

A Short Guide to the School of Marine Sciences Capstone Experience

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Capstone – (noun) 1. a stone that forms the top of a wall, building, or other structure 2. the crowning achievement, point, element, or event; a culmination.

What is a Capstone Experience? The Capstone Experience is required of all University of Maine students. For Marine Science majors, it is normally a research project conceived and completed by a student during the senior year under the direction of a faculty member. The project may be based on field or laboratory experiments, computer modeling, data mining/synthesis, or library research. According to University policy, the experience must (1) be significant, require innovation, show creativity, reflection and synthesis of prior learning; (2) result in a thesis, report, or presentation demonstrating mastery of the subject matter; (3) have faculty-student interaction as an integral part; and (4) be at least 3 credits. In SMS, the capstone also meets the University requirement for a Writing Intensive course in the major. This means students must have the opportunity to revise their writing in response to feedback from their faculty mentor and that a substantial portion of the capstone grade is based on the quality of the written work.

The actual form of the written work may vary. Students who do laboratory or field experiments or computer modeling typically report their research in the format of a journal article, but other documents might also be appropriate. For example, a student might write an annotated field guide to the organisms in a series of habitats that includes a review of the habitat characteristics and details the biology of the organisms. Students doing library research might write a review paper on their topic, a mock grant proposal for a research project based on their question, or even a set of lessons or website for high school/college students based on their topic. Regardless of the format, ALL students should expect to relate their capstone topic to the primary scientific literature. Students should discuss the specific report format and expectations with their capstone advisor before beginning their project.

Capstone project presentation - Students must present their capstone project to the faculty and other students in the School of Marine Sciences at either the capstone mini-symposium (if being held) or at the Center for Undergraduate Research (CUGR) symposium. These events will be scheduled at the end of the spring semester. Students can present their projects either in a short talk (10 minutes) or as a poster. The faculty will award a prize in the spring for the best capstone project completed during the academic year (students who graduate in December WILL be eligible for this award).

How to register for the Capstone? In the School of Marine Sciences, students must complete 3 credits of SMS 400 Capstone Research Experience in Marine Science (these credits may be spread over two semesters), **AND** 1 credit of SMS 404 Capstone Seminar in Marine Science. Students in the Honors Program may substitute HON 498 and HON 499 for SMS 400. Students must have identified a capstone advisor and project in order to register for SMS 400, and can only add the class to their schedules through the SMS office. A capstone registration form is

available from the office. Students should take SMS 400 in the semester before they begin their capstone project (e.g., spring of junior year) as this class offers them an opportunity to discuss current literature and develop a capstone project proposal.

How much time will it take? To some degree, this depends on the nature of your project. Laboratory experiments or field work may require longer hours during an intensive period while library research may be spread over the semester. A *minimum* expectation is that students should spend 3 to 6 hours per week during the semester actively engaged in their project. This corresponds to the time students would spend in a 3 credit lecture or laboratory course. It includes time spent in the lab, field or library as well as time spent writing and meeting with your advisor. Students should discuss time commitment with their advisor and set a work schedule prior to beginning the project.

What products are required? You must complete a short project proposal (5 pages max), your capstone report, and an oral or poster presentation at either the Capstone Mini-symposium (if being held) or at the CUGR symposium. The project proposal will generally be completed as part of SMS 404, the Capstone Seminar class. Students substituting SMS 350 Semester-by-the-Sea undergraduate seminar will complete their project proposal with their faculty advisor.

How will grading be done? As all students are required to take SMS 404, the capstone project proposal will be graded as an assignment in that class. In general, the SMS Curriculum Committee suggests Faculty capstone advisors assign grades in SMS 400 based on the following:

- 60% quality of the Capstone Report (might be 50% report, 10% proposal)
- 10% quality of the Capstone Presentation
- 30% quality of the student's effort.

Capstone Philosophy --Why do it? Think of all your coursework up till now as forming the bases of a stone archway. Each stone depends on the one below it, and the sides of the arches are getting taller and leaning toward each other, but the archway needs something to hold it all together at the top – a capstone. Your capstone project is an opportunity to immerse yourself in a topic that interests you and tie together information you've learned in many different classes. From the educational perspective, the capstone project offers students a way to:

- Experience real investigative scholarship in marine science or aquaculture
- Gain command of a specific topic
- Practice identifying and pursuing a significant question
- Experience synthesizing material from a variety of sources
- Continue & expand exposure to professional literature in marine and related sciences
- Practice using library resources, research methods, and systems of documentation.
- Practice delivery of material via written reports, oral presentations, and posters¹.

