Lakes Environmental Association
2022 Water Testing Report

Chapter 3—High-Resolution Temperature Monitoring

Introduction to High-resolution Temperature Monitoring

LEA began using in-lake temperature sensors to acquire high-resolution temperature measurements in 2013. The sensors, which are also interchangeably referred to as HOBO sensors, are used to provide a detailed record of temperature fluctuations within lakes and ponds in our service area. High-resolution temperature data allow for a better understanding of a waterbody's thermal structure, water quality, and the possible influence of climate change.

Each year, we attempt to capture the entire stratified period within the temperature record, from when stratification begins to form in the spring to when the lake mixes in the fall. Stratification refers to the separation of lake waters into distinct layers and is a natural phenomenon that has important consequences for water quality and lake ecology. See Chapter 1, page 7 of this Water Testing Report for more information about stratification.

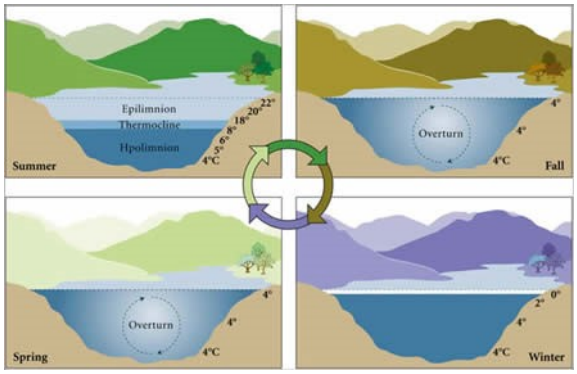
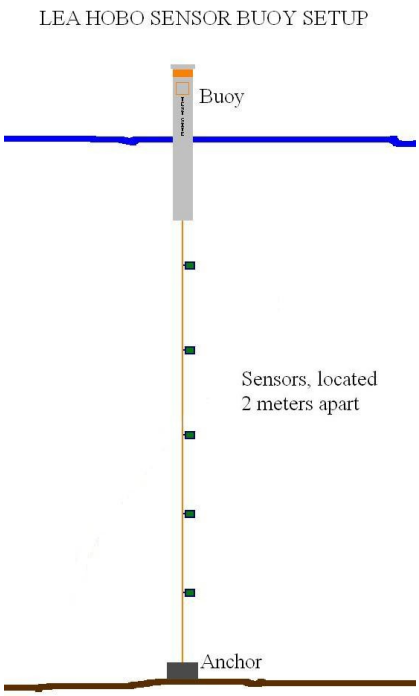


Diagram of Seasonal Stratification and Lake Mixing
Young, M. (2004). *Thermal Stratification in Lakes*. Baylor College of Medicine, Center For Educational Outreach.

Water temperature is critical to the biological function of lakes, as well as the regulation of chemical processes. Lake temperature and stratification are greatly influenced by the weather. Air temperature, precipitation, and wind speed and direction can all affect water temperature and stratification patterns from year to year. Lake size, depth, and shape also greatly impact stratification timing and strength. The larger the difference in temperature between the top and bottom layers of the lake, the stronger the stratification is.



With funding and support from local lake associations, LEA has deployed temperature sensors at seventeen sites on thirteen lakes and ponds. Sensors are attached to a floating line held in place by a regulatory-style buoy and an anchor. The sensors are attached at 2-meter intervals, beginning one meter from the bottom and ending approximately one meter from the top. Each buoy apparatus is deployed at the deepest point of the basin it monitors. The setup results in the sensors being located at odd numbered depths throughout the water column (the shallowest sensor is approximately 1 meter deep, the next is 3 meters, etc.).

Temperature sensors are programmed to record temperature readings every 15 minutes. LEA has for many years used a handheld YSI meter to collect water temperature data; however, this method is time-consuming, resulting in only eight temperature profiles per year. While temperature sensors require an initial time investment, once deployed, the sensors record over 15,000 profiles before they are removed in the fall. This wealth of data provides much greater detail and clarity than the traditional method ever could. Daily temperature fluctuations, brief mixing events caused by storms, the date and time of stratification set-up and breakdown, and the timing of seasonal high temperatures are all valuable and informative events that traditional sampling can't accurately measure.

2022 Monitoring Season

2022 began with shallow snowpack and dry conditions. Spring ice-out occurred on most Lake Region lakes between late March and mid-April. Temperature sensors were deployed in early May. Early season air temperature fluctuations resulted in many lakes warming slightly in mid-May, only to cool again in late May. Most lakes showed two warming periods in June, each followed by a short cooling period before steadily increasing in temperature from early July through mid-August. Most lakes reached peak surface water temperatures in early August before beginning to gradually cool down in mid-August. Interestingly, in many of our lakes, warm temperatures extended deeper into the water column than has been seen in the past three years. Warm, deep waters decrease the temperature difference between surface and deep waters, enabling the breakdown of thermal stratification earlier than has been seen in the recent past.

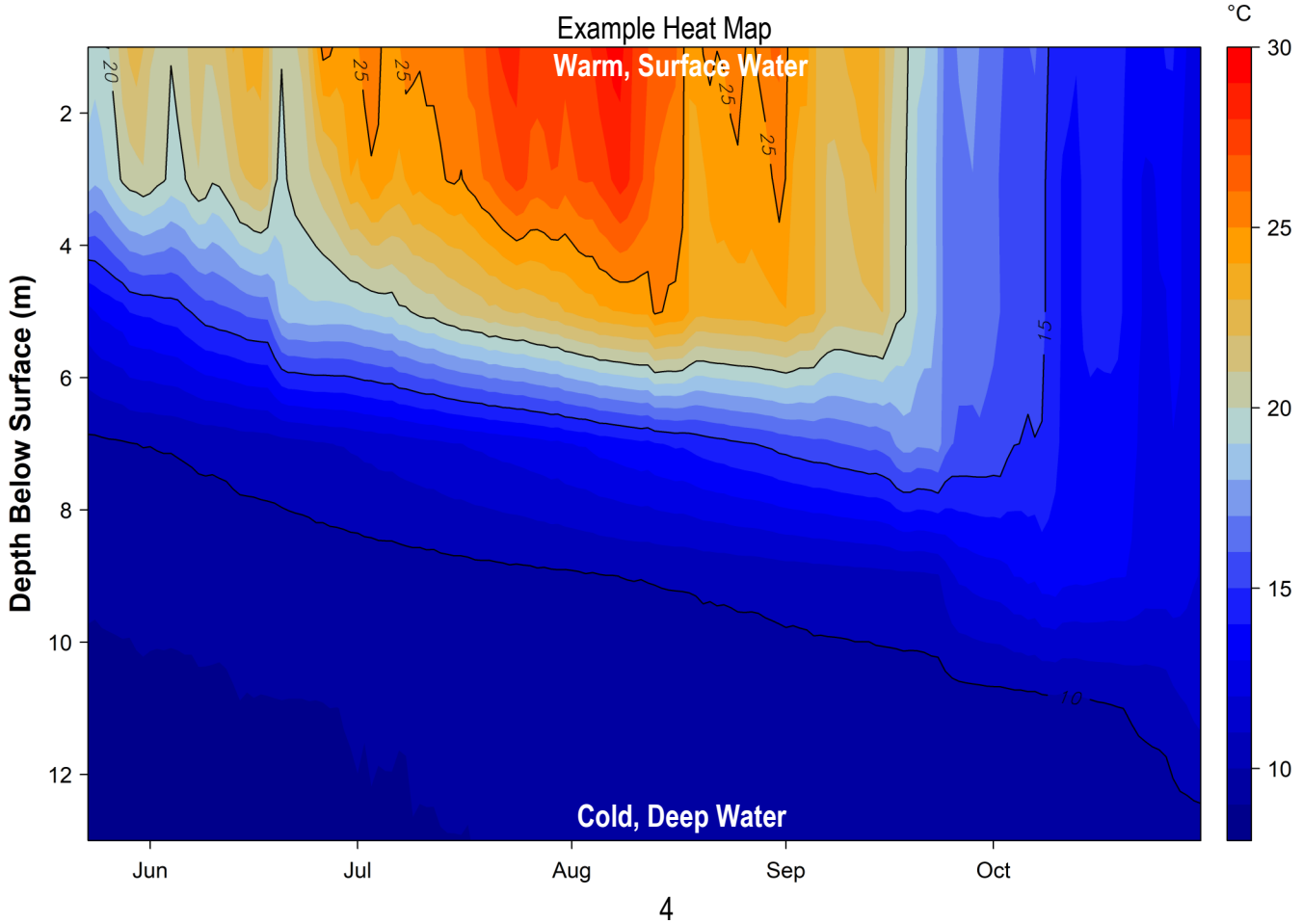
A HOBO temperature sensor

High-resolution Temperature Monitoring: How to Read the Graphs

Temperature monitoring summaries on the following pages include a heat map for each lake, displaying all the data collected in the 2022 season. Heat maps were generated using daily mean temperature values, which help determine temperature across depth and time. Temperature is represented by colored contours, where the red-to-blue color range corresponds to a high-to-low temperature range. The vertical bar on the right side of the heat map indicates the temperature each color represents in degrees Celcius (° C). The horizontal axis shows the months sensors were deployed, while the left- hand vertical axis shows sensor depth (meters) below the water's surface.

Temperature stratification shows up as areas of the plot where colors change in the vertical direction and contour lines are tilted more towards horizontal (from June through early November). The area where temperature changes most rapidly with depth is often referred to as the thermocline. Vertical contour lines indicate mixed conditions, and areas of a single color from top to bottom (such as late October into November) indicate completely mixed conditions. Warm, stratified conditions stand out as darker red areas. Large gaps between lines means there is a temperature difference between depths.

During stratification, the shallower waters do not easily mix with the deeper waters. It is only when the temperature of the upper water cools down that the lake can fully mix. You can see this process happening on each graph: the temperatures near the surface get cooler and the deeper waters get warmer as the barrier between the two layers weakens and the waters begin to mix. The lines converge one by one until the temperature is the same at each depth. This is known as lake turnover or destratification.

