



NOAA
FISHERIES

Grade Level
9-12

Materials

- Computer with access to Internet and Power Point

Audio/Visual Materials

- Computers for each group
- Projector for showing video clip

Teaching Time

Two 45-minute class periods

Seating Arrangement

Flexible

Key Words

- Ecosystem
- Ecosystem-based management

Ecosystem-Based Management

For use with Fish Watch at www.fishwatch.gov



Focus

- Ecosystem-based management

Focus Questions

- How is Ecosystem-Based Management (EBM) applied to fisheries management?

Learning Objectives

- Describe the concept of ecosystem-based management
- Explain the approach and benefits to using Ecosystem-Based Management in fisheries

Background Information

The traditional management strategy for fisheries and other living resources has been to focus on one species of fish or shellfish in isolation. For example, if there were a decline in the number of a certain kind of fish in a region, authorities might decide to decrease the number of that species that could be removed by fishing in a given year. The problem with this approach is that the impact of fishing on a single species is only one variable that affects the health of its population. Additional elements come in to play such as interactions with other species and the effects of pollution and other stresses on habitat and water

National Science Education Standards

Grades 9-12

Content Standard C: Life Science

- Interdependence of organisms

Content Standard F: Science in Social and Personal Perspectives

- Natural resources

Ocean Literacy Essential Principles

Essential Principle 5

The ocean supports a great diversity of life and ecosystems.

Fundamental Concept d

Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

Essential Principle 6

The ocean and humans are inextricably connected.

Fundamental Concept b

From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Fundamental Concept e

Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution and physical modifications (changes to beaches, shores and rivers). In

quality. To more effectively assess the health of any given fishery and to determine the best way to maintain it, the entire ecosystem must be taken into account.

An ecosystem is a geographically specified system of organisms (including humans), the environment, and the processes that control its dynamics. Ecosystem approaches to management use integrated approaches to study and manage the resources of an entire ecosystem. This approach considers the cumulative impacts from various sources and the balance of conflicting uses. Using an ecosystem approach to manage aquatic resources, including fisheries, includes multiple factors such as pollution, coastal development, harvest pressure, predator/prey and other ecological interactions, and watershed management.

Specifically, ecosystem-based management:

- Emphasizes the protection of ecosystem structure, functioning, and key processes
- Is place-based in focusing on a specific ecosystem and the range of activities affecting it
- Explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species
- Acknowledges interconnectedness among systems, such as between air, land and sea
- Integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences
- Recognizes the intrinsic value of ecosystem components
- Is incremental, collaborative, and adaptive in its development over time as new information becomes available or as circumstances change
- Strives to balance diverse societal objectives that result from resource decision-making and allocation.

Sources:

- celebrating200years.noaa.gov/magazine/chesapeake_fish_mgmt/side1.html
- montereybay.noaa.gov/resourcepro/ebmi/welcome.html

In addition, humans have removed most of the large vertebrates from the ocean.

Fundamental Concept

Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean.

Learning Procedure

1. On a screen or white board, project the image of an Alaskan ecosystem from celebrating200years.noaa.gov/breakthroughs/ecosystems/gulf_of_alaska_lme_650.html

As a class, brainstorm all the different interactions that could take place in this ecosystem, and how each variable affects the others. List answers on the board. Use the following guiding questions to stimulate discussion:

- Why and how are these interactions important for managing fisheries in this region?
- Could a fishery be managed even with some of these components and inter-relationships not being taken into account? What might happen if they were?

2. Introduce the term “Ecosystem-Based Management” (EBM) to students, and share some of the background information from this lesson.

3. Tell students they are going to research different regional ecosystems to learn why the EBM approach is being used. Divide students into pairs, and assign them a region from NOAA’s Integrated Ecosystem Assessment Program web site at: <http://www.noaa.gov/iea/index.html>. Have them take notes on their particular ecosystem and the EBM strategies being used to manage it, and share their findings with the class. (More than one group will be researching the same region, so have these group members get together and report their findings to the class as one group.) Alternatively, this research can be assigned as homework the day before instructing this lesson.

4. Have students identify the seafood species in their ecosystems and research them on www.fishwatch.gov. Have them note effects to the ecosystem by the species or fishing operations. Discuss in class.

5. In pairs, have students play the Great Australian Fisheries Challenge game at http://www.afma.gov.au/TLF_version/index.html (they may choose to skip the matching game at the beginning.) Students will role play as fisheries managers and have to make decisions concerning ecosystems, money and fish stocks. They should take notes as they play, noting the challenges they had in managing the fish stocks, and what they learned. Hold a class discussion so students can share their experiences.

6. Have student groups research and create a PowerPoint or multimedia presentation to present to the group that illustrates the components of an ecosystem in their local area (if they live near a coast, the ecosystem should focus on fisheries, but if not, another ecosystem is fine). The presentation should include:

- the ecosystem components
- stakeholders
- management strategies already in place
- major factors affecting the ecosystem
- a map of the ecosystem
- educational materials that exist about the ecosystem

The Bridge Connection

www.vims.edu/bridge

Under Ocean Science Topics, click on Human Activities, then Fisheries.

The “Me” Connection

Using at least two examples to illustrate their points, have students write an essay on how EBM is of personal benefit.

Connections to Other Subjects

Mathematics, Language Arts, Environmental Policy

Evaluation

Group work, class discussions, and presentations allow opportunities for assessment.

Extension

1. Allow time for students to read the article titled “EBM: Putting Theory into Practice in California” at www.csc.noaa.gov/magazine/2012/02/article1.html. Discuss the elements of EBM that are mentioned in this article, and how the Humboldt Bay group implemented their EBM strategy.

2. Have students watch the video clip “NOAA Fisheries Service's New Autonomous Underwater Vehicle” at www.youtube.com/watch?v=4NeCYdHCeIU. They should write a short essay on ways that this technology will be useful in ecosystem-based fisheries management. What data will it provide, and why is this data important?

Additional Resources

Ecosystem Based Fisheries Management in the Chesapeake Bay
chesapeakebay.noaa.gov/ecosystem-based-management/ecosystem-based-fisheries-management

Ecosystem Based Management Tools Network
www.ebmtools.org/

Ecology of the Northeast Continental Shelf: Toward an Ecosystem-Based Management Approach
nefsc.noaa.gov/ecosys/Ecosystems.pdf

NOAA Fisheries Service -Ecosystem-based Fishery Management for the Northeast Continental Shelf
nefsc.noaa.gov/ecosys/EBFMbrochure.pdf