August 14-22, 2010

University of Minnesota and the Bimini Biological Field Station
Tropical Marine Biology and Shark Ecology (CFANS3500)

Photograph of lemon shark, *Negaprion brevirostris* by Tim Calver
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Bimini Biological Field Station
(http://www6.miami.edu/sharklab).

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1. Syllabus
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A. General Course Information

1. General Background
The goal of this course is to provide a meaningful and fun field experience for introductory marine biology students with an interest in sharks. We hope that many will be stimulated to pursue a career in this discipline. Students at Bimini will observe a wide variety of organisms in their natural settings while performing their natural behaviors and interacting with its natural prey and predators. If a habitat is described in lecture, you will swim there and if an organism is mentioned, you will see it alive and in person. Special emphasis is placed on sharks and their ecology. It is our hope that this special experience will inspire an appreciation for the beauty and biological relationships of the marine world in a way few other courses can.

2. Specific Objectives
This course will give you a basic understanding of the major habitats of tropical marine waters (sea grass meadows, rocky and sandy shores, coral reefs, mangrove forests, etc), the organisms which inhabit them (sharks, boney fish, invertebrates, algae, etc), the principals which underlie these relationships (zonation, competitive exclusion, origin of eukaryotes, etc), and some of the policy issues which effect them (settlement of the Bahamas, marine protected areas, etc). After successfully completing this course you should understand: 1) ecosystem form and function in many tropical, marine habitats; 2) shark biology and ecology; 3) evolution and 4) the special issues which challenge third world countries. We hope that you will find this course both intellectually stimulating it will also be one of the most enjoyable and stimulating experiences that you will ever have.

3. Grading
This is a 2 credit course, A-F, offered in spring 2009 (CFANS3500) through the University of Minnesota with the assistance of Bimini Biological Field Station (BBFS). Grades will be assigned by Dr. Sorensen who will consult with all instructors. The university will temporarily assign students a grade of “k” at the end of May which we be updated at the end of August upon course completion. Grading will be based on four factors:
   i) Class participation (33%)
      Students are expected to actively participate in all lectures and trips.
   ii) Journal (33%)
      We expect each student to keep a thoughtful and neat handwritten journal describing their thoughts and experiences(1-3 paragraphs a day). We want to learn what you learned from the experience and if you have interesting ideas (i.e. we are not especially interested in simple descriptions of what you did). Critical thinking and questioning is strongly encouraged. Great journals will identify research questions and address them in a critical manner. The journal must be presented to Dr. Sorensen at course’s end. Remember to bring a blank book to write your journal in.
   iii) Practical exam on Bimini flora and fauna (33%)
      During the course you will be observing and collecting organisms with the instructors from across the island. These will be brought to the lab where they will be discussed and observed. The last day of the class you will be quizzed on your ability to identity about 50 of them to the genus and species level (latin names), and tell us something about their basic biology and ecology. The intent is to teach you about the major groups of marine organisms and how to identity key species in an enjoyable and instructive atmosphere. You will find it helpful to bring some note cards and recommended texts. A list of the species you need to know is shown below and a Powerpoint presentation describing them will be provided by the instructor.
iv) **Independent extra credit project (10%; based on an oral presentation made during the last day)**

You will be given an original peer-reviewed research paper on some aspect of marine life or policy in the Bahamas to read and review before the class at pre-departure meeting. You should read this paper in advance of departure and briefly research the topic during the summer. Ideally, you should prepare a brief, draft Powerpoint presentation should be prepared (it can be modified on Bimini). While in Bimini you will have time to observe and study the organism(s)/systems(s) which are the subject of your paper. You may (or may not) decide to work with other students or staff for this project. There is considerable flexibility in the topic and approach (be creative); consult with the instructor if you have questions and bring the paper with you to Bimini. The day before the last day of class (and the exam), you (individually or as a group) will be offered the opportunity to make a 10-15 minute oral presentation in which you review the paper and the field it represents, add additional background and information that you feel should be of interest to the group based on recent experience that week. This exercise is intended to give you the opportunity to think critically and in detail about a topic of special interest that you will experience on Bimini. You are welcome to expand this project to include an independent research component if you wish but tell the instructor. By completing this option you will alleviate some of the stress associated with the exam and ensure a strong grade in the class. We strongly encourage you to take advantage of this opportunity.

