

Instructors:

Lisa Eby, BRB 103, email: lisa.eby@umontana.edu

Office Hours: Lisa Eby Mondays & Wednesdays 1:00 – 2:00pm or by appointment

T.A.: Andrew Lahr BRB 112, andrew.lahr@umontana.edu; Thursday 4-5pm, Tuesday 5:00-6:00pm 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.

Class Readings:

We will be using Moodle for class (BIOO 340.01). 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 chapters and papers for examples, applications, generalizations, and principles. Questions based on both ***lecture and 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.

Upper Division Writing Requirement: This class in conjunction with two additional upper division writing courses meets the university upper division writing requirement. This class specifically meets the following outcomes through both the paper associated with the review of a management issue and lab reports:

- Identify and pursue more sophisticated questions for academic inquiry
- Find, evaluate, analyze, and synthesize information effectively from diverse sources
- Manage multiple perspectives as appropriate
- Recognize the purposes and needs of discipline-specific audiences and adopt the academic voice necessary for the chosen discipline
- Use multiple drafts, revision, and editing in conducting inquiry and preparing written work
- Follow the conventions of citation, documentation, and formal presentation appropriate to that discipline
- Develop competence in information technology and digital literacy

Grading:

Midterm I	15%
Midterm II	15%
Cumulative Final	10%
Infographic (draft, final, presentation)	15%
Class participation, assignments, quizzes and discussion	15%
Lab grade (7 lab reports, 4 quizzes, and 1 worksheet)	30%

Infographics and Presentation assignments and presentation:

- 1: What is an infographic and approaches for informative infographics (graded, individual assignment, due into moodle Sept 13th)
- 2: Fisheries issue and group membership (credit on time and timely revision if needed, partner/group, due into moodle Sept 22nd)
- 3: Prospectus and annotated bibliography (graded, partner/group, Oct 18th)
- 4: Draft Infographic (for feedback by me and peers, credit depending on quality of draft, Nov 10th)
- 5: Review of 2 to 3 infographics of peers (credit, individual assignment, Nov 22nd)
- 6: Final Infographic and Class Presentation last week of classes (graded, partner/group, Dec 6 & 8th).
- 7: Reflection on Infographic revisions and alterations for different audiences (graded, individual, due Dec 9th moodle)

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. I 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. Student will complete a series of assignments to learn how distill and visualize complex concepts, peer-reviewed information with an annotated bibliography, distill information into a visual infographic, and practice public speaking. A statement of group membership and a proposed topic is due by **Sept 22nd**, an outline for the paper and infographics (including sections, key pieces of information supported by peer-review references) is due by **October 18th**, draft paper and infographics turned in by **November 10th**. Students will get feedback on their paper and infographic by a peer group and the professor by **Nov 22nd**. Final revised papers (8-10 pages) and presentations will be required to be loaded onto moodle and presented in class on **December 6th & 8th**. 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 8 minutes with 2 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 as 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. We can be flexible, but you must contact myself (re: lecture) or the TA (re: lab) if issues arise.***

Missing class: If you need to miss a lecture 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 another lab section that week. Permission needs to be granted before the lab period for this accommodation. Depending on transportation and material constraints this may or may not be possible. Due to the nature of field labs, we cannot make up those in field activities, but lab reports will be completed with class data posted on moodle.

Class final is Thursday December 15th 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.

Date	Lecture Topic and Readings
8/30 – 9/1	Diversity of aquatic environments and fishes & Locomotion Readings: <i>Moyle and Cech Chapters 1 and 2 (pages 1-35) focus on sections 1.1& 1.2; Chapter 2 section 2.7-2.9</i> <i>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.</i>
9/6 – 9/8	Respiration and Circulation Readings: <i>Moyle and Cech Chapters 3 and 4 p. 37-75</i>
9/13– 9/15	Buoyancy and Thermal regulation Readings: <i>Moyle and Cech Chapter 5 page 77-87</i> <i>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.</i> <i>McKenzie et al. 2020. Intraspecific variation in tolerance of warming in fishes. Journal of Fish Biology 98:1536--1555.</i>
9/20 – 9/22	Osmotic regulation, Feeding, and Energetics <i>Recommended: Moyle and Cech Chapter 6 and Chapter 7</i> <i>Required: 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.</i>
9/27 – 9/29	Energetics and Growth: <u>Exam I (9/29 in class)</u> Readings: <i>Moyle and Cech Chapter 8</i> <i>Ruzychki et al. 2003. Effects of an introduced lake trout on native cutthroat trout in Yellowstone Lake. Ecological Applications 13:23-37.</i>
10/4 – 10/6	Sensory Systems Readings: <i>Moyle and Cech Chapter 10</i> <i>Radford et al. 2014 Acoustic communication in a noisy world: can fish compete with anthropogenic noise? Behavioral Ecology.</i>
10/11 – 10/13	Sensory Systems, Communication, and Behavior Readings: <i>Moyle and Cech Chapter 11</i> <i>Vander Sluijs, I., S.M. Gray, M.C.P. Amorim, I. Barber, U. Candolin, A.P. Hendry, R. Krahe, and others. Communication in troubled waters: responses of fish communication systems to changing environments. Evol. Ecol.</i>
10/18 – 10/20	Reproduction and Introduction to Life Histories Readings: <i>Ross 2014 Chapter 9. Life history and Reproductive Ecology (pp. 167-202) in Ecology of North American Freshwater Fishes.</i> <i>Ferguson et al. 2019. Anadromy, potadromy, and residency in brown trout <i>Salmo trutta</i>: the role of genes and the environment. Journal of Fish Biology 95:692-718</i>
10/25 – 10/27	Life History

Readings: Moyle and Cech Chapter 9

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

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

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

11/1 – 11/3 Population Ecology

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

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

11/10 Election Day (11/8) and Population Ecology wrap up

11/15– 11/17 **Exam II (11/15 in class)** Species Interactions

Readings: Moyle and Cech Ch 27 455-468

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

11/22 Community Ecology and Thanksgiving

Readings: Moyle and Cech Chapter 28

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.

