Fall 9-1-2021

BIOO 340.00: Biology and Management of Fishes

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Biology and Management of Fishes **Fall 2021**

Instructors:
Lisa Eby (she/her), BRB 103, email: lisa.eby@umontana.edu
Office Hours: Lisa Eby Mondays & Wednesdays 1:00 – 2:00pm or by appointment
Virtual Office: https://umontana.zoom.us/my/lisa.eby
T.A.: Anthony Dangora (he/his) BRB 112, anthony1.dangora@umconnect.umt.edu; Thursday 4-5pm in BRB 102 conference room or by appointment; **We are not always on email, please plan for a 24-hour delay.

Learning Outcomes:
(1) You will understand aspects of the morphology, physiology, and behavior of fishes, the most diverse group of vertebrates on the planet. (2) You will understand aspects of the population, community, and applied ecology and management of fishes. (3) You will become familiar with field techniques for sampling fishes in Montana. (4) You will become familiar with working with types of data encountered by fisheries biologists. (5) You will learn the fishes found in western Montana.

Statement on safety:
I expect that students, TAs, and I will follow all Franke College of Forestry and Conservation and UM safety best practice protocols (including disinfecting their workspace and equipment, using hand sanitizers, and using masks properly for all inside class activities). Please contact ODE (www.umt.edu/disability) if you need to request an accommodation to be completely remote for the semester, for any safety protocol modification, or other types of accommodation. *If students choose not to follow UM safety protocols, they will be asked to leave the class. The current UM safety guidelines follow:*

- Proper mask use is required within the classroom or laboratory. We will have extras in case you forget.
- If you feel sick and/or are exhibiting COVID-19 symptoms, please don't come to class and contact the Curry Health Center at (406) 243-4330.
- If you are sick or are required to isolate or quarantine, you will receive support to ensure continued academic progress. Please contact the professor or TA as soon as you are aware of the issue so we can make sure that you have access to course material and do not fall behind. To facilitate this class may be recorded and shared with other students within the class.
- UM recommends students get the COVID-19 vaccine. Please direct your questions or concerns about vaccines to Curry Health Center.
- Where social distancing (maintaining consistent 6 feet between individuals) is not possible, specific seating arrangements will be used to support contact tracing efforts. The first class in the classroom we will develop a seating chart that I will turn in, please use that seat throughout the semester. We will track which students are riding together in vehicles for field labs and document seating in labs.
- Please do not regularly remove your masks in the classroom; drinking liquids and eating food is strongly discouraged within the classroom.
- Mask use is required in vehicles when traveling to field sites as part of class or to fieldwork. FCFC has field requirements which we will be sharing during lab.

I would prefer for us to be able to remain in person throughout the semester so please follow the UM Policy now and as it changes throughout the semester. That said, in this ever-changing landscape -- mutual respect, professional behavior, honest and early communication is needed for us to have a successful semester. We will have to be adaptable.

Class Readings:
We will be using Moodle for class (BIOO 340). Go there for readings, class data sets, assignments, and announcements. Useful texts include: (1) Moyle and Cech, Fishes: An Introduction to Ichthyology. Fifth

Edition. (2) Holton, C.J. and H.E. Johnson.2003. Field Guide to Montana Fishes. 3rd Edition. Montana Fish, Wildlife, and Parks Helena, MT. or online at *http://fieldguide.mt.gov/*

See syllabus for the reading schedule. Read reference chapters listed to help clarify the lecture material and required papers for examples, applications, generalizations, and principles. Questions based on both ***lecture and focal questions associated with required reading material*** will appear on the midterms and final exam.

Objectives of class:
This class explores the biology of fishes, the most diverse group of vertebrates. The areas treated include morphological, physiological, and behavioral adaptations of fishes to their aquatic environments, as well as aspects of population, community, and applied ecology. We will be discussing both freshwater and marine fishes with an emphasis placed on freshwater fishes native to Montana.

