Estuary Chesapeake

A parent and teacher led field trip to the

Smithsonian Environmental Research Center

This presentation has two purposes…

Group Training

- For ease of navigation, click this icon,

  Back to Station List

  seen on the bottom of some slides, to go back to the list of the 5 stations

Personal Training

- Click this icon ? to navigate to a slide with more detailed information.

  This information would have been verbalized by a presenter at a group training.

Please use your Estuary Chesapeake Manual to follow along during this presentation

Contents: Click title or icon to jump ahead to that section

Click the at the bottom of each slide to return back to this slide

About SERC

WHAT IS SERC?

- Smithsonian Environmental Research Center (SERC)
- Established in 1965
- Located in Edgewater, Maryland
- Leads the nation in research on linkages of land and water ecosystems in the coastal zone
- Provides society with knowledge to meet critical environmental challenges in the 21st century.

What do SERC Scientists Study?

- Marine and Estuarine Ecology
- Protistan Ecology
- CO_2 and Plant Physiology
- Animal Plant Interaction
- Phytoplankton Ecology
- Microbial Ecology
- Fish and Invertebrate Ecology
- Nutrient Lab
- Quantitative Ecology
- Biogeochemistry
- Photobiology and Solar Radiation
- Benthic Ecology
- Forest Ecology
- Trace Element Biogeochemistry
- Terrestrial Ecology
- Marine Invasion Research
- Ecological Modeling
- Plant Ecology

- Learn more about these SERC labs at our website www.serc.si.edu/research/labs.aspx

Where is SERC?

On the **Rhode River** in Edgewater, MD

Approximately 7 miles south of Annapolis.

Composed of **2,650 acres** of successional and old growth forests, wetlands and **12 miles of shoreline** on the Rhode River.

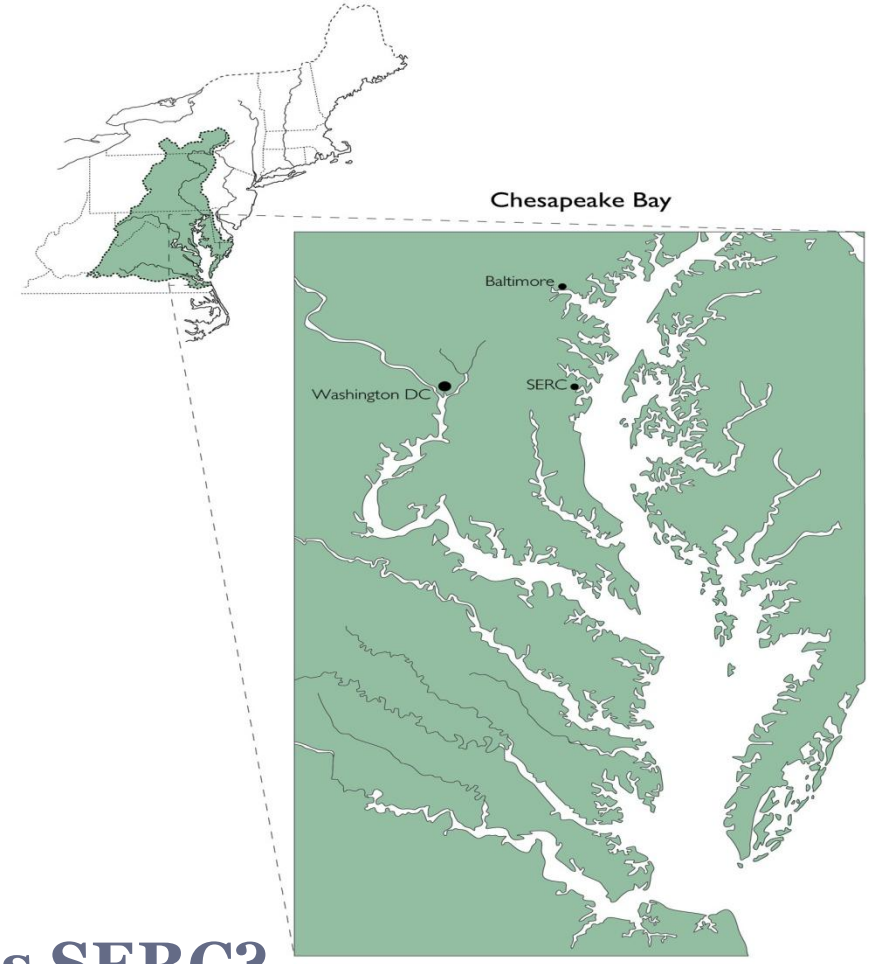
Looking out on the Rhode River and the Chesapeake Bay

SERC's land is part of the Chesapeake Bay Watershed.

The Chesapeake Bay Watershed is an area of 64,000 mi², which includes parts of 6 states:

1. New York
2. Pennsylvania
3. Maryland
4. West Virginia
5. Virginia
6. Delaware

Plus all of Washington D.C.!



Where is SERC?

This map shows where SERC is located in relation to the Chesapeake Bay and its watershed.

When it precipitates, some water:

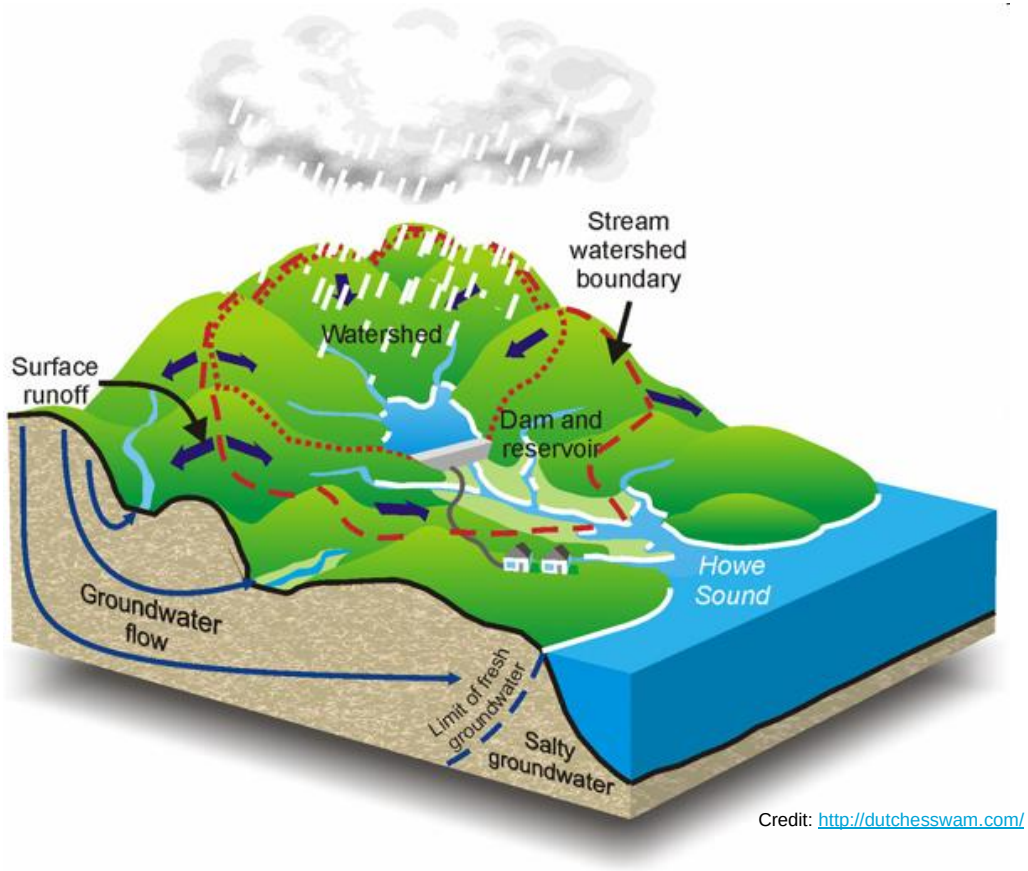
- Flows into and through storm drains.
- Drains directly into creeks, rivers, and estuaries
- Seeps down through the soil and becomes groundwater

All land is part of the watershed for some creek, stream, river or lake.

Everyone in the watershed is connected through the water used for drinking, recreational activities and industries.

What is a Watershed?

The area of land that drains into a specific body of water, like a river, lake, stream, or estuary.



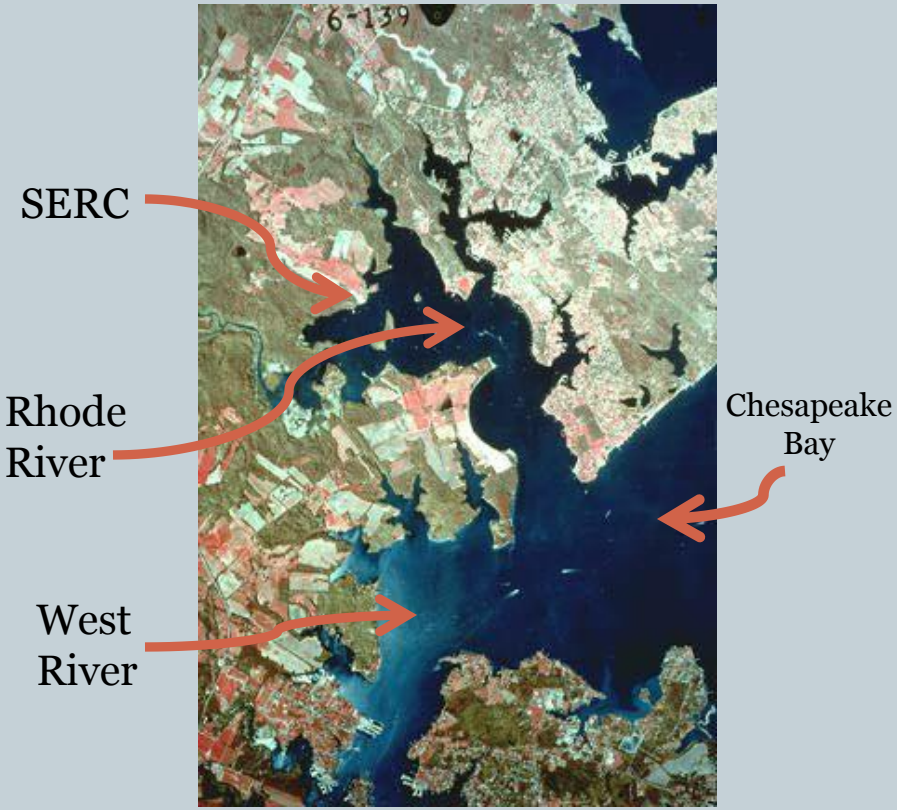
Credit: http://dutchesswam.com/

What is an Estuary?

An estuary is a semi-enclosed body of water where fresh and saltwater mix, and is characterized by:

- Brackish water
- High productivity
  - Abundant organic matter
  - A variety of habitats
  - Diverse animal and plant communities
- Ecosystems like tidal wetlands, shallow mudflats, and submerged aquatic vegetation.

Aerial of the Rhode River



About Estuary Chesapeake

Estuary Chesapeake

Aligned with state content standards for grades 4-6 (adaptable for grades 3-12)

Format for learning is a series of five activity stations in a variety of locations

The class is divided into 5 groups that rotate through all 5 stations.

