

Ichthyology 2011 Syllabus

BOSTON UNIVERSITY MARINE PROGRAM:

Ichthy 1 in Block 3: Oct 27 to Nov 22

Ichthy 2 in Block 4: Nov 28 to Dec 21

Professor: Dr. Phillip Lobel; (*e-mail* plobel@bu.edu, Office phone 617 358 4586,
cell phone 508 274 9783)

Teaching Assistants – Ichthy 1 – Valentina Di Santo

Ichthy 2 – Eli Romero and Valentina Di Santo

Office hours: during course- office hours during class or lab breaks

Classroom: daily schedule: morning lectures 0900hrs to noon,

Laboratory: afternoon lab 1400hrs to 1630hrs

Ichthyology I: An introduction to Ichthyology and fish behavioral ecology.

Lectures will review the evolution, ecology and behavior of fishes. Introduction to the course begins with an overview of fish evolution and the principles of phylogeny. Understanding phylogeny is essential to an appreciation of the many special ecological and behavioral adaptations exhibited by fishes. Other lectures will focus on aspects of behavior and ecology of fishes and will include a review of relevant general principles of ecology and behavior. Topics include: trophic diversity and adaptations, color patterns, life history scenarios, spawning behaviors, communication modalities, migrations, community structure and, of course, sharks. Lectures will include slide and video shows of fishes from around the world and descriptions of what it is like to do field science. Laboratory exercises will include methods in fish anatomy such as skeleton preparation and dissection. We will study fishes in aquaria; observing behavior and listening/recording sounds and electric signals. We will also be getting ready for travel by planning field data objectives and methods.

Ichthyology II: Field trip to Belize.

This course will emphasize the transition from theoretical to practical. Students will experience the process and procedures for undertaking field surveys of marine life in tropical underwater habitats and methods for behavioral-ecological observations. Daily field time will be divided between exploration of new and diverse marine habitats and conducting intensive individual field projects. Field projects will include both class organized observational events and individual student research. Scuba diving is an option for qualified students who also submit appropriate BU dive program forms.

- Students will also have an opportunity to earn a NAUI Skin Diver certification as part of this class. All students will be trained in First Aid and CPR during Block 3.
- Non- certified divers may have the option to “discover scuba” under the close supervision of Prof Lobel, who is also a scuba instructor.

Course prerequisites and expectation of academic background.

Expectation that students will have had introductory biology and zoology courses, The Ichthyology courses will build upon basic scientific skills that you should have acquired during Block 1 and 2 courses including advanced skills in laboratory practice, basic skills in project design and hypothesis testing, library literature search and advanced skills in data analyses and report writing. A basic knowledge of animal anatomy and evolution will be helpful.

Safety in the field: A note about snorkeling, diving and physical condition

The Belize course is a wilderness experience on a coral reef under rugged field conditions. Students must be competent swimmers and with the physical stamina required for daily snorkeling and hiking. The field situation is remote and amenities limited.

Everyone is required to have the BU FitRec Swim card before Block 3 begins.

This is conducted in the BU pool. After 2 weeks of snorkeling in Belize, Students will earn the NAUI Skin Diver certification as part of this class. See: <http://www.nauiww.org/>

Safety, health and comfort are the uppermost concerns for everyone in the course. During Ichthyology 1, we will discuss safety issues and prepare everyone for emergency medical response.

All students will be provided DAN accident insurance by the BUMP program (see <http://www.diversalertnetwork.org/>)

All scuba diving is conducted under the auspices of the BU diving safety program (<http://www.bu.edu/orccommittees/dive/>) and follow AAUS protocols (see <http://www.aaus.org/>) including a required dive medical and all forms submitted in advance. <http://www.bu.edu/orccommittees/dive/forms-and-documents/>

In order to dive as part of the class, you must already be certified by one of the recreational dive organizations (eg NAUI, PADI etc). You must have a specific dive medical (see AAUS for forms and details, soon to be on our class website). CPR and First Aid certification is also required. The BU diving certification process includes training dives to evaluate skills by the Diving Safety Officer (P. Lobel) and a written exam.

