OUTLINE OF SCHEDULE AND ACTIVITIES*
MARINE BOTANY MAYMESTER-MEXICO, MNS 352D
Location: Akumal, Mexico (May 18-June 5 2011)

Note: we will have the final lecture meeting(s) on our return. Students will deliver presentations on specific group projects. The final meeting is tentatively scheduled for Wednesday, 15 June in Port Aransas (and Austin via video link). This course is mainly designed for upper division undergraduate students in the College of Natural Sciences, or students with strong backgrounds and interest in marine science.

Register fall 2010 for MNS 352D and UGS 119 (Scientific Research and Inquiry). Both offered Spring 2011.

Instructor: Dr. Kenneth Dunton (ken.dunton@mail.utexas.edu)
Phone: 361-471- 6744 (Marine Science, Port Aransas)
Co-Instructor: Dr. Stein Fredriksen (Norway); TA's: Kelly Darnell/Nathan McTigue

This course is entirely focused on the ecology of Caribbean coral reef and seagrass communities of the Yucatan Peninsula with special emphasis on the marine vegetation. Our research and learning goal is to understand the effect of anthropogenic inputs of inorganic-nitrogen on tropical seagrasses, algal turfs, and the overall coral reef/coastal ecosystem.






***revised 15 May 2011**

Marine Botany, MNS 352D

Course Description: **Restricted enrollment; contact the department for permission to register for this course. Prerequisites: Upper division standing; Biology 311D; and one of the following courses: Biology 322, 324, 328, Marine Science 320, 352C; and three additional semester hours of coursework in biology. Field work includes a 19-day field trip to Akumal, Mexico (18 May – 5 June). Final class meeting 15 June, 2011.**

This course will focus on the ecology and vegetation of Caribbean ecosystems on the Yucatan Peninsula (Quintana Roo), including coral reefs, seagrass beds, and mangrove communities. Our studies will also include how anthropogenic impacts from increased tourism have affected coastal watersheds and the functioning of these unique ecosystems. Students will participate in lectures and field exercises based from a site on the Riviera Maya at Centro Ecológico Akumal (CEA or the Akumal Ecological Center) in Akumal, Mexico. Instructors include Dr. Ken Dunton (UTMSI), Dr. Stein Fredriksen (Univ. Oslo), Research Associate Susan Schonberg, and class TA's Kelly Darnell, Nathan McTigue, and Mike Gil. Kelly and Nathan are Ph.D. graduate students in Ken Dunton's lab. Mike Gil is a Ph.D. student in coral reef ecology at the University of Florida, a 2008 UT-Austin graduate in Marine and Freshwater Biology (MFB), a Dean's Honored Graduate in the College of Natural Sciences, and a member of the 2007 Akumal class. Other guest lecturers include Dr. Paul Sanchez-Navarro Russell (CEA), Dr. Brigitta Tussenbroek, marine botanist and Unit Manager from the Institute of Marine Sciences and Limnology (ICML) at Puerto Morelos, and visiting faculty from UTMSI, including Dr. Luiz Rocha. The course will include site visits to examine the vegetation and structure of coral reef, seagrass, and mangrove environments. Topics will be covered from an interdisciplinary perspective; our measurements of water quality, plant community structure, species composition, and sediment parameters will be used by CEA and other organizations to develop management and conservation policies of these unique systems. The Riviera Maya is under immense pressure from tourism; however, CEA has emerged as a leading advocate for environmental protection of the area through focused educational efforts. We can help CEA by providing invaluable data on the effects of nutrient inputs from groundwater pollution that originates from wastewater seepage into the porous limestone that underlies the Riviera Maya.

Our class will be initially divided into three groups of 7 students. Each group will receive an overview on each of the three basic topics: subtropical seagrasses, the algae of coral reefs, and the water chemistry of inland and coastal habitats. Students will spend mornings in the field, working in shallow waters from the shore or small boats. Work within each habitat will occur over a 2-day period and each group will be directed by one of the course instructors. Following the completion of the three modules (six-day total), students will divide into seven three-member research teams and begin conducting their approved field studies under the direction of an instructor. Field notebooks and underwater slates will be provided. Measurements and interpretation of environmental parameters (e.g. light attenuation, temperature, salinity, inorganic nutrients, pH, and dissolved oxygen) will be performed using modern instrumentation and computers. We also provide new compound and dissecting microscopes for algal and invertebrate identifications. Students will work together in making observations, collecting field data, performing lab work, and synthesizing their observations. A considerable amount of time will be spent in the water. Afternoons and evenings are spent performing laboratory work, participating in discussion groups, or attending lectures. Following our return from Mexico, we will have one final class meeting (tentatively scheduled for the evenings of 8 and/or 15 June). The final lectures will feature brief presentations by student teams on the results of their focused research. Students can attend the final class meetings in linked video classrooms at UT-Austin or UTMSI in Port Aransas. Please note that this course does fulfill part of the Basic Education Requirement in writing based on field and laboratory data collected for detailed journal entries and the final research paper.

