WORLD WETLANDS DAY

2017

Activity Guidebook

Your guide to educational activities and lessons pertaining to Maryland's Coastal Bays

BROUGHT TO YOU BY THE
MARYLAND COASTAL BAYS PROGRAM
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WELCOME TO THE MARYLAND COASTAL BAYS PROGRAM'S ACTIVITY MANUAL FOR

World Wetlands Day 2017!

Please enjoy this fun-filled guide whose purpose is to spread awareness about the ecological, economic, and cultural importance of wetlands.

THIS HANDBOOK HAS BEEN WRITTEN FOR TEACHERS, STUDENTS, PARENTS, AND OTHER RESIDENTS OF THE MARYLAND COASTAL BAYS
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World Wetlands Day History

The Convention on Wetlands, or the Ramsar Convention, took place in Ramsar, Iran on February 2nd, 1971. The convention produced an intergovernmental treaty that provided a framework for international wetlands conservation and sustainable use[1]. Presently, the convention has 169 member countries and is the only international environmental treaty that targets a particular ecosystem[2]. In April of 1987, the United States joined the convention and currently has 37 Wetlands of Significant Importance sites. To honor the start of the convention, each year on February 2nd, World Wetlands Day is celebrated around the globe.

Lesson Plan Outline

The following page provides a general outline for all of the lesson plans found in this document.

Lesson Title: Description of the activity

Time: Estimated length of time the lesson will take

Grade Range: The provided grade range can usually cover 2 to 3 grades with small modifications to the lesson

Content Standards: Next Generation Science Standards relating to the lesson

Objective: The purpose and goals of the lesson

Background Information: This contains condensed, informative material that pertains to the lesson's purpose and goals. This can be used for the teacher to brief themselves on the subject, or for older students to gain knowledge prior to the lesson.

Materials: A list of materials needed

Set Up: The set up that needs to be completed before the lesson commences

Engaging Questions: Teacher will use these to introduce the lesson and engage the students

Procedure: A step-by-step lesson outline

Data Collection: Tables and charts will be provided (if necessary) to document results

Discussion Questions: Questions that assess the student's comprehension and encourage the analysis of data. The questions can either be verbal discussed or printed and used as a closing activity.

Modifications/Extension Activities: Alterations to the activity that could simplify or extend the lesson depending on the grade being taught

Additional Resources: Teachers or parents can use these websites for more information

Lessons

Lesson #1 Wetland Artist

Lesson Title: Wetland Artist

Time: 45 minutes

Grade Range: Pre-K and Kindergarten

Content Standards:

- NGSS K.L S1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
- NGSS K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
- NGSS K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

Objective: Students will learn what a wetland is and what can be found in it. They will collaborate to create a model of a local wetland using plants and animals. They will be able to ask questions about the relationship between the natural world and those animals that live there. Students should also be able to discuss how they, as humans, may help keep wetlands safe.

Background Information:

Wetlands are areas of land where the soil is covered in water for the whole, or part, of the year[3]. These diverse ecosystems are filled with a variety of plants and animals that engage in important symbiotic relationships. Each plant and animal has its own role, or niche, in the environment. This allows ecosystems to maintain balance. It is important to protect wetlands as they are vital sites of nutrient cycling and juvenile animal growth. On the Eastern Shore of Maryland, we have countless wetlands that are all linked to our six coastal bays. Many local's livelihoods are based around the water, and, therefore, there is heavy reliance on the health of these wetlands and bays.

Materials:

Poster Board (at least 4x4) or use front chalkboard	Marker or Chalk for board
Attached Printables (10 animals/plants/name labels)	Adhesive (tape or glue)
Coloring utensils	Scissors

Set Up:

1. The teacher will need to acquire a poster board (or use their chalkboard) for the wetland scene.
2. The teacher will need to sketch the wetland scene that can be seen in Lesson 1's Printable Resource Pages.
3. Each animal and plant sheet will need to be printed off and cut so each student has a plant or animal. The plants and animals can be repeated. They are found in Lesson 1's Printable Resource Pages.
4. The animal and plant name labels will also need to be printed.

5. Collect enough scissors and coloring utensils for each student.
6. Pull up the Youtube videos on wetlands on a computer (see below).

Engaging Questions:

*Show an image of a wetland. Another option is to play a video:
Assateague Island wetlands- https://www.youtube.com/watch?v=q5_n2aHCAyY
What is a wetland? https://www.youtube.com/watch?v=PUzB0hFtQTg

1. Has anyone seen an environment like this one nearby?
    a. Let the students offer up some answers→ then assist them (ex. Ocean City, Assateague)
    b. It is called a wetland! It has the presence of water for much of the year and certain vegetation and soil.
2. What kind of living things may we find in a wetland? Think both plants and animals!
3. Point out that there is a lot of vegetation and animals. Why do a lot of animals and plants live there? → Tell the students that it is a calm environment which provides safety for young animals to grow and for plants to take root. Much like a school with students in it!

Procedure:

1. The teacher will draw the students in by asking them the "Engaging Questions" listed above.
2. Explain to the students that tidal marshes are a type of wetland found in this area. This is the image you have on the board.
3. Each student will be given a pair of scissors, one animal or plant, and coloring utensils.
4. Explain to the students that each one of these plants and animals live in the local coastal bays.
5. Allow 15 minutes for the students to color their animal or plant.
6. When the students finish, ask for volunteers to share what animal or plant they have. If they do not know, let them know they will find out shortly!
7. Have the students come up one by one and guess where their animal or plant lives. The teacher will then place the animal/plant in the correct location and place the name label beside it.
8. Students will talk about the board together as a class.
9. Teacher can stimulate conversation by asking the students to name one animal or plant they see and tell the class why it is found in that area of the environment.

Data Collection: not necessary

Discussion Questions:

1. Do some animals fly? Which ones?
2. Which animals swim?
3. What is one new animal or plant you learned about today?
4. Do humans use wetlands? If so, how?
5. How can we help keep the wetlands safe?

Modifications/Extension Activities:

1. Take students to observe a local wetland. They should recognize certain plants and animals in the wetland, relationships between them, and how humans may impact the wetlands. Observations and drawings can be made in a journal.
2. Students will choose their favorite wetland animal or plant and draw it on a sheet of paper.

Additional Resources:

The Next Generation Science Standards: http://www.nextgenscience.org/dci-arrangement/

A Young Scientists Introduction to Wetlands: http://www.fxbrowne.com/html/young_scientist.pdf

Lesson #2 I Spy the Baby!

Lesson Title: I Spy the Baby!

Time: 45 minutes

Grade Range: 1st and 2nd

Content Standards:

- NGSS 1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
- NGSS LS1.B: Growth and Development of Organisms: Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)
- NGSS 2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.
- LS4.D: Biodiversity and Humans. There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

Objective: Students will identify local wetland animals in both their juvenile and adult stages of life. The different habitats within a wetland will be identified. Students will also observe where in the tidal marsh environment the animal is found and what characteristics allow them to live there. Students will recap what they learned in a classification table.

Background Information:

A young organism goes through different stages in its development until it reaches adulthood. However, it does not always resemble its parents. This is in part due to the fact that animals live in varying environments; on land, in the water, or a combination of both. The local, diverse wetlands provide a variety of these habitats that allow thousands of animals to grow and have young. Wetlands provide calmer waters and areas of protection that help shelter younger animals. This lab will take a closer look at eight different animals, where they live in a wetland, and differences between the juvenile and adult stages of each animal.

Materials:

Poster Board (at least 4x4) or use front chalk board	8 images of adult wetland animals
Number printables for the board	8 images of juvenile wetland animals
Tape	Marker or Chalk
Scissors	Printable Classification Tables

Set Up:

1. The teacher will need to acquire a poster board (or use their chalkboard) for the wetland scene.
2. The teacher will need to sketch the wetland scene that can be seen in the Printable Resource Pages.
3. The numbers will need to be cut out and taped on the board as seen in the Printable Resource Pages. These numbers correspond to what juvenile animal belongs there. The matching

number is found to the side of the juvenile animal. The adult animals do not have numbers beside them.
4. Cut out all the adult and juvenile animals and have ready to distribute.
5. Print Classification Tables for each student.

Engaging Questions:

1. Do adult humans look similar to baby humans when they are born?
2. Teacher asks:
    a. What similarities do we (teacher and student) have in common?
    →Examples: Do we all have a nose? Do we all have fingers? Do we all have ears?
    b. What are a few differences between adults and babies?
    →Examples: Are we different heights? Are our feet the same size?
3. Explain to the students that in some species, the young do not always resemble the adults.
    a. Ask the students if they can provide any examples.
    b. Inform the students that they will be matching a juvenile animal to its parent and making comparisons.

Procedure:

1. The teacher will engage the students by asking them the "Engaging Questions" listed above.
2. Shuffle the juvenile and adult printables and hand them out to the students so each student has one.
3. Starting at #1, call the students with juvenile animals up one at the time to tape the animal over the corresponding number on the board. If more than one student has the juvenile of that number, tape them side by side.
4. For the adult animals, have each student stand and guess what their animal is.
5. As a class, discuss which juvenile the adult pairs with.
6. As each is answered correctly, the student will proceed to the board and tape their animal near the juvenile.
7. The teacher will write the name of the animal below it on the board.
8. The students will then use the table in the Printable Resource Pages to write the name of the animal, draw both the juvenile and adult stages of each species, and write a fact about each one.

Data Collection: See attached printable in Lesson #2 Printable Resource Pages

Discussion Questions:

1. What juvenile-adult pair surprised you the most? Why?
2. Give one example of how a juvenile looked different from its parent.
3. Are wetlands diverse?
4. Why are wetlands important to this area?
5. What different habitats can you pick out in the wetland?

Modifications/Extension Activities:

1. Turn the activity into a two day lesson by spending one day creating a large image of a wetland (using felt, colored paper, and any other classroom materials) and then elaborating on the importance of wetlands.
2. Provide print offs about each animal that the students can read.

Additional Resources:

The Next Generation Science Standards: http://www.nextgenscience.org/dci-arrangement/

A Young Scientists Introduction to Wetlands: http://www.fxbrowne.com/html/young_scientist.pdf

Lesson #3 Staying Dry in a Wetland

Lesson Title: Staying Dry in a Wetland

Time: One hour

Grade Range: 3th through 5th

Content Standards:

- NGSS LS3.B: Variation of Traits. Different organisms vary in how they look and function because they have different inherited information (3-LS3-1). The environment also affects the traits that an organism develops (3-LS3-2).
- NGSS 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- NGSS 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Objective: Students will recognize why it is important for duck feathers to repel water. Students will be able to comment on how feather adaptations support the survival of the ducks. Students will learn how birds are protected in our local coastal waterways.

Background Information:

Duck feathers may structurally look different species to species because their function changes depending on how they stay warm, hunt for food, fly, swim, and defend themselves. However, despite how their feathers look, all ducks participate in a common behavior called preening. This process cleans their feathers of dirt and allows them to keep them in the best condition possible. The ducks also employ a unique adaptation called a preen gland. The preen gland produces oil that the duck uses to coat their feathers as they clean[5]. The oil allows their feathers to repel water as they swim and hunt. Without the preen gland, ducks would not be shielded from water absorption or the cold. In this lab, students will conduct an experiment determining what would happen if ducks did not have a preen gland.

Local Efforts

The Maryland Coastal Bays Program assists in the protection of ducks in our local waterways through wetlands restoration, protection of habitats, and through education. In the Additional Resource section, a link can be found to a brochure about Skimmer Island, a local, protected area.

Materials:

Printables of ducks on construction paper or old paper bags	Water
Paper towels	Spoons
Canola Oil	Plastic tray
Plastic trays	Paintbrushes
Printable Table	Clear cup

Set Up:

1. Cut out the provided printable of the duck. Or trace and cut out on recycled paper bags.
2. Fill a plastic tray with canola oil, just so the bottom is covered.
3. Repeat step two using water.
4. Place one tray of water and one tray of oil at each group of desks.
5. Place a paper towel and a paint brush at each desk.
6. Place two paper ducks on each paper towel.
7. Have an image or a video of a duck preening ready for the students to view.

