



**Center for International Programs and Sustainability Studies**

**Course Title: Tropical Marine Biology**

**Course code: ENV 3190**

**Total contact hours: 60**

**Prerequisites: Basic concepts in biology preferred**

### **COURSE DESCRIPTION**

The oceans occupy about 71% of the Earth's surface and tropical seas hold the highest ecosystem and species diversity on it. In this course we will introduce the basic concepts of tropical oceanography, marine ecology, and marine biology, with emphasis on the interaction between species, between species and their environment and between ecosystems. We will also learn about human environmental impact, and the utility, management, and conservation of the ecosystems.

Besides class activities this course includes field trips when we will have firsthand contact with the marine environment and coastal population.

### **COURSE PRE-REQUISITES**

For this course it is recommended to have taken general biology, however it is not an essential requirement.

### **CLOTHING AND FOOTWEAR REQUIREMENTS**

Please, take into account the following information:

- o This is an environmental science course.
- o Field work may include long walks, long boat rides and snorkeling activities. Although many places in the country have allowed us to find suitable accommodations, many of the volunteer work stations or research areas require rustic accommodations.
- o Water shoes, Velcro sandals or tennis shoes that you can wet, are necessary for intertidal zone exploration.
- o Personal field notebook is required for the field trips
- o Rain jackets are important on field trips.

## **AUDIENCE**

This course is structured for international students attending the Study Abroad Program at an LCI Education university campus. However, courses are not exclusive to foreigners so local degree-seeking students may enroll in this course. Some of the courses are also taught in Spanish as part of our Bachelor's in Sustainability Management or Business Administration programs.

This is a theoretical-practical course and explores/responds to the following inquiry according to the professional/disciplinary profile:

**What are the most important ecosystems in tropical environments, their biodiversity, ecological services, and vulnerabilities?**

**How to apply this knowledge in carrying out daily actions and propose future solutions that help with the conservation and improvement of the tropical marine ecosystem?**

In order to respond this question, we will study the following generative topics:

- o General oceanography concepts.
- o General ecology concepts.
- o Marine biodiversity.

- Tropical marine ecosystems: Coral reefs, mangroves, Seagrasses, intertidal zones, open oceans and deep sea.
- Human impact in the ocean and conservation efforts.

Along the course, the following **skills** will be fostered:

- Ability to identify the main physical and chemical characteristics of the tropical marine environment and relate them with the organisms that live within.
- Ability to identify the main characteristics of the main tropical areas with emphasis in Costa Rica.
- Ability to identify communities and keystone species that live in each of the studied tropical marine ecosystems.
- Ability to recognize the importance of the oceans in human ecology.
- Ability to recognize the main threats that tropical seas confront and adopt daily action to counteract or minimize our impact.

Among the **values** and **attitudes** that will be promoted among students are the following:

- Systemic thinking.
- Logical and communicative intelligence.
- Interest in solving problems.
- Interest in learning to learn.
- Connect well with others.
- In-depth listening.

## **COMPETENCIES, CRITERIA AND EVIDENCE**

The competencies for the Veritas University are reflexive and integral actions that respond to the professional profile and to the problems of the context, with suitability and ethical commitment, integrating the know-how, and the knowledge to know in a perspective of improvement.

Below are both the disciplinary and general competencies, linked to their criteria and evidence of performance for this course.

Competencies	Key competences	Learning Assessments
Recognizes the main characteristics of the tropical marine ecosystems present in Costa Rica, considering the daily factors that affect them, to promote their conservation	Characterizes tropical ecosystems according to their biodiversity and ecological functions.	Class activities: Research on marine invertebrates, Group research on trendy topics in Coral reefs, Field trip reports, Forum participation, Presentation on selected topic.
	Recognizes the importance of tropical marine ecosystems considering how humans depend on the ocean.	Class activities: Research on marine invertebrates, Individual film analysis, debates, Forum participation, Field trip report.
	Relates the characteristics of the tropical marine ecosystems with actions that promote their conservation.	Class activities: Individual film analysis, debates and group research on trendy topics in Coral reefs, Field trip reports, Forum participation, Presentation on selected topics.
Integrates knowledge, skills and attitudes to learn continuously and through one's life pursuing an efficient development in the	Learning to learn.	Class activities: Research on marine invertebrates, Group research on trendy topics in Coral reefs, Field trip reports, Forum participation,