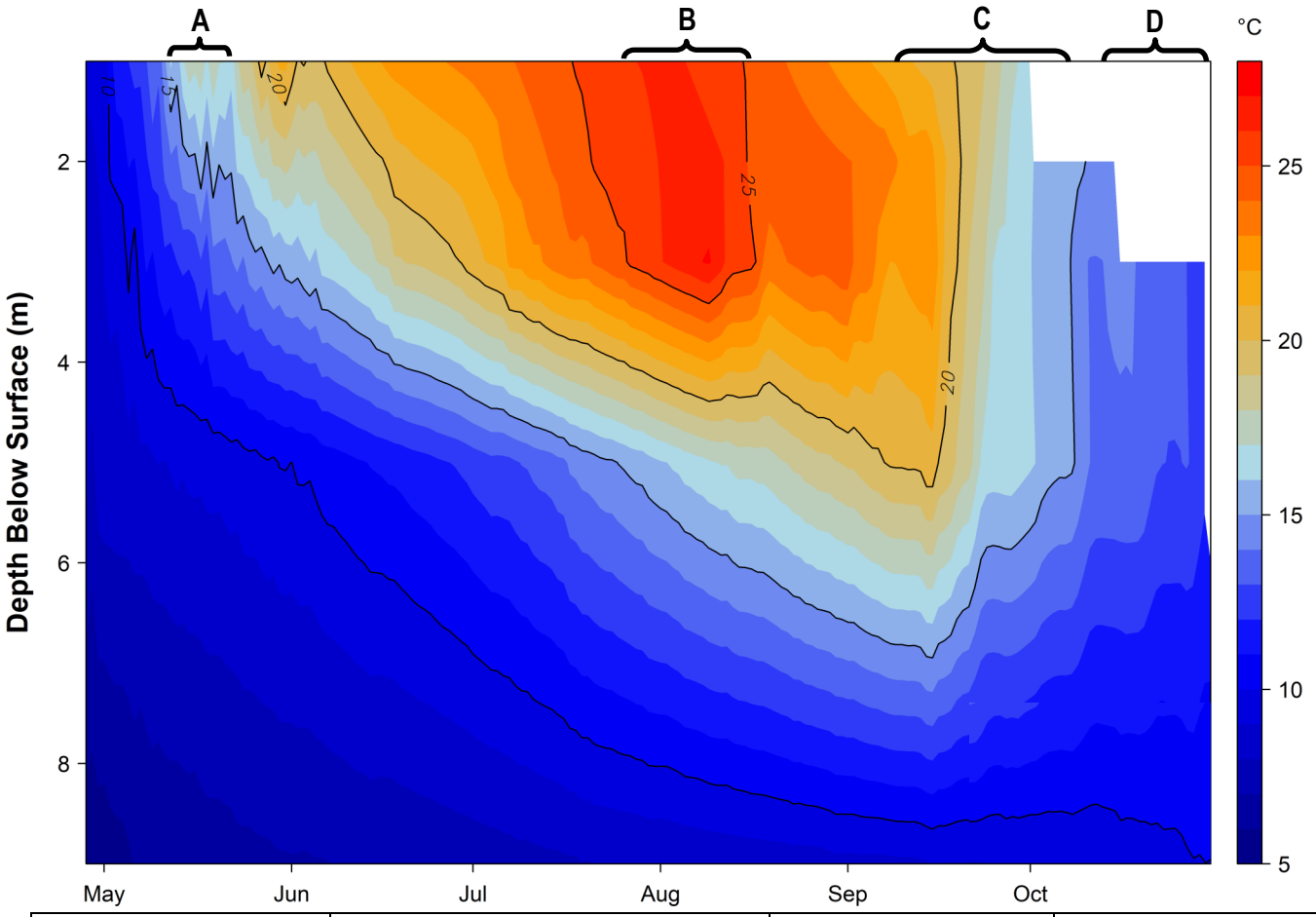


Back Pond

The water column of Back Pond was weakly stratified when sensors were deployed on April 28. By early June, Back Pond had stratified into distinct layers. Surface water temperatures increased in late May; however, due to sensor failure, data describing surface water temperature conditions from June through October is absent. Using data collected during regular water monitoring visits we determined that Back Pond's shallower waters began to cool in mid-August through September. During the summer months, little temperature change was seen in Back Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Full mixing had not yet occurred when sensors were retrieved in late October.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. Early August data collected from regular water monitoring visits show Back Pond's temperature peak (27.1°C/ 80.8°F) on August 1.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



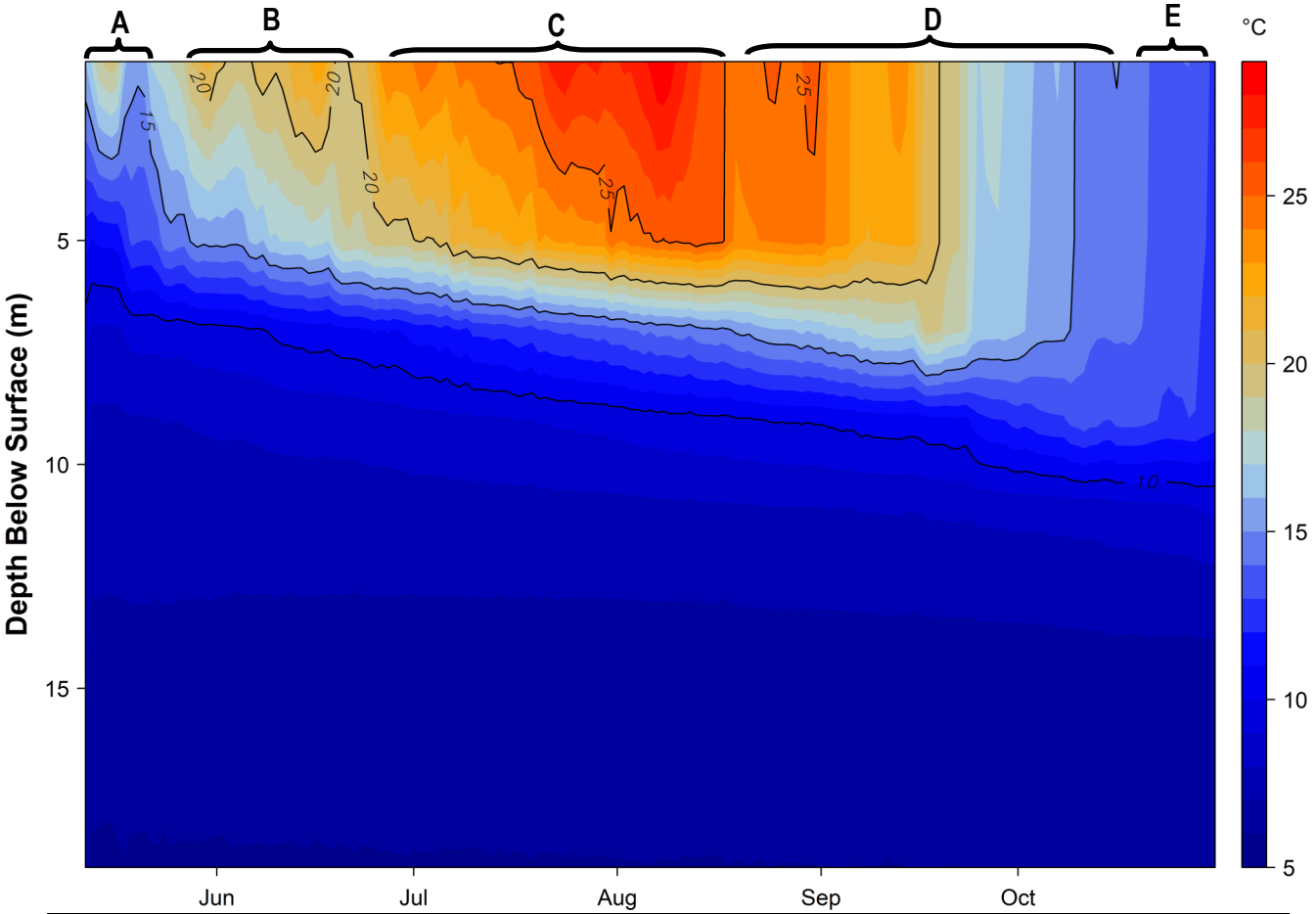
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
4/28/2022	21.7 / 80.8	After Retrieval	10/31/2022

Bear Pond

The water column of Bear Pond was weakly stratified when sensors were deployed on May 12. By early June, Bear Pond had stratified into distinct layers. Surface water temperatures increased in mid-June, cooled in late June, increased steadily from July through mid-August, before beginning to gradually cool from mid-August through October. During the summer months, little temperature change was seen in Bear Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Full mixing had not yet occurred when sensors were retrieved in late October.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases followed by cooling periods.
C. Surface water temperature increases from early July through mid-August, with peak temperature occurring on August 8 (29.0°C/ 84.2 °F).
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



