U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Marine Fisheries Service

Lesson 1: Introduction to the Ocean Sciences

Overview

The purpose of this lesson is to introduce students to the ocean sciences by encouraging them to think about their personal experiences with the ocean and its resources. The lesson also introduces students to the National Ocean Sciences Bowl (NOSB), a national competition for high school students in the ocean sciences. The lesson explains the rules of the competition and provides reasons why students might want to participate. Students practice a Mock Bowl focusing on the competition rules.

Lesson Objectives

Students will:

1. Describe their experiences with the ocean and the ways people use the ocean.

2. Experience a mock National Ocean Sciences Bowl competition

Lesson Contents

1. Introduction to the Curriculum

2. Teaching Lesson 1
    a. Introduction
    b. Lecture Notes

3. Student activity: Mock Bowl Competition

4. Student Handout

Standards Addressed

National Science Education Standards, Grades 9-12
Science in personal and social perspectives

Ocean Literacy Principles
The Earth has one big ocean with many features

DCPS, High School
Environmental Science E.2.1. Understand and explain that human beings are part of Earth's ecosystems, and that human activities can, deliberately or inadvertently, alter ecosystems

What are NOAA and NEMO?
The National Oceanic and Atmospheric Administration (NOAA) is the federal science agency focused on the oceans and atmosphere. NOAA is proud to include some education programs among its top science programs. One of these is the NOAA Enrichment in Marine sciences and Oceanography (NEMO) program that began as a partnership among NOAA and several of Washington, D.C.'s city schools[1]. The purpose of the partnership is to promote ocean literacy and initiate participation of Washington, D.C.'s public schools in the NOSB program. Washington D.C.'s public schools had never participated in NOSB prior to the start of NEMO, despite having the competitions take place in Washington, D.C.

The Purpose of the NEMO Curriculum and Why it's Unique
To prepare students for the NOSB and teach them about the ocean sciences, NOAA developed a set of lessons that teachers in the NEMO program could use in an extracurricular setting to give students a background in the wide range of disciplines that comprise the ocean sciences. These lessons were developed into the formal NEMO curriculum you see here. The lessons are unique in that they are designed to be completed with minimal classroom materials and preparation and do not require that instructors have prior experience in the ocean sciences. Lessons also do not require student access to computers or internet and only require materials found in a typical school (e.g., pen, paper) or grocery store.

What the NEMO Curriculum Curriculum Includes
Each lesson in the NEMO Curriculum includes the following elements: 1) A lesson outline and overview; 2) A PowerPoint presentation for teachers to present the conceptual content of the lesson; 3) A student activity where students apply what they have learned or solidify related concepts through labs, worksheets or games; 4) A Teacher's Edition with subject background, lecture notes, and activity keys; 5) A Student Handout for extra NOSB preparation; and 5) Practice NOSB questions that teachers can use at the end of each lesson to hold a "mock Bowl" to help students prepare for the competition.

Why the NEMO Curriculum was Developed
Teams from NEMO schools have participated in a regional NOSB competition each year since the program's inception in 2008 and in 2011 one NEMO school finished in the top three schools. In addition, student survey data show that the NEMO program positively affected student interest in marine science and pursuing marine science as a career. Based on the local success of the NEMO program, activities used for the program were formalized into a set of cohesive lessons and activities for any educator to use who was interested in exposing their students to the ocean sciences. These lessons are aligned with Ocean

Literacy Principles, National Science Education Standards and D.C. Public School Standards for High School to make them applicable in a formal classroom setting as well.

[1] The Washington, D.C. city schools referred to here are part of the District of Columbia Public School System, a large, urban, public school system.

How to Use the NEMO Curriculum

The curriculum spans several broad topic areas of marine science including biological oceanography, chemical oceanography, geology oceanography, physical oceanography, marine policy and technology. The lessons within each unit of the curriculum are designed to build off one another, so concepts from earlier lessons may come up in later lessons. In many cases, though, individual lessons and activities can be used in a stand-alone format to supplement another curriculum you may be using. The timely information contained in these lessons is applicable to any geographic location and can be used solely for NOSB preparation or as a stand-alone set of activities for a marine science club.

Lesson Outline[2]

I. Introduction

Start the lesson using slide 3-13 of the PowerPoint for Lesson 1 (File: Lesson 1 – Intro to NEMO.ppt) that presents a brief Ocean Quiz. Allow the first student to raise a hand to answer and reward students who answer correctly. There are five questions in the Quiz.

