LECTURE SCHEDULE – UPDATED 09/09/19

Date	Topic	Lecture homework DUE
08/26	Course overview	
08/28	The Stock Concept, Stock dynamics	HW1: Lit, Crib Notes1: Bestgen
09/02	**Labor Day – no class**	
09/04	canceled	
09/09	Abundance estimation I	
09/11	Abundance estimation II – Study design	
09/16	Abundance estimation III – Examples	HW2: Simple estimators
09/18	Age and growth I: Ecological concepts	
09/23	Age and growth II: Estimation techniques	Crib Notes2: MacLean
09/25	Growth and production: Ecology and estimation	HW3: Growth calculations
09/30	Small-scale, subsistence, and artisanal fisheries	
10/02	**FIRST MIDTERM EXAM**	
10/07	Mortality I: Ecological concepts and estimation	
10/09	Mortality II: Estimation	
10/14	Recruitment I: Ecological concepts	HW4: Mortality calculations
10/16	Recruitment II: Mathematical models	
10/21	Recruitment III: Maternal influence	Crib Notes3: Shelton
10/23	Bioenergetics I: Eco-physiological underpinnings	
10/28	Bioenergetics II: The energy budget and models	
10/30	Bioenergetics III: Yellowstone Lake case study	
11/04	**SECOND MIDTERM EXAM**	
11/06	Fisheries management fundamentals, process	
11/11	Evolutionary effects of fishing	Crib Notes4: Belgrano
11/13	Fisheries management practices	
11/18	Stocking and hatcheries	
11/20	Regulating harvest: Demographic principles	Crib Notes5: Rahel
11/25	**Fall break – no class**	
11/27	**Fall break – no class**	
12/02	Indirect effects of harvest regulations	
12/04	Management decisions	
12/09	Suppression of invasive fishes	Crib Notes6: Hansen
12/11	Fishery socioeconomics	
12/19	**FINAL EXAM 4:10-6:10 PM**	

LABORATORY SCHEDULE

Lab	Date	Laboratory Topic (points in parentheses)	Lab assignments DUE	Location
1	08/27	Review math/stats (200)		NR230/232
2	09/03	Review math/stats 2 (200)	Lab 1 report	NR230/232
3	09/10	Statistics and graphing in Excel (200)	Lab 2 calculations	NR230/232
4	09/17	Age and growth 1 (200)	Lab 3 report	NR230/232 208 Wagar?
5	09/24	Age and growth 2 (200)	Lab 4 report	NR230/232
6	10/01	Habitat issues (100)	Lab 5 report	NR230/232
7	10/08	Biological statistics of fish populations (200)		NR230/232
8	10/15	Mortality rates (200)	Lab 7 report	NR230/232
9	10/22	Career advice (200)	Lab 8 report Bring draft résumé to class	NR230/232
10	10/29	Sustainability of commercial fishing (100)	Revised résumé, cover letter	NR230/232
11	11/05	Bioenergetics modeling (200)		NR230/232
12	11/12	Are you going to eat that? (200)	Lab 11 report	NR230/232
13	11/19	Population modeling (200)	Lab 12 “report”	NR230/232
--	11/26	FALL BREAK – NO CLASS		--
14	12/03	Lost Lake Management (100)	Lab 13 report	NR230/232
15	12/10	TBD		NR230/232

***NR230/232 = CLL= Computer Learning Lab, on the second floor of the Natural Resources Building**

Syllabus - Lecture

Instructors

Dr. Brett Johnson, Professor, Department of Fish, Wildlife and Conservation Biology
Office: 233 Wagar; Phone: 970-491-5002; Email: brett.johnson@colostate.edu
Office hours: 10-11 am M, W or by appointment;

GTA: Collin Farrell, Office: 208; Email: collin.farrell@colostate.edu
Office hours: 10-12 Tu, 11-12 Th, or by appointment;
Please do not send email from within Canvas; use the email addresses above.