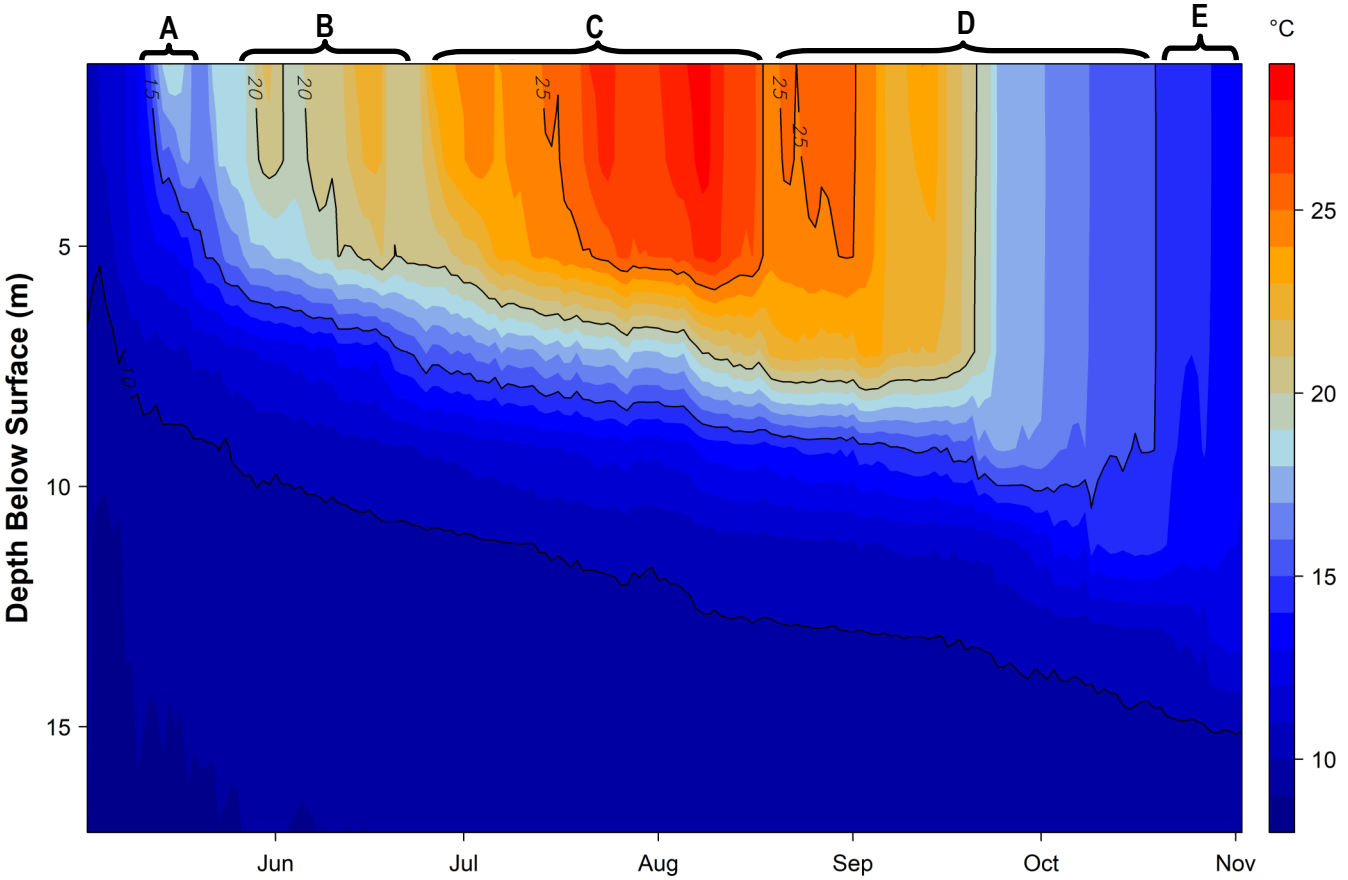
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/12/2022	29.0 / 84.2	After Retrieval	10/31/2022

Hancock Pond

The water column of Hancock Pond was weakly stratified when sensors were deployed in early May. By June, Hancock Pond had stratified into distinct layers. Surface water temperatures increased in early June, followed closely by a cooling period, increased dramatically in mid-June, cooled slightly in late June, and steadily increased again from July through mid-August. During the summer months, little temperature change was seen in Hancock Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Hancock Pond's shallower waters began to cool in late August through October. Full mixing had not yet occurred when sensors were retrieved in early November.

The following events can be seen in the graph below:

A. May data show an early season warm period followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases throughout July, peaks on August 8 (28.6°C/ 83.5°F) and stays warm through mid-August.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



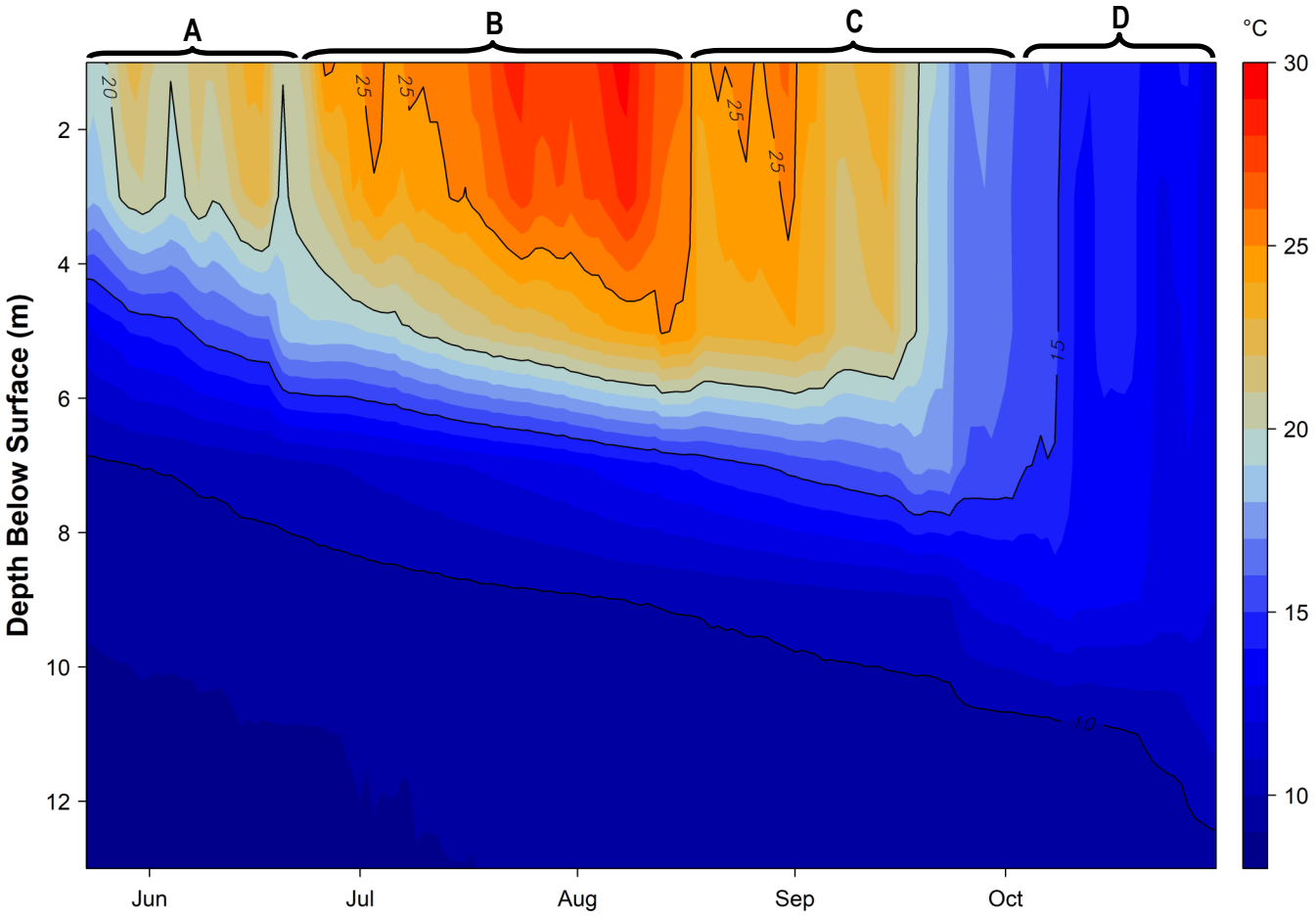
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/2/2022	28.6 / 83.5	After Retrieval	11/2/2022

Island Pond

The water column of Island Pond was stratified when sensors were deployed in late May. By June, Island Pond had stratified into distinct layers. Surface water temperatures increased in early June, then decreased, increased again in mid-June, and decreased again in late June before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in Island Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Island Pond's shallower waters began to cool in mid-August through October. Full mixing had not yet occurred when sensors were retrieved in late October.

The following events can be seen in the graph below:

A. June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases throughout July, peaks on August 7 (29.4°C/ 84.9°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



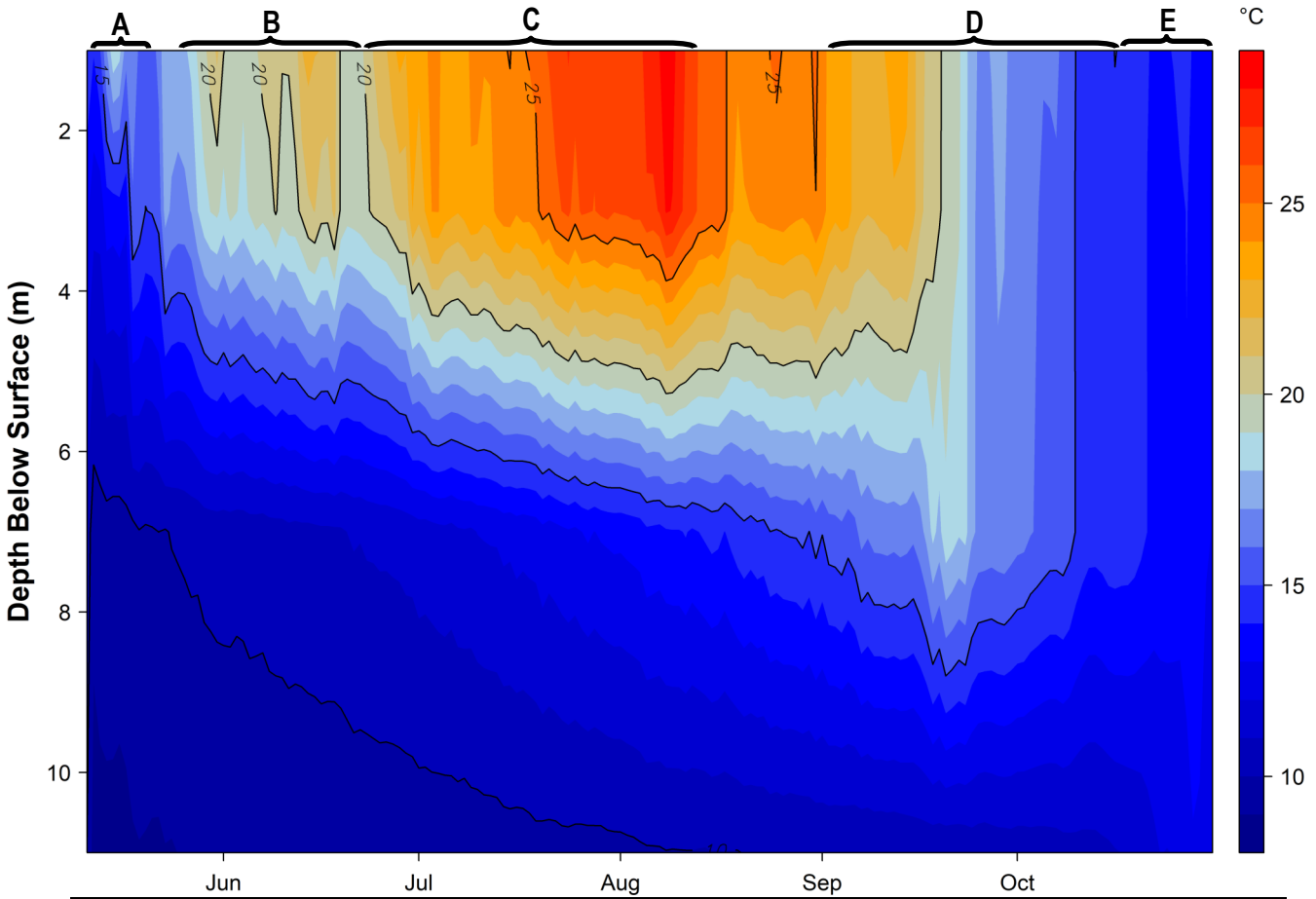
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/23/2022	29.4 / 84.9	After Retrieval	10/31/2022