Once you have finished the Ocean Quiz, ask the students to make a list of the reasons they can think of that humans rely upon the oceans, including necessary resources and enjoyment. Allow students a few minutes to complete the list. Invite students to share some of their answers, and use these answers as a basis for an introductory discussion of marine science. Below are some ideas for questions to lead this discussion:

1. Why is the ocean important to humans?

   The ocean covers almost three-quarters of the Earth's surface and comprises over nine-tenths of our total water resources. Humans use the ocean for food, energy and materials. The ocean supports almost 50% of all species on Earth and provides 5% of total protein in the human diet[3].

2. How do human activities affect the marine environment?

   Humans use the ocean for food, resources, recreation, transportation, and many other purposes. Coastal development may result in marine habitat loss or pollution. If fish populations are overharvested, populations may decrease. Many laws exist to reduce pollution to the marine environment, provide for the sustainable management of fisheries, protect fish habitats, and conserve and protect marine mammals, sea turtles, and various other marine species.

3. Why is it important to study marine science?

   By understanding the interactions between human activities and marine ecosystems, we can help to sustainably manage marine resources. Studying the ocean sciences can open the door to a wide range of rewarding careers in several different fields including science (e.g., biology, chemistry, physics, geology and mathematics), engineering, policy, education and law.

[2]Unless otherwise indicated, all websites provided or referenced in this guide were last accessed in November 2010.

[3] Source: NOAA, http://www.noaa.gov/ocean.html

II. Lecture Notes

After your discussion, use the rest of the PowerPoint for Lesson 1 (starting at slide 14) to present background information on the ocean sciences and the NOSB. Distribute the Student Handout on the NOSB rules.

Previous ocean experiences (Slides 14-18)

1. Following the prompts on the slide, ask students to describe any experiences they have had with the ocean including previous participation at the NOSB.

2. The series of slides from 14-18 provides students with some information about career options in marine science, as well as internship and scholarship opportunities. This information is also included on handouts in the Lesson 1 folder (Files: Scholarship Info.pdf and NMFS-RTR VA Tech.pdf) for interested students.

The National Ocean Sciences Bowl (Slide 20)

1. The National Ocean Sciences Bowl is a national competition for high school students on topics related to the ocean sciences.

2. There are 25 regional competitions across the U.S., and the regional competition winners go on to compete in the national competition.

Motivation for student participation

1. NOSB's **National Ocean Scholar Program**:
   Students who participate in NOSB may be eligible to apply for college scholarships. For more information: http://www.nosb.org/?anchor=nosp

2. NOSB's **Coastal and Ocean Science Training (COAST) Internship Program:**
   Students who participate in NOSB (they don't have to win, just compete) may be eligible to apply for COAST, which funds in-depth marine science internship experiences for high school students. For more information: http://www.nosb.org/?anchor=coast

Learning the NOSB rules (Slide 21)

1. Distribute and read through the Student Handout that summarizes NOSB rules for your students. You may want to review the full competition rules found at http://www.nosb.org/competitions-2/competition-rules/

Develop a strategy based on the rules (Slides 22 and 23)

1. Understanding the rules of the competition may seem trivial, but teams lose points when they do not correctly follow the rules. Some strategy suggestions:
   - Answer multiple choice buzzer questions based on letter rather than the answer itself. If the answer given does not match exactly what is written in the answer booklet, the answer is counted incorrectly even if technically the answer is correct.

- In a multiple choice buzzer question, if all choices have been read, buzz-in quickly even if you don't know the answer. You will not lose points for an incorrect answer as long as all the choices have been read. Thus even a guess in this situation gives you a chance to win points.
- Visit the NOSB website for the most current Bowl information: www.nosb.org

Mock Bowl Competition

Review the NOSB rules on the Student Handout. Then, conduct a Mock Bowl using the 20 questions and 1 team challenge question provided below. The questions focus on the NOSB rules, marine science facts and fun trivia. Depending on the number of students, you may wish to rotate the number of teams.

Lesson 1 also contains an additional PowerPoint presentation of Bowl questions that may interest students in participating in the Bowl (File: Extra Bowl Questions.ppt). These questions are in PowerPoint format to facilitate showing them in a classroom setting. At the real Bowl, questions are read aloud and not displayed.

