Ichthyology – IB 463
Fall 2018

General Description
Ichthyology is a 4 credit courses that focuses on the ecology and evolution of fish. The course has three main goals. First, students should be able to identify the major fish groups of the world and the common species found in Illinois. In doing so, they should be able to explain where they occur in a phylogenetic context and the diagnostic traits used to identify them. Second, students should be able to explain how fish deal with the challenges posed by living in water. This includes how fish move in water, balance their ions, maintain their position in the water column, eat/avoid predation, and obtain information (i.e. sensory systems) in their environments. Third, students should be familiar with the ecological and evolutionary factors that affect the abundance of different fish groups on the earth. This includes discussions of macroevolution, ecology, and conservation.

Pre-Requisites
Students should have had a course in ecology and evolution. For IB majors, IB302 (Evolution) and IB203 (Ecology) meet these needs. For IB honors students, IB 372 (Ecology and Evolution) meets these needs. Most juniors and seniors from NRES will have also had courses with a significant emphasis on ecology and evolution. If in doubt as to whether or not you meet these pre-requisites, then contact the instructor. Typically, juniors and seniors in IB and NRES have had the appropriate training for IB463.

Requirements that IB463 meets
IB463 qualifies as an upper-level laboratory course for IB majors. It also qualifies as an organismal biology course for NRES majors. Finally, graduate students may earn graduate credit through IB 463.

Lecture
Time: 09:30-10:50, T-Th
Place: 225A Talbot

Laboratory
Time: 13:00-16:50, T
Place: 304 Rogers Adams Laboratory

Instructor
Becky Fuller e-mail: fuller@life.uiuc.edu
office: 104 Shelford Vivarium
phone: 333-9065
Office Hours: by appointment

Teaching Assistant
Rachel Moran e-mail: rmoran9@illinois.edu
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Office Hours: by appointment

Required Textbook
The Diversity of Fishes. 2nd edition, 2009. Authors: Helfman, Collette, and Facey.

Note: you can buy used copies of this book at amazon.com. There were also cheap used ones at www.Valorebooks.com

Helpful Additional Resources

Peterson Field Guide: Freshwater Fishes of North America and Mexico. By Page and Burr. Houghton Mifflin Publisher

Fishes of Illinois. by Phillip Smith.

Fishes of the World. By Joseph Nelson.

Course website
https://learn.illinois.edu/course/view.php?id=18070
It's a moodle site.

Course Objectives/Learning Goals
1. Students should be able to identify the major groups of fishes in the world based on their defining characters and traits and explain where they are found (both habitat and geography) and why.

2. Students should be able to explain the major physiological adaptations used by different fish to survive in aquatic habitats. In particular, students should be able to explain how (a) gills work for both respiration and osmoregulation, (b) how fish get air in their swimbladders, (c) tricks for living at great depth, (d) tricks for living in moving water, and (e) the various challenges and solutions that emerge due to variation in lighting environments.

3. Students should be able to interpret data and propose solutions (both ecological and evolutionary) for human-induced changes to environments that affect fish distribution, abundance, and biodiversity today.

Required Work
1. Three hour-long examinations consisting of short essays, solutions to quantitative problems, and simple illustrations of phylogenies and/or key anatomical parts for labeling. Two of the exams will be conducted in class during the semester. The third will take place during finals week. The exams are non-cumulative in the sense that they emphasize material presented since the last exam. However, the nature of the material is cumulative in that the material presented in each lecture builds on information from the previous lectures. The three exams are each worth 50 points towards your final grade.

2. One short research project to be written as a scientific paper. During the first week of class, I will present you with 4-5 different research projects. I will assign you into groups of 4-5 people. You will collect the data with your group. You may analyze your data together and share graphs/results. I will allow you to write the "results" section as a group. However, all other parts of the paper (introduction, materials and methods, and discussion) are to be written independently. There should be no identical sentences/paragraphs. I will hand out a guide as to how the paper should be written. This paper is worth 50 points.

3. One laboratory practical. In this practical, you will be asked to identify various fish to order, family, and/or genus species and may be asked to identify critical structures or relate important characteristics of the group to which a given specimen belongs. The practical is worth 50 points. The practical will take place on the last day of lab in December.

4. Outreach Project. In 2010, 2012, and 2014, the class did an 'outreach project'. The 2010 class made podcasts that centered on fish (http://www.life.illinois.edu/fishfolks). The 2012 class made a webpage on the fishes of Boneyard Creek (http://fishesofboneyardcreek.weebly.com/). The 2014 class dramatically improved the Boneyard Creek website. This year, we are going to discuss various options for the outreach project. It would be nice to build around the Boneyard. I was thinking of podcasts about the various fish pages or perhaps even videos. We can brainstorm this as a group. Regardless of which activity we choose, the project will involve three steps (a) making a draft of your product, (b) receiving critique from your classmates, and (c) revising your product in light of their comments. You will also be required to provide comments on your classmates' assignments.

