Biology 4212 Biology of Fishes
Course syllabus
Winter term 2026

TEXTS: 1. Essential Fish Biology: Diversity, structure and function. Derek & Margaret Burton. Oxford University Press. ISBN: 978-0-19-878556-9 **($88.00).** A used copy is suitable. No older editions are available.

2. (optional) ROM Keys to The Identification of Ontario Freshwater Fishes. Erling Holm. Royal Ontario Museum. **($29.99).** A previously used copy or older edition is suitable.

Lab Manual: Modules provided in the Lab Content Tab of D2L. *The ROM field guide is optional for the Fish identification component of labs and available through University of Toronto press (https://utpdistribution.com/9780888545282/a-fish-guide-to-freshwater-fishes-of-ontario/); the Lakehead bookstore may also have a limited number of copies. However, for those interested in continuing on with fish identification, it is recommended.*

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LECTURES: Lectures start:
Tuesday Jan 6: Tuesday & Thursday – 10:00am to 11:15 am AT-1006

LAB: **Labs start on Thursday January 8th**
Weekly on Thursdays 11:30-2:30pm-CB 3015
Bring your own safety glasses and lab coat

EVALUATION:	Lecture Midterm	= 20%
	Lecture Final	= 30%
	Lab Participation	= 5%
	Dissection report	= 5%
	Lab exam	= 15%
	Written Assignment	= 15%
	Fisheries management (Excel Assignment)	= 10%

***Last date for withdrawal without academic penalty: Friday 6 March 2026**

COURSE OBJECTIVES:

Lectures

Fishes represent the largest and most diverse group of vertebrates. This upper-level course will provide an overview of the diversity and biology of fishes. Lecture material will cover the systematics, evolution, anatomy, biology, and ecology of fishes. Additional topics will include fish behaviour, fisheries techniques, including various aspects of stock assessment and conservation.

Labs in the first half of the course will examine the morphology, classification, and identification of fishes. In the lab you will examine preserved specimens, and will be expected to recognize specific structures and understand the function(s) they serve, how they may differ among groups, and how those structures may serve to define taxonomic groups. At the conclusion of the course you should be able to recognize species of the major fish taxa in Northwestern Ontario, understand how they survive and persist in their environment and, hopefully, have an appreciation of the great array of fish diversity.

The second half of the course will focus on data collection and scientific writing with an emphasis on fisheries management, including the exploration, analysis and interpretation of growth rates from fisheries data, methods in population estimation and stock recruitment models. Rather than conducting experiments on live fish, we will utilize fish population data from the IISD Experimental Lakes Area for analysis and interpretation.

Course Policies

Exams: Missed exams will receive a grade of zero unless you are absent for a documented valid reason such as a family or medical emergency. If you wish to have an exam re-graded, you must submit a written explanation of why you think the assigned grade was incorrect within 2 weeks of return of the exam. Be aware the entire exam will be re-evaluated and your mark may go up, remain the same, or go down.

Note: this does not apply to arithmetic errors such as incorrect addition. You may bring these types of errors to my attention for correction, without a written explanation, at any time.

Written Assignments

Written assignments submitted late will be penalized 10% per day except for a documented valid reason such as a family or medical emergency. Papers will not be graded in the absence of a

completed and signed form indicating the understanding of plagiarism in its many forms. **This will require the completion of an online exercise and quiz relating to plagiarism.** Additional direction regarding topics and format will be provided in class.

Chat GPT

The use of AI assistants (like Chat GPT) may not be used to generate the text of your written assignments. Evidence of this will be considered Academic Dishonesty and appropriate action will be taken (see section below). ***However,*** you ***may*** find the use of Chat GPT helpful in determining actions to take in excel or R for data analysis, which is allowed and can be used if you find it helpful to do so.

Academic Dishonesty

(The following is taken directly from the University website, with minor modification)

The University takes a most serious view of offences against academic honesty. Penalties for dealing with such offences will be strictly enforced.

The following rules shall govern the treatment of candidates who have been found guilty of attempting to obtain academic credit dishonestly.

(a) ***The minimum penalty*** for a candidate found guilty of plagiarism, or of cheating on any part of a course will be a zero for the work concerned.

