

SIO 134: Introduction to Biological Oceanography WINTER 2014

Course Instructor:

Prof. **Michael Landry**, Scripps Institution of Oceanography

E-mail: mlandry@ucsd.edu

Phone: 534-4702

Scheduled Upper Campus Office Hours: Thursdays 1100-1200, York Hall 3030

Teaching Assistants:

Alexandra (Ali) Freibott afreibott@ucsd.edu

Aaron Hartmann achartma@ucsd.edu

Lectures: 0930 - 1050, Tuesday and Thursday, **CENTER 212**

Lecture Notes (PDF files of PowerPoint files) will be available on **Ted**, <http://ted.ucsd.edu>, typically on the afternoon prior to lecture. The purpose of the notes is to facilitate, not substitute for, note taking and lecture attendance. Access is by your personal UCSD Academic Computing **username** and **password**.

Most **assigned readings** are short journal articles (PDF files on the course website) that complement the lectures on important ecological topics or issues of contemporary concern for the marine ecosystem. The details in these readings may go beyond what is necessary for the course, but general concepts presented in the articles are “fair game” for exams. In addition, there are **page readings in the textbook** (noted to the right of each lecture date) that are relevant to concepts and relationships discussed in lectures. Readings are assigned by lecture week and are best completed before the relevant lecture or weekly Discussion Section.

Textbook: *Marine Biology* (4th ed., 2013), J.S. Levinton. Oxford Univ. Press.

Discussion Sections (not mandatory): TA-led sections and review sessions are primarily for the clarification of lecture material and readings, and preparation for exams.

Grading:	Midterm Exam (Thursday, 6 Feb)	70 points
	Final Exam (Tuesday, 18 March)	130 points
	TOTAL	200 points

Evaluation is by letter grade based on two exams. There will be a short non-graded quiz in Discussion Sections during week 4 (before midterm) to familiarize students with exam question style and content. The final exam will cover material not included on the midterm (i.e., non-comprehensive).

Additional reserved text books: Interested students may find additional information on concepts in the following books on library reserve.

Biological Oceanography: An Introduction, C.M. Lalli and T.R. Parsons, Open Univ., 2nd ed., 1997.

Biological Oceanography, C.B. Miller, Wiley Blackwell Publ., 2004.

Marine Biology, J.S. Levinton, Oxford University Press, 3rd ed., 2009.

SIO 134: Introduction to Biological Oceanography

WINTER 2014

Course content: The course presents the basics for understanding the ecology of marine communities in a dynamic and changing ocean environment. In the first part of the course, we will take a process approach, focusing on major functional groups of marine organisms, how they interact in ocean food webs, and how the resulting communities respond to their environment. In the second half, we use this foundation as a basis for considering contemporary issues in ocean ecology, including human and climate influences.

LECTURE SCHEDULE

Date	Topic	Textbook Pages
Week 1	Readings: <i>Anderson & Rice (2006); Miller (2004)</i>	
Jan 7	Overview - habitats, major themes and issues, historical perspective	pp 2-6, 10-12, 13-22
Jan 9	Why plankton “bloom” – the dynamics of ocean biology	pp 200-208
Week 2	Readings: <i>Capone et al. (1997); Hansen & Calado (1999)</i>	
Jan 14	Phytoplankton - diversity and environmental relationships	pp 141-145, 213-214
Jan 16	Zooplankton - diversity and adaptations of planktonic consumers	pp 91-93, 145-154
Week 3	Readings: <i>Koehl & Strickler (1981); Alldredge & Madin (1982); Pomeroy et al. (2007)</i>	
Jan 21	Grazing and secondary production processes	pp 220-222
Jan 23	Organization of pelagic food webs	pp 218-220, 225-236
Week 4	Readings: <i>Ballance et al. (2001)</i>	
Jan 28	Upper ocean circulation, biogeography and ocean biomes	pp 22-24
Jan 30	Seabird ecology of the oceanic tropical Pacific (Dr. Lisa Ballance)	pp 185-194
Week 5	Readings: <i>Frank et al. (2005); Condon et al. (2011), Giovannoni (2012)</i>	
Feb 4	Bottom-up vs top-down controls of marine ecosystems	pp 52-60
Feb 6	Mid-term Exam	
Week 6	Readings: <i>Benoit-Bird (2004), Smith et al. (1989), Van Dover et al. (2002)</i>	
Feb 11	Vertical migrations and life in the twilight zone	pp 154-158, 175-177
Feb 13	Ecology of deep sea organisms and habitats (Prof. Lisa Levin)	pp 404-428
Week 7	Readings: <i>Doney et al. (2009); Jiao et al. (2010); Buesseler et al. (2008)</i>	
Feb 18	New production, elemental cycles and global ocean biogeochemistry	pp 27-33, 208-211, 237-240
Feb 20	Iron limitation and carbon sequestration	pp 211-212
Week 8	Readings:	
Feb 25	Ecology of coral reef habitats (Aaron Hartmann)	pp 378-401
Feb 27	Benthic ecology of hard-substrate coastal ecosystems (Dr. Ed Parnell)	pp 309-327, 371-378
Week 9	Readings: <i>Ducklow et al. (2013); Jackson (2001)</i>	
Mar 4	Sea ice, global warming and the ecology of polar regions	pp 428-432
Mar 6	The ups and downs of ocean fisheries	pp 461-478
Week 10	Readings: <i>Chavez et al. (2003); Gargett (1997)</i>	
Mar 11	Larval ecology and recruitment of ocean fishes	
Mar 13	Human and climate influences, decadal variability	pp 513-515
Mar 18	Final Exam (Tuesday, 0800 – 1100)	