5 Stations

1. About Crabs
2. Water Testing
3. Oyster Bar Community
4. Investigating Plankton
5. Seining (Going Fishing)

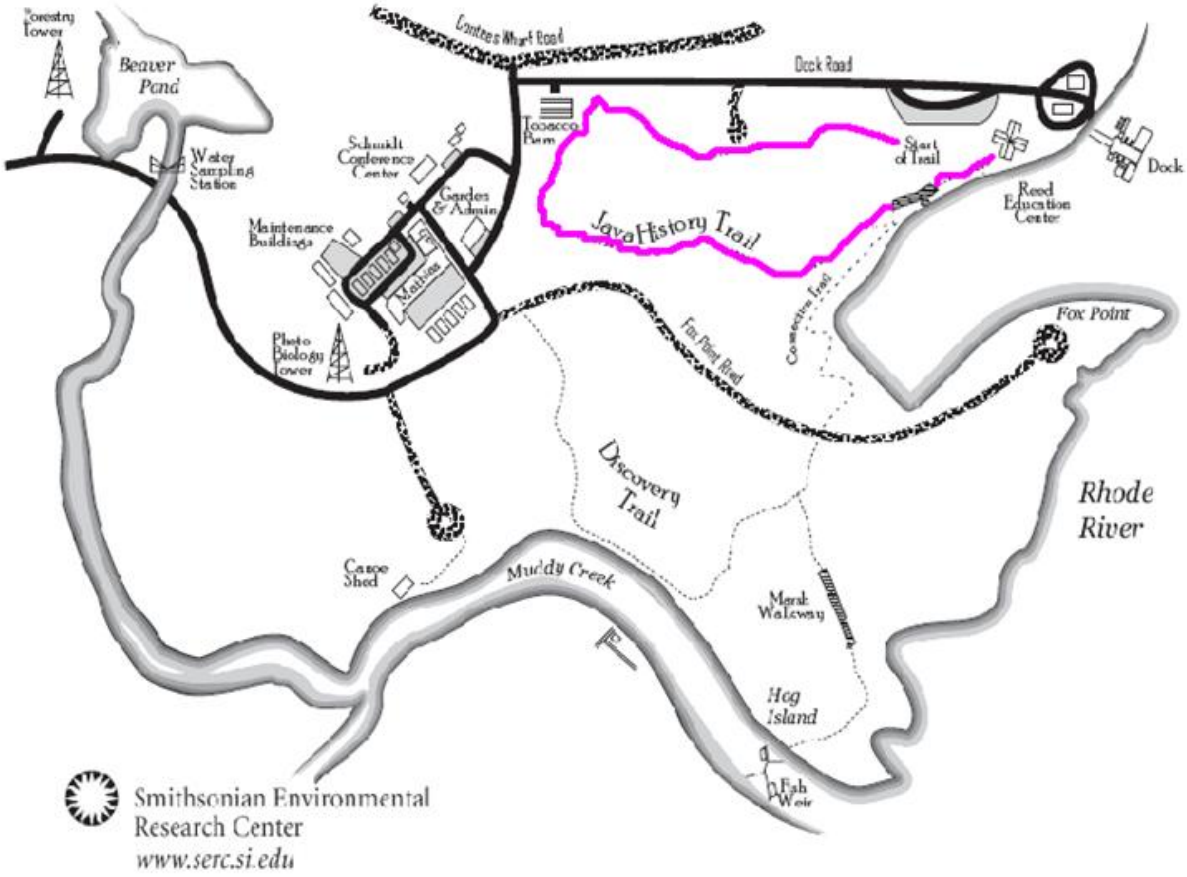
Logistics and Flow

Station Leaders/ Chaperones	SERC Staff/ Volunteers
• Station Leaders become experts on one station • Station Leaders stay at the same station and teach groups of rotating students • Chaperones escort students through transitions (if possible)	• Set up stations before arrival • Provide an updated schedule with times for rotations • Assist with initial rotations • Available to facilitate and assist at all times (including answering questions outside of prepared material)

Logistics and Flow

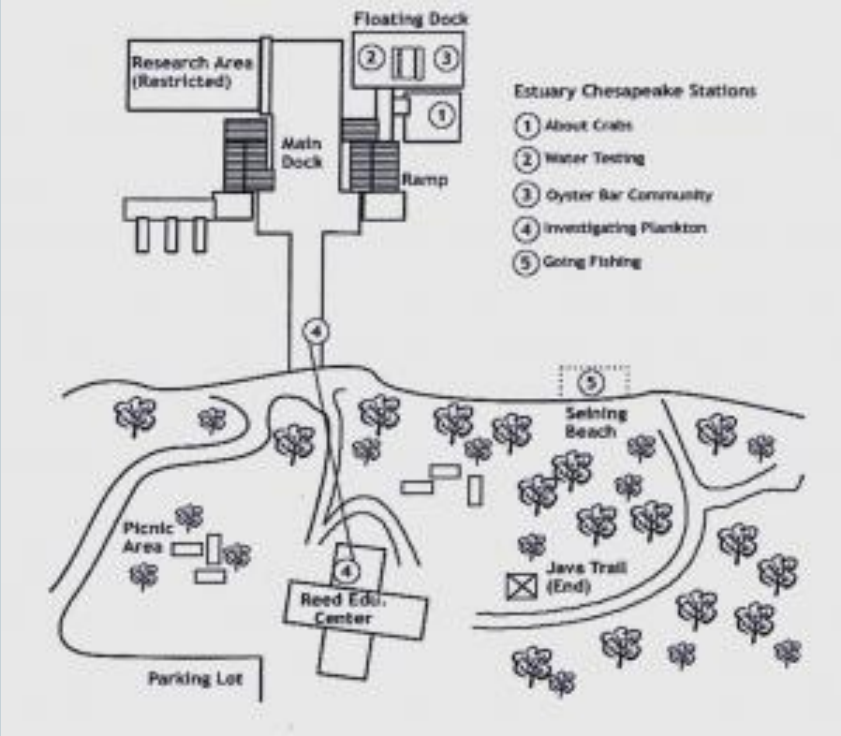
Large groups are split in half

- One group rotates through the 5 Estuary Chesapeake stations
- The other group is involved in activities on the 1.1 mile Java History Trail loop
- After lunch, the groups switch activities.



Logistics and Flow

Station Locations



Sample Schedule

ABC School-Date
9:30-2:15 (53)

GROUP	#1	#2	#3	#4	#5
9:45-10:10	Crabs	Water	Oysters	Plankton	Seining
10:10-10:35	Water	Oysters	Plankton	Seining	Crabs
10:35-11:00	Oysters	Plankton	Seining	Crabs	Water
11:00-11:25	Plankton	Seining	Crabs	Water	Oysters
11:25-11:50	Seining	Crabs	Water	Oysters	Plankton
12:00-2:00	----------Lunch and hike----------				

	#6	#7	#8	#9	#10
9:45-11:45	----------Hike and Lunch----------				
12:00-12:25	Crabs	Water	Oysters	Plankton	Seining
12:25-12:50	Water	Oysters	Plankton	Seining	Crabs
12:50-1:15	Oysters	Plankton	Seining	Crabs	Water
1:15-1:40	Plankton	Seining	Crabs	Water	Oysters
1:40-2:05	Seining	Crabs	Water	Oysters	Plankton

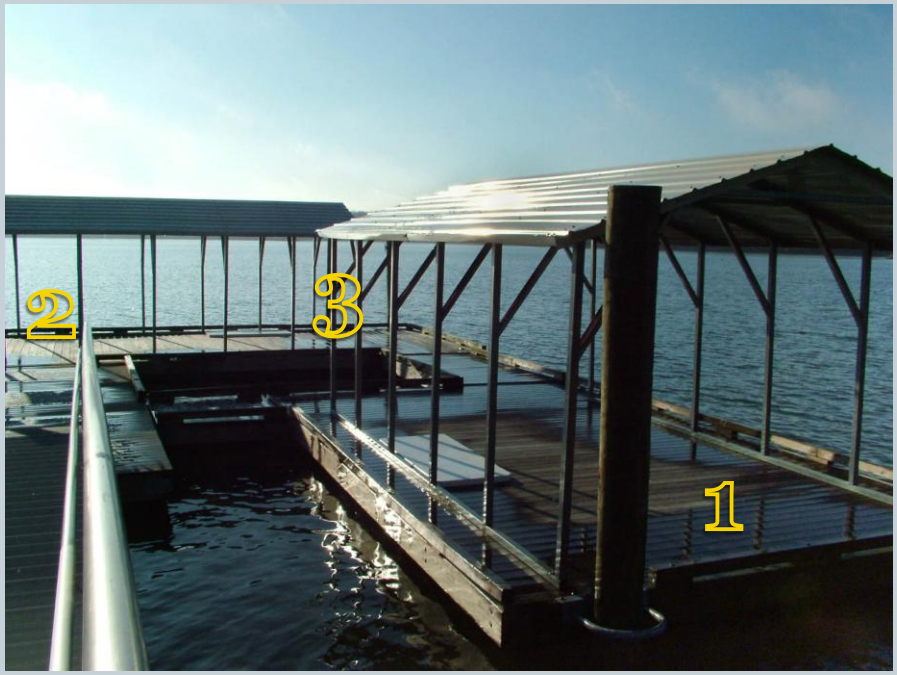
SAMPLE

How To Become an Expert

- Coordinate with your teacher to choose one station. Review this entire presentation, paying close attention to the section on your station.
- Follow our blog: Estuarychesapeake.wordpress.com
  - One stop shop for resources and updates
  - Prompted to receive notifications via email or sign in with a wordpress account
- Check out the website: serc.si.edu/education/programs/estuary/index.aspx
- The Estuary Chesapeake Manual (on the blog)
  - Use it to follow along during this presentation
  - Bring it with you the day of your trip
- Workbook (on the blog)

Choosing Your Station

- Some people like to draw from previous knowledge and experience
- Some people like to try something new
- Talk with your teacher; he/she may have already assigned you a station
- Keep in mind:
  - Stations 1, 2, and 3 are located on the floating dock. If you are prone to motion sickness/sea sickness, avoid choosing one of these stations.



Station 1: About Crabs

(Page 10 in Manual)

Learn ways to catch crabs and study their anatomy & behavior

Overview

Background Information

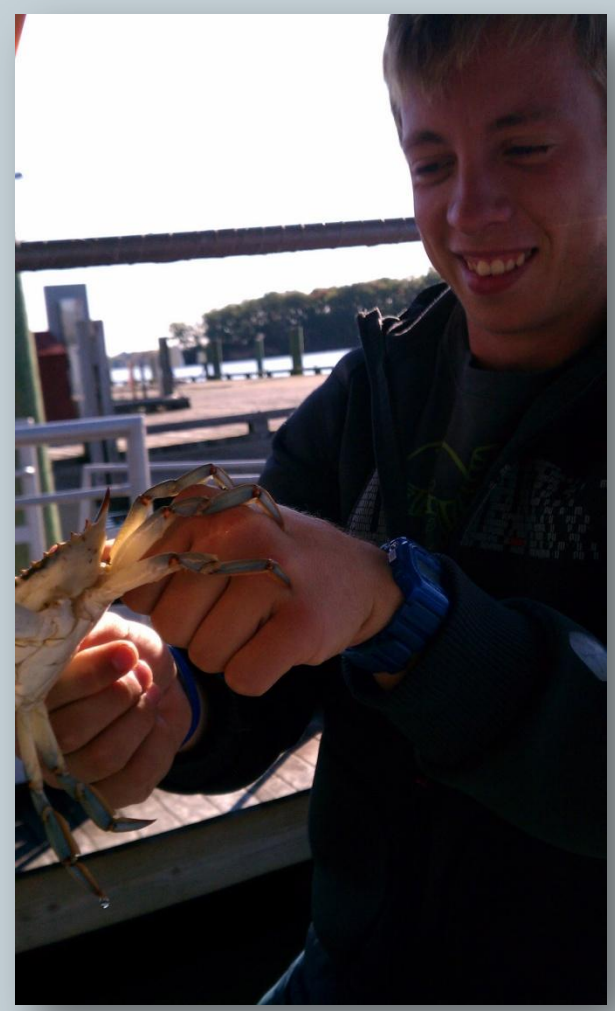
Procedure

Tips

Back to Station List

Overview

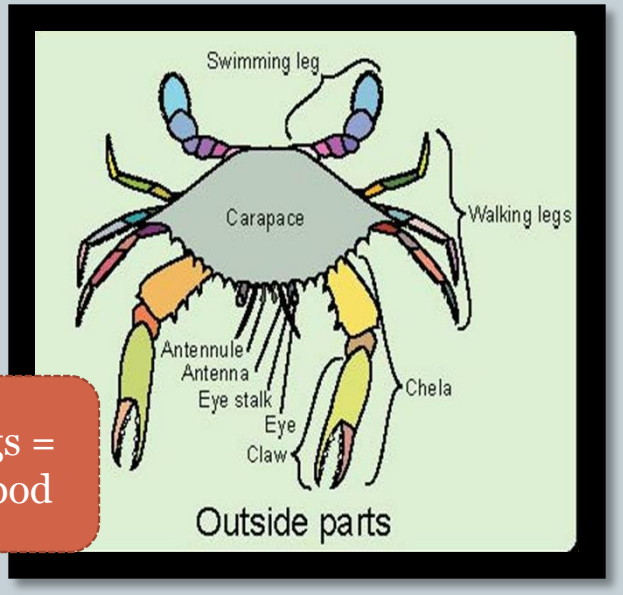
- Spend a majority of the time discussing:
  - Anatomy
  - Sex identification
  - Molting
  - Diet
  - Behavior/migration
- Demonstrate the 3 ways to crab:
  - Commercial pot
  - Snap-pot
  - Baited hand line



