ENR 5350.02
Taxonomy and Behavior of Fishes

Syllabus and Class Schedule
Autumn 2017

Lecture: Wednesday 12:20-1:20 pm
Lab: Wednesday 3:15-6:15pm
***or* Thursday: 4:00-7:00 pm**

Heffner Wetland Research Building

INSTRUCTOR:

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*when emailing, please include "ENR5350.02" in the subject line
*office hours are by appointment

COURSE DESCRIPTION:

Freshwater fish comprise more than 30% of all vertebrate species, yet available freshwaters make up less than 1% of Earth's habitats. In this course we will explore this incredible diversity through the study of fish taxonomy and behavior, with an emphasis on understanding the evolutionary relationships between taxa and the ways that fish have adapted to a wide range of environmental conditions, including environmental variation caused by human activity.

COURSE GOALS:

1. Explore the diversity of fishes, with emphasis on the freshwater fishes of Ohio.
2. Explore fish behavior, especially as it pertains to the ways that fish respond to and interact with their social and ecological environment.
3. Promote critical thinking about how human-induced environmental change influences fish populations.

STUDENT LEARNING OBJECTIVES:

1. Learn to identify the major groups of fishes and their evolutionary relationships.
2. Learn the basic biology of fishes, including morphology and anatomy, behavior, form and function.
3. Learn to identify the major groups of Ohio fishes and to identify common fishes to species-level.
4. Identify morphological and behavioral adaptations to diverse environments.
5. Learn basic fish collection and preservation skills.
6. Investigate the effects of human activities on the diversity of fishes.

COURSE STRUCTURE:

We will meet as one group once per week for a one hour lecture that covers the biology, ecology, and behavior of fishes. The group will be split into two lab sections that also meets ones per week for a three hour field or lab session. The format of the labs will vary from week to week depending on planned field or lab activities. Classes and labs will be held at the Heffner Wetland Research Building.

Lecture:	Wednesdays	12:20 to 1:20 pm
Labs:	Wednesdays	3:15 to 6:15 pm
	Thursdays	4:00 to 7:00 pm

LABORATORY AND FIELD ACTIVITIES:

Labs will be used to gain hands-on experience collecting, identifying, and observing fishes, with an emphasis on Ohio fishes. While identification skills are being learned, students will also be asked to critically evaluate the morphological features we use to ID the fish, identify similarities/differences between distantly and closely related groups, and consider the linkages between these traits and the environments where the fish are found.

Field Sampling: Some labs will be devoted to collecting, preserving, and identifying fishes found in local streams, rivers and ponds. The goal of field sampling will be to familiarize students with fish collection and handling methods, preservation techniques, and identifying live specimens. Appropriate clothing should be worn for field labs (you

may get wet and dirty). Waders are available for use at the Wetlands Centre or you can bring your own.

Lab work: Regular labs will be devoted to learning the basic morphology of fishes through dissection, how to identify preserved fish to species, and how to quantify and analyze fish behaviors. When in the lab students should wear closed-toed shoes and long pants or skirts. Dissection materials and equipment will be provided but you can also bring your own dissection kit if you wish.

COURSE MATERIAL AND RESOURCES

1. Laboratory Manual: We have compiled a Laboratory Manual that is available in electronic format on the class Carmen page (combined in one pdf and by lab in separate modules). You are required to access and read the section for each lab BEFORE arriving to the field site or to the lab. Note that we will periodically be updating the lab manual, but will make sure to announce any changes to the class.

2. Text: There is no required text for this course; however, I *highly recommend* that you consider purchasing the following text:

Trautman, M.B. 1981. The Fishes of Ohio (revised Ed.). Ohio State University Press, Columbus. Pp. 782.

> ***Note****: Limited copies will be available in lab for ID purposes and on reserve at the CFAES library.*

Other Recommended Books

Hubbs, C.L. and Lagler, K.F. (revised by Smith G.R.). 2004. Fishes of the Great Lakes Region. The University of Michigan Press, Ann Arbour. Pp 276.

