Prior Studies

Attitudes Regarding the Ocean

Numerous studies have been conducted to assess public awareness of and concern for environmental issues, of which relatively few have been specific to the ocean (Belden et al 1999c). Americans generally rate ocean health as poor and weakening, but do not perceive the oceans to be in immediate danger (Belden 1999a). Survey respondents in the 1990's blamed humans in general, and supported regulation in the abstract, but felt that individuals had no significant impact (Belden 1999c). A decade later, people had an increased sense of personal impact, with 30% believing that their personal actions had a lot of influence on the health of oceans and coastal regions (AAAS 2004). It is not clear, however, to what extent people are willing to work to save the oceans. In the 1990's, although people placed great personal importance on the oceans, they considered air and water pollution to be more significant environmental issues and crime and education more significant still (Belden 1999c).

The Pew Commission's report on the state of the ocean noted that, "what we once considered inexhaustible and resilient is, in fact, finite and fragile". The report then describes problems of coastal development, impact from nutrient runoff, threats to fisheries, and invasive species, and concludes, "the root cause of this crisis is a failure of both perspective and governance" (Pew 2003). There is a clear connection from the Pew Commission's findings to a need for ocean literacy, to provide the perspective that improves the governance.

Scientific Understanding

The Ocean Project, as well as surveying public attitudes, surveyed public understanding of ocean science, and found it to be poor. Given five questions about the function of the ocean, 69% of respondents could answer only two questions correctly (Belden et al 1999b). This is not a good basis for making policy decisions.

There is often a significant disconnect between peoples' "common sense" conceptual models of physical science and scientific fact. In one famous video (Shapiro et al 1988), Harvard graduates confidently and incorrectly announced that the seasons were due to the distance between the earth and sun. Similar open-ended questions were used by De Laughter *et al* (1998), to assess the preconceptions of students entering introductory earth science courses. Again, student's preconceptions were held quite confidently, in spite of logical contradictions (Halloun and Hestenes 1985a,b, De Laughter et al 1998).

The confidence with which students hold their general (un)scientific preconceptions contrasts with their initial lack of confidence on course-specific material. In surveys conducted at the end of a course, Nufer (2003) found a connection between students'

confidence that they *could* answer course-specific questions and their actual class grades. De Laughter et al, (1998), however, noted that many students choose introductory earth science courses as an easy way to meet general education requirements, and may learn to parrot appropriate responses without gaining true understanding. This model is ill-suited to our intent of assessing general ocean literacy.

Lambert (2001, 2005a,b) studied the impact of high school marine science courses on general scientific literacy, using The Science Assessment In Literacy, SAIL, (Lambert, 2001). SAIL consists of 80 multiple choice questions, of which most relate to specific standards and benchmarks. Seven questions deal with science as inquiry, science in personal and social perspectives, the history and nature of science, and unifying concepts and processes. Students completing marine science courses showed a significant, but small (a few percentage points) increase in scientific literacy (Lambert 2005a,b). Again, this study pointed to the importance of integrative studies and local issues. For undergraduate-level instruction, the integration of current real world science is another important teaching tool.

Dr Lambert noted that more highly educated high school teachers, with a broader scientific knowledge base, were more effective at promoting scientific literacy. As college professors, are on average, more highly educated than high school teachers, college professors should be well prepared to improve scientific literacy among undergraduates. However, in a comparison study, Lambert (2001) assessed the pre and post understanding of science for students who took a large lecture style, college introductory oceanography course. She found that the post score mean of the college student group were not significantly different from the post score mean of the high school student group. This study also supports our hypothesis that one survey instrument may be used to measure ocean literacy in different populations (H1).