

Tropical Marine Biological Research

Summer 2024

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Dates: June 29 – Aug 4: 12 cr; BIOL400 (section with Acevedo-Gutiérrez) is a pre-requisite
Location: Unidad Pichilingue, La Paz, Baja California Sur, México
Coordinator: Alejandro Acevedo-Gutiérrez (email: aceveda@wwu.edu, phone: 650-3653)

You will learn to conduct marine biological research in different tropical habitats from Western Washington University (WWU) and Universidad Autónoma de Baja California Sur (UABCS) faculty. The course will be based at the Unidad Pichilingue, B.C.S., México.

Course Aims

- 1) You will enhance your science process skills in preparation of a career as a scientist: identifying appropriate sources of information; gathering, synthesizing and critically evaluating knowledge; thinking analytically and conceiving scientific questions; designing a research project, including questions, hypotheses, predictions, methods and statistical analyses; collecting and analyzing data; communicating ideas and results concisely and effectively in written and oral form; and working in collaboration with others to integrate knowledge into a coherent body of work.
- 2) You will construct knowledge about the biology and ecology of tropical organisms.
- 3) You will learn to work and interact with students from a different country, culture, and background.

We will use innovative teaching techniques fulfill these aims.

In the classroom you will:

- Participate in activities to share your ideas on key concepts, obtain experimental or observational evidence to test your ideas, and infer conclusions from your evidence.
- Work in randomly-assigned groups to construct your own knowledge.
- Prepare concept maps to identify the theoretical framework of published research and develop your research ideas within an appropriate framework.
- Be actively engaged in brief lectures to learn the most relevant information and current research.

In the lab and field you will:

- Prepare species lists of key tropical habitats from visual and photographic surveys.
- Complete guided physiological, genetic, and behavioral studies on tropical marine organisms.
- In collaboration with other classmates, conceive, develop, complete, and present orally and in writing an independent research project.

Course Description

You should view this course as an apprenticeship in marine biological research, and we will treat you as the fledging scientist that you are. The course will rely on class activities, discussions, laboratory experiments, and field projects. You will engage in extensive independent work, with faculty as your mentors and guides.

The Gulf of California and the Pichilingue Research Institution are an excellent setting for this course. Many diverse and rich marine habitats are easily accessed from the facilities, and provide the opportunity to conduct tropical marine biological research through direct observations and research.

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The facilities allow for both field and laboratory projects.

Provided References

- Copies of research papers. (Distributed by faculty.)
- Kerstitch, A. & Bertsch, H. 2007. Sea of Cortez Marine Invertebrates 2nd edn (revised). Sea Challengers, Gif Harbor, WA.
- Levinton, J. S. 2017. Marine Biology. Function, Biodiversity, Ecology. 5th edition. Oxford University Press. ISBN-13: 978-0190625276
- Steinbeck, J. The Log from the Sea of Cortez.
- Thomson, D. A., Findley, L. T. & Kerstitch, A. N. 2000. Reef Fishes of the Sea of Cortez: The Rocky-Shore Fishes of the Gulf of California (revised edition). University of Texas Press, Austin, TX.

Evaluation and Grading

- Species list*: Cantamar, Calerita, Balandra, Bahia Magdalena, Cabo Pulmo (due July 17th) 5 %
- Photo evidence*: Cantamar, Calerita, Balandra, Bahia Magdalena, Cabo Pulmo (due July 17th) 5 %
- Paper on one guided project (due July 24th, 25th or 28th) 20 %
- Concept maps for each guided project (due July 9th, 16th or 21st) 5 %
- Individual review of classmates' guided project (due July 20th, 21st or 24th) 10 %
- Concept map and proposal of independent project* (due July 22nd) 5 %
- Independent project presentation* (due July 30th) 15 %
- Independent project paper* (due Aug 1st) 20 %
- Participation, includes attendance and completing ungraded assignments: 15 %
 - Choice of guided project paper to write (due July 3rd)
 - Analysis of habitat observations (due July 14th)
 - Scientific questions (due July 14th)
 - Draft paper of one guided project (due July 17th, 19th or 22nd)