knowledge-based society		Presentation on selected topic
Builds the necessary knowledge, skills and attitudes to learn how to communicate orally and in written form in the different disciplines that make up the curriculum.	Communicate thoughts of the discipline orally, in an iconic way, and in written form.	Thematic discussion
Integrates the necessary knowledge, skills, and attitudes to learn teamwork and leadership techniques	Execute teamwork and leadership.	Class activities: marine invertebrates research, Individual film analysis, debates.
Integrates the necessary knowledge, skills and attitudes to learn interpersonal communication techniques	Relate well to others, manage and solve conflicts, negotiate reliably and empathetically, speak responsibly, Listen attentively	Trendy topics in Coral reefs, presentation on selected topics.

## COURSE CONTENTS

### **Topic 1. Introduction to tropical marine biology and oceanography.**

- Characteristics of the tropics.
- Chemical and Physical characteristics of seawater: temperature, salinity, density, light, oxygen, carbon dioxide.
- Ocean acidification.
- Nutrients in the ocean.

- Ocean basin.
- Water movement: Waves-tides and currents.

### **Topic 2. Marine Ecology and main communities.**

- Ecology concepts: individuals, species, populations, communities, ecosystems,
- Interactions between organisms.
- Definition of the main communities.
- Plankton characteristics.
- Eutrophication.

### **Topic 3. Marine invertebrates.**

- Main invertebrates in tropical ecosystems.
- Ecological functions of the marine invertebrates.
- Uses of marine invertebrates.

### **Topic 4. Coral Reefs.**

- Characteristics of coral reefs.
- Biodiversity in coral reefs.
- Importance of coral reefs.
- Human impact in coral reefs and conservation efforts with emphasis in Costa Rica.

### **Topic 5. Other coastal ecosystems: Mangroves, intertidal zones, sea grasses and rocky reefs.**

- Distribution of these ecosystems.
- Biodiversity in these ecosystems.
- Human impact in coral reefs and conservation efforts.

### **Topic 6. Open Ocean**

- Open ocean fish: Characteristics, vulnerability and overfishing and conservation efforts.

- Marine Reptiles: Characteristics, vulnerability, and different approaches in conservation efforts.
- Marine mammals: Characteristics, vulnerability, and different approaches in conservation efforts.

### **Topic 7. The Deep Sea.**

- Exploration of the deep sea and importance.
- Mesopelagic and Bathypelagic zones.
- Biodiversity in the deep sea.
- Hydrothermal vents and cold seeps.
- Deep sea in Costa Rica.
- The future of Deep-Sea exploration.

### **Topic 8. Human impact in the ocean and conservation efforts**

- Marine pollution.
- Specific cases about human impact in the ocean.
- Marine protected areas.
- The law of the sea.

## **METHODOLOGY**

The course will be taught through a combination of lectures, discussions, debates, forum, and research projects with the intervention of both the students and the teacher. We will use Marine biology books and scientific journals as our main source of knowledge and movies, online videos, and news as complementary sources.

The lab session consists of one or two field trips where students will have the opportunity to visualize the information learned in class and report their findings in a written form.

In this course students will be responsible for their own learning, so it is expected that the students bring their own questions, find their own answers, and share all the new built information with the rest of the class. The teacher will be a facilitator of information and techniques.

## **EDUCATIONAL RESOURCES**

In order to guarantee good development of the course, therefore, to guarantee learning, the following resources are available: an updated bibliographic database, multimedia equipment that students can use for their individual presentations; whiteboards readings provided by the educator. All of these complement the suggested projects and provide the students with higher possibilities of knowledge on their own ship. Most of the lessons will take place in the classroom. During independent work periods students will be able to attend the institution. A campus library, study rooms, and computer labs are available for the students' independent work time. Free Wi-Fi connection for students, educators, and staff is provided on campus, which gives students the possibility to work not only in the library or computer labs, but also around campus. For specific lessons and field trips students will have access to specific equipment from the school or rented), like snorkeling equipment, rubber boots, microscope, and sensors. Students must be careful with the equipment and be sure to return everything to the professor after use.

