INTRODUCTION TO COASTAL AND MARINE SCIENCE METHODS

Course Dates: July 12-July 30, 2021
Course Level: Undergraduate (3-credit)
Course Location: Online
Cost: $750

Course Description: This introductory coastal and marine science course will integrate key aspects of sample collection and analytical procedures used in the broader fields of oceanography, biology, chemistry, and ecology through lectures, presentations of field and laboratory techniques, and interpretation and analysis of data collected. This course will cover recent developments and classic concepts in marine science and will give an overview and specific examples of sample collection and analytical procedures. Among the topics covered will include:

- **Sample Collection**: biodiversity sampling (transects, quadrats, etc), passive acoustic monitoring, sediment coring, water collection techniques, marsh sampling; Analytical Methods: DNA extraction, quantifying microbes, microbial abundance, organic and inorganic carbon concentration measurements, primary production measurements in diverse habitats, incubation techniques;

- **Data Analysis**: understanding and analyzing ecological community data, processing and interpreting acoustic data, interpreting microbial phylogeny, flow cytometry data, qPCR data, process rate calculations, statistical calculations (averages, standard deviation, element proportions, percent error), plotting data/graph interpretation.

Course Instructors: Dr. Marshall Bowles, Assistant Professor at LUMCON, Geomicrobiology, mbowles@lumcon.edu
Dr. Stephanie Archer, Assistant Professor at LUMCON, Benthic Ecology, sarcher@lumcon.edu
Dr. Juliana D’Andrilli, Assistant Professor at LUMCON, Environmental Chemistry, jdandrilli@lumcon.edu
Dr. Brian Roberts, Associate Professor at LUMCON, Ecosystem Ecology and Biogeochemistry broberts@lumcon.edu

For more course details, course application, or scholarship application visit lumcon.edu/2021-summer-courses
Introduction to Coastal and Marine Science Methods
Online Course

Course Instructors:

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*lead instructor

Course Synopsis: This introductory coastal and marine science course will integrate key aspects of sample collection and analytical procedures used in the broader fields of oceanography, biology, chemistry, and ecology through lectures, presentations of field and laboratory techniques, and interpretation and analysis of data collected. This course will cover recent developments and classic concepts in marine science and will give an overview and specific examples of sample collection and analytical procedures. Among the topics covered will include: Sample Collection: biodiversity sampling (transects, quadrats, etc), passive acoustic monitoring, sediment coring, water collection techniques, marsh sampling; Analytical Methods: DNA extraction, quantifying microbes, microbial abundance, organic and inorganic carbon concentration measurements, primary production measurements in diverse habitats, incubation techniques; Data Analysis: understanding and analyzing ecological community data, processing and interpreting acoustic data, interpreting microbial phylogeny, flow cytometry data, qPCR data, process rate calculations, statistical calculations (averages, standard deviation, element proportions, percent error), plotting data/graph interpretation.

Rationale: Introduction to Coastal and Marine Science Methods provides instruction in an area that is not offered at most Louisiana universities marrying marine sciences, chemistry, biology, and ecology. The course instructors Drs. Bowles, Archer, D’Andrilli, and Roberts bring to the classroom their expertise in marine science, biology, chemistry, and ecology techniques and best practices in pedagogy. This course will provide more junior undergraduate students an opportunity to experience sample collection and laboratory procedures virtually via videoed segments, and will illustrate various facets of marine science. Offering the course through LUMCON gives students the opportunity to view water sampling with niskins, diverse sediment...
coring techniques, incubation approaches, and laboratory analysis of seawater or sediment, which are not easily obtainable or executed at their home institution. This course will focus on exposing the students to a diverse array of sample collection techniques, analytical methods, and data analyses.

Course Structure: The course is designed to focus on four separate modules (led by each instructor) with an assignment being completed at the end of each module. The modules will be linked together through discussions that span multiple modules.

Course Details:
07/12 – 07/30/2021
Monday – Friday for 3 weeks (15 class days)
Course will meet 9AM-12PM CST

Course Grading System:
3 Credits, Solid Letter Grade (A,B,C,D,F)
- Undergraduate:
  - Participation (4 modules total, 25pts each) = 100 points
  - Discussions (2 total, 50pts each) = 100 points
  - Assignments (4 total, 50pts each) = 200 points
  - Final Exam = 100 points
  - Total = 500 points

Participation:
Each student is expected to remain engaged in course lectures and activities, through thoughtful respectful dialogue with peers and the instructor. Failure to do so will result in less or no participation credit being awarded.

