Macrosystems EDDIE:
Using High-Frequency Data to Manage Water Quality

Lofton, M.E., Cooke, R.L., and Carey, C.C. 15 August 2024.

Macrosystems EDDIE: Using High-Frequency Data to Manage Water Quality.

Macrosystems EDDIE Module 9, Version 1.

https://serc.carleton.edu/dev/eddie/teaching_materials/modules/module9.html

Module development supported by NSF EF-2318861.

Macrosystems EDDIE

Environmental Data-Driven Inquiry & Exploration in Macrosystems Ecology

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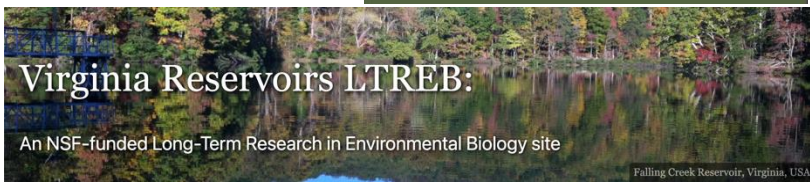
SERC the Science Education Resource Center at Carleton College



Overview of today

- Introduce concepts related to assessing water quality and collecting high-frequency water quality data
- **Activity A:** Access and explore high-frequency water quality data from a drinking water reservoir in southwest Virginia
- **Activity B:** Use high-frequency water quality data to make water treatment plant operation decisions
- **Activity C:** Make water treatment decisions using water quality forecasts

Our focal question for today:

How can we use high-frequency data to improve water quality?

What is water quality?

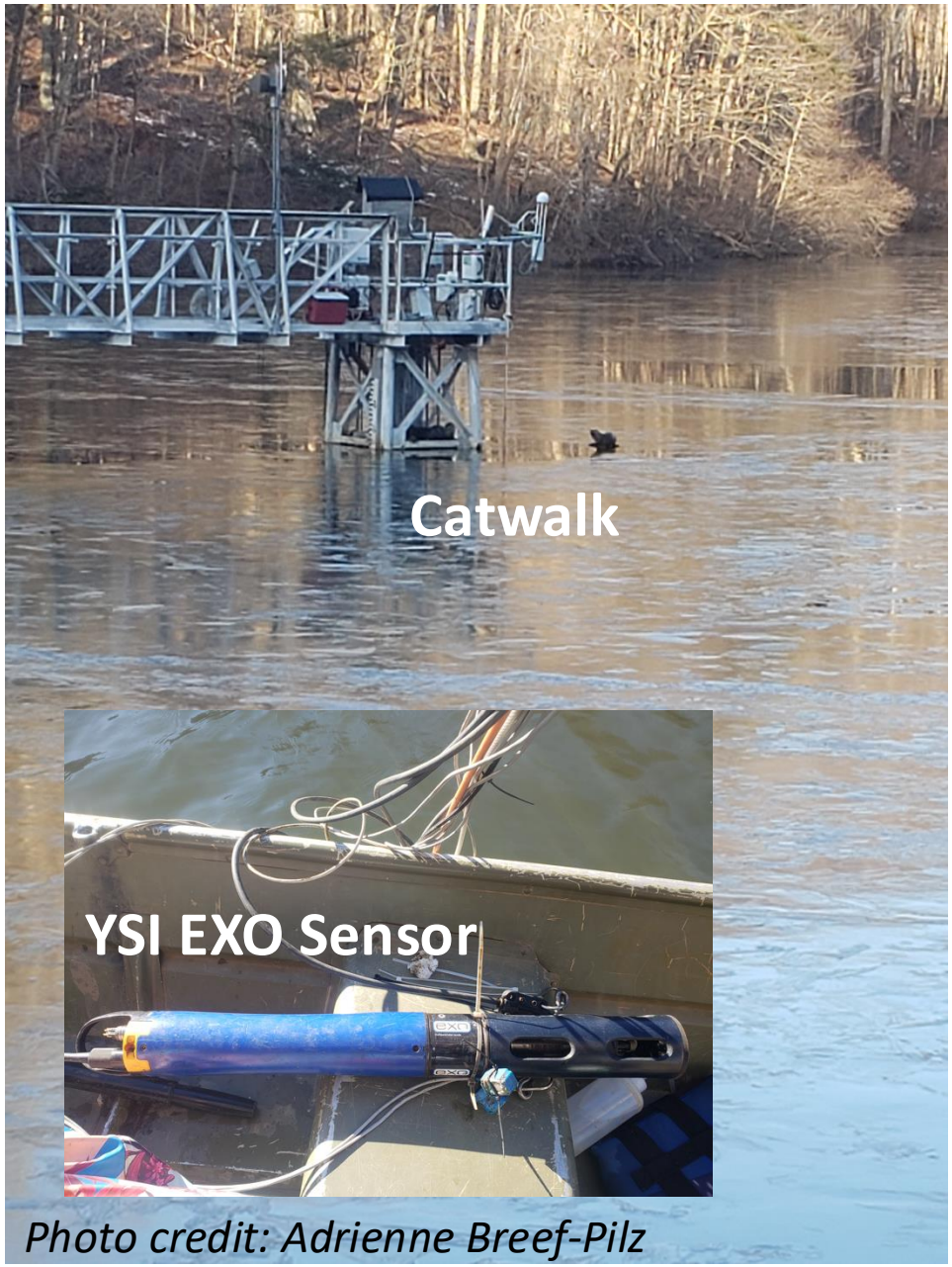
- Suitability of water for human use
  - drinking water
  - swimming
- Ability to support important ecosystem processes
  - sustaining a fish population

