



BIOLOGY OF FISHES; BIOL 335
Syllabus
Spring Semester 2018

Class schedule and locations

Lecture: Grice Marine Laboratory (GML) room 101, Monday 11:00 AM – 1:30 PM.

Labs: Section L01 Monday 2:10-5:10 PM; Section L02 Thursday 2:10-5:10 PM; Location - GML 101.

Instructor

Dr. Antony (Tony) S. Harold, Grice Marine Laboratory (GML), College of Charleston, 205 Fort Johnson, Charleston, SC 29412. Office telephone (843) 953-9180; fax (843) 953-9199; cellular (843) 460-2057; email harolda@cofc.edu.

Office hours and location: GML Annex, Rm. 125. Mailbox located in GML 102. Office hours: Monday 10:00-10:30 AM, Thursday 1:00-1:30 PM, or by appointment, in GML 125.

Course Description

A brief survey of gross morphology with emphasis on the structures used in identification and more detailed considerations of some of the aspects of evolution, ecology, physiology, life history, and behavior.

Learning Outcomes

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. Develop 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 accord with the Honor Code (see Student Handbook).
2. Attendance Policy: You are expected to attend all meetings of the class. More than five unexcused absences in total (either lecture or laboratory) will result in a grade of WA for the course. Note that the Monday lecture periods are each two lectures. Students reporting an absence should go to the Absence Memo Office located at 67 George Street (between Stern Center and Glebe Street) where the student may fill out a form with a schedule of missed classes, dates missed, etc., or visit their website at <http://deanofstudents.cofc.edu/>. A representative from the Absence Memo Office will notify the appropriate faculty by E-mail.
3. Electronic Devices: The use of cellular phones, laptops and other electronic devices during class is a distraction to both instructors and other students; to be fair to all those concerned they must not be in use while class is in session. Consequently, all electronic communications devices (e.g., cell phones, laptop computers) must be turned off during class. The use of a cellular phone for any purpose during a test will be treated as a violation of the Honor Code.

4. Textbooks

Required:

- Helfman, G.S., B.B. Collette, D.E. Facey, and B.W. Bowen. 2009. *The Diversity of Fishes*, 2nd edition. Wiley-Blackwell, Inc. [Be sure to get the 2009 edition, not the first edition published in 1997]
- Kells, V., and K. Carpenter. 2011. *A Field Guide to Coastal Fishes: From Maine to Texas*. Johns Hopkins University Press.

Optional:

- Cailliet, G.M., M.S. Love, and A.W. Ebeling. 1996. *Fishes: A Field and Laboratory Manual on their Structure, Identification, and Natural History*. Waveland Press, Inc., Prospect Heights, Illinois.

5. Laboratory activities

A. Dissections. You will need a dissecting kit, available at the College Bookstore or by on-line purchase from a scientific supply company; always bring the kit to class because, among other activities, the instruments will be needed for handling specimens.

B. Study of the fish skeleton (osteology).

C. Fish identification:

Learning to use dichotomous keys. Identification of specimens collected during class field activities. You will also make identifications of a set of 40 unknowns (you must work independently, **identifying your own unknowns**); these identifications are to be turned in towards the end of the semester for grading. You are to submit a typed list of the family, genus and species names for each jar of specimens you are assigned. The list of

- identifications is to be in numerical order, according to jar number.
- D. Standardized measuring (morphometrics) and counting (meristics) of structures used in identification and systematic analysis.
 - E. Learning the fishes in the Grice Marine Laboratory reference collection with special reference to a list of Required Fish Species, most of which are common in freshwater, estuarine or marine habitats in the Charleston area.

6. Field activities

Field activities are an important component of the course. We will make some shore-based collections using seine nets and other gear and also do some trawling in the harbor on board one of the Marine Resources Research Institute (SC DNR) vessels and the Grice Marine Lab's R/V *Chamberlain*.

During these activities you will use various types of nets and traps to sample the local fish species. We will also measure certain critical environmental parameters, such as temperature and salinity. Among our goals are (a) to report the various fish species found and their relative abundance, (b) to compare the fish faunas in various habitats, and (c) to hypothesize factors that may explain observed differences among species assemblages.

7. Tests/Exams

Identification test: Sight recognition of a subset of the first 50 species on the List of Required Fishes.

Final lab practical: **Cumulative** – sight recognition and identification, as in the Identification test, of a subset of all species on the List of Required Fishes.

Mid-term test: Covers all lecture material in the first half of the course.

Final Examination: **Cumulative** – all lecture material, including morphology and osteology, covered in the course.

Extra Credit Opportunity: Those students in the class that are graduating in May 2018 will take the MFT (Majors Field Test). This test was developed by the Department of Biology to assess how effective our undergraduate degree programs are. 10 extra credit points will be added to each student's points total on the final exam in Biology of Fishes.