**Group assignments for which individual effort will be taken into account when assigning grades. Do include your last name in the file name of every assignment that you submit.*

Grading Scale

95% or greater: A	78-81%:	B-	66-68%:	D+
90-94%: A-	75-77%:	C+	63-65%:	D
86-89%: B+	72-74%:	C	60-62%:	D-
82-85%: B	69-71%:	C-	below 60%:	F**

**For averaging purposes: any F grade will be tallied as 50-60%.

Given the collaborative nature of the class attendance is MANDATORY and assignments will not be received after the DUE date and time.

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Course Aim	Learning Objective	Indicators of Performance (assessment for learning)	Evaluators of Performance (summative assessment)
Development of science process skills	Students will gather, synthesize, and critically evaluate knowledge.	-Whiteboards; discussions; draft paper of guided project.	- <i>Concept map and paper of guided project.</i> - <i>Review of peer's guided project.</i> - <i>Concept map & proposal of independent project.</i> - <i>Paper and presentation of independent project.</i>
	Students will think analytically, develop scientific questions, and design a research project.	-Whiteboards; discussions; self-assessment; concept map of scientific reading; draft paper of independent project.	- <i>Scientific questions from habitat surveys</i> - <i>Concept map and paper of guided project.</i> - <i>Concept map & proposal of independent project.</i> - <i>Paper and presentation of independent project.</i>
	Students will collect and analyze data.	-Whiteboards; discussions; lab experiments; field observations.	- <i>Species list and photo evidence.</i> - <i>Concept map and paper of guided project.</i> - <i>Paper and presentation of independent project.</i>
	Students will communicate ideas concisely and effectively in both written and oral forms.	-Whiteboards; discussions; concept map of scientific reading; draft paper of independent project.	- <i>Scientific questions from habitat surveys</i> - <i>Concept map and paper of guided project.</i> - <i>Review of peer's guided project.</i> - <i>Concept map & proposal of independent project.</i> - <i>Paper and presentation of independent project.</i>
	Students will work in collaboration with others to integrate knowledge into a coherent body of work.	-Whiteboards; discussions; self-assessment; lab experiments; field observations.	- <i>Scientific questions from habitat surveys</i> - <i>Attendance and participation.</i> - <i>Species list and photo evidence.</i> - <i>Paper and presentation of independent project.</i>
Knowledge of tropical marine biology	You will describe the organisms found in tropical marine habitats.	-Whiteboards; discussions; lab experiments; field observations; analysis and presentation of diversity study	- <i>Species list.</i> - <i>Photo evidence of species list.</i>
	You will understand the influence of key factors on the physiological performance of tropical marine organisms.	-Whiteboards; discussions; lab experiments; draft paper of guided project.	- <i>Concept map of guided project.</i> - <i>Paper of guided project.</i> - <i>Review of peer's guided project.</i>
	You will understand the transfer of genetic information in tropical marine organisms.	-Whiteboards; discussions; lab experiments; draft paper of guided project.	- <i>Concept map of guided project.</i> - <i>Paper of guided project.</i> - <i>Review of peer's guided project.</i>
	You will describe the interaction between behavior and environment in tropical marine organisms.	-Whiteboards; discussions; lab experiments; draft paper of guided project.	- <i>Concept map of guided project.</i> - <i>Paper of guided project.</i> - <i>Review of peer's guided project.</i>
	You will understand the relationships between tropical marine organisms and their environment.	-Whiteboards; discussions; lab experiments; field observations; draft paper of guided project.	- <i>Species list and photo evidence.</i> - <i>Concept map and paper of guided project.</i> - <i>Review of peer's guided project.</i> - <i>Concept map & proposal of independent project.</i> - <i>Paper and presentation of independent project.</i>

