DELU-G-89-001 C2

A Delaware Sea Grant

MAS NOTE

From the University of Delaware Sea Grant Marine Advisory Service
College of Marine Studies, University of Delaware, 700 Pilottown Road, Lewes, DE 19958

MARINE CAREERS: The Oceanographer

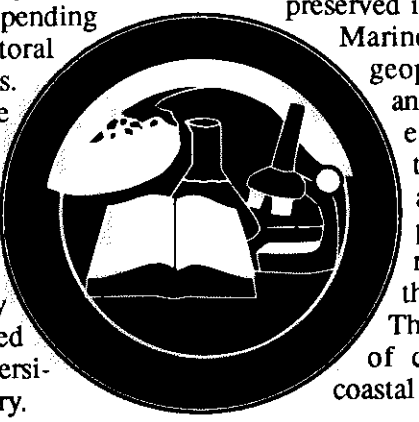
by William R. Hall, Education Specialist (302) 645-4253

To many people, oceanography is synonymous with marine biology, but oceanography includes many different and exciting career opportunities. Yet you should be aware of two things. First, you must understand that ocean careers are usually extensions of land careers. Most scientists build their careers on a strong "land" education base, with courses in biology, geology, chemistry, or physics. Those pursuing an ocean career then apply this knowledge to the ocean rather than the land. Second, since ours is a world of specialists, you should be prepared to spend a lot of time and effort to acquire the education and training needed to work in marine science.

Foremost in your planning should be the thought that oceanography is a *science*. Aspiring oceanographers should start preparing for their careers in junior and senior high school by taking math through calculus and whatever science courses are available, including computer science. When selecting a college, high school students shouldn't concern themselves with whether or not the institution has either an undergraduate or a graduate program in oceanography. Most major oceanography programs are taught only at the graduate level; therefore, select a school based on the merits of its undergraduate program in the sciences and math. It's important that you get the most intense science education for your dollar, choosing your electives well to prepare for your graduate career. Remember, graduate schools are very selective and seek out students with a diverse background that includes a strong concentration in math, physics, chemistry, biology, or geology. If you've been well-prepared in one of these areas, graduate schools know they can teach you oceanography.

Many graduate schools divide oceanography into five major subdivisions—biological oceanography, chemical oceanography, geological oceanography, physical oceanography, and ocean engineering—and, depending on the institution, offer master's and doctoral degrees in one or more of the specializations.

Also note that graduate schools are dynamic institutions, changing as faculty come and go. Visit the schools you're interested in. Take care in choosing an adviser since his or her guidance is critical to your career. And always remember that your ultimate goal is employment—approximately 40% of U.S. oceanographers are employed with the federal government, 30% in universities and colleges, and 30% in private industry.



Biological Oceanographer (marine biologist)—Biological oceanographers are marine specialists who study the plants and animals of our estuaries and oceans. Because of the size and complexity of the ocean, the marine biologist must specialize in a particular area. Some study the dynamics of oceans or estuaries to assess how changes affect marine life; others work in genetics, biochemistry, and fisheries biology; still others examine the effects of pollution on organisms. The opportunities for biological oceanographers are unlimited, but very specialized. The field is the most competitive of the marine sciences and the most difficult in which to secure a job.

Chemical Oceanographer—You might think of the ocean as a big laboratory where there are many organic and inorganic compounds. As the water moves, these compounds may interact, or be used by ocean life, or precipitate to the bottom, or have any number of different fates. Assessing the fate of such compounds is the chemical oceanographer's work. Ocean pollution also offers new challenges to this profession as we find more and more of our man-made compounds in the oceans. Other marine chemists and biochemists are searching for natural products from the ocean for food production, industrial applications, and the prevention and cure of diseases. Opportunities for chemical oceanographers are good and probably will improve as we search for new natural products and try to ascertain our impact on the oceans.

Geological Oceanographer—The bottom of the ocean, three-quarters of the earth, was once thought to be of little interest or value. But in the last few decades, we've begun to search the ocean floor for mineral wealth (oil, sand, gravel, metals, and, yes, even gold and diamonds), as well as for the historical information that is preserved in the minerals' composition and structure. Marine sedimentologists, paleontologists, and geophysicists can interpret the sedimentary and rock records to unravel the history of the earth's evolution and the related changes in the global environment. Recent concerns about global warming, the melting of the polar ice caps, and the resulting sea-level rise and coastal erosion has benefited from the work of coastal and marine geologists. The outlook is good, particularly in the areas of coastal erosion, coastal planning, and coastal engineering.

