STEM Education for Middle School Students

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PEARL Internship Program

STEM Education

- Science, Technology, Engineering, Mathematics
- Based off PLankton And Nutrient Studies (PLANS)
  - Classroom and field activities for high school students in **Calvert County**
  - Different demographic and background understanding

Anacostia River Watershed

- 8.5 miles long
- 176 square mile area of land, eastern half of DC and parts of Prince George's County and Montgomery County
- 2012 EPA report shows pollution from E.coli, DDT, turbidity from suspended solids, excess trash and debris, etc. in the Lower Anacostia

Report Source: EPA Waterbody Quality Assessment Report


Montgomery
County, MD
Paint Br.
Little Paint Br.
Northwest Branch
Sligo Creek
Beaverdam Cr.
NE Branch
Potomac
D.C.
Anacostia
Prince George's
County, MD
Virginia
Anacostia Watershed

Matthew Henson Earth Conservation Center

- Washington, DC
- Field trips to supplement classroom lessons
- PEARL classroom visits

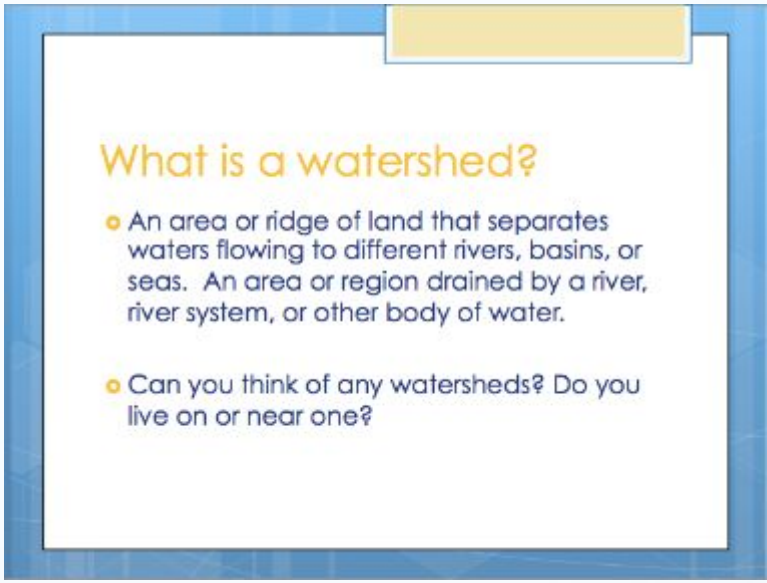

Matthew Henson Center
Washington Navy Yard
Nationals Park
Anacostia River
Anacostia Park, Section D
Anacostia Park, Section C
Buzzard Point
Fort McNair
Fort Leslie J. McNair
Buzzard Point
Anacostia River
Suitland Parkway
Barry Farm
Hillsdale
Frederick Douglass Home
Anacostia Naval Station

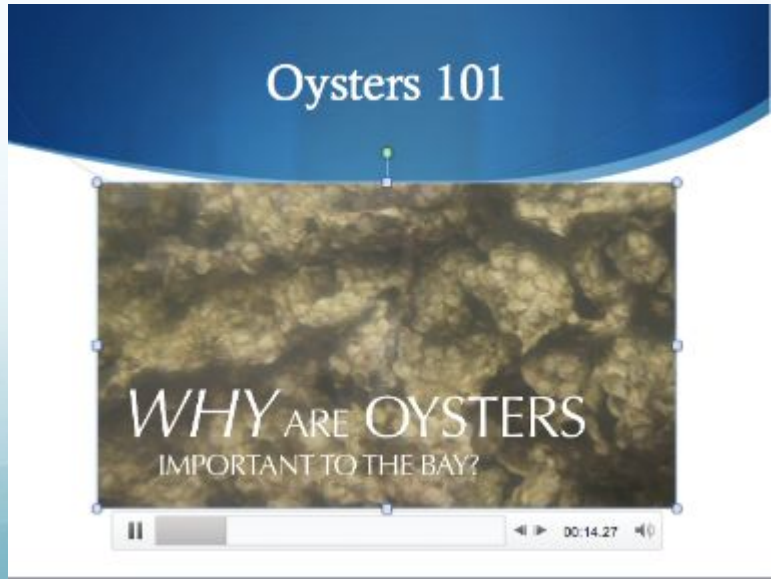
Goals

- Environmental education for urban students
- Connecting students to the environment around them
  - Future stewards of the Anacostia and Chesapeake Bay
- New curriculum for a different population

