

CENTER FOR INTERNATIONAL PROGRAMS & SUSTAINABILITY STUDIES

Course Title: Tropical Marine Biology

Course code: ENV-3190

Total contact hours & credits: 60 hours 4 credits

Prerequisites: Basic concepts in biology preferred

1. 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 geology, 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 first-hand contact with the marine environment and coastal population.

1.1. This is an elective class focused on students being able to answer the following questions:

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?

1.2. In order to respond this question, we will study the following general topics:

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

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

1.3. The course will promote the following skills:

- Ability to identify the main physical and chemical characteristic 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

1.4 Some of the values and attitudes fostered 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

2. Competencies, criteria and evidence

At Veritas University competencies are reflexive and integrated actions that respond to the professional profile and to context issues ideally and ethically through the integration of abilities, skills and knowledge. What follows are the discipline and core competencies and their correspondent key competencies and evidence of learning for this course. What follows are the discipline and core competencies and their correspondent key competencies and evidence of learning for this course.

Competencies	Key competences	Evidence of learning
<p>Discipline</p> <p>Recognizes the main characteristics of the tropical marine ecosystems present in Costa Rica, considering the daily factors that affect them, to promote their conservation.</p>	<p>Characterizes tropical ecosystems according with their biodiversity and ecological functions.</p>	<p>Class activities: Group research on trendy topics in Coral reefs Field trip reports Forum participation Presentation on selected topic</p>
	<p>Recognizes the importance of tropical marine ecosystems considering how humans depend on the ocean</p>	<p>Class activities: Individual film analysis, debates Forum participation Field trip report</p>
	<p>Relates the characteristics of the tropical marine ecosystems with actions that promote their conservation.</p>	<p>Class activities: Individual film analysis, debates and group research on trendy topics in Coral reefs Field trip reports Forum participation Presentation on selected topic</p>
<p>Core/Generic</p>		
<p>Integrates knowledge, skills and attitudes to learn continuously and through one's life pursuing an efficient development in the knowledge-based society.</p>	<p>Learning to learn</p>	<p>Class activities Field trip reports Forum participation Presentation on selected topic Class participation Debate</p>
<p>Builds the necessary knowledge, skills and attitudes to learn how to communicate orally and in written form in the different disciplines that</p>	<p>Communicate thoughts of the discipline orally, in an iconic way, and in written form.</p>	<p>Thematic discussion</p>

make up the curriculum.		
Integrates the necessary knowledge, skills, and attitudes to learn teamwork and leadership techniques.	Execute teamwork and leadership.	Class activities: 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	Class activities: debates and group research on trendy topics in Coral reefs Presentation on selected topic

3. Contents

Topic 1. Introduction to tropical marine biology and oceanography

- a) Characteristics of the tropics
- b) Chemical and Physical characteristics of seawater: temperature, salinity, density, light, oxygen, carbon dioxide.
- c) Ocean acidification.
- d) Nutrients in the ocean
- e) Ocean basin
- f) Water movement: Waves-tides and currents

Topic 2. Marine Ecology and main communities

- a) Ecology concepts: individuals, species, populations, communities, ecosystems,
- b) Interactions between organism.
- c) Definition of the main communities.
- d) Plankton characteristics

- e) Eutrophication

Topic 3. Coral Reefs

- a) Characteristics of coral reefs
- b) Biodiversity in coral reefs
- c) Importance of coral reefs
- d) Human impact in coral reefs and conservation efforts with emphasis in Costa Rica

Topic 4. Other coastal ecosystems: Mangroves, intertidal zones, sea grasses and rocky reefs

- a) Distribution of this ecosystems
- b) Biodiversity in these ecosystems
- c) Human impact in coral reefs and conservation efforts

Topic 5. Open Ocean

- a) Open ocean fish: Characteristics, vulnerability and overfishing and conservation efforts
- b) Marine Reptiles: Characteristics, vulnerability and different approaches in conservation efforts
- c) Marine mammals: Characteristics, vulnerability and different approaches in conservation efforts

Topic 6. The Deep sea

- a) Exploration of the deep sea an importance
- b) Mesopelagic and Bathypelagic zones
- c) Biodiversity in the deep sea
- d) Hydrothermal vents and cold seeps
- e) Deep sea in Costa Rica
- f) The future of Deep sea exploration

Topic 7. Human impact in the ocean and conservation efforts

- a) Marine pollution
- b) Specific cases about human impact in the ocean
- c) Marine protected areas
- d) The law of the sea

4. Methodology

The course will be taught through a combination of lecture, 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 in 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 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.

5. The course will complete the following learning strategies:

5.1 Presentation on selected topic and website

Students (1, 2 or 3) 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.