Discussion:
Students are expected to participate in 2 discussions over the course of the 3 week course. Instructors will pre-select the topic of the discussions. On the first day of instruction students will be presented with a grading rubric and expectations for the discussion. Students will be assigned the topics of discussions 6 classroom days prior to the discussion date, but should expect the focus to be on sample collection, analytical methods, or data analysis. The discussion is left to the instructors’ discretion, though guided by the students’ interests, and could vary from reviewing a published paper or analyzing data in a group format. Students will be graded on their ability to discuss and ask critical thinking questions regarding course material.

Assignments:
Each instructor will give an assignment during their series of lectures with a due date no later than the day after than their lectures are completed. The format and expectations for the assignment are up to the instructor, but can range from multiple choice, short answer, short lab reports, or in depth explorations of real data. Participation in each of these assignments is an absolute requirement of the course: No student can earn graduation credit for this course.

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without participation in each assignment. A student will automatically earn a failing grade in the course for failure to participate in any assignment.

Final Exam:
The final exam will be given on the last meeting date of the course. It will cover all aspects of the course and be equally weighted among the four major modules and discussions. The format of the exam will be mixed, including multiple choice, fill in the blank, and short answer questions.

Prerequisites: None.

Required Text and Other Materials: This course will use selected readings from a variety of published papers and electronic sources. They will be made available during the course.

Student Outcome Objectives: To expose students to a wide variety of marine science and techniques as well as introduce them to the basics of marine ecosystems. Upon completion of this course, the student will:

- Develop a working knowledge of sample collection techniques in the marine environment
- Understand basic data analysis techniques (e.g. quality control and standard curves)
- Describe and practice traditional approaches to study marine microorganism and use the emergent molecular techniques to identify specific microbes
- Demonstrate an understanding of the importance of prokaryotes on biogeochemical processes in marine systems
- Describe metabolic, phylogenetic, and genomic diversity in marine microbes
- Understand a variety of methods to quantify ecological communities.
- Be able to describe species-area relationships and discuss their relationship to quantifying biodiversity.
- Understand the basic principles behind the use of acoustic data for quantifying biological communities.
- Understand the importance of primary production in diverse coastal and marine environments
- Learn and understand different ways to measure primary production and calculate rates across diverse coastal and marine environments
- Practice science communication through discussions
- Understand the facets of conducting field sampling with environmental impacts
- Demonstrate the connections of research responsibility and accountability working individually and in a group setting

Course Requirements:
Each student is required to:

1. Attend all course lectures. Three unexcused absences from lecture will result in the student receiving an FEA (failed due to excessive absences).

2. Read and become familiar with material in all assigned readings prior to attending class.
3. Participate in four assignments, all discussions and the final exam.

