Teaching Interests
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Mission Statement

With our exploding population and degrading environment, we need a new generation of environmental stewards. Teaching these stewards may be the most important task of earth scientists, and is my primary career goal. I have taught introductory oceanography six times, both as a large lecture course and as an honors section, and always emphasized regional issues. My teaching goals mesh well with the recently described ocean literacy standards (COSEE, 2005), and I have just submitted an NSF proposal to develop a way of assessing ocean literacy. My ultimate goal is to improve the teaching of college level introductory oceanography around the country, by creating a new educational resource that turns the idea of a textbook inside out.

Teaching Methods

By contrast with the standard focus on global oceanography, I teach about the processes and issues relevant to the local region (Lambert, 2005). My students at the University of California, Santa Barbara learned about coastal upwelling, kelp forest ecology, larval transport and the PISCO project (piscoweb.org), marine reserves, oil drilling, and sewage treatment. Students at North Carolina State University learned about the Gulf Stream, barrier island processes, beach replenishment and my own research on larval transport in Pamlico Sound. Many of the topics relevant to Santa Barbara are also important to Monterey Bay, and I have worked with the UCSC branch of the PISCO project, studying larval transport in the Bay. I look forward learning more about the specific regional issues from my colleagues at NPS, UCSC, Moss Landing and MBARI (see below under "Bootkext").

I practice inquiry-based learning as much as possible, and keep the students on track with frequent and varied course assignments (Mc Keachie and Svinicki, 2005). I introduce each topic with a list of questions, such as: “do toilets flush differently in Australia?” and encourage students to respond by a show of hands. Many topics are linked with stories and images, such as the making of a paper snowflake (real snowflakes have six points, not eight, due to the structure of the water molecule). Students complete a brief in-class journal assignment daily, noting what they learned and any questions. Quizzes on course material occur every few weeks instead of twice each semester.

In classes of fewer 50 students, the whole class takes field trips to the beach to make observations, ask questions and formulate hypotheses. The final exam at UC Santa Barbara was also conducted on the beach, where students listed observations, questions, and answers based on course material. The students discussed shoreline processes, wave dynamics, water properties, biological oceanography and issues related to sewage disposal and oil drilling. Students in smaller classes or in honors sections of larger lecture courses also complete two major projects (Oceans in the News and Oceans Interpreted).

Ocean Policy Example

In summer of 1999, when the state of California passed AB411, defining the levels of bacterial contaminations that would require beach closures, Huntington Beach in Orange County promptly closed for two months. As there is an outfall about 7km offshore from the beach that discharges partly-treated sewage, the outfall was immediately labeled as a possible source of beach contamination. The Orange County Sanitation District (OCSD) paid for a series of studies of their outfall and infrastructure, to identify possible sources of beach contamination and ways that sewage from the outfall might reach the beach. I was co-chair of an independent review panel convened to ensure that the transport study had been conducted rigorously and honestly. It turned out that the study exonerated the outfall - no viable transport path from the outfall to the beach was found.

This result displeased local environmentalists who had described the outfall as a smoking gun, and wanted to use the beach contamination issue to force OCSD to go to full secondary treatment. The environmentalists, not realizing that many ocean scientists chose that career to help the environment, accused the scientists of lying for pay. Partly in response to environmental concerns, the OCSD board of control voted by a narrow 13/12 margin to go to full secondary treatment. Studies conducted after this vote added weight to the scientific claim that the outfall was not the primary source of beach contamination, but most parties are glad that OCSD is going to full secondary.

I was actually teaching introductory oceanography in Santa Barbara during this controversy (summer of 2002), and presented the entire story to my students. We discussed the various issues and the different ways of thinking (politics, emotions, money, science) that go into making difficult decisions. The day before the OCSD vote, my students voted on the issue. In the five times I have taught this section, student votes have gone several different directions. Many have voted for full secondary, citing an environmental ethic that extends beyond our swimming beaches. This morning, my students at NCSU voted for chlorination and further study.

