Instructions for Students for use in the Hands-On Oceanography Laboratory:

An Integrated Model Simulation and Empirical Laboratory on Biological Encounter Rates

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Computer Simulations

You should treat the computer simulations just like any other experiment. That is, you should make ample notes on your set-up and results. You will be asked to write a laboratory report about both segments of the lab. In your discussion, include answers to at least some of the questions stated below.

1. Measure encounter rates given the model-supplied values. Make sure that the two files "encounter.m" and "enc_code.m" are in the same folder. From within Matlab open and execute the code: "encounter.m." A user interface will pop up with some preset values (Figure 1). (Should you ever accidentally "lose" the interface, just run "encounter.m" again.) Click on the "Run Model" button. What happens? What do you see? If your simulation results in an encounter rate, a second graph appears. What does it show? Keep in mind that your results might differ slightly from your fellow students' because there is a considerable random element in each model simulation. It will be useful to keep track of the group results. Close all open graphs and return to the user interface.

2. In sequence, vary each of the following variables: concentration of searchers and targets, target size, swimming speed of searcher and target. What is the biological meaning of each change you made: are the changes realistic? Should you only use realistic values? Keep track of the effects these variations have on changes in encounter rate. For some variables, small changes in values will change encounter rates much more than large changes in other values. Why is that? Note that changes in target size will not be visible.

3. Based on your model variations, develop a set of predictions specifying the relative importance of each variable for organism encounter rates.

4. Develop an experimental protocol to test those predictions using sea urchin sperm and eggs. Which variables can you change? What should you measure? How? What sample sizes should you gather? Note that the model simulates a hypothetical case and does not provide you with units for space and time dimensions. What will the dimensions of your model system be?

5. For your write-up, think about the model assumptions. What are some shortcomings of this simulation? (For example, targets remain available after they are encountered, feeding or fertilization would 'remove' the target from the pool.) Think of biological manifestations of your model manipulations: how can organisms change their size or speed? What strategies could organisms use to conceal themselves or advertise their presence?