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Center for Engaged Learning Abroad

TROPICAL MARINE ECOLOGY AND CONSERVATION

Course Number: ENVI 2943
Course offered at Sacred Heart College by CELA
Instructor: Ed Boles, Ph.D., Aquatic Ecologist
Credit: 3 hours

COURSE DESCRIPTION

Tropical Marine Conservation Biology is an intensive, 10-day experiential, systems-ecology course that includes classroom, field, and laboratory components in terrestrial riparian, estuarine and marine ecosystems, with emphasis watershed interconnectivity and on reef/mangrove/seagrass ecology and conservation. This course starts in the upper Sibun River Watershed because to better understand marine ecology and conservation, we must understand something of watershed ecology and conservation. Watersheds collect, store, process, transport and distribute water, sediment, dissolved solids, nutrients, organic matter, living organisms and energy from the landscape to the sea. It is the continual input of all these components into the coastal waters and onto the continental shelves of the world that make most coastal zones, with all of their estuaries, so rich and thriving, so productive, until humans interfere.

As most of Central America, except mountainous areas, Belize has been repeatedly inundated and exposed by rising and falling sea levels, with large portions of the country covered by marine-deposited and alternately river carved karst limestone. We will visit a cave system when we talk about ancient marine ecosystems and the amount of plankton, calcareous algae and reef growth it took to create such large limestone deposits, and how watersheds carry dissolved calcium carbonate back to the sea where new reef structure and sediment layers are continually being built by marine organisms. We will travel a reach of the Sibun River to experience how physical and biological energy is harvested and processed by many different gilds of aquatic organisms. We will be building on themes if energy flow, nutrient cycling/processing, successional community structure and interconnectivity as we travel from the mountains and rivers, through savannas, past mainland estuaries, across the inner coastal lagoon, and the Mesoamerican Barrier Reef out to the edge of the continental shelf that gives way to the open Caribbean Sea.

During our travels, from the time we first board the bus together, we will be looking at and categorizing the various and different activities that ultimately affect our marine coastal and deep ocean ecosystems, extrapolating from Belizean examples to what is happening in our own homelands and around the globe. We will see farms and ranches, small industries, rural communities and urban growth as we travel from inland to the edge of the sea, where we meet the fishers. We will also see conservation areas and learn about the tremendous efforts underway within Belize to conserve its marine wonders, especially the barrier reef and its associated cayes, a UNESCO World Heritage site. From our temporary home on Tobacco Caye, a five acre island of sand perched on the reef, we will explore the mangroves, reefs and grassbeds with mask and snorkel, both day and night, as we compile ecology tables and descriptions. As we look back toward the mainland, to the mountains and watersheds and shoreline estuaries, appreciating the interconnectivity, we will discuss the many conservation challenges and the solutions to those challenges.

COURSE OBJECTIVES

At the end of the course, as a student you should be able to:

- Understand terrestrial and marine ecosystem interconnectivity through the hydrologic cycle, dissolved solids/sediment transport and organic carbon/nutrient transfer;
- Sample a variety of habitats using general ecological field sampling and laboratory methods, array and analyze data, and develop basic descriptions/characterizations of aquatic ecosystems;
- Maintain a good field journal with detailed notes tagged with date/time/place;
- Understand the concept of bio-indicator species and rapid-biological-assessment protocols, and be able to determine general habitat quality using these indicators;
- Recognize the various niches within freshwater to marine nutrient-processing systems and the successional transition of aquatic species occupying these niches;
- Grasp the importance of freshwater macroinvertebrate drift, anadromous and catadromous migration, and marine plankton in species/population distribution and ecosystem energetics;
- Discuss nutrient cycling in marine ecosystems, comparing neustonic, pelagic and shallow to deep benthic communities, and contrasting general nutrient cycling in polar, temperate and tropical open oceans;
- Compare/contrast nutrient cycling in coastal mangroves, island mangroves, beach littoral zones, intertidal zones, seagrass beds, un-vegetated sediments and coral reefs;
- Recognize many marine species from our group-compiled ecology table of snorkel sites and know something of their biology and ecology;
- Snorkel more confidently and comfortably around mangrove roots, seagrass beds and coral reefs;
- Grasp the importance of local, regional, and global environmental concerns and conservation issues affecting tropical watersheds and marine ecosystems, and solutions to many challenges we face;
- Realize our individual and collective responsibilities for not only marine ecosystem conservation and sustainable use of marine resources, but for our common global ecosystems and resources.