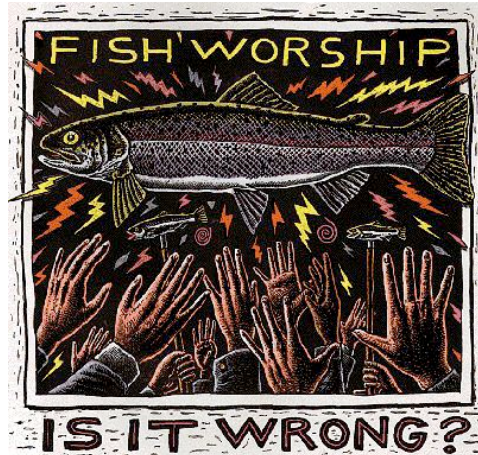
Prof. Phillip Lobel will be providing first aid and CPR training for all students in the class. Prof. Lobel is also the Scientific Diving Safety Officer for Boston University as well as a **DAN Instructor #13032** and a **NAUI Instructor #41363**. He is qualified to teach and certify:

DAN PROVIDER COURSES (see <http://www.diversalertnetwork.org/>)

- O2 First Aid for Scuba Diving Injuries
- Hazardous Marine Life
- AEDs for Scuba Diving and Aquatic Emergencies
- Remote Emergency Oxygen (REMO2)
- Diving First Aid for Professional Divers
- Diving Emergency Management

This syllabus is divided below into two parts for each Block 3 (Ichthy I) and Block 4 (Ichthy II, the Belize trip).

**There is a lot of information in this document.
You are responsible for knowing it!
So review everything carefully.**



Ichthyology I – Block 3

Recommended Course Texts (copies on reserve in the BUMP classroom).

There are two great textbooks for Ichthyology. Our class lectures will refer to material on phylogeny, physiology, behavior and other basic aspects of fish biology that are covered well in these texts. Required readings of selected articles will be distributed as pdf files on the course website.

The Diversity of Fishes: Biology, Evolution, and Ecology by Gene Helfman, Bruce B.

Collette, Douglas E. Facey, and Brian W. Bowen. ISBN: 978-1-4051-2494-2

736 pages, May 2009, Wiley-Blackwell, price \$129.95

(see updates and corrections at- <http://sparc.ecology.uga.edu/~helfman/fishes.html>)

Accessory references (for different perspectives and additional examples) on reserve.

Bond's Biology of Fishes 3rd edition by Michael Barton

ISBN:0120798751 approx. list price \$132.95

Cailliet, G., M. Love, A. Ebeling 1986 **Fishes, a field and laboratory manual on their structure, identification and natural history.** Waveland Press, Ill.

Lauder, G. V. and K. F. Liem 1983 **The Evolution and Interrelationships of the Actinopterygian Fishes**. Bulletin of the Museum of Comparative Zoology Vol. 150 No. 3, Harvard University. This monograph is a scientific treatise on the morphological characters used to define the phylogenetic relationships of advanced fishes. This material will be reviewed in detail during the first several lectures.

Gregory, W. 1933 Fish Skulls – copies of this book will be on reserve and in our lab.

Course materials

Information will be provided to each student that will include

1. Class lecture material
2. Selected literature readings
3. Background reference material for labs and field research

We will make electronic files available for download from the class website.

Reprints of recent scientific papers and books discussed in lab or lecture will be available on reserve in the in the BUMP classroom.