By coincidence, one of the few remaining outfalls in California that is not up to full secondary treatment is located at Goleta Beach in Santa Barbara, right next to the University. I have asked students both in Santa Barbara and elsewhere whether, if it were their sewage and their beach, they would vote to pay $8/month out of pocket for the sewage upgrade. The vote has been almost unanimous in favor of upgrades. This question also led to an "aha" moment, when a student here asked "shouldn't the people who make the sewage pay for its treatment?" and her neighbor replied "you made it". Here in North Carolina, we discuss state beach quality standards which, due to the difficulty of monitoring 3000 miles of inaccessible shoreline on Pamlico Sound on a small budget, are significantly lower than the California standards. We also discuss the impact of outer banks development on beach cleanliness via non-point source pollution (septic is better than sewage, because it reduces population density). I am eager to teach this topic again in California.

Ocean Literacy

If the Earth is a body, the ocean is its blood. Ocean waters circulate over three-quarters of the globe, sustaining life and making the Earth habitable. Most human activities affect and are affected by the health of the ocean. In many of our daily actions, and in our occasional votes on important issues, we essentially decide whether to hurt or heal the ocean. For these reasons, ocean scientists and educators around the country have worked for the past decade to define an ocean-literate person as one who "understands the Essential Principles and Fundamental Concepts of Ocean Sciences, can communicate about the ocean in a meaningful way, and is able to make informed and responsible decisions regarding the ocean and its resources" (oceanliteracy.org).

As yet, no instrument exists to measure public understanding of the Essential Principles and Fundamental Concepts, or to determine how a given educational effort affects Ocean Literacy. Several surveys have been conducted on public attitudes toward the ocean, but relatively few data have been conducted on public understanding of the ocean. The impact of some informal programs is evaluated, but the focus of these evaluations is students' awareness of the ocean, life skills and career choices, not systematic testing of what the students actually learned. Formal educators, such as instructors in college level introductory courses, assess the students understanding of course-specific material, but rarely ask basic ocean literacy questions. The importance of asking these basic questions is underscored by the famous video of Harvard graduates attributing the seasons to the changing distance between the Earth and Sun.

I have just submitted a small pilot study proposal to NSF, with the following objectives: 1) to develop a reliable and validated survey instrument to assess ocean literacy and content knowledge, 2) to determine whether the same instrument may be applied to college level introductory oceanography courses and educational outreach for high school students, and 3) to measure the impact of each type of education effort.

Bootkext

A passing reference to the lack of inquiry-driven college textbooks in marine science (Lambert, 2005) has inspired me to turn the whole idea of a textbook inside-out. Bootkext is both an anagram for 'textbook', and a concept I would like to develop. Where a textbook is a heavy physical object, rather rigid, information-driven, and based on global oceanography, a bootkext is electronic, flexible inquiry-driven and based on regional oceanography. In a standard textbook, the last chapter may cover human impacts, but most courses never get that far. A bootkext is built entirely on current, regional research and issues, and is intended to supplement a standard textbook.

Having studied regional oceanography for the last 17 years, and taught regional issues for the last five, I happen to be well-positioned to create a Bootkext. I have brainstormed a four-page list of issues, topics and experts relating to different regions along the West

Coast, where I have personally studied or have collegial relationships with the local experts. My dream is to have everyone I know send me his/her favorite research and education materials, which I will then edit into resources for introductory oceanography instructors around the country. For example, an instructor interested in Monterey Bay would get links to all the educational and research institutions in the area, and a list of local experts, as well as instructional materials on upwelling shadows, kelp forest ecology, the PISCO project, Monterey Canyon and Elkhorn Slough. Instructional resources will include study questions, topic overviews, web links and PowerPoint presentations based on current research. The Bootkext will also provide information on Ocean Literacy and the assessment surveys described above, reference lists regarding good teaching practices (*e.g.* McKeachie and Svinicki, 2005) and some specific tips culled from a variety of sources. Every aspect of the Bootkext will be tested and improved in my own courses as well as those of any other oceanography instructors I can interest in the project. One publisher is already quite enthusiastic about the project.

References

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Mc Keachie and Svinicki, 2005: Mc Keachie's Teaching Tips, Houghton Mifflin Co, Boston, MA

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