COURSE READINGS

Course materials will come from many sources including peer reviewed journals, technical documents, and other sources made available on the CELA e-campus. Many different field guides and keys that shall be required for field work and shall be available in the field station library. Some materials used in this course include:

Nybakken, J. W. and M. D. Bertness. 2005. Marine Biology: An Ecological Approach, 6th edition. Benjamin Cummings, Publisher.

Horneth, M. and M. Loubeyres. 2014. Tropical Marine Ecology: A Field Guide to Belize.

Kricher, J. A. 1999. A Neotropical Companion: an introduction to the animals, plants, and ecosystems of the New World Tropics. 2nd Ed. Princeton University Press

REQUIRED EQUIPMENT

This is a field-based course that requires interaction with local communities, with fresh and salt water, and exposure to sun. The first 3 days week will be based in the upper Sibun River Watershed and the next 7 days at Tobacco Caye (an offshore island sitting on the Mesoamerican Barrier Reef). If you have your own mask, snorkel, and fins, it is recommended that you bring them. If you do not have your own gear, some equipment is available at the field station. An underwater light is very useful, but we will have some lights for the group. Besides your usual personal items, we also recommend you bring:

- Insect repellent

- Sunscreen
- Hat
- Long sleeve shirt
- Long pants
- Appropriate field shoes (water shoes for walking in stream beds are required as well as more supportive hiking shoes)
- Personal medical and first aid materials (a medical kit will be available with general supplies)
- Headlamp/flashlight with spare bulbs and batteries (preferable waterproof- night snorkeling opportunities)
- Backup pocket-size flashlight
- Binoculars
- Camera
- Waterproof pens and/or soft lead pencils
- Small field notebook (waterproof with Write-in-the-Rain paper recommended)
- Flash drive
- Good attitude (bring extra to share)

STUDENT ASSESSMENT

As a student, you can take this course for credit (issued by your home institution, generally for 3 to 4 credit hours) or you can take it for personal development. For those wishing to receive academic credit for the course or for those wishing to receive a grade for the course and the ability to access a letter of completion from CELA showing that grade, the following assignments will make up the elements of the final grade. For those wishing to take the course for personal development, you will be expected to participate actively in all discussions, labs and field work, maintain a field notebook, complete all field work sheets, and to prepare a presentation for the class, but will not be asked to write the final exam and no grade will be recorded for you.

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
• Field notebook/journal	25
• Exam	15

Attendance/Participation

You are expected to attend all classes and all field trips, labs or other course related events. Readings needs 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

There are often two "classroom" sessions each day, usually right after breakfast and right before dinner. These are roughly hour-long (sometimes one and a half hour) sessions that include a group wellness-check, a short topic-focused lecture, a summary of current events, discussion of upcoming activities and address any group-related questions/issues/concerns. You should come to class prepared to participate in discussions and ask questions/contribute information. Additionally there will be micro-lectures scattered throughout each day, topics dependent on the advantages of the settings we are in at the moment and interesting creatures we meet during our adventures.

So be prepared to take lecture notes in your lecture notebook (*not your field notebook described below*).

Presentation

Each student is required to prepare a short slide presentation, lasting no more than 10 minutes, with time for a few questions. You should develop your slide presentation prior to arriving in Belize and save it on a flash drive or email it to yourself. The challenge is to select a narrow topic of interest to you personally, perhaps a specific marine organism or group of organisms, an ecological phenomenon, or a particular impact to our marine ecosystems that most people may not have thought about. You are encouraged to email the instructor, Dr. Ed Boles at edmonkeybay@gmail.com for topic approval and maybe even an article or two on your topic area relevant to Belize and the region. Be sure to put "CELA Marine Course" as the subject so that I can pick it out of other emails. Presentations will be given on the first three evenings spent at the terrestrial 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 (download pdf copies of those references onto your flash drive or device if available) as a last slide of your presentation (2-5 technical references, no Wikipedia). A rule of thumb on presentations is roughly one information slide per minute, or three to five simple photo slides per minute. Less is often more. Give credit to all photographs you use.

