

**BISC 491: Practical Aquaculture**

Units: 4

**Lectures: Fridays 12:00 – 12:50 pm**

**Laboratory: TBD, 8 hours per week minimum, independent research**

Spring 2023

Location: Hands-on research (wet lab) will be a at AltaSea in the Port of LA, and lab research will be on UPC campus in AHF 316. Weekly lectures and presentations on UPC campus.

Instructors: Prof. Andrew Gracey and Prof. Sergey Nuzhdin

Prof. Gracey Office: AHF 316

Office Hours: Monday 11-noon

Contact Info: gracey@usc.edu

Prof. Nuzhdin Office: RIH 304C

Office Hours: Thursday 10-11am

Contact Info: snuzhdin@usc.edu

## Course Description

This course is intended to be a faculty-supervised research on practical aquaculture and earns four units of elective credit.

Farming of shellfish and macroalgae - presents one promising pathway to a more sustainable global food system. The world is responding to this promise: aquaculture is now the fastest growing food sector globally. However, U.S. investment in aquaculture lags far behind other countries (NOAA, 2020). This directed research BISC 491 will leverage a partnership between academic, non-profit, and commercial organizations, to provide students the opportunity to participate in directed research focused on sustainable marine aquaculture. The available research topics will focus particularly on bivalve and seaweed aquaculture, as ‘unfed’ products that are rich in nutrients for human consumption, and are generally viewed as ecologically-sound since they play important roles in bioremediation, carbon sequestration, and food security. The research focus will be experimental and computational biology, informed by criteria arising through design, economics, and policy.

A unique aspect of this research opportunity is that the research projects will utilize the blue-economy incubator at AltaSea at the Port of Los Angeles. AltaSea is a unique public-private ocean institute dedicated to accelerating scientific collaboration, advancing an emerging blue economy, and inspiring today's generation of students. The research 491 projects will be mostly taking the form of “hands on” research experience in which students will participate in R&D projects that satisfy the research goals of the commercial aquaculture companies that are resident at AltaSea. This provides students with a unique opportunity to conduct research as part of an academic-industry partnership. Examples of potential projects might be the development of seed banks for future commercial restoration efforts, the selective breeding of locally-adapted broodstock, or the establishment of genetic lines that produce sterile offspring that are not only more productive but can protect local populations from the intrusion of non-local genotypes. The majority of the research will be conducted at AltaSea although lab facilities on the USC campus will be used for certain activities, for example, molecular biology analysis of samples collected while undertaking research at AltaSea.

This research course is unique in that it is intended to be more structured than the traditional undergraduate 490 research experience. We anticipate that as many as a dozen students may participate in this course in any given semester and so this course will provide opportunities to undertake team-based research, and so we encourage students to apply together for BISC 491. In addition to gaining research experience, we will have weekly journal club discussions, and presentations by guest speakers. The goal being to deliver a more immersive research experience than might be gained in the traditional directed research courses that are offered in BISC.

## Learning Objectives

Upon completion of this course, students will have gained an immersive research experience in the field of practical aquaculture. Students will also learn about some of the design, ecological and economic principles of aquaculture with a particular emphasis on the role of aquaculture and the ‘blue economy’ as a model for sustainable farming in the future. Students will also learn about the impacts of climate change on aquaculture and how practices must adapt to this challenge.

## Prerequisite(s):

1 from (BISC 103 or BISC 120 or BISC 121)

## Course Notes

Each week, one student will compile and present a brief presentation of the peer-reviewed journal articles described in the table below. Article PDFs will be made available to students on the Blackboard. can deliver these presentations in-person from the Seaweed Lab at AltaSea or can participate remotely via Zoom. The expected format for these presentations will be described in advance.

Approximately every three weeks, the class will receive a presentation by a guest speaker, representing a leader in aquaculture either from industry or academia.

## Communication

Email is the best form of communication.

## Technological Proficiency and Hardware/Software Required

Blackboard will be used to share details and readings for the class. No other technological proficiency is required.

## USC Technology Support Links

[Zoom information for students](https://keepteaching.usc.edu/students/student-toolkit/classroom/zoom/)

[Blackboard help for students](https://keepteaching.usc.edu/students/student-toolkit/classroom/blackboard/)

[Software available to USC Campus](https://software.usc.edu/)

## Required Materials

Required articles will be posted on Blackboard.

## Description and Assessment of Assignments

Research: Students are expected to work on their research projects for 12-16 hours per week. This work may be conducted off-site or on USC campus/AltaSea, and can take the form of hands-on research, literature reviews, and data analysis. Time spent traveling to the offsite location at AltaSea will be taken into consideration when evaluating this effort. The timing of each student’s research activity is expected to be individualized to suit the individual student’s weekly time-table of other academic activities.

Participation in journal club discussions: Journal club articles will be given to students prior to class. Students are expected to read each week’s article in advance and to be prepared to participate in discussions .

Presentation: Each week, a student will be invited to lead the journal club discussion. Students will be expected to present an outline of their intended research project (in week 6), and a summary of their research project in the final weeks of classes.

Written assessment: The outline of each student’s intended research project (due in week 6) will comprise both an oral presentation to the class as well as a 3-page research proposal. This research proposal should include background information with a review of the primary literature, the hypothesis that will tested, and a justification and description of the proposed methods and experimental design.