Engaging Questions:

1. Ask the students if they have any animals at home. Ask the students if they know what protects their pet's bodies. Explain that: humans have hair, dogs and cats have fur, and birds have feathers!
2. *Show an image or video of ducks preening. Ask students to describe any birds they have seen in the wild. Ask students if they have specifically seen any ducks.
3. *Explain preening and why ducks don't "get wet". Why is it important that ducks repel water?

Procedure:

<u>Front Demonstration:</u>

1. Fill the clear cup half way with water.
2. Fill the cup another one-quarter the way up with canola oil.
3. Stir vigorously with a spoon. Let sit for one minute.
4. Have students share verbal observations as the oil and water separate. Record observations in data table.

<u>Student Experiment:</u>

1. Now that they have seen that oil and water separate, tell students that they will be making observations of water's effects on one duck with oiled feathers and one without.
2. Students should begin by making predictions about each duck and how water will affect each.
3. Have students paint oil onto one of their ducks.
4. Have students touch their two paper ducks with just one finger, starting with the duck that is not oiled.
5. Ask students to wipe their fingers off and record their observations in their data table.
6. Each student should take a spoon and scoop one spoonful of water onto the duck that is not oiled.
7. Students should observe what the water does for one minute, and make observations in their data tables.
8. Repeat steps 6 and 7 for the oiled duck.

Data Collection: see attached

Discussion Questions:

1. Which duck repelled water?
2. Why did the duck repel water?
3. How does this function help the duck survive?

4. During this lesson, we learned that ducks need oiled feathers in order to survive in their environment. Why is it then that oil spills harm ducks?
5. Why are ducks and other bird species important in our local tidal marsh ecosystem?

Modifications/Extension Activities:

1. Elaborate on this lesson by teaching the students about buoyancy. Different classroom items can be collected and tested in a bowl of water (float or sink). Students can make predictions, conduct the experiment, and document their results in a table.
2. Students can research different species of duck and create posters on how ducks are important to the wetland/tidal marsh areas. The Maryland Coastal Bays Program website can be utilized to research how endangered birds are being protected in the local waterways.
3. Construct an experiment that examines what happens to a duck when there is an oil spill. Explain the differences to students between natural oil found on duck's feathers, and the detrimental effects of oil spills.

Additional Resources:

Maryland Coastal Bays Program- Skimmer Island Brochure:
http://www.mdcoastalbays.org/content/docs/skimmer-island.pdf

The Next Generation Science Standards:
http://www.nextgenscience.org/dci-arrangement/

A Young Scientists Introduction to Wetlands: http://www.fxbrowne.com/html/young_scientist.pdf

Vanishing Wetlands: A Magic Act? http://questgarden.com/68/07/4/080708102144/index.htm

Lesson #4 Local Land Use Planning

Lesson Title: Local Land Use Planning

Time: Two, 1 ½ hour class periods

Grade Range: 6th through 8th

Content Standards:

- NGSS MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- NGSS MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- NGSS MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Objectives: Students will conduct research to determine the steps that go into designing a town. They will consider physical, economic, and social aspects when determining where to build. They will use the information gained to generate a design solution and practice map-making skills. Students will identify relationships and the complexity of issues between human development and environmental concerns in our local area.

Background Information:

Land use planning is the process of assessing the physical, economic, and social factors of an area so as to stimulate community productivity while maintaining sustainability[6]. It is a difficult process as all three of these factors must be analyzed and evaluated when designating where to build. In our local area, there are critically important waterways and wetlands that need to be protected. Additionally, it is vital to strategize placement of our local built environment due to the ever-growing population, and, as a result, social concerns, of the Eastern Shore. An example of a social concern would be the distance of schools to neighborhoods and housing developments. Also, the placement of wastewater treatment plants and landfills encompasses all three concerns. In this lab, students will design a new town using the land use maps and specific guidelines provided to them.

Materials:

Thin-tip black markers	Copies of all 3 maps[7]
Coloring utensils	Rulers
Printable guidelines[7]	Notebook paper
Access to the World Wide Web	

Set Up:

1. Break the students into pairs.
2. Print off one set of guidelines per pair of students.
3. Print off enough of each map so there are a few groups working on each one. There are three different map options provided in the Printable Resource Pages.

4. Provide a ruler to each pair.
5. Equip each pair with at least 8 different coloring utensils and a thin tip black marker.
6. Find an aerial image of a local town (see below) and pull up on the overhead/projector.

Engaging Questions:

*Explain to students that they are receiving an imaginary plot of land in where they will design their own town. It is a piece of land in this area. They must follow the specific guidelines to ensure that their towns are constructed in an environmentally sound way. Economic and social aspects will also be taken into consideration (location of school to homes, placement of water treatment plant, etc.). Please make sure to stress to the students that the biggest dilemma will be to design the town around the local tributaries with keeping the health of the wetlands in mind.

*Pull up an aerial image of one of our local towns (Ocean City, Berlin, Ocean Pines, Snow Hill, and Pocomoke).

1. Who knows what town this is?
2. Does this town look organized? If so, how?
3. What are some factors that need to be taken into consideration when planning a new town?
    a. Distance to waterways, parks, schools, water treatment plants, farms, etc.

Procedure:

<u>Pre-Planning. Day 1:</u>

1. Find a partner and sit by them.
   Watch the video "Creating a Sustainable Future: Ecosystem Services and Spatial Planning" at https://www.youtube.com/watch?v=DnsAale9D_k
2. Using your computers, work together to research development and land use tactics that minimize impacts to the local waterways and wetlands.
3. Discuss with your partner what important factors need to be considered when planning a new town. Write organized notes on these factors on notebook paper.
4. Read and highlight the guidelines provided to you from your teacher.
5. Study your map and make sure you understand the color designations.
6. On your maps, begin to sketch out in pencil a rough draft of where you and your partner are thinking of designing all the buildings.

<u>Town Development. Day 2:</u>

1. Take out your notes, guidelines, and map from Day 1.
2. Continue to work on the rough draft.
3. When completed, present the town design to your teacher for approval.
4. Once approved, obtain another copy of your map, and work on your final draft.
5. The final draft should be completed with a ruler to ensure neatness. Also use the thin-tip black marker to outline each land use area.
6. Provide a detailed explanation and key for your town on a separate sheet of paper.
7. Prepare to present your completed towns to the class.
8. As a class, assess the best land use plan designed today. Based your decisions on how they met the criteria and how well they will maintain biodiversity and ecosystem services.
9. Complete the discussion questions.
10. Turn in the completed towns, detailed explanation, and questions to your teacher.

Data Collection: not necessary

Discussion Questions:

1. Give two examples you found in your research that helped you decide on your town design.
2. What aspects of your town worked?
3. What challenges did your team encounter when designing?
4. If you could design your town again, what would you change?
5. Why is it important to take into consideration local waterways and different land uses when planning a town? Explain.

Modifications/Extension Activities:

1. Contact the Education Coordinator at the Maryland Coastal Bays Program to set up a day prior to the lesson in to come in and present the Enviroscape. An Environscape is a model that demonstrates how human activity can affect local waterways and wetlands.
2. Using materials found in the classroom, have students conduct a 3-D model of their town and present it to the class.

Additional Resources:

Enviroscape Website: http://www.enviroscapes.com/

The Next Generation Science Standards:
http://www.nextgenscience.org/dci-arrangement/

Lesson #5 Water Chemistry in the Maryland Coastal Bays

Lesson Title: Water Chemistry in the Maryland Coastal Bays

Time: Two, 1 ½ hour lessons
*longer if concluding with a written lab report

Grade Range: 9th through 12th

Content Standards:

- NGSS HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- NGSS HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- NGSS HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience. A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6). Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

Objectives: Students will conduct research to better understand the complex issues that surround the local coastal bays. They will analyze chemical parameters from water samples collected from the six local coastal bays and compare water quality data to that published by the Maryland Coastal Bays Program.

Background Information:

The local coastal bays system is composed of six main bays and their respective tributaries. The six bays are Sinepuxent Bay, Assawoman Bay, Chincoteague Bay, Newport Bay, Isle of Wight Bay, and the St. Martin River. In 2015, the Maryland Coastal Bays Program (MCBP) released a Report Card which grades the bay based on six indicators. The six include four water quality indicators (total nitrogen, total phosphorus, dissolved oxygen, and chlorophyll-a) and two biotic indicators (hard clams and seagrass)[8]. There are many factors that influence these indicators and the overall health of the bay. In this lab, students will conduct experiments using water samples from all six bays to determine their own chemical results for total nitrogen, total phosphorus, and dissolved oxygen. They will compare their results with the MCBP's results, and then research the potential influences that lead to each bay's overall health.

Materials:

- Water quality test kits (LaMotte or Earth Force, link provided)
- Water samples from all six coastal bays
- 500 ml capped solution bottles
- Pipettes
- Test tubes
- Beakers
- Masking tape
- Data sheets
- Coastal Bays Maps

Set Up:

1. The teacher will need to travel to all six coastal bays and collect a 500 ml bottle of water from each. Take a photo at each location so the students can see where the water can from.
    a. Depending on ability for classes to travel, the class could potentially collect the water.
    b. All water should be collected on the same day.
    c. A student could be in charge of one bay if they live nearby.
2. Label each bottle with the name of the bay.
3. The teacher will place one water quality test kit at each lab station (or set of desks). The test kits each come with a set of directions.
4. Each lab station will also have one pipette, three test tubes, pH strips, each parameter's color identification card, masking tape for test tube labeling, and one beaker.
5. Enough printed data collection sheets and coastal bays maps for each person. *Print the coastal bays map so that the pre-lab questions are on the back.
6. Set the 5, 500 ml bottles in the front of the room.
7. *If there is access to laptops, provide each lab group with one. If there are computers in the school library, conduct the online steps there. They will use computers to research the six local coastal bays using the Maryland Coastal Bays Program website. They will use this information to make predictions about the health of each bay.

Engaging Questions:

1. Does anyone live on the water locally?
2. What kinds of activities occur in or around the water that may affect water quality?
3. Why is it important to keep our local waters safe?
    a. Discuss wetland importance and how they filter water and provide natural buffers.
    b. Discuss economic and social importance: livelihoods, lifestyle, tourism industry, etc.

Procedure:

<u>DAY 1</u>

<u>Pre-Lab:</u>

1. Using a computer, open up the Maryland Coastal Bays Program website in your search engine: http://www.mdcoastalbays.org/
2. With your group, research each of the six coastal bays and determine which chemical parameters are impacting the bays.

3. Fill out the provided coastal bays map with the names of the six main coastal bays.
4. Answer the Pre-Lab Questions on the back of the map.
5. Read the directions found in your water quality test kits.
6. After reading the directions, make sure you have all the materials on your lab table to conduct the lab.
7. Optional: *If instructed by your teachers, begin to work on your lab's title, question, background information, hypothesis, and variables.

Day 2

Lab:

1. Take out the direction packet found in your water quality test kits.
2. Proceed to the front of the classroom with your beaker and collect your first sample of water.
3. Label your beaker with the bay name using your masking tape and marker.
4. Using the test kit directions, conduct the water quality tests for pH, phosphate, nitrate, and dissolved oxygen.
5. Use the chemical parameters identification cards to determine your results.
6. Record you results in your table.
7. Repeat steps 2-6 for the other five water samples.
8. Optional: * If instructed by your teachers, complete your materials, procedure, results, and discussion in your lab report.

Data Collection: see attached

Discussion Questions:

1. Why is it important to test of all four of these water qualities and not just one? Could the result of one affect another? Think eutrophication!
2. Based on your findings, which coastal bay would you say is the healthiest? Unhealthiest?
3. Do your results parallel the results produced in the, "Coastal Bays Report Card"? Please explain.

