**“There’s something fishy about oyster reef saltmarsh and seagrass habitats”- Part 1: Assessing fish-habitat value**

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| Introduction/Abstract | **This is the first lesson plan in the four-part series entitled “There’s something fishy about oyster reef saltmarsh and seagrass habitats”. Students will learn to identify oyster reef, saltmarsh, seagrass, and sandflat habitats and will determine the value of each habitat to fish. Students will collect data from a short film of a fish swimming around coastal North Carolina, process and interpret those data, and use supplementary maps to evaluate habitat value. By following a fish and its viewpoint (think fish-cam) around an area where all four habitats exist, students will measure the amount of time the fish spends at each habitat and use that as a proxy for habitat value.** |
| Learning Objectives | 1) Identification of oyster reef, saltmarsh, seagrass and sandflat habitats.2) Data collection of cumulative-elapsed time the fish spends at each habitat type.3) Mapping the extent of each habitat type (area) on an aerial photo.4) Data processing (normalizing the time the fish spent at each habitat by habitat area) and data interpretation. |
| Appropriate Grade Levels | **6-12** |
| Group Size/# of students activities are designed for | **Groups of 2-4.** |
| Setting | **Indoors** |
| Approximate Time of Lesson | **60-90 minutes** |
| Resources Needed for Students | Computer with video-playing software and graphing software (e.g. Excel). The fish-tracking video, a timer (optional because you can use the computer to track time), hard copies of “Study\_area\_map\_grid.jpg”, and colored pencils. You can use the provided student hand out to help guide the students through the lesson, or create your own. |
| Resources Needed for Educators | Computer projector, projection screen or white board, video-playing software and graphing software. |
| Apps/Websites Needed | NA |
| Lesson Activity (step by step description of activity) | Step 1: Show the video “Fish Tracking” that describes acoustic fish-tracking methodology, examples of oyster reef, saltmarsh, seagrass, and sandflat habitats and a short time-lapse movie of a fish moving through Middle Marsh, NC (the fish-tracking video).Step 2: During the fish-tracking video, make sure the students can identify saltmarsh, oyster reef, sandflat, and seagrass habitats in the fish cam. The actual duration of the fish-tracking experiment is 120 minutes. We compress that down to 100 seconds in the video (the video play back is faster than real time).Step 3: Pass out the student hand out. Define fish-habitat value for the students as the total duration that the fish is in a particular habitat. For example, the habitat that the fish is in the longest will be rated as the most valuable. Realize that this is not the most useful definition and will be revised later. Start the fish-tracking video and demonstrate measuring elapsed time the fish is in each habitat (see Step 4 for more information).Step 4: Have the students work in groups. Each group will have a computer with the movie loaded. The students need to create a table similar to Fish\_tracking\_Table\_1.xlsx, “time in habitat” tab. Students will measure the duration the fish is in each habitat (in seconds). This can be done using a hand-held timer or the timer on the play-back bar at the bottom of the video application. When the fish enters a new habitat, the student needs to pause the playback and record the elapsed time the fish was in that particular habitat in the table. At the end of the video each habitat column will have multiple entries because the fish will move in and out of each habitat multiple times. When the fish-tracking video ends, the habitat columns need to be summed, and an example of those sums are provided for each group in the Table.Step 5: Lead a discussion about which habitat is most valuable, based on our working definition of value. With this definition, sandflats should end up to be the most valuable fish habitat and oyster reefs the least valuable. Revisit the working definition and our proxy for fish-habitat value. Why might our definition of fish-habitat value not be appropriate? Look at the map (Study\_area\_map\_color.jpg) and notice that there is much more sandflat and seagrass habitat than oyster reef. Is it really fair to use the duration the fish is in a habitat as a proxy for habitat value given that there are large differences in the areal extent of each habitat?Step 6: Create a habitat map and measure the areal extent of each habitat using the “Study\_area\_map\_grid.jpg” image file and the movie. Using colored pencils, make each habitat a different color on the map (see “Habitat\_map.jpg” as an example). After the habitat map is created, use the grid cells to measure areal extent (each grid cell is 100 m2).Step 7: Have students scale those durations that the fish spent in each habitat by habitat area. A better definition of habitat value is **duration/% habitat area** (expressed as a decimal). If the fish is in oyster reef habitat for 25 seconds and oyster reef covers 0.01 of the study area then the value of oyster-reef habitat to fish is 25/0.01 or 2500. See the “Time normalized in habitat” tab of the table for an example.Step 8: As a class, rank and discuss the value of each habitat. If you were an angler, where would you want to spend your time fishing? What are the characteristics that make different habitats more or less attractive (valuable) to fish? |
| Final Product | Habitat map, spreadsheet and graphs and completed handout. |
| Assessment/Evaluation | Assessment should be based on:-Correctness of the measurements, calculations, and graphs.-Completion and quality of the habitat map.-Contribution to class discussions and completion of the handout. |
| 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: Fish Tracking movie

Study\_area\_map\_color.jpg

Study\_area\_map\_grid.jpg

Habitat\_map.jpg

Fish\_tracking\_Table\_1.xlsx