Keoka Lake

The water column of Keoka Lake was weakly stratified when sensors were deployed in mid-May. By mid-June, Keoka Lake had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in Keoka Lake's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Shallower waters began to cool in mid-August through October. Full mixing had not yet occurred when sensors were retrieved in late October.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases throughout July, peaks on August 8 (28.5°C / 83.3°F), and stays warm through mid-August.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



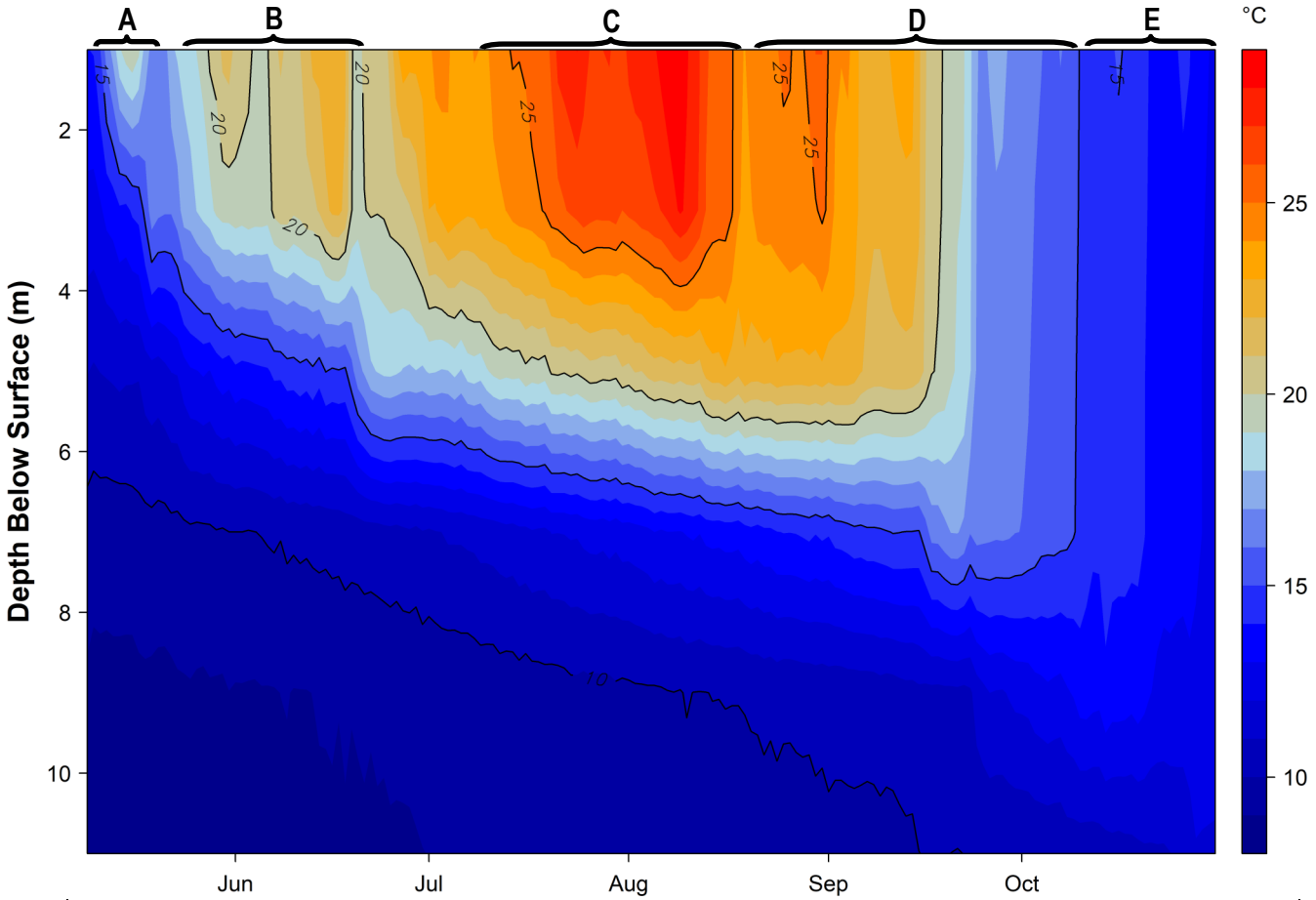
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/11/2022	28.5 / 83.3	After Retrieval	10/31/2022

Keyes Pond

The water column of Keyes Pond was mildly stratified when sensors were deployed in early May. By early June, Keyes Pond had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in Keyes Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Keyes Pond's shallower waters began to cool in mid-August through October. Full mixing had not yet occurred when sensors were retrieved in late October.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases in mid-July, peaks on August 8 (28.9°C / 84.0°F), and stays warm through mid-August.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



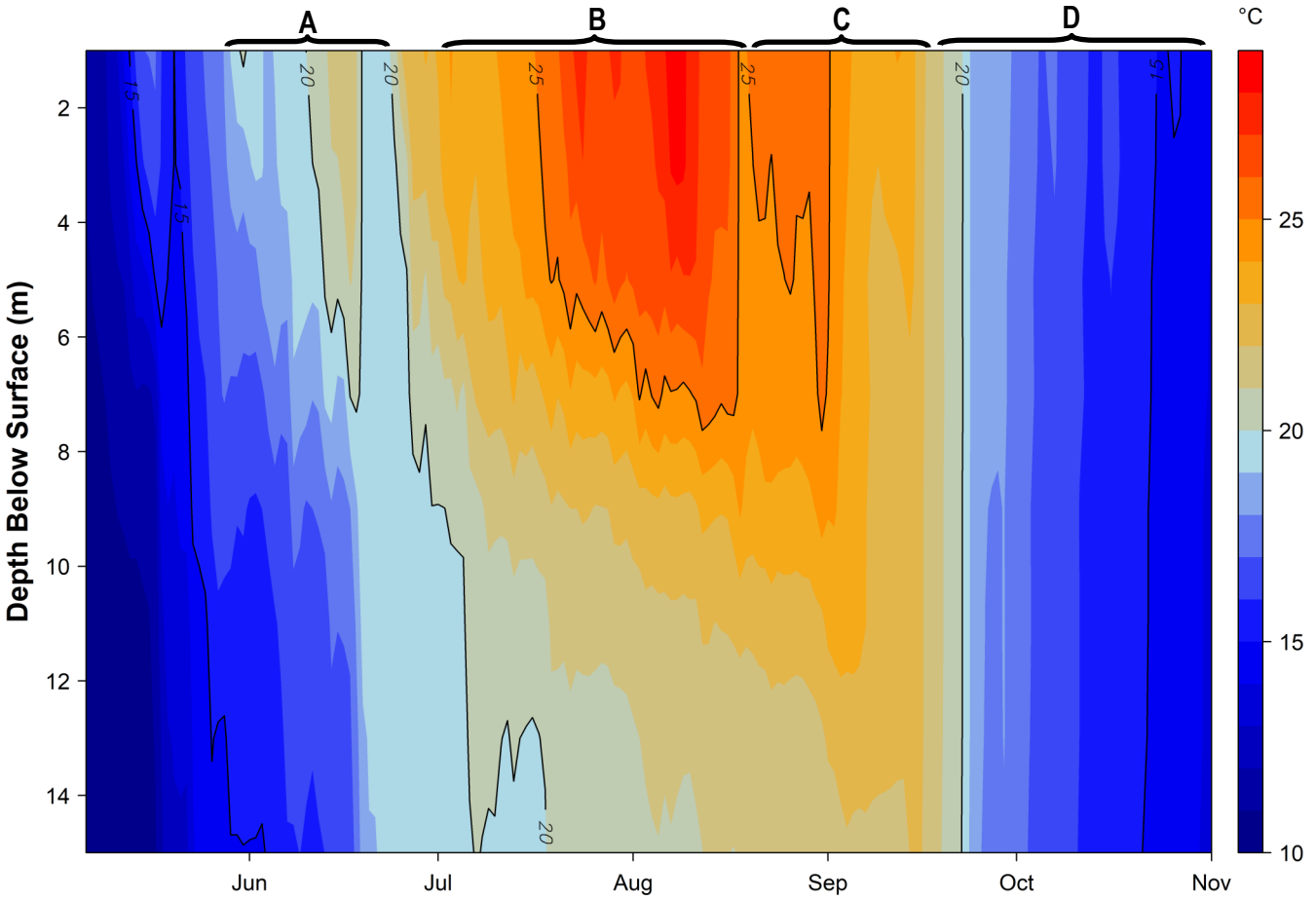
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/9/2022	28.9 / 84.0	After Retrieval	10/31/2022

Long Lake (Middle Basin)

The water column of Long Lake's middle basin was not stratified when sensors were deployed in early May. By June, the middle basin had stratified into distinct layers, but this stratification was not strong. This weaker stratification is likely the result of the lake's long length, which runs parallel to the most dominant north-west wind direction. This large length of open water (fetch size) allows for the build up of large surface and internal waves. Surface water temperatures increased in mid-June and decreased in late June before steadily increasing from July through mid-August. Due to large waves, strong and sustained winds in the summer break down the lake's stratification. The unusually warm bottom waters seen in late June through mid-September are likely a result of this and could allow for nutrient-rich bottom waters to mix with upper waters during algae growing season. Temperatures throughout the middle basin's water column were sufficiently uniform to allow an initial full mixing in mid-September. The water column did briefly and weakly restratify three times in October. Due to equipment malfunction, data from the bottom (17m) water sensor is incomplete. To generate the graph below, temperature data from the 15m sensor was used to estimate water temperatures near the lake bottom.

