Our program objectives were translated into Student Learning Objectives categorized in the Bloom’s Taxonomy Levels of thinking skills in parentheses (Table 1). Where these Student Learning Objectives are introduced, practiced with feedback, and mastered in the Program is summarized in the Curriculum Map (Table 2).

Table 1: Marine Science B.S. Program Student Learning Objectives

<table>
<thead>
<tr>
<th>SLO</th>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLO1</td>
<td>Explain core concepts in Marine Biology and Oceanography.</td>
<td>Comprehension through Evaluation</td>
</tr>
<tr>
<td>SLO2</td>
<td>Examine and discuss current scientific issues using information from the primary literature and from class content.</td>
<td>Analysis and Synthesis</td>
</tr>
<tr>
<td>SLO3</td>
<td>Describe, and apply, key concepts of lab and field safety.</td>
<td>Application</td>
</tr>
<tr>
<td>SLO4</td>
<td>Perform core oceanographic and marine biology-based lab techniques, including “core should be techniques that 350/353 and 470/471 want students to have.”</td>
<td>Application</td>
</tr>
<tr>
<td>SLO5</td>
<td>Access the primary literature to find scholarly articles that discuss the results of experiments.</td>
<td>Application</td>
</tr>
<tr>
<td>SLO6</td>
<td>Summarize scholarly articles from the primary literature, and synthesize summarized information into a literature review.</td>
<td>Synthesis</td>
</tr>
<tr>
<td>SLO7</td>
<td>Write a testable hypothesis.</td>
<td>Application</td>
</tr>
<tr>
<td>SLO8</td>
<td>Independently design and carry out a controlled scientific experiment.</td>
<td>Synthesis and Evaluation</td>
</tr>
<tr>
<td>SLO9</td>
<td>Choose and use appropriate statistical methods to analyze experimental data.</td>
<td>Analysis and Evaluation</td>
</tr>
<tr>
<td>SLO10</td>
<td>Report experimental results in graphs and tables.</td>
<td>Synthesis</td>
</tr>
<tr>
<td>SLO11</td>
<td>Interpret graphically presented data</td>
<td>Evaluation</td>
</tr>
<tr>
<td>SLO12</td>
<td>Draw conclusions from experimental results.</td>
<td>Evaluation</td>
</tr>
<tr>
<td>SLO13</td>
<td>Write a scientific paper that reports the results of an experiment, following accepted guidelines for publication in a scientific journal.</td>
<td>Synthesis and Evaluation</td>
</tr>
<tr>
<td>SLO14</td>
<td>Create and deliver an oral presentation appropriate for a scientific conference or symposium.</td>
<td>Synthesis and Evaluation</td>
</tr>
</tbody>
</table>

2. IS THE PROGRAM MEETING ITS LEARNING OBJECTIVES FOR STUDENTS?

Our department is taking quantitative and qualitative approaches to evaluate whether the Program is meeting our student learning objectives: (i) a comprehensive assessment plan that will evaluate the program in its entirety; (ii) current and graduated student surveys. Our assessment plan will be further developed in the future, and data gathered continuously. However, here we include data already gathered from current and graduated student surveys and from the capstone activity, Senior Thesis Research, of the Marine Science B.S. Program for the past five years.

2.1 Long-term assessment plans (currently in development)

Assessment of Content-based SLOs
Assessing content-based SLOs will be accomplished by a single 40 question multiple choice test at the start of key classes; assessing skills-based SLOs will be accomplished by a series of embedded assignments in key classes.
• The M/C tests will be given in key classes: 171, 172, 201; 250; 265; 425; 440; 461 (maybe 350/353; and 470/471?)
Each M/C test will be composed of 40 questions: X covering material that students gained from previous class(es) (serving as a post-test for that material) and X covering material that students will get from the current class (serving as a pre-test)
• for that material).
• Each test will be given at the start of the course in which testing takes places. The X questions that cover previous material will be drawn from the pre-tests given at the start of 171, 172 and 201. (They may not be the exact questions – but will cover the same material).
• Each test needs to have class credit associated with it so that it is taken seriously / matters.
• A score reporting sheet will be filled out per class, indicating the percentage of each question answered correctly, and data will be added to a spreadsheet for use in statistical analyses.
• Having only 1 relatively short (~30 minutes) multiple choice test in core classes will allow assessment of content without consuming too much class time.
• MARE 171, 172 and 201 will also have pre-test questions; students will be advised at the start of the class about material that they should have mastered previous to that class, and will be responsible for “coming up to speed” on that material before the assessment test. Suggestions for review materials will be provided.
• The reasons for having the post test for the content at the start of the next level class are: 1) it will test the mastery of content retained in long term memory instead of material that was crammed into short term memory for a final; 2) the test will only be taken by students who passed and moved on from the previous class; 3) students will be aware that they are expected to retain content between prerequisite classes and subsequent classes, and will (should) review prerequisite material before the test and 4) content will be tested along the way, instead of in one, extremely large, test taken right before graduation.

Assessment of the skills-based SLOs
• The assignments to assess the skills-based SLOs will be designed as modifications of, or extensions of, assignments that are already in place in the class; for example, accessing the library databases to find a scholarly article, and summarizing it and providing a citation would be a short assignment that would assess SLOs 5 and 6.
• A rubric has been designed that can be used to assess assignments that require various scoring methods.
• A score reporting sheet would be filled out per class, and data would be added to a spreadsheet for use in statistical analyses.

Assessment Flowchart (This is in draft form)
• The M/C tests will be given in key classes: 171, 172, 201; 250; 265; 425; 440; 461 (maybe 350/353; and 470/471?)
The assignments to assess the skills-based SLOs will be designed as modifications of, or extensions of, assignments that are already in place. Instructors will coordinate between classes to decide what content students should know after a course / before the next; also, will collaborate to decide where to put in various assignments to test the various skills based SLOs.

M/C = Multiple choice  
E/A = Embedded Assignment

### 2.2 Assessment of the Capstone Activity (2008-12)
The capstone work for all B.S. students is Senior Thesis, which is an independent research project conducted over two semesters in MARE470 and MARE471. We have...
assessed the below objectives of these courses over 2008-12 (Fig. 1).

**Objectives of MARE470 and MARE471**

1. Perform a literature review relevant to proposed work
2. Generate a sound experimental design following existing scientific literature
3. Develop a written proposal for a marine-related independent research project
4. Collect and record data in accordance with proposed experimental design using accepted scientific techniques
5. Conduct an oral presentation proposed work including preliminary results
6. Demonstrate progress towards the completion of a marine-related independent research project
7. Produce a draft manuscript of research project
8. Deliver a final manuscript of project results
9. Present a research seminar of final project results
Figure 1. Assessment of the objectives of the Marine Science B.S. capstone work, Senior Thesis Research MARE470 and MARE471 over 2008-12. A = Mastery of Task; B = Exceeds Proficiency at Task; C = Proficiency at Task; D = Below Proficiency at Task; and F = Well Below Proficiency at Task.