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Biology Department Learning Goals and Objectives

The Biology department has identified content and practices learning goals, with associated learning objectives, that all biology students should attain by the end of their education at WWU. The goals specifically addressed in this class are:

Science Content Goals

- Our students will acquire in-depth knowledge from the major areas of biology and be able to integrate principles from these areas. They will be able to explain and apply their understanding of the:
 - relationship between structure and function at all levels: molecular, cellular, and organismal.
 - importance of evolutionary theory as a unifying principle of biology.
 - cellular basis for physiological processes
 - interactions between organisms and their abiotic and biotic environment.
- Our students will gain lab and field skills needed to answer biological questions. They will be able to:
 - perform a variety of lab techniques.
 - perform a variety of field techniques.
 - design a biological study and statistically analyze data.

Science Practices Goals

- Our students will develop critical thinking skills. They will be able to:
 - identify questions that can be addressed scientifically.
 - interpret data and draw conclusions from experiments.
 - demonstrate the ability to read, understand, and critically review scientific papers.
- Our students will develop effective quantitative reasoning skills. They will be able to:
 - use mathematical equations to represent and explain biological phenomena.
 - use mathematical equations and models to predict biological outcomes.
- Our students will communicate precisely and analytically in written and oral forms. They will be able to:
 - discuss biological processes using precise scientific terminology.
 - prepare written and oral reports in standard scientific formats.
- Our students will engage independently and collaboratively in the scientific process. They will be able to:
 - apply the scientific process, including designing and conducting experiments and examining hypotheses.
 - acquire the laboratory and/or field skills necessary to perform laboratory exercises and experiments.
 - place their research in a broader scientific context based on current literature.
 - evaluate the work of their peers.

Instructor Responsibilities

We are responsible for teaching you about tropical marine biology and the process of science. You should expect the following from us:

1. Clear learning objectives and criteria needed to succeed in the class: sharing learning objectives for the day and examples of prior student assignments.
2. Innovative learning activities that allow you to construct and expand your understanding of tropical marine biology and the process of science, and elicit evidence of learning: collaborative activities, white-boarding, classroom discussions, critical-thinking questions, and training assignments.
3. A supportive learning environment and instructors that care deeply about whether you learn the material, stimulate your interest and motivate you: positive, engaging, and friendly classroom atmosphere; and constructive, timely and productive feedback on your work.
4. Opportunities for you to become a learning resource to one another: reviewing the work of classmates.
5. Opportunities to monitor your own learning and become aware of your understanding: self-assessment of the learning objectives and big ideas of the class.

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Student Responsibilities

There are both personal and intellectual responsibilities for students. First, you will live in a foreign country in close quarters with other students. This requires that you are mature, considerate, and congenial. Second, this is an upper-division, intellectually-challenging course. This requires that you participate in course activities, work hard and effectively by yourself and with others, think critically, develop your own ideas and opinions, and share your ideas in both written and oral forms.

Shared responsibilities in the classroom:

	Where the learner is going	Where the learner is	How to get there
Teacher	1. Clarification of learning objectives and criteria needed to succeed in the class, including why it is important to learn it.	2. Engineering innovative learning activities that allow learner to construct knowledge and elicit evidence of learning.	3. Providing a supportive learning environment and constructive feedback that moves learner forward.
Peer	4. Activating students as learning resources for one another, including providing constructive feedback and encouragement.		
Learner	5. Becoming owner of her/his own learning, including being motivated, curious and responsible.		

You need to behave appropriately throughout the course to receive a grade in the class.

Inclusiveness and Respect

You are encouraged to speak up and participate during class. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, each one of us will respect, appreciate, and embrace every other member of this class.