What are high-frequency water quality data?

- Measurements taken many times per day or week (for example, every 10 minutes or every day)
- Allows managers and scientists to see patterns that were not observable using low-frequency (for example, once a week or once a month) data

How are high-frequency data collected?

- Automated sensors
  - Attached to buoy, catwalk, etc.
  - Collect data continuously
- Streaming data
  - Data automatically transmitted
  - Allows access to real-time data from the reservoir



Today…

We are going to explore **high-frequency water quality data** from **drinking water reservoirs in southwest Virginia**, and then use that data to make **water treatment plant operation decisions**.

Some of our high-frequency water quality data is collected using a YSI EXO sensor deployed from a catwalk in a drinking water reservoir.

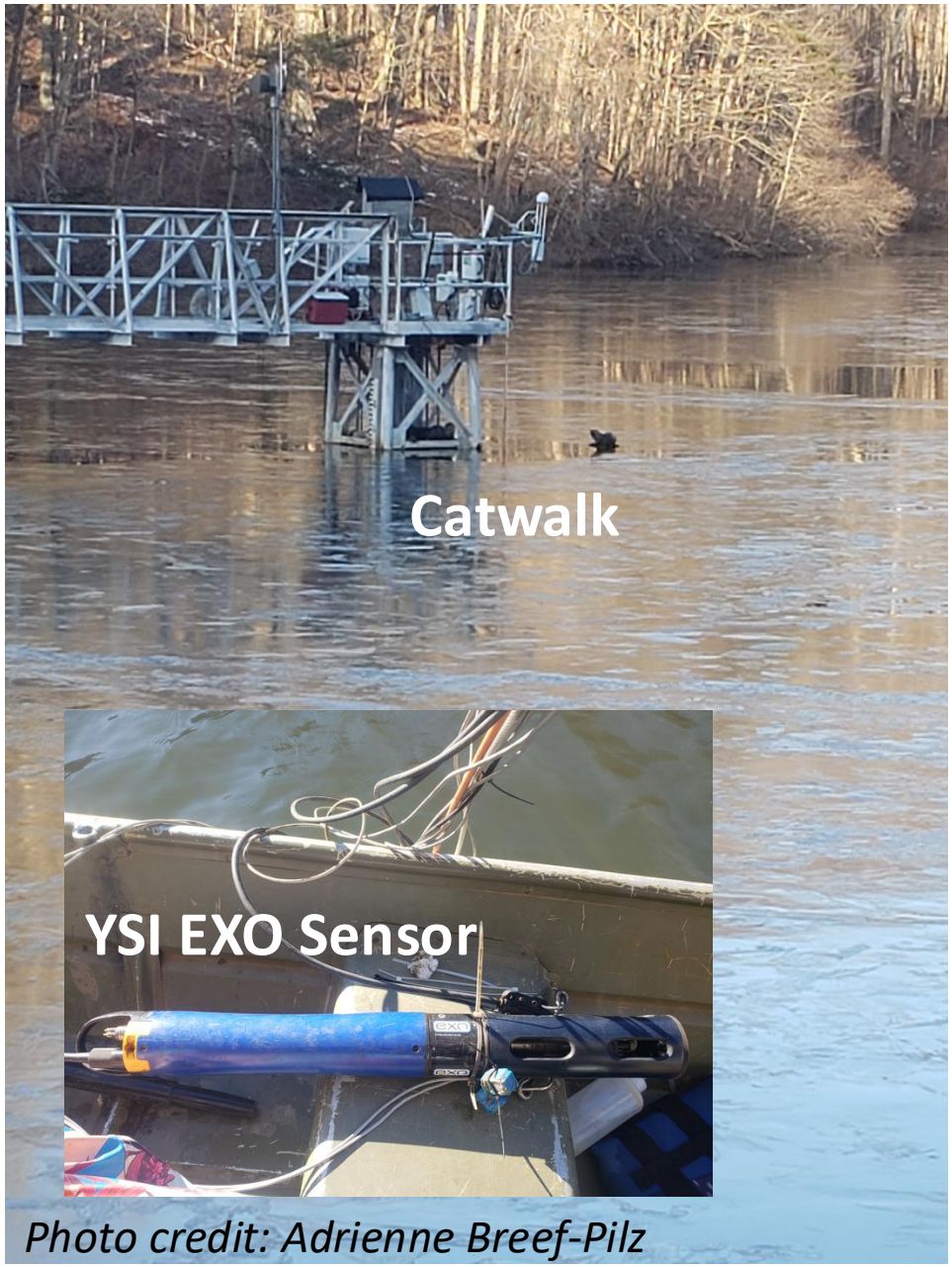


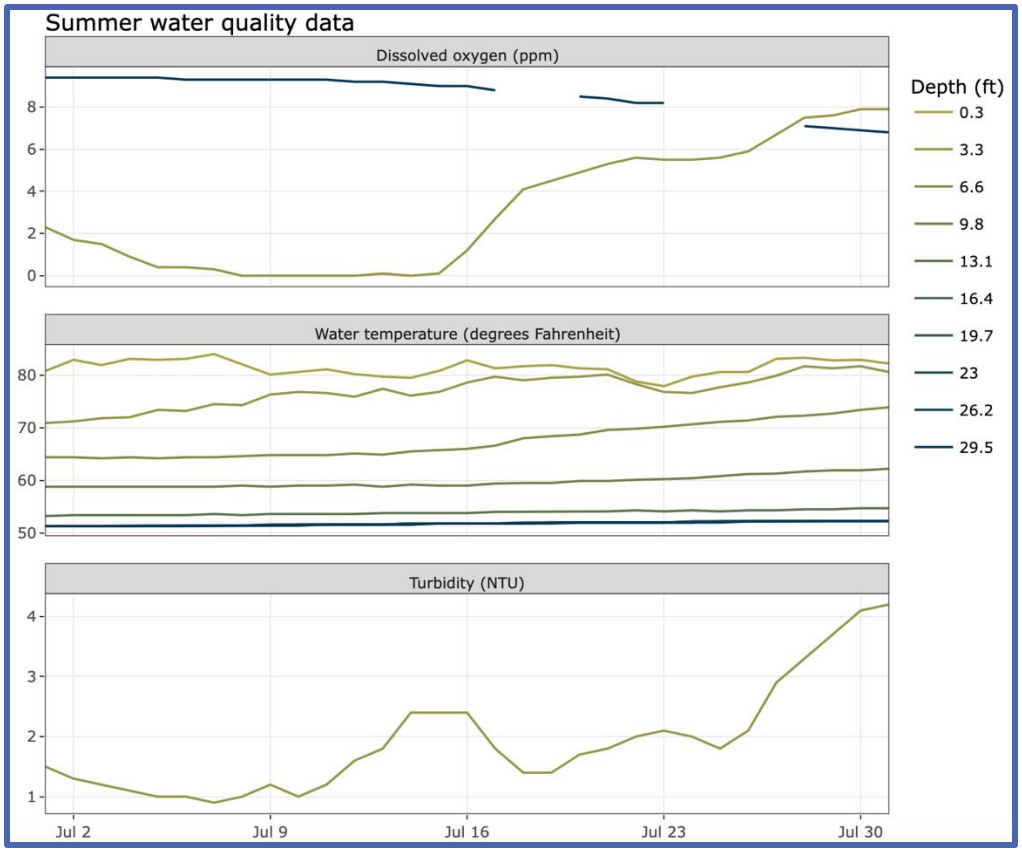
Photo credit: Adrienne Breef-Pilz

Today…

We are going to explore **high-frequency water quality data** from **drinking water reservoirs in southwest Virginia**, and then use that data to make **water treatment plant operation decisions**.