Modifications/Extension Activities:

1. Students will write up a lab report and turn in for a grade. The lab reports could include Title, Problem, Background Information, Hypothesis, Variables, Materials, Procedure, Results, and Discussion. Teachers can modify this where they see fit such as providing a rubric, and giving the students questions that help them write their background information. A sample lab report outline is provided in the Printable Resource Pages for this lesson.
2. Take a field trip to one of the coastal bays with the Maryland Coastal Bays Program to explore the unique flora and fauna of the area and it participate in hands-on activities.

Additional Resources:

Interactive Eutrophication Model:
http://coseenow.net/blog/2008/11/eutrophication-animation/

Water Quality Testing Kit from Earth Force:
http://www.benmeadows.com/earth-force-watershed-field-trip_s_225510/

Water Quality Testing Kit from LaMotte:

http://www.benmeadows.com/lamotte-estuary-monitoring-kit_s_95227/

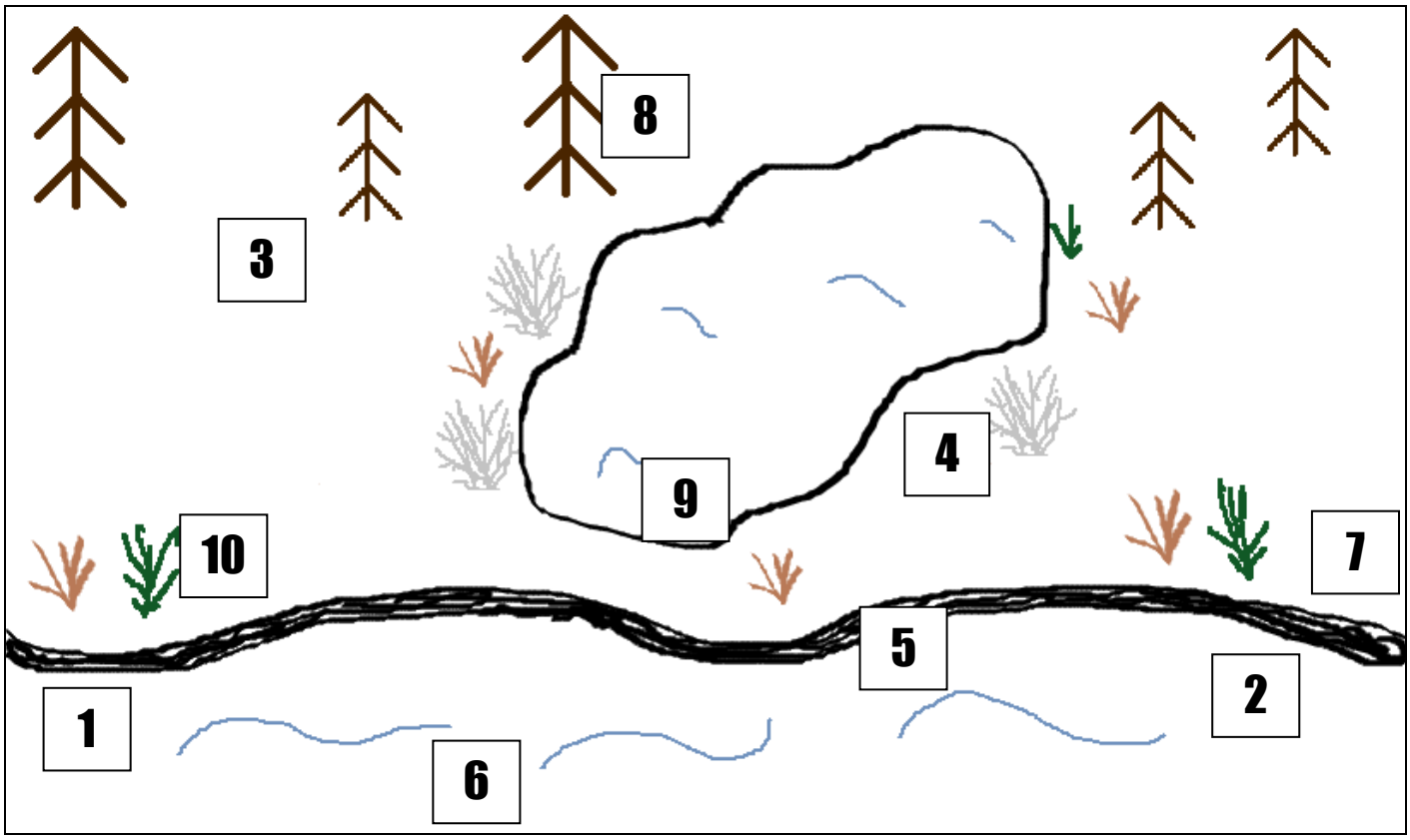
The Next Generation Science Standards:
http://www.nextgenscience.org/dci-arrangement/

The Maryland Coastal Bays 2014 Report Card:
http://ian.umces.edu/pdfs/ian_report_card_536.pdf

Printable Resource Pages

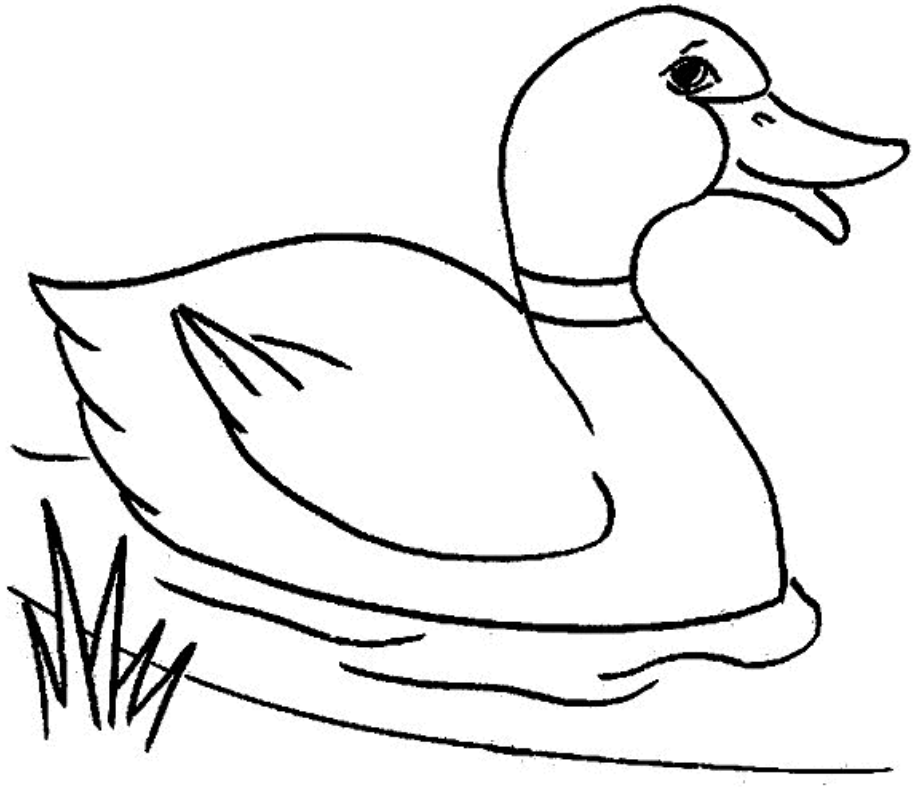
Lesson #1 Wetland Artist

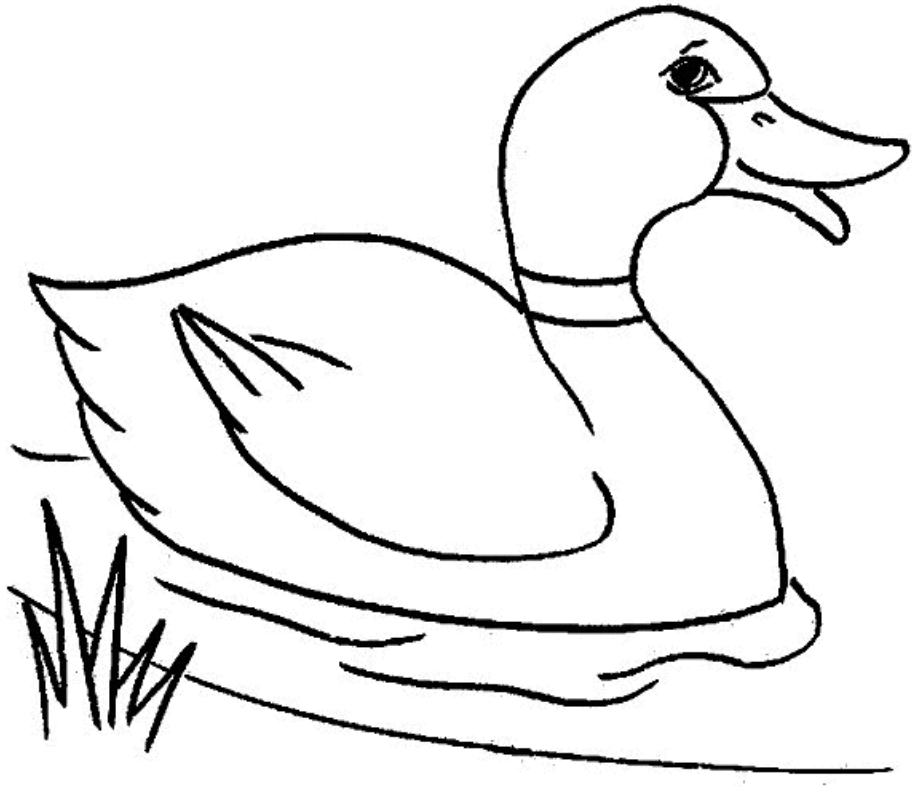
Wetland Scene: This can be drawn on the board and modified. The numbers correspond to the animals and plants that need to be placed there. Teachers, you can use this as a guide as the students guess where their organism goes.



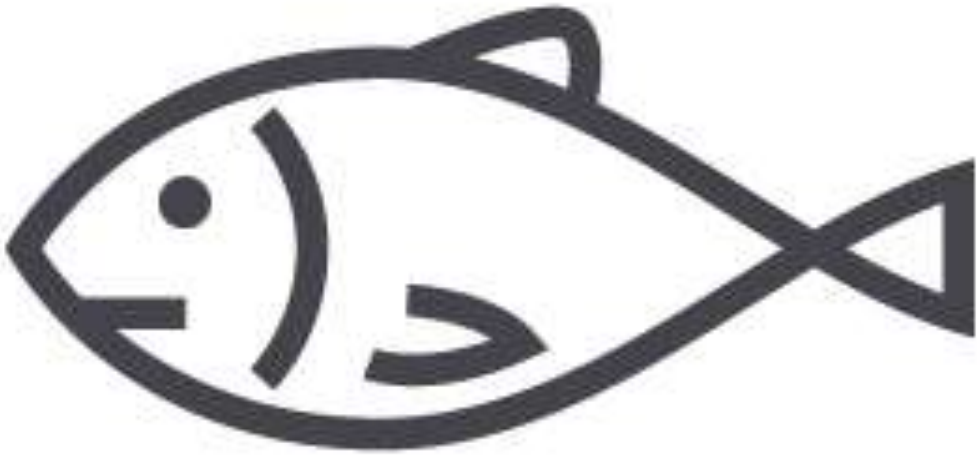
The following pages include images of the animals and plants that need to be printed.

