

FLUORESCENT DISSOLVED ORGANIC MATTER

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Macrosystems EDDIE: Exploring Tradeoffs in Water Quality Management Using Environmental Data.

Macrosystems EDDIE Module 10, Version 1.

https://serc.carleton.edu/eddie/teaching_materials/modules/module10.html

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SERC the Science Education Resource Center at Carleton College

Virginia Reservoirs LTREB:

An NSF-funded Long-Term Research in Environmental Biology site

Falling Creek Reservoir, Virginia, USA

What is fDOM?

- **fDOM is fluorescent dissolved organic matter**
 - Derived from living things (such as tree leaves or phytoplankton) and contains carbon
 - Is not made of particles, but is dissolved in water
 - If light is transmitted through the water, fDOM molecules will absorb it and emit a different wavelength of light – this is the process of **fluorescence**



*The color in coffee is an example of dissolved organic matter.
Photo credit: Wikipedia*

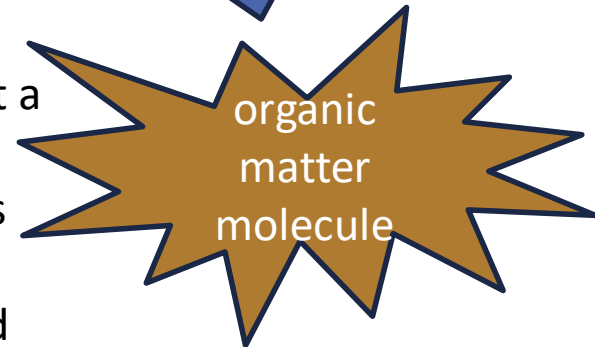
Using fDOM to assess water quality

fDOM sensors measure the amount of **fluorescence** emitted by organic matter

How fluorescence is measured



1. sensor emits light at a specific wavelength into the water, which is absorbed by the organic matter molecule
2. organic matter molecule emits light at a different wavelength (this is **fluorescence**), and the emitted light is measured by the sensor
3. the difference in the light emitted and received by the sensor gives us a metric of the amount of organic matter in the water



Using fDOM to assess water quality

- fDOM is measured in **quinine sulfate units (QSU)**
- **QSU** is an indirect measure that compares the amount of fluorescence emitted by organic matter in water to the amount of fluorescence emitted by a known quantity of quinine sulfate in a laboratory setting
- sensors are calibrated using QSU to ensure consistent readings across sensors and reservoirs
- QSU ranges from



YSI EXO sensor that measures fDOM

Using fDOM to assess water quality

- **Fluorescent dissolved organic matter (fDOM)** is a measurement of naturally-occurring organic matter.
- As we have learned, excessive naturally-occurring organic matter can lead to DBP formation during water treatment
- fDOM does not measure all organic matter, but it can be an indicator of the presence of potential DBP precursors



*Water colored with organic matter
Canning River, Perth, Australia
Photo credit: Mary Lofton*

DBPs are monitored using TOC

- Raw and filtered water are tested once a month for **Total Organic Carbon (TOC)**
- High TOC levels can indicate the presence of DBP precursors which may form DBPs during treatment