Grading:

Midterm I	15%
Midterm II	15%
Final (Comprehensive, synthetic)	12%
Infographic presentation last week of class	12%
Participation: lecture assignments, quizzes, active participation in lecture & labs	16%
Lab grade (lab quizzes & lab assignments)	30%

Infographics Presentation: Presentations will typically be done by a small group of 2-3 students working together. For the presentation, students will describe a fisheries management issue and potential solutions drawn from fish biology and ecology. You must choose a case study that has not been used in class. Essentially, we want students to delve into the conservation and management problem, present the issue concisely and clearly using peer-reviewed references, and potential solutions. This assignment will allow students to practice researching what is known about an issue and species and see how people are applying knowledge to novel situations. In addition, student will learn how to distill information into an infographic and practice public speaking. A statement of group membership and a proposed topic is due by **Oct 14th**, an outline for the infographic (including sections, key pieces of information with references) is due by **Nov 4th**, draft infographic turned in by **Nov 18th**. Presentations will be required to be loaded onto moodle by **Monday Dec 6th** and presented in class on **Dec 7th**. If you are struggling with a topic, please come see me during office hours. I expect to check-in with each group briefly during the semester as questions arise. The presentation of the infographic will have a time limit of 10 minutes with 5 minutes for questions.

Class Policy:
Some of the field and lab projects will be done by teams of students so the resulting data are team or class property. Students are free to discuss results (interacting and learning from each other is encouraged, but all assignments must be prepared individually. *All written material, calculations, and graphs to be submitted and graded in must be your own work (answers must be in your own words).* ***All assignments must be submitted on time; penalties will be 5% of grade each day late unless other arrangements have been made. Please contact me or the TA if issues arise.***

Missing class: If you need to miss a class, please get notes from another student, perform the readings, review the notes, and then come into our office hours with questions regarding the material. If you need to miss a lab, please request to come to the other lab section that week. Permission needs to be granted before the lab period. Depending on transportation and material constraints this may or may not be possible.

Class final is Tuesday December 14th from 10:10-12:10**,** per UM policy – no early exams will be given.

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. If students are caught cheating or plagiarizing on an assignment, they will get a zero for the assignment. If students are caught cheating on more than one assignment or on an exam, they will fail the course. In both cases information will be passed on to the Dean and the Vice Provost of Academic Affairs for further review.

Accessibility: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or experience barriers based on disability, please contact the ODE at: (406) 243-2243, ode@umontana.edu, or visit www.umt.edu/disability for more information. Retroactive accommodation requests will not be honored, so please, do not delay. As your instructor, I will work with you and the ODE to implement an effective accommodation, and you are welcome to contact me privately if you wish.

Date	**Lecture Topic and Readings**
8/31 – 9/2	Diversity of aquatic environments and fishes & Locomotion ***Reference****: Moyle and Cech focus on sections 1.1; 2.7-2.9* **9/2 Required (linking locomotion capacity to invasion):** Starrs, T., Starrs, D., Lintermans, M., & Fulton, C. J. (2017). Assessing upstream invasion risk in alien freshwater fishes based on intrinsic variations in swimming speed performance. Ecology of Freshwater Fish, 26(1), 75-86.
9/7 – 9/9	Respiration and Circulation ***Reference****: Moyle and Cech Chapters 3 and 4 p. 37-75*
9/14– 9/16	Buoyancy and Thermal regulation ***Reference:*** *Moyle and Cech Chapter 5 page 77-87* **Required (determining thermal requirements):** Selong, et al. 2001. Effect of temperature on growth and survival of bull trout, with application of an improved method for determining thermal tolerances in fishes. Transactions of the American Fisheries Society 130: 1026-1037.
9/21 – 9/23	Osmotic regulation, Feeding, and Energetics ***Reference:*** *Moyle and Cech Chapter 6 and Chapter 7* **Required (linking habitat and energetics):** Rosenfeld, J.S. and S. Boss. 2001. Fitness consequences of habitat use for juvenile cutthroat trout: energetic costs and benefits in pools and riffles. Canadian Journal of Fisheries and Aquatic Sciences 58:585-593.
9/28 – 9/30	Energetics and Growth: **Exam I (9/30 in class)** ***Reference:*** *Moyle and Cech Chapter 8* **Required (linking growth and energetics):** Ruzychki et al. 2003. Effects of an introduced lake trout on native cutthroat trout in Yellowstone Lake. Ecological Applications 13:23-37.
10/5 – 10/7	Sensory Systems ***Reference:*** *Moyle and Cech Chapter 10* **Required:** *Radford et al. 2014 Acoustic communication in a noisy world: can fish compete with anthropogenic noise? Behavioral Ecology.*