We are firmly committed to diversity and equality in all areas of life. In this class, we will work to promote an inclusive environment where everyone feels safe and welcome. We recognize that discrimination can be direct or indirect and take place at both institutional and personal levels. We believe that such discrimination is unacceptable and we are committed to providing equality of opportunity for all by eliminating any and all discrimination, harassment, bullying, or victimization. The success of this policy relies on the support and understanding of everyone in this class. We all have a responsibility not to be offensive to each other, or to participate in, or condone harassment or discrimination of any kind. Without failing to speak up, we also have the opportunity to think the best of everyone and give one another the benefit of the doubt.

Equal Opportunity Rights

You have the right to an educational experience that is free from illegal harassment or discrimination on the basis of race, color, creed, religion, national origin, sex, disability, age, veteran status, sexual orientation, gender identity or expression, marital status or genetic information. **If you or someone you know has experienced macro- or micro-aggressions of any kind related to personal identity on campus**, please report any issues to an instructor you feel is an ally, to the Biology faculty member on the College's Equity, Inclusion, and Diversity Committee (Dr. Lina Dahlberg -dahlbec@wwu.edu), to one of our CSE and Biology Community Ambassadors (<https://cse.wwu.edu/biology/cs-es-ambassadors-community-hours>) or using the anonymous form under the Equity and Inclusion tab on the Biology Department homepage (<https://biology.wwu.edu/equity-and-inclusion-issues-biology>). You can also contact the Equal Opportunity Office for additional advice and help (<http://www.wwu.edu/eoo/bias-incident-response.shtml>).

Intellectual Honesty

Science is based on trust. If a scientist states that she carried out a particular study and obtained certain results, the rest of us trust that she did such thing. This is one reason why there is no tolerance for people who are not intellectually honest, and this class will be no exception. <https://wp.wwu.edu/academichonesty/>

From WWU: Plagiarism is presenting as one's own in whole or in part the argument, language, creations, conclusions, or scientific data of another without explicit acknowledgement. (Learn more at [Understanding and Avoiding Plagiarism.](#)) Examples include but are not limited to:

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- Using another person's written or spoken words.
- Using information from a World Wide Web site, CD-ROM or other electronic sources.
- Using statistics, graphs, charts and facts without acknowledging the source of the ideas.
- Paraphrasing: using someone else's argument without acknowledging the source.

Religious Accommodations

Western provides reasonable accommodation for students to take holidays for reasons of faith or conscience or for organized activities conducted under the auspices of a religious denomination, church, or religious organization. Students seeking such accommodation must provide written notice to their faculty within the first two weeks of the course, citing the specific dates for which they will be absent. "Reasonable accommodation" means that faculty will coordinate with the student on scheduling examinations or other activities necessary for completion of the course or program and includes rescheduling examinations or activities or offering different times for examinations or activities. Additional information about this accommodation can be found in [SB 5166: Providing religious accommodations for postsecondary students](#).

Additional Resources

Do you have any concerns about your ability to learn in the classroom or your ability to take assessments in the classroom? Contact the Disability Access Center for advice, help, and to request accommodation (650-3083 or <https://disability.wvu.edu/>).

Do you want feedback on your cover letter or resume? The Career Services Center at Western will gladly review them, compare them with the posting for which you are applying, and provide feedback to you within 48 h: <https://www.wvu.edu/careers/>

Do you feel unwell or have a health-related question? Contact the Health Center (650-3400) or visit the website of Student Health (<https://studenthealth.wvu.edu/>)

Do you have an emotional or psychological concern or question? Contact the Counseling Center (650-3164) or visit the website of Counseling Services (<http://www.wvu.edu/counseling/>).

Do you have a safety concern? Contact the University Police for non-emergency services (650-3555) or visit their website (<http://www.wvu.edu/ps/police/index.shtml>).

Do you have a family or personal crisis or emergency? Contact the Office of Student Life (650-3450) or visit their website (<https://wp.wvu.edu/officeofstudentlife/>).