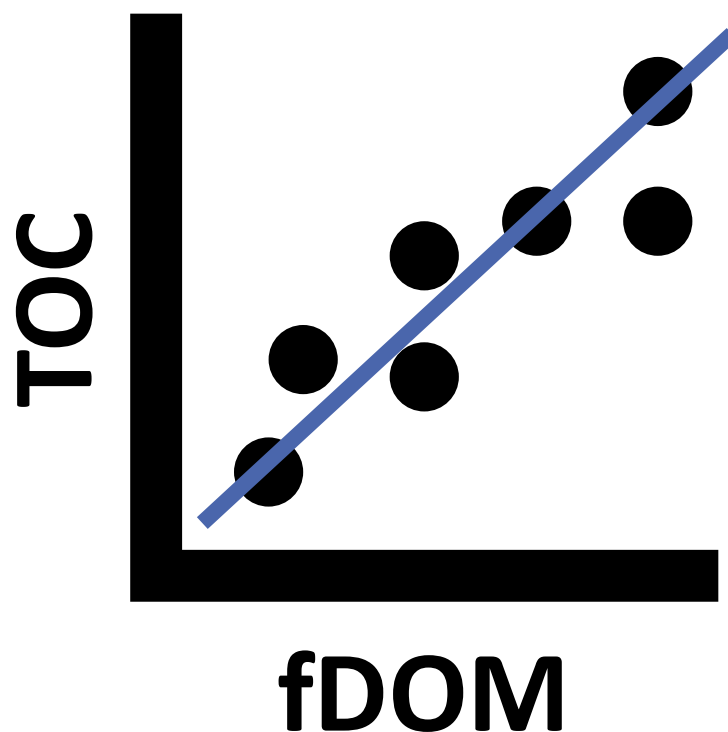


Water samples from Falling Creek Reservoir, Vinton, VA

Photo credit: Bethany Bookout

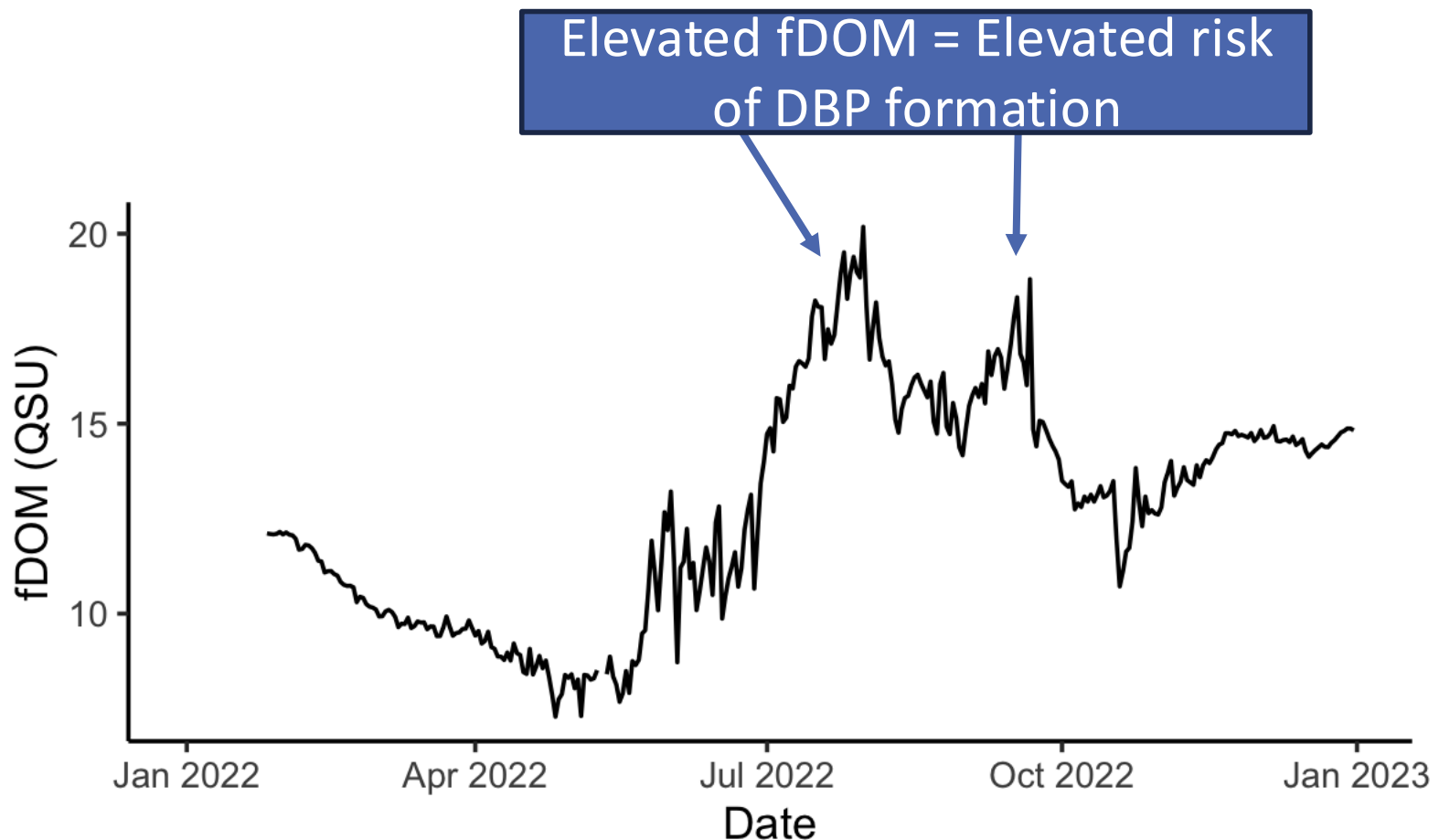
Relating fDOM to total organic carbon (TOC)

- While **fDOM** and **TOC** are not exactly the same, we can use statistics to make a relationship that converts fDOM (in quinine sulfate units) to TOC (in milligrams per liter)
- With this relationship, fDOM data can help us detect the presence of potential DBP precursors and assess DBP formation risk



Using fDOM to assess DBP risk

- A reservoir may be at risk of experiencing water quality degradation due to DBP formation when fDOM is elevated.



End of slideshow – please proceed with module activities!



Exploring tradeoffs in water
quality management using
environmental data

