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**Subjects: Life Science / Biology, Environmental Science, Marine/
Ocean Science Grades: 6-8**

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STAKEHOLDERS OF THE CHESAPEAKE BAY: THE CURSE OF THE EASTERN OYSTER

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Grade Level

Middle School

Subject area: Environmental Science,
Public Policy, or Resource Management

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1. Title

Stakeholders of the Chesapeake Bay: The Curse of the Eastern Oyster

2. Focus

What is a stakeholder and how do they impact oyster management in the Chesapeake Bay?

3. Grade Levels/Subject

6th grade Physical Science, could be scaled up for high school

4. VA Science Standard addressed

SOL 6.9 – Earth Resources which focuses on “public policy decisions relating to the environment”

- Specifically covering key concepts of
 - “management of renewable resources”
 - “cost/benefit tradeoffs in conservation policies”

5. Learning Objectives/Outcomes

- a. Teachers will give examples of oyster management in the Chesapeake Bay
 - i. Students will compare and contrast the differences between stakeholder groups presented by the teacher
 - ii. Students will recognize some of the diverse difficulties of oyster management (e.g. accommodating all groups/users, ecological health, restoration)
- b. Students will play the role of a stakeholder in the Chesapeake Bay and advocate for certain management considerations for oysters via a poster
- c. Students will participate in a discussion on the different policy considerations
- d. Students will individually write up what they would do for oyster management, based on presentations and discussions

6. Total length of time required for the lesson

Two class periods (maybe around ~120 minutes)

7. Key words, vocabulary – all definitions adapted from Google

- Advocate – the action of publicly supporting or recommending a particular cause or policy
- Aquaculture – raising aquatic organisms (oysters) for food, not capturing them in the wild
- Habitat – natural home or environment for a plant or animal
- Management plan – comes up with goals and figures out a process to reach those goals
- Nonprofit – not making or conducted primarily to make a profit
- Policy – the result of a management plan, a course of action adopted by an organization
- Restoration – the action of returning something to its former condition
- Stakeholder – a person with an interest or concern in something

- Water quality – describes the condition of the water, usually with respect to activities like drinking, or swimming or ability of organisms to live in the water (Source: NOAA)

8. Background Information

The role of the teacher during this activity is to provide the background information on oysters (basics about their biology, importance to the Bay and management: [Oyster Fact Sheet](#), [Oysters and the Bay](#)) and facilitate and supervise the group discussion and poster making. Teachers should then familiarize themselves using some of the links from Chesapeake Bay Foundation. The main areas of importance are that oysters filter the Bay making it cleaner, oyster reefs provide essential habitat and shoreline protection through their structure, and oysters are at the center of a large, lucrative, politically important and decreasing commercial fishery within the Bay. Students' grasping at least these main topics is important for the rest of the exercise in order for them to relate these functions of oysters to management objectives by different groups. A couple slides in the PowerPoint are there in order to discuss the importance of oysters and their decrease.

The oyster background is necessary to get to the heart of the activity; the management of oysters. There are a lot of policy considerations related to oysters, but in order to keep it manageable, this activity will only cover a select few: water quality (oysters filter water and make the Bay a cleaner and healthier place), fishing (commercial and recreational fisheries are big money for VA and MD and oysters are a big part of the livelihood of many watermen) recreation (people enjoying the Bay for various activities like swimming or boating), habitat (oyster reefs provide complex habitat structure for many organisms in the Bay like mussels, crabs and shrimp), ecological health (the health of the Bay and all its inhabitants), seafood availability (decrease in the fishery means less oysters for humans to eat, addition of aquaculture oysters), human health (disease from oysters or disease from the Bay due to lack of oyster filtration), shoreline protection (oyster reefs can slow down waves which can help prevent erosion of shoreline, they act as buffers every day and during storm events), research (big academic interest and money concerns oysters in the Bay in many different regards) and economics (money from the fishery but also money from tourism of people coming to visit the Bay). Not all these topics have to be discussed, but the suite of policy considerations covers many of the main policy around oysters today. The goals of oyster management via the Chesapeake Bay Foundation's Oyster Management Document ([Oyster Management](#)) are: increase oyster populations to levels that will restore important ecological functions, achieve a sustainable oyster fishery, reduce the impact of disease on oyster populations and increase hatchery production (unnecessary in this discussion). While these seem like very concrete goals, the ways and means of achieving them are under heavy debate. What is a population level of oysters that will restore important ecological functions? Is that the same level that will support a sustainable commercial fishery? These sorts of questions are the ones being asked by policy makers every day and is why oyster management is so complicated, an idea that needs to be passed on to the students before they complete this activity. Getting the students to understand that this isn't a simple issue will help them be more creative in suggestions for management and understand why the different stakeholder groups exist.

Another key aspect is the management part of it. Gray 2005 is a good paper about participatory management, but I will highlight some of the important pieces here.

