University of Minnesota and the Bimini Biological Field Station  
Tropical Marine Biology and Shark Ecology (CFANS3502)  
August 16-24, 2014

Lemon shark, Negaprion brevirostris by Tim Calver

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Bimini Biological Field Station

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A. General Course Information

1. General Background
The goal of this course is to provide an academically relevant and enjoyable ‘hands-on’ field experience for introductory marine biology students with an interest in sharks. The course is extremely hands-on and intended to provide students with the opportunity to understand what a career in marine biology might be like. By working with active researchers and hearing about their research first-hand, students are provided with valuable networking opportunities. Students at Bimini will observe a wide variety of organisms in their natural settings while performing their natural behaviors and interacting with natural prey and predators. 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. We hope that many will pursue careers in marine biology or related fields.

2. Objectives
This course will give students a basic understanding of the habitats of tropical marine waters (sea grass meadows, rocky and sandy shores, coral reefs, mangrove forests, etc.), the organisms which inhabit them (sharks [in particular], 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 affect them (settlement of the Bahamas, marine protected areas, etc.). After successfully completing this course students will understand: 1) ecosystem form and function in key tropical marine habitats, 2) shark biology and ecology, 3) evolution, 4) Bahamian culture, and 5)special issues which challenge third world countries. We expect that students find this course to be one of the most enjoyable and stimulating experiences that they have ever had.

3. Grading
This is a 2 credit course (CFAN 3502), A-F, offered in the summer through the University of Minnesota with the assistance of Bimini Biological Field Station (BBFS). Grades and course registration is in the summer session. Grades will be assigned by Dr. Sorensen who will consult with the other instructors. Grading will be based on four factors:

   i) An Advance independent project (10% for paper ; and possible extra credit for a powerpoint)
      You must write an original 3-5 page research paper on some aspect of a particular marine species or set of marine species found in Bimini waters. A hard copy of this paper must be delivered on, or before, the class leaves. It should be written in Times font 12 and double spaced. The paper must be well written, follow scientific format and refer to at least three peer-reviewed articles (similar to FW2003). Topics may address any aspect of the species (or set of species) including taxonomy, ecology, behavior, or management, etc. It should be a critical review and address strengths and weaknesses of the topic being reviewed and future research needs. You should select a topic of interest of personal interest that you expect to develop a better understanding of while in Bimini. To help you pick a topic the class Moodle site will be uploaded with over a dozen articles on marine organisms found in the Bimini area. You should reference at least one of these. You are welcome to expand this project to include an independent research component while you are on Bimini for a Powerpoint presentation (see below). Please consult with the instructor if this is your intention.

      Ideally, you will also prepare a brief, draft Powerpoint presentation on your topic which could be modified on Bimini. It should be 4-8 slides and be designed to fill 5-10 min. While in
Bimini you will be offered the chance to present this Powerpoint for extra credit (an extra 5%). If we have bad weather, the chance will come before the end of class. By completing this option you could alleviate some of the stress associated with the exam (see below) and ensure a strong grade in the class. Alternatively, if the class is going well and you are very comfortable with your performance you may choose not to give this presentation so you can focus on species identifications.

i) Class participation (25%) 
Students are expected to actively participate in all lectures and trips. Dr. Sorensen will evaluate this.

ii) Journal (25%) 
We expect each student to keep a thoughtful and neat handwritten journal describing their thoughts and experiences (1-3 paragraphs each day). We want to learn what you learned from the experience and if you have interesting ideas (i.e. we are interested in what you actually learned and thought about course content vs. simple descriptions of what you did). Critical thinking and questioning is strongly encouraged. Great journals will identify research question(s) each day and discuss them in a critical manner. The journal must be presented to Dr. Sorensen at course’s end. Remember to bring a blank notebook to write your journal in.

iii) Practical exam on Bimini flora and fauna (40%) 
During the course you will be observing and collecting organisms. These will be brought to the lab where they will be discussed and observed. The last day of the course you will be quizzed on your ability to identity about 50 of them to the genus and species level (i.e. 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 identify 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 found below and a Powerpoint presentation describing them will be provided by the instructor on Moodle. Sometimes students find it useful to do a little research on these species before leaving for Bimini. Dr. Grubbs is in charge of this component of the class.

4. Tentative Class Schedule and Syllabus (see Section D and course syllabus for details) 
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 presented as an accompanying document but note that it will change to accommodate weather, tide and experimental needs which are unpredictable.

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 and he has a degree in Biological Oceanography. 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 and founder/owner of Sharklab. Professor Gruber is a behaviorist who directs shark research year round at BBFS and other locations. Several highly experienced staff including graduate students and postdocs from BBFS will also be actively involved in the course (driving boats, etc.).
6. Recommended texts and reading
While recommend two texts that may be purchased from Amazon (about $20 each), several copies of these and other guides are found at the field station so this is not a required purchase.