Product

- Middle school teachers given environmental science curriculum
- Lesson Plans:
  - Watershed education
  - Plankton sampling
  - Oysters and Filter Feeders
  - Nutrient Enrichment
- Plankton ID Sheet
- Plankton Manual
  - Specific to Anacostia (fresh water) species



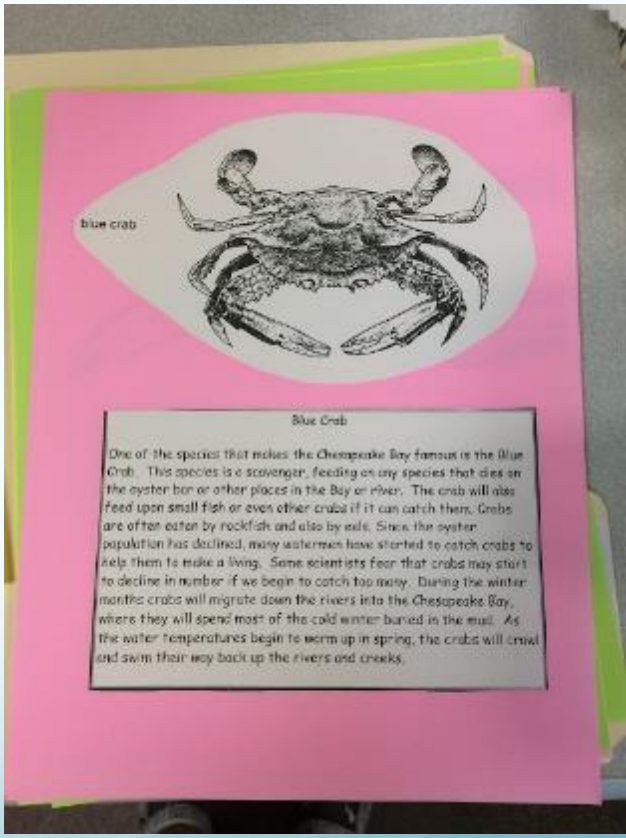


What's Inside

- Four Units
- Introductory PowerPoint
- Student and/or Teacher guides
- Activity guide
- Student worksheet

Watershed Education

- What is a watershed and what is MY watershed?
- Organisms of the Bay and food web activity
- Watershed box activity
- Guide to using Enviroscape model



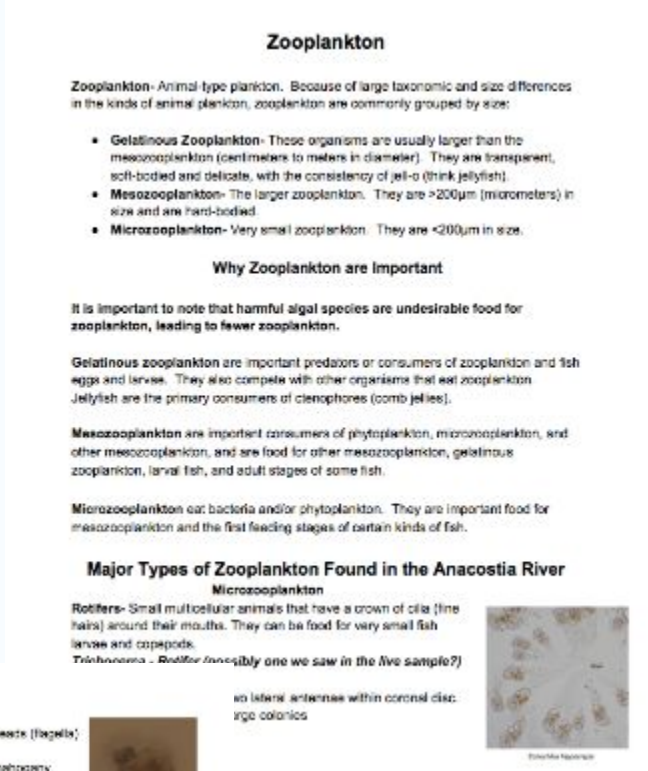
Using the Enviroscape Model

Plankton Sampling

- Concentrated sample from Anacostia
- How to use a microscope
- Identifying plankton
  - Worksheet to guide plankton observations
    - Color?
    - Phyto- or zooplankton?

