OC434/534, FW434/534 Estuarine Ecology

Byron C. Crump
College of Earth, Ocean and Atmosperic Sciences
342 Burt Hall
541-737-4369
bcrump@coas.oregonstate.edu
http://people.oregonstate.edu/~crumpb/index.html

Fiona Tomas Nash
Fisheries and Wildlife
258 Nash Hall
541-737-4531
fiona.tomasnash@oregonstate.edu
http://fw.oregonstate.edu/content/fiona-tomas-nash

Course credits

For 4 credits this course combines 30 hours of class time, 60 hours of assignments and online activity (reading, literature research, writing), and 30 hours of active learning time for laboratory training in field sampling, laboratory and field analysis techniques, data analysis, and data interpretation.

Grading mode

Letter grading (A–F)

Prerequisites, co-requisites, and whether they are enforced or not:

Undergraduates enrolling in this course should have taken at least one related 300-400 level course such as OC 331 Introduction to Oceanography, OC332 Coastal Oceanography, OC333 Oceans, Coasts, and People, BL370 Ecology, BL351 Marine Ecology, FW321 Applied community and Ecosystem Ecology, and FW320 Intro to Population Dynamics.

There are no prerequisites for graduate students.

Course content

This course is designed to provide graduate and senior undergraduate students with integrated and synthethetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen.The major topics of the course include: geomorphology, estuarine physics and chemistry, primary producers (phytoplankton, benthic algae, salt marsh, seagrass, mangrove), secondary producers (microbial food web, zooplankton, benthos, nekton, birds, mammals), ecosystem metabolism, cycling of C, N, P, and S, estuarine food webs, fisheries, restoration, management, and impacts of climate change. Field experiences and current literature will also be used to encourage students to integrate lecture topics and synthesize information to learn of how the physical, chemical, and biological properties of estuaries regulate ecological processes.

Lecture topics

I. Introduction to Estuaries
    Origin and geomorphology, distribution of estuarine types
    Overview of physics of estuarine systems
    Overview of estuarine chemistry
II. Estuarine Primary Production
    Estuarine Phytoplankton
    Seagrass, other submersed aquatic vegetation, and benthic algae
    Salt marshes and Mangroves
III. Estuarine Secondary Production
    Estuarine birds and mammals
    Estuarine nekton including fishes and other free-swimming consumers
    Benthos
    Zooplankton
    Microbial food web
IV. Carbon and Nutrient Cycling
    Estuarine microbial ecology and biogeochemical processes, C, N, P, S cycles
    Net ecosystem metabolism
    Estuarine food webs and trophodynamics
    Element budgets and case studies in carbon and nutrient cycling
V. Human Impacts, Management, and Ecosystem Services
    Human impacts, eutrophication, pollution, habitat alteration, and harvesting
    Invasive species
    Ecosystem services and management
    Effects of climate change
    Estuarine ecosystem modeling

Research Topic Paper

The purpose of this assignment is to allow students to dig deeper and learn more about a topic in Estuarine Ecology. Each student will select a topic, confirm it with the instructors, conduct literature research on that topic, and write a paper addressing that topic within the context of estuarine ecosystem processes. The narrative of this paper should emphasize an ecosystem perspective and be composed in the following format:

- *First paragraph*: Briefly explain the research topic. This should be written so a general reader will understand what is being written about, how it is involved in estuarine ecology, and why it is interesting.
- *Narrative*: Prepare four to five pages of text (undergraduate) or seven to eight pages of text (graduate)(double spaced excluding figures and references) that presents the topic and explains the linkages between your topic and estuarine ecological processes.

The paper will be evaluated on: (1) how thoroughly it describes the topic and demonstrates the depth of the literature research, (2) how well it synthesizes information from the course, and (3) how well it describes your topic in an ecosystem perspective. Figures and illustrations are welcome additions to the paper, but the student should NOT include figures presented in the class (i.e., find new ones).

The end product of this paper will help students integrate information from the course and will potentially be useful for students writing research proposals, project reports, or theses.

