	7.5	2.4
2 Mayhew	9/11/98	6.5	2.1
2 Mayhew	9/17/98	7.5	1.8
2 Mayhew	7/9/99	7.0	1.4
2 Mayhew	7/16/99	7.0	1.4
2 Mayhew	7/23/99	6.5	2.2
2 Mayhew	7/30/99	7.0	1.2
2 Mayhew	8/6/99	7.0	2.4
2 Mayhew	8/13/99	7.0	1.9
2 Mayhew	8/20/99	7.0	2.0
2 Mayhew	9/6/99	6.5	1.9
2 Mayhew	9/11/99	7.5	2.6
2 Mayhew	9/18/99	2.0	3.0
2 Mayhew	9/24/99	3.0	2.4
2 Mayhew	10/3/99	4.5	2.9
2 Mayhew	10/8/99	4.5	------
2 Mayhew	5/16/00	4.7	2.6
2 Mayhew	5/30/00	5.0	2.3
2 Mayhew	6/18/00	6.0	1.6
2 Mayhew	6/23/00	6.5	1.3
2 Mayhew	6/30/00	6.0	1.9
2 Mayhew	7/7/00	5.5	2.0
2 Mayhew	7/13/00	6.5	1.8
2 Mayhew	7/20/00	6.5	1.9
2 Mayhew	7/26/00	6.5	1.5
2 Mayhew	8/11/00	5.5	3.4
2 Mayhew	8/18/00	5.5	3.0
2 Mayhew	8/23/00	5.5	3.0
2 Mayhew	9/1/00	6.0	1.5
2 Mayhew	9/8/00	5.5	2.4
2 Mayhew	9/14/00	6.0	2.9
2 Mayhew	9/27/00	5.0	3.1
2 Mayhew	6/9/01	5.5	2.1
2 Mayhew	6/18/01	7.5	1.4
2 Mayhew	6/25/01	5.8	1.6

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
3 Pasquaney	8/28/96	8.0	1.9
3 Pasquaney	9/4/96	8.5	1.9
3 Pasquaney	5/29/97	6.0	0.6
3 Pasquaney	7/18/97	6.8	1.7
3 Pasquaney	7/24/97	7.5	1.3
3 Pasquaney	7/31/97	10.0	1.4
3 Pasquaney	8/6/97	10.5	1.2
3 Pasquaney	8/27/97	8.0	1.4
3 Pasquaney	9/5/97	7.5	1.8
3 Pasquaney	4/29/98	6.0	0.8
3 Pasquaney	6/24/98	5.5	2.1
3 Pasquaney	6/30/98	4.5	1.7
3 Pasquaney	7/6/98	3.5	3.9
3 Pasquaney	7/15/98	5.0	3.0
3 Pasquaney	7/21/98	5.7	2.8
3 Pasquaney	8/2/98	6.0	3.0
3 Pasquaney	8/3/98	6.0	2.1
3 Pasquaney	8/18/98	7.5	0.7
3 Pasquaney	8/25/98	7.5	1.6
3 Pasquaney	9/1/98	9.0	3.3
3 Pasquaney	9/11/98	8.5	2.5
3 Pasquaney	9/13/98	8.0	------
3 Pasquaney	9/18/98	8.5	2.7
3 Pasquaney	4/22/99	6.5	1.6
3 Pasquaney	5/9/99	8.0	2.0
3 Pasquaney	7/12/99	7.0	1.5
3 Pasquaney	7/18/99	7.0	1.1
3 Pasquaney	8/16/99	7.0	0.9
3 Pasquaney	8/25/99	7.0	1.7
3 Pasquaney	9/12/99	8.0	0.9
3 Pasquaney	5/16/00	4.5	2.1
3 Pasquaney	5/29/00	4.8	1.6
3 Pasquaney	6/28/00	7.5	1.9
3 Pasquaney	7/6/00	6.3	1.5
3 Pasquaney	7/11/00	6.5	2.0
3 Pasquaney	7/20/00	8.0	1.8
3 Pasquaney	7/28/00	6.9	1.6
3 Pasquaney	8/11/00	5.3	3.9
3 Pasquaney	8/18/00	7.2	2.6
3 Pasquaney	8/25/00	6.5	2.4
3 Pasquaney	9/1/00	6.6	2.2
3 Pasquaney	9/6/00	7.5	2.1
3 Pasquaney	9/14/00	7.9	2.4
3 Pasquaney	9/21/00	6.8	1.5
3 Pasquaney	6/15/01	7.5	1.3
3 Pasquaney	6/22/01	7.8	1.6
3 Pasquaney	6/29/01	8.0	1.4
3 Pasquaney	7/9/01	8.0	1.4
3 Pasquaney	7/20/01	7.8	1.2
3 Pasquaney	7/28/01	7.5	1.6
3 Pasquaney	8/19/01	8.2	1.3
3 Pasquaney	8/27/01	8.8	1.4
3 Pasquaney	9/3/01	8.5	1.5
3 Pasquaney	9/23/01	10.0	2.6
3 Pasquaney	10/1/01	7.8	2.7
3 Pasquaney	10/10/01	7.3	3.4
3 Pasquaney	10/17/01	7.0	2.8
3 Pasquaney	6/13/02	6.4	1.6
3 Pasquaney	6/21/02	9.2	1.3

