This extra credit opportunity is designed to expose you to more detail about biological oceanography than we have time for in class. You may choose to do any one of the three extra credit assignments below. Your score will be based on your answer—not much time/effort will result in not much extra credit. The Extra Credit is worth up to 50% of a discussion section assignment, and the extra credit will be added to that component of your grade.

The papers are available on the class website, under the “assignments” section at the bottom of the page. You should turn in a typed essay with your name and TA or section at the top. No late EC will be accepted.

1) Choose either the topic of (A) Global Warming, (B) Pelagic Migrations, or (C) Whales and Whaling. You are welcome to read all of the papers, but should only turn in extra credit for one of those three topics.

2A) For the Global Warming articles:
What is expected to happen to phytoplankton productivity in the oceans if warming continues? Will the oceans respond the same way everywhere? How do we know that we’re not simply seeing the impact of short-term events like El Niño? For the squid article, is global warming the only thing that is causing range expansion? What is unusual about the Humboldt Squid’s expansion compared to other organisms? Based on both articles and any materials from class (such as the discussion of ocean acidification), describe what you think it might be like to live in California (in terms of your interactions with the oceans) 100 years from now.

2B) For the Migration articles:
What new technology has allowed us to directly study the way animals migrate? Based on the articles, explain how migration might benefit the animals in terms of their adaptation to the environment. What oceanographic cues do you think the animals are responding to? (make sure to include examples from both articles).

2C) Whales and Whaling:
Explain how Roman and Palumbi estimated the historical size of the whale populations before industrial whaling. From the PNAS article, describe what the long-term effects on the food-web structure of the North Pacific have been. Include in your answer a discussion of top-down versus bottom-up effects, trophic transfer, and the impacts of removing apex predators from the food chain. Finally, one major criticism of these papers is that there is no way to ecologically sustain the population sizes of whales that the authors suggest (pre-industrial whaling). Explain how you, as a marine scientist, would determine if it were even possible to support the whale populations in the context of a marine food web.