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You need not have an ocean nearby to teach about the ocean. Teachers in K-12 classrooms have for decades turned to the integrated concepts of the sea to help them teach topics as obvious as density and biodiversity but as varied as alliterative poetry, industrial design, and international law. The large number of magnet schools using marine themes is evidence that teachers believe oceanic learning can enhance all parts of the curriculum. Indeed, one highly successful program uses the ocean environment as an integrating context across disciplines and subject matter (McDonnell, 2001) and

another has used explored linkages between marine science and science content standards (New Jersey Sea Grant College Program, 2000). This Digest is designed to share a rationale for teaching about oceans and briefly introduce the kinds of resources available to assist with such efforts.

As a self-designated marine educator living in central Ohio, I still challenge people to find a topic in the school curriculum that cannot be taught using a marine connection. While my dreams of waking to sea sounds are most often fulfilled through use of nature recordings, I nevertheless persist in bringing the sea into my work with teachers. It's simple. Anyone can teach about the sea if they have one right outside. It takes a creative and determined spirit to teach about the ocean whenever and wherever the many opportunities arise, but there are many resources available to those up to the challenge (Fortner, 1998).

WHY TEACH ABOUT OCEANS?

Some have suggested that our planet should really be called Ocean, because there is far more ocean than there is earth. The absolutely overpowering dimensions of the ocean demand that it have curricular attention. Oceans cover 70% of Earth's surface and contain 95% of the life-bearing space. Oceans interact with other parts of the Earth system in major ways: they circulate heat and thus influence world climate; life came from the sea and its biological diversity is greater than that of the land; ocean forces shape the land, daily adding and subtracting measurable parts of the areas where over 50% of humans choose to live. The importance of the oceans to global conditions is reflected in the National Science Education Standards (National Research Council, 1996) that include content standards related to the ocean's role in natural systems, climatic conditions, life's diversity, and Earth's geological history.
The lure of the sea has given us the literature of danger and mystery, the artistry of coral colors and breaching whales, the promise of untapped resources, and the history book stories that ignite our passion for exploration. We need the sea, and wherever we are in the world that sea is part of our sense of place. Teachers can use this natural affinity for the sea by using oceanography as a theme to integrate school subjects and develop active learning opportunities (Brown & Hansen, 2000).

Yet the wonders of the sea have not protected it, and many global environmental concerns have examples if not origin in the sea. SeaWeb, an organization that provides excellent information for making people aware of the sea, lists eight categories of concern:

1. The discharge of pollutants from various sources on land and from ships.

2. Fisheries issues, including overexploitation, by-catch, and impacts of fishing gear.

3. Nutrient enrichment from fossil fuel burning, agriculture practice, and municipal waste.

4. Loss or disturbance of coastal habitats and resulting population effects on sea life.

5. Introduction of non-native species where they did not exist before.

6. Destruction and degradation of estuaries.

7. Reduction in stratospheric ozone, with increased UVB impacts on larval organisms and plankton.

8. Global climate change.

If we are to protect the resources of the ocean and secure for the future those ecosystem benefits we now collect from it, such as oxygen production, food resources and climate moderation, more people need to realize their responsibility for the health of the seas. Education is the answer.

WHERE CAN I GET RESOURCES FOR TEACHING ABOUT THE OCEAN?

For educators not having direct access to coastal facilities, three alternative types of resources are suggested: people, libraries, and the Internet.

1. People. Who is doing marine education in my area?

People who teach about the ocean are excited about sharing this experience. The

members of the National Marine Educators Association (NMEA) welcome newcomers to their regional and state chapters and to the national organization. Members of NMEA and its chapters are teachers from preschool through graduate school, and include those who work in public aquaria and coastal science centers as well. The top marine educators of the world come to NMEA to learn more, and each year the annual summer conference is host to a number of visitors from around the globe. Visit the NMEA Internet site [http://www.marine-ed.org] to locate the nearest chapter and learn about this year's conference.

The National Sea Grant College Program (a part of NOAA) has 30 coastal programs. Each has an education component, and many deal with K-12 education. As the Cooperative Extension Service and 4-H do for Land Grant institutions, the Sea Grant Educators Network is responsible for making the research done by Sea Grant accessible to learners of all ages. Sea Grant education is approached differently among the 30 coastal programs, but you can meet most of the educators through NMEA.

2. Libraries. What print materials are available for marine education?

"Current: The Journal of Marine Education" is the journal of NMEA. Each issue contains information about oceanic topics, the "sea stars" who are leaders of marine education, and classroom-ready activities. If you want to use real drift data to teach about how a spill of bathtub toys taught oceanographers new information about Pacific currents, you can find that information in this journal. A special issue (Volume 15(1) in 1998) focused on the influence of Sea Grant on marine education and what Sea Grant does in many arenas of education: K-12, university level, informal, teacher education, and outreach to private and government sectors.

