

BIOLOGY OF FISHES; BIOL 335

Syllabus

Fall Semester 2018

Class meetings: Mon. & Thurs. 12:45 PM – 2:00 PM. GML 101

Laboratory: Mon. or Thurs. 12:05 PM – 5:05 PM. GML 101

Instructor

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Office Hours

In my office at the Grice Marine Laboratory (room 206) by appointment, or before lectures or after laboratories (by appointment). There are **no excuses** to not come by my office to discuss any issues related with this course or any other topic related to fishes. My door is always open, and I expect all students to stop by my office to introduce yourselves at some point early in the semester, preferably in the first half! I do not bite, I love talking about fishes. Please come and talk to me EARLY on!

Course Description

This course will introduce you to various aspects of morphology, evolution, ecology, physiology, life history, behavior and conservation of fishes, as well as provide a brief survey of the structures used in identification of fish, paying special attention to the local Charleston area fauna. This will be accomplished by combining a series of class lectures and laboratory sessions, complemented with multiple field trips, practical exercises, use of dichotomous keys and specimen examinations. The first part of the course will cover general morphology, physiology and taxonomy, the second part stresses life histories, ecology and conservation. This course is part of the Global Foodways program (<http://blogs.cofc.edu/global-foodways/>)

Student Learning Outcome)

- Learn how to identify and recognize main taxonomic groups of fishes and their general characteristics; use of dichotomous and taxonomic keys.
- Learn to use different sources of scientific information in order to gain further knowledge about fish biology and ecology.
- Identify the various elements affecting the sustainability of fish populations today and relationships among them.
- Identify past fishery policies and practices that have led to changes in fish populations
- Synthesize knowledge regarding the sustainability of a commercial fishery, a specific freshwater fish conservation case or the importance of fish as food
- Appreciate the challenges of studying aquatic mobile organisms such as fishes
- Learn to have a good time while learning new information, because learning about fishes is fun.

Policies and Requirements

1. This course will be conducted strictly in accordance with the honor system of the College of Charleston (<http://www.cofc.edu/studentaffairs/HonorBoard.htm>). All work that you turn in for this course (whether for paper, exam or quiz) must be your own, and have not been utilized in any way for other course assignments (in doubt, check with me). Any form of plagiarism (intentional and unintentional), cheating, or presenting someone else's work as one's own will be treated as a serious academic transgression and will be communicated accordingly by the instructor as an honor code violation to the Division of Student Affairs. A student found responsible for academic dishonesty will receive a XF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the X to be expunged. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board. Please remember that unauthorized collaboration --working together without permission-- is a form of cheating. Unless I specify that you can work together on an assignment and/or test, no collaboration is permitted. Other forms of cheating include possessing or using an unauthorized study aid (such as a PDA, iPhone or smart phone with class relevant data), copying from another's exam, fabricating data, plagiarizing, and giving unauthorized assistance. Remember, research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the professor. You can find the complete Honor Code in the Student Handbook at http://www.cofc.edu/studentaffairs/general_info/studenthandbook.html. Be smart, learn a lot and have fun.

2. It is strongly recommended that you attend all class and laboratory meetings, unless you have a legitimate excuse (extreme illness or emergency), which should be communicated in advance to the instructor. Please show up on time. A word of advice, if you miss classes you will have great difficulties passing this course, I expect to cover certain materials in more depth than the textbooks do. Laboratory exercises are due at the beginning of each laboratory session. Students who need special accommodation to fully participate in this class are encouraged to speak to me as soon as possible so I can make proper accommodations, as well as to contact the Center for Disability Services (SNAP@cofc.edu).

3. All students are expected to turn in the papers and assignments by the beginning of the class period on the dates scheduled. Late papers will be marked down one full letter grade for every day of delay (so you receive an F for an assignment that is 4 days late). You should hold onto electronic and Xeroxed copies of all your assignments until the final grade for the class has been turned in.

4. Do not leave the class for a break during lecture – it is distracting and rude to have classmates come and go. If you are late you are welcome to join us, but please try to not be late.

Cell phones off/silent and out of sight unless you are expecting a truly urgent call beforehand (please notify instructor). NO TEXT MESSAGING DURING CLASS PLEASE! It can wait. It is a pet peeve of mine, if you cannot spend 70 minutes paying attention and participating in a fish biology class, then why did you sign up for the class? Also no laptops without special permission based on demonstrated need. I have been receiving lately complaints from students saying they are very distracting during lectures. Please stay awake, participate actively and be attentive. I encourage you to raise your hand or get my attention to interrupt lectures or labs at any time to ask a question.