4. **Tentative Class Schedule and Syllabus (see Section C for detail)**
This is primarily a field-course and we will be working approximately 14 hours a day. Most days will start with a lecture followed by a field trip at 10AM. Generally the afternoon will be the same. Evenings will have some spare time but you expect to devote this largely to studying the specimens you collect and your independent projects. A tentative syllabus is shown in Section C (below) but note that it will change to accommodate weather, tide and experimental needs which are rather unpredictable (see below) but can determine whether or certain types of work can be done or not.

5. **Faculty and Staff**

Dr. Peter Sorensen is a Professor at the University of Minnesota in Fisheries, Wildlife, and Conservation Biology. His expertise lies in fish physiology and behavior including migratory marine species. Dr. Dean Grubbs is research faculty at Florida State University. His expertise is in shark biology, fisheries science and natural history. He has extensive expertise of Bimini flora and fauna and the primary instructor. Dr. Samuel H. Gruber is an adjunct professor in the University of Miami’s Rosenstiel School of Marine and Atmospheric Science. Dr. Gruber is the founder and administrator of the Bimini Biological Field Station (BBFS). Professor Gruber is a behaviorist who directs shark research year round at BBFS and other locations. Several highly experienced staff from BBFS will also be actively involved in the course (driving boats, etc.)

6. **Recommended texts and reading**

Bring your assigned manuscript (Appendix C) and any others related to it that you may have found during the summer. We also recommend two texts:


*Note: BBFS has a range of fiction and nonfiction books for you to read*
B. Logistical Information

1. Rendezvous and Travel
The class departs for Florida on August 14, 2010 from Minneapolis International Airport. It is your responsibility to meet the class at the departure gate (i.e. proceed through security) one hour before departure. We suggest arriving to the airport 2 hours in advance. Remember to bring money for meals while traveling and to check luggage, and to keep passport on your person. You should have already received flight info for the USA by separate email (contact Peter Sorensen asap if not). If you miss the flight to Fort Lauderdale, we cannot guarantee that you will be able to catch up with the class and there can be no refunds. The class will spend the night of August 14 in Fort Lauderdale (likely the Comfort Inn); these arrangements have already been made by the university. The class will then leave for Bimini the morning of August 15. Departure time at Bimini Island Air (954-938-8991) will be about noon from the Fort Lauderdale Executive Airport. Contact John Vreyens (U of MN coordinator; 612-624-3221; Vreyens@umn.edu), or Dr. Sorensen (651-324-5641; cell) for specific details. Return date is August 24. Information for international flights to/from Bimini will be provided to the class in Ft. Lauderdale by Dr. Sorensen.

2. Daily Schedule at Bimini Biological Field Station (BBFS)
Everyone will arise at 7:30 AM for breakfast to be served by staff. Lectures are typically held from 8-10 AM although schedules will change with weather conditions. The class will then travel by foot, boat or truck to the particular habitat discussed that morning in lecture. In the field, students will be guided by the staff and are responsible for collecting and observing common species as well as joining field lectures. Students return to BBFS for lunch around noon. A second lecture is typically given from 1-3 PM after which the class will travel to a new habitat and repeat the morning’s field activities. The group returns to BBFS for a hot meal between 5 and 6 PM. Dinner will be held from 6:30 -7:30 PM. All students are expected to participate in cleaning the dining hall and dishes. Class will resume at 8:00 PM. The evening usually comprises a laboratory period with time for identification of specimens collected that day. There may be occasional lectures at this time as required. The formal laboratory period ends around 10 PM. Students then are free to study QUIETLY and independently or in groups.

3. Study Area
Class is held at the Bimini Biological Field Station on the island of South Bimini, Bahamas. The Biminis are located about 85 km east of Miami and are about 12 km long. Approximately 1,200 people live on North Bimini. South Bimini, the site of BBFS, is relatively isolated and with seasonal vacation homes. There are no stores! Bimini is a typical, relatively undeveloped West Indian island with all the associated charms (e.g., foods, clothing, architecture). Sunburn and insect bites are the main physical hazards. Be prepared to be flexible as weather conditions can change.