This course is designed to provide research experiences to upper-division undergraduate students. The course was first taught in May 2005 with 17 students. The samples and data gathered by the students and instructors resulted in the publication of a journal paper entitled*: "Isotopic and elemental indicators of nutrient sources and status of*

coastal habitats in the Caribbean Sea, Yucatan Peninsula, Mexico", which was published in the *Journal of Coastal and Estuarine Science* in 2007. A second journal paper "*Origins and Fate of Inorganic-Nitrogen from Watersheds to Coastal Ocean on the Yucatan Peninsula, Mexico"*, based on data collected by students in the 2007 class, was just published in 2010. **Both papers (posted on Blackboard) are REQUIRED reading by all students in this course**. Unfortunately the 2009 trip to Akumal was cancelled within two weeks of departure because of fears relating to the H1N1 epidemic and moved to Puerto Rico. We plan to prepare a third publication on the Riviera Maya ecosystem that focuses on trophic structure based on data and samples under our collective efforts in May/June 2011. We highly encourage students to develop independent research projects (individual or small group) for additional credit or to satisfy requirements of other UT interdisciplinary programs (e.g. Bridging Disciplines Program (BDP): Environment or the new Environmental Science Degree). We will have a minimum of six instructors that can provide mentorship and assist with logistics.

Course Syllabus

Field and Laboratory Research Journal: Students are required to maintain a detailed field and laboratory journal that details their activities, observations, and data collecting efforts. Information on the content and format of journals will be provided at the beginning of the course. Emphasis is placed on an understanding of the effects of nitrogen loading and other anthropogenic disturbances on the water column and on the production ecology and trophic structure of seagrass beds, coral reef, and macroalgal communities.

Program Design and Habitat Modules:

One of our overall objectives is to evaluate the effects of anthropogenic activities on the submerged macrophyte communities of the northern Yucatan Peninsula coast in the Caribbean Sea. We will focus our comparison on the vegetative communities at two sites, Akumal Bay (adjacent to our hotel) and Xaak Bay, a beautiful pristine lagoon about 20 minutes by boat north of Akumal. Field work on seagrasses and macroalgae will be conducted in both lagoons. However, we will have the flexibility of visiting additional sites as time and interest permits (this includes Sian Ka'an Reserve, 45 minutes south of Akumal). The Sian Ka'an Reserve will be an all day field trip. Otherwise, field work will generally take place in the morning with lab work in the afternoon.

As stated above, each group of 7 students will initially rotate through three class modules. The day-to-day activities associated with each 2-day module are summarized below. Following the modules, focused field research will commence until the end of our stay in Mexico. We will also set aside days for exploration or cultural activities.

Seagrass Module (Kelly Darnell/Mike Gil)

Day 1: *Xaak Bay* (pristine site). Travel by boat. In situ measurements of water quality (i.e. various environmental parameters as listed above) and seagrass characteristics. Collect seagrass samples for subsequent quantitative analysis of biomass, shoot density, leaf chlorophyll content and epiphyte composition and abundance.

Day 2: *Akumal Bay* (anthropogenic site). Same measurements as described above.

Macroalgal/Coral Reef Module (Stein Fredriksen/Nathan McTigue)

Day 1: *Yalku Lagoon*. Travel by vehicle or bicycle. *Yalku Lagoon* is an extraordinary beautiful lagoon characterized by fresh water inflows from groundwater inputs. Extremely good for snorkeling and characterized by a diverse algal flora and coral reef community on the outer edge. We will collect algae and in situ measurements of water quality along the estuarine gradient in this lagoonal system.

Day 2. Akumal Bay and Xaak Bay. Travel by boat. Synoptic quantitative measurements of drift macroalgae, seagrass epiphyte species composition and environmental parameters in both bay systems to assess the effects of anthropogenic activities. Our focus will be on the seaweeds growing around seagrass beds and the coral reefs.

Water Chemistry Module (Ken Dunton)

Day 1. *Caleta Yal Ku Chico*. Travel by boat. This is a relatively small lagoon that is dominated by groundwater inflows that originate in the Akumal area. It is bordered by dense mangroves communities. Sampling here will primarily include the measurement of biogeochemical properties of the sediments and water column.

