OCEANOGRAPHY IN THE HIGH SCHOOL SETTING

By John A. Fornshell and Frank D. Ferrari

ALL STUDENTS AT Thomas Jefferson High School for Science and Technology (TJHSS&T), a magnet school for students with exceptional science aptitude in Northern Virginia, are required to complete a senior research project in 1 of 14 different subject areas. For the past eight years, students at TJHSS&T have had the option of studying oceanography as seniors. The course that started as a biological oceanography course in 1989 has been expanded to encompass physical oceanography as well and depends on cooporation of government and university science laboratories at the Smithsonian Institution, the U.S. Naval Academy (USNA), and Old Dominion University.

The course objectives are to give the students experience in working in the fields of biological or physical oceanography. For the students working in the area of biological oceanography, initial instruction lasting six to eight weeks in the collection and identification of marine planktonic animals is provided by joint instruction by scientists and technical staff members from The Invertebrate Zoology Department of the Smithsonian Institution's Natural History Museum (NMNH). Following this, the students design a research project that, if successfully completed, is potentially suitable for presentation at a scientific meeting. By the end of the 1995/96 school year, ~47% of the students had presented their projects in scientific meetings or published them in scientific journals (examples are provided in Table 1). From the onset, the course has received material and personal support from the Department of Invertebrate Zoology of the NMNH. Ship time has been supplied by the Smithsonian Environmental Research Center (SERC), the Oceanography Department of the United States Naval Academy, and Old Dominion University's Center for Coastal Physical Oceanography (CCPO). The last named institution has been a major source of information, assistance in instruction, and software packages for the study of physical oceanography. The Jet Propulsion Laboratory PODAAC program has also contributed several software packages to the school.

Field work begins with one instructional field trip in which all students learn the basic methods of oceanographic work on a ship. This includes collecting plankton samples, preserving the samples, and recording significant physical data to be used in the analysis of the samples. The students receive these instructions from their school-based teacher and from the scientists and technicians from the NMNH. The work has been conducted on the *R/V SAXITILUS* belonging to SERC the USNA research vessel YP 686 and ODU's *R/V HOLTON.*

The laboratory work on the biological oceanography projects is done in the classroom space provided for the course at TJHSS&T and at the Invertebrate Zoology laboratory at the Smithsonian Institution Museum Support Center. As part of the research project, the students are required to conduct background studies and a literature search using the NMNH libraries. They also frequently contact Smithsonian scientists and researchers at other institutions.

The students working in the area of Physical Oceanography receive a significant amount of support and encouragement from the faculty of Old Dominion University's CCPO. For one day early in the academic year, the students visit CCPO and interact with several faculty members. This is particularly helpful because they do not have access to physical oceanographers in the Northern Virginia area. The scientists and faculty of CCPO have supplied the students with several software packages for processing and analyzing physical oceanographic data and computerized atlases. The faculty of CCPO are most helpful to the students in refining their projects and finding sources of information. Most of the interaction is long distance via e-mail. The contact with CCPO gives the students a sense of being part of the scientific community much as the interaction of biologically inclined students with Smithsonian scientists.

The faculty of the USNA has also been particularly helpful for those students working on submarine acoustics projects. In this case the assistance has

Table 1
A partial listing of publications by students in the Oceanography class at TJHSS&T

Edwards, K., K. Johnson, M. Stefan, and S. Winters, 1992: Effects of human activity on zooplankton populations in selected tributaries of the Chesapeake Bay. In: *Conference Proceedings Marine Technology Society*, Vol. I, Marine Technology Society, Washington, D.C., 421–425.

Garmew, T.G., S. Hammond, A. Mercantini, J. Morgan, C. Neunert, and J.A. Fornshell, 1994: Morphological variability of geographically distinct populations of the estuarine copepod *Acartia tonsa*. In: *Ecology and Morphology of Copepods*. F.D. Ferrari and B.P. Bradley, eds. Kluwer Academic Publishers, Dordrecht, 149–156.

Scanlin, M. and J.W. Reid, 1996: A new species from California, U.S.A.: *Hesperodiaptomas californiensis* (Crustacea: Copepoda: Calanoinda: Diaptomidae). *Proc. Biol. Soc. Washington, 109*, 103–111.

Ankerbrandt, K. 1996: Tracing water masses in the Chesapeake Bay. *EOS, 77*, S161 (Abstract).

Halden, J., 1996: Computer generated sound speed profiles as a means of describing water masses. *EOS, 77*, S161 (Abstract).

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been in the form of software packages for computing acoustic properties. The USNA has also provided ship time on the YP 686. The USNA and the American Meteorology Society through the Maury Project has also provided many sources of teaching materials for the instruction of physical oceanography.

The interaction between TJHSS&T and the institutions of higher learning and research centers such as the Natural History Museum make it possible for TJHSS&T to offer a successful course in Oceanography to high school students. Public schools cannot muster the resources for such a course without assistance from the oceanographic community. Although oceanography is traditionally a graduate school program of study, it is important to the future of the science to expose high school students to the field. High school seniors are in fact only four or five years away from applying to graduate school. It is then a good time to begin the development of intellectual interests that may last throughout their working lives. ❑