## **LEARNING ASSESSMENT**

Evaluation compiles and evaluates evidence by considering feedback providing pre-established criteria. The course evaluation must be aligned with the competencies and the teaching methodology. There is a rubric for each evaluation resource, and the details will be provided in **CANVAS LMS**. Even though the rubric grants a grade, it is also a quantitative and qualitative description of the students' performance. The rubrics include the core and discipline key competences.



ASSIGNMENTS	PERCENTAGE VALUE
Presentation on selected topic and website	30%
Class activities	10%
1. Invertebrates	10%
2. Group research on trendy coral reefs topics	10%
3. Individual film analysis	10%
4. Debate on controversial topics about marine organisms	10%
Field trip	20%
Forum: Current news in marine biology	10%

## LEARNING STRATEGIES AND RUBRICS

The following learning strategies will be developed:

### 1. Presentation on selected topic and website

Students (1 or 2) will choose a topic from the list in section 5.2.2 of the syllabus (or propose a new one) in order to present an oral Bibliographic Revision.

This presentation should include new, scientific information about the topic, also studies and data.

#### 1.1 Requirements:

- The topic should be specific
- Students should select the topic on the second week of classes.

- The topic should be explained in general way first, then more specific, and later present some study cases
- Students must do a PowerPoint or a presentation in another format
- Oral presentations should not exceed 15 minutes of exposition plus 5 minutes for questions (20 minutes total).
- Students must create a website beside the presentation
- Each student or group will send the website of their topic to all classmates and the instructor. The website should include the main information, extra information, videos, data, pictures, link to related websites and references. sites.google.com, weebly.com, Wix.com. wordpress.com,
- At least 5 scientific references should be used and cited (internet sources are not considered scientific references) but they may be included within this list as well
- Both the website and the presentation should have references in APA format.
- The recommended order of the presentation is:
  1. Title and participants.
  2. Objectives.
  3. Introduction.
  4. Specific information about the topic.
  5. Study cases.
  6. Conclusions.
  7. References.

### 1.2 Ideas for Class presentation:

- Effect of Some Natural Events in marine life:
  - Hurricanes
  - Tsunamis
  - Bioluminescence
  - El Niño & La Niña events
  - Invasive species

- Tidal energy
- Herbivores in the Caribbean reefs : Sea urchin (*Diadema antillarum*)
- Sharks attacks (Myths and Reality)
- Sustainable fisheries
- Communication skills on cetaceans
- Whaling (current situation)
- Migration in the ocean
- Medicine and the ocean
- Media and the ocean
- Oil spills and effect on marine life
- Biomimicry
- Coastal development
- Immortality in the ocean
- Plastic pollution
- Jellyfish overpopulation
- Echolocation
- Sound pollution
- Effects of transportation in the ocean

\*\*\* You can propose a new one related with our major, your interests, your experience or your curiosity

## 2. Class activities:

**a. Marine Invertebrates research:** The assignment consists of research about a specific group of invertebrates, the students will create a presentation (PowerPoint, Prezi, etc.). Each group member must participate actively during research and presentation. The students will present to the rest of the class information about the basic anatomy of the invertebrates, feeding behavior, reproductive behavior, defense mechanisms. human interactions and fun facts. All of these should be presented with the help of images or short videos. The presentation must last around

10 minutes and when it finishes there will be a 5 minute session of Q&A and the opportunity for the rest of the class to express their opinion about this topic. Scientific journals, or websites from official institutions can be used as a source of information.

**b. Group research on trendy topics in Coral reefs:** The assignment consists of research on a given topic related to coral reefs, and the students must edit the professor's presentation on coral reefs adding slides with main data, images and if possible, videos. Each group member must participate actively during research and presentation. The presentation must last around 10 minutes and when it finishes there will be a 5 minute session of Q&A and the opportunity for the rest of the class to express their opinion about this topic. Scientific journals, or websites from official institutions can be used as a source of information.

**c. Individual film analysis:** Students will watch an assigned documentary related to the ocean, then answer a series of questions related to it, and will look for extra information in news, scientific journals, or websites about the topic. The critical thinking, writing techniques and willingness to learn more about the topic will be evaluated.

### 3. Debate:

The debate is an act of human communication that consists of the discussion about a controversial topic between two or more groups of people. The debates are not necessarily won by who has the reason, but who knows how to best support their ideas. Students will research on their own time about an assigned topic and in the class, students are expected to meet and put their ideas together and agree in the approach of the discussion. Each group will have 5 minutes to present to the audience (rest of the class) their main points of view and then both groups will have 10 minutes for a Q&A session.

