Syllabus
ENVS 411: Marine Dead Zones

CRN 27034
Winter Term 2015
Tuesdays & Thursdays 4-5:50 pm, 142 Columbia

Instructor: Maya Rommwatt
Office Hours: Tuesdays 2-3 pm, 47A Columbia, and by appointment
Email: rommwatt@uoregon.edu
Phone: (503) 467-9471

Course Description

Marine dead zones are increasing globally and are often linked to human activity, particularly agriculture. They pose a serious threat to marine health and can have large impacts on natural resource economies. This course will explore the connections between environmental regulation, pollution, and marine ecology through an in-depth look at marine dead zones. We will use the dead zone in the northern Gulf of Mexico and the issues surrounding it as a case study in order to explore how the factors controlling it apply to dead zones in other places. We will examine nonpoint source pollution, the law and policy related to this form of pollution, marine eutrophication and how it can lead to dead zones, the marine ecology of dead zones themselves, and how dead zones are affecting communities through impacts to fisheries.

Course Goals

- □ Learn the rudimentary science related to dead zones, including the biology, chemistry, and physical processes responsible
- □ Identify the effects of the dead zone on fishing communities
- □ Explore land uses that increase nutrient pollution
- □ Learn the basic structure of environmental law in the US
- □ Understand the role of the Clean Water Act in regulating nutrient pollution
- □ Explore mitigation solutions to nutrient pollution

Learning Objectives

By the end of the course, students will be able to identify connections between environmental law and policy, land use, river pollution, and marine ecology. Students will understand how dead zones are formed by biotic and abiotic factors, and they will understand how to assess the land use practices that cause dead zones to persist globally. They will also be able to assess the effects of marine dead zones on local communities through impacts to natural resource economies. Students will learn how the Clean Water Act works in regards to both point and nonpoint source pollution, and they will learn to examine strategies for enforcing the Act. Furthermore, students will understand the connections water creates across landscapes, from land use practices and regulatory structures to marine ecosystems. Students will be poised to look for solutions to the problems associated with nutrient runoff and marine dead zones.

Course Requirements

Readings: We will be using the Blackboard website for this course. All of the readings listed on the course schedule below will be available on the website, at the very latest one week in advance. There is no textbook for this class.

Discussion Participation (10%): A portion of every class will be devoted to small group and full class discussion as we cover the material in that day's reading. The discussion question format will vary with the course material, ranging from understanding key figures and findings from scientific papers and in depth exploration of paired scientific papers that provide differing opinions/results, to explorations of proposed mitigation methods and legal tools.

Global Dead Zone Presentation (5%): You will research a particular dead zone we have not discussed in class (Gulf of Mexico or Chesapeake Bay). In addition to providing a history of your chosen dead zone, you will need to identify its causes and the environmental and/or human impacts associated with them. Presentations will be held on a rolling basis throughout the term, generally one or two per class, and should be 5-10 minutes in length. You're welcome to use any media you like to facilitate your presentation, including none. There will be time for the class to ask questions. A link to the sign-up spreadsheet is available on the Blackboard site under "course information", and here: https://docs.google.com/spreadsheets/d/1dY2Xc4OcthiBWcbLxW3wcg-9Qt34Guyl52LF6PrX-pw/edit?usp=sharing

Global Dead Zone Report (10%): Reports should summarize the findings from your presentation in 2-3 pages, double-spaced, not including references, with 1-inch margins and 12-point font. Please use APA style citation. References must be provided. Reports are due at the time of your presentation (paper copy or emailed to me).

Midterm Exam (20%): The midterm exam will cover material explored through the last class before the exam. It will consist of multiple choice, short answer, and long answer questions.

Solutions Paper (25%): You will explore a proposed or hypothetical solution to the environmental and policy problems identified throughout the course in a research paper. Papers will be 6-10 pages in length, double-spaced, not including references, with 1-inch margins and 12-point font. Please use APA style citation. References must be provided. You have the freedom to focus more or less on a particular area (for instance, science vs. policy) as you see fit. You will need to submit a topic idea to me week 3 (worth 3% of your total grade), a draft outline week 5 (worth 7% of your total grade), and a final draft week 9 (worth 15% of your total grade). Submit your final draft to Blackboard.

PIELC Memo (10%): Attend one panel or lecture that you think has relevance to our course at the Public Interest Environmental Law Conference, March 5th-8th on the UO campus. Provide a memo describing the panel/lecture and how it relates to the course.