We will explore the following variables:

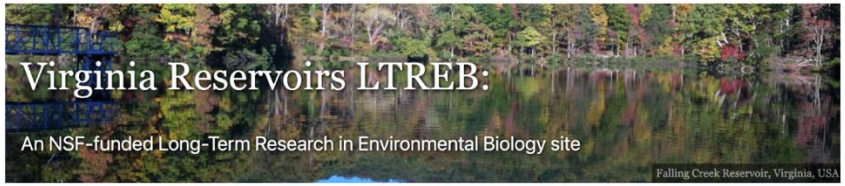
- Water temperature
- Dissolved oxygen (DO)
- Turbidity



Today…

We are going to explore **high-frequency water quality data** from **drinking water reservoirs in southwest Virginia**, and then use that data to make **water treatment plant operation decisions**.

We will explore data from Falling Creek Reservoir and Beaverdam Reservoir in Vinton, VA.



WESTERN VIRGINIA WATER AUTHORITY

Map of Virginia Reservoir LTREB sites

Today…

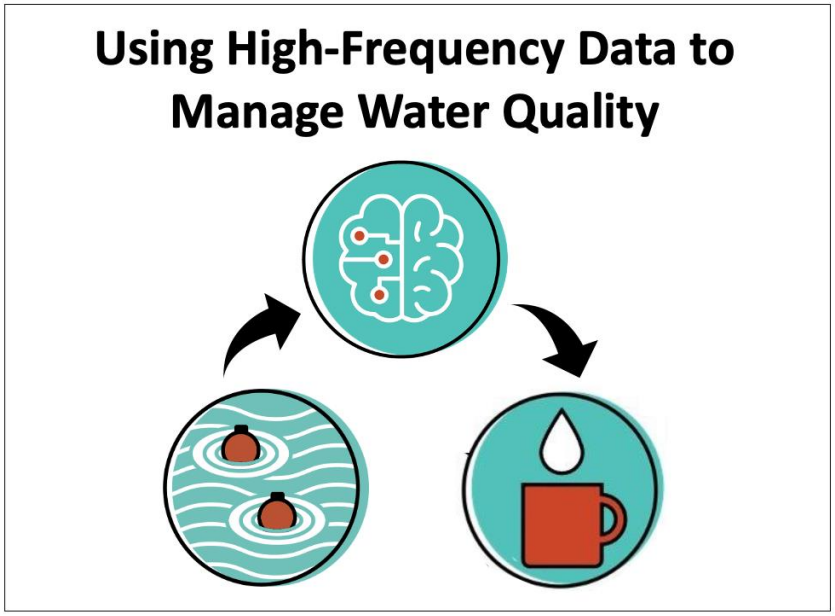
We are going to explore **high-frequency water quality data** from **drinking water reservoirs in southwest Virginia**, and then use that data to make **water treatment plant operation decisions**.

We will use high-frequency water quality data to inform decisions about **water withdrawal depth** and **water treatment.**

Spring Hollow Reservoir Treatment Plant
Photo credit: Western Virginia Water Authority

Learning objectives of today's module:

1. Define key measures of surface freshwater quality
2. Explain how water temperature changes over the course of a year in a temperate reservoir and how these changes affect water quality
3. Interpret high-frequency water quality data to make decisions about water extraction depth for a drinking water reservoir
4. Evaluate water quality data and forecasts to make decisions about drinking water treatment