GRADING for Ichthy 1:

- **Written & practical exams, topic papers, research proposals (70%)**
- **Laboratory exercises including fish skeleton preparation. (25%)**
- **Laboratory etiquette & participation.... Proper and clean laboratory hygiene and clean-up after every exercise is required (5%)**

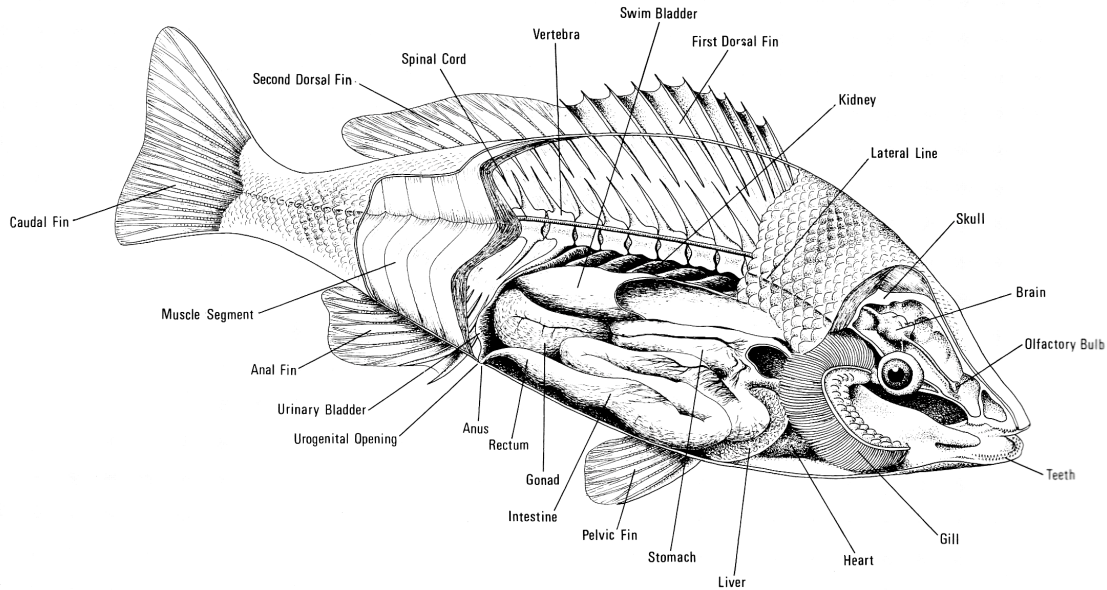
Tentative LECTURE AND LAB SCHEDULE

The proposed schedule may be modified as we progress according to the general needs of the class for review and clarifications. Special events at BUMP or other extrinsic factors may also affect our schedule. Students are also expected to attend the BUMP seminar. Students input on topics of special interest are welcome and may be incorporated into the lecture series. Students are welcomed to provide immediate feedback to the professor regarding the pace of the lectures and the difficulty of the material presented. Labs are also intended as a time for students to discuss questions and issues with the Prof. and TA.

Field trip during Block 3.

- New England Aquarium
 - intro to fish form & function
 - observe diversity
 - observe and record feeding behaviors and morphology
 - study species identification of Caribbean fishes

Guest lectures TO BE SCHEDULED (some as BUMP seminars)- the class schedule below will be augmented with guest lectures and may be modified as class progresses – see bulletin board outside classroom: changes will be announced in class at start of first lecture.



Basic skills students should learn from Ichthyology:

- Lecture portion of the course (A topical approach)
 - To understand how life in water constrains anatomy and physiology of fishes.
 - To understand how ecological processes shape fish life histories.
 - To gain an understanding of the evolutionary history of fishes.
 - To learn basic principles of biogeography and patterns of biodiversity.
 - To introduce some of the key issues in fish conservation biology.
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- Laboratory portion of the course (A phylogenetic approach)
 - To learn to use dichotomous keys effectively and determine identities of unknown specimens.
 - To gain an appreciation of causes and consequences of intraspecific variation.
 - To learn methods for collecting and preserving fish specimens.
 - To learn key features of major fish families, orders and higher relationships of fish world-wide.
 - Ability to dissect unfamiliar fish and interpret anatomical structures.
 - Identification of fish based on skeletal features
 - Basic fish measurements

Goals for ichthyology students: *You should learn to:*

1. Recognize the common fish to at least to the family level and know how the families are grouped into orders and superorders.
2. Recognize basic anatomy; know the reasons for differing structures (evolutionary relationships; specific adaptations).
3. Identify a fish (at least to some level) from a remnant: left by a predator; in the gut of another fish; or at an archeological site.

