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OFFICE HOURS: R Emlet – please come by anytime; we'll talk immediately, or set a time.

N Nakata – email for appointment

DESCRIPTION OF COURSE

Estuaries are complex aquatic ecosystems situated at the interface with the coastal ocean and the terrestrial environment. Through a combination of lectures, field trips, and field and laboratory exercises, students will learn about various habitats and components of these biologically rich systems. Lectures will cover a broad range of topics on how estuaries function physically and biologically and their importance to living organisms including humans. Factors that control the abundance, distribution, production, and diversity within estuarine habitats will be identified and explored. Field trips to various habitats will let students see and sample patterns of abundance and diversity. Field and laboratory work will teach students how organisms work, how they modify their environments and interact with other organisms. Organism identification, methods for sampling and quantifying patterns, and preparation of data will also be parts of field and laboratory exercises. Student presentations on world estuaries will be an opportunity for the class to learn about other estuaries – how they work, how they are used, and what their current state is.

This course is taught at the Oregon Institute of Marine Biology in Charleston Oregon. Each week it meets for one full day.

COURSE GOALS/LEARNING OUTCOMES A student will:

- Become proficient in describing the various estuarine habitats, in explaining physical and biological factors in those habitats that influence the abundance and distribution of organisms, and in understanding energy flows in and between estuarine environments.
- Explore firsthand the superb estuarine habitats, including salt marshes, intertidal sand and mud flats, and subtidal regions that are particularly well represented in the Charleston/Coos Bay, Oregon coastal region.
- Use the tools of research ecologists; analyze population variability and quantify abundance and distribution of organisms in different habitats.
- Learn about estuaries around the world and some of their challenges both common and unique.

REQUIRED READING for the course:

No required texts; there are reference books in the back of the classroom and I may recommend readings during lectures.

FIELD TRIPS AND RECOMMENDED ATTIRE

- We will take a number of field trips in this course. Many will involve intertidal exploration, others will be aboard small and medium sized OIMB vessels.
- You should have a good pair of knee-high GUM BOOTS; or HIP-WADERS are okay

- Old and warm clothing is recommended for field trips.
- RAIN GEAR is also recommended, we will be working low tides when it may be raining (this is fall in Oregon).
- Laboratory equipment will be supplied, but if you have a dissecting kit bring it along to lab. Also bring your calculator.
- FIELD NOTEBOOK -taking notes on field trips & in lab is strongly recommended. This will help you carry out the assigned work and should be reviewed in preparation for exams.

ANTICIPATED SCHEDULE OF INSTRUCTIONAL TOPICS BY WEEK

See the attached Course Schedule for Fall 2022.

Basis for Undergraduate Grading:

| | |
|------------------------|------------|
| Organism quiz (wk 5) | 50 points |
| Midterm (wk 6) | 100 points |
| Final exam (wk 11) | 100 points |
| Lab/Field work | 125 points |
| Estuarine Presentation | 75 points |
| TOTAL: | 450 points |

EXAMINATIONS -

- An Organisms Quiz will be given on week 5 as a tool to get students to learn names and be able to identify some important members of estuarine habitats.
- MIDTERM I about 1.5 hours long will be given during week 6. The midterm will cover lectures, labs and discussions for Weeks 1 through 5.
- FINAL EXAM will be cumulative and also cover lecture, lab and discussion materials. A sample exam will be made available before the Final.
- Midterm I score will be replaced by the FINAL EXAM score if the latter is better.

OTHER WORK

- The lab and fieldwork component of the grade will be based on participation in these parts of class AND on individual or small group assignments that will be collected and graded.
- World Estuary Presentation - For the class to learn more broadly about similarities and differences, I have compiled a list of estuaries from which I would like pairs of students to choose and then prepare a presentation – see description below.
- Missed work must be made up in a timely fashion that both student and instructor agree on. Many of the class assignments will be group efforts, so it is important that you contribute to your group's effort and not delay the work.
- .- Scores for all parts of the course will be available to students who wish to discuss their performance.