### 4. Field trips:

Field trips give students the opportunity to observe the ecosystems and organisms studied in class, to question their own observations and have a real picture of the ecological and social

reality of marine ecosystems and their surroundings. Field trips are assessed as reports and students can work in groups of 2 or 3 students. Each report should have an introduction, a methodology, results and discussion. It requires bibliography. The location and day of the field trip depends on the weather, ecological and/or budget conditions, in the same way, the specific information that is required in the field trip report can change depending on the location. Specific instructions will be provided before the field trip.

**Important:**

- Lodging and main meals are covered by the course.
- Participants must be fully enrolled in this course and no guests are allowed.
- Students must be on time for all field trip activities including departure from places and pre-scheduled mealtimes.

**5. Forum participation:**

Students will have the opportunity to participate every week in a News Forum in Canvas, the student can upload recent news (published in the last 6 months) related to marine biology. At least 5 news should be uploaded (no more than one per week) and they should also have 5 replies in another classmate's news. The posted news should include a link of the source and one paragraph summary. The replies must show/use a respectful tone, show critical and creative thinking, show deep reflection and clarity, students can respond with their opinion, with previous knowledge, with another article with something you observed or with a well thought question.

Replies that are not acceptable:

“cool”, “I agree”, “Love it”, “ouch”, “lol “ , or any other one word answer, or meaningless response.

## **ATTENDANCE**

### **Regarding classes:**

1. Students are only allowed a total of two (2) nonconsecutive (back-to-back) class absences. A student shall fail the course if more than two absences are registered.
2. Three late arrivals to class (within the first 15 minutes) are treated as one absence. Attending class 30 minutes late without an official justification will also count as an absence.
3. In the case of an absence from any assignment evaluated in class (presentations, evaluations, field trips, etc.) a student will be given a grade zero unless an official document is presented within one week of the absence.
4. If a student presents an official document to excuse the absence, the missed assignment is to be presented on that same day.

### **Regarding field trips:**

5. An unjustified absence on a field trip will immediately result in the loss of all points assigned to that specific trip. However, if an official document justifying the absence is presented, 50% of the assignment points may be obtained on presentation of a complementary research assignment, to be agreed upon with the professor, within one week of the field trip.
6. An absence on a field trip may be justified should two course field trips coincide. In such a case, and in order to avoid losing points, students shall be able to opt for carrying out a research assignment.

## CODE OF CONDUCT

Professors have the right to expel a student from the classroom should he / she/they:

- 1) Is disruptive in the classroom.
- 2) Behave in a disrespectful way.
- 3) Be under the influence of alcohol or even smell like alcohol.
- 4) Be under the influence of any illegal drug.
- 5) Shows hygiene problems that may disturb other students.

## ELECTRONIC DEVICES

The use of cell phones, smartphones, or other mobile communication devices is disruptive and is therefore prohibited during class. **Please turn all devices OFF and put them away** when class begins. Devices may be used only when the professor assigns a specific activity and allows the use of devices for internet search or recording. Those who fail to comply with the rule must leave the classroom for the remainder of the class period. Using devices while the professor or other peers are lecturing, or presenting is perceived as a lack of interest and disrespectful.

## PROGRAM POLICIES

The student must comply with the provisions of the CIPSS Program Policies available on the Canvas platform.

## BIBLIOGRAPHY

Barnes, R. S., & Hughes, R. N. (2006). *An introduction to marine ecology*. Oxford: Blackwell Science.

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Humann, P., & DeLoach, N. (2002). *Reef fish identification: Florida, Caribbean, Bahamas* (3rd ed.). Jacksonville, Fla.: New World Publications.

Moyle, P., & Cech, J. (2004). *Fishes: An introduction to ichthyology* (5th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Nybakken, J., & Bertness, M. (2005). *Marine biology: An ecological approach* (6th ed.). San Francisco: Pearson/Benjamin Cummings.

Reynolds, J. (1999). *Biology of marine mammals*. Washington: Smithsonian Institution Press.

Brusca, R., & Brusca, G. (2003). *Invertebrates* (2nd ed.). Sunderland, Mass.: Sinauer Associates.