Background Information

External Anatomy

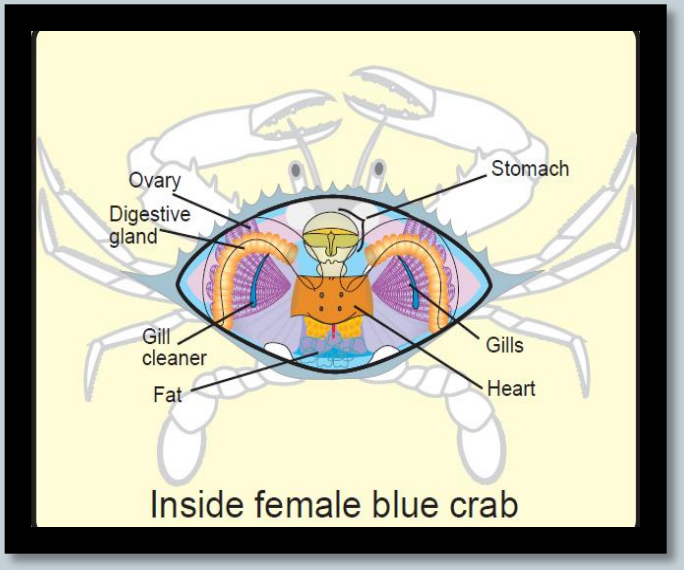
- Scientific name: *Callinectes sapidus*
- "Beautiful swimmer that tastes good."
  - name due to swim paddles on swimming legs



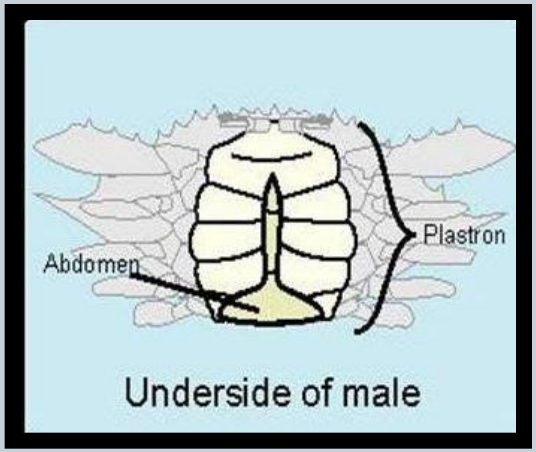
10 legs = decapod

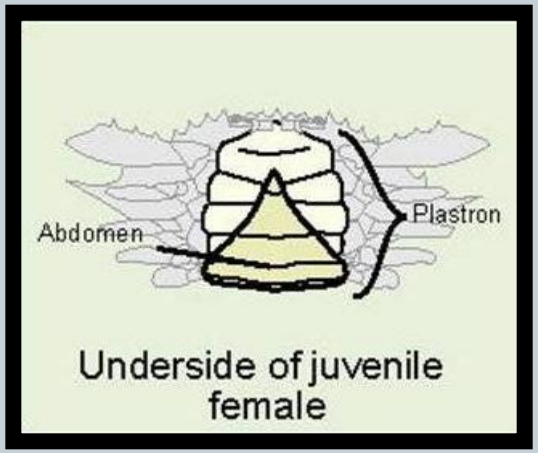
Internal Anatomy

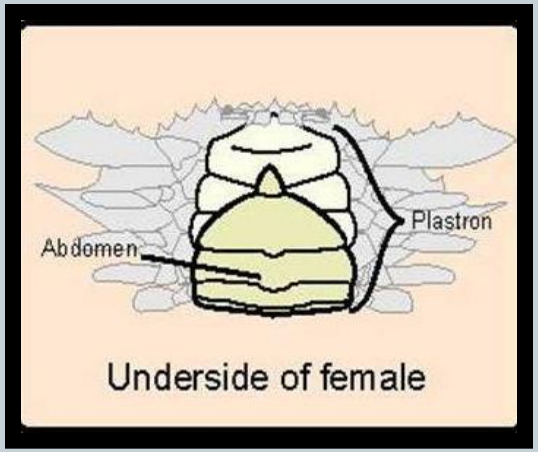
- Crabs can survive outside of water by repeatedly passing aerated bubbles across their gills



Background Information







Male

Immature Female

Mature Female

Washington Monument

Pyramid

Capitol Dome

Background Information

Molting

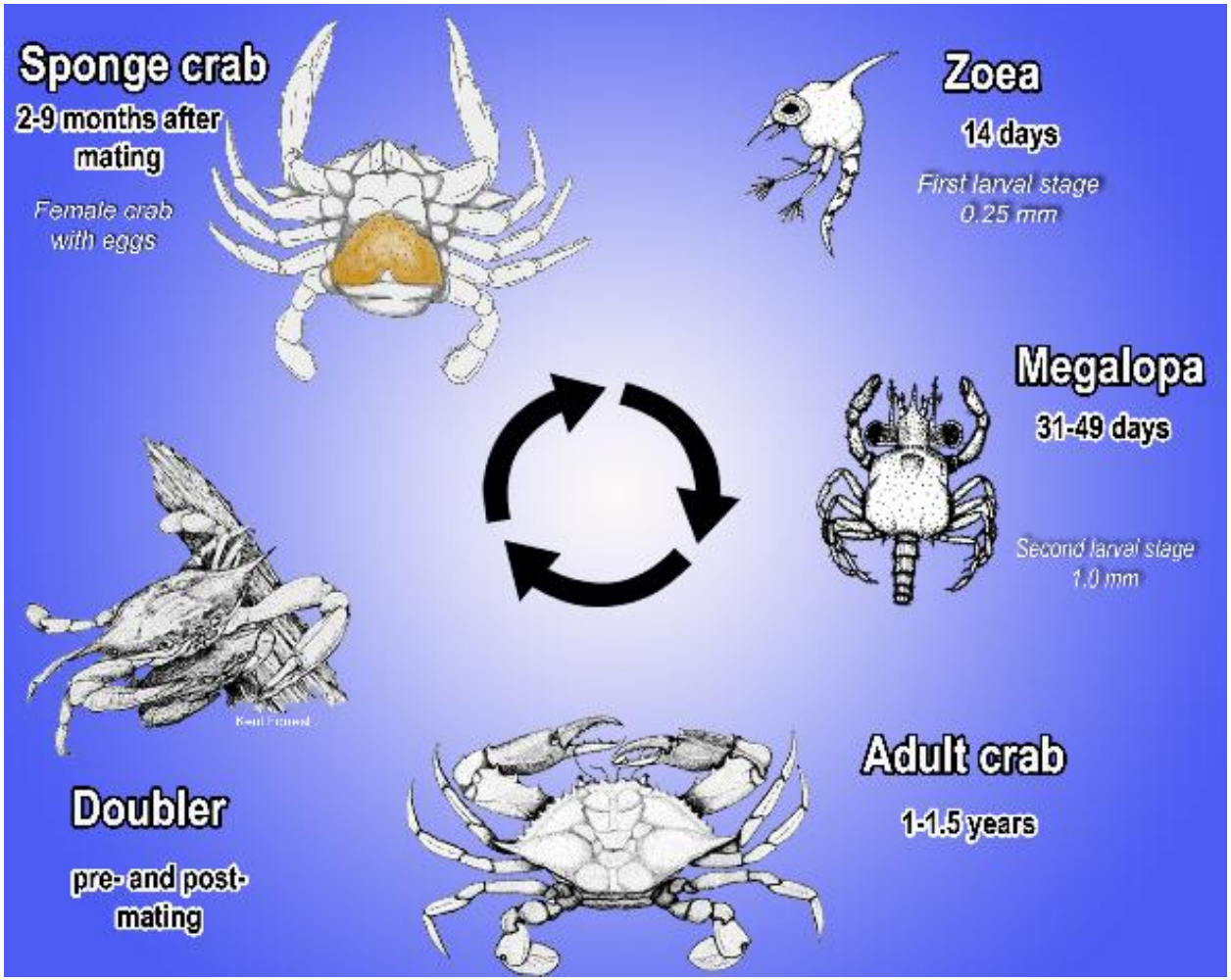
- Crabs start life as zooplankton, and grow through a three stage process called **MOLTING**, which occurs 27-29 times during their life
- **Exoskeleton**- an external skeleton- a crab's shell that must be shed in order to grow
- The crab backs out of the old shell and then **expands its new shell by pumping water** into its body
- It takes about 72 hours (three days) for the soft shell to harden.
- The crab increases by 1/3 every time it molts

Background Information

- The Terminal Molt
  - When a female blue crab reaches sexual maturity, she goes through a terminal molt
  - Before her last molt, the female will send out chemical signals to male crabs
  - When her shell is soft from molting, she can be inseminated
  - The female can store the sperm in sperm packets to fertilize eggs at any time after her terminal molt
  - A female will lay eggs 1-3 times in her lifetime

Life Cycle of the Female Blue Crab

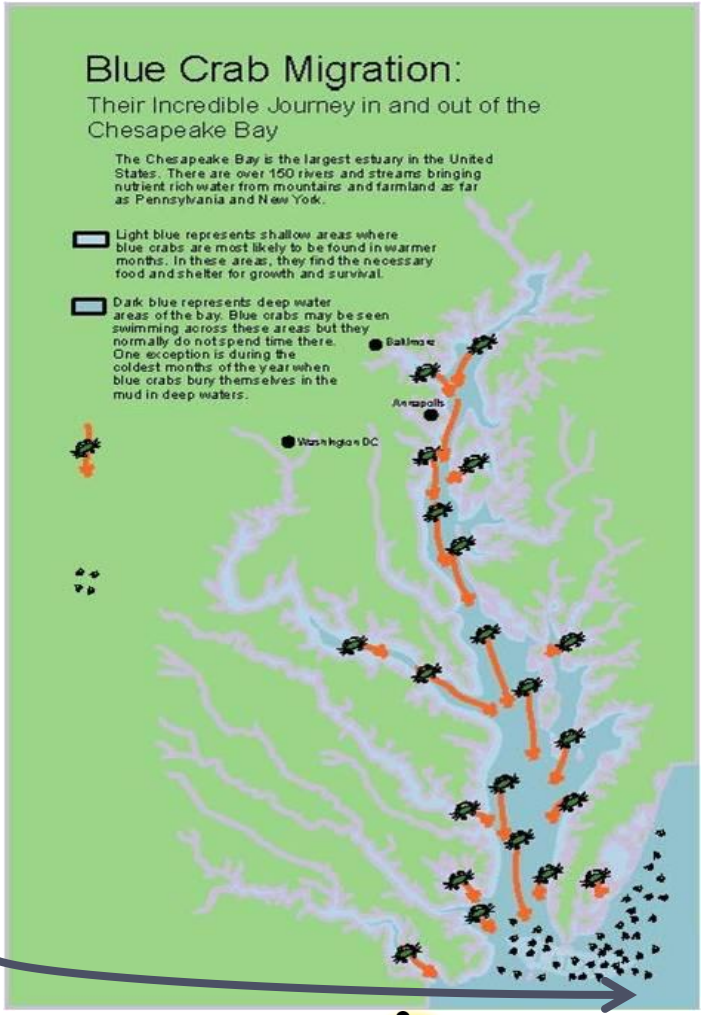
Background Information



Background Information

Female Blue Crab Migration

- Female blue crabs swim all the way out to the saltier waters near the mouth of the bay to lay eggs
- When eggs hatch, they are microscopic zooplankton called zoea