4. Weather
Bimini is tropical and you can expect daytime temperatures to be in 90’s and humid with evenings in the 80’s with frequent showers. August is also the start of the hurricane season and these storms can be unpredictable and devastating in the Caribbean - you/ we must be prepared for this possibility. BBFS has considerable experience with these situations. Should a severe hurricane be predicted for Bimini, we would evacuate the class to a location on the mainland where the storm is not predicted to strike and where we would endeavor to continue the course or return. Unfortunately in the case of a hurricane a refund would not be possible because funds will have already spent to run the course. This is all very
hypothetical and there is no point in worrying. To summarize:
1. Be prepared and bring rain gear (as described below).
2. Be assured that BBFS and U of MN are ready for all weather events.
3. Tell your parents/significant others that if a hurricane to appear, communication will be difficult (but not impossible) so they should not worry but in true emergencies may contact the International Programs Office (Cynthia Moore, 612.624.3221) and they will share what information they can (privacy laws limit information sharing). Also BBFS is usually in marine radio contact with the mainland through Dr.Gruber’s Miami Office (305-274-0628). Also, see communications section below.

5. Accommodations
The night before arriving at Bimini we stay at a motel in Fort Lauderdale after which we will all be staying at the BBFS which is a converted wooden frame duplex. It has five bedrooms (four persons per room in bunk beds), two bathrooms with showers, a small kitchen, a dining hall, a lecture hall, and a deck. BBFS has central air-conditioning (modest), indoor plumbing, and reliable power. It is comfortable and safe, but not luxurious. It has a computer with sporadic and very slow wireless internet access. The station has several pet dogs so if students are allergic to dogs they should bring medication. Fresh water is limited and you may have to take showers in brackish water. Two cisterns filled by wells supply brackish wash water and store captured rainwater. A desalinator supplies drinking water so it must be used judiciously.

6. Food
While you will need to buy meals in Florida (dinner first day), on Bimini, the staff will prepare all meals. Food is of good quality and vegetarian meals (ovo-lacto) are accommodated. The menu is a pleasant mixture of typical American meals (e.g., spaghetti, chicken) and Bahamian treats (e.g., conch chowder, souse chicken). The staff will strive to provide healthy, nutritious and adequate amounts of food, which will be needed considering the physical exertions of the students during field trips! All students will participate in dining room clean up on a rotating basis.

7. Physical Conditioning
Physical and psychological demands of the course are similar to those experienced when one spends a very active day at the beach, seven days in a row. Sunburn, insects, and salt water and hot/cold are the greatest physical challenges. Students should be able to swim/ snorkel and beach-walk several hours twice each day in the ocean where modest waves and currents can be expected. (Note that swimming is more arduous than it lakes). No special exercise or preparedness is necessary but it will help to be in good condition.

8. Medical Advice
There are no particular health precautions or necessary immunizations. However, medical facilities on the island are limited and all field work including that with sharks has some inherent danger. In an extreme emergency, people can be airlifted to Miami for treatment. Due to the isolated nature of the study site, students with chronic health problems, such as heart conditions, allergies or sun intolerance should consult their physicians before registering. The station has several pet dogs so if you are allergic to dogs you should bring medication. Inexpensive travel insurance is readily available through the University of Minnesota and a good idea. You will be required to sign a waiver of liability.

9. Communications
There is no telephone at BBFS but there is continuous radio contact with Dr. Gruber’s office in Miami for emergencies (305-274-0628). Internet access (including Skype) and email is available but limited and slow. Cell phones often do not work in Bimini and if they do, there usually are expensive because of international charges. There is no post office on South Bimini but students can buy and mail postcards on North Bimini on the last day. In the event of an emergency, students can receive faxes via the Big
Game Club (242-347-3391) or contact Dr. Gruber’s Miami office (305-274-0628) which can convey a message by radio. John Vreyens (course coordinator for the U of MN: 612-624-3221; Vreyens@umn.edu) is also a good contact.

9. Supplies and clothing
Self-sufficiency and preparedness is important as there are no stores in Bimini. **You are restricted to 40 lb. in SOFT luggage** (total weight (i.e. including carry-on), a duffle bag is strongly recommended, overweight is charged). We suggest the following:

**Required:**
- **PROOF OF CITIZENSHIP** (valid passport for all citizens; keep on your person)
- Notebook and writing utensils (pencils) for general class notes
- Notebook to serve as your class journal
- Notecards for species identification, text (mentioned above)
- Literature pertaining to your class project (assigned manuscript and related material)
- Good quality dive mask, fins and snorkel (visit dive shop for advice, expect to spend about $100)
  - (you should consider the type of fins that requires bootees to reduce the chance of blisters)
- 2 Bathing suits
- 2 Bath Towels
- Footwear for wet and muddy or rocky beach walks (rubber sandals with straps are good)
- Sweatshirt or light jacket for occasional cool, damp evenings
- Rain gear (field trips are **never** canceled; an inexpensive rainsuit is a good choice, poncho is OK)
- Sunscreen (waterproof, 30; spray-on is good for back)
- Insect repellent
- Personal medication (Tylenol, allergy medicine for pets and dust if needed)
- Personal toiletries
- Money (see costs below)
- Clothing (the basics for 7 days; maybe 8 pairs of underwear and t-shirts, a few pairs of socks, 2 pairs of shorts and a pair of pants?)
- Cap for the sun, sunglasses