STUDENT WORKLOAD EXPECTATIONS

- Students are expected to come to class and participate in the lectures, field trips and laboratory exercises. Promptness is both expected and appreciated. I strongly encourage you to read about topics discussed in lecture by using the reference collection or the OIMB/UO library. While there is no required textbook, students are expected to be able to access cited references on

reserve or through resources of the OIMB Rippey Library. Please do not remove reference books for more than 1 day and sign them out.

- Some field and laboratory assignments will require students to work up data and prepare graphs or statistical analyses. To the extent these are not completed during class times, students will be responsible for completion of the work outside of class. Work will be collected after class or a reasonable interval and evaluated.

DIFFERENTIATION OF GRADUATE VS UNDERGRADUATE WORKLOAD

For undergraduate credit the course will consist of the exams and the grading scheme described above. However, undergraduates have the option of choosing a modified graduate student scheme. Instead of testing undergraduates can choose to write 2 term papers in lieu of midterm and final exams. These will be evaluated and graded according to the scheme for graduate students. Once the first midterm has been given, the choice of grading scheme cannot be changed. Papers are due on **Tuesday Nov 1** and **Monday Nov 28, 2019**.

For graduate students, 2 literature-based research papers (approx. 10 typed pages, double-spaced) will be assigned in lieu of the midterm and final. A description of the Research paper is attached. Each paper will be critically read and marked by the instructor and graded for content, style, and grammar. Then the paper will be returned to the student for a complete rewrite. The paper will then be re-graded. This write/rewrite scheme is meant to give (graduate) students critical feedback and an opportunity to improve writing skills. Graduate students will still be required to take the Organism Quiz (week 5), make an Estuarine Presentation and participate fully in lab and discussion. The 200 points normally assigned to the Midterm and Final will be split equally into 2 parts, one part for each paper.

For students with disabilities:

The University of Oregon is working to create inclusive learning environments. Please notify me [Emlet] if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact the Accessible Education Center in 360 Oregon Hall at 541-346-1155 or uoaec@uoregon.edu. Website: <https://aec.uoregon.edu/>

ESTUARINE BIOLOGY (BI 454/554, 5 credits) Fall 2022 –

Class Schedule: All weeks: Tuesdays, 0830 – 1715 OIMB campus (**unless noted otherwise)

Week 1 Introduction to estuaries – importance to society, marine relations, geological types

Sept 27 (Tuesday) 0735 PDT +1.08 ft hLow; 1345 PDT +7.94 hHigh Tide (Sunrise 0710; Sunset 1905)

****0700 Field trip to Portside mudflat – bring animals and sieved-sand back to lab for tanks.**

1030 Introduction to the class, goals, grading, expectations.

1100 OIMB orientation Dining Hall

1200 lunch

1315 Lecture: Overview of estuaries – importance, distribution in space and time.

1430 Set up aquaria in class room

1600 Class discussion - plan settlement plate study

Week 2 Circulation and Sedimentation

Oct 4 0908 PDT 5.71 ft lHigh Tide; 1407 PDT hLow+3.69

0830 Lecture: Types of estuaries and circulation, sedimentation

1000 Field trip: Boat trip up Coos Estuary – sampling stations for temp, salinity, sediments, etc

Group 1 (5) depart at 10:00 am - sample lower estuary I; disembark at Town dock ca. 11:30

Group 2 (5) meet at 11:00 at van, drive to exchange site Town dock – 11:30 sample Isthmus S and

lower Coos River to Forks

Group 3 (5) meet at 12:30 at van, drive to exchange site Forks – 13:00 sample upper Coos River back to Town dock

Group 4 (5) meet at 14:00 at van, drive to exchange site Town dock – 14:30 sample lower estuary II

All groups - when not in boat work to prepare/deploy settlement plate experiment(s).