Diet

Background Information

- Crabs are predators and scavengers in benthic communities
- Diet
  - Benthos (bottom dwellers)
  - Thinshelled bivalves (e.g. soft shelled clams
  - Crustaceans (e.g. other shelled organisms)
  - Fish
  - Marine worms (e.g. nematodes)
  - Plants
  - Detritus (dead material)

Procedure

1. Discussion

I. Introduce and discuss vocabulary:

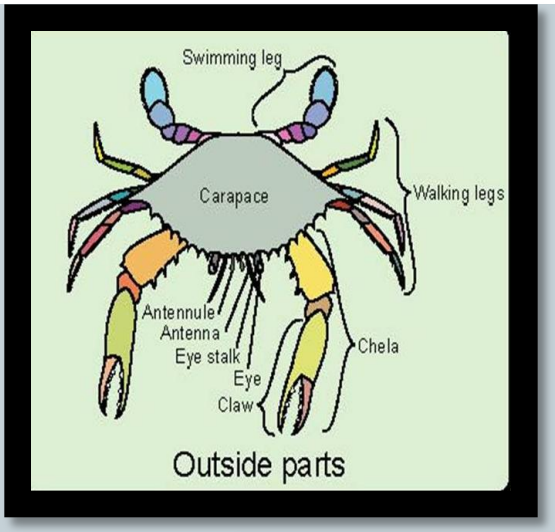
- Crustacean
- Exoskeleton
- Decapod
- Scavenger
- Predator
- Detritus

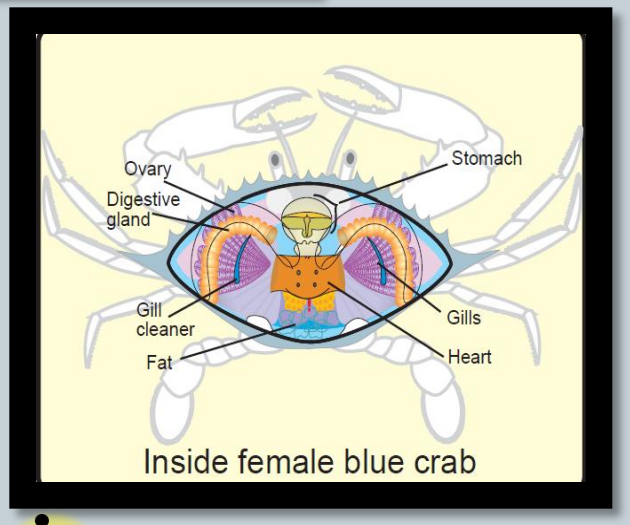
Procedure

II. Discuss external anatomy using diagram and live crab:
   - Carapace- back of shell
   - Abdomen
   - Mouth
   - Eye stalks
   - Claws
   - Walking legs
   - Swim paddles

III. Use diagram provided to explain:
   - Internal anatomy

IV. Discuss molting, crab diet, life cycle of a female blue crab
   - Migration of a female blue crab





Procedure

2. Commercial trap

- If there is nothing in the trap, ask for a **resident crab** from the Reed Center
- The entry holes on the sides are **one-way**
- Rectangular **turtle excluders** over the entry holes
- According to NOAA, crab traps become **"ghost traps"** after their float line is severed by vessel propellers, chafed due to wave action, or affected by strong currents.
  - These traps continue to capture fish, crabs, and turtles which cannot be released

3. Snap Pot Method

I. Demonstrate how all 4 sides open when the line is slack

II. Lower the trap to the bottom of the river

III. Wait several minutes

IV. Strongly tug the line to "snap" the trap shut and raise it up to the dock

Procedure

4. Hand Lines

I. Traditional "chicken neck on a string" method

II. There are 6-10 handlines hanging off the dock, already baited

III. Students kneel on the dock with both knees,

IV. Have students sing Row Row Row Your Boat to make sure they pull slowly

V. A tug indicates a crab is biting- grab a net to scoop it out just below the surface

Procedure

Tips

- **Handle with care!**
  - Use tongs ("crab'r grab'r") to hold the crab if you are unsure of holding the crab with your hands. (Click the question mark to learn how to hold a crab with your hands.)
- **Do not** allow students to hold the crab unless you teach them how.
  - If a large crab is caught, please save it in a bucket of shallow water to show other groups.
  - Keep the bucket in the shade.
  - Put only ONE crab per bucket– they will fight and pull off each other's limbs if put together in a confined space!
- The students coming to this station are coming from seining, and so are often late. Adjust time accordingly

Station 2: Water Testing

(Page 15 in Manual)

Perform a series of water quality tests that help to understand healthy and unhealthy changes in the river, which affect the plants and animals seen in other stations

Overview

Background Information

Procedure

Tips

Back to Station List

Overview

- Consists of 5 tests:
  1. Salinity
  2. pH
  3. Turbidity
  4. Depth
  5. Temperature

- Emphasize purpose and discussion of results
  - Ask: **Why** did we get this result? **What** factors affect this condition? **How** does this condition affect organisms?

- Watch time.

Water Testing Data Sheet

Station 2: Water Quality Testing

School:_____ Date: _____

Directions: Record all data collected for each of the five tests

Test	Unit	Group 1	Group 2	Group 3	Group 4	Group 5
Salinity	ppt	A	A	A	A	A
		B	B	B	B	B
		C (Rhode River)	C (Rhode River)	C (Rhode River)	C (Rhode River)	C (Rhode River)
pH	log(L/mol)	Mystery	Mystery	Mystery	Mystery	Mystery
		Rhode River	Rhode River	Rhode River	Rhode River	Rhode River
Depth	cm					
Turbidity (depth of light penetration)	cm					
Temperature	°C or °F					

Background Information

- SERC scientists have been studying the Rhode River for almost 50 years
  - ***Collect water samples regularly*** to test the water's ability to sustain life, i.e. the water quality
  - Among these tests are salinity, pH, depth, turbidity, and temperature (the tests conducted at this station)
  - The results of these tests give information about the conditions that impact the Rhode River's organism

Background Information

Factors that affect water quality

Salinity
- Precipitation
- Location
- Runoff
- Temperature

pH
- Precipitation
- Depth
- Dissolved gases like CO_2
- Ions in soil
- Plant matter

Depth
- Tides
- Location
- Wind
- Sedimentation

Turbidity
- Runoff→ Sedimentation
- Harmful Algal Blooms
- Oyster population decline
- Human activities

Temp.
- Ambient air temperature
- Precipitation
- Depth
- Mixing
- Direct exposure to sun

Procedure

1. **Discuss location**
   - ***Locate SERC*** on the map provided (on the Rhode River)
   - The Rhode River meets up with the West River and empties into the Chesapeake Bay
2. **Define estuary and watershed**
   - The Rhode and the West River are sub-estuaries of the Chesapeake Bay.
   - *Define* ***estuary*** *and* ***watershed*** and discuss their importance
3. **Introduce the tests and discuss purpose**
   - The results of the 5 tests are a ***snapshot of the environmental conditions*** at the time of collection
   - Important to know specific quantitative information about the habitat of the organisms under investigation
   - ***Before collecting data, define each test; discuss the factors that cause the condition to change***

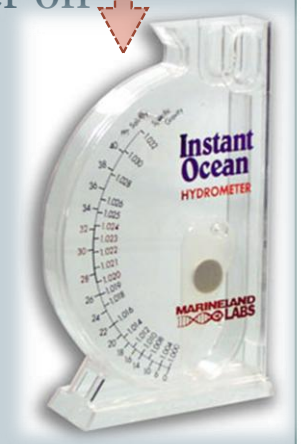
Procedure- Salinity

4. Salinity- test #1

- ***Purpose***: Students test 3 samples of water and determine where in the Chesapeake Bay a particular salinity might be found
- ***Define salinity*** and discuss salinity gradients in the bay.

1. There are 3 bottles with corresponding hydrometers
   - Bottle A: Fresh (<1ppt)
   - Bottle B: Ocean (35+ ppt)
   - Bottle C: Brackish (1-22ppt)- collected from the Rhode River off the dock. Hold onto student's life jacket while they collect.
2. Fill hydrometer A with water from Bottle A
3. Record data
4. Rinse hydrometer with fresh water
5. Repeat with each of the water samples

Read the outside set of numbers for the ppt

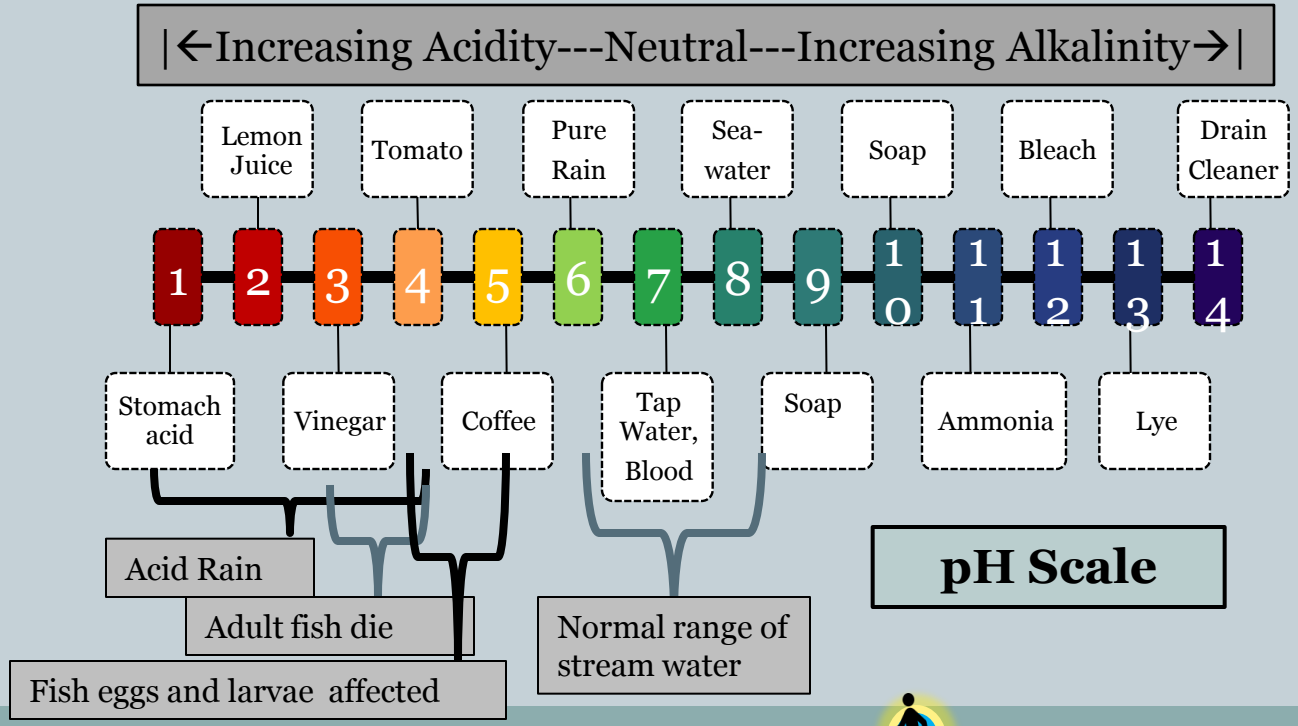


Get as many students involved as possible!