Moyle, P.B. and Cech, J.J. 2004. Fishes: An Introduction to Ichthyology (5^{th} Ed.). Prentice Hall, Upper Saddle River, NJ. Pp. 726.

Holm, E., Mandrak, N.E., and Burridge, M. 2008. The ROM Field Guide to Freshwater Fishes of Ontario. Royal Ontario Museum, Toronto, Ontario. Pp. 432.

Magnhagen, C., Braithwaite, V.A., and Forsgren, E. 2008. Fish Behaviour. CRC Press. Pp. 662.

3. Web Resources: The class website on CARMEN will be used to make announcements, promote peer-peer discussions, post additional readings and resources, etc. Please check it often.

A class website, https://u.osu.edu/enrfishtax/, will be used for posting #scicomm assignments. All students must sign in to u.osu.edu and then be added to the class site in order to post their #scicomm assignments.

Other potentially useful on-line tools:

http://www.fishbase.org/search.php

http://currents.plos.org/treeoflife/article/the-tree-of-life-and-a-new-classification-of-bony-fishes/

http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/Ichthyology/catalog/fishcatmain.asp

http://swordtail.tamu.edu/anyfish/Main_Page

http://evolution.berkeley.edu/evolibrary/article/fishtree_01

NOTE: There will be **supplemental readings** assigned for discussion in some classes. These readings will be posted on Carmen. Readings are meant to augment material covered in lecture and solidify your understanding of the general concepts presented; therefore, these readings are required.

STUDENT EVALUATION

Lab Quizzes (4 total, 5% each)	= 20%
Midterms (2 total, 8% each)	= 16%
Field Collection and Report	= 25%
Behavioral Observations Report	= 15%
#scicomm assignments (2 total, 7% each)	= 14%
Attendance and Participation	= 10%
TOTAL	**=100%**

GRADING SCHEME

93-100%	A	80-82	B-	66-69	D+
90-92	A-	77-79	C+	60-65	D
87-89	B+	73-76	C	<60	E
83-86	B	70-72	C-		

Important Dates (W/Th)

September 6/7	Lab Quiz #1
September 20/21	Lab Quiz #2
September 27	#scicomm #1 due
October 4/5	Lab Quiz #3
October 11	Midterm #1
October 25/26	Lab Quiz #4
November 2	#scicomm #2 due
November 16	Field Collection and Report due
November 29	Midterm #2
December 6	Behavior Observations Report due

Lab Quizzes (20%): There will be **four** in-lab quizzes worth 5% each. There will be NO final practical examination. Lab Quizzes are aimed at helping you master your identification skills, including morphology and anatomy of fishes, learned in the field and lab (e.g. fish identification) and as such are practical in nature. Quizzes are not cumulative (i.e. you will be tested on material from the previous 1-3 labs). All quizzes are mandatory and make-up quizzes will only be administered for those students with documented excuses (e.g. health or family emergency).

Midterms (16%): There will be two midterms worth 8% each. There will be NO final examination. Midterms will cover material presented in lecture (e.g. theory), videos, and assigned readings. (i.e., the answer to the question, “Will this be on the Midterm?” is “YES”). Midterms are not cumulative, but having a good grasp of the major themes presented throughout the semester (e.g. reproductive behavior, habitat preference, etc.) will help you to do well on the midterms. Both Midterms are mandatory and make-up exams will only be administered for those students with documented excuses (e.g. health or family emergency).

Field Collection and Report (25%): Learning how to collect, preserve, and identify fishes is an essential skill-set for many careers in aquatic and environmental sciences. During several lab sessions we will collect fish from waterbodies around Columbus using a variety of methods, with the goal of creating a class fish collection. A sub-

sample of all fish species collected (with the exception of rare or endangered species which must be returned to the wild) will be preserved and made available for students to identify **outside of class/lab time**. Students will work to identify each specimen and create a report describing the fish communities at each site (see "Field Collection and Report Instructions" on Carmen). While students may work in pairs in the lab, reports must be created independently. The instructors and TA's will help guide you through the identification keys but will NOT verify your identifications.