4. Conduct themselves in a manner respectful, harmless, and non-disruptive to the instructor and fellow students.

5. Accept and abide by all other parts and provisions of this syllabus.

### Course Content - Syllabus

<table>
<thead>
<tr>
<th>Day</th>
<th>Lecture</th>
<th>Assessment / Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Dr. Bowles Lecture: Introduction to Coastal and Marine Science “What is in seawater and sediment”</td>
<td>Lab: Collecting a marsh sediment core, extracting porewater, collecting samples</td>
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<td>Assignment 1: Characterizing and quantifying microbes in the marine environment</td>
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<tr>
<td>Tuesday</td>
<td>Dr. Bowles Lecture: Part 1 “How do we analyze microbial communities?”</td>
<td>Lab: Introduction to Molecular techniques Part 1: DNA extraction, quantifying microbes</td>
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<tr>
<td>Wednesday</td>
<td>Dr. Bowles Lecture: Part 2 “How do we analyze microbial communities?”</td>
<td>Lab: Introduction to Molecular techniques Part 2: characterizing microbes</td>
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<tr>
<td>Thursday</td>
<td>Dr. Archer Lecture: Biodiversity - what is it and why do we care?</td>
<td>Lab: Traditional methods for assessing biological communities</td>
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<tr>
<td></td>
<td></td>
<td>Assignment 2: Understanding species-area relationships and comparing ecological</td>
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<tr>
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<td>communities Assignment 1 is due</td>
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<tr>
<td>Friday</td>
<td>Dr. Archer Lecture: Quantifying ecological communities: the importance of understanding species-area relationships</td>
<td>Lab: Species-area curves, comparing sampling methods across habitats</td>
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<tr>
<td>Monday</td>
<td>Dr. Archer Lecture: Alternative methods for quantifying ecological communities: A passive acoustics case study</td>
<td>Lab: Sound data, what is it and how do we analyze it?</td>
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<tr>
<td>Tuesday</td>
<td>Discussion 1 led by Drs. Bowles and Archer</td>
<td>Assignment 2 is due</td>
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<tr>
<td>Day</td>
<td>Lecture/Activity</td>
<td>Lab/Activity</td>
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<tr>
<td>Wednesday</td>
<td>Dr. D'Andrilli Lecture: “What’s in seawater? (Part 2) Marine water elements, field sampling methods, life in the field, and impact</td>
<td>Lab: Preparation, sample collection, filtration, preservation (working with chemicals), and storage Assignment 3: Carbon materials in marine waters: quantity, quality, and cycling</td>
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<tr>
<td>Thursday</td>
<td>Dr. D'Andrilli Lecture: Carbon Cycling Part 1 “How do we analyze organic and inorganic carbon in marine waters?”</td>
<td>Lab: Introduction to aquatic carbon measurements: quantity, quality, and analyzing data</td>
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<tr>
<td>Friday</td>
<td>Dr. D'Andrilli Lecture: Carbon Cycling Part 2 “How do we analyze organic and inorganic carbon in marine waters?”</td>
<td>Lab: Analyzing data for consistency and reproducibility, communication exercises, and evaluations of environmental impact</td>
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<tr>
<td>Monday</td>
<td>Dr. Roberts Lecture: Primary production in pelagic ecosystems</td>
<td>Lab: collecting water columns samples, setting up PP incubations, and calculating rates Assignment 4:Calculating PP in diverse coastal and marine ecosystems Assignment 3 is due</td>
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<tr>
<td>Tuesday</td>
<td>Dr. Roberts Lecture: Primary production in benthic ecosystems</td>
<td>Lab: collecting intact sediment cores, setting up PP incubations, and calculating rates</td>
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<tr>
<td>Wednesday</td>
<td>Dr. Roberts Lecture: Primary Production and Respiration in marsh ecosystems</td>
<td>Lab: sampling marsh above and belowground biomass, measuring in situ gas fluxes, calculating PP rates using different approaches</td>
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<tr>
<td>Thursday</td>
<td>Discussion 2 led by Drs. D'Andrilli and Roberts followed by exam review with all instructors</td>
<td>Assignment 4 is due</td>
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<tr>
<td>Friday</td>
<td>Final Exam</td>
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**Make-up Procedure:**
The instructors will make extraordinary efforts to ensure that students facing unforeseen and urgent problems have an opportunity to succeed in the course. As you can imagine, however, this privilege is too often abused, and abuse causes the establishment of stipulations for all students. Understanding that personal problems can arise on dates and occasions important in this course, the instructors have developed the following policy for remediation (make-up work):

1. **Discretion.** Make-up work is allowable only at the discretion of the lecturer responsible for the material.

2. **Request for Remediation.** The student must request any and all make-up work. Within 24-hours of missing an exam the student must contact the lecturer either by phone or email to request remediation. In all cases, acceptable reasons for requesting remediation are (i) personal illness, (ii) illness of dependent, (iii) death of immediate family member. In all cases, requests for remediation must be accompanied by documentation substantiating the reason for missed work.

3. **Assignment Remediation.** Participation in each assignment is an absolute requirement of the course (see Course Requirements above). If you miss an assignment you must contact the instructor within 24 hours of the due date to request a make-up otherwise you will be assigned a grade of “0” for that assignment. The instructor will allow a make-up if your reasons for missing the assignment are deemed acceptable.

**Academic Honesty Policy:**
Dishonesty cannot and will not be tolerated. Cheating during examinations and submission of non-original work are each grounds for dismissal from the course. Plagiarism or any other form of dishonesty detected in reports or exams will result in a course grade of F.

**In the Case of Extreme Emergency:** Students will be notified about their responsibilities in the case of an extreme emergency (such as hurricanes).