4. Design and execute a scientific study to generate information about a fish or fishery.

Lecture Topics

- Identification of fishes
- Taxonomy and systematics
- Genetics and speciation
- Zoogeography and distribution
- External form and structure
- Skeletal and muscular system
- Swimming and locomotion
- sensory mechanisms
- Osmotic/ionic regulation and acid base balance
- Buoyancy regulation
- Feeding, digestion, and nutrition
- Reproduction, egg/larval development, and metamorphosis
- Behavior
- Habitat requirements and zonation of habitats

Tentative LECTURE AND LAB SCHEDULE

[this means that the below schedule is subject to change – see website for updates]

Daily schedule – Ichthy 1 -Class starts daily at 900hrs Unless otherwise noted

Throughout the class, we will schedule observation periods for students to watching behavior of Belize fishes in the reef aquariums and the acoustic behavior of spawning cichlids. These will be scheduled according to the fish's clock.

Thursday, Oct 27- Introduction: review syllabus, course organization, grading, & projects.

Belize preparations

Reefs and Fishes of Belize: preparatory natural history slides & video

Friday, Oct 28 – Why fishes are interesting- World-wide Biodiversity

Introduction to basic fish anatomy and meristics- how to identify species, terminology of shapes, terminology of parts.

- Scientific diving: history and today

Lab: Meristics lab- fish dissection,

Monday, Oct 31- Intro to phylogeny -Review taxonomic hierarchy nomenclature

Fish evolution; geological time and evolutionary trends

A cladistic review of the evolution and morphology of fishes

Lab: NEW ENGLAND AQUARIUM FIELD TRIP

Tuesday, Nov. 1 - Fish phylogeny continue

Fish skull skeleton prep see Cailliet pages 31 to 38,

LAB – Specimen examination by phylogeny and skeleton;

Making a fish skull skeleton (to be done over the next few weeks).

******Fish skeleton get started and find a fish this weekend******

Boston markets survey of fishes for sale

Wednesday, Nov. 2 Evolution of the cranial structures and trophic functional morphology,
Lab: examine fish skeletons; comparative examination caudal fin structures, videos and slides.

Discussion of the market survey results

First-Aid training:

Thursday, Nov. 3 – Sharks, Skates and rays – behavior, ecology and conservation.

Lab – Shark (dogfish) dissection

Tagging wild elasmobranchs: passive and active tracking of acoustic tags.

First-Aid training:

Friday, Nov 4- Evolutionary biology of herbivorous fishes; anatomy, behavior and ecology, Body shapes and color patterns

Lab: examine specimens. **First-Aid training:**

Monday, Nov 7 – continue lectures topics

Lab- Reefs and Fishes of Belize: slides & video show

First-Aid training:

Tuesday, Nov 8 - Reproduction, dispersal and recruitment

Lab – videos and photo review of fish spawning

Reefs and Fishes of Belize: natural history slides & video show

First-Aid training:

Wednesday, Nov 9 - Fish acoustics & behavior

Lab: observing fish behavior- methods and technologies

First aid written exam

Thursday,, Nov 10 — continue behavior, ecology and physiology

Lab: discussion, Biodiversity conservation lessons: seahorses (video)

Reefs and Fishes of Belize: slides & video show

Friday, Nov 11- **Veterans Day** – no classes

Monday, Nov 14 - Fish otoliths: biology and technology

Lab- Fish specimen anatomical examinations, count otolith rings

Tuesday, Nov 15 - Review of life histories; slides continued

Lab: observing fish behavior (aquarium study)

Larval fish specimen identification, larval fish biology- Otolith Lab.