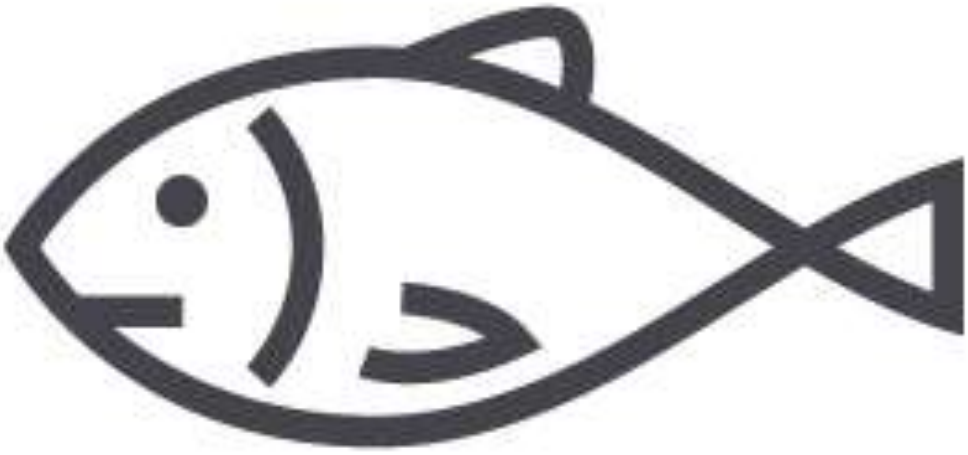
1. Male Mallard Duck: male ducks are called drakes, their feathers repel water



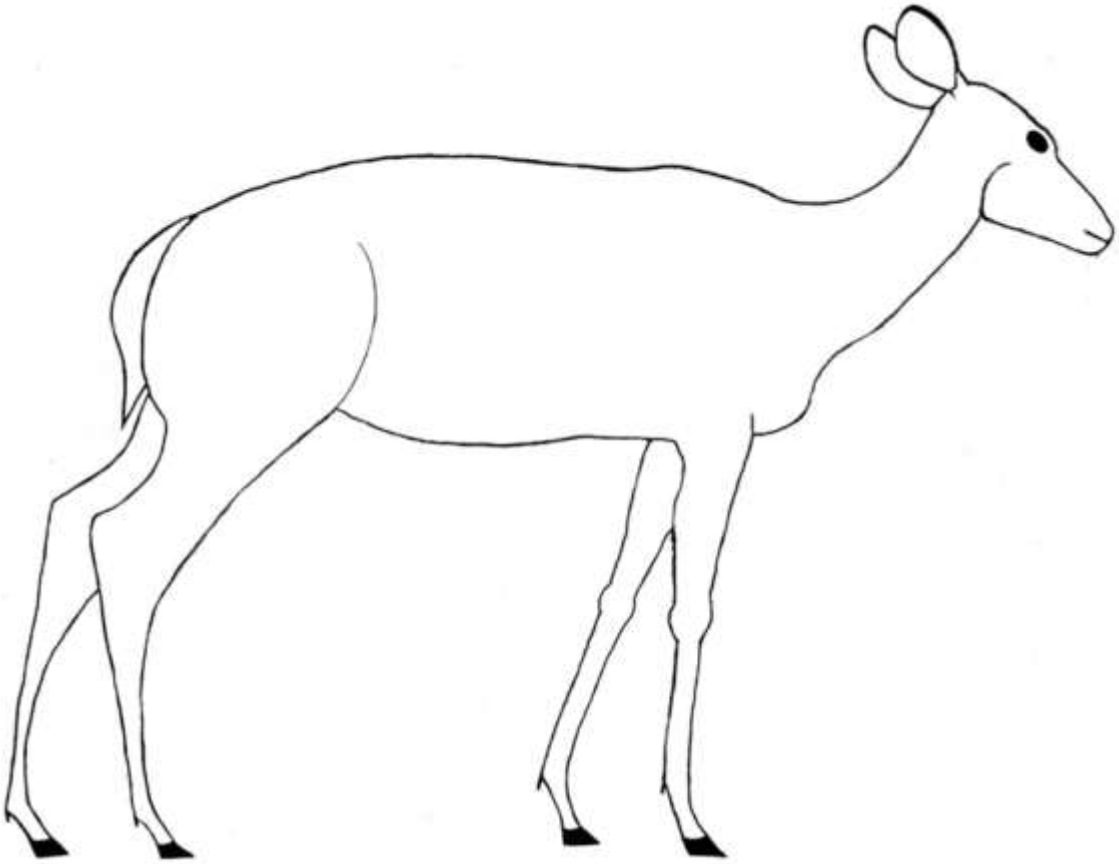


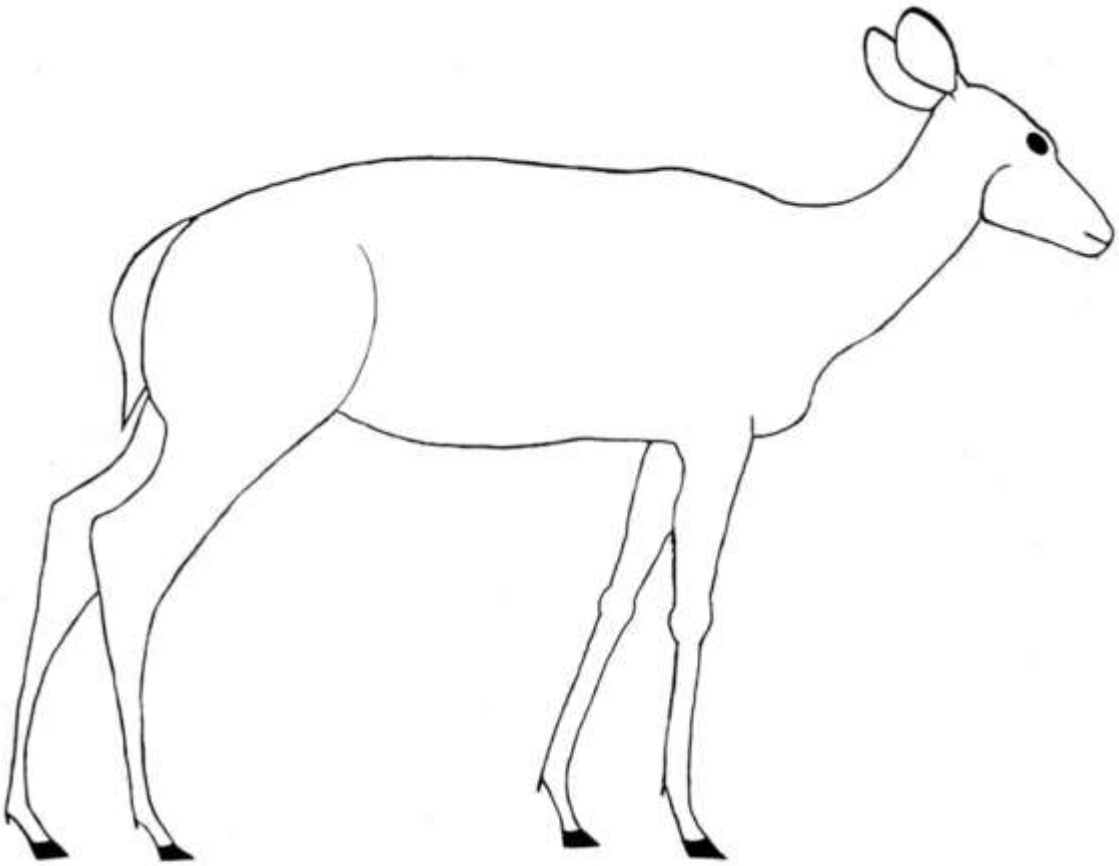
2. Hickory Shad: live in the ocean and spawn (lay eggs) in freshwater