5.1.1 Requirements:

- The topic should be specific
- Students should select the topic the second day of classes.
- The topic should be explained in general way first, then more specific and later present some study cases
- Students have to 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 have to 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
- 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.
- 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

5.1.2 Ideas for Class presentation:

1. Effect of Some Natural Events in marine life:
 - Hurricanes
 - Tsunamis
2. Bioluminescence
3. El Niño & La Niña events
4. Invasive species
5. Tidal energy
6. Herbivores in the Caribbean reefs : Sea urchin (*Diadema antillarum*)
7. Sharks attacks (Myths and Reality)
8. Sustainable fisheries
9. Communication skills on cetaceans
10. Whaling (current situation)
11. Migration in the ocean
12. Medicine and the ocean
13. Media and the ocean
14. Oil spills and effect on marine life
15. Biomimicry
16. Coastal development
17. Immortality in the ocean

18. Plastic pollution
19. Jellyfish overpopulation
20. Echolocation
21. Sound pollution
22. Effects of transportation in the ocean

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

5.2 Class activities:

- a. **Group research on trendy topics in Coral reefs:** The assignment consists of a research on a given topic related to coral reefs, and the students have to edit the professor 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 10 minutes session of Q&A and the opportunity for the rest of the class to express their opinion about this topic. Scientific journal, or websites from official institutions can be used as a source of information.
- b. **Individual film analysis:** Students will watch an assigned documentary related with the ocean, then answer a series of questions related to it, and will look for extra information in news, scientific journals or web site about the topic. The critical thinking, writing techniques and willing to learn more about the topic will be evaluated.
- c. **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. Student 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.

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

5.4 Forum participation:

Students will have the opportunity to participate every week in a News Forum in Canvas, the student can upload a recent news (published in the last 6 months) related with marine biology. At least 5 news should be upload (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”, 😊 “ , or any other one word answer, or meaningless response.

Important information for all assignments:

All assignments will have specific instructions, but there are a some format requirements to follow in all

- 12 pt. Times New Roman Arial, Cambria or Calibri font, in letter size pages
- 1.5 spacing
- Name, class, and date in header
- Title
- Align margins with page borders
- Submit electronically to Canvas platform and sent to the professor to sonia.gamboa@veritas.cr
- Include references APA style.

6. Didactic 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 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 used.

7. Audience

This course is structured for International Students attending the Study Abroad program at Universidad Veritas. However, courses are not exclusive to foreigners so a few native students could

enroll in this course. Some of the courses are also taught in Spanish as part of our Bachelors in Sustainability Management.

8. Assessment of learning outcomes

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

8.1. Rubric to evaluate Presentation on selected topic and website

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved 1	observations
Establishes a research problem and a research question, hypothesis and objectives of high impact and relevance in the discipline.						
The student shows domain of the content, shows understanding of the						

methodology, techniques and results of the studies that cites, and explains the importance of his/her arguments.						
The content of the presentation is new, relevant with the specific selected topic, is accurate and shows data.						
Answers the question or hypothesis raised, assumes a position with respect to the findings.						
The presentation is organized in a logical order with fluency and cohesion within the group members. Uses time wisely						
There's clear balance between the amount of text, images, infographics and videos. Good selection of fonts						
The website is well organized, easy to navigate, with links, images, videos and specific data.						
The bibliography is optimal. The website has references, at least 5 scientific references from journals and in APA format.						

Avoids citing educational texts and sources of dubious credibility.						
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8.2. Rubric to evaluate group research on trendy coral reefs topics

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved 1	observations
The students show domain of the content, understanding of the methodology, techniques and results of the studies that cite and explain the importance of their arguments.						
The content of the presentation is new, relevant, and related to the specific selected topic, it's accurate and shows data.						
Answers the question or hypothesis raised. assumes a position with respect to the findings.						
The presentation is organized in a logical order with fluency and cohesion						

within the group members. Uses time wisely						
There's clear balance between the amount of text, images, infographics and videos. Good selection of fonts .						

8.3. Rubric to evaluate the analysis of video

A Documentary analysis about marine biology will be assigned as out of class work. The report will demonstrate writing skills and the students 'ability to understand the documentary's core theme.

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved 1	observations
Formal presentation requested (with student's name and audio-visual reference)						
Introduction of at least 2 specific paragraphs that capture the attention about the audiovisual theme						
Development of the report, with at least 3 key aspects of the audiovisual explaining them in light of class material						
Extra current information about the presented situation with references						

Presentation of information with proper writing and well-written words (spelling)						
At least 3 conclusions or final considerations						

8.4. Rubric to evaluate the debate on controversial topics about marine organisms

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved 1	observations
All statements, body language, and responses were respectful and given using appropriate language						
All information presented in this debate was clear, accurate and thorough						
All counter-arguments were valid, relevant and strong						
Every major point was well supported with several relevant facts, statistics and/or examples						
The team clearly understood the topic in depth and presented their information forcefully and convincingly)						

