

## ICHTHYOLOGY

**BIOL 632-01, 632-L01**

**EVSS 724-01, 724-L01**

Fall Semester 2016

Tues & Thurs 8:00 - 11:00 AM

GML 101

### **Instructor**

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### **Course Description**

A study of the biology of fishes, emphasizing diversity and evolution, morphology, ecology, physiology, life history, behavior, systematics and biogeography. Laboratory work focuses on groups important in the local fauna.

Prerequisites: BIOL 600, 601, 610, and 611 or permission of the instructor.

### **Student Learning Outcomes**

Students are expected to show mastery in the broad area of ichthyology (fish biology), with special reference to evolutionary relationships, adaptive morphological attributes, biogeography, ecology, and physiology. Mastery is also required in laboratory and field based activities, with an emphasis on anatomy and identification of fish species. The degree to which students have learned this material will be evaluated by (a) a written mid-term test and a final examination, (b) two laboratory practical tests, and (c) their ability to critically evaluate published works in fish biology and write about their findings in a Critique Project report that will be graded. Each student will also lead a discussion in class based on their project and this will also be evaluated.

## Course Objectives

1. Define, describe, and explain the following concepts as they relate to fishes: speciation, phylogeny, life history, biogeography, ecology, osmoregulation, reproductive mode, and biodiversity. Provide specific examples of fish taxa for these processes and their effects on diversity.
2. Study live and preserved fish specimens towards recognition of an array of species, with emphasis on those of the Charleston Harbor and immediate coastal region. Develop knowledge of the families and higher categories of fish classification.
3. Acquire a knowledge of the skeleton and other anatomical components and their functions. Apply information about these structures to an understanding of the functional morphology of fishes, with an emphasis on locomotion, buoyancy control, feeding, and osmoregulation.

## Policies and Requirements

1. This course will be conducted in accordance with the Honor Code of the College of Charleston.
2. Textbooks (both required):  
Hastings, P.A., H.J. Walker, Jr., and G.R. Galland. 2014. *Fishes: A Guide to their Diversity*. 1st edition. University of California Press, Oakland, 311 pages. ISBN 978-0-520-27872-1 (cloth); ISBN 978-0-520-28353-4 (paper)  
Helfman, G.S., B.B. Collette, D.E. Facey, and B.W. Bowen. 2009. *The Diversity of Fishes*. 2<sup>nd</sup> edition. Wiley-Blackwell, Inc., 720 pages. ISBN 978-1-4051-2494-2
3. Additional material:  
Dissecting kit, available from College Bookstore or by ordering on-line (e.g., from DR Instruments at <https://www.drinstruments.com/advanced-biology-kit.html>). Always have your instruments with you in class, since the second half of the period often includes time for pursuing ongoing laboratory work.
4. Laboratory activities:
  - A. Handling and manipulation of fish specimens and some dissection. See

Appendix on Lab Safety.

- B. Osteological study of dried skeletal preparations and cleared and stained fish specimens.
  - C. Identification:  
Learning to use dichotomous keys and to record specimen attributes commonly used in ichthyology. Identification of a set of "unknown" fish specimens.
  - D. Studying the fishes in the Grice Marine Laboratory study collection, especially those on a list of taxa, to be distributed in class. The emphasis will be on representatives of families occurring in the southeastern United States. Specimens will also be obtained in the field for study in the laboratory.
  - E. Exercises in systematic study of fishes, such as phylogenetic and morphometric analysis.
  - F. A number of field activities will provide experience with collecting techniques and examples of fish assemblages from the area around Charleston. These trips will include beach seining, collecting in the salt marsh, and trawling from a vessel operated by the South Carolina Department of Natural Resources.
5. Tests/exams: There will be two tests on lecture material: a mid-term test and a final examination. Both will consist of questions of various types, with an emphasis on objective questions (multiple choice, true/false), but there will also be some requiring written or analytical answers.
6. Critique project:  
We will read a series of published papers from the journal *Copeia* on various aspects of fish biology; each student will lead an in-class discussion of about 20 to 30 minutes in length based on one such paper. A "hard copy" of the critique is to be turned in during the class immediately prior to the beginning of these discussions (see schedule for exact date). You should obtain the article you will critique and all others to be discussed directly from the on-line holdings of the journal *Copeia* through the College's library web resources: a list of articles will be provided from which you will choose your article. Hard copies of each issue of *Copeia* are also available in the stacks at the Marine Resources Library.
7. Allocation of points earned on tests, assignments, and participation to the overall grade:

*Lecture*

- A. Final examination 20%
- B. Paper Critique 15%
- C. Mid-term test 15%

*Laboratory*

- D. Mid-term lab test 15%
- E. Identification of unknowns 10%
- F. Final laboratory practical 20%
- G. Laboratory exercises/participation 5%

8. Grading scale:

100-90 = A 89-85 = B+ 84-80 = B 79-75 = C+  
 74-70 = C 69-60 = D 59-00 = F

9. Disabilities accomodation:

**COURSE SCHEDULE**

**Required readings**<sup>1</sup> are chapters or page ranges in the course texts by Helfman et al. (2009) [abbreviated HCFB] and Hastings et al. (2014) [HWG]. Other readings, to be provided, are Cailliet et al. (1996) [CLE], and Moyle, P.B. and J.J. Cech, Jr. (1996) [MC].

Date	Topic	Readings <sup>1</sup>
August		
Tu 23	Introduction: The diversity of fishes	HCFB 1, 2
Th 25	Basic morphology: external and other features	HCFB 1, 2 HWG pp. 1-12
Tu 30	Systematics and fish taxonomy; dichotomous keys and other tools used in identification	HCFB 2
September		
Th 01	Fish diversity 1: Agnatha, Gnathostomata and Chondrichthyes	HCFB 11, 12, 13
Tu 06	Fish diversity 1: Agnatha, Gnathostomata and Chondrichthyes, continued	HCFB 11, 12, 13
Th 08	Field activity: seining at Fort Johnson. low tide 7:02 AM (1.08 ft)	
Tu 13	Osteology - study of the skeleton; clearing and staining technique	HCFB 3; CLE 3, pp. 38-40

Th 15	Fish diversity 2: Osteichthyes; Sarcopterygii vs. Actinopterygii; Living Sarcopterygii; <b>SIGN UP FOR CRITIQUE ARTICLE BY TODAY</b>	HCFB 13
Tu 20	Introduction to estuarine fish ecology	MC 31
Th 22	Fish diversity 3: basal Actinopterygii; Polypteriformes through Clupeomorpha	HCFB 14
Tu 27	Harbor trawling cruise: 8:30 - 11:00 AM <b>(Roumillat and Harold)</b>	
Th 29	Reproduction and growth lecture and lab <b>(bring dissecting kit) (Roumillat)</b>	HCFB 4, 9, 10
October		
Tu 04	Fish diversity 4: Euteleostei; Ostariophysii through Myctophiformes	HCFB 14
Th 06	Phylogenetic systematics lecture and lab	HCFB 2; CLE 9
Tu 11	Field activity: beach seining at Folly Beach	
Th 13	Mid-term test on lecture material	
Tu 18	Fish diversity 5: Acanthomorpha; Paracanthopterygii to Percomorpha (first part of Perciformes)	HCFB 14, 15
Th 20	Mid-term lab test (covering Required Fish Species No. 1 through 59, Myctophidae)	
Tu 25	Fish diversity 5 continued: Acanthomorpha; Paracanthopterygii to Percomorpha (remainder of Perciformes)	HCFB 14, 15
Th 27	Deep-Sea Fish biology	HCFB 18
November		
Tu 01	Fish Diversity 6: Perciformes continued, Tetraodontiformes, Pleuronectiformes	HCFB 15
Th 03	Fish ecology and assemblages	HCFB 19, 20; CLE 13; MC 27
Tu 08	Fall Break	
Th 10	Form and function of feeding; <b>CRITIQUES DUE; CRITIQUE DISCUSSIONS BEGIN</b>	HCFB 8
Tu 15	Coral reef fish ecology; <b>CRITIQUE DISCUSSIONS BEGIN</b>	MC 33
Th 17	Form and function of buoyancy control; <b>CRITIQUE DISCUSSIONS</b>	HCFB 4, 5