ERIC Resources: Searching the ERIC database with the descriptors "marine education" or "oceanography" provides a wealth of resources from research articles to classroom activities. The following examples from recent years indicate the range of information available.

* Scuba Science (Glickstein, 2000)

* Connecting to the Standards through marine science (New Jersey Sea Grant College Program, 2000)

* Island of the Sharks activity (Gowell, 1999)

* CD-ROM: Our crowded shores. Balancing growth and resource protection (NOAA, 1998)

* Best practices in marine and ocean science education (McDonnell, 2001)

* Investigating sand on the coast of Oregon and Washington (Komar, 2002)

* Three Forms of Assessment of Prior Knowledge, and Improved Performance Following an Enrichment Programme, of English Second Language Biology Students within the Context of a Marine Theme (Feltham & Downs, 2002)

* Small Enclosures for Aquatic Ecology Experiments (Galford, 2000)

* Crayfish Investigations: Inquiry in Action for Grades 4-8 (Martin-Hanson, 2001)

* Oyster reef communities in the Chesapeake Bay. A primer. (Harding, et al, 1999)

* The coral reef alphabet book for American Samoa. (Madrigal, 2001)

3. Internet. What are the key sites for marine education?

The primary information source for marine education is The BRIDGE, a cooperative project of NMEA, Sea Grant, and the National Ocean Partnership Program. It was designed to bring together teachers, scientists, industry and academics. In less than ten

years of active development, The Bridge has become a comprehensive source of accurate and useful information on global, national, and regional marine science topics. Saying that it is a collection of web sites for ocean teaching does not do justice to the value and quality of this award-winning site. It is a very teacher-friendly resource, whether you seek information on a particular science topic, or activities for a certain grade level, or material specific to your region. A popular monthly feature is the Data Port, in which real ocean data sets are accessed in a classroom activity. Archives are available on sea turtle nest mapping, zebra mussel population growth, harmful algal bloom distribution, how shipwrecks can teach us about ocean currents and water characteristics, and more.

People resources are an important part of the BRIDGE project as well. For example, all web sites are reviewed by at least one teacher and one scientist before being linked. This improves the likelihood that the information is credible and pedagogically appropriate. Teachers who want to help with this critical review process can sign up to be TROLLs (Teacher Reviewers of On-Line Learning)! TROLLs live under the BRIDGE, of course, and keep out riffraff, web sites in this case. The BRIDGE rewards its TROLLs with incentives and acknowledgement on a special page. The science reviewers are STARs (Science and Technical Advisory Reviewers). STARs protect legitimate users from groups with agendas, dot-coms, and hobbyists who are just learning to make web pages.

In addition to being used by teachers, the BRIDGE is used by scientists to access teachers with current information. Announcements are posted of special programs, courses, laboratory opportunities, and student events. The Resource Pavilion includes connections to research laboratories, virtual expeditions, and national programs. If you have difficulty finding information on the BRIDGE, use the Scuttlebutt section to ask for it. You can access BRIDGE resources from the NMEA home page, or go directly to it at http://www.vims.edu/bridge.

SeaWeb does not have the strong teacher or scientist involvement that the BRIDGE does, but its Internet resources are substantial nevertheless. At http://www.seaweb.org you will find great amounts of information and credible links to the sciences of environmental issues. This organization has the public opinion survey information that supports the continued need for ocean education. A link to SeaWeb from KIDSNET includes audio broadcasts from famous people who study the sea [http://www.kidsnet.org/seaweb/].

NOAA, the National Oceanic and Atmospheric Administration, is the science agency that deals most directly with the oceans. It has a well-organized home page with information about ongoing science, including fisheries topics, global climate change, severe weather events, and special places such as marine sanctuaries, estuaries, dead zones, and the like. Visit NOAA for your science updates at http://www.noaa.gov/. Aquarius, an underwater project hosted by NOAA, can be accessed at

http://www.uncwil.edu/nurc/aquarius/.

There are many other ocean-related Web resources intended for teachers or students. Following are three examples:

* Planet Ocean, DiscoverySchool

http://school.discovery.com/schooladventures/planetocean/index.htm l

* Ocean Planet, Smithsonian

http://seawifs.gsfc.nasa.gov/ocean_planet.html

* Sustainable Seas, National Marine Sanctuaries

http://www.sanctuaries.nos.noaa.gov/sse/education/sseeducation.htm l

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