Final Exam (20%): The final is not cumulative. It will cover material discussed since the midterm exam. The final exam will consist of multiple choice, short answer, and long answer questions. The final is scheduled for March 18th, at 12:30 p.m. (2 hours).

Late Policy: Late work will be accepted up to two days (48 hours) beyond the scheduled deadline with a 5% grade reduction for each day. The midterm and the final exams cannot be rescheduled. If you are having an emergency that impacts your work, let me know as soon as possible.

Grading Standard: A grades will be given for achieving above 90% and above of the total points (90-92.9 is an A-, 93-96.9% is an A, and 97-100% is an A+), B grades for 80% and above, C grades for 70% and above, D grades for 60% and above, and F grades for 50% and above.

Assignment	Due Date	Points
Discussion Participation	--	50 (5/week)
Presentation	--	25
Presentation Report	--	50
Solutions Paper Topic	1/22	15
Solutions Paper Outline	2/5	35
Midterm Exam	2/10	100
Solutions Paper Final Draft	3/5	75
PIELC memo	3/12	50
Final Exam	3/18 at 12:30	100
Total Points		500

*All due dates are for class time of that date (4 p.m.), unless otherwise noted.

Classroom Conduct:

- □ I expect students to arrive to class on time, turn cell phone ringers off and refrain from texting/internet usage, and stay for the duration of the class. If you cannot make it on time be mindful of your disruption. I have a no laptops policy in the classroom. Please speak with me if you feel you need to take electronic notes.
- □ The classroom is a space for open and safe engagement. Students are expected to respect the opinions of everyone in the room and be mindful of differing opinions. We come from varying histories and experiences and will treat each other with respect.
- □ We will follow the University's rules and guidelines for behavior. Cheating and plagiarism will not be tolerated.
- □ If you have a disability and need arrangements please let me know at the outset of the term so we can make the proper arrangements.

Course Schedule

Week 1

1. 1/6/2015. Introductions, course business. Introduction to dead zones, eutrophication.
   Readings:
   a. The Dead Zones: Oxygen Starved Coastal Waters, Joyce, 2000
   b. Nutrient pollution of coastal rivers, bays, and seas, Howarth et al., 2000
   c. Global Change and Eutrophication of Coastal Waters, Rabalais et al., 2009

2. 1/8/2015. Biological causes of dead zones; harmful algae blooms.
   Readings:
   a. Ecology, pp 72-77 & 107-119 & 440-449
   b. HABs and eutrophication, Anderson et al, 2002
   c. Competition, Hu et al., 2010
   d. HABs causes, Sellner et al., 2003

Week 2

3. 1/13/2015. Science of hypoxia including upwelling, relationships to marine life, algal blooms, natural causes and normal hypoxic zones
   Readings:
   a. Knauss, Chapter 1
   b. Waves, Tides and Shallow Water Processes, Park, 2008, pp 150-188 & 190-193
   c. Limnology, 245-250
   d. Why is the Northern End of the CCS so Productive?, Hickey & Banas, 2008

4. 1/15/2015. Natural dead zones. Global scale of dead zones and rate of increase.
   Readings:
   a. Emergence of anoxia, Chan et al., 2008
   b. Upwelling-driven, Grantham et al., 2004
   c. Spreading Dead Zones, Diaz & Rosenberg, 2008

Week 3

5. 1/20/2015. Introduction to case study #1: Mississippi River and the Gulf of Mexico
   Readings:
   a. Gulf of Mexico Hypoxia, Rabalais et al., 2002
   b. Hypoxia in the Northern Gulf of Mexico, Dale et al., 2010, page xliii (Executive Summary) to page 22.

6. 1/22/2015. Challenges posed by climate change.
   Due: Solutions paper topic
   Readings:

a. http://www.smithsonianmag.com/science-nature/ocean-dead-zones-are-getting-worse-globally-due-climate-change-180953282/?no-ist
b. The impact of climate change on the world's marine ecosystems, Hoegh-Guldberg & Bruno, 2010
c. Ecological responses to recent climate change, Walther et al., 2002
d. Forecasting Agriculturally Driven Global Environmental Change, Tilman et al., 2001

Week 4

7. 1/27/2015. Effects on fisheries.
   Readings:
   a. Spring algae bloom and larval fish survival, Platt et al., 2003
   b. Demersal fish and invertebrate biomass, Keller et al., 2009
   c. Effects of Hypoxia on the Northern Gulf of Mexico Coastal Ecosystem: A Fisheries Perspective, Chesney and Baltz, 2001
   d. Dead zones enhance key fisheries, Altieri, 2008