8.5 Rubric to evaluate the field trip

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved	observations
The report follows the format requirements: 12 pt. Times New Roman Arial, Cambria or Calibri font, 1.5 spacing, Name, class, and date in header, title, Align margins with page borders, APA style in references						
Organization: introduction, objectives (general and specific), methodology, results, conclusions and bibliography						
The introduction is engaging, states the main topic and previews the structure of the paper. Includes references .						
The methodology describes the procedure followed according to the itinerary and lists the materials used. Answer in detail the following questions: Where?, When?, and how?						
The results include pre-established questions, list of species, observations						

about their abundance and behaviors. Include other observations and any measure take it in the field.						
The conclusion is engaging and restates the thesis.						
No errors in punctuation, capitalization and spelling (check the latin names),						
All cited works, both text and visual, are done in the correct format with no errors.						
Includes 5 or more 5 major references (e.g. science journal articles, books)						
Students actively participate in all field trip activities, show punctuality respect and initiative						

8.6. Rubric to evaluate virtual forum

Indicator	Excellent 5	Very good 4	Sufficient 3	Needs improvement 2	Not achieved 1	Observations
Upload 5 news related with marine biology						
The 5 news were published in the last 6						

months, and one paragraph summary plus the link is posted						
Replies show a respectful tone, show critical and creative thinking, show deep reflection and clarity.						
Replies are based on your critical, previous knowledge, with another article with previous observations or a well thought question						

9. Attendance

Students are only allowed a total of 2 non consecutive (back to back) absences. The student will fail the course if he/she has more than two absences. Students will have a 0 on any assignment evaluated in class (presentations, evaluations, field trips, etc.) if he/she is absent unless the student presents an official document no later than one week after the absence. If the student presents an authoritative report to excuse the absence, he/she must submit the missed assignment on that same day. An unjustified absence to a field trip will immediately mean losing all of the points assigned to the field trip. If an official document is presented for the field trip absence students will have to present a research assignment to obtain 50% of the points. The only exception to this rule is when two-course field sessions collide in programming. Students can then opt for doing a research assignment not to lose any points.

Three late arrivals to class (15 minutes later) are treated as one absence. If you tend to be late for class, you will lose 25% of your total grade. If you are 30 minutes late to class you will be considered absent.

10. Code of conduct

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

- 1) Be 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) Hygiene problems that may disturb other students.

11. Electronic devices

The use of cell phones, smart phones, 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.

12. Bibliography

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

Castro, P., & Huber, M. (2010). *Marine biology* (8th ed.). New York: McGraw-Hill.

Goreau, T. F., Goreau, N. I., & Goreau, T. J. (1979). Corals and coral reefs. *Scientific American*, 241(2), 124-136.

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

13. Course Schedule

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 a. 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 Video discussion</p>
3		<p>Topic 2. Marine Ecology and main communities</p> <p>a. Ecology concepts: individuals, species, populations, communities, ecosystems,</p> <p>b. Interactions between organism.</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 Professor's exposition Video analysis</p>
4	<p>Recognize the importance of tropical marine ecosystems considering how humans depends on the ocean</p>	<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 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 Students presentations</p>
6		<p>Topic 4. Other coastal ecosystems: Mangroves, intertidal zones, sea grasses and rocky reefs</p> <p>a. Distribution of this ecosystems</p> <p>b. Biodiversity in these ecosystems</p> <p>c. Human impact in these</p>	<p>Group activity about organisms in the intertidal zone Professor's exposition Field trip analysis of information Students presentations</p>

		ecosystems and conservation efforts	
7		Topic 5. Open Ocean a. Open ocean fish: Characteristics, vulnerability and overfishing and conservation efforts	Professor's exposition Class activities 2 : Individual film analysis
8		Topic 5. Open Ocean b. Marine Reptiles: Characteristics, vulnerability and different approaches in conservation efforts	Professor's exposition Video analysis Class activities 3: Debate on controversial topics about marine organisms
9		Topic 5. Open Ocean c. Marine mammals: Characteristics, vulnerability and different approaches in conservation efforts	
10		Topic 6. The Deep sea a. Exploration of the deep sea an importance b. Mesopelagic and Bathypelagic zones c. Biodiversity in the deep sea d. Hydrothermal vents and cold seeps e. Deep sea in Costa Rica f. The future of Deep sea exploration	Professor's exposition Group project in different areas of the ocean Students presentations
11	Relates the characteristics of the tropical marine ecosystems with actions that promote their conservation.	Topic 7. Human impact in the ocean and conservation efforts a. Marine pollution b. Specific cases about human impact in the ocean	Professor's exposition Brainstorm Students presentations

12		c. Marine protected areas d. The law of the sea	Professor's exposition Conclusions grades

14. General Observations

The student must comply with the provisions of the CIPSS Academic Policies Regime. To consult it you must go to the Veritas website to the CIPSS page to the Home Menu and download it.