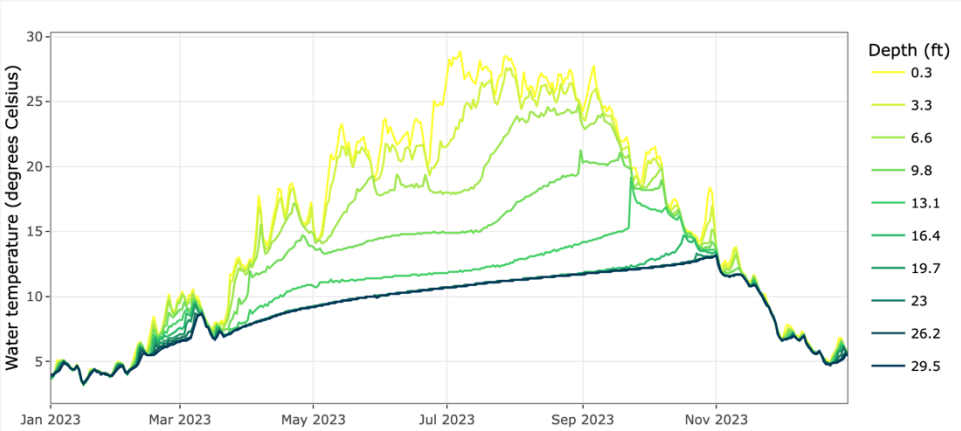


Activity A: Select a site and explore water quality data

Objective 1: Select and learn about a focal drinking water reservoir

Objective 2: Explore real-time high-frequency water quality data from your chosen reservoir

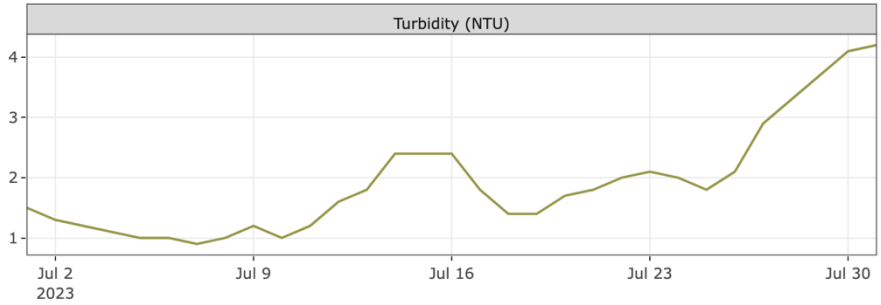
Site photo

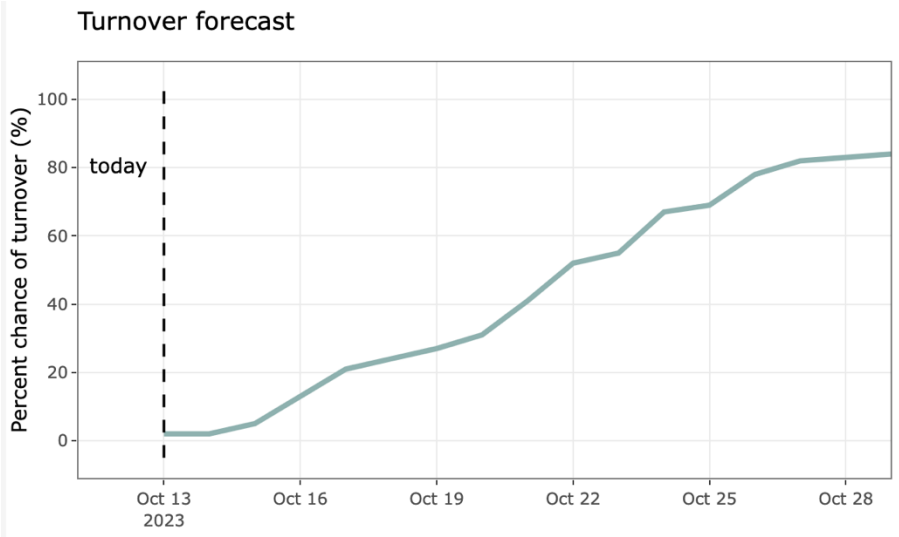


Activity B: Use high-frequency water quality data to make operation decisions

Objective 3: Use high-frequency water quality data to make water withdrawal depth decisions at different times of year

Objective 4: Define water quality forecasting and interpret a fall turnover forecast