8. 1/29/2015. Effects on Gulf shrimp fishery (case study revisited).
   Readings:
   a. Effects of Hypoxia on the Shrimp Fishery of Louisiana and Texas, Zimmerman & Nance, 2001
   b. Linking hypoxia to shrimp catch in the northern Gulf of Mexico, O'Conner & Whitall, 2007
   c. Aggregation on the edge: effects of hypoxia avoidance on the spatial distribution of brown shrimp and demersal fishes in the Northern Gulf of Mexico, Craig, 2012

Week 5

9. 2/3/2015. Nutrient enrichment.
   Readings:
   a. The Large-Scale Flux of Nutrients, Forsberg, 1994
   b. Gulf Hypoxia Action Plan, Mississippi River Gulf of Mexico Watershed Nutrient Task Force, 2008
   c. Hypoxia in the Northern Gulf of Mexico, Dale et al., 2010, pp 23-41 & 51-76

10. 2/5/2015. Water quality, nonpoint sources, and point sources, midterm review.
    Due: Solutions paper outline
    a. Nonpoint and point sources, Puckett, 1994
    b. Halting Hypoxia, Landers, 2008
    c. Hypoxia in the Northern Gulf of Mexico, Dale et al., 2010, pp 77-87
    d. Agricultural phosphorus and water quality: A US Environmental Protection Agency perspective, Parry, 1998
    e. Nonpoint pollution of surface waters with phosphorus and nitrogen, Carpenter et al., 1998

Week 6

11. 2/10/2015. Midterm (no readings).

12. 2/12/2015. Farming practices and the farm bill.
    Readings:
    a. The 20th century transformation, Dimitri et al., 2005
    b. Farmers' adoption of conservation agriculture, Knowler & Bradshaw, 2007
    c. Farmers' motivations, Ryan et al., 2003
    d. https://www.congress.gov/bill/113th-congress/house-bill/2642, skim read only

Week 7

13. 2/17/2015. Loss of wetlands and filtering systems.
    Readings:
    a. Wetlands at your service: reducing impacts of agriculture at the watershed scale, Zedler, 2003
    b. Landscape attributes as controls on ground water nitrate removal capacity of riparian zones, Gold et al., 2001
    c. Urbanization and the loss of resource lands in the Chesapeake Bay watershed, Jantz et al., 2005
    d. Nitrate removal in stream riparian zones, Hill, 1996

14. 2/19/2015. Environmental Law.
    Readings:
    a. Environmental Law and Policy, Salzman & Thompson, 44-85 & 321-335

Week 8

15. 2/24/2015. The Clean Water Act.
    Readings:
    a. The Clean Water Act: a summary of the law, Copeland, 1999
    b. Environmental Law and Policy, Salzman & Thompson, 2010, pp 146-172
    c. Has the CWA been a success?, Andreen, 2004

16. 2/26/2015. Citizen suit provisions; the Public Trust Doctrine.
    Readings:
    a. The public in action, George et al., 1997
    b. Restoring the Trust, Klass & Huang, 2009
    c. Nature's Trust, Wood, 2013, pp 3-18 & 125-161

Week 9

17. 3/3/2014. Case study #2: Chesapeake Bay hypoxia and the TMDL program.
    Readings:
    a. Eutrophication of Chesapeake Bay, Kemp et al., 2005
    b. The CWA returns part I, Houck, 2011
    c. Development TMDL, Shenk & Linker, 2013

18. 3/5/2015. The TMDL program continued.
    Due: Solutions paper final draft, submit on Blackboard
    Readings:
    a. EPA's TMDL program, Birkeland, 2001
    b. The new face of the CWA, Boyd, 2000

Week 10

19. 3/10/2015. Water Quality Trading.
    Readings:
    a. Point/nonpoint trading, Letson, 1992
    b. Water quality trading and nonpoint source pollution, Ruppert, 2004
    c. Crunch time for water quality trading, King, 2005
    d. Point-nonpoint, Fang, 2005
    e. Market-based approaches, Paragahawewa, 2006

20. 3/12/2015. Policy considerations and the political climate, PIELC group debriefing, and final review.
    Due: PIELC memo
    Readings:
    a. Controlling nonpoint source pollution, Mandelker, 1989
    b. Agricultural nonpoint source water pollution policy: The case of California's Central Coast, Dowd et al., 2008
    c. Least cost management, Ribaudo, 2001