B. Logistical Information

1. Rendezvous and Travel
The class departs from the Minneapolis International Airport (MSP) (electronic ticket will be provided by the university). It is your responsibility to be at the departure gate one hour before the class leaves (i.e. check in and go through security). We suggest arriving at the MSP airport 2 hours in advance. Remember to bring money for meals and luggage check. Keep your passport on your person. If you want to find your own way to Bimini please let the University know when you register in April. If you miss a flight, we cannot guarantee that you will be able to catch up with the class and there can be no refunds. You are responsible for getting to and from the airport yourself.

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 BBFS 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 and has about 200 residents. 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.

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. However, 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 will not be possible because funds will have already been spent to run the course. (This is all hypothetical and there is no point in worrying.) Be assured that BBFS and U of MN are ready for all weather events (hurricanes) and have held classes successfully during hurricanes in the past. Tell your parents/significant others that if a hurricane were to appear, communication will be difficult but BBFS is in marine radio contact with the mainland through Dr. Gruber’s Miami Office in the event of an emergency. No news should always be interpreted as good news. Be aware that the ability to predict storms is poor so we will not make plans a long way in advance.

5. Accommodations
We will 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 modest central air-conditioning, indoor plumbing, and reliable power. It is comfortable and safe, but not luxurious. It has a computer with sporadic and some wireless internet access. The station has several pet dogs so students who are allergic to dogs 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 fresh water 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) can be accommodated but advance notice is needed. The menu is a pleasant mixture of typical American meals (e.g., spaghetti, chicken) and Bahamian treats (e.g., conch chowder, souce 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 in the ocean is more arduous than in 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 very 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, anxiety disorders must consult with their physicians before registering. The station has several pets so if you are allergic to dogs you should bring your own medication. You will be required to sign a waiver of liability by BBFS. The university provides health insurance but it is concerned with severe problems.

9. Communications
There is no telephone at BBFS but Internet access (including Skype) is available although limited and slow. Cell phones often do not work in Bimini and if they do, they usually are expensive because of international charges. There is no post office on South Bimini. Communications are limited and it is best to plan on not having them with the mainland. However, the instructor always has access to a phone and marine radio so can get messages out if there is an emergency. It is best to tell your friends and relatives not to expect to hear from you while you are in the Bahamas and that no news is very good news.
10. Supplies and clothing
Self-sufficiency and preparedness is important as there are no stores in Bimini. **You are restricted to 40 lb. of luggage in a duffel or gym bag** (soft luggage can collapse for storage and it is lightweight). Bring the following:

**Required:**
- **Valid passport** keep on your person) or if you are not from the USA you must have original copies of all Visas and passports.
- **Personal medication** (Tylenol, allergy medicine for pets and dust if needed)
- Notebook and writing utensils (pencils) for general class notes and class journal (1 notebook can be used for both purposes, it will be returned)
- Notecards for species identification
- Good quality dive mask, fins and snorkel (visit a 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
- 1 Bath towel (1 is provided by BBFS for the beach)
- Waterbottle
- Sneakers or tennis shoes for wet and muddy or rocky beach walks
- Light jacket for occasional cool, damp evenings
- Light-weight rain gear (field trips are **never** canceled; a poncho is OK)
- Sunscreen (waterproof, 30; spray-on is good for back)
- Insect repellent
- Personal toiletries
- Cash (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?)
- Memory stick for photographs and optional powerpoint
- Cap for the sun
- Sunglasses (preferably polarized)
- Lightweight rash shirt to protect you from jellyfish

**Recommended:**
- Identification guides/texts for class (some copies available at BBFS)
- Sandals
- Camera (preferably waterproof – a disposable camera is fine)
- Motion sickness pills or ginger (if you are at all prone to seasickness)
- Booties or socks for swim-fins
- Band-aids in case you get blisters
- Laptop (BBFS has a communal computer but it still may be useful as there is wireless: the risk is yours)
- Collecting net
- Weight belt (for expert snorklers)

**Not needed:**
- Bed linens (provided by BBFS)
- 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 and identification guides)
- Dress clothing other than for traveling (there are few places to go on Bimini)
- Cell phones (likely will not work and if they do, they will be very expensive)
11. Costs
Your University fee covers all transportation and accommodation. However, it does not include various miscellaneous fees such as luggage check-in fees in the USA ($25), a final class dinner in Bimini ($25?), airport incidentals ($25?), a Sharklab souvenir (t-shirts are available for $25), a Bimini souvenir ($25), and lunch on the way home ($25). You should therefore bring about $200 US in cash for these expenses. Sharklab does not have a cash machine nearby and US dollars are accepted in town.