Class Presentation

The purpose of this assignment is to allow students to explore in greater depth the ecology of an individual estuary and to gain experience with oral presentation. These presentations will also benefit the entire class by introducing them to many different estuaries. Each student will choose an estuary, confirm it with the instructors, conduct literature research (i.e., peer-reviewed scientific literature) on that estuary, and prepare a 10 minute presentation with slides within the context of estuarine ecosystem processes. The topics to cover in this presentation are:

- *Geomorphology*: Explain location, shape/size, geological history, freshwater source(s), tidal influence, and major components of the ecosystem.
- *Biochemistry*: Current understanding of the primary sources and sinks of nutrients, carbon cycling, and trophic status (mesotrophic, eutrophic, etc.).
- *Biology*: Describe the organisms involved in the estuarine food web, and the organisms of particular value to humans.
- *Human influence*: Describe how human activities have changed the ecology of the estuary.
- *Current research*: Summarize a recent peer-reviewed paper describing a new ecological discovery or finding.

Field Laboratory

The class will travel to three estuaries on the Oregon coast on weekends during the quarter – Tillamook Bay, Coos Bay, and Yaquina Bay – to conduct field sampling for laboratory educational activities and to observe and experience the ecosystems presented during lectures. Topics to be covered will include wetland restoration programs on Tillamook Bay, the seagrass monitoring program at the Sough Slough National Estuarine Research Reserve of Coos Bay, and water quality monitoring on Yaquina Bay.

Learning Outcomes

- All students (graduate and undergraduate) will develop an understanding of the organisms, environments, and ecological processes in estuarine systems, will learn how ecological processes affect carbon and nutrient cycles, and will apply these concepts to questions and problems (e.g., nutrient loading, eutrophication, restoration) in different estuarine systems.
- Graduate students taking this course will develop the ability to critically read and understand papers from the literature, evaluate potential flaws in past or current estuarine paradigms, articulate ideas, and distinguish prospective future research directions in estuarine ecology. In addition, they are expected to integrate information from the course and formulate linkages between estuarine ecosystem processes and the student's research (or management) project and/or interests.
- Undergraduate students in the course will also develop the ability to critically read and understand papers from the literature. They are also expected to integrate information from the course and formulate linkages between estuarine ecosystem processes and the student's selected paper topic.

Evaluation of student performance

Grades will be based on a midterm exam, a written research topic paper, a final exam, and overall participation in class activities.

Midterm Exam	25%
Research Topic Paper	25%
Final Exam	25%
Presentation	15%
Participation	10%

Slash and cross-listed course information

Learning Resources

Primary Textbook (Required):

- Day, J.W.J., Crump, B.C., Kemp, W.M., and Yáñez-Arancibia, A. (eds.). (2013). Estuarine Ecology, second edition. Hoboken, New Jersey: John Wiley and Sons.

Secondary Sources (Not required):

- Bianchi, T.S., Allison, M.A., and Cai, W.J. (eds.). (2013). Biogeochemical Dynamics at *Major River-Coastal Interfaces.* New York: Cambridge University Press.
- Kirchman, D.L. (2008). *Microbial ecology of the oceans, second edition.* Hoboken, New Jersey: Wiley.
- Baltzer, D.P., and Sharitz, R.R. (eds.). (2007). *Ecology of Freshwater and Estuarine Wetlands.* Berkeley: University of California Press.
- Hobbie, J.E. (2000). *Estuarine science: a synthetic approach to research and practice.* Island Press.
- Day, J.W.J., Hall, C.a.S., Kemp, W.M., and Yanez-Arancibia, A. (1989). *Estuarine Ecology.* New York: John Wiley and Sons.

The class will be supplemented by both classic papers covering topics in the course as well as selected papers dealing with contemporary issues in estuarine ecology.

Statement Regarding Students with Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098."

Link to OSU Statement of Expectations for Student Conduct

http://oregonstate.edu/studentconduct/offenses-0~~http://oregonstate.edu/admin/stucon/achon.htm~~