Physical Oceanographer—Ocean currents, waves, estuarine and coastal circulation, world climate, and the interaction between the atmosphere and the ocean all have one thing in common—they are studied by the physical oceanographer. This scientist looks at the physical properties and movement of the water in the sea and examines how they influence our environment. Some physical oceanographers take a global perspective, looking at the earth as a whole, while others look at regional systems, like an estuary. As with many areas of the marine sciences, the physical oceanographer is sometimes part of a team composed of other specialists, such as biological or chemical oceanographers. These scientists may work on a project involving circulation and how it influences the presence of certain species of fish or the pollution of an estuary. Physical oceanographers have the enviable position of almost unlimited job potential. There simply are not enough of them to fill the jobs currently available.

Ocean Engineer—Whether it's solving a beach erosion problem or designing and building port facilities, marine equipment, or a "Texas tower" for offshore drilling, ocean engineers face unique challenges. Building structures near or on the oceans presents situations and environments not present on land. Corrosion, water pressure, sedimentation, storms, and a host of other variables challenge not only design, but also materials and construction. Each job is different because of exposure, salinity, weather, or whatever. In fact, one area that ocean engineering centers on is the development of specific composite materials to cope with the stresses of the ocean. The engineer's job is to find solutions that will enable humans to work with or live in the marine environment. Ocean engineers are always needed.

Sources of Marine Careers Materials

Single copies of the following publications are usually free or available at a minimal charge from their addresses.

Anderson, Aubrey L. 1987. *Questions about Careers in Oceanography.* TAMU-SG-87-401. Marine Information Service, Sea Grant College Program, Texas A & M University, College Station, TX 77843-4115.

Burtis, William S. *Ocean Opportunities.* Marine Technology Society, 1730 M St., N.W., Washington, DC 20036.

Careers in Marine Science. National Aquarium in Baltimore, Dept. of Education and Interpretation, Pier 3, 501 East Pratt Street, Baltimore, MD 21202.

Careers in Oceanography. School of Oceanography, Oregon State University, Corvallis, OR 97331.

Hollin, Dewayne. 1987. *Vocational-Technical Marine Career Opportunities in Texas.* TAMU-SG-80-402(r). Marine Information Service, Sea Grant College Program, Texas A & M University, College Station, TX 77843-4115.

Hollister, Charles D. *Careers in Oceanography.* American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009.

Hollister, Charles D. "In Pursuit of Oceanography and a Better Life for All." *Oceanus,* Vol. 26, No. 2, Summer 1983.

Hollister, Charles D., and John G. Sclater. "Graduate Enrollment in Oceanography." *EOS—Transactions of the American Geophysical Union,* Vol. 62, No. 48, 1 December 1981, p. 1162.

Nowell, D. Arthur R. M., Charles D. Hollister, and Arthur B. Baggeroer. "Contemplating Tomorrow's Oceanographers." *Sea Technology,* Vol. 26, No. 10, October 1985, pp. 57-65.

Professional Marine Careers. 1980. Bulletin E-1356, MICHI-SG-79-410. Cooperative Extension Service, Michigan State University, East Lansing, MI 48824.

Scientific Marine Careers. 1980. Bulletin E-1355, MICHI-SG-79-48. Cooperative Extension Service, Michigan State University, East Lansing, MI 48824.

Technical Marine Careers. 1980. Bulletin E-1357, MICHU-SG-79-409. Cooperative Extension Service, Michigan State University, East Lansing, MI 48824.

The following represent particularly good reference books in the field. Check with your librarian. He or she may have a copy or be able to locate one.

"Environmental Scientists and Conservation Occupations." Reprinted from *Occupational Outlook Handbook,* 1984-85 Ed., U.S. Dept. of Labor, Bureau of Labor Statistics, Bulletin 2205, 16th ed., 1984 (updated every two years).

Heitzman, William Ray. 1988. *Opportunities in Marine and Maritime Careers* (2nd Ed.) Horizons—A Division of National Textbook Company, 4255 West Touhy, Lincolnwood, IL 60646—1-800-323-4900.

Oceanography in Action. Naval Oceanographic Office, Bay St., St. Louis, NSTL, MS 39522.

University Curriculum in Oceanography and Related Fields. Marine Technology Society, 1730 M Street NW, Washington, DC 20036.

1/89:4K