Mock Bowl Quiz

1. Question Type: Multiple Choice, Bonus
   Subject: Marine Science

   What large marine mammal, whose skeleton is on display at the Smithsonian Institution in Washington, DC, went extinct in the past 250 years:
   w. Puff, the magic dragon
   x. Stellar's sea cow
   y. Blue whale
   z. Manatee

2. Question Type: Multiple Choice, Toss-up
   Subject: Marine Science

   The ocean is a pretty noisy place. Which of these factors has the most influence on the speed of sound in water:
   w. Humidity
   x. Air pressure
   y. Salinity
   z. Temperature

3. Question Type: Multiple Choice, Toss-up
   Subject: Marine Science

   Marine sponges are:
   w. algae
   x. macro plankton
   y. sessile animals
   z. plants

4. Question Type: Multiple Choice, Bonus
   Subject: Entertainment

   The movie *Happy Feet* focuses on what type of penguin colony:
   w. Rockhopper
   x. Emperor
   y. Gentoo
   z. Adelie

5. Question Type: Multiple Choice, Toss-up
   Subject: Marine Science

   What kind of fish is most often used in McDonald's fish sandwiches:
   w. Catfish
   x. Walleye pollock
   y. Tilapia
   z. Atlantic cod

6. Question Type: Multiple Choice, Bonus
   Subject: Entertainment

   Green sea turtles like Squirt from *Finding Nemo* travel independently at what age:
   w. 3 years
   x. Immediately
   y. 3 months
   z. 3 weeks

7. Question Type: Multiple Choice, Bonus
   Subject: Entertainment

   This actress provided the voice of Dory in *Finding Nemo:*
   w. Whoopi Goldberg
   x. Rachael Ray
   y. Scarlett Johanssen
   z. Ellen Degeneres

8. Question Type: Multiple Choice, Toss-up
   Subject: Marine Science

   How long is a newborn baby blue whale:
   w. 5 feet
   x. 25 feet
   y. 10 feet
   z. 40 feet

9. Question Type: Multiple Choice, Toss-up
   Subject: Marine Science

   Where did the largest tsunami occur:
   - **w. Alaska[4]**
   - x. Thailand
   - y. Japan
   - z. Hawaii

10. Question Type: Multiple Choice, Bonus
    Subject: Marine Science

    Which of the following is not a common name for dolphinfish:
    - w. Dorado
    - x. **Bottlenose**
    - y. Mahi-Mahi
    - z. Dolphin

11. Question Type: Multiple Choice, Toss-up
    Subject: Marine Science

    Which of the following is one of the fastest fish in the world:
    - **w. Swordfish**
    - x. Clownfish
    - y. Striped bass
    - z. King salmon

12. Question Type: Multiple Choice, Toss-up
    Subject: Marine Science

    Chilean sea bass is popular but threatened fish sometimes eaten at restaurants. Chilean sea bass is:
    - w. another name for striped bass
    - x. another name for largemouth bass
    - y. is not really a bass, but a halibut
    - **z. is not really a bass, but a Patagonian toothfish**

[4] Source: NOAA, http://nctr.pmel.noaa.gov/faq_display.php?kw=16

13. Question Type: Multiple Choice, Bonus
    Subject: Marine Science

The movie *March of the Penguins* was filmed in:
- w. The Arctic
- x. South Africa
- y. The North Pole
- **z. Antarctica**

14. Question Type: Multiple Choice, Toss-up
    Subject: Marine Science

    What is the biggest fish in the sea:
- w. Bluefin tuna
- x. Swordfish
- y. Barracuda
- **z. Whale shark**

15. Question Type: Multiple Choice, Toss-up
    Subject: Marine Science

    Which of the following eat adult sea turtles:
- w. Crabs
- x. Dolphins
- **y. Sharks**
- z. Whales

16. Question Type: Multiple Choice, Bonus
    Subject: Marine Science

    What tuna is used for canned white meat tuna:
- w. Yellowfin
- **x. Albacore**
- y. Tongol
- z. Bluefin

17. Question Type: Multiple Choice, Bonus
    Subject: Marine Science

    Why do most shark attacks occur?
- w. *Jaws* is accurate: sharks target humans as prey
- x. Sharks never attack people
- y. Sharks are blind and hunt by biting anything they run into
- **z. Shark attacks are often a case of mistaken identity**

