**“There’s something fishy about oyster reef saltmarsh and seagrass habitats”- Part 2: Reef restoration**

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| Introduction/Abstract | **This lesson is designed to follow the “Assessing fish-habitat value” lesson where the students will be introduced to the oyster-reef habitat. Here, students will be presented with data collected from a patch reef and a fringing reef located in Middle Marsh, North Carolina. They will synthesize various aspects of those data and rank the importance of each factor. Using their rankings, students will choose which type of reef is more valuable for fish and will write a proposal for a reef-restoration project.** |
| Learning Objectives  | 1) Describe the importance of oyster-reef habitat.2) Compare the fish-habitat value of patch and fringing reefs.3) Synthesize and interpret ecological data.4) Communicate a summary of their findings. |
| Appropriate Grade Levels | **6-12** |
| Group Size/# of students activities are designed for | **Groups of 2-4** |
| Setting  | **Indoors** |
| Approximate Time of Lesson | **180 minutes** |
| Resources Needed for Students  | Map of Middle Marsh (Study\_area\_map), data set of fish and organisms collected from Middle Marsh (Oyster Data), computers with Microsoft Excel or other graphing package |
| Resources Needed for Educators  | Computer projector, projection screen or white board, video-playing software and graphing software. |
| Apps/Websites Needed | Extensions:Oyster Catch per year <http://portal.ncdenr.org/web/mf/65>Current Oyster Locations (pg 33) <http://portal.ncdenr.org/c/document_library/get_file?uuid=396fef00-911d-47be-a658-2d74ca1837ad&groupId=38337>  |
| Lesson Activity (step by step description of activity) | Step 1: Show the video “Oyster-reef Habitat” that describes the different types of reefs, including fringing and patch reefs. Step 2: Have the students list the differences between fringing and patch reefs on the “Oyster Data Worksheet” versions 1, 2, or 3.Step 3: Students look at the map of Middle Marsh to understand where the fringing and patch reefs are located, from which the data set was collected.Step 4: Have students analyze the data collected from the patch and fringing reefs. There are two versions of this data set available for use. Each version increases in difficulty by providing less information for students.* Version 1 (Oyster Data V1) is complete with all of the graphs and data sums provided. To be used with Oyster Data Worksheet V1.
* Version 2 (Oyster Data V2) provides summed data and percentages but does not provide the graphs. To be used with Oyster Data Worksheet V2.
* Version 3 (Oyster Data V3) provides the raw data. Students would need to sum data and create a graph on their own. To be used with Oyster Data Worksheet V3.

Step 5: After students have read the data set they need to synthesize or sum those data collected. This step can be done in two ways:a. Students look at the data and sum the organism populations themselves (V3).b. Students are given the data sums provided by the teacher (V1 or V2).Step 6: After summing the data, calculating percentages, and creating graphs (or examining those products provided) they would create a Factor Comparison Chart that is driven by the results. Teacher would give one factor (e.g. Highest number of fish) and check which type of oyster reef it falls under, either Patch or Fringing.Step 7: Discuss, as a class, some of the most important factors each group found and create a comprehensive list. Students can add factors that they had not thought of to their own factor-comparison charts.Step 8: Students use their factor-comparison chart to determine the factors that are most important for defining habitat value for each reef type. Teacher may want students to rank the factors in order of importance or choose the top two they feel are most important.Step 9: Students will conclude by deciding which type of reef has the most value. |
| Final Product  | Students will communicate their conclusion through means of a written proposal, PowerPoint presentation, poster, debate, speech, or other means. Final product should include the presentation of data to support their rationale. |
| Assessment/Evaluation  | Evaluate the quality of students’ final product. Assessment should be based on:-Correctness of the calculations and graphs produced.-Completion of the factor-comparison chart.-Quality of final product showing clear data-driven support for their choice of restoration. |
| NC Essential Standards | **Middle School**6.L.2 Understand the flow of energy through ecosystems and the responses of populations to the biotic and abiotic factors in their environment.8.E.1 Understand the hydrosphere and the impact of humans on local systems and the effects of the hydrosphere on humans**Biology**Bio.2.1 Analyze the interdependence of living organisms within their environments* Generalizing that although some populations have the capacity for exponential growth, there are limited resources that create specific carrying capacities and population sizes are in a dynamic equilibrium with these factors. (e.g. food availability, climate, water, territory).

Bio.2.2 Understand the impact of human activities on the environment (one generation affects the next).* Explain factors that impact North Carolina ecosystems. (Examples: acid rain effects in mountains, beach erosion, urban development in the Piedmont leading to habitat destruction and water runoff, waste lagoons on hog farms, Kudzu as an invasive plant, etc.). Exemplify conservation methods and stewardship.

**Earth and Environmental Science**EEn.2.2 Understand how human influences impact the lithosphere.* Explain the effects of human activity on shorelines, especially in development and artificial stabilization efforts.

EEn.2.7 Explain how the lithosphere, hydrosphere, and atmosphere individually and collectively affect the biosphere* Compare impacts of biotic and abiotic factors on biodiversity
* Infer the relationship between environmental conditions and plants and animals that makeup and live within various biomes that comprise the biosphere.
* Explain effects of human population growth, habitat alteration, introduction of invasive species, pollution and overharvesting on various plant and animal species in NC.
* Summarize ways to mitigate human impact on the biosphere.

**Major Themes in AP Environmental Science*** Science is a process.
* Science is a method of learning more about the world.
* Science constantly changes the way we understand the world
* The Earth itself is one interconnected system.
* Natural systems change over time and space.
* Biogeochemical systems vary in ability to recover from disturbances
* Humans alter natural systems.
* Humans have had an impact on the environment for millions of years.
* Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment
* Human survival depends on developing practices that will achieve sustainable systems.
* A suitable combination of conservation and development is required.
* Management of common resources is essential

**Big Ideas for AP Biology** * Organism activities are affected by interactions with biotic and abiotic factors
* The stability of populations, communities and ecosystems is affected by interactions with biotic and abiotic factors.
* The structure of a community is measured and described in terms of species composition and species diversity
* Human activities impact ecosystems on local, regional and global scales
* Interactions between populations affect the distributions and abundance of populations
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| Next Generation Science Standards  |

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| MS-LS2-2. | Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. |

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Appendices:

* Oyster Data V1.xlsx
* Oyster Data V2.xlsx
* Oyster Data V3.xlsx
* Oyster Data Worksheet V1.docx
* Oyster Data Worksheet V2.docx
* Oyster Data Worksheet V3.docx
* Oyster Data Worksheet TEACHER SAMPLE.docx
* Study\_area\_map.jpg