Dissection Kit – The typical blue one they sell at the library works fine (scissors, tweezers, needles, etc.). Please mark/tag all you instruments and tools, or you will be misplacing them in the laboratories.

Lab Notebook: Given the amount of material covered in this course, you may find it useful to maintain a lab notebook. In this notebook, you can keep sketches, definitions, and any other notes that help you learn the material and study for exams. Any type of notebook can be used. This is not a class requirement, but merely a helpful suggestion.

Classroom activities

Lectures in class will provide you with base information regarding the biology of fishes, but more in depth knowledge will be acquired through laboratory sessions and by consultation of the textbooks. You are expected to have read the relevant sections of the textbooks prior to the lectures and labs. The main textbook used for this class (Helfman et al. 2009) is a very extensive book and may seem “arid” at times, but is a great source of information. If you become especially interested in any specific topics related to fishes after a class, please come to my office and I will be able to hand you extra complementary and in-depth materials!

It is strongly suggested that during lectures you take your own notes. Take notes when the course becomes interesting, when it is dull and when pictures of fish are being shown (basically always take notes). Copies of most of the overheads used in the class will be made available on the web to all students before the lecture, but this is not an excuse for you not to take notes or to stop attending the classes. Under no circumstances believe that you can pass this course by just reading the handouts, they are just a compliment to your own notes and the textbooks. If you miss a class, please contact your classmates and make a copy of their handouts, since they will have essential class notes written on them.

Laboratory activities:

- A. *Dissections*. You will need a dissecting kit, available at the College Bookstore; **always bring the dissection kit to laboratory sessions because, among other activities, the instruments will be needed for handling specimens while making identifications.**
- B. *Study of the fish skeleton* (osteology).
- C. *Morphometrics and meristics*. Standardized measuring (morphometrics) and counting (meristics) of structures used in identification and systematic analysis.
- D. *Diversity*. Learning the fishes in the Grice Marine Laboratory reference collection.
- E. *Fish identification*. Learning to use dichotomous keys and identification of specimens collected during class field activities. You **NEED** to have one of the two required fish identification guides, bring to every laboratory section.
- F. *Field sampling techniques*. Use of different methodologies employed to capture fishes in various environments

During the laboratory sessions you will have **to complete the identification of a set of 40 unknown fish specimens** (you **must** identify your **own** unknowns to receive a grade) from the laboratory collection. You are to turn in by the set date 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.

Field activities:

Field activities are an important component of the course, mostly taking place during laboratory sessions. We will make some near-shore collections locally and do some trawling in Charleston

harbor on board one of the SC Department of Natural Resources vessels. Please bear in mind that some flexible scheduling will be necessary in order to allow for certain field activities to occur. Specific notice of special scheduling needs will be given in advance to allow for field activity planning and logistical preparations, as well as to insure full student participation (do not miss the field trips!).

During some field activities we will use various types of nets and traps to sample the fish species present in different aquatic habitats. We will also measure certain critical environmental parameters that might help explain the fish species found at each location. Among our goals are to (a) report the various fish species found and their abundance, (b) describe and compare the fish faunas in various habitats, and (c) hypothesize about which factors could explain any observed differences among the sampled fish species assemblages.

Proper foot protection will be needed to participate in field trips, and the instructor will turn back any students not wearing proper shoe wear.

Web based research exercise

You will be required to answer a series of questions that will be given to you in advance by the instructor regarding different aspects of fish taxonomy and biology. Specific instructions will be issued with the assignment, and the necessary information to answer these questions should be obtained from www.fishbase.org, an ichthyological website that accumulates extensive information on fishes that can become a very useful tool for students. Please note that this webpage can be slow at times and has been known to crash when too many users are logged on, so please do not all wait until the last moment to do this assignment!

Research paper:

You will be required to write a paper that reviews the current published research on some specific aspect of fish biology. The topic may be chosen from a list that will be provided or ideally, subject to approval by the instructor, you may choose a topic on your own (I encourage you to do the latter!). Focusing on the importance fishes as food is also an option. The paper should be no longer than 1500 words in length (not including Literature Cited) with a **minimum** of 10 references from the **primary scientific literature**. Review articles from scientific journals or popular magazines such as *Scientific American*, *Discover*, *Endeavor*, and *Science News* **do not** represent publication of original, peer-reviewed, research and are, therefore, not part of the primary scientific literature. **You can cite some non-primary sources but you must still have at least 10 cited from the primary literature.** Follow the *Journal of Fish Biology* (Journal of the Fisheries Society of the British Isles) literature cited format exactly! Type references to the articles in the format as described in the instructions to authors from the journal *JFB* under the heading REFERENCES. Instructions to authors can be found in actual *JFB* journals or in the journal's webpage, it is your responsibility to find them, read them and follow them! Pay close attention to the format of the cited articles; the appropriateness of these references to your topic and adherence to the format will be graded.