Wednesday, Nov 16 - Belize projects and field preparations

Thursday, Nov 17 - Belize projects and field preparations

Friday, Nov 18 – review lecture in preparation for exam

Monday, Nov 21 – Final Exam

papers due –Nov 22 (Block 4)

Fish skull / skeleton presentations study day

Tuesday, Nov 22 – no class: individual preparations for travel

Wednesday, Nov 23 - no class: individual preparations for travel

Fish Skull / Skeleton Lab

Students will be expected to prepare a fish skull / skeleton as part of the requirements for Ichthyology one. How to prepare a fish skull is described in Cailliet et al.'s Lab book on pg. 31 – 38, and will also be discussed during lab/class. Students will be required to give a 15 minute power point presentation showing there results.

Importance (paraphrased from Cailliet et al.): Once must first understand the basic structure of bones and how they are arranged in order to understand how they function. Also, variations in bone morphology among species are important taxonomic characters when identifying and classifying fish.

Skeleton: The skeleton should be cleaned of any flesh. The cleaned bones should be reassembled and mounted true to original form. All bones should be labeled.

Presentation: The power point presentation should show before and after pictures of your fish (a digital camera will be made available). Your presentation should also point out important functional features of each skull / skeleton including but not limited to: Feeding mechanism, fin adaptations, evolutionary traits, and swimming mechanisms. The power point presentation should incorporate knowledge gained during Ichthyology class lectures.



Ichthyology II – Block 4

The Belize Field Course

See attached calendar for detailed schedule

Course goals and outline

This course aims to introduce students to the rigors of field science and natural history studies. **See calendar for schedule and events.**

GRADING Evaluation

1. Review of your field notebook (detailed log of your field time and observations).
2. Recognition of Belize species
3. Oral progress reports of research projects to be given in the field.

4. Participation and data recording in class projects
5. Final written and oral report of class or independent field projects
 - For grading criteria of written reports, an outline "Evaluation of Written Reports", will be provided in class.

Basic skills students should learn from Ichthyology:

- Sight identification of major fish taxa.
- Methods in conducting field study of fishes

Goals for ichthyology students -You should learn to:

1. Recognize species in the field.
2. How to conduct safe field studies of fishes while snorkeling.



Class schedule

Travel: depart Nov 29, return Dec. 11, 2010
 Class presentations and papers due Dec 20, 2010

**Outline of the Belize course travel logistics and agenda
 (weather dependent!)**

Tuesday Nov 29. - Depart Boston

- ❖ You must be at the airport by 2 hrs in advance with no more than two bags each weighing less than 50lbs. You are responsible for getting to the airport and for any excess baggage costs.
- ❖ We arrive Belize in early pm and take a 4+ hour bus ride to Glovers Guest House.
 - Pack empty water-bottle and flashlight to be easily accessible
 - Remember NO water can go thru airport security
- ❖ We overnight on Sittee river.

Wednesday Nov 30. - We transit by boat from Sittee River to Wee Wee Caye

- ❖ Arrival day is spent with orientation to the field site and snorkeling exercises.

Thursday Dec1 through Sunday Dec 9 – Field trips and individual projects

Saturday Dec 10 - pack up on caye and move back to Sittee River

Sunday Dec 11– depart Sittee River early to Belize airport

- ❖ We stop enroute at the Belize Zoo (also a shopping opportunity)
- ❖ We depart Belize in early pm and return Boston at midnight

- Everyone arranges his or her own transport from Logan to dorm/apt.

Monday Dec 12 – *day off to crash and clean*

Tuesday Dec 13 - Tuesday Dec 20 – analyze data, write report & presentation.

**Tuesday Dec 20 – research project presentations and paper due
- lab and gear cleanup**

General Information

This is a statement regarding the fact that all students are bound by the Academic Conduct Code, a copy of which all students should have. When 2 or more students are allowed to collaborate in the course, for example on lab or field projects, please understand that you are expected to turn in your own write-ups without the assistance of your partner(s). You and your partners may use the same data set gathered by working collaboratively but your papers must be your own thinking, analyses and writing.

- See the following article for specific discussion of why it is considered plagerism to cut and paste from the internet and to included in your report verbatim.

http://www.the-scientist.com/yr2003/oct/opinion_031020.html