5. Attendance/Participation. I expect you to attend class and to participate in class activities. There will be various activities that we do in the classroom, and we will assign points for these. Not every class will have a 'graded' activity, but many will. There will be a total of 50 points for classroom activities.

6. In-class presentations (graduate students only). The graduate students will give four presentations to the undergraduates covering four articles in the primary literature. These presentations will be about 15-20 minutes each. The goal here is to take a slightly complicated primary literature paper and make it easily understandable to your classmates. You may meet with the instructor (either Fuller or Fields) to discuss the paper and receive some guidance on the presentation.

Critical Dates
Examination #1: TBA
Examination #2: TBA
Examination #3: TBA

Paper due on TBA
Lab Practical on TBA

Grade Determination:

The final grade is based on the cumulative point total from all required work. The accumulation of at least 90% of the possible points will guarantee a grade of A; accumulation of at least 80% of possible points will guarantee a grade of B; accumulation of at least 70% of possible points will guarantee a grade of C. Grades below the level of C are not mentioned in polite company, but will be assigned without hesitation if necessary.

The instructor reserves the right to use discretion in individual cases that will not violate the rules given above. In other words, no student that accumulates the minimum percentage of points for a specific letter grade will receive anything below that letter grade, but in some cases I might award a specific grade to someone whose percentage total is slightly below the minimum for that grade. For example, no one who garners at least 70% of the possible points will receive a grade below C, but there may be a case in which a student accumulates less than 70% of the points but still receives a grade of C. This can happen if the student starts poorly but shows steady improvement throughout the semester such that the poor start might deserve some forgiveness. Similarly, this might happen if the student had problems with test taking but participated well in class activities to the point where I was convinced that the student had a good grasp on the material. These are two examples of several possible special cases.

The required work will contribute to the cumulative points as follows:

1. Each hour-long examination – 50 points (3 exams in total)
2. Research Project / Paper – 50 points
3. Lab Practical – 50 points
4. Outreach Project – 50 points
5. In-Class Activities/Attendance - 50 points
6. In-Class Presentations (Graduate Students Only) - 50 points

Note: The undergraduates have a total point possibility of 350 points. The graduate students have a total point possibility of 400 points.

Disability Accommodations

To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class are asked to see me as soon as possible.

Statement of Academic Integrity

I expect you to be familiar with and adhere to the university's academic honor code as described in the Student Code (http://studentcode.illinois.edu/article1_part4_1-401.html). Any claim of ignorance of the student code is unacceptable. No forms of cheating will be tolerated. Anyone found guilty of cheating will receive a 0 for that assignment and may be referred to the Senate Committee for Student Discipline.

Important General Policies:

1. You are responsible for everything covered in lectures and assigned readings. Note that for some topics, the assigned reading may not have extensive overlap with the lecture material. This means that you may encounter exam questions on material that is covered in the text but was not discussed in lecture. I expect you to know and understand the assigned material regardless of its origin (textbook or lecture). Of course, office hours and review sessions may be used for questions about any required material.

2. You are free to ask for a re-evaluation of any part of any examination (i.e. a "regrade") under these conditions. First, your request must be made in writing and turned in to me no later than one week after your graded examination is returned to you; no requests will be accepted after the one-week deadline. Second, your request must be in the form of a one-page, typewritten, double-spaced justification of why you believe your answer was graded incorrectly or why the question was unfair, etc. This justification must compare your answer to the full-credit answers that will be posted (which will have been written by one of your colleagues in the class – no names will be revealed of course) and explain why your answer is as good as those. Third, by making such a request for a regrade you accept that I may exercise my option to regrade one or more of your other answers on that same examination. Fourth, all re-grading decisions are final.

3. If you miss a scheduled examination, you must notify me no later than one week before the examination. When you notify me we will schedule a make-up examination for you. If you miss a scheduled examination due to illness or unanticipated circumstances, you must bring a doctor's note to verify the illness or other documentation for other circumstances. When you present that material to me, we will schedule a make-up examination for you. If there are other circumstances that create a problem for you in taking an examination on the scheduled day, please talk to me about them.

4. Late assignments will be docked points. Turn in your assignments on time.

5. If you wish to be excused from class to observe a religious holy day in your faith, please notify me in advance so that we can arrange for you to make up the work you will miss.

6. Students with disabilities who need to take exams at DRES should notify me in advance of the test.

7. I will call your attention to these policies on the first day of class and thereafter expect you to be familiar with them.

8. Please notify me if you need these documents provided in an alternative format. This document along with all other supplementary material will be available on the course webpage.