Final Exam

There will be an exam near the end of 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 seagrape tree or lounging on a porch or pier overlooking the Caribbean. It should be low stress.

Course Notebook

Everyone is expected to keep an on-going field notebook during this course. This is a very good and basic practice that all field and research-oriented professionals should develop. The field notebook should have a hard cover, be smaller that letter size to fit in pack pockets, lined or unlined (your choice) and preferably waterproof (but not required- alternately you may want to have a thick zip-lock bag or other water proof sleeve for your notebook). You can record all information such as field observations, lecture notes, drawings, diagrams, maps, tracings, rubbings field data, thoughts, reflections, ideas and any other recordable information you consider relevant in this one notebook. Remember to date each entry. This will be a good study tool for the exam. If you like to draw, water color, etc. bring your favorite tools. Some supplies will be available.

Field/ Lab Participation

The field component of this course is very important. Typically we invest two to four hours (sometimes more) in field activities and one to two hours in lab during a day. This represents about six to nine 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 over ride 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 in the boat. The buddy system will be 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. We shall all be participating in and contributing to development of a taxonomic inventory of each site and maintaining taxonomic lists both in our field books. Students are strongly encouraged to review guide books after each field trip and identify those species seen with certainty. Additionally, we concentrate on sampling and describing the taxanomic assemblage of components of the aquatic ecosystems that seldom receive attention. Each student has the opportunity to focus on one of these areas, working together with others, depending on the class size. Each group is responsible for gathering any field data related to their specific project activity, sorting samples in the laboratory, compiling a labeled reference collection (consisting of photographs) and developing tables for all taxa identified. Identifications for many organisms may be at the family level or even higher and ecological information may be unknown, but this effort will build on former efforts and be used by future students who shall build on and refine the list. 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.

- **Freshwater biota survey** – During interaction with streams and rivers, we will be conducting aquatic macroinvertebrate sampling, visual freshwater fish encounter surveys, and keeping a wildlife sighting list (amphibians, reptiles, birds and mammals).
- **Community interviews** – Whenever there is an opportunity and a cooperative community member willing to talk about local resource use/conservation concerns, we will conduct informal interviews, most involving local fishers, farmers, and folks in the tourist industry.
- **Plankton survey**- This very important but patchy component of marine ecosystems differs greatly from one area to the next, from day and night and from season to season. However, very few surveys have been conducted. This effort involves a comparison of plankton tows collected from a mangrove lagoon and from over the reef area and a comparison of samples collected during the daytime and at night from both sites. Limited by the availability of taxonomic keys, many organisms cannot be identified below the family level. However, a taxonomic list will be developed, taxa richness estimates developed, most abundant taxa recognized and percentages of holoplankton and meroplankton determined.
- **Grassbed epiphyte and epizooid survey**- Grassbeds have received significant research attention, but there is much to be learned about these diverse communities. Comparison of epibionts from grassbeds within more exposed areas behind the barrier reef will be compared to grassbeds in more protected lagoons.
- **Drift line biodiversity survey**- investigation of the macroinvertebrate assemblage associated with the detritus line made up largely of seagrasses and macro-algae reveal an interesting and little investigated community important in nutrient processing within the intertidal zone. We shall compare drift line samples collected from a couple of different areas, an open shoreline and a more protected shoreline, develop a taxonomic list of invertebrates and describe composition of the detritus material.
- **Shell hash biodiversity survey**- substrates of coral and shell rubble harbor a diverse community of brittle stars, anemones, small crabs and a host of other organisms. Rubble beaches may harbor a high diversity of marine life that is poorly known. This effort will shed light on the potential importance of these areas.
- **Mangrove prop-root epibiont survey**- Plants and animals growing on red mangrove prop-roots have been studied and are recognized as important nursery areas for many commercial marine species. However, there is still much to learn about the composition of the assemblage and zonation of epibionts on the roots related to tidal rise and fall, some organisms being able to survive exposure during low tide.
- **Sargasso weed communities**- Large patches of Sargasso weed are floating islands of many interesting organisms. Netting some of this algae and holding it in a tank for a period of a few hours reveals a diverse assemblage of bryzoans, anemones, gastropods, crustaceans and even algae.