Day 2. *Casa Cenote* (and other local cenotes). An all day field trip (includes hiking) to well known Casa Cenote to a host of other poorly known cenotes that are known only to the local inhabitants and never visited by tourists. Some of these are located deep in the jungle on trails.

Tentative Schedule:

18 May (Wednesday):

Late afternoon arrival in Cozumel followed by escorted ferry transit to Playa del Carmen and vehicle transport to Akumal
Late Afternoon Orientation: Facilities Tour, Course Logistics and Organization.
Dinner at 1830

19 May (Thursday) Morning Orientation:
Medical and Health Issues; Field and Lab Safety Procedures and Protocols (Course Instructors)
Swim tests in the pool and snorkeling check-out, exploration of Akumal reef system

Introductory Mini-Lectures: Mini-Lecture*: An Introduction to the Akumal Ecosystem*, by Dr. Paul Sanchez-Navarro Russell (CEA); *The Benthic Fauna and Flora* by Dr.Stein Fredriksen
Dinner @ 1830

20-26 May
0630 Breakfast
0700-1230 Field Work (by module)
1230-1330 Lunch
1400-1600 Lecture and Research Team Presentations
1830 Dinner
2000 Research Team Gatherings

26 May (Thursday)
Quizzes in morning; free time in afternoon for independent study or personal free time (eg. Reef exploration, Mayan Ruins at Tulum, etc.). Dinner at 1830.

27 May (Friday)
Free Day. Dinner at 1830.

28 May to 3 June with exception of a class free day (date TBD)
Conduct focused field research studies. Dinner at 1830. Afternoon class gatherings from 1400-1600.

3 June (Friday)
Data synthesis. Dinner at 1830.

4 June (Saturday)

Free day for student-selected activities following submission of journal, completion of laboratory clean-up, etc. Dinner at 1830.

5 June (Sunday)

Early morning to afternoon departures to Playa del Carmen for ferry transit to Cozumel Airport and home (breakfast on your own)

15 June (Wednesday)

Final class meeting; brief presentations of independent research projects or assigned student-led group discussions: Held in Port Aransas with connection to UT-Austin classroom via video link at 1900.

Some Afternoon Discussion Topics (mini-lectures and student led discussions of their research):

Seagrasses: Biology and Ecology
Algal Taxonomy, Morphology, and Ecology
Algal Life Cycles
Abiotic Factors, Photosynthesis, and Plant Growth
Coral Reef Ecosystems
Coral Reef Fishes
Tropical Mangrove and Seagrass Ecosystems
Ecosystem Structure and Function
Food Webs and Trophic Interactions
Conservation, Management and Human Disturbances

Possible Day Field Trips

Cozumel. Travel by ferry from Playa del Carmen. We'll visit the pristine coral reefs of Cozumel to examine the qualitative and quantitative differences in turf macroalgae that inhabit the reef system.

Sian Ka'an Reserve. Travel by vehicle. This is an all-day field trip to examine the zonation and ecological characteristics of a pristine and enormously productive subtropical ecosystem. Sampling of biogeochemical and water column properties is critical. Collection of biota is not allowed in the reserve.

Grading and Evaluation:

Final course grades are based on quizzes, on-site field practical's, a presentation, a written report, and your journal:

(3) Field Practical's @ 5% each (15%)
Written Field and Laboratory Journal (35%)
Group Final Presentation (15%)
Written Report (35%)

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***Faculty*:** Ken Dunton is a marine ecologist whose research focuses on the role of marine plants as carbon sources in marine food webs from the Arctic to the Antarctic. He teaches both graduate courses and undergraduate courses in the Department of Marine Science. He has also taught an undergraduate course for the University of Alaska in Tropical Coral Reef Ecology in 2001 and 2003 (in Fiji). He has been teaching field oriented summer courses at UTMSI continuously since 1988 (Marine Botany and Estuarine Ecology). He taught this course with friend and colleague, professor Stein Fredriksen (Univ Oslo) in Akumal in 2005 and 2007, and in Puerto Rico in 2009.

Course Logistics

Air Travel to Cozumel: For their flexibility, students are expected to make their own travel arrangements. Round-trip airfares to Cozumel range from $450-$550 from Austin, Houston, or Corpus Christi. Students must arrive in Cozumel by the afternoon of 18 May; the field component of the course ends the evening of 4 June 2011, with departure on 5 June.

Accommodations in Akumal: We have arranged very nice accommodations at the *Hotel Club Akumal Caribe.* The *Akumal Caribe* offers individual bungalows, surrounded by lush tropical gardens just steps from the beach. The bungalows are air conditioned, contain private showers, a mini-refrigerator, and can sleep 2 people. They are very nice.

