

SIO 222: Marine Bioacoustics

(spring 2017)

Instructors: Dr. Simone Baumann-Pickering and Dr. Ana Širović

Lectures: MW 9:30 – 10:50 Vaughan 300

Office hours: Dr. Baumann-Pickering: Wed 10–11 (Ritter Hall 200F)

or by appt. (sbaumann@ucsd.edu)

Dr. Širović: Wed 11–12 (Ritter Hall 200B) or by appt. (asirovic@ucsd.edu)

Materials for the course:

Readings: *Principles of Marine Bioacoustics* by Au and Hastings
Fisheries Acoustics: Theory and Practice by Simmonds and MacLennan
Primary literature – weekly reading assignments and reading lists will be distributed in class.

Other resources: *Marine Mammals and Noise* by Richardson, Greene, Malme, and Thomson
Sound Communication in Fishes (Vol. 1) by Ladich
Animal Communication and Noise (Vol. 4) by Brumm

Course content:

This course will cover the fundamentals of wave theory, sound propagation, acoustic analysis methods, physiology, and communication theory that are required for understanding primary literature on topics in marine bioacoustics. In addition, during the course we will cover various topics of marine bioacoustics such as: instrumentation, fisheries acoustic, animal hearing and sound production, behavioral importance of sound production by animals, and impacts of anthropogenic sound on marine animals.

Learning objectives:

By the end of the course you will:

- 1) Have understanding of the basics of acoustic theory.
- 2) Be familiar with methods employed to collect and analyze acoustic data.
- 3) Understand methods of sound production and reception by marine animals.
- 4) Have knowledge of behavioral importance of sound production by animals.
- 5) Have broad familiarity with bioacoustic primary literature.

Pre-requisites:

Graduate level standing or approval of the instructor.

Grading:

The grades in the course will be assigned on a straight scale (90% for A, 80% for B, etc.). The course grades will be based on homework problem sets, your paper review sections and final presentations, as well as class participation. Point breakdown is as follows:

Problem sets	100 points	(50 points each HW)
Paper review	75 points	
Presentations	75 points	
Participation	50 points	
Total points	300	

Problem sets:

There will be two take-home problem sets assigned during this course. The sets will be designed to test your understanding of basic acoustics principles and fisheries acoustics

concepts covered in class and readings. If submitted by email, answers to the problem set have to be emailed before start of the class (by 9:30 am) on the due date. Late answers will be penalized with 10% deduction. No answers will be accepted after the discussion of the problem set in class.

Paper reviews:

During the course, we will work on a review paper on the impact of sound on marine animals, with the goal of submitting this paper to a peer-reviewed journal over the summer. Therefore, every student in the class will be responsible for conducting a thorough investigation of the primary literature on one of the topics that will be featured in the paper. By the end of the course, you will have to write a review over the state of knowledge on the topic, which should make the bulk of the chapter on that topic in our review paper. A good starting point for this review will be the course textbook and optional reading. But keep in mind that most textbooks listed there are getting to be old and will not include the cutting edge work and papers from the last 10-20 years. If you are having problems finding literature or otherwise with your preparations, come see us as early as possible, so we can help you move along with the project. You will also present the findings of your literature review to the class in a 15-20 min presentation. All presentation will be given during the last week of classes (see schedule below).

Other policies:

- Do not use cell phones during class.
- Use email only for short communication. If you have lengthy questions about the class, grades, readings, assignments, etc. please come see us. These kinds of issues are resolved more quickly in person than over email.
- Do your readings *before* each class. It will help you follow and participate in discussions.

Tentative class schedule:

Class date	Topic	Book chapter	Homework	Instructor
4/3	Introduction to class; Bioacoustic instrumentation & recording in the lab and field	Au & Hastings: Ch. 2, 3, 5.3, 5.5–5.6		AŠ
4/5	Waves and acoustics fundamentals	A & H: Ch. 1		Guest: J Hildebrand
4/10	Acoustic propagation	A & H: Ch. 1.2.6, 4, 5.4		AŠ
4/12	Sound analysis theory	A & H: Ch. 6	HW 1: Acoustic calculations	AŠ
4/17	Detection, classification, localization, and their real-life applications	A & H: Ch. 5.7, 12		SBP
4/19	Fisheries acoustics I: scattering and fish biomass estimation	Simmonds & MacLennan: Ch. 5	HW 1 due	SBP
4/24	Fisheries acoustics II: target strength etc.	S&MacL: Ch. 6, 7		Guest: J Jaffe
4/26	Survey design, fisheries acoustics applications/case studies	S&MacL: Ch. 8 Scientific papers	HW 2: Fisheries acoustics	Guest: D Demer
5/1	Comparative anatomy of auditory systems across taxa	A & H: Ch. 7		SBP
5/3	Hearing in marine animals	A & H: Ch. 9 Scientific papers	HW 2 due	SBP
5/8	Psychoacoustic experiments and methodologies	A & H: Ch. 8 Scientific papers	Start paper reviews	Guest: B Branstetter
5/10	Fundamentals of animal communication; Sound production mechanisms	A & H: Ch. 10		SBP
5/15	Echolocation and target detection/discrimination	A & H: Ch. 11		SBP
5/17	Ocean noise	Scientific papers		AŠ
5/22	Impact of sound on marine animals. Regulation & mitigation.	Scientific papers		Guest: A Scholik–Schlomer
5/24	PAM as tool for study of animals: Case studies	Scientific papers		AŠ
5/29	Memorial day – No class!			
5/31	Other applications of acoustics	Scientific papers		AŠ
6/5	Final presentations		Reviews due	
6/7	Final presentations		Reviews due	