A 12-page report of the student’s research including abstract, methods, results, discussion, and references is due on the last day of classes. The write-up is expected to take the form of a standard scientific journal article with a title and abstract (1 page), an introduction to the research that include a review of the primary literature (2 pages), a detailed materials and methods (2 pages), and results section with figures and tables as appropriate (4 pages), and a discussion of the study (3 pages). The list of cited references does not count to the 12-page target length. An example of an appropriate write-up will be provided to the class.

## Grading Breakdown

| **Assignment** | **% of Grade** |
| --- | --- |
| Journal club participation | 10 |
| Proposed research presentation | 10 |
| 3-page research project proposal | 20 |
| Final research project presentation | 10 |
| 12-page research report | 50 |
| Total | 100 |

## Course-specific Policies (Assignment Submission, Grading Timeline, Late work, and Technology)

Written assignments will be submitted through Blackboard, instructions will be provided closer to the due dates.

## Classroom norms

1. Listen actively and attentively.

2. Be courteous. Don’t interrupt or engage in private conversations while others are speaking.

3. Ask for clarification if you are confused.

## Course evaluation

Students will submit confidential course evaluations, available online during week 13. More information will be provided in lecture.

## Course Schedule: A Weekly Breakdown

|  |  |
| --- | --- |
| **1/9** | **Introduction and logistics of the course, who are we, what do we expect, what is AltaSea** |
| 1/13 | Guest speaker: Thomas Grimm, Carlsbad Aquafarm |
| 1/20 | Naylor, R.L., et al., A 20-year retrospective review of global aquaculture. Nature, 2021. 591(7851): p. 551-563. |
| 1/27 | Cisneros-Montemayor, A.M., et al., Enabling conditions for an equitable and sustainable blue economy. Nature, 2021. 591(7850): p. 396-401. |
| 2/3 | Gentry, R.R., et al., Offshore aquaculture: Spatial planning principles for sustainable development. Ecol Evol, 2017. 7(2): p. 733-743. |
| **2/10** | **Student research proposal presentations** |
| **2/10** | **Research pre-proposal due** |
| 2/17 | Guest speaker: Peter Struffenegger, Urchinomics |
| 2/24 | Wade, R., et al., Macroalgal germplasm banking for conservation, food security, and industry. PLoS Biol, 2020. 18(2): p. e3000641. |
| 3/3 | Roque, B.M., et al., Red seaweed (Asparagopsis taxiformis) supplementation reduces enteric methane by over 80 percent in beef steers. PLoS One, 2021. 16(3): p. e0247820. |
| 3/10 | Georges, M., C. Charlier, and B. Hayes, Harnessing genomic information for livestock improvement. Nat Rev Genet, 2019. 20(3): p. 135-156. |
| **3/17** | **Spring Break** |
| 3/24 | Guest speaker: Gary Molano, USC, The giant kelp genome project |
| 3/31 | Stewart-Sinclair, P.J., et al., A global assessment of the vulnerability of shellfish aquaculture to climate change and ocean acidification. Ecol Evol, 2020. 10(7): p. 3518-3534. |
| 4/7 | Gimenez, I., G.G. Waldbusser, and B. Hales, Ocean acidification stress index for shellfish (OASIS): Linking Pacific oyster larval survival and exposure to variable carbonate chemistry regimes. Elementa-Science of the Anthropocene, 2018. 6. |
| 4/14 | Novaglio, C., et al., Deep aspirations: towards a sustainable offshore Blue Economy. Rev Fish Biol Fish, 2021: p. 1-22. |
| 4/21 | **Student research project oral presentations** |
| 4/28 | **Student research project oral presentations** |
| 5/11 | **Final 12-page research report due** |

**Statement on Academic Conduct and Support Systems**

**Academic Conduct:**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](https://policy.usc.edu/scampus-part-b/). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on [Research and Scholarship Misconduct](https://policy.usc.edu/research-and-scholarship-misconduct/).

**Students and Disability Accommodations:**

USC welcomes students with disabilities into all of the University’s educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at [osas.usc.edu](http://osas.usc.edu/). You may contact OSAS at (213) 740-0776 or via email at [osasfrontdesk@usc.edu](mailto:osasfrontdesk@usc.edu).

**Support Systems:**

*Counseling and Mental Health - (213) 740-9355 – 24/7 on call*

[studenthealth.usc.edu/counseling](https://studenthealth.usc.edu/counseling/)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*

[suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org/)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call*

[studenthealth.usc.edu/sexual-assault](https://studenthealth.usc.edu/sexual-assault/)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086*

[eeotix.usc.edu](https://eeotix.usc.edu/)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

*Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298*

[usc-advocate.symplicity.com/care\_report](https://usc-advocate.symplicity.com/care_report/)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

*The Office of Student Accessibility Services (OSAS) - (213) 740-0776*

[osas.usc.edu](http://osas.usc.edu/)

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

*USC Campus Support and Intervention - (213) 821-4710*

[campussupport.usc.edu](https://campussupport.usc.edu/)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity, Equity and Inclusion - (213) 740-2101*

[diversity.usc.edu](https://diversity.usc.edu/)

Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu/), [emergency.usc.edu](http://emergency.usc.edu/)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu/)

Non-emergency assistance or information.

*Office of the Ombuds* - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

[ombuds.usc.edu](http://ombuds.usc.edu/)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

*Occupational Therapy Faculty Practice - (323) 442-33*40 or [otfp@med.usc.edu](mailto:otfp@med.usc.edu)

[chan.usc.edu/otfp](http://chan.usc.edu/otfp)

​Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.