> *Graduate Student Supplement:* In addition to independently identifying the species collected during sampling, graduate students will be required to identify a series of preserved specimens collected by the Ohio EPA and incorporate this information in their report.

Behavioral Observations Report (15%): A major objective of this course is for students to learn about the behavior of fishes. Behaviors are typically easy to observe and are often the first response of an animal to external stimuli. Thus observing and quantifying fish behavior helps to increase our understanding of how fishes interact with their social and ecological environment. For this assignment students will form teams of 2-3 (graduate students must work individually) and develop a hypothesis-driven observation project based on a set-up of live fish in Dr. Gray's fish lab. Time during labs will be made available for students to observe the live fish prepared for these projects. Students must generate their own hypothesis, predictions and observational design, analyze their results and submit a short scientific report (see "Behavior Observation Report Instructions" on Carmen). The hypothesis and observational design **must be approved by your TA no later than October 26th by 9:00pm.**

> *Graduate student supplement*: Working independently, graduate students have the option of a behavioral project using the live fish set-up provided or alternatively developing a project of their own based on other media (e.g. videos, manipulative computer programs, etc.). Their project **must still be approved by the Instructor no later than October 26th by 9:00pm**.

#scicomm Assignment (14%): Scientific communication, providing outreach and engagement with the public, is essential to the conservation of fish biodiversity. Increasingly, scientific communication (#scicomm) is facilitated through social media outlets such as Twitter, Facebook, personal or lab blogs, etc. The goal of this assignment is for students to use multimedia formats to present a fish story that is accessible to the public and relevant for the people of Ohio. These can take the form of written blogs, sound clips, videos, animations, etc. Each student is required to create **two posts** to the class website (https://u.osu.edu/enrfishtax/). Students are encouraged to post on more than two topics and to direct the public to their posts via social media.

Posts will be graded based on accuracy of content and accessibility to a diverse audience. If a student posts more than twice, the top two grades will be used to determine the final #SciComm grade. (Details on #SciComm Instructions sheet).

Attendance & Participation (10%): Attendance for all components of this course is mandatory - missing class or lab will result in a lower participation mark. Unavoidable absences require prior permission of the instructor (email or phone call). Points for participation will come from a variety of in-class assignments, discussions, and lab-based activities. Participation in on-line discussions on Carmen (e.g. posting about new fish-related discoveries from the media or scientific papers of interest, i.e. “Catch of the Day”) will be monitored and considered for additional participation points.

Written Assignments: Format and Submission: All written assignments are to be submitted electronically using Carmen Dropbox by 11:59 pm on the date that they are due unless stated otherwise. Written assignments should have 1” margins, 12 pt Times New Roman font, double line spacing, and all pages should be consecutively numbered, including the cover page. All written assignments should include a cover page that provides your name, name.#, title of the assignment, and the date. In-text citations and reference lists should follow the instructions found in the Author Guidelines for the Journal of Fish Biology (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1095-8649/homepage/ForAuthors.html). A single file saved as a Word document with your name and assignment title as the file name (e.g. “GRAY_Annotated Bibliography”) should be submitted.

***Late Assignment Policy*:** Reports and papers are due by the times stated in the Instructions. Late assignments will not be accepted without prior permission.

UNIVERSITY RESOURCES

The university has a variety of resources in place to support students and a safe campus environment. Students experiencing stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use or *any event that has significantly impacted your concentration on education, work or family matters* are encouraged to contact the Office of Student Life at 614-292-9334 (https://studentlife.osu.edu/) and/or Counseling and Consultation Services (CCS) at 614-292-5766 (www.ccs.osu.edu) for assistance, support, and advocacy. CCS offers a number of FREE *drop-in-when-you-are-able* workshops (http://www.ccs.ohio-state.edu/drop-in-workshops/). No registration is necessary, no prior appointment is needed, and workshops are open to all enrolled OSU students.

