



BIOLOGY OF FISHES; BIOL 335
Syllabus
Spring Semester 2020

Course Prerequisites: BIOL 111/111L, 112/112L, 211/211D

Class schedule and locations

Lecture (CRN 20156): Rita Hollings Science Center (RITA), room 103, Tues/Thurs 09:25 – 10:40 AM.

Labs (Grice Marine Laboratory rm 101): Section L01(CRN 20157), Tuesday 2:30-5:30 PM; Section L02 (CRN 21590), Thursday 2:30-5:30 PM. A shuttle operates between main campus and the Grice Marine Laboratory. Reservations will guarantee your ride and can be made at <http://ssm.cofc.edu/shuttle.php>).

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: Wednesday 11:15-11:45 AM in RITA 226/228, or in GML 125 Friday 10:00-11:00 AM or by appointment.

Laboratory Teaching Assistant

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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. 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 cell phones 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. The use of a cellular phone or any other electronic device for any purpose during a test/exam will be treated as a violation of the Honor Code. You may, however, use a laptop computer or tablet during class for note taking, web access, or other activities associated with the lecture/lab.

4. Disabilities accommodations

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.

5. 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.

6. 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. A kit that includes fine-tipped forceps will be most helpful in addition to medium forceps, needle probe, scalpel, and scissors. Always bring your dissecting kit to lab. We will be using these instruments for study of both external and internal anatomy.
- 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. Through the semester you will making drawings of representatives of each of the Required Fishes in a notebook (blank paper and pencil). Please have the notebook with you for your lab on Diversity and Relationships of Fishes I in late January. A complete and carefully prepared notebook can earn you up to 10 extra credit points on the Final Lab Practical.

7. Field activities

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.

8. Tests/Exams

Mid-term 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 Mid-Term Identification Test, of a subset of all species on the List of Required Fishes.

Mid-Term Lecture Test: Covers all lecture material in the first half of the course.

Final Examination: **Cumulative** – all lecture material, also including morphology and osteology, covered in the course. Note that visual and written material distributed and presented during laboratory periods is also part of the lecture portion of the course and will be tested on the Mid-Term Lecture Test and the Final Examination.

9. Graded work:

<i>Lecture</i>	
A. Mid-term lecture test	20%
B. Final Examination	25%
<i>Laboratory</i>	
C. Mid-term lab test	15%
D. Final lab practical	20%
E. Identification of unknowns	15%
F. Laboratory notebook; adherence to course policies	05%

10. 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

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		
09	Introduction to Biology of Fishes: and the course layout	
14	Fish form, diversity and classification.	1, 2, 3

16	Osteology: Study of the skeleton	3; CLE 1, 3
21	Osteology: Study of the skeleton	3; CLE 1, 3
23	Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
28	Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
30	Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes), through Amiiformes	11, 13
February		
04	Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes)	11, 13
06	Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
11	Phylogenetics and fishes	2, CLE 9
13	Phylogenetics and fishes	2, CLE 9
18	Phylogenetics and fishes	2, CLE 9
20	MID-TERM LECTURE TEST	
25	Fish ecology and diversity	21, 24; MC 27
27	Fish ecology and diversity	21, 24; MC 27
March		
03	Fish ecology and diversity	21, 24; MC 27
05	Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) through Tetraodontiformes	15
10	Fish assemblages in estuaries	MC 31
12	Fish assemblages in estuaries	MC 31
17	SPRING BREAK	
19	SPRING BREAK	
24	Form and function of feeding	8; CLE 13
26	Form and function of feeding	8; CLE 13
31	Form and function of feeding	8; CLE 13
April		
02	Gas bladders and buoyancy control	4, 5, 7
07	Gas bladders and buoyancy control	4, 5, 7
09	Form and function of locomotion	5, 8; MC 2
14	Form and function of locomotion; IDENTIFICATION OF UNKNOWNNS DUE (both lab sections); submit by email to Dr. Harold as Excel file attachment or in class as a <u>typed</u> hard copy.	5, 8; MC 2
16	Speciation and biogeography of fishes	16
21	Speciation and biogeography of fishes	16
Sat Apr 25	FINAL EXAMINATION: RITA 103, 08:00 - 11:00 AM	

LAB SCHEDULE (GML 101)
L01 (Tuesday) and L02 (Thursday)

Date	Topic	Readings¹
January		
09	L02: Introduction to morphology of fishes	3; CLE 3
14	L01: Introduction to morphology of fishes	3; CLE 3
16	L02: Observing and recording morphological features	3; CLE 3
21	L01: Observing and recording morphological features	3; CLE 3
23	L02: Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
28	L01: Diversity and relationships of fishes I: Agnatha, Chondrichthyes	11, 12, 13
30	L02: Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes); Osteology	13
February		
04	L01: Diversity and relationships of fishes II: Osteichthyes, Sarcopterygii, basal Actinopterygii (ray-finned fishes); Osteology	13
06	L02: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
11	L01: Beach seining (low tide 3:44 PM, height -0.1');	
13	L02: Beach seining (low tide 5:22 PM, height -0.7')	
18	L01: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii.	14
20	L02: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii	14
25	L01: Diversity and relationships of fishes III: Teleostei through Paracanthopterygii.	14
27	L02: Larval and juvenile fish studies	9
March		
03	L01: IDENTIFICATION TEST (Required Fishes # 1 – 40) (starts at 3:00 PM)	
05	L02: IDENTIFICATION TEST (Required Fishes # 1 – 40) (starts at 3:00 PM)	
10	L01: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) through Tetraodontiformes	15
12	SPRING BREAK	
17	SPRING BREAK	
19	L02: Diversity and relationships of fishes IV: Acanthopterygii (spiny-rayed fishes) through Tetraodontiformes	15

24	L01: Identification of fish samples; trawling on R/V Chamberlain	
26	L02: Identification of fish samples; trawling on R/V Chamberlain	
31	L01: Larval and juvenile fish studies	9
April		
02	L02: Study of trawl catch, internal anatomy with dissections	CLE 2 and 4
07	L01: HARBOR TRAWLING CRUISE (tentatively)	
09	L02: HARBOR TRAWLING CRUISE	
14	L01: Study of trawl catch, internal anatomy with dissections	CLE 2 and 4
16	L02: FINAL LAB PRACTICAL (starts at 3:00 PM)	
21	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 ensure 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.