Ichthyology: Schedule of Lectures and Reading

Note: Any deviations from the schedule will be announced in class. The amount of reading will not increase, but may decrease if we run behind schedule.

Date	Topic	Reading
1. 8/28 – Tuesday	Class Introduction, What is a fish? What do we want to learn? Basic Fish Trivia. Why do we care about phylogenies?	Ch. 1-2, pg. 3-19
2. 8/30 – Thursday	Discuss Tuesday in the Field. Decide on Field Projects. Early Vertebrates, Jawless Fishes.	Ch. 11, pg. 169-179 Ch. 13, pg. 231-241
3. 9/4- Tuesday	Fossil Fishes & The Evolution of Jaws.	Everyone: Anderson et al. 2011. Undergrads - Make a list of 10 questions about this paper. Grads: in-class summary of Anderson et al. 2011. Ask The Expert: Dr. Phil Anderson.
4. 9/6 – Thursday	Outreach Project: Getting Organized	None
5. 9/11 – Tuesday	Character matrix for Chondrichthyes	Ch. 11, pg. 197-200; Ch.12, pg. 205-230
6. 9/13 – Thursday	Chondrichthyes - Come to class with 10 cool facts about Chondrichthyes. They must have some sort of 'evidence' for them besides Shark Week. We will try to make sense out of these facts.	
7. 9/18 - Tuesday	More Chondrichthyes	
8. 9/20 - Thursday	Carp & Game Fish – Prep for field trip	Ch. 26, pg. 596-605 Ask The Expert: Skype John Chick
9. 9/25 - Tuesday	Day to Catch Up & Review	
10. 9/27 - Thursday	Exam #1:	
11. 10/2 - Tuesday	General Patterns in Fish Evolution - Making it to Teleosts	Ch. 11, pg. 185-196 Ch. 3, pg. 23-40 Ch. 17, pg. 353-359
12. 10/4 - Thursday	The Teleost Genome duplication event	Ch. 17. Everyone: Amores et al. 2011 Grads: In-class Summary of Amores et al. 2011 Ask the Expert: Dr. Julian Catchen
13. 10/9 - Tuesday	Sarcopterygii & Coelacanths &	Ch. 13, pg. 242-259

	lungfish & Tetrapods	Ch. 11, pg. 179-185,186-187
14. 10/11 - Thursday	Zoogeography: Spotlight on cichlids	Ch. 16, pg. 329-354. Ch. 15, pg. 307-312
15. 10/16 - Tuesday	Electric Signaling: Spotlight on Osteoglossomorpha	Ch. 6, pg. 80-84 Ch.14, 261-264
16. 10/18 – Thursday	Elopomorpha & Clupeomorpha: fish hearing, lateral line & glass eel conservation	Ch. 6, pg. 75-80 Ch. 14, pg. 264-267 Everyone: in-class discussion of Vogel 2010.
17. 10/23 - Tuesday	Swim Bladders, Buoyancy, Adaptation to depth & Crazy Deepwater Fishes	Ch. 5, pg. 68-70. Ch. 18, pg. 393-401.
18. 10/25 - Thursday	Respiration & Gills: Spotlight on Cottids	Ch. 5, pg. 57-66. Ch. 15, pg. 299-300 Grads: in-class summary of Mandic et al. 2009
19. 10/30 - Tuesday	Day to Catch Up & Review	
20. 11/1 - Thursday	Exam #2:	
21. 11/6 - Tuesday	Vision in variable aquatic lighting habitats	Ch. 6, pg. 84-87. Everyone: Fuller et al. 2010.
22. 11/8 - Thursday	Speciation in fishes - Moran Guest Lecture	TBA
23. 11/13 - Tuesday	Mating Systems & Parental Care: Spotlight on Gasterosteiformes	Ch. 21, pg. 455-476 Ch. 15, pg. 298-299
24. 11/15 - Thursday	The Physiology of Reproduction: Spotlight on Poeciliidae	Ch. 9, pg.130-137. Ch. 25, pg. 605-607. Everyone: in-class discussion of Reznick et al. 2002
25. 11/27 - Tuesday	Dams, Life History / Life tables: spotlight on salmonids.	Ch. 24, pg. 525-532. Ch. 14, pg. 275-279.
26. 11/29 - Thursday	Dams, Life History / Life tables: spotlight on salmonids.	Ch. 26, pg. 591-596. Everyone: Karieva et al. 2000. Science
27. 12/4 - Tuesday	Fish Olfaction	
28. 12/6 - Thursday	Marine Reserves	Ch. 26, pg. 618-623 Everyone Lubchenko & Grorud-Colvert 2015; Hillborn 2015.
29. 12/11 - Tuesday	Day to Catch Up & Review	
TBA	Final Exam	