WEEKLY READING ASSIGNMENTS

SIO 134: WINTER 2014

Week 1

Text: pp 2-6, 10-12, 13-22, 200-208

Anderson, T.R. & T. Rice. 2006. Deserts on the sea floor: Edward Forbes and his azoic hypothesis for a lifeless deep ocean. *Endeavour* 30: 131-136.

Miller, C.B. 2004. The spring phytoplankton bloom. Chapter 1 (pp 1-19) in Miller, C.B. *Biological Oceanography*, Blackwell Science Ltd., Oxford.

Week 2

Text: pp 91-93, 141-154, 213-214

Capone, D.G. et al. 1997. *Trichodesmium*, a globally significant marine cyanobacterium. *Science*, 276: 1221-1229.

Hansen, P.J. & A.J. Calado. 1999. Phagotrophic mechanisms and prey selection in free-living dinoflagellates. *J. Eukary. Microbiol.* 46: 382-389.

Week 3

Text: pp 218-222, 225-236

Aldredge, A.L. & L.P. Madin. 1982. Pelagic tunicates: unique herbivores in the marine plankton. *BioScience*, 32: 655-663.

Koehl, M.A.R. & J.R. Strickler. 1981. Copepod feeding currents: Food capture at low Reynolds Number. *Limnol. Oceanogr.*, 26: 1062-1073.

Pomeroy, L.R., P.J. leB. Williams, F. Azam & J.E. Hobbie. 2007. The microbial loop. *Oceanography*, 20: 28-33.

Week 4

Text: pp 22-24, 185-194

Ballance L.T., D.G. Ainley & G.L. Hunt. 2001. Seabird foraging ecology. Pages 2636-2644 In: Steele, J.H., S.K. Thorpe and K.K. Turekian (eds.), *Encyclopedia of Ocean Science*, Academic Press.

Week 5

Text: pp 52-60

Frank, K.T., B. Petrie, J.S. Choi & W.C. Leggett. 2005. Trophic cascades in a formerly cod-dominated ecosystem. *Science*, 308 (5728): 1621-1623.

Condon, R.H., D.K. Steinberg, P.A. del Giorgio, T.C. Bouvier, D.A. Bronk, W.H. Graham & H.W. Ducklow. 2011. Jellyfish blooms result in major microbial respiratory sink of carbon in marine systems. *PNAS*, 108: 10225-10230.

Giovannoni, S.J. 2012. Vitamins in the sea. *PNAS*, 35: 13,888-13,889.

Week 6

Text: pp 154-158, 175-177, 404-428

Benoit-Bird, K.J. 2004. Prey caloric value and predator energy needs: Foraging predictions for wild spinner dolphins. *Marine Biology*, 145: 435-444.

Smith C.R. et al. 1989. Vent fauna on whale remains. *Nature* 341: 27-28.

Van Dover C.L. et al. 2002. Evolution and biogeography of deep-sea vent and seep invertebrates. *Science* 295: 1253-1257.

Week 7

Text: pp 27-33, 208-212, 237-240

Doney, S.C., V.J. Fabry, R.A. Feeley & J.A. Kleypas. 2009. Ocean acidification: the other CO₂ problem. *Annu. Rev. Mar. Sci.* 1: 169-192.

Jiao, N. et al. 2010. Microbial production of recalcitrant dissolved organic matter: long-term carbon storage in the global ocean. *Nature Rev., Microbiol.* 8: 593-599.

Buesseler et al. 2008. Ocean iron fertilization – Moving forward in a sea of uncertainty. *Science* 319: 162.

Week 8

Text: pp 309-327, 371-401

Week 9

Text: pp 428-432, 461-478

Ducklow, H.W. et al. 2013. West Antarctic Peninsula: An ice-dependent coastal marine ecosystem in transition. *Oceanogr.* 26: 190-203.

Jackson, J.B.C. et al. 2001. Historical overfishing and the recent collapse of coastal ecosystems. *Science*, 293: 629-638.

Week 10

Text: pp 513-515

Chavez, F.P. et al. 2003. From anchovies to sardines and back: Multidecadal change in the Pacific Ocean. *Science*, 299: 217-221.

Gargett, A.E. 1997. Physics to fish: Interactions between physics and biology on a variety of scales. *Oceanography* 10: 128-131.