Do you have concerns related to being an undocumented student? Contact Student Outreach Services (650-7443) and check the following site: <https://www.wvu.edu/undocumented-students>.

Do you have financial difficulties? Go to the Financial Aid Services Center and schedule an appointment with a financial aid counselor (http://www.finaid.wvu.edu/client_services/pages/contact.php)

Do you identify as a member of the LGBTQ+ Community? Learn about resources and support by emailing L. K. Langley (they/them/theirs) at L.K.langley@wvu.edu or by visiting <https://lgbtq.wvu.edu/>

Do you or someone you know need confidential support related to sexual violence? Contact CASAS (650-3700 or <https://pws.wvu.edu/consultation-and-sexual-assault-support-casas>), the Student Health Center, and/or the Counseling Center.

To report sexual violence, please contact University Police, Bellingham Police, and/or the Title IX Coordinator in Western's Equal Opportunity Office (650-3307). Faculty are required to report sex discrimination, including sexual violence that they learn about to the Title IX Coordinator.

Are you or someone you know in distress? Help is available anytime, all the time. <https://suicideprevention.wvu.edu/get-help/>

We also encourage you to check the syllabi policies for students: <https://syllabi.wvu.edu/>

Changes might be made to the syllabus along the course. These changes will be announced in advance.

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TROPICAL MARINE BIOLOGICAL RESEARCH (BIOL 437)

12 credits

(48 h/week, five weeks, field-based, taught in Mexico)

Week 1: 29 June – 5 July

Science content covered

Tropical habitats:

Coral reefs

Estuaries

Subtidal (non-coral reefs)

Population structure and genetics

Mangroves

Intertidal

Science practices covered

Developing research questions

Research conducted

Species surveys

Activities employed

Lectures:

3 h/day, 6 days/week = 18 h

In-class discussions

In-class exercises

In class lectures

Labs:

5 h/day, 6 days/week = 30 h

Field trips

Faculty-guided student work

Week 2: 6 – 12 July

Science content covered:

Physiological and morphological adaptations to the tropics:

Both physical and biological stresses:

Temperature

Light and UV

Salinity

Nutrients

Science practices covered

Analyzing data

Presenting results orally

Interpreting data

Research conducted:

Guided research project

Presentation of guided research project

Activities employed

Lectures:

4 h/day, 6 day/week = 24 h

In-class discussions

In-class exercises

In class lectures

Labs:

4 h/day, 6 days/week = 24 h

Lab experiments

Field trips

Faculty-guided student work

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Week 3: 14 – 20 July

Science content covered

The behavior of marine organisms:

Invertebrates

Fish

Seabirds

Marine mammals

Science practices covered:

Presenting results in written form

Research conducted

Guided research projects

Activities employed

Lectures:

2 h/day, 6 days/week = 12 h

In-class discussions

In-class exercises

In class lectures

Labs:

6 h/day, 6 days/week = 36 h

Lab experiments

Faculty-guided student work

Field trips

Week 4: 21- 27 July

Science content covered

The ecology and conservation biology of tropics and local habitats:

Primary and secondary production, decomposition

Conservation biology of tropical regions

Research conducted

Independent research project

Activities employed:

Lectures:

2 h/day, 6 days/week = 12 h

In-class discussions

In-class exercises

In class lectures

Labs:

6 h/day, 6 days/week = 36 h

Independent lab experiments

Independent field work

Field trip

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Week 5: 28 July – 3 August

Science processes covered

Presenting results in oral form

Research conducted

Independent research project

Activities employed:

Lectures: 1 h/day, 6 days/week = 6 h

In-class discussions

In class lectures

Labs: 7 h/day, 6 days/week = 42 h

Independent lab experiments

Independent field work

Total credit hours lecture:	$18 + 24 + 12 + 12 + 6 =$	72 h
Total credit hours lab :	$(30/3) + (24/3) + (36/3) + (36/3) + (42/3) =$	56 h
TOTAL		128 h