Procedure- pH

5. pH- test #2

- ***Purpose***: Discuss why the pH value of the water is so important to organisms both **sessile** and **free swimming**.
- ***Define*** pH, acid/acidity, and base/basic/alkalinity. Relate these to sour lemonade and Tums/Rolaids/Pepto Bismol respectively



Procedure- pH

- **Have the students…**

1. Without revealing the identity of the sample, fill one of the viles from the box ¾ full with ***vinegar.***
2. Add 10 drops of ***indicator fluid***, invert and swish to mix evenly (will turn red, pH ~ 3)
3. Place vile in open spot on the left side of the comparator, and ***compare the sample to the colors in the comparator***
4. Record data
5. Fill the 2nd vile with water from Bottle C ***(Rhode River),*** and repeat steps 2-6
6. Discuss results and implications of this data.
7. ***Rinse*** both viles with water from the bottle labeled "H_2O rinse"

Procedure- Depth

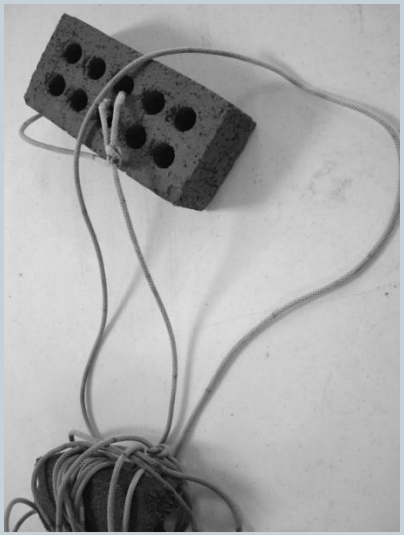
6. **Depth- test #3**
   - ***Purpose***: Determine the depth of the Rhode River near the dock
   - ***Discuss*** tides and the conditions present in shallow water

i. While holding onto the buoy end of the line, lower the brick over the side of the dock into the water until it hits the bottom. Be sure to hold onto the life jacket of any student leaning over the dock.

ii. When the line is taut, pinch the line at the surface of the water.

iii. Count the colored markings (10 cm apart) as the brick is pulled up.

iv. Record data.



Procedure- Turbidity

4. Turbidity

- ***Purpose***: to determine how far light penetrates down into the water column using a Secchi Disk
- ***Define*** turbidity, explain the Secchi Disk, and discuss the causes and implications of turbidity

i. Hold the foam end of the line, and lower the disk into the water, very slowly.

ii. When the black and white pattern can no longer be seen, pinch the line at the surface of the water, and count the marked lines (10cm apart) as the disk is pulled up.

iii. Record data in cm

Procedure- Turbidity

iv. Use the large wooden measuring stick on the dock to show how far light penetrates.

- Point to the total depth on the measuring stick
- Subtract the amount of centimeters of light penetration
- Anything below this level isn't receiving light
- Have a student stand next to the stick to compare their height to the deepest point of light penetration

Procedure- Temperature

5. Temperature

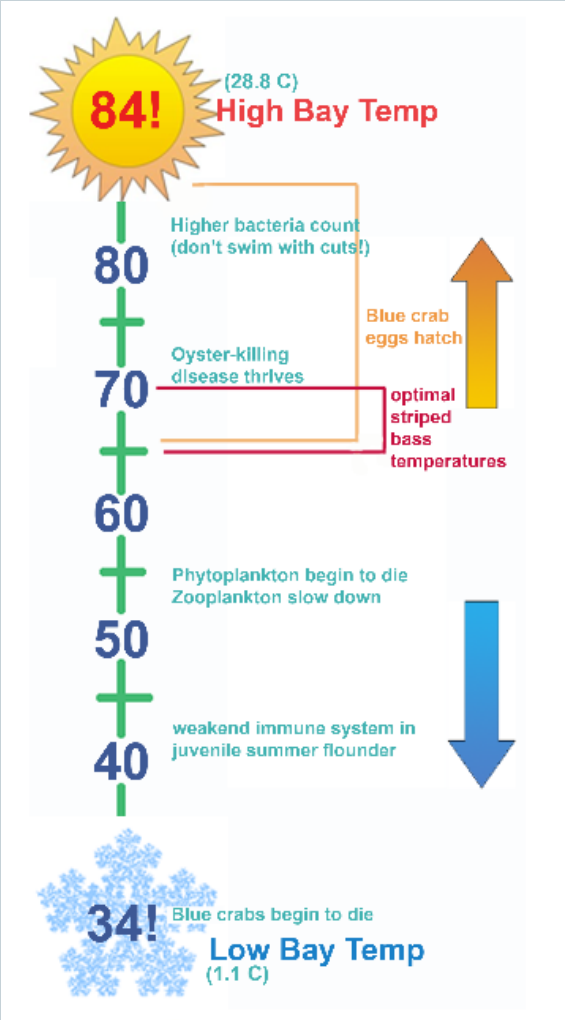
- ***Purpose***: Find the temperature of the Rhode River
- ***Discuss*** why scientists are interested in water temperature (ectotherms, tolerance ranges, vertical stratification)

i. 2 thermometers hang from the dock to the right of the table (looking towards the Reed Center)

ii. Read and record both temperatures

iii. Teach students the quick method for converting Celcius to Fahrenheit:

- ***C→F, double and add 30***



Tips

- Get all of the students involved
  - Try starting from the left and giving jobs to students down the line. Have the far right student be the recorder to keep their attention
- Emphasize the purpose
  - The rapid and quantitative nature of this station can leave students feeling disconnected if the purpose is not emphasized.
  - Be clear that these tests provide a baseline of the conditions experienced by the organisms they are studying at other stations.
- 5 tests in 20-25 minutes can be tight.
  - Watch the time
  - It's better to cover 4 tests comprehensively than 5 tests insufficiently
    - Temperature can be briefly discussed at the end if time is short, since students are the most familiar with it

Station 3: Oyster Communities (Page 23 in Manual)

Investigate an oyster community to learn about oysters and the habitat oyster shells provide for many kinds of organisms

Overview

Background Information

Procedure

Tips

Back to Station List

Overview

- Empty oyster shells provide an apartment-like complex for a host of other ***benthic*** (bottom-dwelling) organisms.
- ***Discuss*** the importance of oysters as filters for the Chesapeake Bay
- ***Sort*** through the basket of benthic oyster shells
  - ***Identify and count*** the organisms present in the basket

Oyster Community Data Sheet

Oyster Bar Community

School Name _____ Date _____

Directions: For each organism down the left column, count and tally the number found in each group rotation.

Organism	Group 1	Group 2	Group 3	Group 4	Group 5
Oyster Spat					
Barnacle					
Bryozoans					
Amphipod					
White-fingered Mud crab					
Sea Anemone					
Soft Shell Crab					
Nematode					
Blenny					
Naked Goby					
Grass Shrimp					
Clam Worm					
American Eel					
Mussel					
Other:					

Background Information

About Oysters

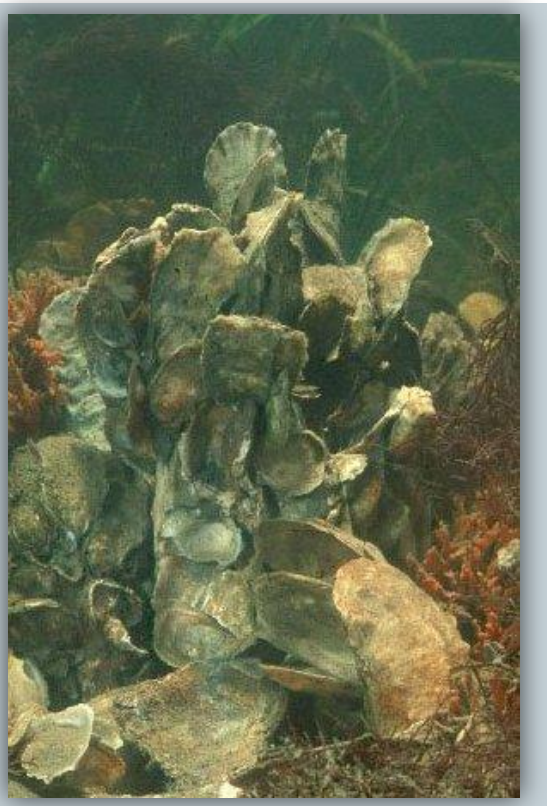
Bivalves

Live oysters serve as **filtration** factories, filtering 50 gallons of water per day per oyster.

An oyster bar is a diverse and dynamic community that provides protection, food, and a stable **habitat** for many other organisms.

Keystone species

- provide valuable shelter and habitat, improve water quality, and reduce bank erosion.



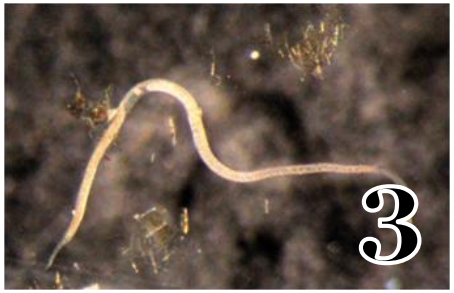
98% decline in population for the Chesapeake Bay oyster

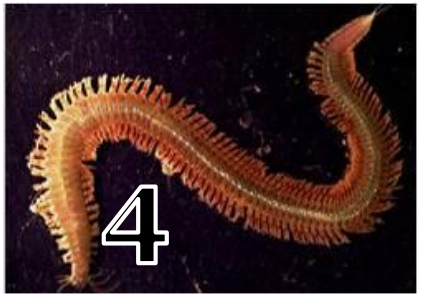
- overharvesting
- disease (MSX and Dermo).

Oyster Reef Inhabitants

1. Barnacles
2. Bryozoan
   (moss- like organism)
3. Nematode
4. Clam Worm
5. White-fingered Mud Crab
6. American Eel

Background Information





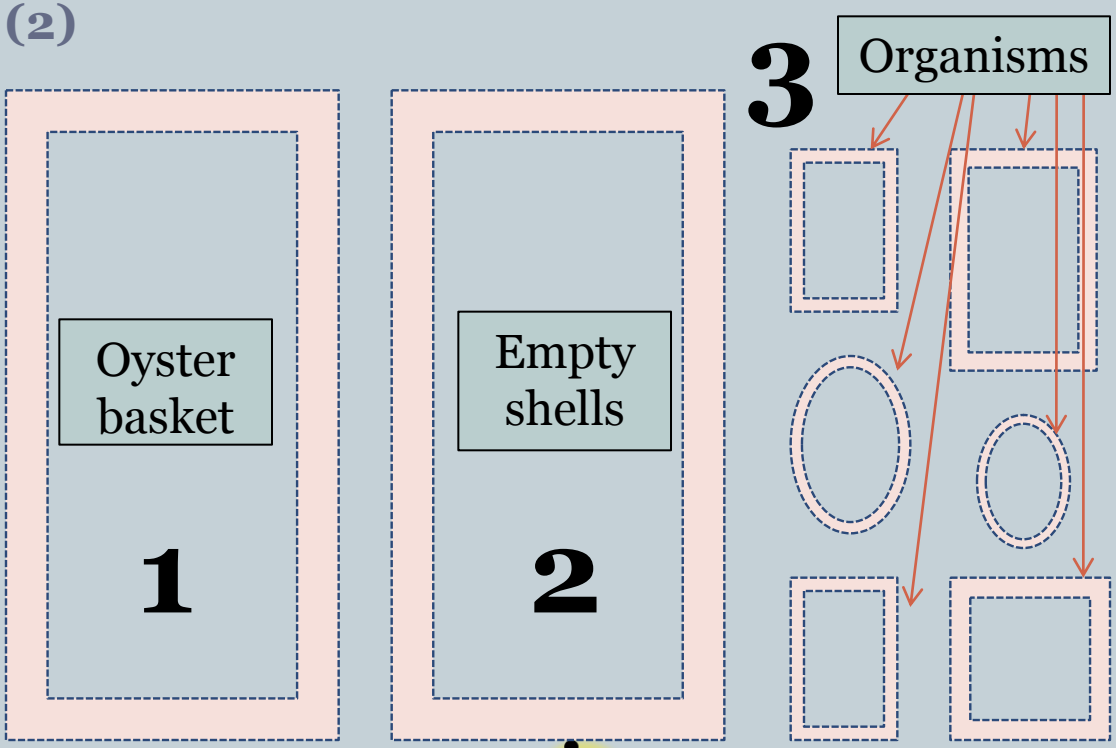
Oyster Reef Inhabitants

1. Naked Goby
2. Striped Blenny
3. Amphipod
4. Grass shrimp
5. Pumpkinseed
6. White Perch

Background Information

Procedure

- The oyster basket will be pulled up from the bottom of the river and resting in a bin filled with water **(1)**
- Sort through the shells, only removing organisms that are *not* attached (i.e. barnacles or bryozoan).
  - Place examined shells in bin **(2)**
  - Place organisms in small water-filled containers **(3)**
  - Move the basket out of the bin to find organisms in the water with nets
  - Use magnifying glasses and viewers to examine
  - Use the boards and fish guide to identify organisms
  - Count and record




3

Tips

- At the beginning of the rotation, discuss oysters and oyster communities away from the tables. Once the students' hands are in the baskets, they will be distracted.
- Use the Estuary Chesapeake Manual, boards, and fish guides to identify organisms
- When refilling water in the bins, pour the water over the dock, not the table, to prevent puddling.

