**“There’s something fishy about oyster reef saltmarsh and seagrass habitats”- Part 4: Seagrass Structure and Habitat Biodiversity**

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| Introduction/Abstract | **This lesson is designed to follow the “Assessing fish-habitat value” lesson plan where the students were introduced to the seagrass habitat. The objective here is to have students gain insight into ecosystem services the seagrass habitat provides. Students will begin by examining seagrass cover and learn about patchy and continuous seagrass beds. Next, the students will manipulate a dataset to explore habitat quality and biodiversity of seagrass. The lesson is in two parts, which can also be used as stand-alone exercises.** |
| Learning Objectives | Part A: Structure  1) Examine the biotic and abiotic factors that define seagrass-habitat quality.  2) Compare and contrast the structure of continuous and patchy seagrass habitats.  Part B: Function as Fish Habitat  1) Compare the biodiversity of patchy and continuous seagrass habitats. |
| Appropriate Grade Levels | **8-12** |
| Group Size/# of students activities are designed for | **Groups of 2-4** |
| Setting | **Indoor** |
| Approximate Time of Lesson | **90 minutes (Parts A and B)** |
| Resources Needed for Students | Data spread sheets, computers with a graphing program (e.g. Excel), Seagrass video, quadrat photos, colored pencils (optional), and NOAA seagrass density chart. |
| Resources Needed for Educators | Smart board or projector, video-playing software and graphing software. |
| Apps/Websites Needed | http://ccma.nos.noaa.gov/products/biogeography/benthic/htm/images/manual/aid.gif  Coastal Habitat Protection Plan: http://portal.ncdenr.org/web/mf/n.c.-marine-habitat for additional information |
| Lesson Activity (step by step description of activity) | Part A: Structure  1. Watch Seagrass video and identify different biotic and abiotic factors that define fish-habitat quality.  2. Facilitate a discussion of biotic and abiotic factors for seagrass habitat quality and make a list on the board. Discuss where seagrasses are located in NC.  3. Investigate seagrass density using the photos provided in the folder. Each quadrat is 0.25 m2. Instruct students to use the NOAA density chart to estimate percent seagrass cover in each of the photos. Students should be instructed to use their best approximation and be consistent in their classifications. What is the mean sea grass density for patchy and continuous seagrass beds?  4. Have the students work individually or in small groups to examine the data presented in the file “Sea\_Grass\_Data.xlsx” and the tab “Seagrass Transect Data”. The spreadsheet presents percent seagrass-cover data, from quadrats, obtained every 2 m along a 50-m-long transect through continuous and patchy seagrass beds. Have the students graph distance on the X-axis and % cover on the Y-axis for both patchy and continuous seagrass beds (one graph to make comparisons clearer). Discuss why % seagrass cover across the patchy bed is not always less than the continuous bed and what “patchy” actually means in terms of values measured with a quadrat.  5. Have the students draw a 50 m X 50 m scaled picture of each type of seagrass bed and place the location of the 50-m transect on the picture. The student’s pictures should correspond to those data they just graphed. A third person should be able to reconstruct the student’s graph by collecting % cover data from the picture along the transect line. Graph paper may help here.  Part B: Function as Fish Habitat  Step 1: Students will work individually or in small groups to examine the data presented in the file “Sea\_Grass\_Data.xlsx” and the tab “Seagrass Trawl Data”. Prior to analyzing those data, have students predict which type of seagrass bed will have the highest diversity. Discuss student ideas.  Step 2: Calculate the total and average number of each fish species sampled in continuous and patchy seagrass beds using the spreadsheet. Graph those data and compare continuous and patchy seagrass beds.  Step 3: Have the students think about which type of seagrass bed has the highest biodiversity and number of fish. They should support their ideas with quantitative data from the spreadsheet.  Step 4: Class discussion. Which type of seagrass bed is more valuable fish habitat? Why are fish utilizing continuous seagrass beds differently than patchy beds? Discuss predator-prey interactions and refuges.  Optional Step 5: Have individuals research an assigned species within the data set to determine average size, diet, predators, phylum, and class. Groups will then create models of a seagrass habitat and include at least 3 food chains, 1 predator-prey relationship, and 2 examples of competition (interspecies and intraspecies). Alternatively, simple food webs can be created based on the research. |
| Final Product | Students will hand in the completed graphs, written answers to questions, and the research project. |
| Assessment/Evaluation | Evaluate the quality and correctness of students’ graphs and answers.  -Quality of final products showing clear data-driven support for their findings. |
| NC Essential Standards: Earth/Environmental Science | **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 |
| Next Generation Science Standards | MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. |

**Appendices:**

Part A:

Quadrat photos

Seagrass percent cover scales.jpg

Sea\_Grass\_Data.xlsx

Part B:

Sea\_Grass\_Data.xlsx

**Sample Answer for Food Chains**

sea grass → common shore crab → sheepshead sea grass → brown shrimp → toadfish

sea grass → marsh grass shrimp → spot sea grass → arrow shrimp → silver perch → flounder

sea grass → planehead filefish → pinfish sea grass → blue crab → northern puffer