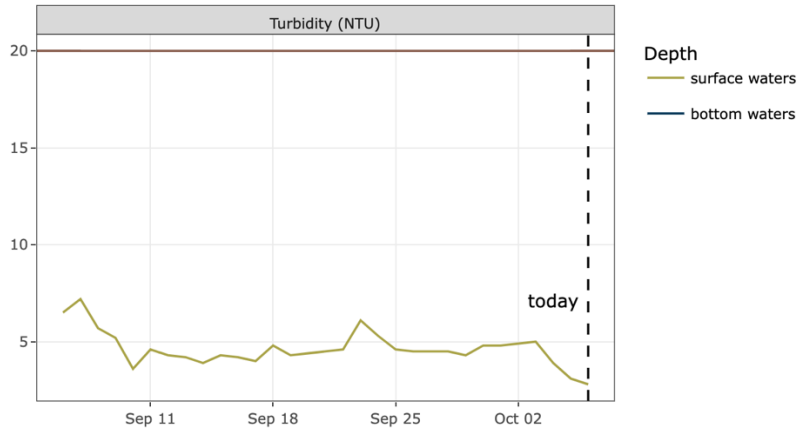


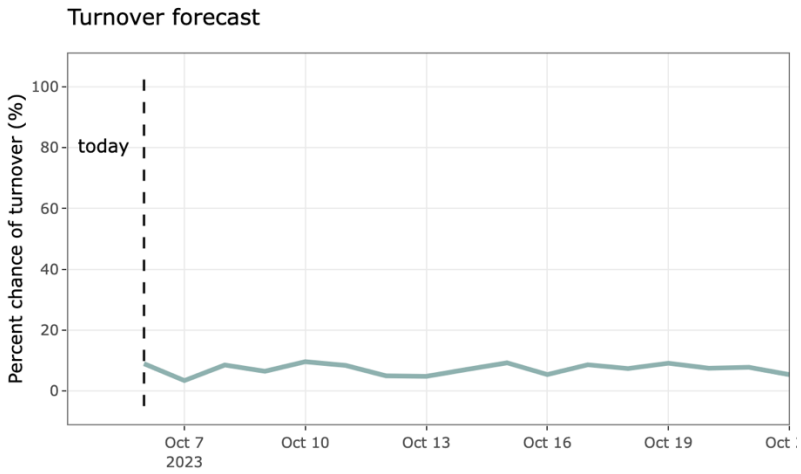


Activity C: Make water treatment decisions using high-frequency water quality data and forecasts

Objective 5: Make water treatment decisions using water quality data forecasts

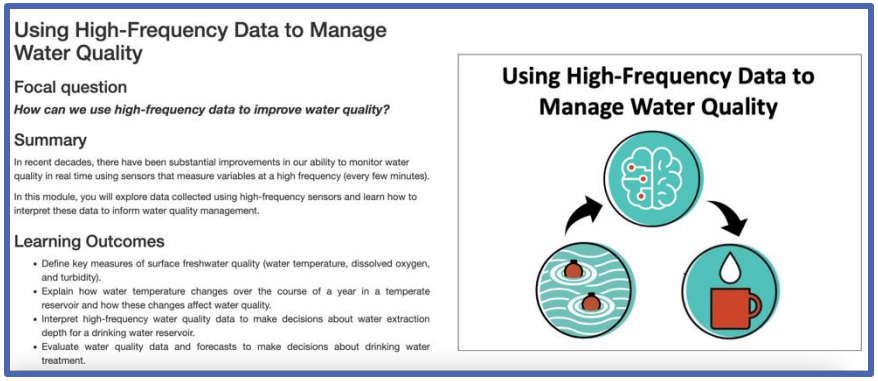
The horizontal line indicates the raw water turbidity threshold of 20 NTU.





Canvas + Shiny App

- The module can be accessed through your course Canvas site
- You will complete module activities in an R Shiny app, which is an interactive website
- Be sure to complete the ”Quick-start” guide to the module and watch the video that explains the interactive module features
- Questions are embedded in the app and you will answer these in a Canvas quiz



Using High-Frequency Data to Manage Water Quality

Focal question

How can we use high-frequency data to improve water quality?

Summary

In recent decades, there have been substantial improvements in our ability to monitor water quality in real time using sensors that measure variables at a high frequency (every few minutes).

In this module, you will explore data collected using high-frequency sensors and learn how to interpret these data to inform water quality management.

Learning Outcomes

- Define key measures of surface freshwater quality (water temperature, dissolved oxygen, and turbidity).
- Explain how water temperature changes over the course of a year in a temperate reservoir and how these changes affect water quality.
- Interpret high-frequency water quality data to make decisions about water extraction depth for a drinking water reservoir.
- Evaluate water quality data and forecasts to make decisions about drinking water treatment.

Using High-Frequency Data to Manage Water Quality

Thank you for participating!

Check out our other water quality & management module:

- **Module 8:** Using Ecological Forecasts to Guide Decision Making

Find out more at:
macrosystemsEDDIE.org

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