

ICHTHYOLOGY

BIOL 632-01, 632-L01

EVSS 724-01, 724-L01

Fall Semester 2017

Tues & Thurs 8:15 - 11:15 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*. 2nd 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 accommodation: If there is a student in the class who has a documented disability and has been approved to receive accommodations through the Center for Disability Services / SNAP, please discuss this with the instructor during office hours.

COURSE SCHEDULE

Required readings¹ 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 ¹ |
|-----------|--|---------------------------|
| August | | |
| Tu 22 | Introduction: The diversity of fishes | HCFB 1, 2 |
| Th 24 | Basic morphology: external and other features | HCFB 1, 2 HWG pp. 1-12 |
| Tu 29 | Systematics and fish taxonomy; dichotomous keys and other tools used in identification | HCFB 2 |
| Th 31 | Fish diversity 1: Agnatha, Gnathostomata and Chondrichthyes | HCFB 11, 12, 13 |
| September | | |
| Tu 05 | Fish diversity 1: Agnatha, Gnathostomata and Chondrichthyes, continued | HCFB 11, 12, 13 |
| Th 07 | Fish diversity 2: Osteichthyes; Sarcopterygii vs. Actinopterygii; Living Sarcopterygii; SIGN UP FOR CRITIQUE ARTICLE BY TODAY | HCFB 13 |

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| Tu 12 | Osteology - study of the skeleton; clearing and staining technique | HCFB 3; CLE 3, pp. 38-40 |
| Th 14 | Field activity: seining at Fort Johnson | |
| Tu 19 | Introduction to estuarine fish ecology | MC 31 |
| Th 21 | Fish diversity 3: basal Actinopterygii; Polypteriformes through Clupeomorpha | HCFB 14 |
| Tu 26 | Harbor trawling cruise | |
| Th 28 | Reproduction and growth | HCFB 4, 9, 10 |
| October | | |
| Tu 03 | Fish diversity 3: basal Actinopterygii; Polypteriformes through Clupeomorpha | HCFB 14 |
| Th 05 | Mid-term test on lecture material | |
| Tu 10 | Fish diversity 4: Euteleostei; Ostariophysii through Myctophiformes | HCFB 14 |
| Th 12 | Fish diversity 4: Euteleostei; Ostariophysii through Myctophiformes | HCFB 14 |
| Tu 17 | Fall Break | |
| Th 19 | Phylogenetic systematics lecture and lab | HCFB 2; CLE 9 |
| Tu 24 | Mid-term lab test (covering Required Fish Species No. 1 through 59, Myctophidae) | |
| Th 26 | Fish diversity 5: Acanthomorpha; Paracanthopterygii to Percomorpha | HCFB 14, 15 |
| Tu 31 | Field activity: Beach seining | |
| November | | |
| Th 02 | Fish ecology and assemblages | HCFB 19, 20; CLE 13; MC 27 |
| Tu 07 | Form and function of feeding; CRITIQUES DUE; CRITIQUE DISCUSSIONS BEGIN | HCFB 8 |
| Th 09 | Fish Diversity 6: Perciformes continued, Tetraodontiformes, Pleuronectiformes; CRITIQUE DISCUSSIONS | HCFB 15 |
| Tu 14 | Early life history stages of fishes; CRITIQUE DISCUSSIONS | HCFB 9, 10 |
| Th 16 | Form and function of buoyancy control | HCFB 4, 5 |
| Tu 21 | Form and function of locomotion | HCFB 4, 8 |
| Th 23 | Thanksgiving Break | |

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| Tu 28 | Geographic patterns and processes - biogeography of fishes; IDENTIFICATIONS OF UNKNOWN DUE | HCFB 16 |
| Th 30 | FINAL LAB PRACTICAL | |
| December | | |
| Th 07 | FINAL EXAMINATION: 8:15 - 11:15 AM | |

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.