Plankton Manual

- 2 parts
- Manual
  - 8 pages
  - Vocabulary
  - Descriptions
  - Roles in environment
  - More examples
- ID Sheet
  - 2 pages
  - Images and names



Zooplankton

Zooplankton- Animal-type plankton. Because of large taxonomic and size differences in the kinds of animal plankton, zooplankton are commonly grouped by size:

- **Gelatinous Zooplankton**- These organisms are usually larger than the mesozooplankton (centimeters to meters in diameter). They are transparent, soft-bodied and delicate, with the consistency of jell-o (think jellyfish).
- **Mesozooplankton**- The larger zooplankton. They are >200µm (micrometers) in size and are hard-bodied.
- **Microzooplankton**- Very small zooplankton. They are <200µm in size.

Why Zooplankton are Important

It is important to note that harmful algal species are undesirable food for zooplankton, leading to fewer zooplankton.

Gelatinous zooplankton are important predators or consumers of zooplankton and fish eggs and larvae. They also compete with other organisms that eat zooplankton. Jellyfish are the primary consumers of ctenophores (comb jellies).

Mesozooplankton are important consumers of phytoplankton, microzooplankton, and other mesozooplankton, and are food for other mesozooplankton, gelatinous zooplankton, larval fish, and adult stages of some fish.

Microzooplankton eat bacteria and/or phytoplankton. They are important food for mesozooplankton and the first feeding stages of certain kinds of fish.

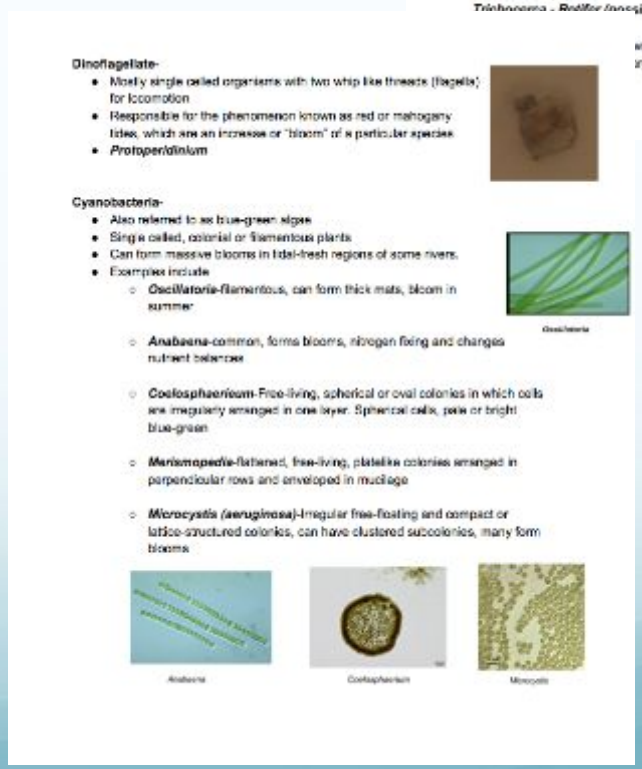
Major Types of Zooplankton Found in the Anacostia River

Microzooplankton

Rotifers- Small multicellular animals that have a crown of cilia (fine hairs) around their mouths. They can be food for very small fish larvae and copepods.

Trichocerca* - *Rotifer (possibly one we saw in the live sample?)