¹ Goals adapted from Gottschalk, K. & Hjortshoj, K. 2004. *The Elements of Teaching Writing*. Bedford/St. Martin's, New York.

Setting the stage: Efficiency vs. Investigation

When you have a deadline for a term paper, the following method works really well:

Choose a topic → Locate some sources on the topic → Read the sources, take notes and record quotes on note cards → Construct outline from the notecards → Following the outline, write the paper, incorporating the source material at appropriate sections → Document references and proofread → Turn it in.

But this method discourages real investigation! Your capstone project will be far more rewarding if you include time for:

- Narrowing the focus of the research
- Identifying significant questions
- Selecting references most relevant to those questions
- Thinking about the research material
- Exploring how science is actually done (hands-on lab and/or field work)
- Developing a position and voice as a real author (How do *you* think it all fits together?)

In order investigate a topic thoroughly, you need to allow yourself plenty of time. A capstone project is not a glorified lab report or term paper and cannot be satisfactorily completed in one or two weeks. A capstone project should reflect the continuum of inquiry – expect to move back and forth between asking questions, finding resources or conducting experiments, interpreting your data/resources, and reporting your research. Any of the SMS faculty members (especially the Capstone Seminar instructors) can help with identifying resources and focusing on a topic or question. Your capstone advisor will help you plan the project, and will be responsible for grading the final report.

Suggested steps in a successful Capstone project

1. Identify your broad area of interest
 - a. What class in your major have you liked the most?
 - b. Was there a topic in that class that really interested you?
 - c. Is there a topic you wish you'd learned about but haven't yet?
 - d. Is there a topic that's been in the news lately that you want to learn more about?
2. Begin your Background Research
 - a. Review papers can be helpful because they often suggest unanswered questions
 - b. Search a variety of electronic databases for relevant articles – not all databases cover the same journals.
 - c. Ask instructors from your classes for suggested readings on the broad topic and for help to identify SMS faculty whose expertise are in your area of interest.
 - d. Read papers to get a sense of the state of knowledge concerning your topic. What questions do you have about the content of the papers?
3. Narrow your focus, identify a question and a capstone advisor
 - a. Evaluate background papers – are some more closely related than others? Were any especially interesting? Does some information seem to be missing?

- b. Try mapping out the topic to show the relationships between your questions, the background paper topics, and your broad topic.
 - c. Now start asking questions to generate some more focused questions. What do you know about your topic? What do you *want* to know? Look at your map of the topic/background research – are some subtopics clustered together? Why are there links? What might affect those links? How? Why?
 - d. Talk to the faculty who are knowledgeable about your topic of interest– do they have relevant/doable projects that need students? If you are pretty certain about the topic you want to pursue, will they serve as your capstone advisor? If not, can they suggest someone else?
4. Plan your project with your capstone advisor
- a. Discuss the topic in detail with your advisor (who may send you back to the library!)
 - b. Write a brief proposal for your project: What is the larger context for your project? (Why research this topic?) What are your specific research goals? How are you going to address them? Do you need specific equipment? Will you do field work?
Note: The Capstone seminar instructor will require this proposal as an assignment.
 - c. With your advisor, craft a timeline outlining when you will complete your research/experiments/etc., when you will be meeting with your advisor to discuss progress, when your first draft is due, when your faculty advisor will return comments to you, and when the final report is due.
 - d. Be sure to discuss the format of the report with your advisor before you begin!
5. Continue your Capstone research
- a. You’ve already started, and having a plan is half of the battle!
 - b. Have fun investigating!
 - c. Don’t forget to talk to your advisor...
6. Write your capstone report
- a. Proofread everything you write BEFORE you hand it in!
 - b. Based on your advisor’s feedback, revise, revise, revise.
 - c. Submit an electronic copy of your final report to the SMS office for our records.
 - d. Present your project at one of the symposia.