**Recommended:**
- Identification guides/texts for class (some copies available at BBFS)
  - Camera (preferably waterproof – a disposable camera is fine)
- Small battery-powered or 110V clamp-on fan with extension cord (sleeping on hot nights?)
- Motion sickness pills (if you are prone to seasickness)
- Light cloth gloves for collecting specimens underwater
- Light-weight ‘rash’ shirt or t-shirt for diving (protect you from sun, stinging jellyfish & coral)
- Bootees or flip-flops for beach walking
- Laptop (BBFS has a communal computer but it still may be useful as there is wireless-your risk)

**Not needed:**
- Bed linens and small towels (provided by BBFS)
- Weight belt (provided by BBFS)
- SCUBA gear (no opportunity or need for this)
- Books (BBFS has a good supply of fiction)
- Good clothing other than for traveling (there are few places to go)
- Cell phones (likely will not work and if so, they will be very expensive)
10. Costs
Your $2,600 fee covers all transportation and accommodation. However, it does not include various miscellaneous fees such as luggage check-in fees in the USA ($50), a dinner in Florida before departure ($20), a final class dinner in Bimini ($20), airport departure tax in Bimini ($15), incidentals on Bimini ($20?), a Sharklab souvenir (t-shirts are available for $20) and lunch on the way home ($10). You should bring $150-$200 US in cash for these expenses. Bimini does not have a cash machine nearby but US dollars are accepted everywhere.

11. Code of behavior
All students are expected to represent themselves, the University of Minnesota and the United States in a responsible manner at all times (Remember John Vreyens’ lecture). You need to be respectful of the laws in the Bahamas and the guidelines of the BBFS where you will be a guest. Drs. Sorensen and Gruber have the authority to expel students without refund from the class in extreme situations. The Sharklab is dry (Dr. Gruber’s lecture).

12. Questions
If you have questions regarding logistics, please email or call Peter Sorensen (612-624-4997 (O); soren003@umn.edu). In an emergency you can also contact The University of Minnesota IPFANS office (John Vreyens: 612-624-3221; Vreyens@umn.edu) or Dr. Gruber (305-274-0628; sgruber@rsmas.miami.edu), or Dr. Sorensen on his cell (651-324-5641).
C. Course Specifics

1. Tentative 2010 Schedule  (will change with weather, tides, and course needs)

August 14:

Mid-day: Meet at gate for the flight, Minneapolis International Airport, Fly to Fort Lauderdale, Night at motel in Ft. Lauderdale with class

August 15:

Morning: Breakfast, van to Ft. Lauderdale Executive Airport
Afternoon: Flight to Bimini
Orientation to BBFS
Evening: Field trip: shell beach

August 16:

Morning: Lecture: Taxonomy - Plants, Animals through simple Chordates
Afternoon: Lecture: Marine Plant Communities I: Seagrass
Field Trip: Seagrass Community
Evening: Lab: ID of Seagrass Critters
Lecture: History of Bimini and its development (Sorensen)

August 17:

Morning: Lecture: Tides: Ecology of Sandy Intertidal
Field Trip: High and Low Energy Sandy Beaches
(Walking – Nixon’s Harbor & Shell Beach)
Afternoon: Lecture: Coral Reef Lecture Morphology and zonation-1
Field Trip: Hard Coral Community (Snorkeling – Three Sisters)
Evening: Lab: Evening seine in Turtle Grass
ID of Intertidal creatures

August 18:

Morning: Lecture: Rocky Intertidal Ecology
Field Trip: Rocky Intertidal Community (walking)
Afternoon: Lecture: Lecture: Coral Reef Morphology & Zonation- 2;
Field Trip: Miilipora & Plexaurid Community (Snorkeling Turtle Rock)
Evening: Lab: ID of Millepora and Plexaurid Community specimens

August 19 (shark-day 1):