Station 4: Investigating Plankton (Page 29 in Manual)

Learn how to collect and identify plankton, the basis of the aquatic food chain.

Overview

Background Information

Procedure

Tips

Back to Station List

Overview

- Collect plankton at the dock
- Bring the sample back to the classroom
- Teach and discuss about phytoplankton, zooplankton, their importance, and their role in the aquatic food chain
- Distribute the sample to the students to look at under microscopes

3 main points to emphasize

- Phytoplankton produce more than **50% of the world's oxygen**
- Many aquatic organisms start their lifecycle as plankton, which means **free-floater/drifter.** Plankton are **very diverse** in behavior and morphology
- Plankton are the **basis of the marine food chain**

Background Information

Plankton means free-floater/ drifter

There are 2 groups of plankton:

- Phytoplankton
  - Plant-like
    - Producers
- Zooplankton
  - Animal-like
    - Consumers

Background Information

Phytoplankton

Important Fact: Phytoplankton produce >50% of the world's oxygen

Zooplankton

Producers= Convert the sun's energy into food

Process called photosynthesis

2 products

Glucose

Oxygen

Consumers= Get their energy from consuming other organisms

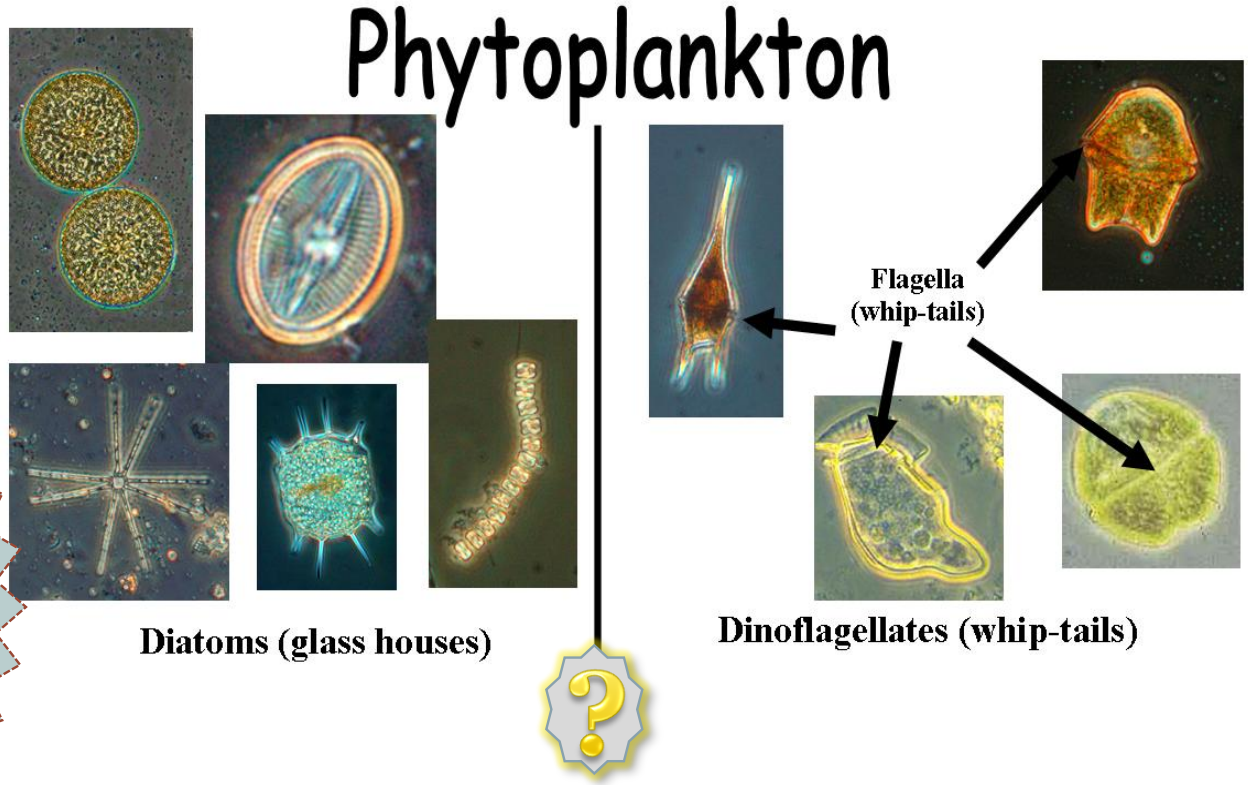
Eat phytoplankton

Eat other zooplankton

Background Information

Diversity of Phyto-plankton

Some phytoplankton are mixotrophic, meaning they can get their energy from the sun, or by consuming other organisms



Diversity of Zoo-plankton

Background Information

There are 2 types of zooplankton:
-Those that stay small throughout the whole life cycle
-Those that grow out of an early planktonic state during the life cycle

Baleen Whale

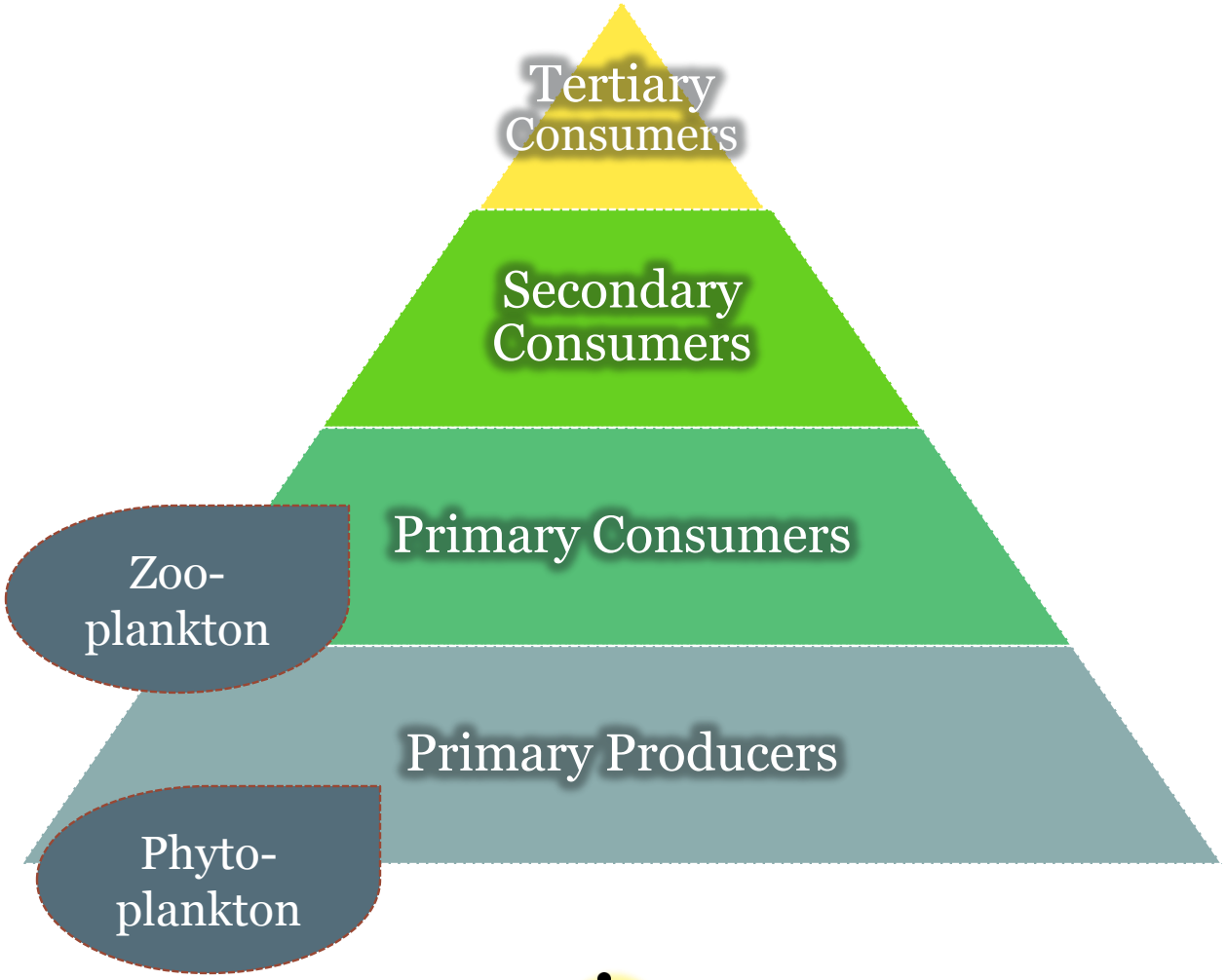
- Baleen whales can be the length of three school buses- **and they eat nothing but plankton!**
- Baleen whales have special teeth called baleen.
  - Open mouth
  - Take in water and plankton
  - Baleen filters the food out of the water.
  - Swipe their tongue across the baleen to pick up the plankton

Background Information

Background Information

Plankton are the base of the marine food chain

- Plankton are abundant in the world's surface waters
- Remove ~3 billion tons of CO_2 from Earth's atmosphere through photosynthesis
- Food source for many aquatic organisms
- Easily demonstrated with the linear food web on the walls in the classroom



Background Information

Transfer of energy in a food chain

Dinoflagellate

Nauplius

Sheepshead Minnow

White Perch

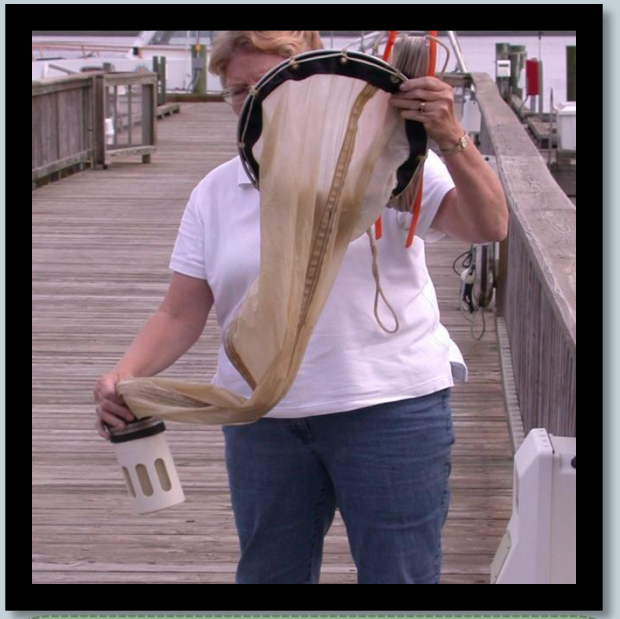
Striped Bass

Osprey

In reality, the transfer of energy is not always this linear. Food webs are usually interconnected and varied.

Procedure

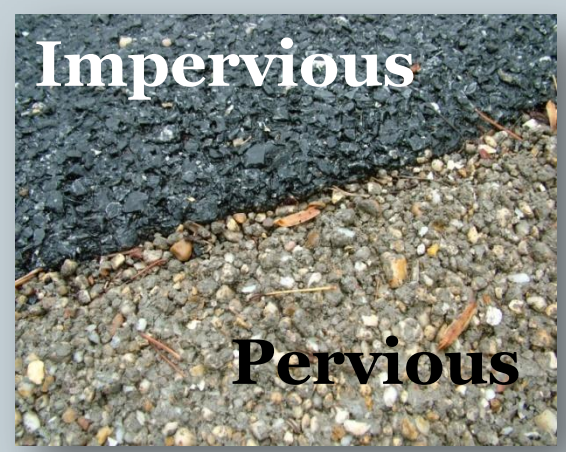
1. The plankton tow
   I. Go down to the dock to pick up the group- they will be coming from station 3 (oyster communities)
   II. Explain how the plankton tow works
      1. Twist the bottle onto the bottom of the net
      2. Lower the net and bottle in the water, and walk down the dock while pulling the tow just below the surface of the water
      3. Pull the rope up and unscrew the bottle. Leave the net on the dock, and bring the bottle up to the center



The plankton net is made up of a fine mesh with holes of only 90 microns wide. Anything larger than 90 microns gets collected in the bottle at the bottom

Procedure

2. On the way back to the classroom, briefly talk about pervious surfaces
   - The gray gravelly path past the dock is a pervious surface
   - Pervious surfaces absorb water, which helps to:
     - Prevent runoff
     - Allow for groundwater recharge
     - On a larger scale, reduce storm surge
   - The opposite is an impervious surface. Impervious surfaces, like regular sidewalks and black tops, are sealed to keep water out for durability
     - Water in precipitation events runs off impervious surfaces and enters water bodies (like the Rhode River), and carries debris and pollution with it.