The following events can be seen in the graph below:

A. June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases in July, peaks on August 8 (26.8°C / 80.2°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperature becomes uniform throughout the water column resulting in lake mixing.



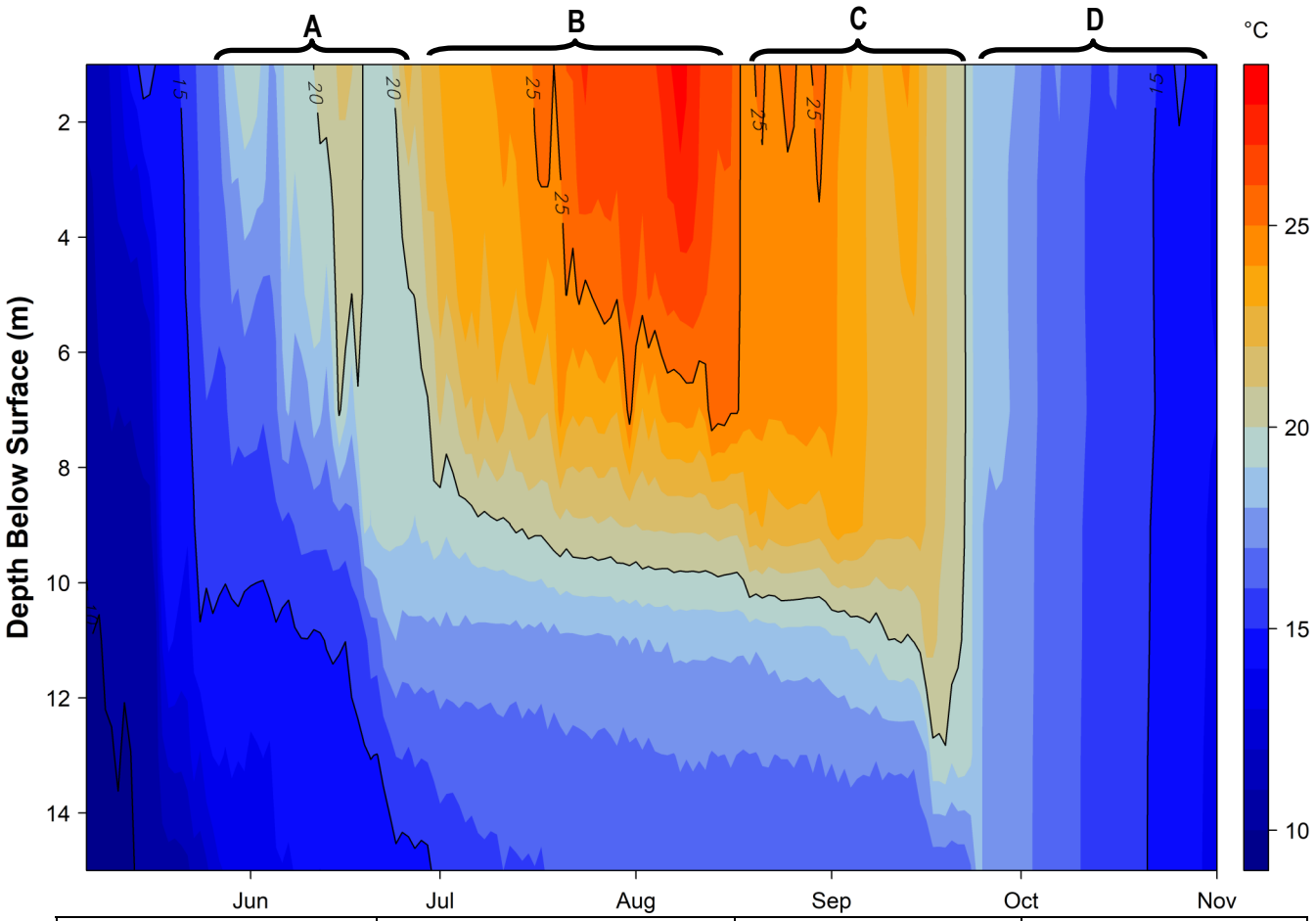
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/6/2022	26.8 / 80.2	9/14/2022	11/1/2022

Long Lake (South Basin)

The water column of Long Lake's south basin was weakly stratified when sensors were deployed in early May. By June, the south basin had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, temperature increase was seen in the south basin's deep waters, but the increase was not large enough to break down the south basin's stratification. This temperature difference between shallow and deep waters limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. The south basin's shallower waters began to cool in mid-August and by late September were sufficiently cooled to allow full mixing.

The following events can be seen in the graph below:

A. June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases in July, peaks on August 8 (28.5°C/ 83.3°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column in late September, which persisted as water cooled.



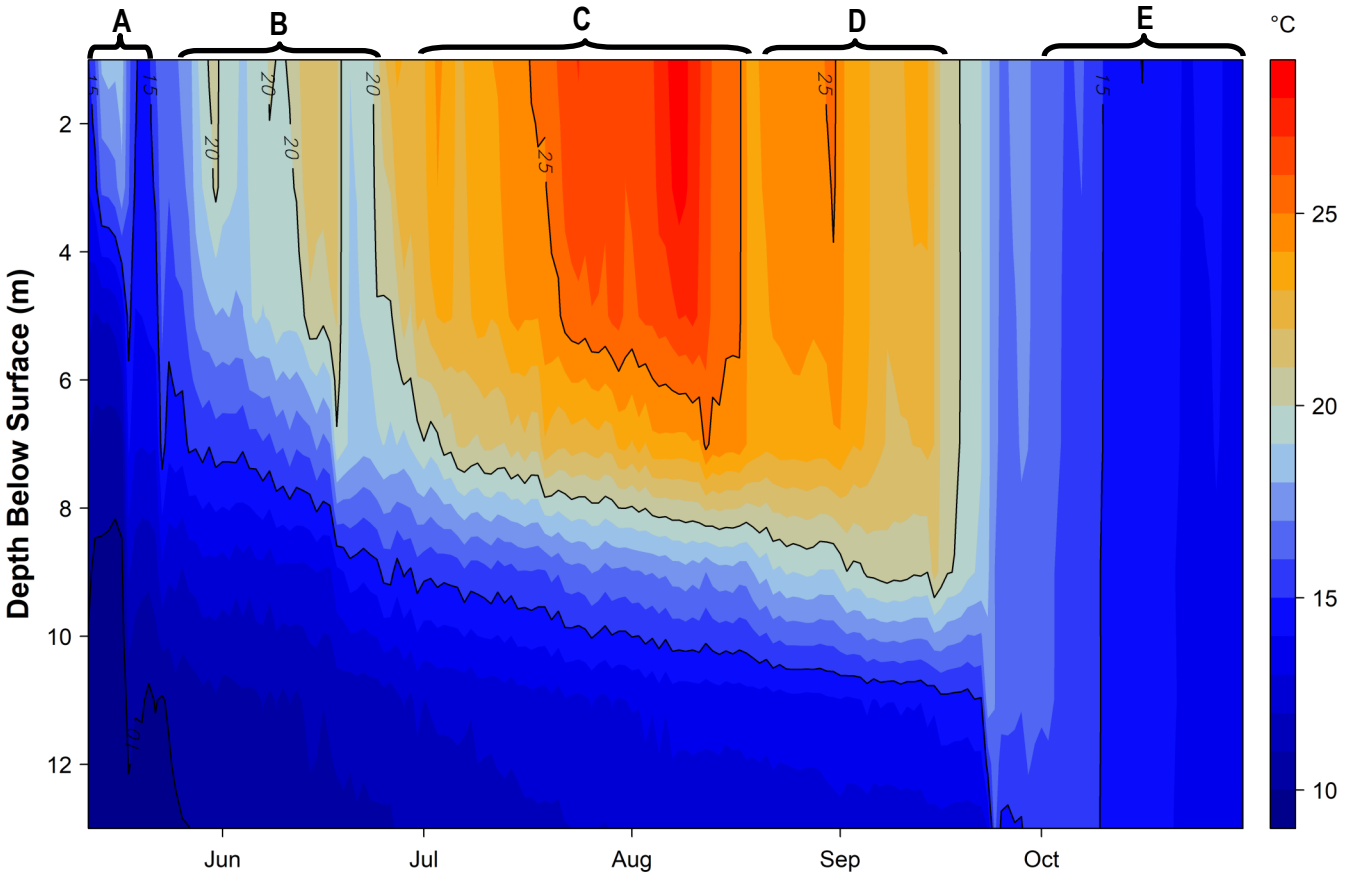
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/6/2022	28.5 / 83.3	9/24/2022	11/1/2022

McWain Pond

The water column of McWain Pond was weakly stratified when sensors were deployed in early May. By June, McWain Pond had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in McWain Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. McWain Pond's shallower waters began to cool in mid-August and by late September were sufficiently cooled to allow full mixing.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases in July, peaks on August 8 (28.5°C/ 83.3°F), and stays warm through mid-August.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are sufficiently uniform to facilitate full mixing.



