



**BIOLOGY OF FISHES; BIOL 335**  
**Syllabus**  
**Spring Semester 2019**

**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, Friday 10:00-11:00 AM, 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 or silenced 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.

## 8. Graded work:

### *Lecture*

A. Mid-term lecture test	20%
B. Final Examination	30%

### *Laboratory*

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 Readings**<sup>1</sup> 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 <sup>1</sup>
<b>January</b>		
14	Introduction to Biology of Fishes: course layout, introduction to fish diversity and classification.	1, 2, 3
21	Martin Luther King Day - no class	
28	Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
<b>February</b>		
04	Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes), through Amiiformes	11, 13
11	Phylogenetics, diversity and biology of Teleostei and basal Acanthomorpha (Fish Diversity III in part)	14
18	Phylogenetics and fishes	2, CLE 9
25	<b>MID-TERM TEST</b>	
<b>March</b>		
04	Fish ecology and diversity	21, 24; MC 27
11	Fish assemblages in estuaries	MC 31
18	<b>SPRING BREAK</b>	
25	Form and function of feeding	8; CLE 13

April		
01	Form and function of feeding	8; CLE 13
08	Gas bladders and buoyancy control	4, 5, 7
15	Form and function of locomotion	5, 8; MC 2
22	Speciation and biogeography of fishes	16
Tues 23	Speciation and biogeography of fishes	16
Fri 26	<b>FINAL EXAMINATION: GML 101, 08:00 - 11:00 PM</b>	

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

Date	Topic	Readings <sup>1</sup>
<b>January</b>		
Thu 10	L02: Introduction to morphology of fishes	3; CLE 3
Mon 14	L01: Introduction to morphology of fishes	3; CLE 3
Thu 17	L02: Observing and recording morphological features	3; CLE 3
Mon 21	Martin Luther King Day - holiday. No lab today	
Thu 24	L02: Osteology	3; CLE 1, 3
Mon 28	L01: Observing and recording morphological features	3; CLE 3
Thu 31	L02: Species discrimination and morphometrics	
<b>February</b>		
Mon 04	L01: Osteology	3; CLE 1, 3
Thu 07	L02: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii.	14
Mon 11	L01: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
Thu 14	L02: Identification of unknown fish specimens	
Mon 18	L01: Beach seining (low tide 12:59 PM, height -0.79'); trawling on R/V Chamberlain	
Thu 21	L02: Beach seining (low tide 3:26 PM, height -1.10'); trawling on R/V Chamberlain	
Mon 25	<b>L01: IDENTIFICATION TEST (Required Fishes # 1 - 50) (starts at 3:00 PM)</b>	
Thu 28	<b>L02: IDENTIFICATION TEST (Required Fishes # 1 - 50) (starts at 3:00 PM)</b>	
<b>March</b>		
Mon 04	L01: Phylogenetics laboratory	2; CLE 9
Thu 07	L02: Phylogenetics laboratory	2; CLE 9
Mon 11	L01: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) through Tetraodontiformes	15

Thu 14	L02: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) through Tetraodontiformes	15
Mon 18	<b>SPRING BREAK</b>	
Thu 21	<b>SPRING BREAK</b>	
Mon 25	L01: <b>HARBOR TRAWLING CRUISE</b>	
Thu 28	L02: <b>HARBOR TRAWLING CRUISE</b>	
April		
Mon 01	L01: Study of trawl catch, internal anatomy with dissections	CLE 2 and 4
Thu 04	L02: Study of trawl catch, internal anatomy with dissections	CLE 2 and 4
Mon 08	L01: Identification of unknown fish specimens	
Thu 11	L02: Larval and juvenile fish studies	9
Mon 15	L01: Species discrimination and morphometrics; <b>IDENTIFICATIONS OF UNKNOWNNS DUE (both lab sections);</b> submit unknowns by email or hard copy	
Thu 18	L02: <b>FINAL LAB PRACTICAL (starts at 3:00 PM)</b>	
Mon 22	L01: <b>FINAL LAB PRACTICAL (starts at 3:00 PM)</b>	
Tue 23 ("Monday" lab)	L01: Larval and juvenile fish studies	9

## 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.