



## **BIO 489: Tropical Marine Ecology and Conservation**

**Credit Hours:** 3 credit hours

### **Instructor Contact Information**

Instructor: Kenneth C. Mattes, PhD

**Course Dates:** Session 1: June 14 – June 24, 2025

### **Required Text:**

Most all course readings will be made available to students, in electronic format, via CELA's online platform. Hard copy readings from the marine center library will also be provided upon arrival. Students with a strong interest in tropical marine ecology and conservation are encouraged to purchase one of the books listed below (not required):

1. Kaplan, Eugene H. 1982. A Field Guide to Coral Reefs of the Caribbean and Florida. Houghton Mifflin Co., Boston, New York.

Other materials used in this course:

1. Goldberg, Walter M. 2013. The Biology of Reefs and Reef Organisms. The University of Chicago Press Ltd. London.
2. Humann, Paul and Ned Deloach. 2014. Reef Fish Identification, Florida, Caribbean, Bahamas. 4th ed. New World Publ. Inc. Fl.
3. Humann, Paul and Ned Deloach. 2013. Reef Coral Identification, Florida, Caribbean, Bahamas. 3rd ed. New World Publ. Inc. Fl.
4. Humann, Paul, N. Deloach and L. Wilk. 2013. Reef Creature identification, Florida, Caribbean, Bahamas. 3rd ed. New World Publ. Inc. Fl.

### **Course Description**

Tropical Marine Ecology and Conservation is an intensive, experiential coral reef ecology course that covers a ten-day timeframe and includes classroom, field and laboratory components. The focus is to learn the key biotic and abiotic components of a coral reef system and how they interact. Students will come to understand the worldwide importance of coral reefs as well as their "canary in a coal mine status". The course explores the current state of the Belize Barrier Reef east of Ambergris Caye and south to Caye Caulker. The biological and ecological history of this reef system will be used to inform attempts to predict its future under varied management strategies. Our local findings will be theoretically applied to all coral reef systems. We will also explore anthropogenic activities that have positive and negative impacts on these ecosystems in general. Lectures will encompass uninformed human activities locally and globally that can be addressed to achieve a more positive outcome for coral reefs.

The effectiveness of social media tools to raise awareness and change behavior will be discussed. Students will leave this program armed with the knowledge, drive and inspiration to contribute to global change from any corner of the earth. They will also have a firm grounding that will help them continue on in this field, if they so wish. The NOAA blog for coral reef scientists (Coral-list) will be used for discussions of current issues and display methods of interacting with leading researchers.

**Field work will be mainly snorkeling. As much as eight hours per day will be spent at sea. This is a very physical course. Students should be prepared for rigorous activity with much sun exposure.** Because we work exclusively inside the barrier reef seas are calm and sea sickness is uncommon. We will examine and compare different reef locations, using actual MPA's (Marine Protected Areas) to assess their effectiveness. Video and photographic documentation has become a highly valuable asset in marine environments. Students are encouraged to bring digital, underwater equipment. We will document percent of live coral coverage, abundance of specific coral pathogens, specificity of coral grazers, reef damage due to human activity and much more. Images will form part of a tracking system to determine changes in the reef and specific corals over time. Part of most evenings will be spent reviewing images to improve identification ability and confirm data. Evening briefings will intimately familiarize you with each site to be visited the next day.

Students will have a learning experience at more than a dozen of the most spectacular coral reef locations left on earth. Daily, you will encounter endangered species that only a lucky few will ever see. Your instructors have lived and worked on the edge of the Belize Barrier Reef system for nearly 25 years. The broad ecological concepts we discuss are rooted in the day to day life and struggle of a marine community shaped by what has become its dominant component, humans.

### **Course Goals and Learning Objectives**

At the end of the course, students should be able to:

- Explain the phylogenetic classification system of coral reef organisms
- Identify the most common and many lesser species found in a Belize Coral Reef system
- Explain their niche and its importance to the reef system
- Describe the complex symbiosis of corals
- Describe the abiotic features that characterize coral reefs, mangrove biomes, and sea grass beds.
- Easily stay informed on the latest research developments and status of coral reef systems
- Explain and communicate the importance of coral reef ecosystems and the threats that endanger them.
- Use your voice and actions as a powerful force to save coral reefs.

### **Course Policies**

#### **Attendance and Participation Policy**

Students are expected to attend all class sessions on all days of class. It will be the responsibility of the student to contact the course instructor, preferably before the absence, to provide the appropriate documentation and verification for the reason for the absence, and to plan with the course instructor for missed work. Students missing a class session without

following this protocol will be subject to limited participation in hands-on practice at the instructor's discretion.

Regardless of the reason for absences, both absences from class will count toward the percentage of allowed absences. A "class" is one class session- some days, there are multiple class sessions. Students are responsible for all missed class material. Students may be subject to limited participation in hands-on practice at the instructor's discretion if they have missed the underlying material needed to safely perform the task at hand.