12. Code of behavior
All students are expected to represent themselves, the University of Minnesota, BBFS, and the United States in a responsible manner at all times. 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 does not permit alcohol.

13. Questions
If you have questions regarding logistics this summer, please email or call Peter Sorensen (612-624-4997 (O); soren003@umn.edu).

C. Emergencies

In Bimini:
This international field class works in dangerous waters with sharks, jellyfish, tides and hurricanes. It is also relatively remote and communication links are poor. Although student well-being is the first priority of BBFS and university staff, there are situations we cannot control. In the event of a medical or personal emergency, the university would work with BBFS to evacuate you to Florida and inform your parents and significant others (if you give us permission) via the CFANS Student Services office (see below). These costs would be covered by University insurance. Note that you must sign agreements with both the University and BBFS that alleviate us of responsibility and that instructors cannot provide any details of student condition if there is an emergency without explicit permission form the student. Nevertheless, you should feel free to discuss any personal or health concerns with Dr. Sorensen before or during the class.

From Home:
If your close friends or family have an urgent need to contact you while you are at BBFS they should contact the CFANS International Programs office which will work with Dr. Gruber’s Miami office to get a message to BBFS via marine radio. If the matter is especially urgent or time sensitive emails should also be sent to the people below – mark ‘URGENT CFANS3502’

Emergency Contacts:
While or before traveling, Peter Sorensen (instructor): soren003@umn.edu; 651-324-5641 (cell #; will not answer on Bimini)

Bimini: a local number for Sharklab that may or may not work is: 242-347-4538

Uof MN (home base while gone): Pedro Bidegaray, Director International Programs (CFANS); pbidegar@umn.edu Office: 612-624-3221 0r 7402 (M-F: 8-4:30), Cell: 612-910-1108

IMPORTANT NOTE: If for any reason you have to return home early (illness, family emergency, storms, etc.), you will personally have to cover the costs of your trip home. The costs of the course also cannot be refunded. If you are concerned about this you may want to consider private travel insurance.
D. Tentative Schedule (times and schedules change with weather/ tides)

Day 1:  
**Morning**  Meet at gate for the flight, Minneapolis International Airport,  
Fly to Bimini  
**Afternoon:** Orientation, History of the Bahamas

Day 2:  
**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

Day 3?:  
**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

Day 4?:  
**Morning:**  Lecture: Rocky Intertidal Ecology  
Field Trip: Rocky Intertidal Community (walking)  
**Afternoon:**  Lecture: Lecture: Coral Reef Morphology & Zonation- 2;  
Field Trip: Millipora & Plexaurid Community (Snorkeling Turtle Rock)  
**Evening:**  Lab: ID of Millipora & Plexaurid Community specimens

Day 5? (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)

Day 6? (Shark day-2)  
**Morning:**  Lecture: Diversity of Elasmobranchs  
Field trip: Lemon sharks in pens  
Lab: Shark dissection  
**Afternoon:**  Lecture: Bimini shark research and sensory systems  
Field Trip: Shark Dive and Artificial reef (Sapona)
Evening: Study for exams and presentations

**Day 7? (Wrap-up)**

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

*Afternoon:* Tiger shark capture and work up
Alice town trip or trip around island (leisure time)

*Evening:* Lecture on dolphins

**Day 8?**

*Morning:* All day trip to visit dolphin pods offshore

**Day 9?**

*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
Actinia bermudensis
Actinopyga agassizii
Avicennia germinans
Batillaria minima
Bulla occidentalis
Callinectes sapidus
Cardisoma guanhumi
Cassiopea xamachana
Cittarium pica
Clibanarius tricolor
Coenobita clypeatus
Condylactis gigantea
Cyphoma gibbosum
Diadema antillarum
Dictyota
Diploria labyrinthiformis

Divaricella quadrisulcata
Echinometra lucunter
Ecteinascidia turbinata
Eucidaris tribuloides
Fasciolaria tulipa
Gonodactylus oerstedii
Gorgonia ventalina
Grapsus grapsus
Halimeda
Hermodice carunculata
Holothuria mexicana
Littorina angulifera
Loimia medusa
Manicinia areolata
Millepora alcicornis
Nerita peloronta
Nerita versicolor

Nodilittorina tuberculata
Ocypode quadrata
Oliva reticularis
Ophiocoma wendti
Oreaster reticulatus
Penicillus
Petrochirus diogenes
Porites astreoides
Puperita pupa
Rhizophora mangle
Siderastrea radians
Stenopus hispidus
Strombus gigas
Syringodium filiforme
Thalassia testudinum
Turbanaria

(Plus 10 fish families TBA)