Procedure

3. Classroom Discussion

I. Before students enter classroom, preface by saying:

- Everyone sit at a stool (placed on the opposite side of the table)
- There are microscopes at every stool. There is nothing to see in them yet so do not touch. Everyone will get a chance to use them before the end of the rotation

II. Lead a discussion based around the three main points about plankton:

- Phytoplankton produce more than **50% of the world's oxygen**
- Many aquatic organisms start their lifecycle as plankton, which means **free-floater/drifter.** Plankton are **very diverse** in lifestyle and morphology
- Plankton are the **basis of the marine food chain**

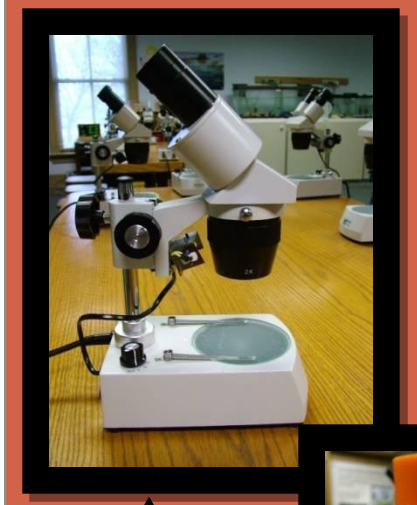
Discussion

Procedure

III. Talk about:

- the 2 types of plankton and how they obtain energy (emphasize that phytoplankton produce >50% of the world's oxygen)
- the types of phytoplankton (diatoms and dinoflagellates)
- the 2 categories of zooplankton (stay small and grow bigger)
- how plankton are the basis of the aquatic food chain and lead them through the food chain on the wall

Looking at the Samples



Microscope

Sample Bottle

Procedure

- Explain how to use the microscopes
  - Only **touch 3 parts**:
    - **Oculars** adjust the width of the eye pieces
    - The **focusing knobs** on the left and right turn towards and away from the body to focus in on the sample
    - The light switch- turn it 2 clicks for optimum light
- Distribute small sample bottles (prepared during discussion by other adult if possible)
  - Only fill each bottle to about 1/2 inch from the bottom
  - Every student gets a bottle
  - Go around to help students focus on sample
- Discuss what types of plankton students see

Tips

- It helps to **have 2 adults at this station**, one to pick up students at the dock and lead the discussion, and one to fill the bottles and escort the students to station 5 at the end of the rotation
- Set the **stools** up so that they are only on the **opposite side of the table**, so all students face the front when seated
- **Finicky microscopes are common**. If one is hard to focus, try zooming all the way out, and then slowly zooming in.
- If time allows, students can dump their samples into **fish tank #4 to "feed the oysters."** Otherwise, the water can be dumped

Station 5: Seining/Going Fishing (Page 34 in Manual)

Catch fish with a large seine net, identify several species, and learn about fish anatomy

Overview

Background Information

Procedure

Tips

Back to Station List

Overview

- Explain the use of seining by Piscataway Indians and current SERC scientists
- Explain the parts of the net and how to seine; demonstrate
- Talk about the safety rules
- Students don waders and seine
- Count, identify, and record collected organisms
- Release and change out of waders

Seining Data Sheet

Seining (Going Fishing)

School Name _____ Date: _____

Directions: For each organism down the left column, count and tally the number caught in each group rotation.

Organism	Group 1	Group 2	Group 3	Group 4	Group 5
American Eel					
Anchovy					
Blue Crab					
Grass Shrimp					
Hogchoker					
Jellyfish					
Killifish					
Menhaden					
Mummichog					
Perch					
Pipefish					
Pumpkinseed					
Rockfish (Striped Bass)					
Silverside					
Spot					
White fingered Mud Crab					
Other:					
Other:					

Background Information

- Seining is a fishing method used to catch near-shore fish and crabs by means of a long vertically hanging net
- Before European colonization, Piscataway Indians seined on the beaches of the Rhode River
- Approx. 350 species of fish in the Chesapeake Bay and 40-50 in the Rhode River.
  - Some are permanent residents
  - Some inhabit the river only for parts of their life cycle (migratory)
  - The shallow waters of the Rhode River provide a nursery for small fish

Background Information

- Fish adaptations
  - Colorations help camouflage fish from predators
  - The shape of the mouth can indicate lifestyle. Shapes vary according to the kinds of food they eat and where they live in the water column
- Shape, coloration, and external structures help scientists differentiate species

The downward pointing face as seen in this Norfolk Spot indicates a bottom feeder.

The sleek body shape of the Striped Bass indicates a sleek strong swimmer

Background Information

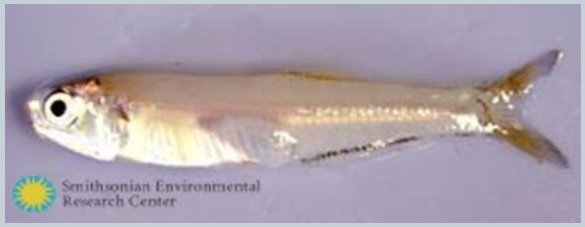
Striped Bass (Rock Fish)

White Perch

Mummichog

Striped Killifish

Silverside



Anchovy

Background Information

Pumpkinseed

Norfolk Spot

Sheepshead Minnow

Menhaden

Grass Shrimp

Procedure

1. **Discuss** historical context
2. **Identify** the weights, buoys, net, and poles

3. **Demonstrate** how to use the net
   - **2 people** walk out holding the poles close together
   - Once pair reaches the **waist of the shortest partner**, stop and extend the net until taut
   - Each partner holds a pole like a shovel, facing the beach (**tilt at a 45° angle**)
   - **Walk** towards the beach, while slowly **tapping the bottom** of the River with the poles
   - Once at the shoreline, **scoop up the net** and let the beach crew scoop the fish

Procedure

4. Go over safety rules
   - Only students holding the net should be in the water
   - Don't go in the water without an adult
   - Wet hands before touching fish
   - Scoop not squeeze
   - Don't step on the net

5. Get waders on as many students as possible (one adult to help students)
   - No shoes inside waders. Sit on a bench when dressing.

Procedure

5. **2 students and 1 adult per net** go out (up to 3 nets for large groups)
6. Beach crew consists of all of the students not in the water.
   - When the net comes in, **sort fish into containers** of water
7. **Record** data
8. Use fish guides and boards to **identify and count** the fish

Tips

- Instruct the students to sit on the benches once they get to the seining beach to run through the instruction quickly
- As soon as students come out of the water, have them change back into their shoes
- Unless the group is very small with a high adult to student ratio, only allow each student to seine once

Tips For Success

- **Get to know your station before you get here**
  - Go through this presentation again
  - Read through the manual
- **Check out the blog**
  - Estuarychesapeake.wordpress.com

End of presentation

More Information For Viewers at Home

The following slides are not meant for a group training presentation. They are included as additional information for teachers, parents, and chaperones. The Exploring the Chesapeake Workbook contains additional detailed information. The workbook and other materials are located on the blog: http://estuarychesapeake.wordpress.com/downloadabledocuments

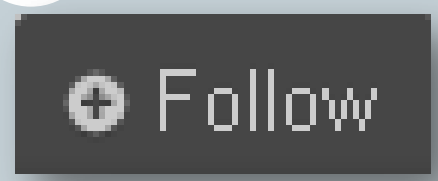
BACK to presentation

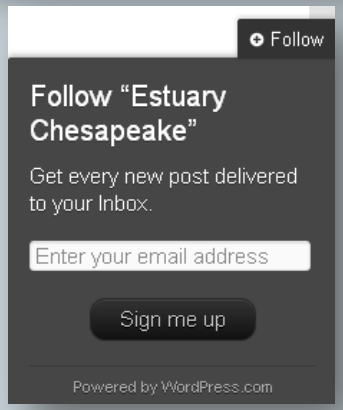
The Blog

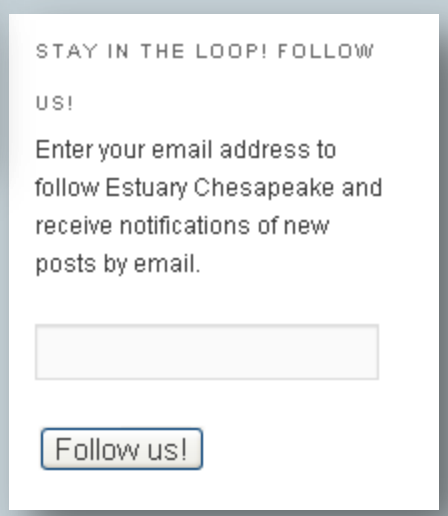
Estuarychesapeake.wordpress.com

How is the blog different from the website?

- Geared towards preparing you for your trip by streamlining the process of acquiring materials and learning concepts
- It's an exchange between teachers, parents, SERC staff, and students.
- Easily ask questions, leave comments, responses, and feedback







- Receive email notifications from the blog by clicking "+ follow"
  - Sign up for email notifications by entering your email address
  - If you have a wordpress account, you can follow the blog by signing in with your username

BACK to presentation

Ghost Traps

In 2006, the NOAA Chesapeake Bay Office (NCBO) and Maryland Department of Natural Resources (MD DNR) collaborated on the design of a survey to provide a precise estimate of the number of ghost pots in Maryland waters. This survey was implemented by NCBO in 2007 and provided an **estimate of 85,000 derelict pots submerged in Maryland waters**

By 2009, some watermen who were out of winter work because of new Virginia laws that banned winter crabbing, were enrolled in a government program geared toward finding and recovering derelict crab traps. **Watermen's boats were outfitted with side–imaging sonar and were offered $300 per day plus expenses,** with the goal to go out and bring in as many ghost traps as possible. Maryland arranged a similar program, with slightly different numbers, but the same equipment and goal.