- Interest in participatory fisheries management over the past few decades because of the dissatisfaction with how fisheries management is currently performing

- Concept of top down (management objectives coming from above) vs. bottom up (stakeholders and end users deciding what management objectives should be and passing them up)
- The legitimacy of participatory government lies in the involvement of stakeholders in decision making
- Allows variability – stakeholders in one area will not come up with the same management objectives as stakeholders in another region
- Participatory management is a process of consensus seeking negotiation, not hierarchical command or market driven, everyone needs to arrive at the same page

In addition to understanding some of the basics concerning the policies regarding oysters and management, the teacher should understand a bit about the different stakeholder groups that the students will be representing and how each group would react to different policies. These groups include Watermen, Aquaculturists, Scientists, Non Profits, Citizens, Chefs and Government. Each of the Info Sheets on the different stakeholder groups has a basic outline of the views of different groups in relation to some of the policy. It will be the job of the student to determine which policy considerations are most important based on their stakeholder group. Here are some links to some of the stakeholder groups if the teacher wants to peruse and get a better sense of what the groups are in their own words ([NOAA \(Fed Govt\)](#), [Chefs \(Seafood safety\)](#), [Watermen](#), [Chesapeake Bay Foundation \(Non Profit\)](#), [Citizens Group](#)). The teacher should be able to guide the student stakeholder groups if they are making a policy ranking decision that doesn't align completely with the group they are representing.

Additional documents attached include an introductory PowerPoint and Info sheets for each of the stakeholder groups with a brief summary of what their group means and all the policy considerations for them to consider based on that information.

9. Student Handouts

The attached Word document possesses the Information sheets which are the main forms that the students will need. Title "Info sheets". Also attached is a document called "Info on the Policy Choices" which provides some background on the policy options that the student stakeholder groups will be ranking and have to choose between.

10. Materials and Supplies

Each team will require the following

- Multiple copies of the Info sheets for their stakeholder groups
- Poster board
- Various markers, pens, decorating devices in order to create a poster
- Possibly pre-made printouts of all the policy considerations that they can then just stick on their poster, then elaborate from there
- Stickers to put next to highest ranked management priorities – the amount of colors for each stakeholder group to have a separate color

11. Classroom setup

As long as the students have adequate room in order to make their posters, no other specific set up is needed. Each group should separate themselves from the others while making their posters.

12. Procedure

Day 1

Background and introduction of the topic – 30 minutes

The lesson should start with teachers going over some of the basics of oyster biology and the history of oysters within the Chesapeake Bay (use Slides 2-3 of the PowerPoint, especially the link about cool oyster facts. Before you lecture about why oysters are important, have the students tell you why they think oysters are important. In the notes of the PP I created some main bullet points that you should get the students to understand. Also allow students the time to understand the graph on Slide 3. Have them explain what the graphs mean, the X and Y axes, where oysters used to be, where they are now. Ask what can cause the decline in oysters). Before the slides, you may want to ask what students already know about oysters to get an idea of their level of knowledge.

They should then transition into what management is, and the role of management in the Chesapeake Bay, specifically participatory management (Slides 4 – 7) and why the participatory process matters. Slide 4 is a transition to management, give the students some good news and get them thinking about what are ways that oysters can be helped. Slide 5 gets into a little bit about the management of oysters in Maryland and Virginia. Gives students some context about the real world. Make it clear that it's the government agencies they have to convince when defending their stakeholder groups. Learning about how management decides to manage resources comes next in Slide 6. Before clicking through the options, ask the students what they think management is; looking for descriptive words here. Maybe give them some examples about what is involved in management. When you finish on the participatory word, ask the students what they think that means before going onto the next slide. At the start of slide 7, you have the definition of what participatory management is in this context and then it gets into the question of who and what stakeholders are? Slide 8 provides an example of identifying stakeholders, in case that concept is more difficult for the students to grasp. This example provides them with a relatable situation that they can hopefully learn from and apply to the oyster scenario. Ask the students for their opinions on who stakeholders are, this can then be applied to the oyster context.

The teacher should then go over what each of the stakeholder groups (Slides 9-15) are in some level of detail, referring to the information from the real-life stakeholder websites. This should be a sufficient amount of introductory material so after this, the group project can be introduced. Each student will be put into a group of a particular stakeholder. Students can be placed randomly into groups, or teachers can ask the group at the beginning of the activity "Who likes to cook?" or "Who likes to be on the water?" in order to specify the group students are in and perhaps increase their care for the group and their priorities. The ice cream example is a way of getting students more invested in the stakeholder idea and the notes on Slide 7 provide some other notes that could hopefully work to get the students interested in stakeholders and why they are important.

- Watermen
- Non profits
- Government agency
- Academic
- Aquaculture
- Citizen
- Chef

After hearing about management of oysters and their specific stakeholder groups, student groups will take part in two concurrent activities: ranking the policies on their stakeholder worksheets according to their stakeholder group and making a poster that advocates their stakeholders' views on where policy priorities should focus on from the pre-selected list of policy options. See the attached info sheet, and print it out for the stakeholder groups, to aid the student stakeholder groups in determining what policy options their group would support.