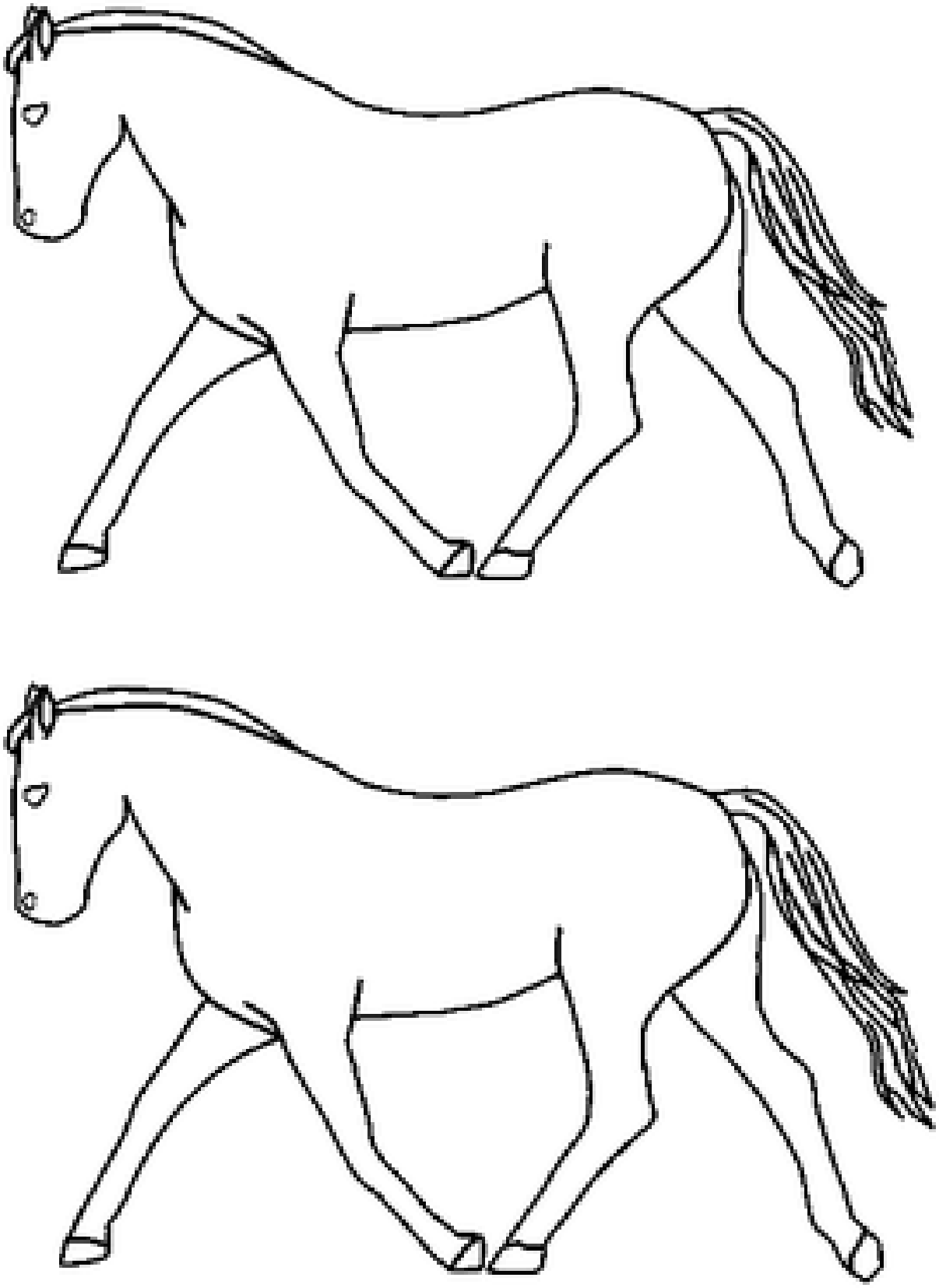


3. Female White-tailed Deer: herbivores (only eat plants)

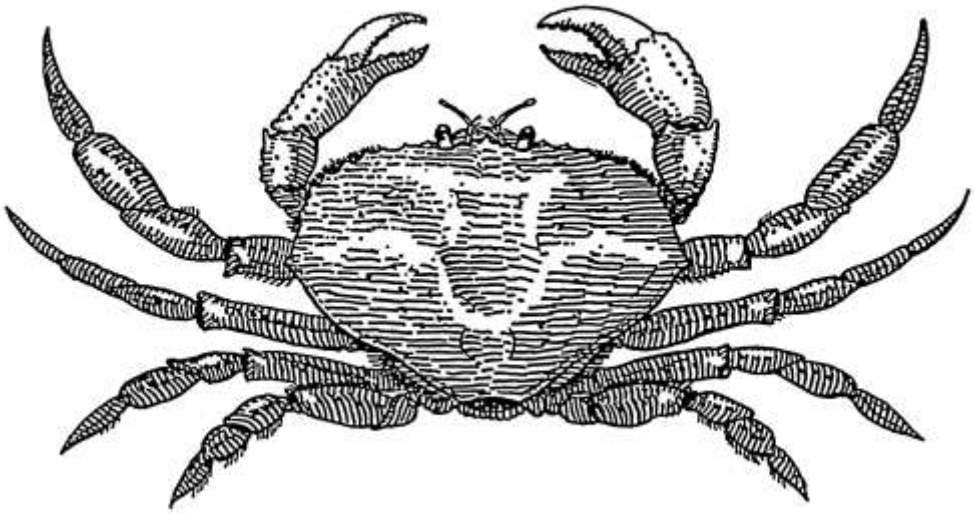


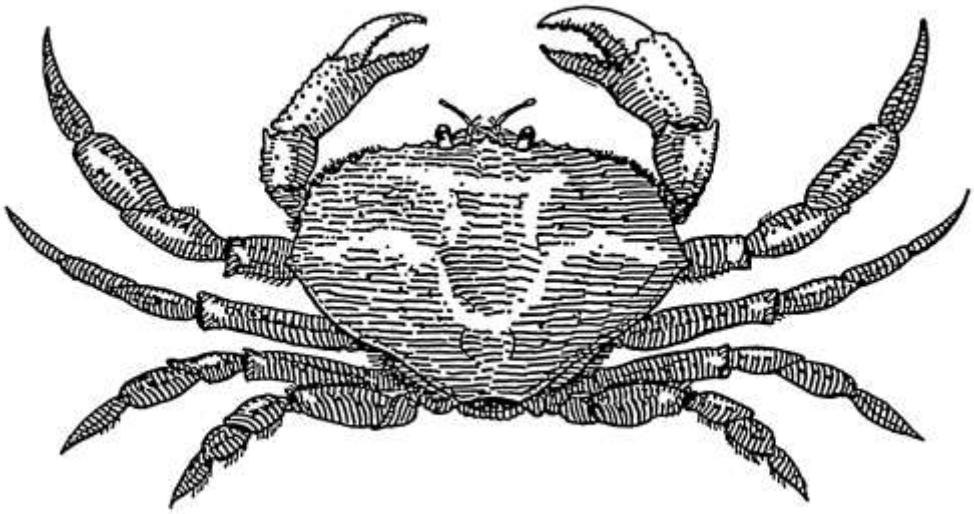


4. Horse: Assateague's "wild ponies" rumored to have arrived on Spanish galleon ships in the 1800s.

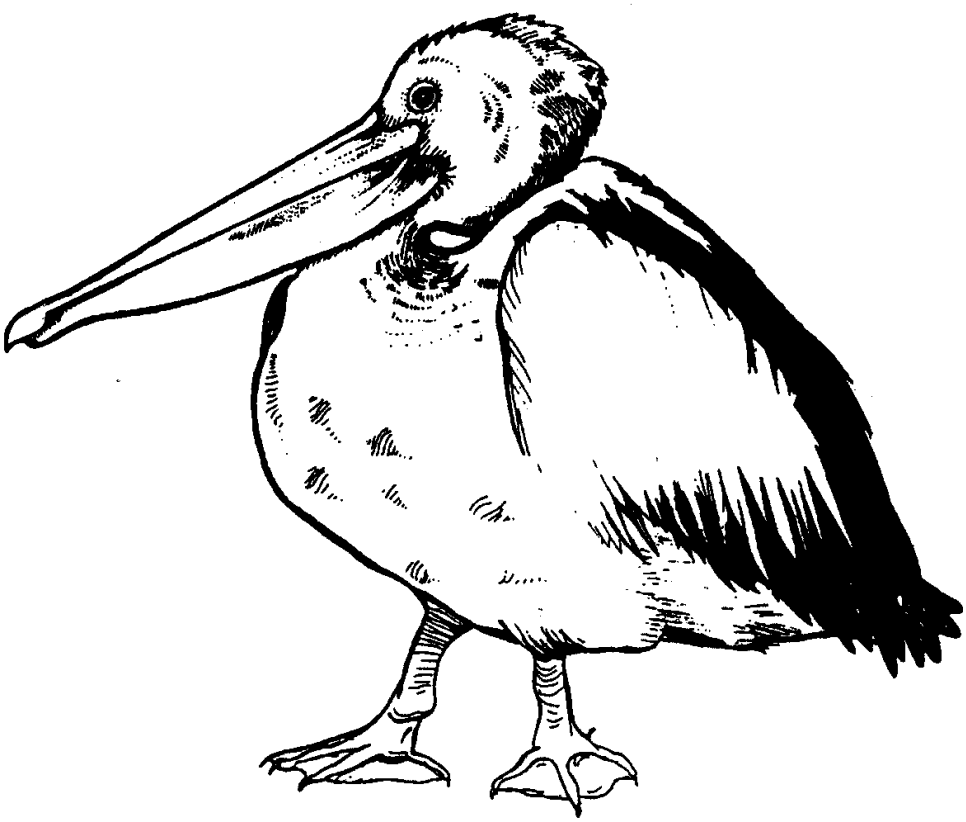


5. Blue Crab: Their scientific name *Callinectes sapidus* means beautiful swimmer.

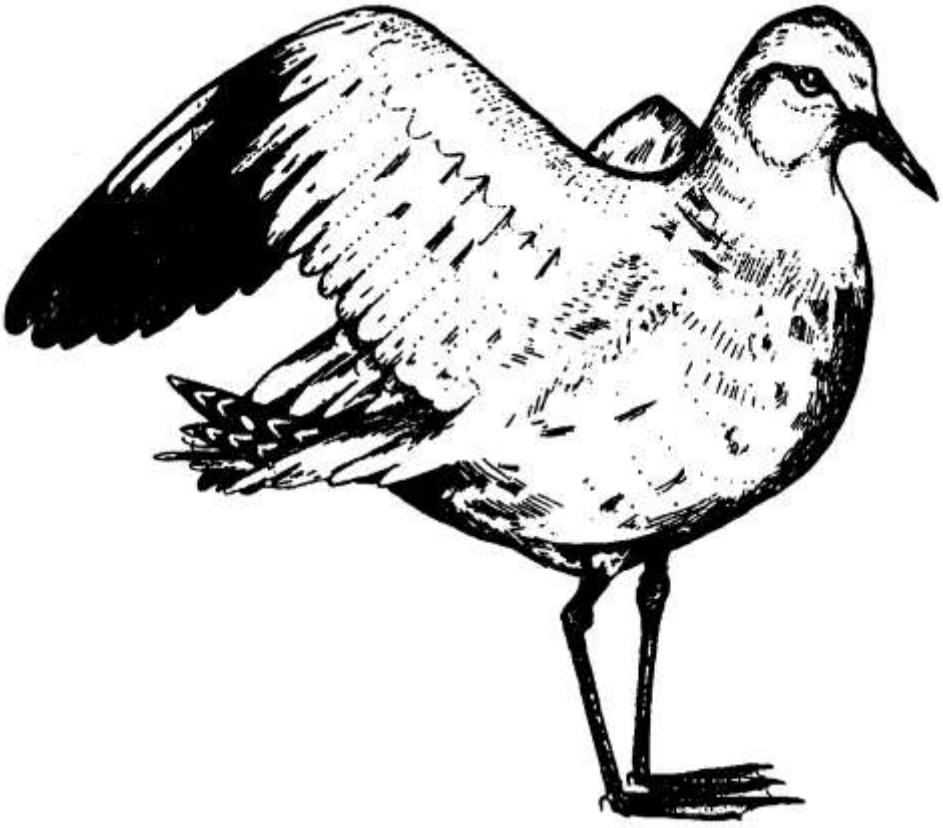




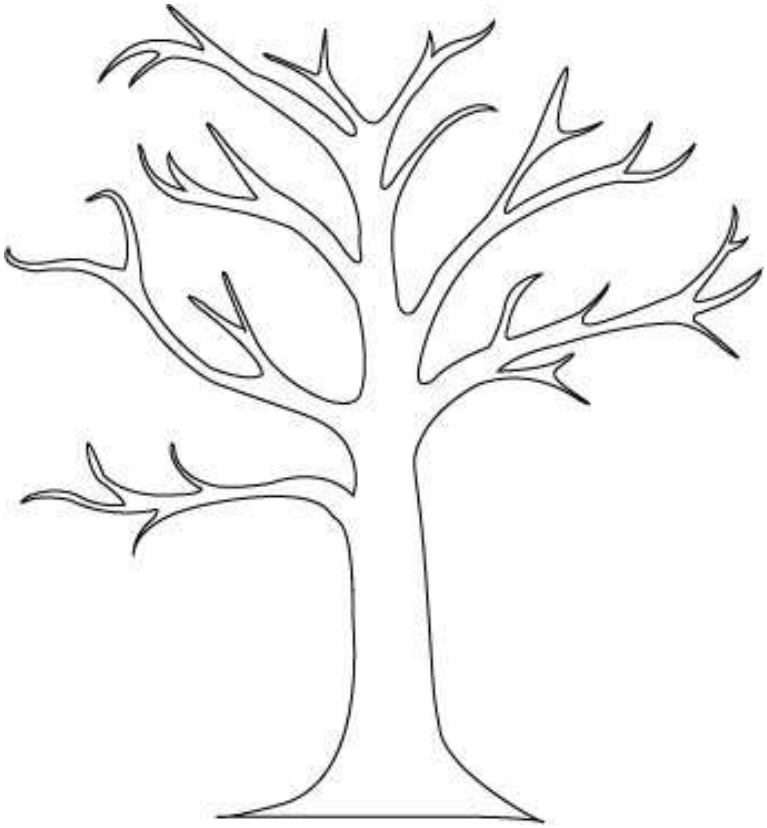
6. Brown Pelican: dive headlong into the water to fish. Scoop fish and water up in their bills