Morning: Lecture: Marine Plant Communities II: Mangroves
Field Trip: Experimental sampling of Mangroves
Afternoon:
Field trip: Bonefish hole snorkel
Aya’s spot to feed young lemon sharks
Evening: Lecture: Basic Taxonomy of Fishes
Lab: Fishes, continue critter identification (Sorensen)
August 20 (Shark day-2)

Morning: Lecture: Diversity of Elasmobranchs (Taxonomy & Reproduction)
Field trip: Lemon sharks in pens
Lab: Shark dissection

Afternoon: Lecture: Bimini shark research and sensory systems (Doc)
Field Trip: Shark Dive and Artificial reef (Sapona)

Evening: Study for exams and presentations

August 21 (Wrap-up)

Morning: Exam on identification of local flora and fauna
Project presentations

Afternoon: Tiger shark capture and work up
Alice town trip

Evening: Banquet

August 23: Morning: Course wrap up
Lab cleanup, strip beds, lunch
Depart to Fort Lauderdale, and then on to Minneapolis

*Time and opportunity permitting, a nature walk will be scheduled while fisheries students can visit with a bone fisherman

2. Species to be identified

| Acanthopleura granulata | Divaricella quadrisulcata | Nodilittorina tuberculata |
| Actinia bermudensis | Echinometra lucunter | Octopode quadrata |
| Actinopyga agassizii | Ecteinascidia turbinata | Oliva reticularis |
| Avicennia germinans | Euclidaris tribuloides | Ophiocoma wendti |
| Batillaria minima | Fasciolaria tulipa | Oreaster reticularus |
| Bulla occidentalis | Gonodactylus oerstedii | Penicillus |
| Calinectes sapidus | Gorgonia ventilina | Petrochirus diogenes |
| Cardisoma guanhumi | Grapsus grapsus | Portites astreoides |
| Cassiopea xamachana | Halimeda | Puerita papu |
| Cittarium pica | Hermodice carunculata | Rhizophora mangle |
| Clibanarius tricolor | Holothuria mexicana | Siderastrea radians |
| Coenobita clypeatus | Littorina angulifera | Stenopus hispidus |
| Condylactis gigantea | Loomia medusa | Strombus gigas |
| Cyphoma gibbosum | Manicina areolata | Syringodium filiforme |
| Diadema antillarum | Millepora alcicornis | Thalassia testudinum |
| Dictyota | Nerita peloronta | Turbanaria |
| Diploria labyrinthiformis | Nerita versicolor | (Plus 10 fish families TBA |
3. Marine Biology Papers for Bimini Class (students or groups of student need to pick one paper and review and research in advance for class presentation at BBFS)


To understand the difference between marine biology and marine ecology, it may be useful to look at a community of organisms. A marine biologist may focus on behavioral relationships between the organisms in one particular species while someone studying ecology would study how the behavior of one organism influences another. An ecologist would also look at abiotic factors and how they influence that organism. A scientist studying community ecology might study a group of organisms to see how they influence other species and abiotic factors. The major subcategories of ecology are: Physiological Volunteer in Caqalai. Home Programs Tropical Marine Biology and Conservation in Fiji. Program Information. Dive in crystal blue water and discover the rich biodiversity of the South Pacific while assisting with research aiding the sustainable management of marine resources and local marine protected areas. Contribute to national efforts to conserve Fiji’s delicate coral reefs and marine ecosystems while living on GVI’s research base on the stunning Caqalai Island. United Nations Sustainable Development Goals. Next. Data collected on crown of thorn surveys, dives against debris, beach cleans, coral bleaching surveys and The Great Fiji Shark count will be shared with relevant partners. Your Program Specific Training. Dive Training. In the Marine Biology and Ecology Group we use a range of observation, sampling and monitoring methods, as well as state-of-the art experimental facilities and analytical techniques to investigate the genetic, molecular, physiological, structural and behavioural effects of natural environmental (e.g. ocean warming, ocean acidification, low oxygen) and anthropogenic pressures (e.g. light, nutrient, sound & plastic pollution, resource use and. Denisse is an Ecuadorian marine biologist who graduated with a Master of Studies (Marine Biology & Geographic Information Systems) from the University of Western Australia. Initially, she came to Read More. A matter of taste: Spatial and ontogenetic variations on the trophic ecology of the tiger shark at the Galapagos Marine Reserve. PLOS ONE, 14(9), e0222754. https://doi.org/10.1371/journal.pone.0222754. Partners.