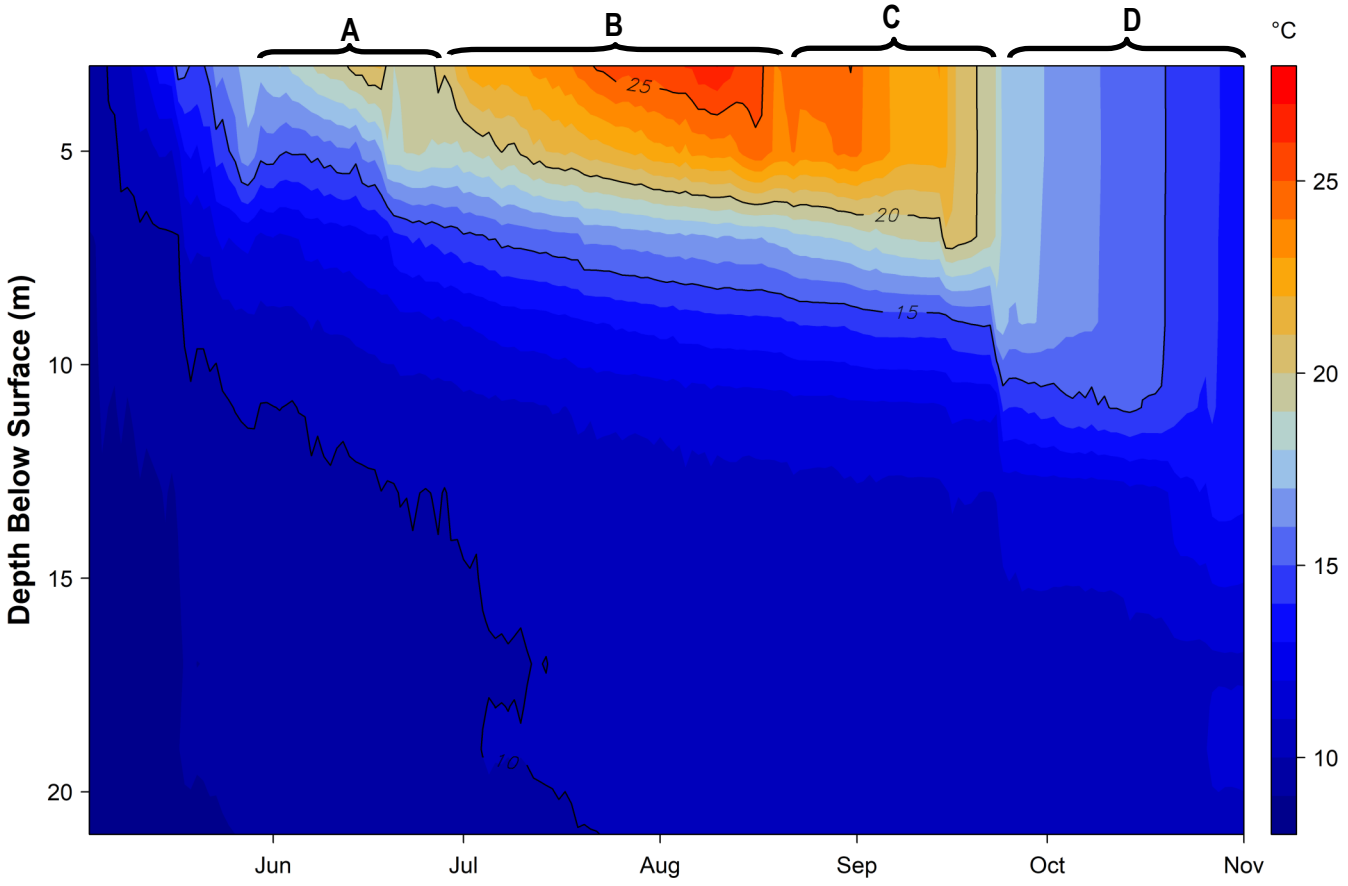
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/12/2022	28.5 / 83.3	9/30/2022	10/31/2022

Moose Pond (Middle Basin)

The water column of Moose Pond's middle basin was weakly stratified when sensors were deployed in early May. By June, the middle basin had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in the main basin's deep waters, creating large temperature differences between shallow and deep waters. A large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. The main basin's shallower waters began to cool in mid-August through October. Full mixing had not yet occurred when sensors were retrieved in early November.

The following events can be seen in the graph below:

A. June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases in July, peaks on August 8 (27.6°C/ 81.7°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



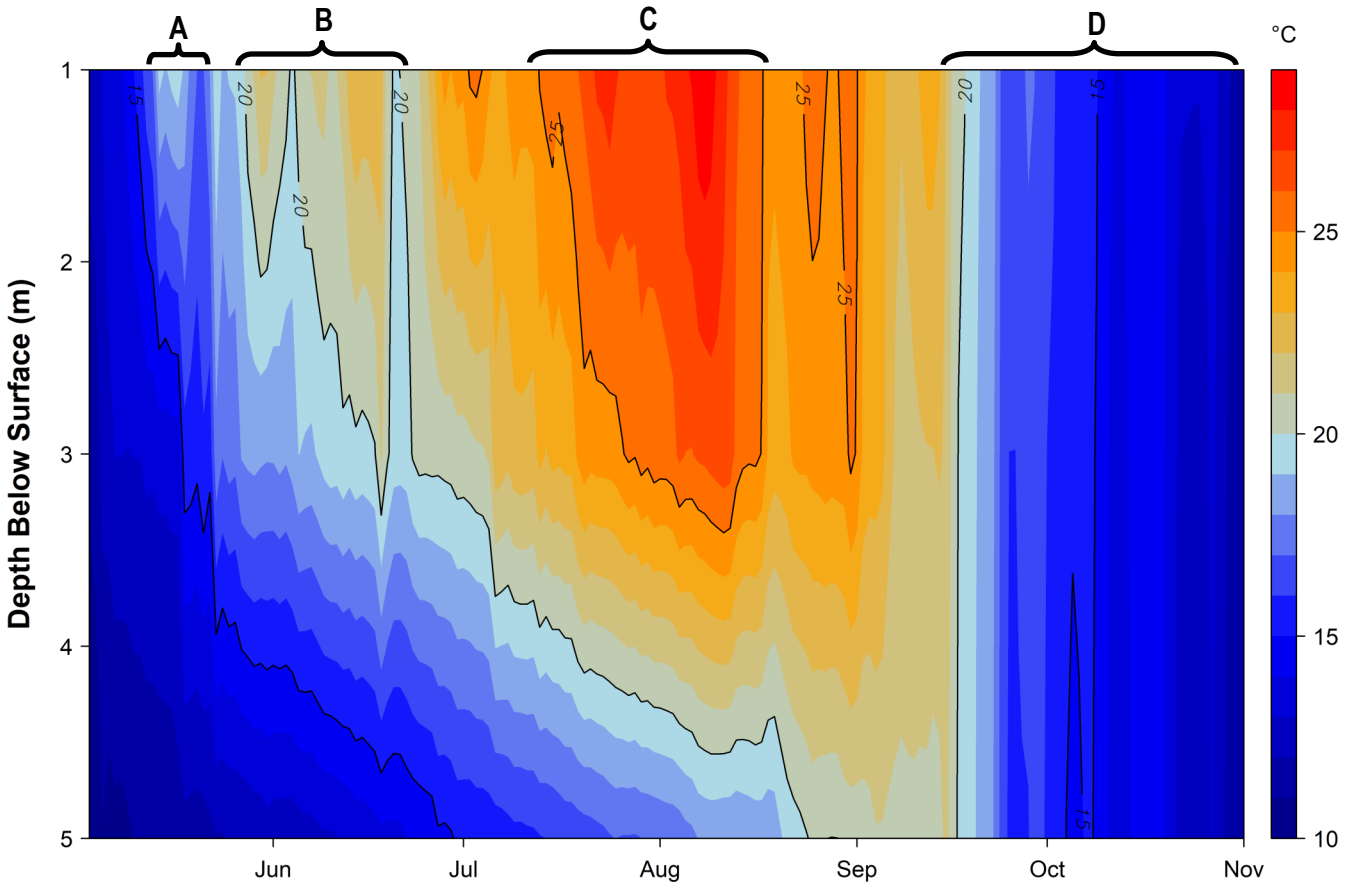
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/3/2022	27.6 / 81.7	After Retrieval	11/1/2022

Moose Pond (North Basin)

The water column of Moose Pond's north basin was not stratified when sensors were deployed in early May. By June, the north basin had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. The unusually warm bottom waters seen in mid-August through September could allow for nutrient-rich bottom waters to mix with upper waters. This could provide algae with an additional food source. The north basin's shallower waters began to cool in early mid-August and were sufficiently cooled to allow full mixing by mid-September.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases in July, peaks on August 8 (28.8°C/ 83.8°F), and stays warm through mid-August.
D. Stratification broke down in mid-September, resulting in uniform temperatures throughout the water column.



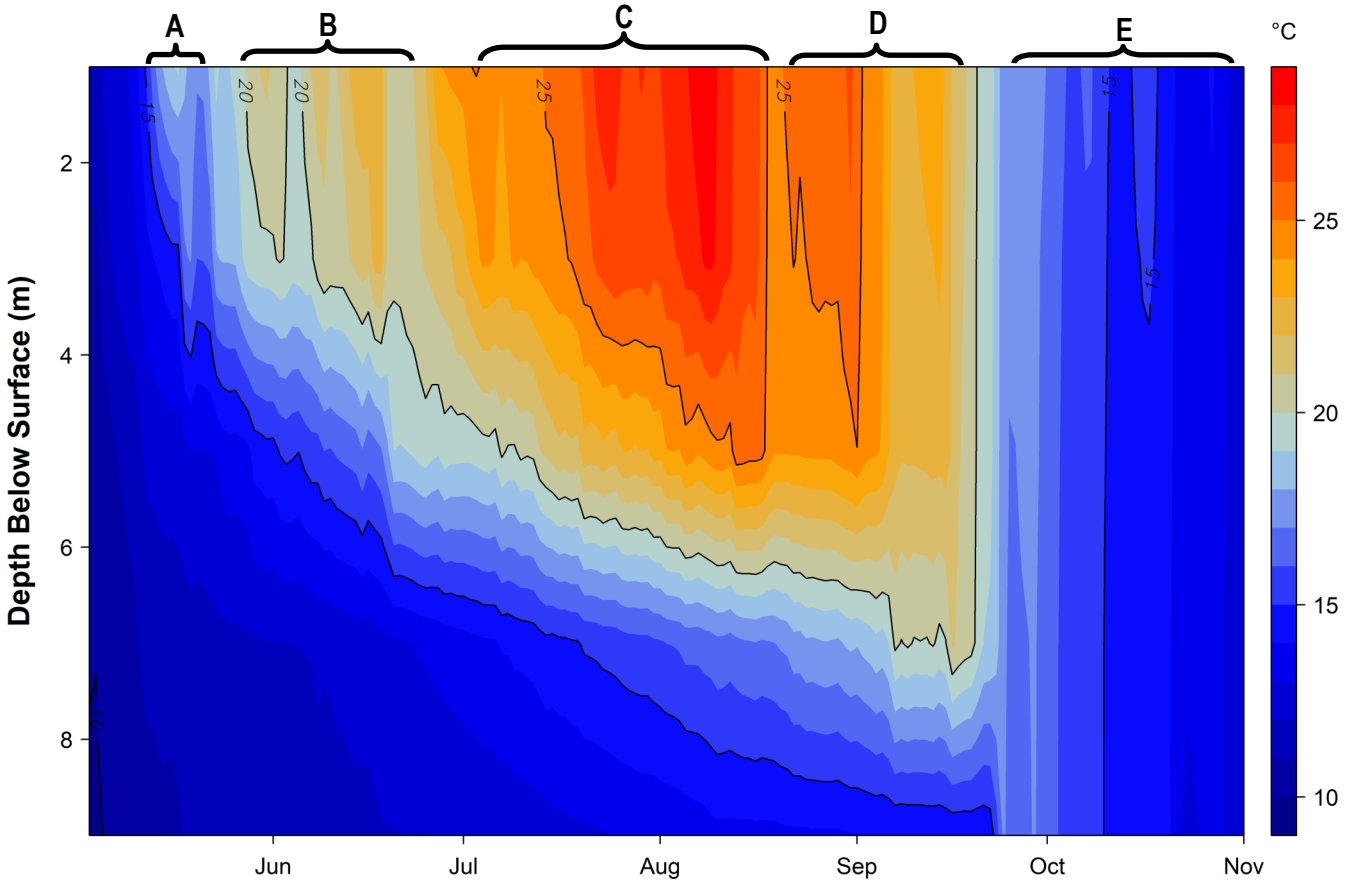
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/3/2022	28.8 / 83.8	9/16/2022	11/1/2022