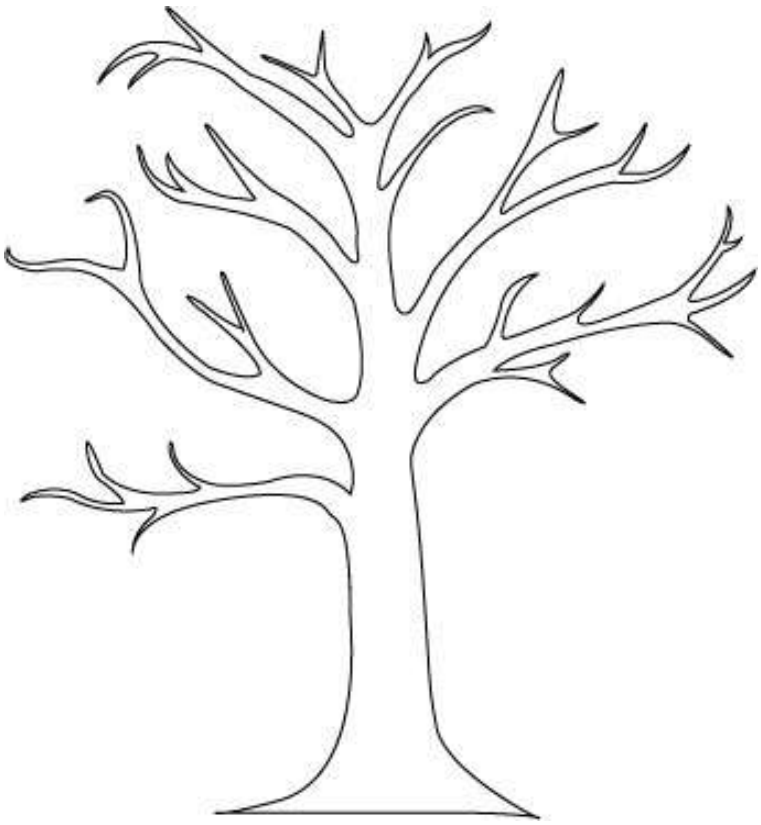


7. Laughing Gull: has a hysterical, laughing-like call

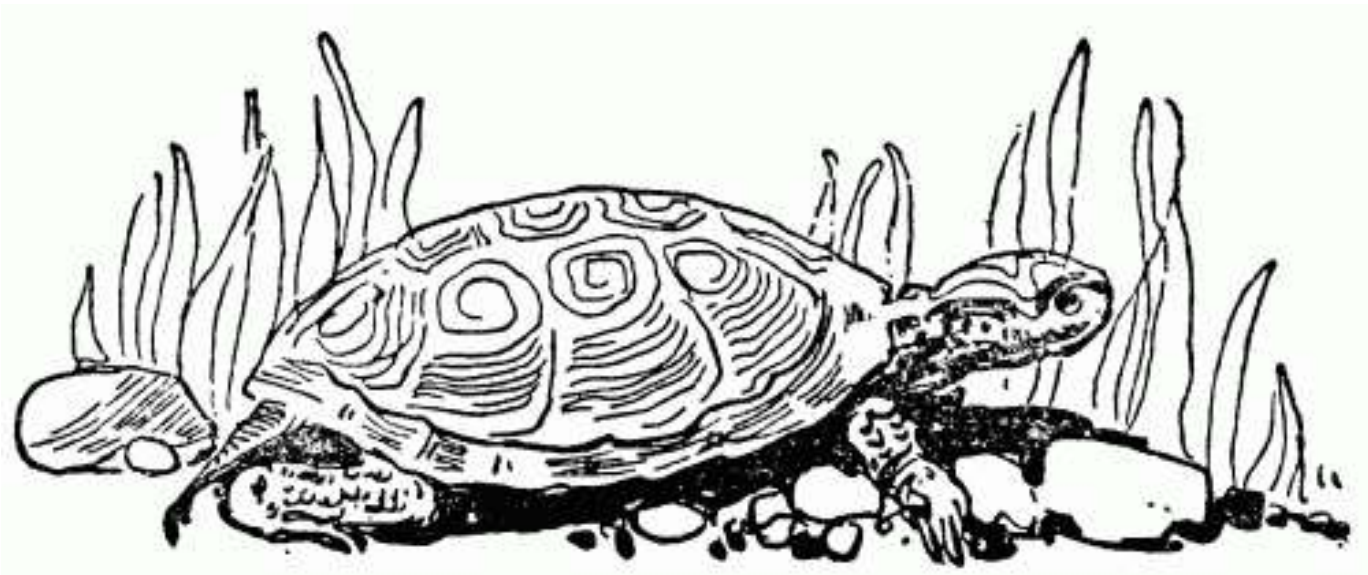


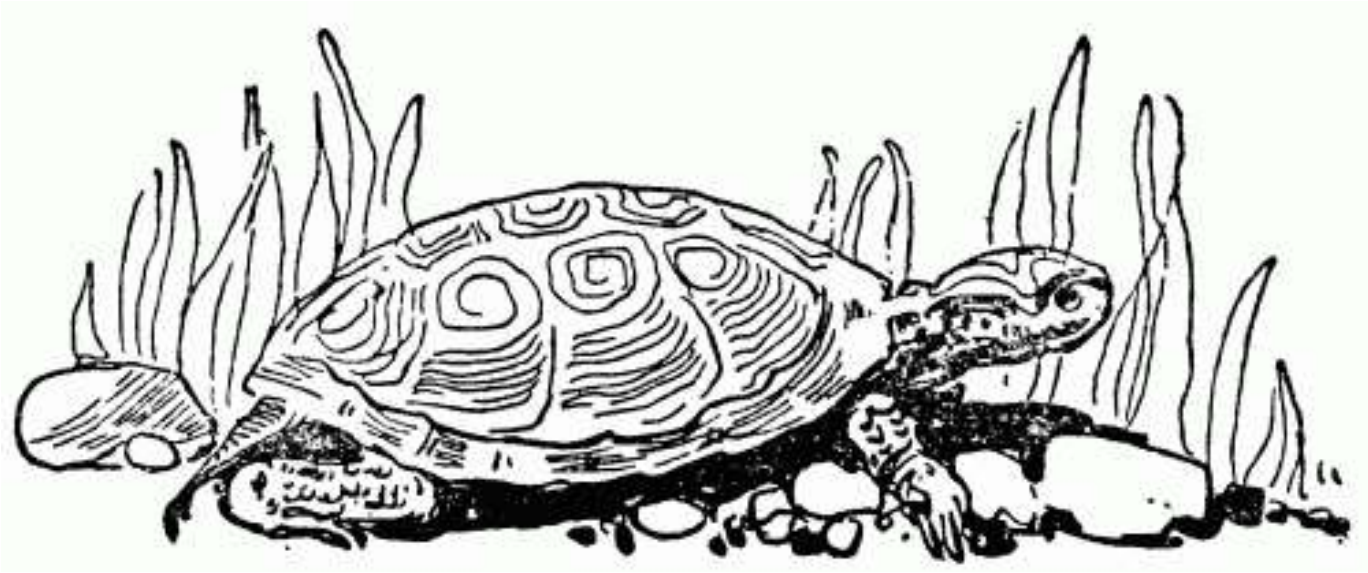
8. Dead Bald Cypress: This is an example of a dead bald cypress. The dead trees are good for the environment because they still hold soil in place, provide habitat, and the branches (snags) provide an observation place for hunting and migratory birds.





9. Diamondback terrapin: the Maryland state reptile!





10. Cattail:a native marsh plant that help keep erosion under control and provide habitat



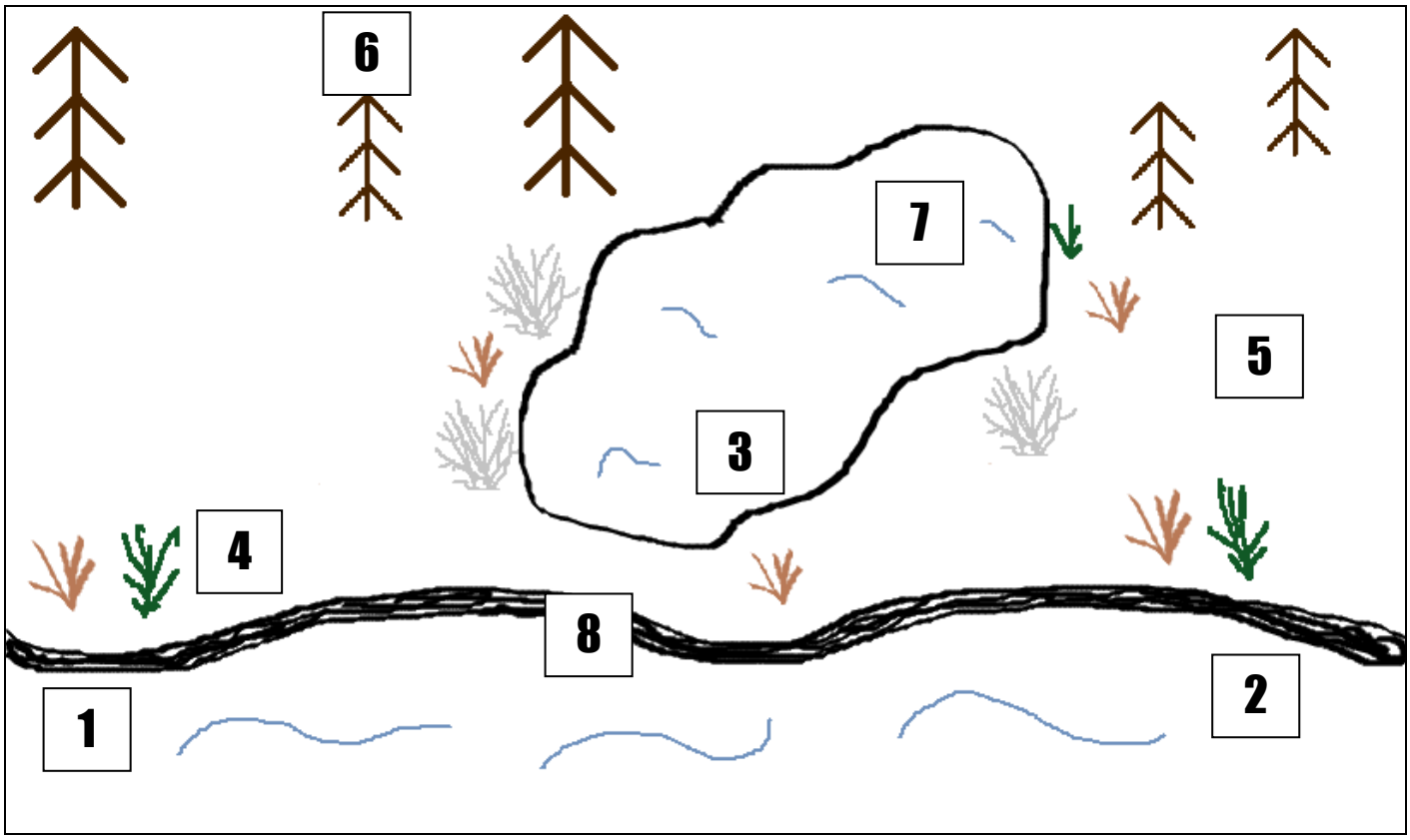



The following are name cards that can be printed, cut, and pasted next to the organism at the end of the lab.

Male Mallard Duck
Hickory Shad
Female White-tailed Deer
Horse
Blue Crab
Brown Pelican
Laughing Gull
Dead Bald Cypress
Diamondback Terrapin
Cattail

Lesson #2 I Spy the Baby!

Wetland Scene: This can be drawn on the board and modified. The numbers correspond to the juveniles of each animal.



Write the name of the animal seen and sketch it out! ☺

Animal Name	Juvenile	Adult	Fact
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

1. 2.

3. 4.

5. 6.

7. 8.

Mallard ducks: male ducks are called drakes, females are hens, their feathers repel water

Bald Eagle: carnivorous, national bird

Diamondback Terrapin Turtle: the Maryland state reptile!

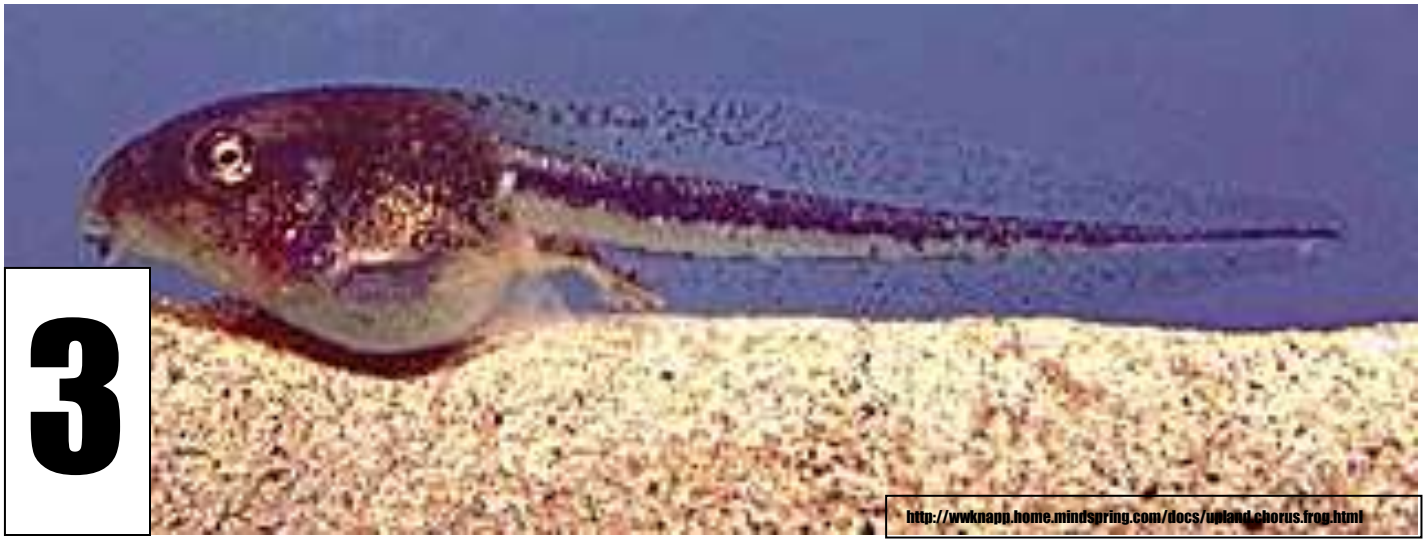
Oyster and Spat: filter feeding invertebrates (clean the water!)