Tu 22	Form and function of locomotion; <b>CRITIQUE DISCUSSIONS</b>	HCFB 4, 8
Th 24	Thanksgiving Break	
Tu 29	Geographic patterns and processes - biogeography of fishes; <b>IDENTIFICATIONS OF UNKNOWN DUE</b>	HCFB 16
December		
Th 01	<b>FINAL LAB PRACTICAL</b>	
Tu 08	<b>FINAL EXAMINATION: 8:00 - 11:00 AM</b>	

Appendix: Laboratory Safety Protocol

During this class you are expected to handle fish specimens that are preserved in aqueous solutions of 50% isopropyl alcohol or 70% ethyl alcohol. Both chemicals can be potentially hazardous, and the following safety precautions must be observed by all students participating in BIOL 632/EVSS 724 in order to insure your safety. Students dismissed from a teaching lab due to violations of the following safety procedures will not be allowed to re-enter the laboratory until authorized to do so by the instructor. Any course work missed because of a violation of these guidelines cannot be made up at another time (or by an extension of the lab period) and will be treated as an unexcused absence.

1. You are responsible for knowing the biological, chemical, electrical, ergonomic, mechanical, and physical hazards associated with the equipment and materials that are being utilized in the laboratory. Listen to all instructions and ask questions about that which you do not understand. MSDS safety sheets for 50% isopropyl alcohol and 70% ethyl alcohol are available in GML 101 and 201.
2. Know the location of safety equipment: telephones, emergency shower, eyewash, fire extinguisher, fire alarm pull.
3. Know the appropriate emergency response procedures. If there is an injury or emergency, call 953-5611.
4. Do not work alone in the laboratory if you are working with hazardous materials or equipment.
5. Do not engage in horseplay, pranks or other acts of mischief while in lab.

6. Drinking, eating, and application of cosmetics is forbidden in GML 101 and 201 when alcohol containers are open or preserved fish specimens are present. Smoking is forbidden in all College buildings.

7. Closed toe shoes are required in GML 101 and GML 201. The heel and top of foot must be covered. High heeled shoes, sandals, and perforated shoes are not permitted. This is to protect your feet from glass if a specimen jar is accidentally dropped.

8. Appropriate protective gloves will be available to students in GML 101 and 201 in order to handle fish that are preserved in alcohol solutions if needed. Alcohol solutions can cause upon direct contact minor skin irritations. If skin irritations are detected, please wash exposed surface with mild soap and plenty of water.

9. Protective eyewear will be available to students in GML 101 and 201 in order to protect their eyes if needed while removing and returning fish specimens to their containers, since alcohol solutions could be accidentally splashed if fish are handled incorrectly. Alcohol solutions can cause severe eye irritation and discomfort if in direct contact, and reversible and/or irreversible corneal damage may occur. If alcohol is splashed on eyes, immediately flush eyes with plenty of water for 15 minutes.

10. Treat sharps and broken glassware containers carefully. Broken glass should be disposed of in properly marked safety containers. All sharps (needles, razor blades, etc.) used for any purpose must be disposed of in specially labeled SHARPS containers.

11. Use good personal hygiene. Keep your hands and face clean. Wash hands thoroughly with soap and water after handling any chemical or biological agent.

12. Clean up the work area on completion of an operation or an experiment. Before leaving the laboratory, you are responsible for making sure your lab area is clean and organized.