Required Materials

- Calculator capable of computing basic statistics
- FW 401 slides (Canvas). These are copyrighted materials so you may not duplicate or distribute any of them, they are solely for your use in the course.
- There is no required textbook for this course

Prerequisites

FW300, M141/155/160, ST301/ST307 or equivalent. Computer literacy is assumed.

Time and Place

Lecture: M, W 9:00-9:50 am, 132 Wagar
Lab: Tu 2:00-4:50, 107 Wagar, or NR230/232 (see Lab schedule)

Credits and Instructional Methodology

This is a 3-credit class, with lecture (2 credits) and laboratory (1 credit; computer-intensive exercises and hands-on techniques).

Special Needs

Please let me know as soon as possible if you have any special needs so that we can accommodate you.

Learning Objectives

Fishery Science is a quantitative, ecological discipline that interfaces with human dimensions. The course requires students to draw on knowledge gained throughout the Fisheries and Aquatic Sciences curriculum (math, statistics, and fishery and wildlife biology, ecology, conservation biology, economics and human dimensions) to tackle complex concepts and apply that understanding to real world datasets and contemporary fisheries management issues.

Expected Competencies

By the end of the course, students will have a firm grasp on the fundamentals of fish population dynamics, including basic concepts and stock assessment methods, and will learn how to apply demographic and ecological concepts to the management of sport and non-game fish populations and communities. Students will leave the laboratory section with essential practical and computer skills for gathering, analyzing and interpreting fishery data, and preparing reports in scientific format.

My Expectations of You

- Attendance is very important- exams are largely based on material presented in class; if you miss a class you should get notes from a classmate.
- Students should come to class having read assigned readings, participate in exercises and discussions, and perform all homework and laboratory assignments.
- Students should expect to spend at least 10 hours per week outside of class reading and doing lab reports and homework for this class.
- Ask questions! If something is unclear to you it probably is to others also, and your questions make the class more interesting for everyone.
- Respect your classmates and your instructor. This includes not chatting and turning off your cell phone during class periods.

Student Conduct

No academic dishonesty will be tolerated. This course will adhere to the Academic Integrity Policy of the General Catalog and the Student Conduct Code. You may be asked to sign an Honor Pledge before taking each exam. I reserve the right to assign negative points or other penalties for academic misconduct on exams or assignments.

Using personal electronic devices (smart phone, tablet, laptop, etc.) in the classroom can hinder instruction and learning, not only for the student using the device but also for other students in the class. You may only use personal electronic devices in class for class-related purposes.

I do not allow students to record video of my lectures, or to post or distribute copies of course materials anywhere.

Required Reading

There is no textbook for this class. Readings will be available online. Papers should be read before coming to class- "crib notes" will be required for some readings.

Homework Assignments

You will do much better in the course if you do the homework- these assignments are designed to help you do better on lab reports and exams. Late homework, including crib notes, will not be accepted. All homework assignments should be turned in electronically on Canvas and must be in the form of a PDF file. No photos/images of homework will be accepted- scan it or import photos to a document, make sure they are oriented correctly and are sized for standard letter size paper (8-1/2 x 11"), then export as a PDF and upload to Canvas.

Grading Policies

Course grades will use the +/- grading system; Pass/Fail is not an option. In general course grades will follow the conventional curve (below) but adjustments may be required based on class performance.

	A+	A	A-	B+	B	B-	C+	C	D	F
Upper (%)	100	96.9	92.9	89.9	86.9	82.9	79.9	76.9	69.9	59.9
Lower (%)	97.0	93.0	90.0	87.0	83.0	80.0	77.0	70.0	60.0	0

Breakdown of the course grade is as follows:

Assessment instrument	Weight
Midterm exam I	15%
Midterm exam II	15%
Final exam	15%
Lab assignments	40%
Homework, participation	15%

Exams are cumulative and include lecture and laboratory material and readings. No electronic devices, except calculators, are allowed during exams. You cannot use your cell phone as a calculator on exams.