Blue Crab: Their scientific name *Callinectes sapidus* means beautiful swimmer.

Hickory Shad: live in the ocean and spawn (lay eggs) in freshwater

http://www.chesapeakebay.net/fieldguide/critter/hickory_shad

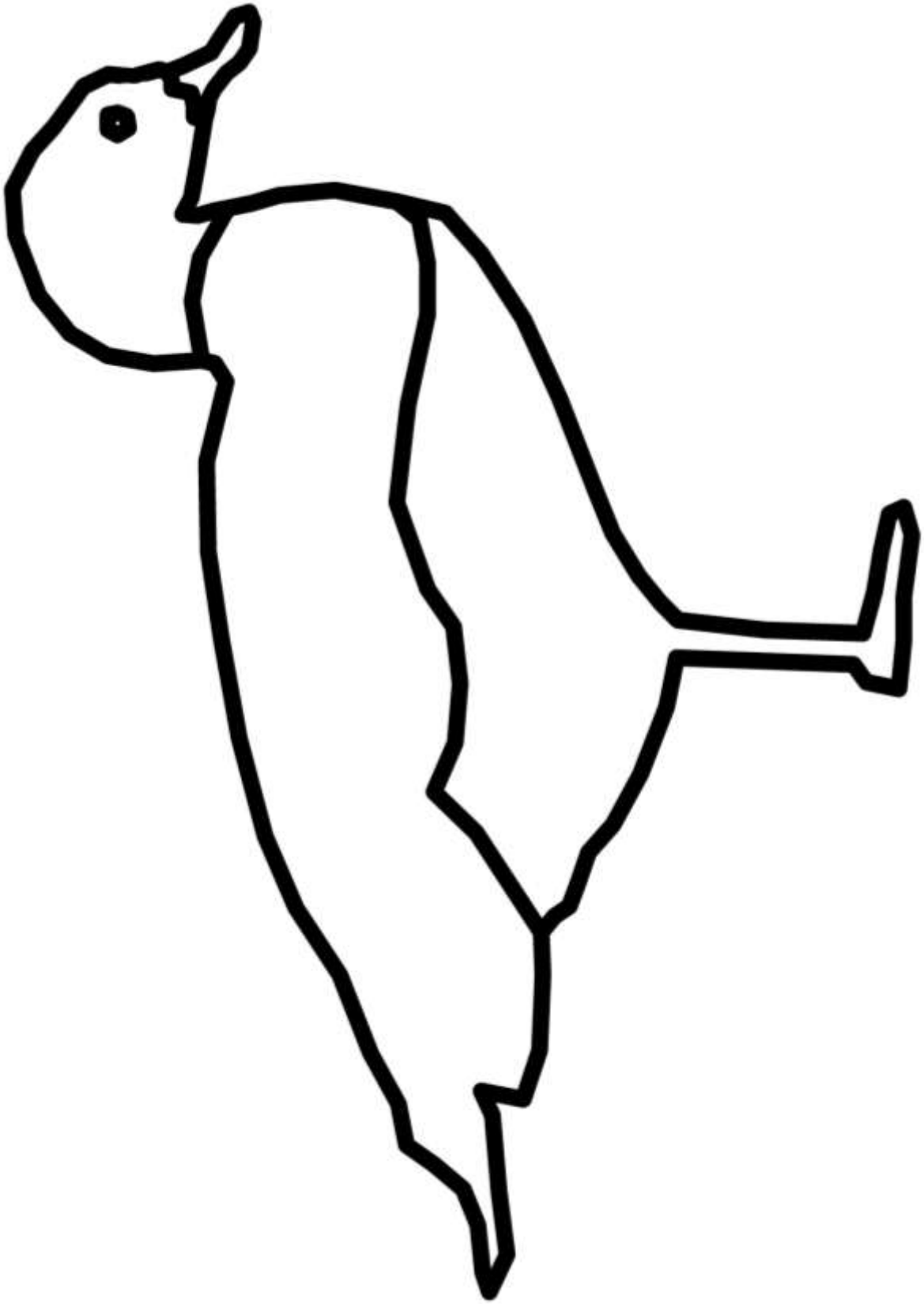
White-tailed Deer: herbivores (only eat plants)



Upland Chorus Frog: always one of the first frogs to begin calling in the spring

Lesson #3 Staying Dry in a Wetland

Print and trace enough ducks on recycled paper (brown paper bags) so there are two per person.



Staying Dry in a Wetland Lab

Name:_____

What did the duck without the oil feel like?

_____

_____

What did the duck with the oil feel like?

_____

_____

How will the water affect each duck?

	Prediction	Result
Duck without oil		
Duck painted with oil		

Local Land Use Planning

Team members:

_____

_____

A template has been provided to your group representing the area you have to develop. It contains 442 blocks each representing one acre. Your goal is to create the most sustainable, environmentally-friendly city while still meeting the planning requirements.

*You must ensure that EVERY guideline is followed, all while keeping the environment and local coastal bays in mind.

The area is divided as follows:

40 acres are rivers that connect to bays: light blue.
80 acres are wetlands that are next to one of the water sources: light purple.
40 acres are land **too sloped to build on**: tan.
42 acres are forest: dark green.
240 acres are good for development: light green.

*The land is colored according to the above designations and **it cannot be altered or changed**.*

Laws

1: At least 20 percent each of the forest, wetlands and water area must be preserved.
2. Landfills must be at least two acres away from all housing, wetlands and fresh water sites.
3. Roads and bridges may cross rivers and wetlands, but they must go around large natural areas.
4. Roads must be connected to all developed areas of the city.
5. There must be **no building** over wetlands, sloped land, and water. Only parks may partially cover these habitats and roads/bridges may cross them.

The Activity:

The group must decide where to put the following:
40 acres for a landfill
20 acres for utilities such as power plants, water treatment etc.
40 acres for parks and wildlife
40 acres for housing
40 acres for shopping
20 acres for anything environmental: community gardens, a zoo, campground, nature park, etc.

30 acres of roads and bridges –Make sure you connect the town to everything else you build. *You can have more than 30 acres of roads→just remember! Roads are impervious surfaces- you only want what you need!

Make sure the map has a key that designates what everything is.

All members of the group must turn in their own questions and answers, but you only have to turn in one map per team!

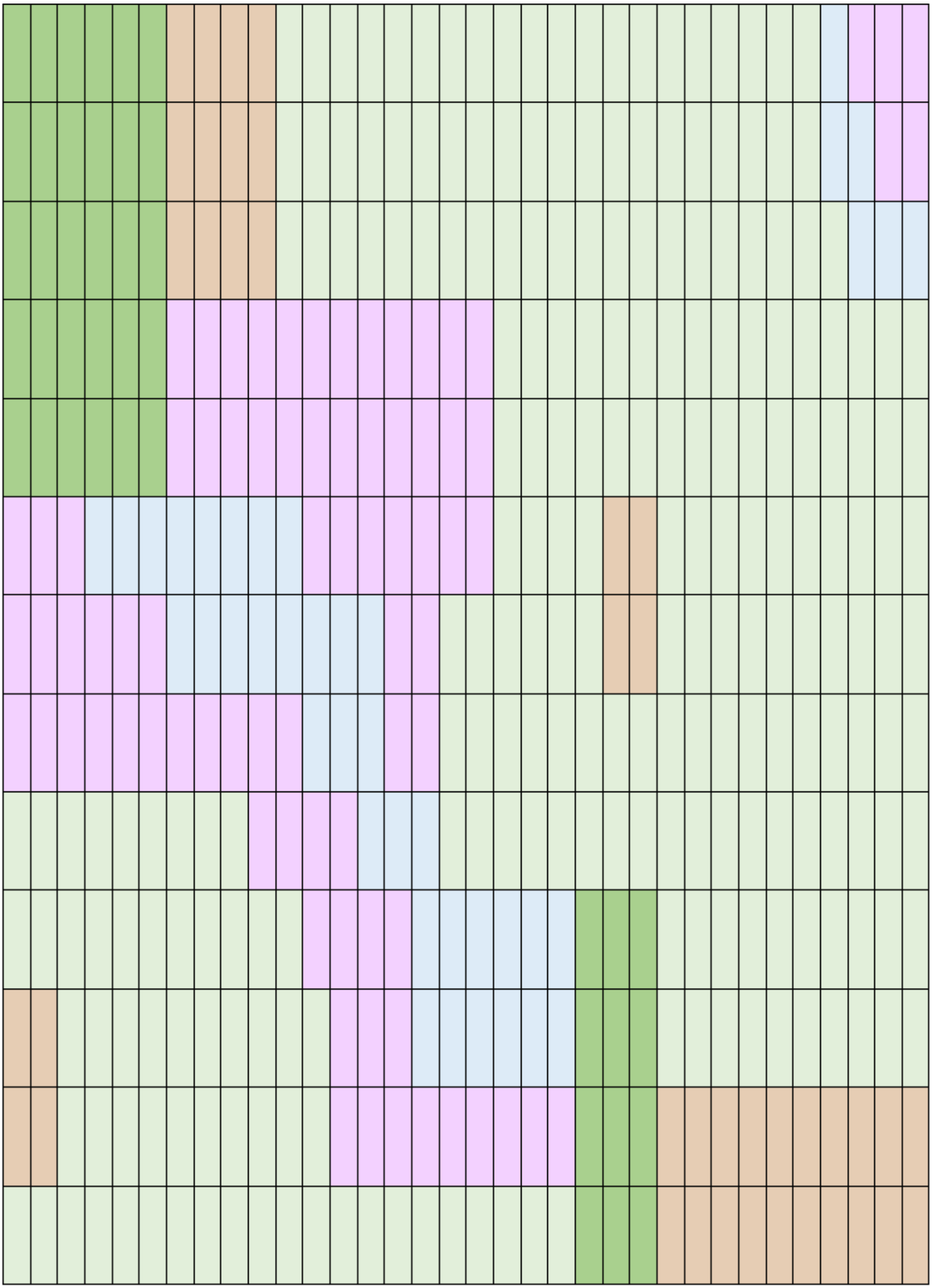
Questions:

How did the features of the land prevent you from particular decision plans?