Students who are not graduating this May will not take the MFT test and can earn the same number of extra credit points by completing additional lab work. That work will comprise identifying 10 more unknown fish species. This opportunity will be explained further in class.

8. Distribution of grades:

<i>Lecture</i>	
A. Mid-term lecture test	20%
B. Final Examination	30%
<i>Laboratory</i>	
C. Identification test	10%
D. Final lab practical	20%
E. Identification of unknowns	15%
F. Participation; adherence to course policies	05%

9. Grading scale:

A	94-100%
A-	90-93%
B+	87-89%
B	84-86%
B-	80-83%
C+	77-79%
C	74-76%
C-	70-73%
D+	67-69%
D	64-66%
D-	60-63%
F	<60%

LECTURE SCHEDULE (Monday, GML 101)

Specified Readings¹ below are chapter numbers in the course textbook, *The Diversity of Fishes*, 2nd edition, by Helfman et al. (2009), except **CLE** = Cailliet et al. (1996), and **MC** = Moyle, P.B. and J.J. Cech, Jr. (2000). *Fishes: An Introduction to Ichthyology*. Prentice-Hall, Englewood Cliffs, N.J. (CLE and MC readings will be provided).

Date	Topic	Readings ¹
January		
08	Introduction to Biology of Fishes: course layout, introduction to fish diversity and classification.	1, 2, 3
22	Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
29	Osteology of fishes	3; CLE 1, 3
February		
05	Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes)	11, 13
12	Phylogenetics and fishes	2, CLE 9
19	Fish ecology and diversity	21, 24; MC 27
26	Fish ecology and diversity	21, 24; MC 27

March		
05	MID-TERM TEST	
12	Fish assemblages in estuaries;	MC 31
19	SPRING BREAK	
26	Form and function of feeding	8; CLE 13
April		
02	Gas bladders and buoyancy control	4, 5, 7
09	Form and function of locomotion	5, 8; MC 2
16	Speciation and biogeography of fishes	16
23	Speciation and biogeography of fishes	16
Fri 27	FINAL EXAMINATION: GML 101, 12:00 – 3:00 PM	

**LAB SCHEDULE (GML 101)
L01 (Monday) and L02 (Thursday)**

Date	Topic	Readings¹
January		
Mon 08	L01: General morphology of fishes lab exercise	3; CLE 3
Thu 11	L02: General morphology of fishes lab exercise	3; CLE 3
Mon 15	Martin Luther King Day - holiday. No lab today for L01.	
Thu 18	L02: General morphology of fishes lab exercise	3; CLE 3
Mon 22	L01: General morphology of fishes lab exercise	3; CLE 3
Thu 25	L02: Diversity and relationships of fishes I: Agnatha, Chondrichthyes; Dichotomous keys and identification	11, 12, 13
Mon 29	L01: Diversity and relationships of fishes I: Agnatha, Chondrichthyes; Dichotomous keys and identification	11, 12, 13
February		
Thu 01	L02: Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes)	11, 13
Mon 05	L01: Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes)	11, 13
Thu 08	L02: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
Mon 12	L01: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
Thu 15	L02: Phylogenetics laboratory	2; CLE 9
Mon 19	L01: SPRING BREAK	
Thu 22	L02: SPRING BREAK	
Mon 26	L01: Field activity: Trawling on R/V Chamberlain; identification of unknowns	
March	L01: Phylogenetics laboratory	2; CLE 9
Thu 01	L02: IDENTIFICATION TEST (Required Fishes # 1 – 50) (starts at 3:00 PM)	

Mon 05	L01: IDENTIFICATION TEST (Required Fishes # 1 – 50) (starts at 3:00 PM)	
Thu 08	L02: Field activity: Trawling on R/V Chamberlain; identification of unknowns	
Mon 12	L01: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) as far as Perciformes	15
Thu 15	L02: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) as far as Perciformes	15
Mon 19	L01: Diversity and relationships of fishes IV continued: Acanthopterygii (spiny-rayed fishes): Perciformes through Tetraodontiformes	15
Thu 22	L02: Diversity and relationships of fishes IV continued: Acanthopterygii (spiny-rayed fishes): Perciformes through Tetraodontiformes	15
Mon 26	L01: HARBOR TRAWLING CRUISE	
Thu 29	L02: HARBOR TRAWLING CRUISE	
April		
Mon 02	L01: Fish reproduction and growth	20; CLE 12, 14
Thu 05	L02: Fish reproduction and growth	20; CLE 12, 14
Mon 09	Identification of unknowns	
Thu 12	Species discrimination and morphometrics; IDENTIFICATIONS OF UNKNOWNNS DUE (both lab sections); submit unknowns by email or hard copy	
Mon 16	Species discrimination and morphometrics	
Thu 19	L02: FINAL LAB PRACTICAL (starts at 3:00 PM)	
Mon 23	L01: FINAL LAB PRACTICAL (starts at 3:00 PM)	

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 335/335L 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.