APPENDIX I. Newfound Lake Volunteer Monitor Data (1986-2008)

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
2 Mayhew	7/5/01	6.0	1.3
2 Mayhew	7/14/01	8.0	1.3
2 Mayhew	7/19/01	7.5	1.5
2 Mayhew	7/29/01	5.5	1.6
2 Mayhew	8/1/01	7.0	1.6
2 Mayhew	8/9/01	7.0	1.1
2 Mayhew	8/15/01	6.5	1.2
2 Mayhew	8/27/01	7.5	1.7
2 Mayhew	9/3/01	6.0	1.6
2 Mayhew	9/12/01	7.0	1.4
2 Mayhew	9/26/01	7.0	2.4
2 Mayhew	6/10/02	5.5	3.0
2 Mayhew	6/19/02	7.0	2.0
2 Mayhew	6/26/02	7.5	1.1
2 Mayhew	7/8/02	7.0	1.0
2 Mayhew	7/22/02	6.5	1.1
2 Mayhew	7/29/02	6.5	------
2 Mayhew	8/5/02	7.5	1.4
2 Mayhew	8/12/02	6.5	1.7
2 Mayhew	8/19/02	8.0	1.6
2 Mayhew	8/28/02	7.0	1.9
2 Mayhew	9/4/02	6.5	1.5
2 Mayhew	9/9/02	7.0	1.2
2 Mayhew	9/18/02	8.0	1.6
2 Mayhew	6/4/03	6.5	2.1
2 Mayhew	6/14/03	7.5	1.1
2 Mayhew	6/19/03	7.0	1.7
2 Mayhew	6/25/03	7.0	1.3
2 Mayhew	7/8/03	8.5	1.1
2 Mayhew	7/18/03	8.5	2.1
2 Mayhew	7/29/03	8.5	1.4
2 Mayhew	8/6/03	8.5	1.9
2 Mayhew	8/13/03	8.0	2.1
2 Mayhew	8/20/03	8.5	1.9
2 Mayhew	8/28/03	8.5	1.9
2 Mayhew	9/6/03	6.0	1.6
2 Mayhew	9/13/03	8.5	2.0
2 Mayhew	9/22/03	9.0	2.3
2 Mayhew	6/16/04	8.5	------
2 Mayhew	6/25/04	8.5	1.3
2 Mayhew	7/12/04	9.0	2.1
2 Mayhew	7/19/04	7.0	2.0
2 Mayhew	7/26/04	6.5	2.2
2 Mayhew	8/2/04	8.5	2.0
2 Mayhew	8/14/04	8.5	1.9
2 Mayhew	8/20/04	9.5	1.8
2 Mayhew	8/24/04	9.0	2.4
2 Mayhew	8/30/04	8.5	1.8
2 Mayhew	9/11/04	6.5	2.7
2 Mayhew	9/22/04	6.0	2.5
2 Mayhew	7/5/05	5.0	2.4
2 Mayhew	7/11/05	8.0	2.4
2 Mayhew	7/19/05	8.5	2.0
2 Mayhew	7/26/05	7.0	1.4
2 Mayhew	8/8/05	7.0	0.9
2 Mayhew	8/17/05	6.5	1.3
2 Mayhew	8/24/05	7.0	1.4
2 Mayhew	9/2/05	7.0	1.6
2 Mayhew	9/7/05	7.5	1.9