Academic Integrity: This course adheres to the Code of Student Conduct (http://studentaffairs.osu.edu/csc/) and policies set by the OSU Committee on Academic Misconduct (http://oaa.osu.edu/coam.html). All students should familiarize themselves with these materials, and act appropriately. Academic misconduct is defined by the Ohio State University's Code of Student Conduct (Section 3335-23-04) as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Academic misconduct will not be tolerated in this class. For more information, please feel free to review the "Ten Suggestions for Preserving Academic Integrity" http://oaa.osu.edu/coamtensuggestions.html or "Eight Cardinal Rules of Academic Integrity" http://www.northwestern.edu/provost/students/integrity/rules.html.

Accommodating Students' Learning: For circumstances approved by the university, we can make accommodations that facilitate your learning in this class. If you have university-approved circumstances that require special accommodations (e.g., student athlete, ROTC, Marching Band, a disability), it is your responsibility to let the instructor know at the beginning of the semester or as soon as it comes to your attention during the semester. You are also required to inform the instructor about a need to miss class prior to any excused absence. If you have a disability, then please register with the Office for Disability Services (ODS) as soon as possible by contacting (614) 292-3307, and let your instructor know.

Reporting Incidents of Bias: To ensure a safe learning environment, please speak to the instructor immediately if you feel that you have experienced bias (whether based on race, ethnicity, gender identity or expression, sexual orientation, religion, national origin,

age or sex) within the classroom. You can also anonymously report any incidents of bias experienced on campus to the Bias Assessment Response Team (BART).

Career Services: The School of Environment and Natural Resources has a Career Services Office located in 210 Kottman Hall. Please call the main office at 614-292-2265 or email senr@osu.edu to schedule an appointment or use the available Express Walk-In Hours hosted every Friday 9am – 4pm.

Schedule of Lectures and Labs

***Note: this schedule is subject to change as the course progresses**

Week: Dates	Lecture	Lab	Assignments Due
1: 08/23-08/24	Course overview Intro to the origins of fishes Morphology, anatomy, use of keys	Safety and Equipment Dissections Key to families	
2: 08/30-08/31	Terminology, taxonomy, phylogeny Field collection and preservation methods	***Field trip*** – Olentangy River (ORWRP)	
3: 09/06-09/07	Jaws, fins and bones Agnatha vs. Gnathostomata	Petromyzontiformes, Acipenseriformes, Lepisosteiformes, Amiiformes, Clupeiformes, Cypriniformes, Siluriformes, Esociformes	***Lab Quiz #1***
4: 09/13-09/14	Diversity, form and function Gnathostomata (cont'd) & Teleostei	***Field trip*** **-** Scioto River (Ford Mackey Wildlife Area)	
5: 09/20-09/21	Diversity, form and function Teleostei (cont'd)	Cypriniformes, Salmoniformes, Atheriniformes	***Lab Quiz #2***
6: 09/27-09/28	The weird and the wonderful	***Field trip*** – Big Walnut Creek (Big Walnut Creek Park)	**#scicomm Assignment #1 DUE**
7: 10/04-10/05	Review	Perciformes, Cyprinodonitformes, Scorpaeniformes	***Lab Quiz #3***
8: 10/11-10/12	***Midterm #1***	Wednesday: Open lab for identification ***(open to both sections)***	***Midterm #1***
	Thursday: Autumn Break – NO CLASS or LAB		
9: 10/18-10/19	Fish behavior	***Field trip*** – Scioto River (Riverside Dr. & Butts Rd)	
10: 10/25-10/26	Reproductive behavior and diversity	Video observations In-lab activity	***Lab Quiz #4***
11: 11/01-11/02	Applied Fish behavior	Fish observations	**#scicomm Assignment #2 DUE**
12: 11/08-11/09	Human impacts on fishes: Part 1	Fish observations	Reading: Fishing impacts
13: 11/15-11/16	Human impacts on fishes: Part 2	Fish Observations	Reading: Fishing impacts **Field Collection Report DUE**
14: 11/22-11/23	***Thanksgiving – NO CLASS or LAB***		
15: 11/29-11/30	***Midterm #2***	Open lab for observation analysis	***Midterm #2***
16: 12/06	***Final Lecture***	***NO LABS***	**Behavior Report DUE**