A warning to the student and student's home university point person may result if the student is absent 12.5% of the total number of class meetings. If a student is absent 25% of the total number of class meetings, the course instructor must notify the Registrar's Office which will initiate the withdrawal of the student from the class with a grade of WF (Withdrawn-Fail).

### **Grading Scale:**

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93-100%	= A	73-76.99%	= C
90-92.99%	= A-	70-72.99%	= C-
87-89.99%	= B+	67-69.99%	= D+
83-86.99%	= B	63 -66.99%	= D
80-82.99%	= B-	60- 62.99%	= D-
77-79.99%	= C+	59 and below	= F

### **Assignments and Points**

Students can earn a maximum of 100 points (= A) during the course. Grades will be computed as follows:

- Class attendance and participation 10%
- Field/lab project participation 25%
- Presentation 25%
- Journal 25%
- Exam 15%

### Attendance/Participation

You are expected to attend all classes and all field trips, labs or other course related events. Readings need to be done in advance of the class to which they apply. You are expected to actively participate in discussions, making reference to assigned readings and materials. In the field you will be assessed on your attentiveness, ability to demonstrate skills, careful collection of data and completion of data sheets, responsibility for personal and group safety/security, and respect for the local fauna and flora around you. This course emphasizes teamwork and your willingness to engage in group work will be reflected in your participation grade.

### Class Participation

Throughout this course, instructors will assess students on their participation in labs and activities both in and out of the classroom. To do well on this assessment:

-Be sure to do your best in all labs and activities and complete corresponding handouts and pages in workbook

- Be an active and engaged participant (pay attention during class, volunteer answers, ask questions, etc)
- Be a team player and be helpful to your peers and instructors both in and outside the classroom
- Be prepared and on time for all activities

Please note: this is not an exclusive list. A student's behavior, attitude, and actions throughout their program may have an impact on their Participation and Performance Score.

### Presentation

Each student is required to prepare a short presentation, lasting no more than 15 minutes, including time for a few questions. You will develop your PowerPoint presentation prior to arriving in Belize. Approved topics are listed below, and topic selection will be on a first-come-first-serve basis. Each student will submit a first choice and second choice option to the course instructor by email and you will be notified as to your topic quickly. Presentations will be given on available evenings spent at the island field station and will be followed by a discussion period. You will be responsible for finding your own resource materials (*use the internet and/or library*) and are expected to include a bibliography as a last slide of your presentation. A rule of thumb on presentations is roughly one information slide per minute, or three to five simple photo slides per minute. Considering that your presentation will be about 10 minutes with 5 minutes for questions, you should keep your presentation to about 10 to 15 (if some of them are just photos) slides.

### TOPICS

Coral symbiosis / Fish cleaning behavior / Marine Protected Areas / Coral Bleaching  
Barrier Reef structure / Sponges / Annelids / Mollusks / Arthropods / Echinoderms

Species analysis of any one of the following:

Green Turtle / Nurse shark / Manatee / Blue Tang / Moray Eel / Spiny lobster

### Final Exam

There will be an exam during the course (see lecture schedule and assignments). Expect a combination of essay, short answer questions, multiple choice, fill in the blanks, and diagrams to label. The exam must be taken on the scheduled date; failure to show up for an exam will result in a zero being awarded. The exam will be comprehensive and should take between 2-3 hours to complete. You will be taking the exam while lying in a hammock, sitting beneath a sea grape tree or lounging on a porch or pier overlooking the Caribbean. It should be low stress.

### Journals

Students are expected to keep a journal during this course. Use a sturdy notebook that is comfortable to write on in the field. Journals include notes on classroom lectures, field lectures, any field observations, thoughts and ideas related to field activities, drawings, maps, and any other recordable information the student considers relevant. Part of each evening should be spent summarizing your day and putting it in perspective. Toward the end of the course you will be asked to submit your journal to the instructor. Once all journals have been reviewed, your journal will be returned to you on the last day of the course.

### Field/ Lab Participation

The field component of this course is very important. Typically, we invest six to eight hours in the field, one hour in class and some days an hour in lab during a day. This represents about eight to ten hours of time, varying from one day to the next, that you as a student are expected to invest. Full participation by students is expected unless medical or other serious reasons arise that preclude your involvement. Health and safety concerns override all other issues on field trips and each participant is expected to abide by the policies of CELA. This is a water-based course and each student must be a good swimmer or wear a life jacket at all times while on the boat or in the water. The buddy system is mandatory for all aquatic excursions, hikes, night walks and other similar activities. During the planning, preparation and execution of field trips each participant is expected to make observations, ask questions, take notes, record data, work instruments, collect samples, document conditions, help carry stuff and have fun.