...an lateral antennae within coronal cilia; ...rge colonies



Dinoflagellate-

- Mostly single celled organisms with two whip like threads (flagella) for locomotion
- Responsible for the phenomenon known as red or mahogany tides, which are an increase or "bloom" of a particular species
- ***Protoperidinium***

Cyanobacteria-

- Also referred to as blue-green algae
- Single celled, colonial or filamentous plants
- Can form massive blooms in tidal-fresh regions of some rivers.
- Examples include
  - **Oscillatoria**-filamentous, can form thick mats, bloom in summer
  - **Anabaena**-common, forms blooms, nitrogen fixing and changes nutrient balances
  - **Coelosphaerium**-Free-living, spherical or oval colonies in which cells are irregularly arranged in one layer. Spherical cells, pale or bright blue-green
  - ***Merismopedia***-flattened, free-living, platelike colonies arranged in perpendicular rows and enveloped in mucilage
  - ***Microcystis (aeruginosa)***-Irregular free-floating and compact or lattice-structured colonies, can have clustered subcolonies, many form blooms

Oscillatoria

Anabaena

Coelosphaerium

Microcystis

Plankton ID Sheet

Phytoplankton

Diatoms

Melosira

Leptocylindrus

Skeletonema costatum

Dinoflagellates

Protoperidinium

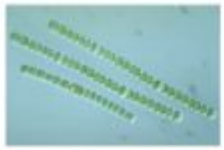
Scenedesmus

Chlorophyta

Pediastrum

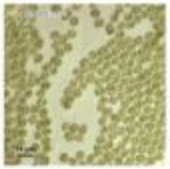
Green Chlorophyte

Cyanobacteria



Anabaena

Coelosphaerium



Microcystis

Zooplankton

Rotifer

Keratella cochlearis

Brachionus

Conochilus hippocrepis

Tintinnids

Tintinnopsis fimbriata

Copepods

Acartia tonsa

Cyclops bicuspidatus

Cladocerans

Daphnia

Diaphanosoma

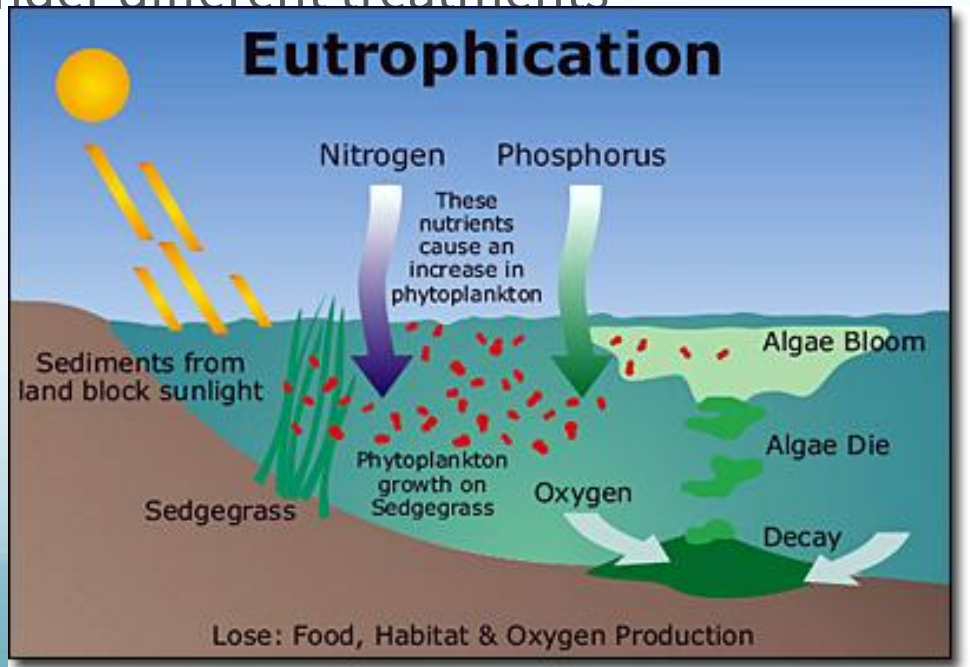
Bosmina longirostris

Oysters and Filter Feeders

- Key species in the Bay
- The Great Filter Feeder Race
  - Oysters only vs. Oysters and Friends
- Aquaculture
- Freshwater Mussel surveying

Nutrient Enrichment

- Introduction to nutrients and eutrophication
- Human and city impacts on nutrient loads
- Model Nutrient Experiment
  - Algae under different treatments