10/12 – 10/14 Sensory Systems, Communication, and Behavior

Reference: *Moyle and Cech Chapter 11*

Required*:* *Vander Sluijs, I., S.M. Gray, M.C.P. Amorim, I. Barber, U. Candolin, A.P. Hendry, R. Krahe, and others. 2011. Communication in troubled waters: responses of fish communication systems to changing environments. Evol. Ecol.*

10/19 – 10/21 Reproduction and Introduction to Life Histories

Reference: *Moyle and Cech Chapter 9*

Required: *Heath et al. 2003. Rapid evolution of egg size in captive salmon. Science 299:1738-1740.*

10/26 – 10/28 Life History

Reference: *Moyle and Cech Chapter 9*

Required: *Conover et al. 2005. Darwinian fisheries science. Canadian Journal of Fisheries and Aquatic Sciences 62:730-737.*

Required: *Rowe and Hutchings.2003. Mating systems and the conservation of commercially exploited marine fish. Trends in Ecology and Evolution 18:567-572.*

11/2 – 11/4 Population Ecology

Required: *Berkeley et al. 2004. Fisheries Sustainability via protection of age structure and spatial distribution of fish populations. Fisheries 29:23-32.*

Required: *Schindler et al. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465:609-615.*

11/9 Population Ecology wrap up and 11/11 Veteran's Day

11/16– 11/18 Species Interactions and **Exam II (11/18 in class)**

Reference: *Moyle and Cech Ch 27* 455-468

Required: *Marcogliese, D.J. 2004. Parasites: small players with crucial roles in the ecological theater. Ecohealth 1:151-164.*

11/23 Species Interactions and 11/25 Thanksgiving

Reference: M*oyle and Cech Chapter 28*

11/30– 12/2 Community Ecology and Fish in an Ecosystem Context

Required: *Jackson, D.A. P.R. Peres-Neto, and J.D. Olden. 2001. What controls who is where in freshwater fish communities- the roles of biotic, abiotic, and spatial factors. Canadian Journal of Fisheries and Aquatic Sciences 58:157-170.*

Required: *Wipfli and Baxter 2010. Linking Ecosystems, food webs, and subsidies in salmonid watersheds Fisheries 35:373-387.*

12/7 – 12/9 Student Presentations (12/7) and Class wrap-up and student evaluations (12/9)

12/14 Final Exam Week: Exam will be Tuesday December 14th 10:10 to 12:10 in lecture classroom.
Final Exam will cover lectures, lab concepts, and readings from the entire semester.

Lab Schedule

Week of:	***Topic***	***Readings and Assignments***
8/31	Working with Fisheries Data Where: Computer Rm – HS 114 Tuesday SH 106 Thursday	*Analyzing Fisheries Data Assignment (1)*
9/7	Field Lab on Active & Passive Capture Techniques [C] (Where: meet between Health Sciences and Bioresearch Buildings)	*Seining and Netting Techniques Assignment (2)*
9/14	Fish Passage Barriers on the Landscape - FishXing Where: Computer Rm HS114	*Nislow et al. 2011. Variation in local abundance and species richness of stream fishes in relation to dispersal barriers: implications for management and conservation. Freshwater Biology 56:2135-2144.* *Swimming Performance of Species and Barriers on the Landscape Assignment (3)*
9/21	Anatomy and Functional Morphology of Fishes[C] Where: HS 204	Moyle and Cech: Chapter 2.2: p. 15-26 *Functional Feeding Morphology Assignment (4)*
9/28	Field lab – Snorkeling Where: Meet at footbridge by dog park on the far side	*Snorkeling Assignment (5)*
10/5	Field Lab – Electrofishing[C] Where: Meet at parking lot before footbridge- campus side	*Electrofishing and Population Estimation Assignment (6)*
10/12	Age and Growth[C] Where: HS 204 .	*Maceina et al 2007. Current Status and Review of Freshwater Fish Aging Procedures... Fisheries 32:329-340* *Age and Growth Assignment (7)*
10/19	Bioenergetics Where: Computer Rm – HS 114	*Bioenergetics Assignment (8)*
10/26	Zoogeography & Fish Families Where: HS 204	*Rahel, F.J. 2000. Homogenization of fish faunas across the United States. Science 288:854-856*
11/2	ID – Fishes of Montana **Lab Quiz 1 – Fish Families** Where: HS 204	