There are a variety of field activities on which to focus. Field activities will be selected from but are not exclusive to the following list, depending on the availability of field equipment and weather conditions. Other activities may be offered and some activities in this list might not be feasible, but you will be advised on these changes upon arrival to the stations.

- **Pool work.** Part of the first day will be used to check out equipment, develop skills and learn advanced techniques for working in the water.
- **Snorkeling** will be the main activity (time wise) through which the class will explore, learn, and collect data. Habitats will include back reef, patch reef, turtle grass beds and mangrove biomes. Surveys will be conducted on fish, corals and other invertebrates.
- A **Nocturnal Plankton Survey** will be used to determine the composition and extent to which plankton collection at night can be used in the fish rejuvenation project under development.
- A **Night Beach Seine** will be conducted to learn the technique and determine the composition of the near shore fish communities.
- A **Mangrove prop-root epibiont survey** will be conducted to enable tracking of an area called “the mangrove isles”. Data will help to gain an understanding of seasonal variation in this community. Mangroves in Belize are under threat from an invasive isopod first discovered at Carrie Bow Caye. We will document its presence and record island structure to enable tracking of deterioration.
- **Terrestrial vegetation and beach survey.** On a barrier island such as Ambergris Caye the entire island strongly influences the reef and surrounding waters.
- **Coral disease and bleaching survey.** Corals of Belize and around the world, are challenged by increasing water temperatures and pollutants. Photographic documentation will be made of disease and bleaching damage found during snorkeling trips. Continued documentation by other classes will enable tracking to determine long term trends.
- **Marine fishes and large invertebrate survey.** We will be recording fish and large invertebrate sightings on each snorkel and compiling sighting information on a master list during the course.

Throughout these efforts all of us who have cameras will be taking photographs, with the best photographs for each species being retained for the course report (credit of the photographer

given for each photograph used). A final draft of the report will be emailed to each student after the course is complete.

### **Time and Commitment**

Class sessions and volunteer activities will take up a large portion of your day. This course will cover a large volume of terms, techniques, and information. We expect that you will find the time you invest to be productive and helpful, both in this class and going forward.

### **Supplies**

You will need proper snorkel equipment to get the most from this course. Good equipment is not inexpensive but relative to other costs it is a small price to pay. We recommend either “Mares” or “Cressi” brands. Other brands may look similar but do not perform as well. **You will need a mask, snorkel and fins.** Do not buy short fins (<15 in.). They do not give adequate propulsion. 15 to 22 inches are preferable. Do not buy full face masks that enclose eyes, nose and mouth. A standard dive mask is required. One model does not fit all. The size and shape of your face is important. A small face calls for a low-profile mask. A large face requires a high-profile mask usually with side lens panels. This type of mask has the advantage of better peripheral vision but will leak with small faces. If you have a local dive shop to go to it is best to visit there but do not buy. Just try on different masks then buy that model on-line more cheaply. A good test of mask fit is to put the mask to your face without the strap in place and breath in through your nose. If the mask seals it will stay on your face due to the suction produced. If the mask you choose presses against your forehead between your eyebrows it is too small and will be uncomfortable. For personal advice you may contact the professor directly. However, we often have some extra equipment for those whose best efforts at selection have failed. For snorkels, most work fine but the simpler, the better.

**A terrestrial flashlight is required.** We will provide dive lights for night dive only. Also **bring reef safe sunblock** (google it) and bug spray. A hat, sunglasses and beach towel are highly recommended. Have some tight-fitting clothing, maybe lycra, that can be worn in the water if sunblock fails. Don't plan to walk barefoot. We hesitate to require underwater, digital cameras due to their cost, however, they will be most helpful and give you remarkable memories and tales to share.

### **Technology**

Please ensure that your phone is off during class sessions.

**COURSE READINGS WILL BE ASSIGNED DAILY VIA OUR ONLINE PLATFORM OR IN-PRINT VIA THE MARINE CENTER LIBRARY.**

### **CELA POLICIES and RECOMMENDATIONS:**

1. CELA is committed to the sustainable development of Belize. You can play a part in that by ensuring that you leave only your footprints behind in Belize. Please do not leave any garbage behind at any classroom or field site. Where you have a choice, CELA encourages students to drink soft drinks from glass bottles (they can be recycled) and not from plastic (they are burned). Please use cloth bags instead of taking plastic bags from stores. Where possible, avoid buying food in Styrofoam containers. Take short showers.

2. CELA values the diversity of its student body, staff and faculty. As such, we are committed to gender-neutral and bias-free language. Everyone is expected to support this policy in written materials and spoken contributions to class sessions.

3. CELA is committed to intellectual and academic honesty. In any assignment, please ensure that you give credit to the original author(s) to avoid any issues of plagiarism.

4. Everyone is expected to participate in the course. Classroom discussions and field experiences benefit from your questions and thoughts.