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
3 Pasquaney	6/28/02	8.2	1.1
3 Pasquaney	7/9/02	9.0	1.5
3 Pasquaney	7/16/02	7.5	1.3
3 Pasquaney	8/1/02	9.3	1.9
3 Pasquaney	8/9/02	8.0	1.2
3 Pasquaney	8/14/02	10.4	2.0
3 Pasquaney	8/23/02	9.4	1.1
3 Pasquaney	8/28/02	9.5	0.9
3 Pasquaney	9/4/02	8.8	------
3 Pasquaney	9/16/02	8.7	1.5
3 Pasquaney	9/24/02	8.9	1.6
3 Pasquaney	4/29/03	8.0	1.7
3 Pasquaney	5/5/03	7.7	2.0
3 Pasquaney	5/15/03	7.6	2.0
3 Pasquaney	6/11/03	9.4	1.1
3 Pasquaney	6/18/03	9.5	1.1
3 Pasquaney	6/25/03	8.0	1.5
3 Pasquaney	7/13/03	9.8	1.3
3 Pasquaney	7/31/03	10.6	1.2
3 Pasquaney	8/6/03	10.3	1.6
3 Pasquaney	8/12/03	8.4	2.1
3 Pasquaney	8/20/03	8.5	1.3
3 Pasquaney	8/26/03	8.5	1.7
3 Pasquaney	9/2/03	8.9	2.1
3 Pasquaney	9/9/03	9.5	1.4
3 Pasquaney	9/17/03	10.2	1.5
3 Pasquaney	9/23/03	9.6	1.6
3 Pasquaney	10/7/03	8.5	2.4
3 Pasquaney	10/14/03	8.4	2.7
3 Pasquaney	10/21/03	7.2	3.3
3 Pasquaney	4/19/04	8.5	1.5
3 Pasquaney	4/29/04	8.3	1.2
3 Pasquaney	5/5/04	7.9	1.5
3 Pasquaney	5/12/04	7.9	1.7
3 Pasquaney	6/6/04	8.3	1.3
3 Pasquaney	6/13/04	8.9	1.3
3 Pasquaney	6/22/04	8.5	1.4
3 Pasquaney	7/1/04	8.5	1.2
3 Pasquaney	7/7/04	8.0	2.1
3 Pasquaney	7/14/04	7.5	2.1
3 Pasquaney	7/27/04	8.4	0.6
3 Pasquaney	8/3/04	9.5	1.4
3 Pasquaney	8/10/04	9.8	1.4
3 Pasquaney	8/20/04	9.8	1.8
3 Pasquaney	8/27/04	9.8	1.4
3 Pasquaney	9/2/04	10.8	1.8
3 Pasquaney	9/8/04	9.9	2.1
3 Pasquaney	9/15/04	10.2	1.7
3 Pasquaney	9/22/04	9.5	2.6
3 Pasquaney	9/30/04	8.5	1.6
3 Pasquaney	5/27/05	8.0	1.1
3 Pasquaney	6/21/05	4.1	2.4
3 Pasquaney	6/29/05	4.2	2.4
3 Pasquaney	7/5/05	4.9	1.9
3 Pasquaney	7/13/05	5.6	1.6
3 Pasquaney	7/19/05	6.6	1.9
3 Pasquaney	7/29/05	8.2	1.5
3 Pasquaney	8/10/05	8.5	1.1
3 Pasquaney	8/19/05	8.3	1.3

APPENDIX I. Newfound Lake Volunteer Monitor Data (1986-2008)