- **Intertidal sandy beach infaunal survey**- coral sand beaches are typically small and patchy within the Mesoamerican reef area, but contain an infaunal assemblage that is important in the processing of buried detrital material. Communities show changes along a gradient from sub-tidal to supra-tidal and annelids, as in soils, play a key role in detritus processing.
- **Coral disease and stress survey**- Corals of Belize, as around the world, are challenged by increasing water temperatures and pollutants. Photographic documentation of diseases found during snorkeling trips and, when possible, identification of conditions noted would contribute to our awareness of this threatening phenomenon.
- **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.

Summary

The course consists of about 90 hours of contact time over a 12 day period. See the daily schedule for details of activities. The course time is roughly divided as follows:

- In class (lecture/discussion/presentations/small field lectures) = 25 hours
- Laboratory time = 15 hours
- Field work = 50 hours
- Total = 85 hours actual time

Considering the standard formula of 1 hour of lecture time equating to 1 hour of contact time, 2 hours of lab time being equal to 1 hour of contact time and 3 hours of field time equal to 1 hour of contact time, total contact hours for evaluating academic credit is estimated to be **57.5.**

DAILY COURSE SCHEDULE – *Subject to change*

This is a detailed schedule showing what you can expect each day. This itinerary starts at TREES when you meet the course instructor and does not contain the first two days during which you will be staying in San Ignacio. This itinerary is not set in stone as nature and other circumstances are not always predictable and plans may have to change to adapt to or take advantage of a changing situation. However, we plan to implement this schedule as it is seen here, while expecting some changes along the way.

DAY	SCHEDULE	NOTES
1 Dec 26	Arrive at BZE Int'l airport and transport to San Ignacio	• Arrival Day
2 Dec 27	**5:30-** Arrive at TREES in late afternoon and settle into rooms **6:30-** Dinner **7:30- Lecture 1**- Introduction to Belize **8:30-** Optional night walk	• CELA course info session and TREES Hosting Center introduction with orientation of property. • **Lecture 1**- Short introduction to Belize, general geology, geography, ecosystems, protected areas and our plans • Optional night walk around promises or free time to work on presentations in the evening and get to know people in the course, guide, instructor and staff

3 Dec 28	**5:30-** Early morning birding- optional **7:30-** Breakfast **8:30- Lecture 2** **9:30**- Break **10:00**- **Lecture 3** **12:00-** Lunch **1:30-** Afternoon hike **5:00-** Group wellness check and first student presentations **6:30-** Dinner **7:30-** First set of student presentations, and review of next day itinerary **9:00-** Night walk or snorkel, optional	• **Lecture 2**- Introduction to Tropical Marine Ecology and Conservation, what a watershed is and does, and interconnectivity between terrestrial and marine ecosystems through the global hydrological cycle. • Introduction to field notebooks. • **Lecture 3**- Introduce sediment/dissolved solid transport and to detritus processing and associated niches • Afternoon hike to the headwaters of Dry Creek in the Sibun Forest Reserve and introduction to field tropical riparian ecology (*scoping a rapid assessment site*). • First set of student presentations (5 or 6) given after dinner, 15 minutes each including questions (format provided) • Option for a night walk or river snorkel (about 1 hour)
4 Dec 29	**5:30-** Early morning birding- optional **7:30-** Breakfast **8:30-** Group wellness check **Lecture 3** **9:30-** Second set of student presentations **11:00-** Lunch will be early **1:00-** Dry Creek Field effort **2:00- Lecture 4** **6:30-** Dinner **7:30**- short aquatic macroinvert lab **9:30**- Night snorkel optional	• **Lecture 3**- Issues and Consequences of Humans Living in Watersheds. Cumulative impacts of all terrestrial human activities must ultimately be absorbed by marine ecosystems especially when riparian forests are removed • **Lecture 4**- Streamside discussion on rapid assessment protocols, ecology tables (common/ scientific names, ecological information-habitats, food, predators, particulars) • **Field Activity**- rapid assessment exercise in Dry Creek to conduct habitat characterization, macroinvert/fish information for ecology tables • **Lab**- identification and photography of aquatic macroinverts using digital microscopes
5 Dec 30	**6:30-** Begin packing for departure to Tobacco Caye **7:30-** Breakfast **8:30-** Depart for Dangriga, briefly stopping along the way to discuss land use issues and human impacts **11:00-** catch the boat for Tobacco Caye **12:00-** Lunch at Tobacco Caye **1:00-** Room assignments and orientation to Tobacco Caye **2:30**- Snorkel school off of the sandy beach and first grassbed snorkel **5:00-** Group wellness check, **Lecture 5**, brief review of next day's activities **6:30-** Dinner **7:30-** Night walk around the island	• Introduction to Tobacco Caye- Largely owned by Creole Belizeans who share family ties and long histories with this 5 acre patch of sand sitting atop the Mesoamerican Barrier Reef. We may be sharing the island with another group or two, but overall this is a very small island community. • **Lecture 5**- Introduction to Marine Ecology. Division of marine world into ecological units based on light, temperature, inputs (terrestrial/watershed, ocean surface currents and upwellings, with a focus on mangroves, grassbeds and reefs. We will also talk about snorkeling rules and review the snorkel plan for our time on the caye. • **1st Snorkel**- grassbeds and docks on west side of island after everyone checks out with use of mask and snorkel, first entry onto fish and invertebrate ecology table. • The night walk involves photo opportunities for littoral zone nocturnally active semi-terrestrial and sea creatures