Moose Pond (South Basin)

The water column of Moose Pond's south basin was weakly stratified when sensors were deployed in early May. By June, the south basin had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in the south basin's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. The south basin's shallower waters began to cool in mid-August and by mid-September were sufficiently cooled to allow full mixing.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases in mid-July, peaks on August 8 (28.8°C/ 83.9°F), and stays warm through early September.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. Temperatures throughout the water column are sufficiently uniform to facilitate full mixing.



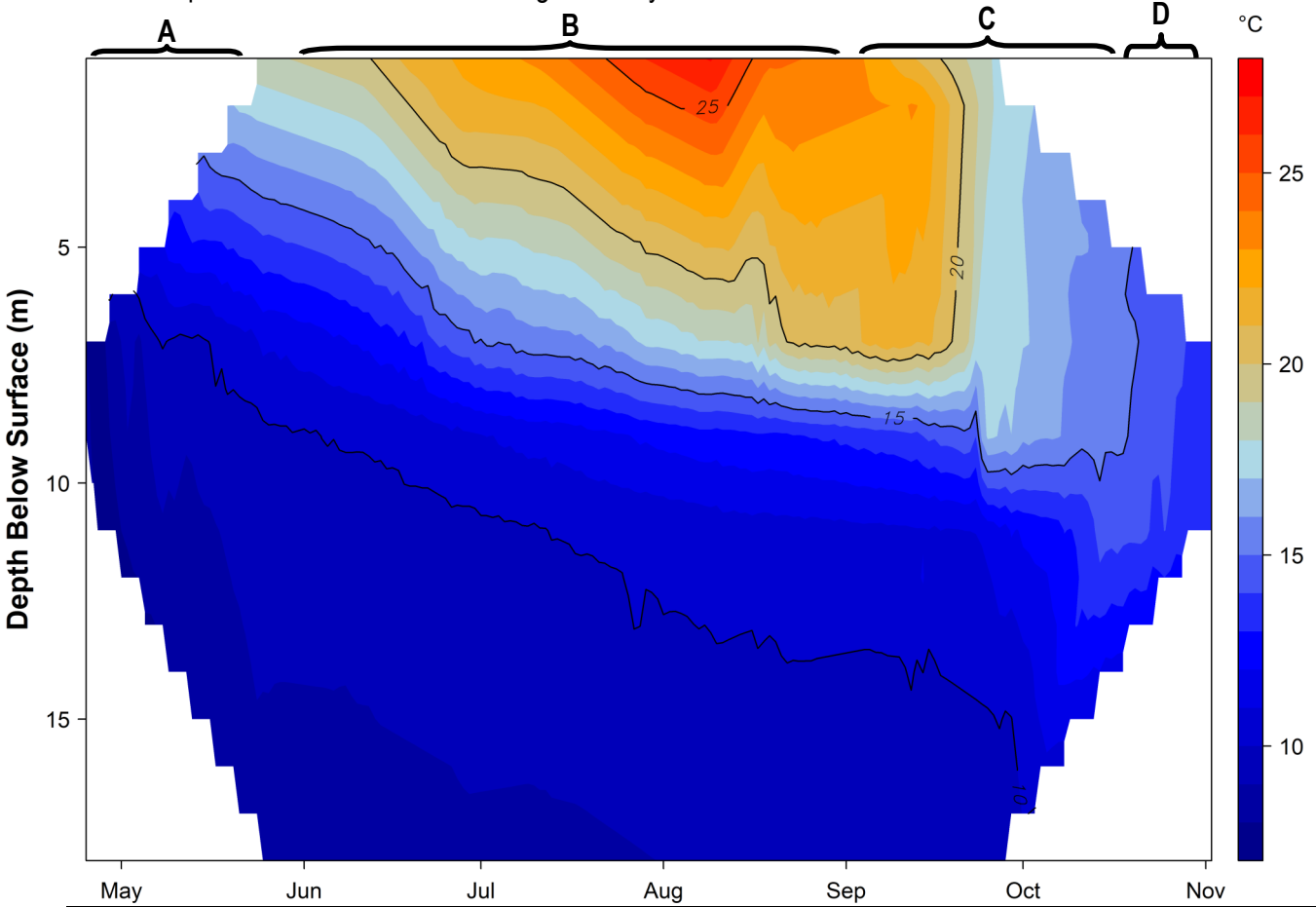
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/3/2022	28.8 / 83.9	9/25/2022	11/1/2022

Peabody Pond

Several temperature sensors malfunctioned this season. The following data analysis relies on both working sensors and regular water monitoring data to characterize Peabody Pond's 2022 temperature profiles. The water column of Peabody Pond was stratified when sensors were deployed on May 15. In June, surface water temperatures began a steady increase, which continued through mid-August. During the summer months, little temperature change was seen in Peabody Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Peabody Pond's shallower waters began to cool in August. Full mixing had not yet occurred when sensors were retrieved on November 2.

The following events can be seen in the graph below:

A. May and June data show early season warm periods, followed by cool periods.
B. Surface water temperature increases steadily from mid-June through August, with peak temperature occurring on August 10 (27.0°C/ 80.6°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



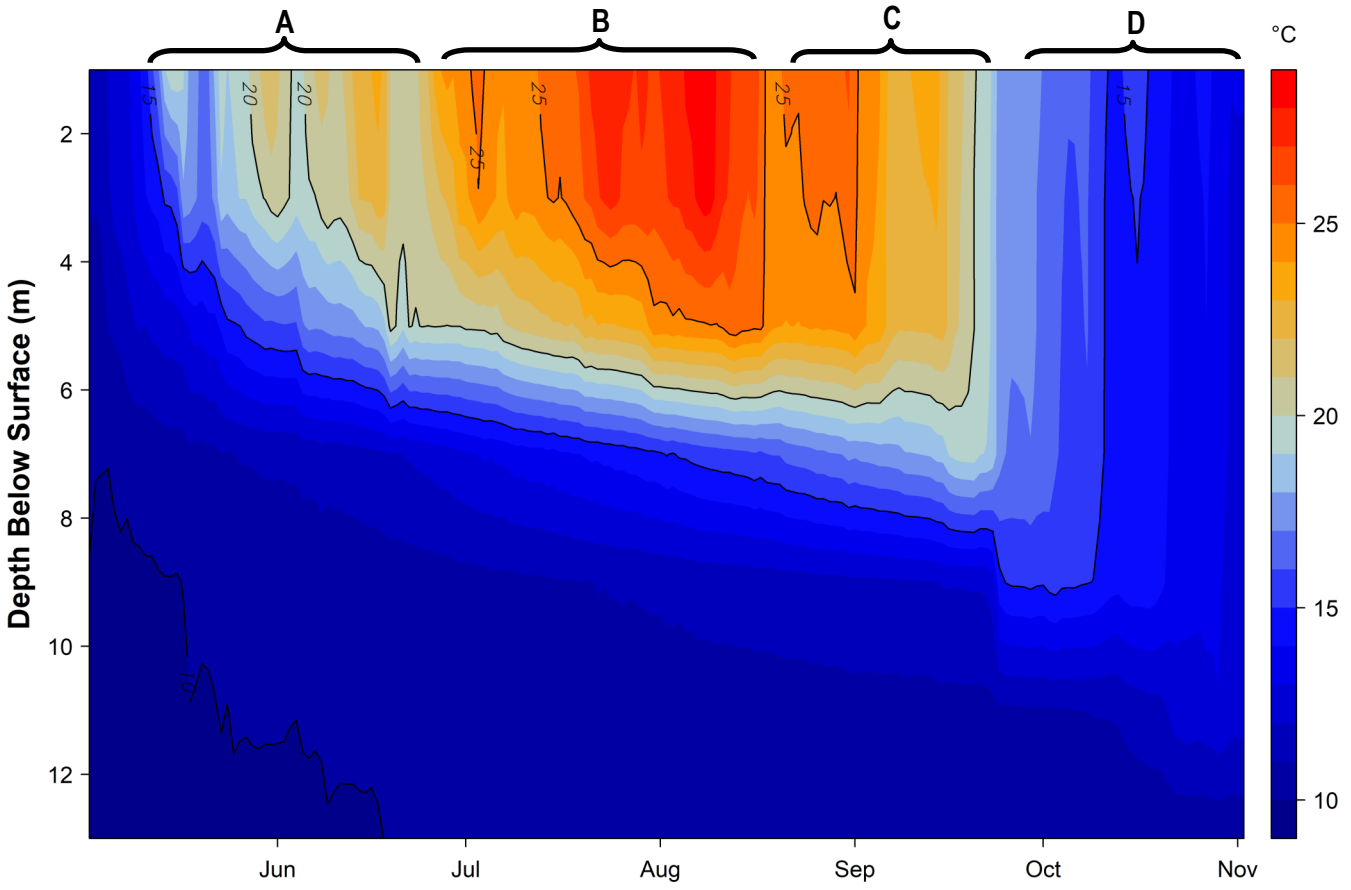
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/2/2022	27.0 / 80.6	Unknown	11/2/2022

Sand Pond

The water column of Sand Pond was weakly stratified when sensors were deployed in early May. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in Sand Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Sand Pond's shallower waters began to cool in mid -August through October. Full mixing had not yet occurred when sensors were retrieved in early November.