Please prepare your paper as though it were a manuscript for publication, following formats for manuscripts of the journal *Journal of Fish Biology*. The title should head the first page, followed by the Abstract and then the Introduction, Materials and Methods (your own methods! What did you use, where?), Results, Discussion (these two last sections can be combined into a single "Results-Discussion" section), Acknowledgments, References. The main differences between a published article, as seen in the published journal, and your paper are that your paper should be double-spaced (typed) in a 12 pt. font and presented in single (not double) columns. Any figures

or tables you use should be numbered, captioned, referenced according to their literature source, and placed at the back of your paper, each on a separate page. See the JFB website, where manuscript formatting rules are presented in great detail, and consult an actual article published in JFB.

Submit your typed final paper properly formatted by the due date. I will accept preliminary versions of the paper **only before the specified date**, which I will correct, comment and return to you (but not grade). The final paper will be graded as if it were a submission to a scientific journal. Content of the paper (50%) and its adherence to proper format (50%) will be graded.

Research paper oral presentation (Mini Symposium)

The results from your research paper will be publicly presented to the class during the Laboratory sessions. The format of these presentations should adhere to standard research symposium oral presentation guidelines. Time limits will be strictly enforced and presentations should be restricted to ten minutes total (9-8 minutes for presentation and 1-2 minutes for questions). Presentations can be supported different graphical aids, though the use of Powerpoint presentations is recommended. The content (50%) of the presentations as well as their style and clarity (50%) will be evaluated and graded. A very strong recommendation: practice your talk multiple times before the actual class presentation.

Tests/Exams

Final lab practical: It will mainly consist of the sight recognition and identification of a subset of species from the **List of Required Fishes** (106 different species). At each station you should give the family, genus, and species names, plus the accepted common name for the fish. There will also be stations dealing with general morphology and osteology of fishes. A **first lab practical** will be held so you can practice, and it will include only the first 30 species from the List of Required Fishes.

Mid-term test: Will include all the lecture material covered in the first half of the course (morphology, evolution, diversity and physiology of fishes), including the October 4th lecture.

Final Examination: Cumulative – it will include all lecture material covered in the course, though emphasizing the lecture materials covered in second half of the course (life history, ecology, behavior and conservation of fishes).

Grading:

Mid-term test	15%
Research project paper	13%
Research project presentation	4%
Final Examination	25%
Web based exercise	4%
Identification of 40 unknowns	15%
First lab practical (1-30 fishes)	4%
Final lab practical (1-106 fishes)	20%

Grading scale:

93-100 = A	Superb
90-92 = A-	Excellent
87-89 = B+	Very good

83-86	= B	Good
80-82	= B-	Just good
77-79	= C+	Above average
73-76	= C	Average
70-72	= C-	Below average
67-69	= D+	Acceptable
63-66	= D	Barely acceptable
62-60	= D-	Almost acceptable
<60	= F	Failing

Helpful Advice to do well in this class:

1. Attend class! Attend class!
2. Get involved. Ask questions (to both the instructor and your peers).
3. Don't just take notes, LISTEN, QUESTION, and LEARN during class time (active learning).
4. Rewrite your notes promptly (within 24 hours of lecture)
5. Keep up. Ask Questions. Search for deeper knowledge
6. Get some sleep outside of class. If you come to class and sleep, you can't expect to learn much.
7. Study to understand, not to remember. Though some remembering is required too.
8. Remember to think logically about biological concepts; you will frequently be able to reason out an answer instead of just memorizing it.
9. Come see me with your questions or concerns, I will be happy to help!
10. Fishes are cool, be sure to try to learn as much as you can about these animals... my job is to help you in doing so.

Laboratory Safety in BIOL 335:

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 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 fish 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.

13. Always have your College of Charleston identification and insurance information with you when working in a laboratory or in the field. MedicAlert identification must be worn if you have any potential life-threatening chemical sensitivities or medical conditions.

14- Appropriate clothing must be worn during field trips. The instructor will determine and inform the students ahead of time of what specific clothing and protective gear must be worn for each individual field trip, depending on the environment or gear being used. Proper foot protection will be needed to participate in field trips, and the instructor will turn back any students not wearing proper shoe wear.