6 Dec 31	**6:00-** Coffee for early risers **7:30-** Breakfast **8:30-** Wellness check, **Lecture 6**, show ecology table and review of the day's plans **10:00-** 2nd group snorkel **12:00-** Lunch **1:30-** Mangrove visit, 3rd snorkel **5:00-** Group wellness check and **Lecture 7** **6:30-** Dinner **7:30-** work on ecology table, identifying fishes seen using keys and adding the common and scientific names to the list, along with ecological information (habitats, food, predators, particulars) **9:00-** Night snorkel to look for green moray eels, octopus, small groups	• **Lecture 6**- Mangal Forests and Intertidal Mud Flats of the Tropics. Describes structure, functions, services and biodiversity of mangroves both on the mainland coasts and on islands separated from the main influences of watershed discharge. • **2nd Snorkel**- this will likely be over the reef just on the southern end of the island. This is a small, but healthy reef patch that we will access from shore. Because it is so close, this will become our recreational snorkel spot. • Visit mangrove island, walk in the mangroves, take a short sediment core, identify tree types, spot insects, crustaceans, reptiles and birds associated with mangal forests. • **3rd Snorkel**- slow, quiet drift-snorkel around the edge of a mangrove-lined lagoon, exploring the underwater prop-roots of red mangroves • **Lecture 7**- Grassbeds and Un-vegetated Sub-tidal Sediments. Discusses structure, functions and ecology
7 **Jan 1**	**HOLIDAY**	• **OFF**
8 Jan 2	**6:00-** Coffee for early risers **7:30-** Breakfast **8:30-** Wellness check, **Lecture 8**, review of the day's plans **10:00-** Shoreline/plankton field/ lab **12:00-** Lunch **1:30**- 4th Snorkel **5:00-** Group wellness check and **Lecture 9** **6:30-** Dinner **7:30**- continue lab time, night time plankton tow **9:00**- 5th Snorkel (optional), night time plankton tow	• **Lecture 8**- Coral Reef Ecology. A rapid view of complexity, diversity, nutrient cycling, energetics and carbon sequestration in these ancient ecosystems, drawing comparisons of Pacific/Atlantic reef diversity • **Shoreline/Plankton Sampling**- Work in groups to sample and photo-document organisms in littoral zone habitats (drift lines, shell hash, sandy beaches, wood) and collect a set of plankton daytime samples from snorkeling in pairs • **4th Snorkel**- Reef channel or patch reef south of channel, depending on waves, tide and weather • **Lecture 9**- Plankton Dispersal and Interconnectivity. This genetic and energetic mechanism interconnects remote ecosystems that may sometimes be an ocean apart, harbors a high diversity of marine organisms and can tell us a lot about the state of our marine systems • **Lab**- work on ecology table, examine/identify photograph plankton and littoral fauna with digital microscope • **5th Snorkel**- We will go in small groups in a shallow cove to find green moray eels, octopus and other nocturnal creatures, going in small groups, about 30 minutes each

