

FINAL EXAM
DUE JUNE 10TH, 5:00 PM (NOTE: DATE CHANGED!)

Exam Policy:

This is an open book exam. You are encouraged to discuss the questions with others in the class. However, the work that you turn in must be your own. In the unlikely event that multiple students submit answers that are not deemed to be independent, those students will not receive credit for that portion of the exam.

In all cases *support your answer with evidence / concepts / theories from the primary literature*. That is, your responses **must** include bibliographic citations supporting your viewpoints and conclusions. It is unlikely that you will be able to answer these questions based only on the class required or additional readings (though those are excellent places to start).

Your responses are limited to 7,000 characters (without spaces). This is roughly equivalent to 2 single-spaced pages with 1" margins and 12 point font. Portions of responses that exceed the character limit will not be considered in grading. Your bibliography will not count towards the character limit.

Although your grade will not be based on writing quality directly, poorly written answers are unlikely to receive full credit because your answers will be unclear. Plan on spending plenty of time proofreading and editing your writing for clarity.

Please e-mail your answer to me directly. Late assignments will be assessed a 10% penalty per day.

Question 1

Worm and Myers (2003) (2003) used a meta-analytic framework to test whether northern shrimp populations were "top-down" limited by cod. Recently, Koeller (2009) presented evidence suggesting that climate-forcing playing a key role in the productivity of shrimp stocks.

Review the approaches and conclusions drawn by each, and then provide your own review of the relative weight of evidence for both perspectives. What information / methods might you use to evaluate the relative contribution of "top-down" and "bottom-up" influences?

Question 2

There is a growing concern over the possible impacts of fisheries that target small pelagic fishes (sardines, anchovies, pilchards, sand lance).

- A. Using case studies and examples from the literature, predict the potential impacts of this activity on marine ecosystems and species. In your review, make sure to provide a critical analysis of the weight of evidence for “bottom up” effects and the alternative ways of detecting them.
- B. What evidence would you need to conclude that increased landings of these species are promoted by removal of apex predators from marine ecosystems? Explain.

Question 3

Predation mediated density dependence (PMDD) has been widely documented in coral reef ecosystems.

- A. What attributes of these reef ecosystems (and the species that inhabit them) might act to make PMDD especially important here.
- B. Based on your understanding of other marine ecosystems and the fishes that live in them, do you think that the significance of PMDD is more widespread? Explain.
- C. What specific challenges in detecting density-dependence in fishes might make detecting PMDD in other ecosystems difficult?

References:

- Koeller, P., C. Fuentes-Yaco, T. Platt, S. Sathyendranath, A. Richards, P. Ouellet, D. Orr, U. Skuladottir, K. Wieland, L. Savard, and M. Aschan. 2009. Basin-scale coherence in phenology of shrimps and phytoplankton in the north Atlantic Ocean. *Science* **324**:791-793.
- Worm, B., and R. A. Myers. 2003. Meta-analysis of cod-shrimp interactions reveals top-down control in oceanic food webs. *Ecology* **84**:162-173.