If you must miss an exam or lab due to sickness or personal tragedy, Dr. Johnson must be consulted before the exam/lab begins--call and leave a message if necessary! Otherwise, you may receive a zero on the exam/lab. I reserve the right to base grades on a subset of course scores instead of a makeup. Car/bike trouble is not an excuse for missing class.

Recommended References

The following list of references is provided to supplement material presented in class, to give you some resources to dig more deeply into topics that interest you, and to allow you to review basic concepts covered in prerequisite courses (you may also wish to review course notes from prerequisite courses).

Craig, J. F., editor. 2016. Freshwater fisheries ecology. John Wiley and Sons, West Sussex, U.K.

Dytham, C. 2011. Choosing and using statistics: A biologist's guide. John Wiley & Sons.

Gotelli, N. J. 2008. A primer of ecology, 4th edition. Sinauer Associates, Inc., Sunderland, MA.

Guy, C. S. and M. L. Brown, editors. 2007. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, MD.

Helfman, G. S., B. B. Collette, D. E. Facey, and B. W. Bowen. 2009. The diversity of fishes. Wiley-Blackwell, Oxford, UK.

Hubert, W.A. and M. C. Quist (eds). 2010. Inland fisheries management in North America. American Fisheries Society, Bethesda, Maryland.

Ogle, D. H. 2016. Introductory fisheries analysis with R. Taylor and Francis, Boca Raton, FL.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.

Zale, A. V, D. L. Parrish, and T. M. Sutton, editors. 2012. Fisheries techniques, third edition. American Fisheries Society, Bethesda, Maryland.

Syllabus – Laboratory

Laboratory Objectives:

1. provide you with essential computer skills that employers and graduate schools will expect you to possess,
2. improve your ability to collect, analyze and interpret fish and fishery data, and
3. allow you to hone your critical thinking, technical writing and scientific graphics skills.

Laboratory Grading:

Attendance at all lab sessions is required, no matter what the topic. All lab sessions have points associated with them regardless of whether there is a required write-up/report. If there are field trips or participation-only labs they will count toward your grade. If you miss a participation-only lab (excused or unexcused), it cannot be made up and you will get a zero for that lab.

Laboratory reports make up the single largest portion of your grade in this course. Thus, you would be wise to do your best on each lab. If you don't understand how your report was graded, come see Dr. Johnson or the GTA. It is your responsibility to retain a copy of any assignments you turn in.

Grading of lab reports will be performed in accordance with laboratory objectives and the rubric below. Thus, reports getting the highest grades will be those that a) demonstrate computer proficiency relative to the tasks in the lab exercise, b) are numerically correct, showing all work clearly and concisely (calculations need not be typed- write neatly on a separate sheet and scan it you're your report), and c) adhere to the Guidelines for the Preparation of Scientific Reports (below).

1. Completed laboratory reports must be submitted via Canvas, as a PDF file.
2. Lab reports are due on the date specified in the lab schedule, at the beginning of the lab period. Labs are late after 2:00 p.m. Tuesday. Don't fall behind!
3. Late labs submitted by: Penalty
   Wednesday 5 p.m. - one day late **-10%**
   For each day thereafter (8-5 p.m.) **-10% additional** (-50% maximum)
   Late lab reports will not be accepted after the date of the exam for that section of the course.
5. You may drop 1 lab grade. Use this option wisely, when you really need it.

Your work: I encourage students to discuss and help each other on lab assignments but each student must prepare their own lab report independently (see section on academic integrity) unless an assignment is specifically designated as a "team" assignment. You may not copy material from current students or from students that took the course in the past.

Guidelines and Grading Rubric for the Preparation of Laboratory Reports

Lab reports must be submitted on Canvas, as a PDF file. You should scan any hand-written calculations and include with your report. When a written answer is required use clear, complete sentences. Reports should have the following sections in this order: Introduction, Methods, Results and Discussion, References, Tables, Figures, Appendices. Approximate number of pages for each section, as well as the typical percentage of the lab grade for each section are shown in parentheses.