Meals in Akumal: We will have two kitchenettes stocked with food for breakfast, lunch, and snacking. Students will also be provided with a modest per diem allowance for occasional meals on their own. We have made arrangements to have most of our dinners in the Pueblo, at the El Ultimo Mayo restaurant, at 1830. Meals will feature traditional local foods, prepared by people who have strong Mayan heritages. We'll also eat occasionally at restaurants in Akumal. The costs of all meals are included in the course fee.

Jellyfish and Sea Lice Protection: Between March and September there is an increased risk of being stung by Sea Lice, a type of jellyfish common in the Gulf and Caribbean Sea. There is a new product called *Safe Sea* that offers both UV and Sea Lice protection. My colleagues that work in these areas strongly advise using it. See www.nidaria.com for information on ordering.

DAN (Divers Alert Network) Insurance: Strongly recommended for anyone snorkeling or intending to SCUBA dive. See: http://www.diversalertnetwork.org/index.asp

Health Preparations: Before acceptance, you must begin the UT UHS Travel Health Program Online counseling. Initiate this process as soon as possible. http://www.utexas.edu/student/health/promotion/travel.html

Students need to fill out a medical report when accepted into the class. http://www.utexas.edu/student/abroad/ccs/medical.pdf. Make an appointment with your doctor or a UT doctor for advice on recommended inoculations and for any medical updates. Before seeing the doctor you need to complete and sign the student side of the medical report. The other side of the medical report needs to be completed by the doctor.

Passports: Students must have passports—it is now a requirement to enter Mexico. Passports are good for 10 years and are necessary if you plan to travel down to Belize before or after the class. Go to http://travel.state.gov/passport/passport_1738.html or consult the UT Austin West Mall Post Office (which can also expedite its processing for an additional fee.)

General Information: Credit and debit cards are NOT widely accepted in Mexico. In big cities and at some of the larger hotels, credit cards are accepted, but as a general rule cash is the only option. The majority of motels, most restaurants, gas stations, and mini supers (where you get cokes, snacks etc.) do not take credit cards. It is better to bring cash. Do not use debit cards except at a reliable ATM!!

You must have at least 500 pesos on hand when you enter Mexico. Once you arrive in Akumal you can obtain Pesos from ATMs at the food market. Avoid using a credit card; instead, save on ATM and bank fees by using a Check Card (the Austin UFCU Check Card works great in Mexico and fees are minimal).

In Akumal and a lot of the other tourist towns there are phones that let you call home collect with an English-speaking operator. They are a big rip off, with charges of about $10/min or more. It is better to get a phone card, after you arrive in Akumal, for Ladatel, the local phone company. They are available at mini-supers or the pharmacy. These cards are what the locals use and they work at the Ladatel phones that are on nearly every corner. You have to dial the country code etc., but many of the phones have instructions on how to do that in English. Calls to the U.S. are about $1/min or less and the cards come in a variety of denominations (pesos). I usually get a 100 peso card, (about 10 USD depending on exchange rate) and that's usually enough for 2-3 short calls home. Recently I have had very good success with our cell phones for texting, but arrangements must be made in advance with your carrier, otherwise the charges are likely to be exorbitant.

Packing List

Mask, snorkel and fins!
Lycra skins for sun, jellyfish, and coral protection
Hat
Sunglasses with a cord (2 pair)
Safe Sea Sun Block and Jellyfish Protection (see www.nidaria.com)
Light weight rain jacket
2 long sleeve synthetic shirts (capilene or polypropylene)
2-3 t-shirts
lycra sun top (or rash guard) for snorkeling
1 pair lightweight trousers
2 pairs shorts and swimwear
Shoes and sandals
Reef booties or shoes with good soles for wading/walking on rocky shores (old tennis shoes or wetsuit booties)
Insect repellant
Water bottles (two)
Dry bag (sun screen, glasses, water bottle, chapstick etc)
Camera, film, batteries
Binoculars
Passport*
Airline ticket or record locator for e-tickets*
Insurance cards*
Alarm clock
Coffee cup and koozie
Light towel
Small Flashlight and batteries
Calculator with statistical functions for linear regressions
Group Proposal and your Field Journal
Meat tenderizer for jellyfish stings
First aid items (eg. adhesive bandaids, Neosporin, Immodium A-D, Tylenol, Pepto-Bismol, Benadryl, Q-tips, iodine, etc. or specific medications that you may require!)
Mexican pesos and traveler's checks* (at least $50 depending on your own personal needs
Earplugs or headphones to insure a sound sleep

* Make copies that you leave at home for emergency back-up
NOTE: Statistical hand calculators and field notebooks WILL BE PROVIDED!!!