11/29– 12/1 Community Ecology and Fish in an Ecosystem Context

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

12/6 – 12/8 Student Presentations and Class wrap-up

12/15 Final Exam Week: Exam will be Thursday December 15th 10:10 to 12:10 in lecture classroom.

Final Exam will cover lectures, broad lab concepts, and readings from the entire semester.

Lab Schedule

<u>Week of:</u>	<u>Topic</u>	<u>Readings and Assignments</u>
8/30	Working with Fisheries Data Where: Computer Rm	<i>Analyzing Fisheries Data Assignment (1)</i>
9/6	Field Lab - Passive Capture Techniques Where: meet between Health Sciences and Bioresearch Buildings	<i>Field lab – Passive and Active Capture Techniques. Fish Methods.</i>
9/13	Working with CPUE Data Where: Computer Rm	<i>Active and Passive Capture Techniques Assignment (2)</i>
9/20	Anatomy and Functional Morphology of Fishes Where: HS 204	Moyle and Cech: Chapter 2.2: p. 15-26 <i>Functional Feeding Morphology Assignment (3)</i>
9/27	Field Lab – Snorkeling Where: Meet at footbridge by dog park on the far side	<i>Snorkeling Assignment (4)</i>
10/4	Field Lab – Electrofishing Where: Meet at parking lot before footbridge- campus side or TBD	<i>Electrofishing and Population Estimation Assignment (6)</i>
10/11	Age and Growth Where: HS 204	<i>Maceina et al 2007. Current Status and Review of Freshwater Fish Aging Procedures... Fisheries 32:329-340</i> <i>Age and Growth Assignment (5)</i>
10/18	Bioenergetics Where: Computer Rm – HS 114	<i>Bioenergetics Assignment (7)</i>
10/25	Zoogeography & Fish Families Where: HS 204	<i>Rahel, F.J. 2000. Homogenization of fish faunas across the United States. Science 288:854-856</i>
11/1	ID – Fishes of Montana Lab Quiz 1 – Fish Families Where: HS 204	
11/8	No labs this week	11/8 is election day
11/15	ID – Fishes of Montana Lab Quiz 2 - Fishes of MT Where: HS 204	
11/22	No labs this week	Thanksgiving Break

11/29 ID – Fishes of Montana
Lab Quiz 3 - Fishes of MT
Where: HS 204

12/6 ID – Fishes of Montana *Finish species ID and synthesize distribution
and relationship among species*
Lab Quiz 4 - Fishes of MT
Worksheet for Fish in Section 5

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.

Lab reports: Every lab will have a due date on the handout. For many of the labs, we will be posting class data after all labs have been completed for that week. Reports will be due Fridays by 5pm of the following week.

Please note the 7 lab reports will be composed of addressing specific questions with the data set that you are collecting. For the field lab, you are learning (1) field, lab, and computer skills, (2) How to summarize data to address common fisheries questions including appropriate citation of tables, figures, and appropriate citation of peer-reviewed literature, (3) and how to effectively, fully, and concisely address questions. This allows you to develop competence in information technology and digital literacy, recognize and practice how to write formal reports and follow discipline-specific conventions. Because this is part of the dispersed upper division writing requirement, we will be grading lab reports on content, appropriate professional conventions for reports, and writing including the use of strong topic sentences, logical flow of answers, appropriate citation formats, and grammar.

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 feel 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.

Disability modification: 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.

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](https://www.umt.edu/student-affairs/community-standards/default.php). <https://www.umt.edu/student-affairs/community-standards/default.php>

- 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.

Current campus guidance for COVID-19:

- The university encourages COVID-19 vaccines and boosters, which are offered for both students and employees at the Health Services Pharmacy inside Curry Health Center.
- Masks are only required inside Curry Health Center and in some medical/research laboratories on campus. This requirement will be clearly posted. Required or not, we respect those choosing to wear a mask to reduce the spread of respiratory viruses.
- COVID testing for students is available at Curry Health Center. For employees, contact your primary care provider or visit a walk-in clinic. Free at-home tests can be [ordered online](#) or there may be tests available through the Health Services Pharmacy, call 243-5171.

See [Fall 2022 Official Dates and Deadlines](#) calendar (https://www.umt.edu/umonline/keep_on_teaching/default.php) see below but please double-check the official dates on UM's website.

Deadline	Description	Date
To 15 th instructional day	Class Day 15: <ul style="list-style-type: none"> • 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 19, @5 PM
16 th to 45 th instructional day	Through Class Day 45: <ul style="list-style-type: none"> • 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 20 – October 31 @5 PM
Beginning 46 th instructional day	After Class Day 45: <ul style="list-style-type: none"> • 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 1 – December 9 @5 PM