1. Introduction (~½ page; 10%): Include some background to set the stage for the topic, then describe the objectives of the laboratory exercise (in your own words) and why the exercise is relevant to the discipline. Cite other literature as necessary.
2. Methods (<1 page; 15%): Briefly describe the mathematical, statistical, sampling and other procedures used. This should be detailed enough for someone to repeat your work. Cite other literature as necessary.
3. Results and Discussion (1-2 pages; 35%): Describe what you found, refer to appropriate tables and figures, answer any questions posed in the lab handout and discuss your conclusions and how these findings relate to published work on the topic (include citations). Hand- written calculations should be included as an "Appendix" and referenced as such in the Results and Discussion section.
4. References (10%): your laboratory reports must have a "References" section wherein you document any information sources used in your report. Each report must cite at least three relevant peer-reviewed scientific journal articles not provided in the course. You may also include additional articles, books and book chapters, agency reports, contract reports, theses and dissertations, and internet web sites. Note that using information from another source without crediting the source is considered plagiarism. If have questions about this, talk to your GTA or Dr. Johnson.
   We will follow American Fisheries Society scientific journal style for bibliographic information in lab reports. See Homework #1 handouts. It may also help you to look at a recent issue of the journal Transactions of The American Fisheries Society for examples of proper bibliographic format.
5. Tables (30% for Tables and Figures): Tables come after the References section and before Figures. All tables should be numbered and include a descriptive table heading at the top of the table that completely describes the table, including symbol definitions, abbreviations used, and units of measure. See example Table below (Rand et al. 1993).
6. Figures (30% for Tables and Figures): Figures come after the Tables. Graphs should be computer-generated and imported into your report. See example Figure below (Rand et al. 1993). Each graph must be numbered and must have the following features :
   a. A descriptive figure caption at the bottom of the figure that completely describes the figure, including symbol, lines, and abbreviations used. In short, a figure must stand on its own, allowing the reader to understand and interpret the figure without consulting the text of the report.
   b. Completely labeled axes, with units of measure shown.
   c. If multiple data ranges are presented, clearly label each with unique markers and line types, and define each in the figure caption.
   d. If regressions lines are presented then report the r^2, equation, and sample size.
7. Appendices (may not be needed): Include any scanned material as an appendix. Number appendices consecutively with headings such as "Appendix 1: Hand Calculations for Lab X".

Example from: Rand, P. S., D. J. Stewart, P. W. Seelbach, M. L. Jones, and L. R. Wedge. 1993. Modeling steelhead population energetics in Lakes Michigan and Ontario. Transactions of the American Fisheries Society 122:977-1001.

TABLE 3.—Estimates of hatchery and wild steelhead smolt equivalents (in thousands) for Lakes Michigan and Ontario from 1975 to 1990. Estimates are provided for the proportion (with 95% confidence interval, CI) of each smolt year-class that was wild (P_W). These estimates were based on examinations of scales from adult fish taken in the sport fisheries in both lakes. Proportions were multiplied by the number (N) of hatchery smolt equivalents (FS = fall–spring run; SU = summer run) to estimate whole-lake yield of wild smolts (N_W).

	Lake Michigan					Lake Ontario			
Year	Number of scales	P_W (95% CI[a])	N_{FS}	N_{SU}	N_W	Number of scales	P_W (95% CI[a])	N_{FS}	N_W
1975			449	0	320[b]			0	70[c]
1976			609	125	283[b]			67	60[c]
1977			548	45	98[b]	147	0.33 (0.15)	112	50
1978			359	104	98[b]	319	0.20 (0.09)	113	29
1979			795	127	98[b]	255	0.29 (0.11)	144	39
1980			856	3	98[b]	285	0.18 (0.09)	231	39
1981			473	114	209[b]	142	0.29 (0.15)	233	58
1982	26	0.21 (0.29)	311	123	93	202	0.24 (0.12)	210	49
1983	35	0.44 (0.34)	543	71	267	238	0.29 (0.11)	219	70
1984	54	0.41 (0.27)	877	177	434	128	0.34 (0.16)	163	58
1985	95	0.22 (0.16)	667	131	178	42	0.29 (0.27)	175	45
1986	105	0.06 (0.09)	782	350	65			206	57[c]
1987	182	0.17 (0.10)	705	329	172			437	83[c]
1988	116	0.12 (0.11)	392	252	80			411	60[c]
1989	150	0.17 (0.11)	437	351	137			415	61[c]
1990	117	0.13 (0.11)	475	351	111			480	78[c]