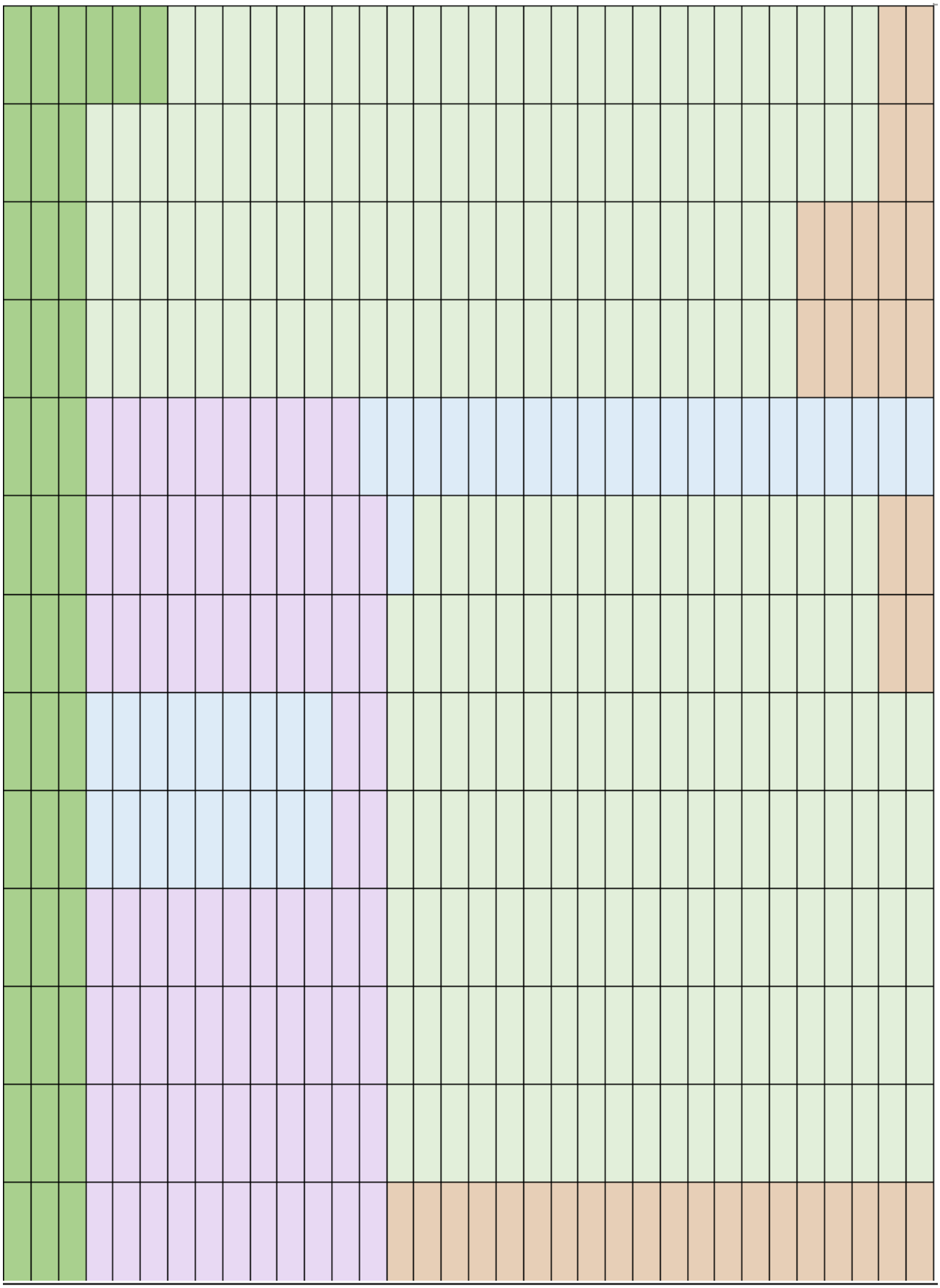
Were you able to preserve the environment while allowing for development?

How do you think this activity compares to the real life process of land use planning?

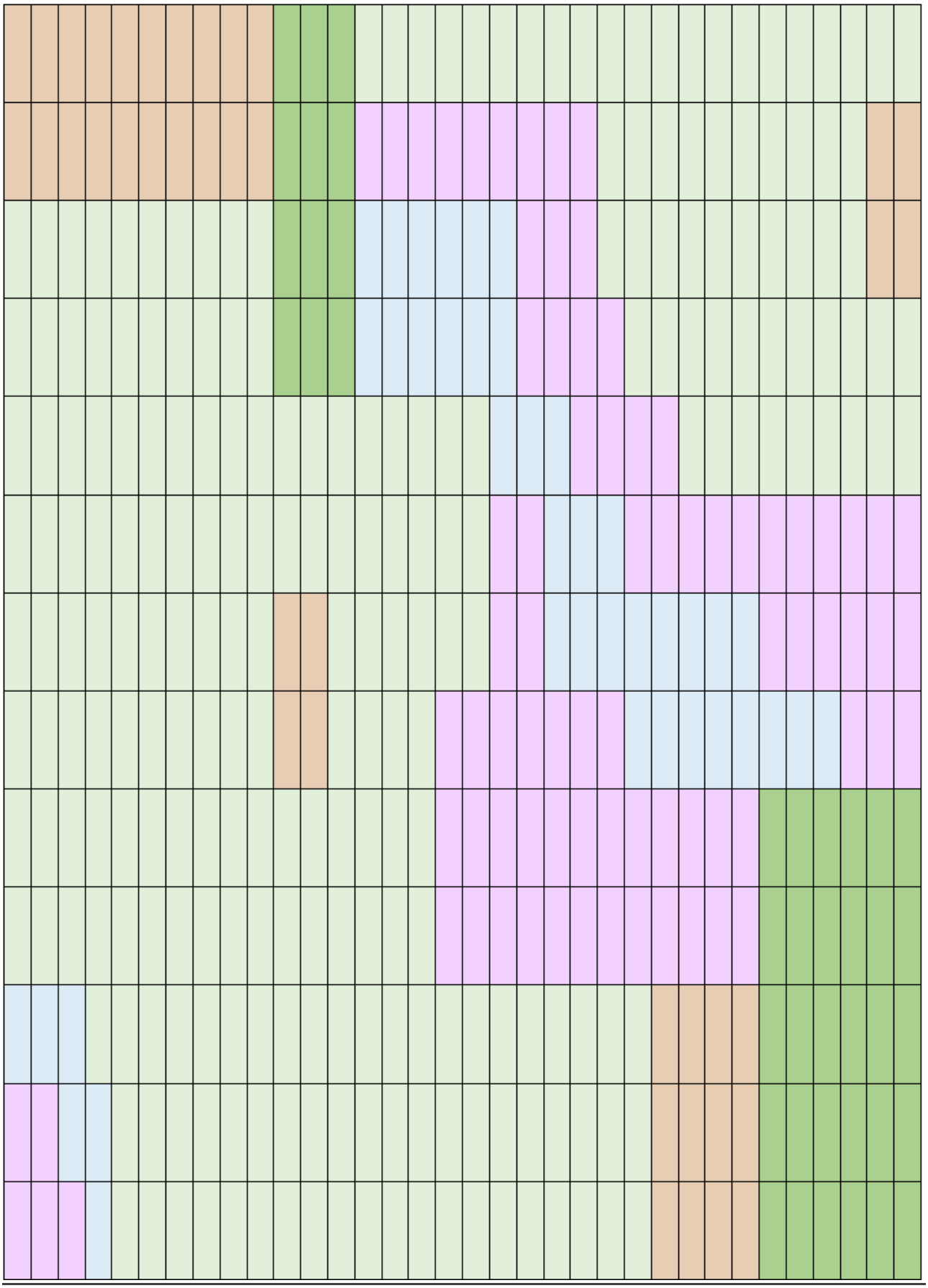
Land Use Map #1



Land Use Map #2

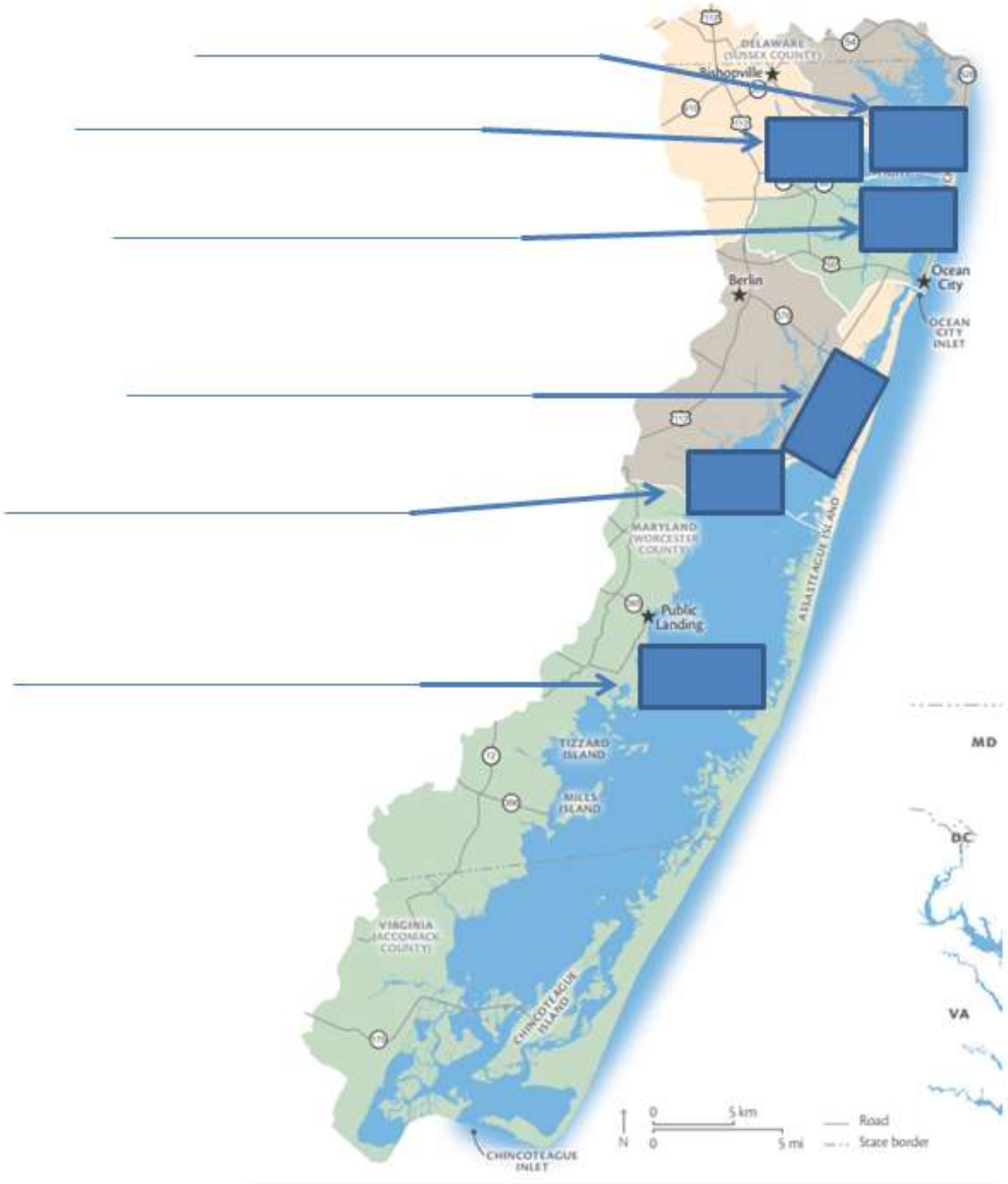


Land Use Map #3



Lesson #5 Water Chemistry in the Maryland Coastal Bays

<u>MD Coastal Bays Map:</u> Using the coastal bays website, label each of the coastal bays.



Pre-Lab Questions:

1. Based on your online research, which of the coastal bays seems to be in the worst health? Why?

2. What are some of the concerns for the local bay?

3. Any many of the issues surrounding the bays caused by humans?

4. What is eutrophication and why may it have an impact in our local area?

Table 1: Students can record the results of the water quality tests in this table.

Coastal Bay	**Phosphorous (ppm)**	**Nitrogen (ppm)**	**Dissolved oxygen (DO)**	**pH**
Assawoman Bay				
Isle of Wight Bay				
St. Martins River				
Sinepuxent Bay				
Chincoteague Bay				
Newport Bay				

Example Outline for Lab Report:

Title:

Question:

Background Information: Can set up as a series of questions

Hypothesis:

Variables:
Dependent:
Independent:
Controlled:

Materials:

Procedure:

Results: Charts and graphs

Discussion: A rubric can be provided to students to use

References

1. The Ramsar Convention Secretariat. (2016). Wetlands are essential to our future… Retrieved from http://www.worldwetlandsday.org/about

2. U.S. Fish and Wildlife Service (2016). Ramsar wetlands convention. Retrieved from https://www.fws.gov/international/wildlife-without-borders/ramsar-wetlands-convention.html

3. Defenders of Wildlife. (2017). Basic facts about wetlands. Retrieved from http://www.defenders.org/wetlands/basic-facts

4. Young, D. (2013, May 5). Animal adaptations: Engaging investigations. Retrieved from http://thirdgradethinkers8.blogspot.com/2013/05/animal-adaptations-engaging.html

5. Animal Corner. (n.d.) Ducks. Retrieved from https://animalcorner.co.uk/animals/ducks/

6. Food and Agriculture Organization of the United Nations. (1993). Guidelines for land use planning. Retrieved from http://www.fao.org/docrep/T0715E/T0715E00.htm

7. Gunther, M., personal communication, Wor-Wic Community College, January 20th, 2017.

8. Maryland Coastal Bays Program.