Homework Assignment #6 (Due June 6, 2012)

1) Bluefin tuna don’t eat phytoplankton, but we demonstrated that it is possible to predict tuna “hotspots” by understanding trophic transfer and food webs. How would you go about doing a similar analysis for white sharks (or is this even possible?)

2) In a simple NPZ model, we assume that all phytoplankton are essentially the same, all zooplankton are essentially the same, and all nutrients can be modeled by tracking the most limiting one. In more complex models, we often add 2 different sizes of phytoplankton and zooplankton, a second nutrient, and detritus. Draw this model, labeling all the boxes, then discuss whether you think this is more useful, or still too simple, to explain ocean biology. How many “boxes” do you think we’d need to adequately model the oceans?

3) Eppley gave a growth-temperature relationship for phytoplankton, while Huntley-Lopez gave a similar relationship for zooplankton. In HW3, you calculated how much faster phytoplankton should grow in a warmer world. Now do the same for zooplankton (using the same data on temperature). Based on those results, what would you expect to happen in terms of top-down versus bottom-up control?

4) Review your midterm, and choose any one question you did not get full credit for. Answer it again. (if you got a perfect midterm score, congratulations! You can skip this question).

Graduate-Level Questions:
G1. You’ve probably heard Dr. Bruland talking about “developing your chemical intuition”. You should also have an intuitive feel for what typical biological values are for the ocean. Give ballpark values (and units) for the following: 1) average surface chlorophyll at the MBARI M1 mooring, 2) surface chlorophyll during a red tide, 3) nitrate concentration at 100 m, 50 km offshore, 4) nitrate concentration at the surface, 500 km offshore, 5) a typical carbon:chlorophyll ratio for phytoplankton, 6) a typical phytoplankton and zooplankton growth rate for Monterey, 7) the proportion of total primary production by the <5 µm size class (explain where you are), 8) a typical concentration of viruses in the coastal ocean, 9) a typical half-saturation constant for nitrate uptake by phytoplankton, 10) “high” and “low” concentrations of dissolved iron in surface seawater.