The following events can be seen in the graph below:

A. May and June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases in July, reaches a peak on August 8 (28.9°C/ 82.9°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



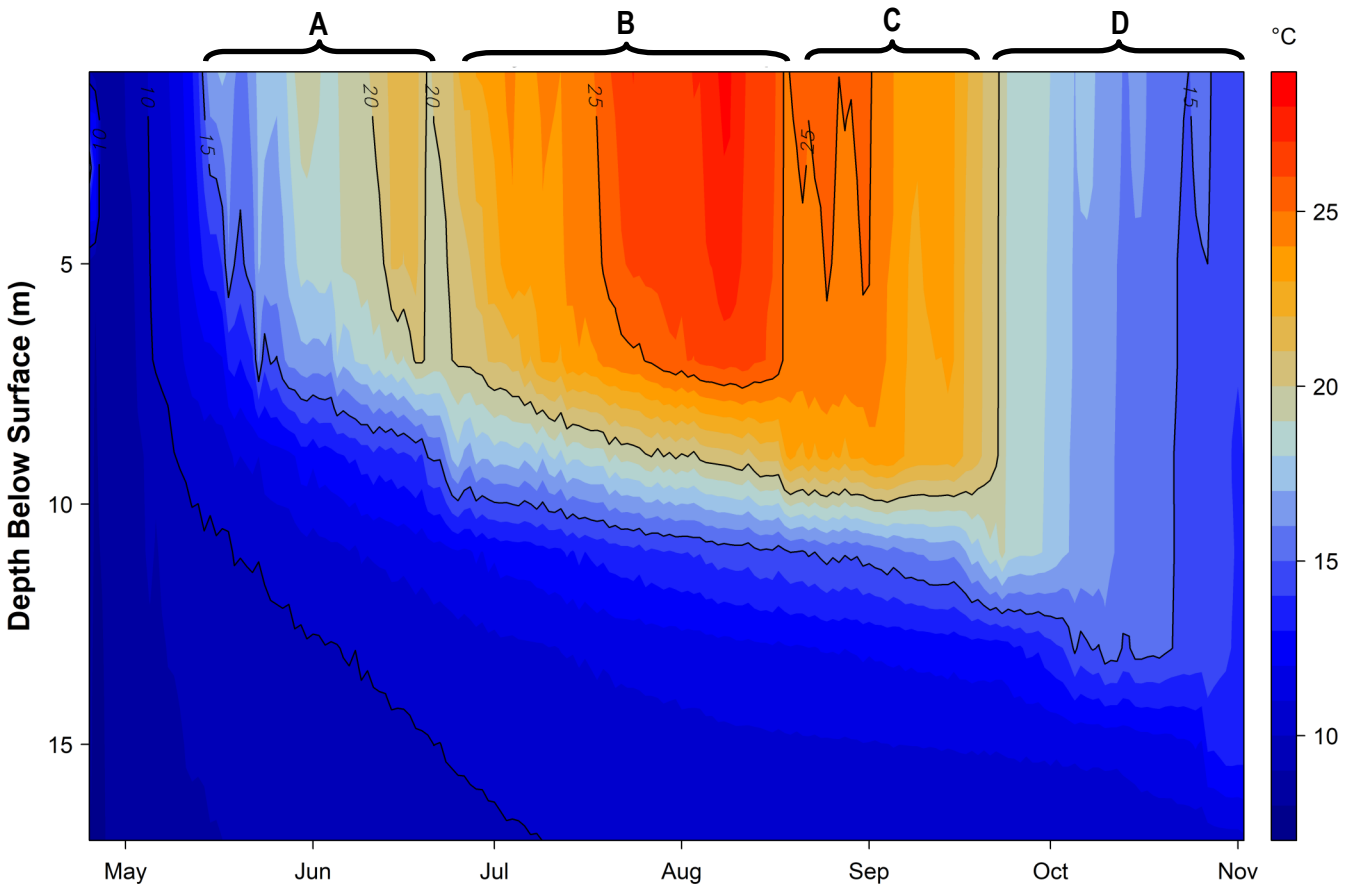
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
5/2/2022	28.9 / 82.9	After Retrieval	11/2/2022

Trickey Pond

The water column of Trickey Pond was not yet stratified when sensors were deployed in late April. By June, Trickey Pond had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. During the summer months, little temperature change was seen in Trickey Pond's deep waters, creating large temperature differences between shallow and deep waters. This large temperature difference limits cooler, nutrient-rich deep waters from mixing with warmer surface waters. When these two layers mix, it provides algae with an additional food source. Please note that the watershed can still contribute phosphorus to the lake, regardless of stratification. Trickey Pond's shallower waters began to cool in mid-August through October. Full mixing had not yet occurred when sensors were retrieved in early November.

The following events can be seen in the graph below:

A. May and June data show two surface water temperature increases, followed by cooling periods.
B. Surface water temperature increases in July, peaks on August 8 (28.3°C/ 82.9°F), and stays warm through mid-August.
C. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
D. Temperatures throughout the water column are becoming more uniform, but temperature differences in the deep waters indicate that full mixing has not yet occurred.



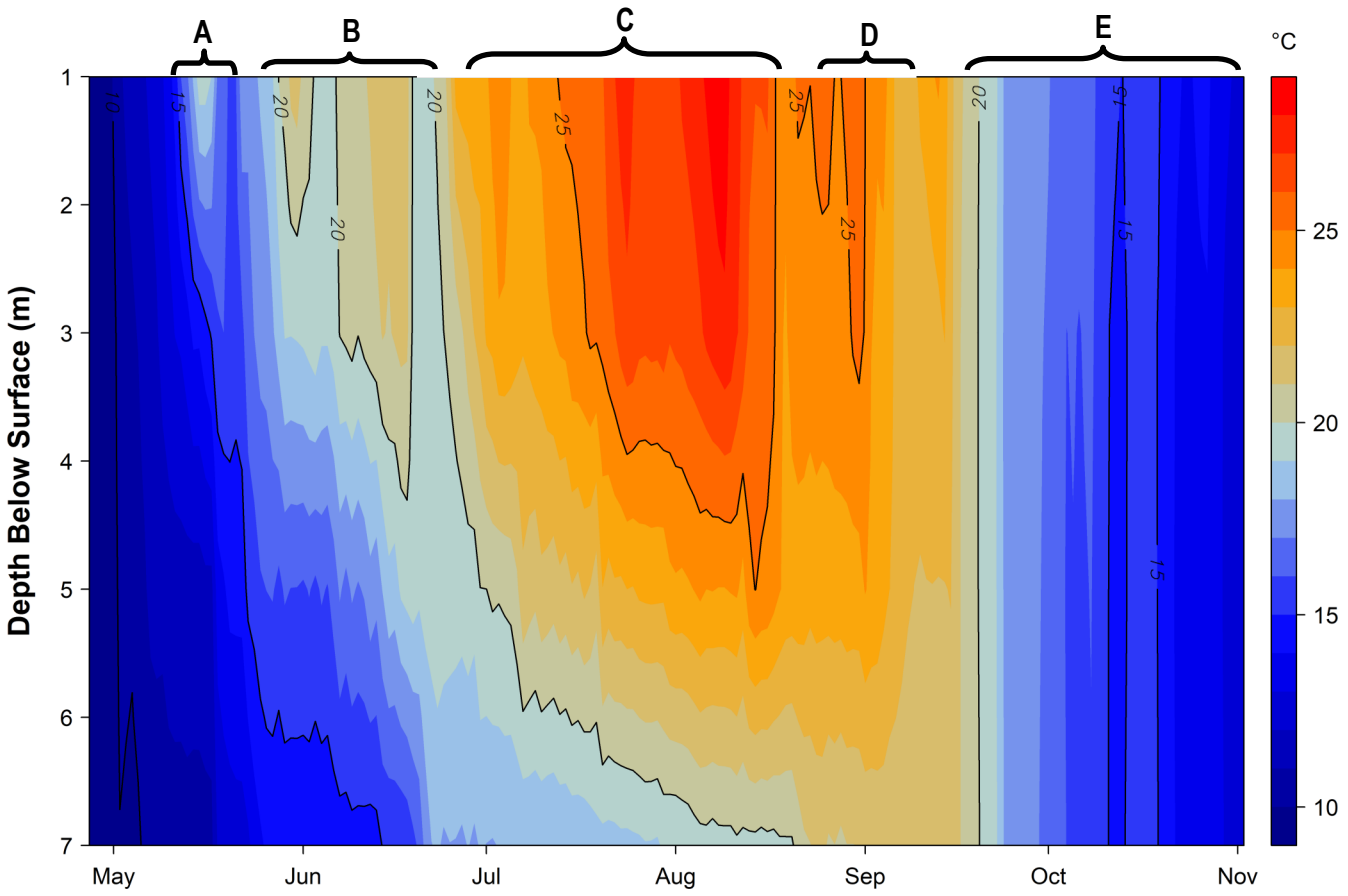
Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
4/25/2022	28.3 / 82.9	After Retrieval	11/2/2022

Woods Pond

The water column of Woods Pond was not yet stratified when sensors were deployed in late April. By June, Woods Pond had stratified into distinct layers. Surface water temperatures increased in June and had two distinct warming periods, followed by cooling periods before steadily increasing from July through mid-August. The thermocline was pushed down to the bottom of the pond in September, which could allow for nutrient-rich bottom waters to mix with upper waters during the algae growing season. By the middle of September, the water column had fully mixed.

The following events can be seen in the graph below:

A. May data show an early season warm period, followed by a cool period.
B. June data show two surface water temperature increases, followed by cooling periods.
C. Surface water temperature increases in July, peaks on August 8 (28.7 °C/ 83.7°F), and stays warm through mid-August.
D. Shallow waters mix with waters from the middle depths, pushing the thermocline deeper into the water column.
E. The water column is near uniform in temperature and fully mixed.



Deployment Date	Peak Temperature (°C/ °F)	Full Mixing	Retrieval Date
4/27/2022	28.7 / 83.7	9/16/2022	11/2/2022