

Marine Ecology 2011

Professor Mark E. Hay

(Tu, Th 1335-1455h in Coll of Computing 17)

Office is 2102 in the Ford Env. Science and Eng. Building

Office phone – 404-894-8429

mark.hay@biology.gatech.edu

Class Requirements and Grading - Tests will consist of a mix of short answer (a few sentences to a paragraph) questions mandating that you understand and be able to work with the concepts we have covered and multiple choice questions. There are three exams. The last exam will include more material from the later lectures but will cover the entire content of the course. I EXPECT YOU TO READ THE ASSIGNED PAPERS BEFORE COMING TO EACH CLASS. I will give pop quizzes designed to see if you read the papers as assigned (i.e., to punish you for not reading the papers and not being prepared to participate – there will be no make-ups for missed pop-quizzes, but you can drop ONE. Thus don't miss class and don't be late). Additionally, I am not reluctant to ask questions on the tests that have been addressed directly by the papers, but little, if at all, in class.

Before 12 April, you are to find, read, and summarize in one page or less (12 pt font, double spaced, 1 inch margins all round) two primary research papers about any topic on our schedule. These papers cannot be ones assigned for reading. Include the following in each summary: 1) a quick summary of the hypotheses tested, methods used, and findings, 2) strengths of the study (what makes it interesting, novel, substantial and rigorous, etc.), 3) limitations of the study (are the methods suitable for the questions addressed? Do the author's conclusions exceed the foundations of their data? etc.), and 4) a short statement on the overall value of the paper given its relative strengths and limitations.

FOR GRAD – We will meet separately on 7 weeks during the term (assuming 7 of you; and tentatively scheduled for Wed afternoon/early evening on Feb 2,9,23, March 2,9,30, and April 6). At each meeting, one of you will take either a topic listed on the syllabus or another of your choice that I approve (e.g., The role of biodiversity in marine community function; Invasive species; Cross-ecosystem energy or nutrient subsidies, etc...) and lead a presentation/discussion of that topic. The week before the discussion you will provide 1-2 papers that the other participants are to have read before coming, and a list of other pertinent papers (as future readings if that are interested, but you should have read these in preparation for your presentation and be knowledgeable of them. You will be graded on your breadth of knowledge of the topic, how well you organize and present this, how prepared you are to lead the discussion, and the general "learning value" of the day presentation/discussion you run.

Everyone will get a grade on your degree of participation during the discussions that others are leading.

Grading –

Pop Quizzes	5pts
Exam 1	25pts
Exam 2	30 pts
Exam 3	35 pts

Two summary papers	5 pts
Class participation/discussion	3 pts extra credit
GRAD Presentation	35 pts
GRAD participation	5 pts

Job Opportunities, Summer courses, etc. - Many of you will be interested in summer jobs involving marine ecology, summer classes, etc. Information I get regarding these will be posted on my office door and often announced in class and/or sent in emails. Doing well, preferably very well, in this class obviously enhances my ability to promote you for such opportunities. I also may hire assistants for the summer, and I work in Fiji and Florida, so.....

Schedule of Topics and Readings

JANUARY

- 13 - **Introduction to the course – This is about marine ecology, but also about SCIENCE** –Read the one page essay attached to this outline and get comfortable with asking “stupid” questions. If we don’t ask these questions, we stay stupid – so speak up; doing so also will help you and those around you, and the “stupid” questions are often some of the most critical ones....
- 18 - **Overview of the ecological state of the ocean**
READ – Jackson JBC. 2008. Ecological extinction and evolution in a brave new ocean. Proc. Nat Acad. Sci. 105: 11458-11465.
- 20 - **Eco-Engineering sustainable ecosystems (an example)**
READ - Burkepile DE and ME Hay. 2008. Herbivore species richness and feeding complementarity affect community structure and function: the case for Caribbean reefs. Proc. Nat. Acad. Sci. 105:162021-16206.
- 25 - **Rigor, experimental design, and science as a “way” of knowing, not just what is known**
READ – Chamberlin, T.C. 1965. The method of multiple working hypotheses. Science 148: 754-759.
AND
Hurlbert, S.H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54:187-211.
Sorry about the length of today’s reading assignment, but it is a critical topic that will allow you better insight into the validity of many of the other papers you will read.
- 27 - **Sex in the sea I: fertilization**
READ - Clifton, K.E. 1997. Mass spawning by green algae on coral reefs. Science 275:1116-1118.
Yund PO. 2002. How severe is sperm limitation in natural populations of marine free-spawners? Trends in Ecology and Evolution 15: 10-13

FEBRUARY

- 1 - **Sex in the sea II: Sex change**
READ – Munday PL, White JL, and Warner RR. 2006. A social basis for the development of primary males in a sex-changing fish. Proc. of the Royal Soc. B. 273:2845-2851.
- 2 - **Grad discussion (Daniel Hicks – Issues of climate change)**
- 3 - **Zygote/Larval behavior (now what do the babies do?)**
READ - Strathmann, R.R. 1980. Why does a larvae swim so long? Paleobiology 6:373-376

Harrington L, Fabricius K, De'Ath G, and Negri A. 2004. Recognition and selection of settlement substrata determine post-settlement survival in corals. *Ecology* 85: 3428-3437.

8 - Dispersal and open vs closed populations:

READ – Marshall, DJ, K Monro, M Bode, MJ Keough, and S Swearer. 2010. Phenotype-environment mismatches reduce connectivity in the sea. *Ecology Letters* 13:128-140.

9 - Grad discussion (Larisa Pender-Healy – Chemical signaling in the plankton)

10 - Local recruitment despite pelagic dispersal – how might it be achieved?