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
2 Mayhew	9/19/05	8.0	2.5
2 Mayhew	10/3/05	6.5	2.2
2 Mayhew	6/22/06	5.5	2.1
2 Mayhew	6/30/06	6.5	1.9
2 Mayhew	7/6/06	6.5	------
2 Mayhew	7/12/06	7.0	1.3
2 Mayhew	7/20/06	7.0	1.1
2 Mayhew	7/25/06	6.0	1.3
2 Mayhew	7/31/06	7.5	1.4
2 Mayhew	9/4/06	6.5	1.6
2 Mayhew	9/12/06	7.5	1.7
2 Mayhew	9/18/06	6.5	1.4
2 Mayhew	9/27/06	8.0	1.6
2 Mayhew	6/3/07	7.0	1.8
2 Mayhew	6/20/07	8.5	1.4
2 Mayhew	6/28/07	8.0	1.7
2 Mayhew	7/5/07	7.0	------
2 Mayhew	7/14/07	7.5	1.4
2 Mayhew	8/1/07	7.5	0.9
2 Mayhew	8/7/07	8.0	1.4
2 Mayhew	8/21/07	7.5	1.6
2 Mayhew	8/28/07	8.0	1.4
2 Mayhew	9/7/07	7.5	1.4
2 Mayhew	9/25/07	7.5	1.7
2 Mayhew	6/21/08	9.5	0.6
2 Mayhew	7/11/08	7.5	1.3
2 Mayhew	7/16/08	7.0	1.4
2 Mayhew	7/25/08	5.0	2.4
2 Mayhew	8/7/08	6.5	0.0
2 Mayhew	8/16/08	6.0	1.8
2 Mayhew	8/24/08	6.0	1.5
2 Mayhew	9/4/08	6.0	1.6

Site	Date	Secchi Disk Transparency (meters)	Chlorophyll *a* (*u* g/l)
3 Pasquaney	8/26/05	7.8	1.5
3 Pasquaney	9/2/05	8.6	1.9
3 Pasquaney	9/14/05	8.6	1.9
3 Pasquaney	9/25/05	8.2	2.2
3 Pasquaney	6/28/06	6.5	1.9
3 Pasquaney	7/4/06	7.2	1.6
3 Pasquaney	7/11/06	7.9	1.1
3 Pasquaney	7/19/06	7.5	1.2
3 Pasquaney	7/26/06	6.8	1.1
3 Pasquaney	8/4/06	9.3	1.2
3 Pasquaney	8/13/06	7.8	1.6
3 Pasquaney	8/22/06	9.2	1.9
3 Pasquaney	8/29/06	9.0	1.6
3 Pasquaney	9/5/06	9.6	1.3
3 Pasquaney	9/13/06	9.8	1.4
3 Pasquaney	9/22/06	9.8	1.4
3 Pasquaney	9/30/06	10.3	1.8
3 Pasquaney	10/7/06	9.9	1.4
3 Pasquaney	6/2/07	10.8	1.4
3 Pasquaney	6/10/07	10.5	0.6
3 Pasquaney	6/17/07	9.5	1.4
3 Pasquaney	6/25/07	8.9	------
3 Pasquaney	7/3/07	8.0	2.8
3 Pasquaney	7/10/07	7.3	1.2
3 Pasquaney	7/20/07	6.8	1.6
3 Pasquaney	7/26/07	9.0	5.4
3 Pasquaney	8/3/07	9.2	1.0
3 Pasquaney	8/10/07	9.8	1.1
3 Pasquaney	8/16/07	9.8	0.6
3 Pasquaney	8/24/07	9.8	1.4
3 Pasquaney	9/6/07	9.5	1.7
3 Pasquaney	9/17/07	9.5	1.3
3 Pasquaney	9/25/07	10.5	1.4
3 Pasquaney	6/8/08	10.5	1.0
3 Pasquaney	6/18/08	11.3	0.6
3 Pasquaney	6/26/08	8.5	1.0
3 Pasquaney	7/4/08	8.6	0.8
3 Pasquaney	7/13/08	7.0	1.7
3 Pasquaney	7/23/08	6.1	1.3
3 Pasquaney	7/30/08	6.3	1.2
3 Pasquaney	8/2/08	6.5	------
3 Pasquaney	8/12/08	5.6	1.9
3 Pasquaney	8/28/08	7.5	1.4
3 Pasquaney	9/11/08	7.2	1.6
3 Pasquaney	9/22/08	7.6	2.3