11/9	No labs this week	**11/11 is Veterans Day**
11/16	ID – Fishes of Montana **Lab Quiz 2 - Fishes of MT** Where: HS 204	
11/23	No labs this week	**11/25 is Thanksgiving Break**
11/30	ID – Fishes of Montana **Lab Quiz 3 - Fishes of MT** Where: HS 204	
12/7	ID – Fishes of Montana **Lab Quiz 4 - Fishes of MT** **Worksheet for Fish in Section 5** Where: HS 204	***Finish species ID and synthesize distribution and relationship among species***

Field Labs: For field labs, please dress for the weather and be ready to get wet. Even though we will have dry suits and/or waders to use in class, we cannot guarantee that you will return clean and dry. If you have to go to class or work after lab please bring extra clothes those days.

Computer Labs: Typically meet in the Health Sciences building computer lab HS Room 114

When are lab reports due? If you are using your data, lab reports are due the following week's lab period. If we are combining the data from the entire class (as indicated by a ^{C}) then data will be posted on Friday by 5pm (after the Thursday lab) on the class Moodle page. In this case, lab reports are due Friday by 5pm. This ensures everyone has equal time to complete the assignment.

More about course policies and class expectations

Cell phones and mini-computers: Please turn off electronic devices during class unless they are being used for notes or an in-class exercise. We expect you NOT to be texting, browsing, or checking e-mail during class. *If you need to engage with your electronic device, please leave the classroom.*

Attendance: Attendance is expected and contributes to the "Class participation" portion of your course grade. Absences are not excused unless you have extenuating circumstances and have contacted an instructor in advance of the class.

Classroom environment: Students at University of Montana are diverse in many ways, including race, gender, age, religion, preparedness, and mobility. Please help create a respectful learning environment by honoring all student contributions and expressing your views in ways that do not diminish other students' perspectives.

Academic honesty, plagiarism, and student conduct: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code.

- Academic dishonesty of any form is unacceptable and will be taken seriously by the instructor, the Franke College of Forestry and Conservation, and the University of Montana. This includes plagiarism, when you copy materials from other sources without citing the source or copy someone's work, and cheating, copying material from other students during tests or quizzes. In both cases, you will fail the assignment/exam and the information will be passed on to the Dean and the Vice Provost of Academic Affairs. It is your responsibility to be familiar with, and adhere to, the University's definition of plagiarism and student misconduct in the conduct code (page 6).

Course withdrawal deadlines: See calendar [Autumn 2021 (umt.edu)]

Important Dates Restricting Opportunities to Drop a Course Fall 2021:

Deadline	Description	Date
To 15th instructional day	**Class Day 15:** • **Last day to drop individual classes on CyberBear with refund** • Last day to withdraw from (drop all courses) with a partial refund – Withdrawal Policy linked below. • Last day to add classes with electronic override on CyberBear. • Last day to change credits in variable credit courses & switch grade mode in CyberBear. • Last day to change grading option to or from audit. • Last day to buy or refuse UM's student health insurance coverage.	September 20, @5 PM
16th to 45th instructional day	**Through Class Day 45:** • Course adds & drops require instructor's & advisor's approval using the Course Add/Change/Drop link in CyberBear. $10 fee applies per add or drop. • A 'W' will appear on the transcript for dropped classes. No refunds. • Students can change variable credit amounts and grading options (**except audit**) on eligible courses using the Course Add/Change/Drop link in CyberBear.	September 21 – November 1 @5 PM
Beginning 46th instructional day	After Class Day 45: • Adds require instructor's and advisor's approval using the Course Add/Change/Drop link. $10 fee applies. • Drops require instructor's, advisor's, and Dean's approval via Course Add/Change/Drop link. $10 fee applies. • A 'WP' or 'WF' will appear on the transcript for dropped classes. No refunds. • Students can change variable credit amounts, or change grading options, (except audit) using the Course Add Change Drop link in Cyberbear.	November 2 – December 10 @5 PM