Model Nutrient Experiment

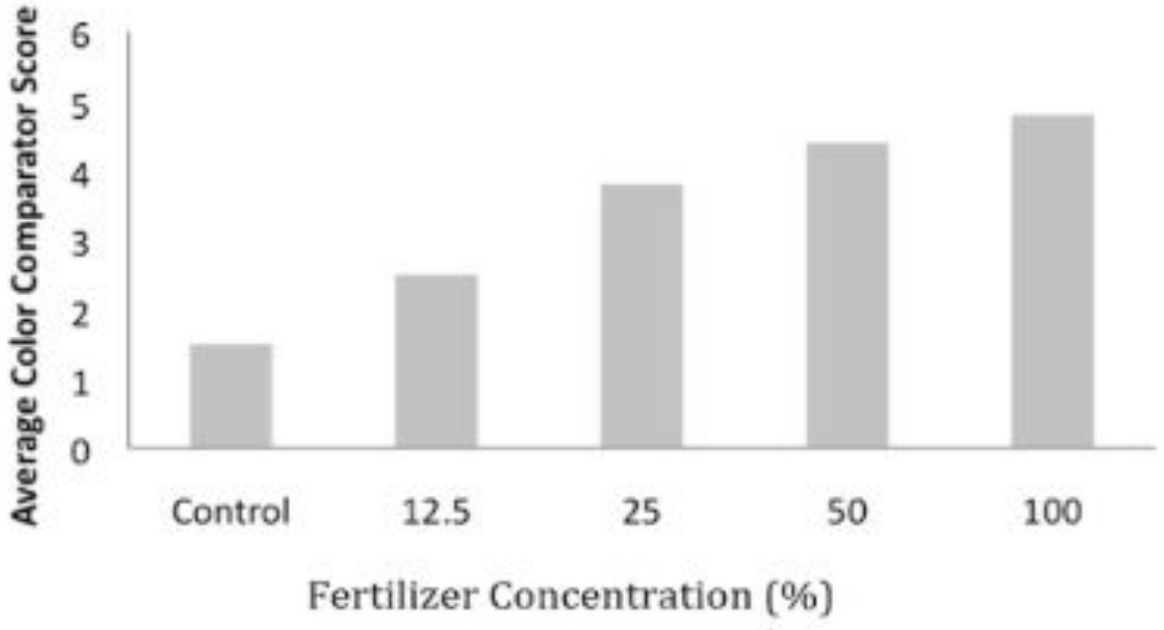
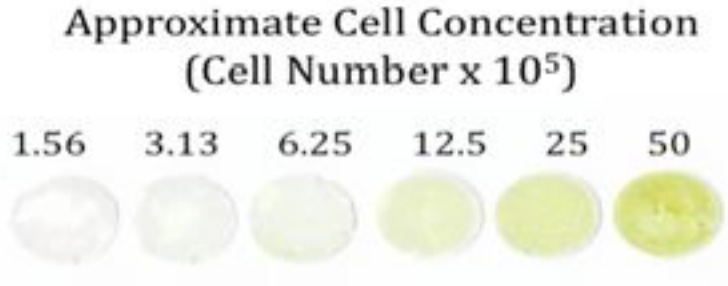
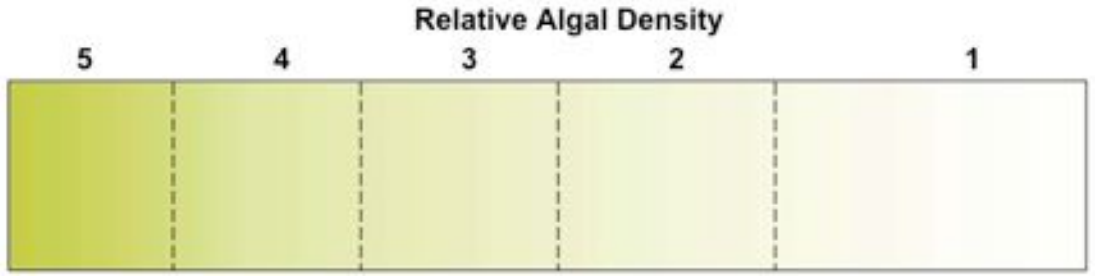


Figure 1. Algal growth response to varying levels of plant fertilizer.





Looking Forward

- Five schools, 2018-2019
- Teacher Workshops
- Collaboration with local nonprofits
- STEAM-Ward 8 Arts & Culture Council
- Environmental education for all

Questions?