(b) A candidate found guilty of cheating on a formal examination or a test, or of serious or repeated plagiarism, or of unofficially obtaining a copy of an examination paper before the examination is scheduled to be written, ***will receive zero for the course and may be expelled from the University.***

A copy of the "Code of Student Behaviour and Disciplinary Procedures" may be obtained from the Office of the Registrar.

Proposed Schedule (subject to change):

Lecture or Lab	**Date**	**Topic**	**Recommended readings**
Lecture 1	Jan 6	What is a fish/basic anatomy and phylogeny	Burton Chapter 1, Appendix 15.1, Chapter 13
Lecture 2	Jan 8	Phylogeny continued; Hagfish and lampreys, Evolution of jaws, Elasmobranchs; Teleosts, Coelacanth, Dipnoi: lungfish, Actinopterygii: sturgeons, paddlefish	Burton Chapter 1
Lab	**Jan 8**	**Dissection lab Part I**	
Lecture 3	Jan 13	Teleostei, phylogenetic trends: Osteoglossomorpha, Elopomorpha, Otocephalomorpha, Euteleostei	Burton Chapter 1
Lecture 4	Jan 15	Anatomy: Skeletal, appendicular, scales, musculature, gas bladder	Burton Chapter 2, 3

Lecture or Lab	Date	Topic	Recommended readings
		Locomotion: aquatic habitat, drag, thrust, propulsion, fin aspect ratio, control, schooling	
Lab	Jan 15	**Dissection Lab Part II**	
Lecture 5	Jan 20	Feeding: jaws, pharyngeal jaws, dentition, mouth position, digestion	Burton Chapter 4
Lecture 6	Jan 22	Circulatory transport and gas exchange; Respiration: gill structure, gill function, ventilation, air breathing	Burton Ch. 5, 6
Lab	Jan 22	**Fish ID Part 1: Basic ID**	
Lecture 7	Jan 27	Metabolism and homeostasis; excretion and osmoregulation	Burton Ch. 7, 8
Lecture 8	Jan 29	Metabolism and excretion continued	Burton Ch. 7, 8
Lab	Jan 29	**Fish ID Part 2: Advanced ID**	
Lecture 9	Feb 3	Reproduction	Burton Ch. 9
Lecture 10	Feb 5	Hormones and the nervous system	Burton Ch. 10, 11
Lab	**Feb 5**	**Fish ID Part 3: Further advanced ID and anatomy review**	
Lecture 11	Feb 10	Perception and sensation: photoreception, mechanoreception, (sound, lateral line), equilibrium and balance, chemoreception (smell, taste), electroreception, magnetic reception	Burton Ch. 12
Lecture 12	**Feb 12**	***NO LECTURE***	
Lab	**Feb 12**	**LAB EXAM**	
Reading break	***Feb 17-21***	***Reading break***	***Reading break***
MIDTERM	Feb 24	**MIDTERM EXAM**	
Lecture 13	Feb 26	Fisheries management overview	
Lab	**Feb 26**	**Aging Lab – Brenden Slongo, Danielle Gartshore**	
Lecture 14	Mar 3	Age and growth estimation	Burton Ch. 16
Lecture 15	Mar 5	Estimating abundance	
Lab	**Mar 5**	**Computer lab- estimating growth, abundance using real data**	
Lecture 16	Mar 10	Mortality and survival	
(using lecture time for field trip)	Mar 12	**Field trip: Dorion Fish Hatchery**	
Lab	**Mar 12**	**Field trip: Dorion Fish Hatchery**	

Lecture or Lab	Date	Topic	Recommended readings
Lecture 17	Mar 17	Effort, MSY and sustainable yield	
Lecture 18	Mar 19	Stock-recruitment models	
Lab	**Mar 19**	**Computer lab- estimating mortality using real data; get help with your project**	
Lecture 19	Mar 24	Mating, behaviour	Burton Chapter 9, Section 14.8, 13.12…
Lecture 20	Mar 26	Locomotion, migration	Burton Ch. 14
Last Lab	**Mar 26**	**In Lab fisheries analysis assignment (computer-based)**	
Lecture 21	Mar 31	Feeding ecology and diet; Physiology and energetics in fisheries research	
Lecture 22	Apr 2	*Guest lecture: Dr. Rob Mackereth, MNR- Brook trout in Lake Superior tributaries*	
Final exam	**TBD**	**Location TBD**	