18. Question Type: Multiple Choice, Bonus
    Subject: Marine Science

    NOAA stands for:
    w. National Ocean and Atmosphere Association
    x. National Oceans and Air Administration
    y. Nature, Ocean, and Air Association
    z. National Oceanic and Atmospheric Administration

19. Question Type: Multiple Choice, Toss-up
    Subject: Marine Policy

    The agency primarily responsible for promoting stewardship of marine resources is:
    w. NFS
    x. EPA
    y. NASA
    z. NOAA

20. Question Type: Multiple Choice, Bonus
    Subject: Marine Policy

    The majority of water pollution comes from which of the following sources:
    w. Drilling and mining
    x. Shipping spills
    y. Trash/sewage dumping
    z. Land run-off

Team Challenge Question
Category: Biological

Look at the organisms labeled A and B on the next page. (Note that B includes two pictures of the same organism.)

1. Identify on the lines below whether the organisms in A and B are seals or sea lions: (2 pt)

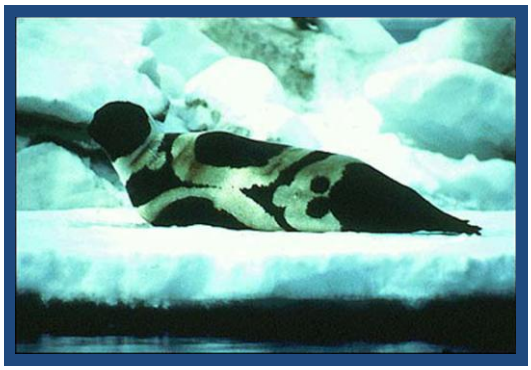
A._____

B._____

2. Name two identifying features that you used to make your determination. (2 pt)

3. At what taxonomic level do seals and sea lions differ? List all the common taxonomic levels shared by the two. (5 pt)

A. 

B.  

ANSWER

Category: Biological

Look at the organisms labeled A and B on the next page. (Note that B is two pictures of the same organism.)

1. Identify on the lines below whether the organisms in A and B are seals or sea lions (2pt) [5]:

A. Sea lion (1pt)

B. Seal (1pt)

2. Name two identifying features that you used to make your determination (2pt)

Sea lions have ear flaps and seals don't (1pt).
Sea lions can turn their flippers backward to prop themselves up while seals lay on their bellies (1pt).

3. At what taxonomic level do seals and sea lions differ? List all the common taxonomic levels shared by the two. (5pt)

Seals and sea lions belong to the same kingdom (Animalia) (1pt), phylum (Chordata) (1pt), class (Mammalia) (1pt), and order (Pinnipedia) (1pt), but are in different families (1pt).

Note: Sea lions are in the family Otariiae, while true seals (earless seals) are in the family Phocidae.

[5] Photo: NOAA, http://www.afsc.noaa.gov/nmml/california/el_nino/impacts.php
Photo (left): NOAA, http://www.alaskafisheries.noaa.gov/protectedresources/seals/ice.htm
Photo (right): NOAA, http://www.noaanews.noaa.gov/stories2008/20080326_ribbonseal.html

Summary of Rules for Ocean Sciences Bowl Competitions

Competition Format: 6 minute buzzer round, 2 Team challenge questions; break; Second 6 minute buzzer round

Type of Question	**Question Format**	**Answer Time**	**Who Can Answer**	**Can I confer with my team to answer?**	**Do I need to be recognized by moderator to answer?**	**Can I interrupt the moderator and answer a question before it is read in its entirety?**	**How to answer**	**Point Value**
Toss-Up	Multiple choice or short answer	5 seconds	The first player on either team to activate the buzzer system	No! If you confer, your team loses the opportunity to answer and the other team is given a chance	Yes! You lose a chance to answer if you respond before being recognized	Only if you are sure you know the answer If you interrupt and answer incorrectly, your team will lose 4 points	For multiple choice questions: The letter, the exact wording of the answer choice or both [Alternate language used for the answer is not acceptable]; The 1st answer is counted only	4
Bonus	Question given to team that answers a toss-up question correctly	20 seconds	Team Captain only	Yes; But only before the Captain begins answering the question	N/A (Only Team Captain can answer)	Yes; No points are deducted for incorrect answers	Same as above	6
Team Challenge	Written response graded over competition break	2 minutes	N/A	Yes	N/A	N/A	N/A	Up to 20 points; partial credit can be earned