Coastal Seas as a Context for Science Teaching: A Lesson from the Chesapeake Bay

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Lessons that employ authentic environmental data can enhance the ability of students to understand fundamental science concepts. This differs from traditional "environmental education" in that school curricula need not set aside time for educators to teach only environmental topics. Rather, the "environment" is used to advance student learning in science and technology. The success of this approach depends on programs that encourage scientists to communicate more effectively with teachers at all education levels. The expanding diversity of research and monitoring activities on the world's marine waters constitutes an outstanding potential education resource. Many of these projects involve remote sensing with sophisticated instrumentation and employ Internet technology to compile measurements, interpret data using graphs and satellite imagery, and share the results among scientific colleagues and the general public alike. Unfortunately, these resources, which constitute a much shortened path between research findings and textbook presentation, are seldom interpreted for use by K-12 educators. We have developed an example that uses the Chesapeake Bay as a paradigm to demonstrate how such interpretation can assist educators in teaching important principles in physical oceanography and marine ecology. We present this example using PowerPoint to conduct a virtual tour of selected Internet sources. Our example begins with the conceptual "salt wedge" circulation model of Chesapeake Bay as a partially mixed estuary. Teachers have the opportunity to explore this model using salinity, temperature, and dissolved oxygen data taken from a research vessel platform during summer professional development programs. This source of authentic data, originally obtained by teachers themselves, clearly demonstrates the presence of a pycnocline and deep-water anoxia. Our lesson plan proceeds to interpret these data using additional Internet-based resources at increasing scales of time and space. The "salt wedge," pycnocline, and anoxia are examined using graphics derived from data taken by researchers using "ScanFish," a towed instrument that samples temperature, salinity, and dissolved oxygen at a resolution of only a few meters vertically and horizontally. The seasonal dynamics of these parameters at a given location are interpreted using biweekly monitoring data obtained as part of the state-federal Chesapeake Bay Program. The influence of annual variations in freshwater input is examined using stream flow data from U.S. Geological Survey gauging stations. Satellite remote sensing images from the TOPEX/Poseidon project are used to show how El Niño and La Niña events in the mid-Pacific affect the Chesapeake Bay system via rainfall on its watershed. Finally, the life cycle of the blue crab (Callinectes sapidus) is presented to show how an estuarine organism has adapted to this truly unique and dynamic coastal environment.