Course Syllabus

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**4 credits, 3 hours of lecture + 1 hour forum discussion. Grading: class exercises, take-home midterm exam, in class final (exam essay and computation questions similar to those posed in discipline written exams). The class meets Mon, Wed, Fri from 1:00 to 1:50 p.m. in Wlkn 235. Forum discussion TBA.**

**Course instructors:**

**Ricardo Letelier Burt 140, ph: 7-3890, email: letelier@coas.oregonstate.edu**

**Text:**

**Miller and Wheeler Biological Oceanography 2nd ed. (the book is available in the OSU bookstore), plus assigned readings for class lectures and forum discussions.**

**A) Course description:**

Life in the sea will be examined based on concepts of ecosystem structure and functioning in the context of evolutionary adaptation and of population and community ecology. The course will cover major characteristics of ocean biota and ocean ecosystems. Main themes will be centered on the bioenergetics of marine systems at levels ranging from the individual to ocean biomes, and on how ocean biota facilitates diverse marine biogeochemical processes. Patterns of distribution of organisms and of biological activity will be analyzed on spatial scales ranging from microns to global, and on time scales from seconds to decades. Impacts of human activity on ocean ecosystems will also be discussed.

**B) Reading and reference materials**

  Miller & Wheeler *Biological Oceanography*, 2nd ed, 2012, Blackwell  (recommended)

  Lecture notes and journal articles for review and discussion

**C) Learning goals**:

* Reinforcement of concepts learned in OEAS 540: The Biogeochemical Earth, students  can describe the interaction of hydrodynamics, chemical properties of seawater, and  geological processes on the structure and functioning of marine ecosystems.
* Be able to answer questions in class about material in the previous lectures  and assigned readings for the current lecture
* Apply concepts learned in class to interpret results and conclusions of published  literature
* Students will be curious, skeptical and creative in examining the literature and new ideas.
* Synthesize biogeochemical and biological data to propose testable hypotheses  relevant to problems in ocean ecology.
* Demonstrate written and oral communication skills in class and in forum  discussions

**D) Assessment and grading (A-F)**

* Take-home midterm (25%)
* In class participation (15%)
* homework assignments (10%)
* Leading forum discussions, and participating in the other fora (25%)
* Final exam (25%)

Major themes:

**I Key concepts:**

General ecological concepts

1. Ecosystem ecology and population/community ecology
2. Biodiversity
3. Bioenergetics
4. Limiting factors
5. Trophodynamics / food webs
6. Growth/reproduction/life histories
7. Interactions: predator-prey, competition for resources, symbiosis,  allelopathy
8. Evolutionary adaptation
9. Ecosystem and community resistance and resilience to perturbation

Life in the ocean

1. Challenges of living in a salty, fluid, often cold and light-limited  environment, Reynolds number
2. Size spectrum and biomass-specific metabolic rates of ocean biota
3. Distribution of marine organisms in time and space - biogeograpy
4. Sensing the environment
5. Specific adaptations to oceanic habitats

**II Specific issues in marine ecology:**

Marine biogeochemical cycles from a biological/ecosystem perspective

1. Primary production (photosynthetic and chemosynthetic): biochemistry, biodiversity of autotrophs, mixotrophy
2. Fates of production: respiration by heterotrophs in water column and benthos, heterotrophic bacteria carbon consumption and growth efficiency, export flux to subsurface and benthic food webs
3. Food web interactions: microphagous versus macrophagous food webs, microbial loop, microzooplankton and mesozooplankton,
4. Biology of nitrogen cycle processes: nitrogen fixation, nitrification denitrification, ANAMMOX

Population and community ecology of marine organisms

1. Population dynamics, r versus K selection
2. Microbial communities
3. Planktonic communities
4. Benthic communities
5. Fish populations

Marine biomes and seascapes

1. General overview of oceanic regions, satellite oceanography, seasonal  cycles
2. Open ocean gyres, long term time series at HOTS and BATS
3. Upwelling systems – equatorial and coastal, plankton and benthos
4. Temperate shelves and coastal ecosystems, impacts of river discharge on  planktonic and benthic habitats
5. Polar oceans – extremes of seasonal light cycle and temperature, role of  ice, results of specific studies in the Arctic and Antarctic
6. HNLC regions and iron limitation, iron enrichment experiments
7. Regime change – effect of decadal climate shifts on ocean ecosystems, e.g.  examples of succession of mesozooplankton communities with change in ocean circulation and water temperature

The human footprint on ocean ecosystems, principals of ecosystem resistance, resilience, and state change

1. Eutrophication, harmful algal blooms
2. Invasive species
3. Focus on the future: ocean biochemistry and ecology in a warmer world

**Forum Evaluation:**

Below you will find descriptions of different levels of class participation, which should help you facilitate meaningful discussions, both in class and during forum.

**Excellent**

Offers insight that illuminates the readings; clarifies confusion that has emerged in the discussion; connects current reading with previous readings or class topics; asks questions that stimulate discussion; challenges peers with opposing views; synthesizes the comments of others; listens and understands the ideas articulated by others; understands the reading or can precisely articulate what isn’t understood.

**Above average**

Provides accurate and relevant information from the reading to the discussion, engages in discussion (does not simply respond to discussion leader’s questions); ventures interpretations and analysis rather than simply reporting information; comments demonstrate an understanding of the reading or topic; can distinguish personal opinions from those of the author; can connect your ideas with others’ ideas and the readings.

**Average**

Listens attentively but reluctant to participate; comments center on personal experiences and feelings; answers information questions only; understands the general ideas in the readings but uncertain about specifics; comments lack connection to ideas expressed by others.