15. Report any accident or injury, however minor, to your instructor or lab manager immediately. An accident report form must be completed and forwarded to the department chair, dean, and to the Director of Environmental Health and Safety

COURSE OUTLINE

Date	LECTURE TOPIC	Readings ¹
August		
Th 23	End of the Line Movie (<i>in class</i>)	
Mo 27	Course Introduction. History of Ichthyology	1
Th 30	History of Ichthyology. General Morphology	1, 3
September		
Mo 3	Skeleton, Skin and Scales	3
Th 6	Systematics and Evolution. Diversity of Fishes I WEB BASED EXERCISE DUE	2, 11
Mo 10	Diversity of Fishes II	11, 12, 13, 14, 15
Th 13	Diversity of Fishes III	11, 12, 13, 14, 15
Mo 17	Hurricane Cancellation	
Th 20	Diversity of Fishes IV	11, 12, 13, 14, 15
Mo 24	Diversity of Fishes V	
Th 27	Diversity of Fishes VI	11, 12, 13, 14, 15
October		
Mo 1	Soft Anatomy RESEARCH PAPER DRAFT DUE	4
Th 4	Respiration, Circulation and Metabolism	5
Mo 8	Homeostasis	7
Th 11	Sensory Perception I	
Mo 15	MID-TERM TEST	6
Th 18	Sensory Perception II	6
Mo 22	Swimming and Locomotion	8
Th 25	Reproduction	20
Mo 29	Early Life History	9
November		
Th 1	Age and Growth	10
Mo 5	FALL BREAK (no class)	
Th 8	Feeding. Fishes as predators and prey I	8, 18, 19
Mo 12	Feeding. Fishes as predators and prey II RESEARCH PAPER DUE	8, 18, 19
Th 15	Schooling and Migration	21, 22
Mo 19	No Class	
Th 22	THANKSGIVING BREAK (no class)	
Mo 26	Conservation and Fisheries I	25
Th 29	Conservation and Fisheries II	25
December		
Mo 3	Conservation and Fisheries III	25
Tu 11	FINAL EXAM (cumulative) (12-3 PM)	

Specified Readings¹ are chapters in the text by Helfman.

Date	LABORATORY 1	
August		
Mo 27	Introduction to Laboratory & MRL Basic fish morphology.	
Mo 3	Introduction to use of identification keys; Osteology	
September		
Mo 10	Grice Cove Seining <i>Field Trip</i>	Low tide 3:15
Mo 17	Charleston Harbor Trawling Cruise <i>Field Trip</i>	
Mo 24	FIRST LAB PRACTICAL EXAM (first 30 fishes only)	
October		
Mo 1	Folly Beach Seining <i>Field Trip</i>	
Mo 8	Internal Anatomy Laboratory	
Mo 15	Grice Cove Seining <i>Field Trip</i>	
Mo 22	Morphometrics and meristics laboratory	
Mo 29	IDENTIFICATION OF 40 UNKNOWNNS DUE in Class Fisheries Discussion / Fish as Food	
Mo 5	RESEARCH PAPER PRESENTATIONS	
November		
Mo 12	RESEARCH PAPER PRESENTATIONS	
Mo 19	FALL BREAK - NO LAB	
Mo 26	FINAL LAB PRACTICAL (all 106 required fishes, osteology, external morphology) RESEARCH PAPER PRESENTATIONS	
Mo 3	NO LAB	

Always bring your fish ID Book and dissection Kit to Laboratory.

Date	LABORATORY 2	
August		
Th 23	NO LAB	
Th 30	Introduction to Laboratory & MRL Basic fish morphology.	
September		
Th 6	Introduction to use of identification keys; Osteology	
Th 13	Grice Cove Seining <i>Field Trip</i>	Low tide 5:45
Th 20	Charleston Harbor Trawling Cruise <i>Field Trip</i>	
Th 27	FIRST LAB PRACTICAL EXAM (first 30 fishes only)	
October		
Th 4	Folly Beach Seining <i>Field Trip</i>	
Th 11	Internal Anatomy Laboratory	
Th 18	Grice Cove Seining <i>Field Trip</i>	
Th 25	Morphometrics and meristics laboratory	
November		
Th 1	IDENTIFICATION OF 40 UNKNOWNNS DUE in Class Fisheries Discussion / Fish as Food	
Th 8	RESEARCH PAPER PRESENTATIONS	
Th 15	RESEARCH PAPER PRESENTATIONS	
Th 22	THANKSGIVING (no Lab)	
Th 29	FINAL LAB PRACTICAL (all 106 required fishes, osteology, external morphology)	

Please be prepared for the field trips, bringing the appropriate clothing and shoe ware (you very likely will get wet) and showing up in the GRICE Lab on time! You cannot miss field trips