Wehrtmann, I. (2009). *Marine biodiversity of Costa Rica, Central America*. Dordrecht: Springer.

\*Other Scientific papers will be assigning during the course

## CHRONOGRAM

Week	Sub competency	Contents	Learning strategies
1	Characterizes tropical ecosystems according with their biodiversity and ecological functions	Topic 1: Introduction to tropical marine biology and oceanography. Characteristics of the tropics b. Chemical and Physical characteristics of seawater: temperature, salinity, density, light, oxygen, carbon dioxide. c. Ocean acidification.	Professor's exposition. Brainstorm activity about ocean characteristics.
2		Topic 1. Introduction to tropical marine biology and oceanography. d. Nutrients in the ocean. e. Ocean basin.	Reading discussion. Professor exposition. Video analysis.



3.		<p>Topic 1. Introduction to tropical marine biology and oceanography.</p> <p>f. Water movement: Waves-tides and currents</p>	<p>Professor exposition.</p> <p>Video discussion.</p>
3	<p>Recognize the importance of tropical marine ecosystems considering how humans depends on the ocean</p>	<p>Topic 2. Marine Ecology and main communities</p> <p>a. Ecology concepts: individuals, species, populations, communities, ecosystems.</p> <p>b. Interactions between organisms.</p> <p>c. Definition of the main communities.</p> <p>d. Plankton characteristics.</p> <p>b. Eutrophication.</p>	<p>Group activity about interactions in the ocean.</p> <p>Professor's exposition.</p> <p>Video analysis.</p>
4		<p>Topic 3. Coral Reefs.</p> <p>a. Characteristics of coral reefs.</p> <p>b. Biodiversity in coral reefs.</p> <p>c. Importance of coral reefs.</p>	<p>Professor's exposition.</p> <p>Class activity 1: Group research on trendy coral reefs topics.</p>
5		<p>Topic 3. Coral Reefs.</p> <p>d. Human impact in coral reefs and conservation efforts with emphasis in Costa Rica.</p>	<p>Reading discussion.</p> <p>Student presentations.</p>

6		<p>Topic 4. Other coastal ecosystems: Mangroves, intertidal zones, sea grasses and rocky reefs.</p> <p>a Distribution of these ecosystems.</p> <p>b. Biodiversity in these ecosystems.</p> <p>c. Human impact in these ecosystems and conservation efforts</p>	<p>Group activity about organisms in the intertidal zone.</p> <p>Professor's exposition.</p> <p>Field trip analysis of information.</p> <p>Student presentations.</p>
7		<p>Topic 5. Open Ocean</p> <p>a. Open ocean fish: Characteristics, vulnerability and overfishing and conservation efforts.</p>	<p>Professor's exposition,</p> <p>Class activity 2:</p> <p>Individual film analysis.</p>
8		<p>Topic 5. Open Ocean.</p> <p>b. Marine Reptiles: Characteristics, vulnerability and different approaches in conservation efforts.</p>	<p>Professor's exposition.</p> <p>Video analysis.</p> <p>Class activities 3: Debate on controversial topics about marine organisms.</p>
9		<p>Topic 5. Open Ocean</p> <p>c. Marine mammals:</p>	

		Characteristics, vulnerability and different approaches in conservation efforts.	
10	Relates the characteristics of the tropical marine ecosystems with actions that promote their conservation.	<p>Topic 6. The Deep Sea.</p> <p>a. Exploration of the deep sea and importance.</p> <p>b. Mesopelagic and Bathypelagic zones</p> <p>c. Biodiversity in the deep sea</p> <p>d. Hydrothermal vents and cold seeps</p> <p>e. Deep sea in Costa Rica</p> <p>f. The future of Deep Sea exploration</p>	<p>Professor's exposition</p> <p>Group project in different areas of the ocean</p> <p>Students' presentations</p>
11		<p>Topic 7. Human impact in the ocean and conservation efforts.</p> <p>a. Marine pollution.</p> <p>b. Specific cases about human impact in the ocean.</p>	<p>Professor's exposition.</p> <p>Brainstorm.</p> <p>Students' presentations.</p>
12		<p>c. Marine protected areas.</p> <p>d. The law of the sea.</p>	<p>Professor's exposition.</p> <p>Conclusions.</p> <p>Final grades.</p>