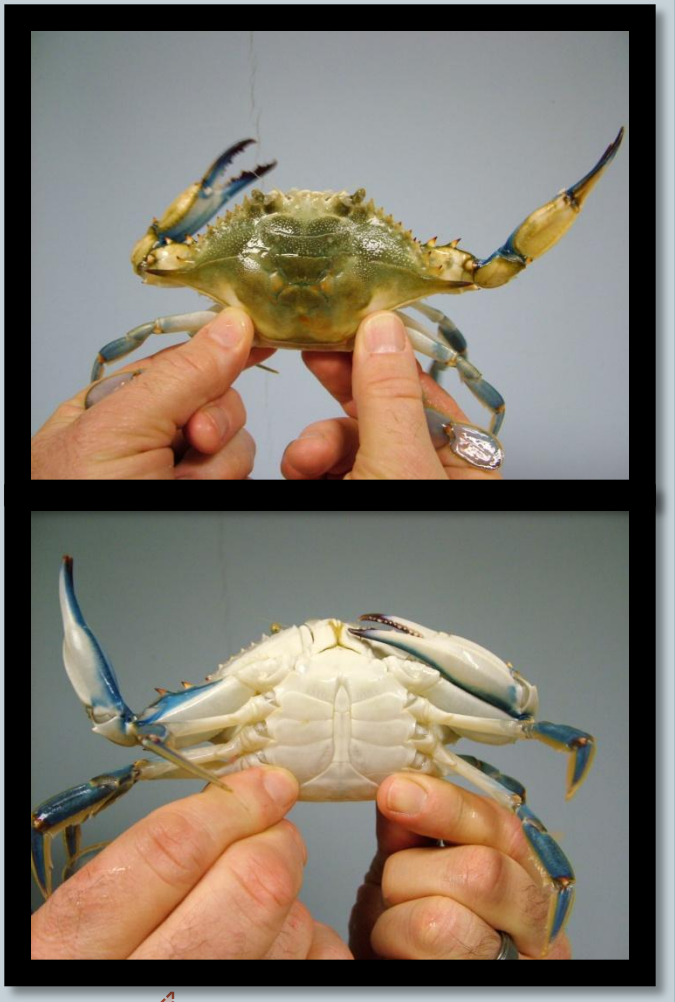
Since 2008, over 30,000 ghost traps have been recovered from the Chesapeake Bay and its tributaries

Click here to read a NOAA/MDNR fact sheet on ghost pots from 2008

BACK to presentation

How To Handle a Crab

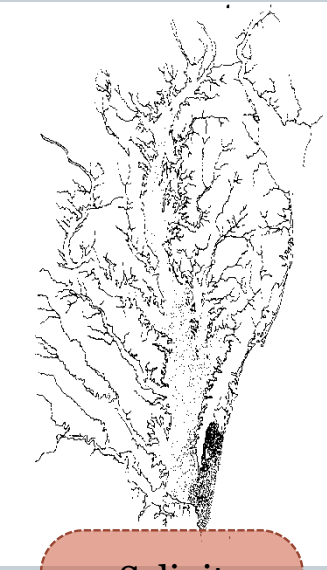
- Option 1: Use crab'r grab'r to pick up the crab from behind
- Option 2:
  - Use the crab'r grab'r to pick up the crab, and then hold the crab with both hands by its swimming legs (see right).
  - Thumbs are steady on the back of the shell above the joint, and the forefingers are on the apron bent down and out of the way of the pincher claws
  - Firm grip, but don't tug on the legs. The crab should stop moving if held correctly



BACK to presentation

Salinity

- **How does salinity change?**
  - In the Chesapeake Bay, freshwater drains from the rivers to combine with salt water from the Atlantic Ocean. This creates a salinity gradient of higher concentration near the ocean, as seen in the image to the right.
  - Salinity also changes vertically in the water column. Because salt water is more dense than freshwater, it tends to settle below the freshwater and create layers. If these layers become unstable because of precipitation, temperature, or winds, these layers mix. This mixing is important for the cycling of nutrients in the water.
- **Why do we care about salinity?**
  - The geographic range of most aquatic organisms is largely dependant on salinity. Drastic changes in salinity cause populations to shift.
  - For example, recent increased precipitation events have caused salinity to drop. Because pumpkinseed prefer fresher waters, students observed an increase in pumpkinseeds at the seining and oyster community stations.



Salinity Gradients across the Chesapeake Bay

BACK to presentation

Measuring Salinity

Salinity is measured in **parts per thousand (ppt).**

The **more salt** there is in the water, the **denser** it is.

When you use the hydrometer to measure the salinity, you are measuring the density of the water.

Dense water (saltier water) will cause the lever to float and point to a higher number.

This can be explained using marbles.

Of 1000 marbles, if 999 are white and 1 is blue, the concentration of blue marbles could be expressed as 1 part per 1000.

Similarly, if the hydrometer reading is 15 ppt that would mean for every 1000 molecules, 15 of them are salt molecules, and 985 are water molecules.

BACK to presentation

pH

- How does pH change?
  - Precipitation events, like **acid rain**, can change pH.
  - Precipitation events also trigger **runoff**, which can carry chemicals into the water that can change pH.
  - Seasonal changes
    - **Leaves** that fall off deciduous trees in the autumn increase the acidity of water
  - **Dissolved gases** can change pH
    - As temperatures in the bay increase, CO_2 is released into the water , and changes the acidity.

- Why do we care about pH?
  - Shallower waters, like parts of the Chesapeake Bay, the Rhode River, and Muddy Creek, have a **greater response** to the effects of acid rain
  - pH doesn't usually change drastically, but a shift above or below neutral levels causes numerous **biological effects**
    - For example, SERC scientists observed low population numbers of Yellow Perch in Muddy Creek compared to historical accounts. The study found that increased acidity in Muddy Creek, due to acid rain, caused aluminum to be released from the sediment. The free aluminum coated the Yellow Perch eggs, **affected their ability to regulate internal salts**, and therefore caused them to die. Adult Yellow Perch were unaffected, but eggs and larvae could **not survive in the acidic conditions.**
  - **Increased CO_2** in the atmosphere has the potential to affect aquatic organisms
    - The low pH (higher acidity) can dissolve calcium carbonate, an element found in the shells of organisms, like some oysters and plankton.

BACK to presentation

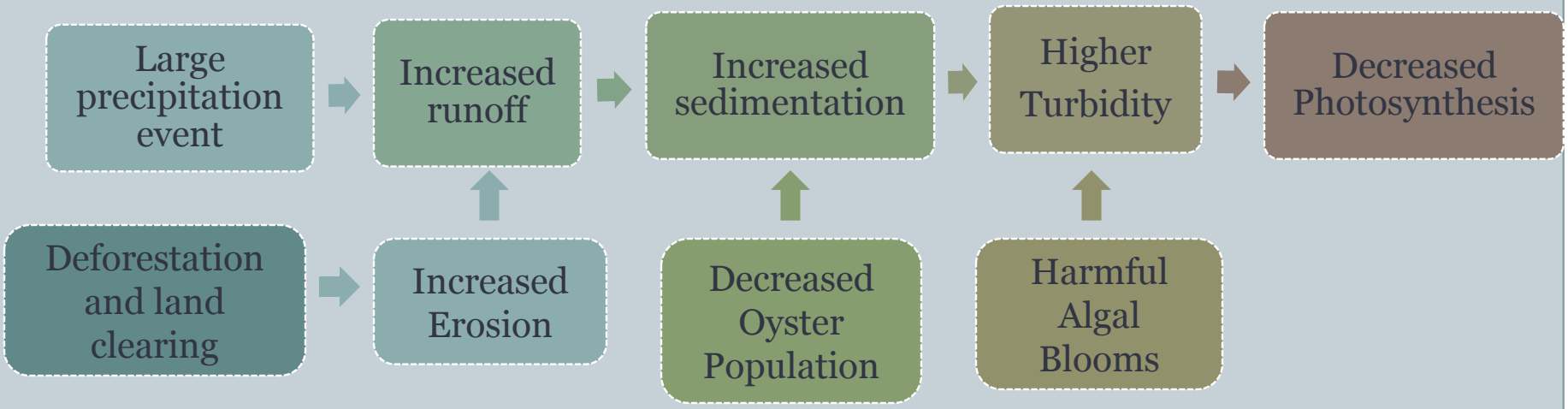
Depth

- How does depth change?
  - Parts of the Chesapeake Bay's rivers, estuaries, and marshes are tidal, meaning the depth changes at different times of the day
  - Precipitation, or lack of, has a major impact on depth
  - Increased erosion leads to increased sedimentation, which decreases the depth of the water.
- Why do we care about depth?
  - Aquatic organisms inhabit the different vertical zones of the water column.
    - For example, submerged aquatic vegetation, oysters and reef communities inhabit the benthic zone (the bottom).
    - Fish, and some aquatic mammals and reptiles, move in the pelagic zone, the open water zone above the benthic zone.
    - The Euphotic zone is the portion of the water that receives sunlight. Photosynthetic organisms are restricted to this area.

BACK to presentation

Turbidity

- **How does turbidity change?**

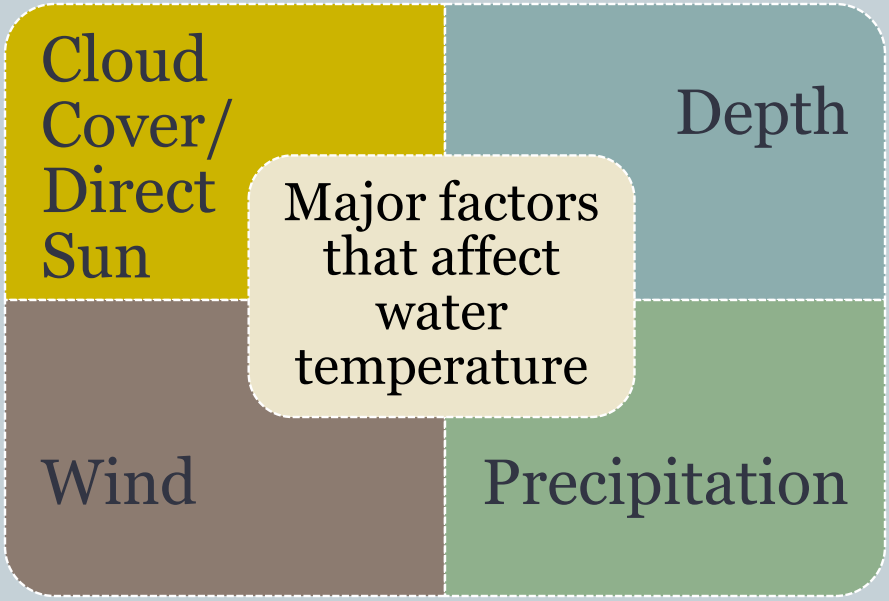


- **Why do we care about turbidity?**

BACK to presentation

Water Temperature

- How does water temperature change?



- Why do we care about temperature?
  - Some organisms have temperature dependent triggers for certain biological processes
    - Water temperature changes can serve as cues for fish to migrate
    - Ectotherms depend on the outside environment to control their body temperature (read more on the next slide)
  - Warm water holds less oxygen than cold water

BACK to presentation

Ecto- and Endotherms

- Humans usually maintain a constant body temperature of 98.6°F. This is because humans are endotherms, which means our body involuntarily regulates its temperature from the inside.
- Some animals, like reptiles and amphibians, are ectotherms- meaning they regulate their body temperature using the outside environment.
  - For example, turtles and snakes will sit in direct sunlight or lay on a warm surface to increase their body temperature.
  - In some species of turtles, the sex of an embryonic turtle is temperature determined. The temperature of the ground around the nest of eggs at the time of sex determination in development controls whether the turtles are male or female. The temperature range for males and females differs between species
- Ectotherms depend on certain temperature ranges to maintain processes like digestion and circulation.
  - Changes in the ambient water and air temperature can affect these processes

BACK to presentation

Sessile vs Free Swimming

Sessile	Free- Swimming

• Stationary in a fixed location
  ○ Oysters
  ○ Submerged aquatic vegetation
  ○ Anemone
• In unfavorable conditions, sessile organisms must adapt/adjust because they are unable to move
	• Able to move through the water column
	  ○ Fish
	  ○ Blue Crabs
	• In unfavorable conditions, can move to waters of better quality.

BACK to presentation

Oyster Reef Inhabitants

- Oyster larvae are free floating for the first several weeks of their lives. Once they attach to older oyster shells or other hard substrate they are considered “spat” until they grow to be larger than 1”
- The naked goby gets its name from its lack of scales
- Naked Gobies and Skillet Fish can look similar in size and color, but skillet fish have a defined tear drop shape.
- Nematodes and clam worms look similar in size and color. Clam worms are usually slightly larger, and have noticeable leg-like appendages radiating out both sides of the body
- Amphipods are very prevalent in warmer months

BACK to presentation

Two Types of Phytoplankton

Diatoms	Dinoflagellates

• Nickname: Glass houses
  ○ Silica in cell walls
• Diatomaceous earth
  ○ A distinct layer used as a reference for geologic dating
• Current Uses
  ○ Previously used in toothpaste
  ○ Sanding and polishing compounds
  ○ In filtration units
	• Flagella: whip-like structure that increases movement
	• Dinoflagellates have boom-and-bust population cycles
	  ○ Population booms can create Harmful Algal Blooms with visible coloration "called red tide"

BACK to presentation

Zooplankton

Grow Larger

- Ex: The blue crab's first stage of life as zooplankton is called zoea. It then molts into a megalopa (still plankton) and then eventually to an adult crab (no longer plankton)
- A nauplius is the larval stage common to many aquatic organisms.
  - Examples of organisms that have this early planktonic stage are barnacles, clam worms, and fish louse.

Stay Small

- Some zooplankton remain free floating plankton throughout their entire life cycle
  - Examples: Copepods, rotifers, tintinids

BACK to presentation