[a] Calculated as in Seelbach and Whelan (1988).
[b] Estimate based on winter severity–wild smolt yield model for Lake Michigan.
[c] Estimate based on winter severity, July flow–wild smolt yield model for Lake Ontario..

Example from: Rand, P. S., D. J. Stewart, P. W. Seelbach, M. L. Jones, and L. R. Wedge. 1993. Modeling steelhead population energetics in Lakes Michigan and Ontario. Transactions of the American Fisheries Society 122:977-1001.

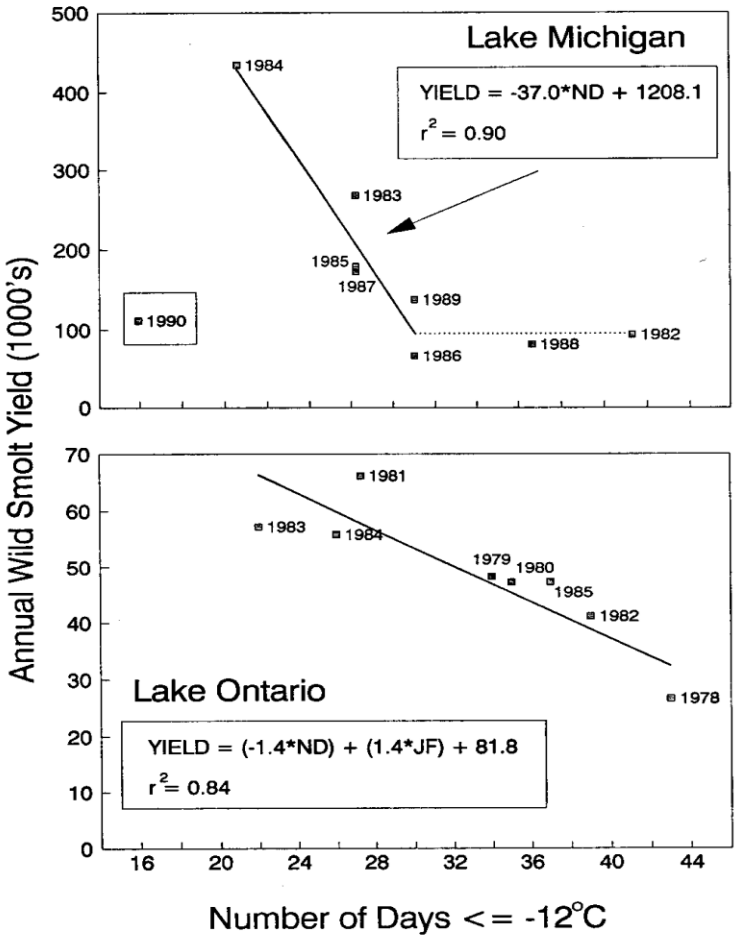

FIGURE 3.—Estimates of annual steelhead smolt yield in Lakes Michigan and Ontario based on an examination of scales taken from adults caught in the sport fishery. The data were regressed against a winter severity index (ND, number of days with air temperatures of −12°C or below). The estimate for the 1990 year-class was excluded from the Lake Michigan regression model because returns were incomplete for that cohort. Lake Ontario wild smolt yield varied as a function of winter severity and mean July stream flow (JF) in the year previous to smolting.