READ – Almay GR, Berumen ML, Thorrold SR, Planes S, and Jones GP. 2007. Local replenishment of coral reef fish populations in a marine reserve. *Science* 316: 742-744.

AND

Dixon DL, GP Jones, PL Munday, S Planes, MS Pratchett, M Srinivasan, C Syms and SR Thorrold 2008. Coral reef fish smell leaves to find island homes. *Proc. R. Soc. B* **275**, 2831-2839

15 - Guest lecture – Dr. Roberta Bonaldo

Roberta is in Fiji, I'll add the reading she wants to assign once she decides on it.

17 - EXAM

22 - Competitive interactions structuring marine communities

READ – Long JD, Hamilton RS, Mitchell JL. 2007. Asymmetric competition via induced resistance: specialist herbivores indirectly suppress generalist preference and populations. *Ecology* 88: 1232-1240.

23 - Grad Discussion (Claire Dell – Bottom-up vs Top-down regulation of communities)

24 - Competition – Most critical among similar or dis-similar species?

READ - Burkepile, DE, JD Parker, CB Woodson, HJ Mills, J Kubanek, PA Sobecky, and ME Hay 2006. Chemically-mediated competition between microbes and animals: microbes as consumers in food webs. *Ecology* 87:2821-2831

MARCH

1 - Consumer-Prey interactions I

READ – Duffy, J.E. and M.E. Hay. 2001. Ecology and evolution of marine consumer-prey interactions. Pages 131-157, In Bertness, M, M.E. Hay and S.D. Gaines (eds.) *Marine Community Ecology*, Sinauer Press, Sunderland, Massachusetts

- 2 - Grad discussion (Lauren Connolly – Trophic Cascades)
 - 3 - Consumer-Prey interactions II (Defenses and chemical defenses as examples of using the mechanisms to scale up to ecological and evolutionary consequences)
READ – Hay ME. 2009. Marine chemical ecology: Chemical signals and cues structure marine populations, communities, and ecosystems. **Annual Review of Marine Sciences** 1: 193-212.
 - 8 - Chemical signals in the plankton
READ Pohnert G, Steinke M, and Tollrian R. 2007. Chemical cues, defense metabolites and the shaping of pelagic interspecific interactions. *Trends in Ecology and Evolution* 22:198-204.-
 - 9 - Grad discussion (Mihika ???? – topic to be determined)
 - 10 - Trophic Cascades
READ – Myers RA, et al. 2007. Cascading effects of the loss of apex predatory sharks from a coastal ocean. *Science* 315:1846-1850.
AND
Dulvey NK, Freckleton RP, and Polunin NVC. 2004. Coral reef cascades and the indirect effects of predator removal by exploitation. *Ecology Letters* 7:410-416.
 - 15 Trait mediated interactions: The ecology of fear.
READ – Peckarsky BL, et al. 2008. Revisiting the classics: considering nonconsumptive effects in textbook examples of predator-prey interactions. *Ecology* 89:2416-2425.
 - 17 - EXAM
 - 22 - SPRING BREAK
 - 24 - SPRING BREAK
 - 29 - Disease and impacts on marine communities
READ – Harvell CD, et al. 1999. Emerging marine diseases: Climate links and anthropogenic factors. *Science* 285:1505-1510
 - 30 - Grad discussion (Dylan Grippi – maybe effects of diseases..)
 - 31 - Facilitation/positive interactions and the structure of marine communities
READ – Bruno JF, Stachowicz JJ, and Bertness MD. 2003. Inclusion of facilitation into ecological theory. *Trends in Ecology and Evolution* 18: 119-125
- APRIL**
- 5 - The limitation of studying parts: the need for a systems approach

READ - Hay ME, Parker J, Burkepile D, Caudill C, Wilson A, Hallinan Z, Chequer A. 2004. Mutualisms and aquatic community structure: the enemy of my enemy is my friend. *Annual Review of Ecology, Evolution, and Systematics* 35: 175-197

6 - Tiffany Andras – topic?

7 – Top-down vs bottom up effects on community structure

READ - Burkepile, DE and Hay ME. 2006. Herbivore versus nutrient control of marine primary producers: Context-dependent effects. ***Ecology*** 87: 3128-3139.

12 - Fishing and effects on marine ecosystems

READ - Crowder LB, EL Hazen, N Avissar, R Bjorkland, C Latanich, MB Ogburn. 2008. The Impacts of Fisheries on Marine Ecosystems and the Transition to Ecosystem-Based Management. *Annu. Rev. Ecol Evol Syst* 39: 259-278

13 - Jennifer Tang presents on ?????

14 - Pollution, dead zones and effects on marine ecosystems

READ - Breitburg DL, DW Hondorp, LA Davias, RJ Diaz. 2009. Hypoxia, Nitrogen, and Fisheries: Integrating Effects Across Local and Global Landscapes. *Annu. Rev. Mar. Sci.* 1: 329-349.

19 - Climate change, global warming, and effects on marine systems

READ - Hoegh-Guldberg, O et al. 2007. Coral reefs under rapid climate change and ocean acidification
Source: *SCIENCE*, 318 (5857): 1737-1742 DEC 14 2007

20 - Max Zlatopolsky presents on ???

21 - Ocean acidification and effects on marine ecosystems

READ - Doney SC, VJ Fabry, RA Feely, JA Kleypas. 2009. Ocean Acidification: The Other CO₂ Problem. *Annu. Rev. Mar. Sci.* 1: 169-192.

26 - Coral reefs as an example of the synergistic effects of multiple stressors

READ - Hughes TP, NAJ Graham, JBC Jackson, PJ Mumby, RS Steneck. 2010. Rising to the challenge of sustaining coral reef resilience. *Trends in ecology and Evolution* 25:633-642.

28 - Final EXAM