9 Jan 3	**6:00-** Coffee for early risers **7:30-** Breakfast **8:30-** Wellness check, **Lecture 10**, review plans **10:00-** depart for all day snorkel trip **11:00-** 6nd snorkel **12:00-** Lunch **1:30-** 7th snorkel **3:00-** 8th snorkel **6:30-** Dinner **7:30-** update ecology tables **9:00-** 9th Snorkel	• **Lecture 10**- Structure and Functions of Open Oceans. Takes in the larger, global perspective of marine ecosystems, those that occupy most of Earth's surface and of which we know least about-the open oceans. • **6th Snorkel**- maybe Whale Shoals or another reef area • **7th Snorkel**- either reef or mangrove • **8th Snorkel**- either reef, mangrove, or tidal channel • Remember to update the sighting list for each of our snorkel spots, but otherwise the evening is open to relax. • **9th Snorkel**- night snorkel over grassbeds west of the island looking for snake eels, puffer fishes and other creatures
10 Jan 4	**6:00-** Coffee for early risers **7:30-** Breakfast **8:30-** Wellness check, **Lecture 11**, review plans **10:00-** 10th group snorkel **12:00-** Lunch **1:30-** 2nd work in grassbeds **5:00- Lecture 12** **6:30-** Dinner **7:30-** work on ecology table, and lab activities **9:00-** 11th Snorkel (optional)	• **Lecture 11**- Human Impacts on Marine Ecosystems. Reviews a wide range of human activities related to marine ecosystem degradation and ties us in personally • **10th Snorkel**- Possibly the spur and groove out front depending on conditions, photograph coral • **Field effort**- Working in grassbeds. Each of 3 groups will lay out transects, snorkel survey by data sheet for comparison and ample cores for lab work • **Lecture 12**- Invasions of Pathogens, Parasites and Predators and Other Ecosystem Modifiers • **11th Snorkel**- patch reef off the southwest end of the caye.
11 Jan 5	**6:00-** Coffee for early risers **7:30-** Breakfast **8:30-** Study break **9:**30- Begin exam **12:00-** Lunch **1:30-** 12th and last snorkel **5:00-** Group wellness check and lecture **6:30-** Dinner **7:30-** finish up work on ecology table, **9:00-** Last opportunity for an night snorkel	• Study break is an opportunity to ask questions, clarify concepts, review your notes and prepare for the exam • The Exam will take about two hours and can be taken wherever you find a comfortable spot away from the others. Instructor will make rounds any answer questions. • **12th Snorkel**- Group choice, but must be near the caye. • **Lecture 13**- Global Warming and Global Marine Systems. This is a view of the most important challenge facing humanity and the Earth, its impacts and potential impacts to marine ecosystems and the impact of solutions proposed
12 Jan 6	**7:30-** Breakfast **8:30-** Early morning departure from Tobacco Caye **9:00-** Visit Bird Caye, a rookery **12:00-** Packed lunch, depart for San Ignacio Possible stops in route	• Begin packing early, before breakfast, of if you packed the night before, we may have time for one last snorkel. • We will stop off at Bird Caye on our way to town, a mixed rookery of Man-o-War and Brown Boobies, a good photo opportunity • We may stop at a lime kiln and visit St. Herman's Cave on the way back to San Ignacio
13 Jan 7	**7:30-** Breakfast, hand in your field **8:30-** Begin Exam **10:30-** Presentations **12:00-** Lunch **1:00-** Canoe trip on Macal River	• Hand in your field notebooks for evaluation by the instructor while you are taking the exam
14 Jan 8	**Departure for Int'l Airport**	• Time TBD

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). Belikin and Stout beer bottles are recycled but Lighthouse bottles are not. Please use cloth bags instead of taking plastic bags from stores. Where possible, avoid buying food in Styrofoam containers.
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.