Week 3 – Estuarine gradients - ecotones

Oct 11 0734 PDT +1.53 ft hLow Tide; 1339 PDT +8.29 PDT hHigh Tide

0830 Lecture - Gradients – Sedimentation, Ecotones, resources and boundaries

0945 Field trip to Charleston Marina Docks

1100 Lecture: Tides

1200 Lunch

1315 Field trip: Metcalf marsh to see high tide

14:00 Work up data from cruise.

Prepare and weigh Coos sediment samples for drying

Week 4 Salt Marshes and Mangroves

Oct 18 0834 PDT +5.64 ft High Tide; 1336 PDT +4.2 ft Low Tide

0830 Lecture: Salt Marshes

1030: Fieldtrip to Metcalf Marsh, plant identification, quantitative transects

possibly late lunch? – will resume after lunch

ca 1415 Initial laboratory work up field samples (weigh and dry plant and sediment samples)

1600 Lecture: Mangroves - replacement of salt-marsh in the tropics

Week 5 The estuarine environment and boundary layers

Oct 25 1231 PDT +8.4 ft High Tide; 1909 -0.37 ft Low Tide (Sunset 1818)

0830 Estuarine Organism Quiz (on mudflat, fouling and saltmarsh organisms)

0900 Lecture - TBA

1030 Work up data from Coos Bay transect and continue salt marsh samples - dry weights

1200 Lunch

1315 Lecture – Lecture on boundary layers

1500 field study on boundary layers

Week 6 Seagrasses, Phytoplankton and Detritus

Nov 1 1244 PDT +3.82 ft Low Tide; 1823 PDT +6.74 ft High Tide

0830 Midterm Exam I

1100 Lecture: Seagrasses importance & ecology

1200 Lunch

1315 Lecture: Estuarine production, detritus and energy flows

1430 – work up salt marsh data

(Nov 6 Daylight savings time ends)

Week 7 Benthic Communities

Estuarine sand and mudflats – physical and environmental conditions, patterning of organisms

Nov 8 (NEW Pacific Standard Time) 1129 PST +8.5 ft; 1817 -0.68 ft Low Tide (sunset 1659)

0830 Lecture: Infaunal community interactions I.

1000 Lecture: Infaunal community interactions II.

1200 Lunch

break in middle of day – late afternoon and evening low tide

15:45 Field trip to Dome House sand flat for quantitative sampling of infauna.

Week 8 More on Benthic Communities

Nov 15 1036 PST +4.37ft Low Tide; 1600 PST +6.31 ft High Tide

0830 Lectures: Infaunal community interactions II and Estuarine Nekton

1000 Laboratory: Work up samples/data from quantitative field trip continue lab work of mudflat or saltmarsh data. Sort gravel/shell hash, identify different species, measure juveniles and adult butter clams (others too?) Construct size frequency plots; attempt to age the butter clams.

1200 Lunch

13:15 – Saltmarsh lab work

1430-1700 First 5 presentations on World Estuaries

Week 9 Sediments and Anoxia –

Nov 22 1016 PST +8.58 ft hHigh Tide; 1708 PST -0.06ft lLow Tide (Sunset 1646)

0830 Lecture: Decomposition, sediment chemistry and biogeochemical cycling

1030 Field trip trawling on "RV PLUTEUS" to collect subtidal organisms of the Coos estuary

12:00 Lunch

1315 Look at and key out organisms collected on dredge trip

1430-1700 Last 5 presentations on World Estuaries

Week 10 Fouling Communities and Negative Estuaries

Nov 29 1017 PST +3.65 ft hLow Tide; 1555 PST +7.18 ft hHigh Tide

0830 Lecture: Fouling communities and Introduced Species

1000 Retrieve and examine fouling plate experiments and evaluate patterns

1200 Lunch

1315 Lecture: Negative estuaries and other topics TBA

1400 Settlement plate presentations

1530 Lab clean up

Dec 6 Final Exam is Tuesday of exam week:

0830 Exam in classroom