- Water Quality
- Fishing – commercial and recreational
- Recreation
- Habitat
- Ecological Health
- Seafood availability
- Human health
- Shoreline protection
- Research
- Economics

The rankings should be done first in order for students to be able to think about what to put on their poster. Emphasize that only one policy area can be selected for each number. This instruction has been added to the information sheets. In order to ensure that all students are participating, teachers can have it so students will each have to talk about one of the top areas they ranked (if there are 5 group members, pick the top 5 group rankings to divide) when students give the poster presentation the next class period. Have each group member create a card about one of the areas to discuss during the poster presentation. Teachers will collect the groups completed worksheets and before Day 2 should compile them into some sort of visual graph that the students could go over. The type of graph would could do to show importance is up to you, but possibly with percentages; X% of the stakeholder groups ranked habitat as a 5 or above in importance, X% ranked economics as a 9 or above in importance. In order to minimize teacher work between days 1 and 2, students could play specific colored stickers next to their highest ranked priority so that the teachers don't have to read through all the worksheets.

Making the Poster – 30 minutes

Students should break into their groups and use the pre-cut cards (if this is how the teacher wants to do it) to create a poster that focuses on areas of policy involved in oyster management that their stakeholder group would find important. The teacher should emphasize that the students should be able to justify their decisions and backup why they made certain choices. For example, if a student put that watermen valued shoreline protection the most, they should be able to explain why. Also the

teacher should emphasize that they are going to be presenting in front of their fellow stakeholder groups and they should be trying to convince them that their policy decisions are what's best for management. Emphasize that they are trying to convince their classmates, members of other stakeholder groups with perhaps different priorities, of why their decisions are the right ones for management.

Day 2

Graph Results, presenting posters and discussion – 1 hour

The teacher should spend some time going over the graphs they compiled and showing the top overall choices of the groups before they present their posters. Depending on what kinds of graphs were created, the discussion will vary.

Students will present their posters to the class and must be prepared to defend their choices. Teachers can decide if they want the students to be able to ask other stakeholder groups questions during this initial presentation time, or to save them for the end. After the posters are presented, the teacher can lead a discussion about which groups were most convincing and why. Part of this end discussion can also be concerning the broader topic of participatory management and involving stakeholders. If the teacher wants to bring it outside of the oyster discussion into a wider environmental policy topic, that works too. This discussion can emphasize the pros and cons of participatory management, how difficult it can be, but how important it is. The poster itself is a form of assessment and so is the teacher led discussion, but the teacher can also have students individually do a written assessment, discussed in the next section.

13. Assessment

The poster itself, the rankings, what the students wrote, how they presented the different policies, and their presentations, their public speaking, their arguments, are all forms of assessment so the teacher can see if they understood the topics presented. These are, however, all on a group level. The teacher could (possibly as a homework assignment) have each student write a short report about what they think are the best policies for oysters in the Chesapeake Bay, after having heard all the presentations. This is a way for the teacher to get the student to think about all the policies individually and combine them in unique ways that the stakeholder groups weren't able to do.

Possible questions based on the Learning Objectives are listed below. These could be part of the discussion the teacher leads in class, or part of the homework assignment.

- a. Students will learn basics of oyster management in the Chesapeake Bay and its complications → ex: Maryland/Virginia/DC management, accommodating all groups/users, ecological health, restoration
 - i. What's the most complicating part of oyster management in the Chesapeake Bay in your opinion, and why?
 - ii. Example Answer: Trying to include all different stakeholder opinions in order to come up with one cohesive management plan. Everyone has such different priority that getting them all to decide is hard and the oysters suffer for it.

- iii. Example Answer: Taking into account all the different states that feed into the Chesapeake Bay watershed. People in Pennsylvania have to care about their waterways because they eventually make it to the Bay, but residents in PA don't get to enjoy the benefits of the Bay, which makes making decisions that impact oysters a faraway idea.
- b. Students will play the role of a stakeholder in the Chesapeake Bay and advocate for certain management considerations for oysters via a poster
 - i. What motivates different stakeholder groups to work together? If they have different views, why do they choose to work together?
 - ii. Example Answer: Working together allows more action to happen and allows stakeholders to have at least a small voice in the overall management process. By refusing to work together they ensure that none of their voices get a say, and they have to abide by any top down management decisions. Working together and compromising is better than being left out of the process completely.
- c. Students will participate in a discussion on the different policy considerations
- d. Students will individually write up what they would do for oyster management, based on presentations and discussions
 - i. C and D questions are covered in the homework write up assignment

14. References

<http://www.cbf.org/3.-about-the-bay/chesapeake-bay/creatures-of-the-chesapeake/oysters> (Oyster Fact sheet)

Gray, T (2003) Theorising about fisheries governance' Paper given at the Fisheries Governance Workshop, Newcastle University, September 2003