LECTURE SCHEDULE - 2016

Date	Topic	Homework DUE
08/22	Course overview	
08/24	The Stock Concept, ESUs	Citations Crib notes: Metcalf
08/29	Abundance estimation I – Statistical underpinnings	
08/31	Abundance estimation II – Study design	
09/05	**Labor Day – no class**	
09/07	Abundance estimation III – Examples	Simple estimators
09/12	Age and growth: Ecological concepts	
09/14	Ken Kehmeier: Glade Reservoir	Crib notes: NCWCD, STP
09/19	Age and growth: Estimation techniques	Crib notes: MacLean
09/21	Growth and production: Ecology and estimation	
09/26	Catch up	Growth calculations
09/28	**FIRST MIDTERM EXAM**	
10/03	Mortality I: Ecological concepts and estimation	
10/05	Mortality II: Estimation	
10/10	Recruitment I: Ecological concepts	Mortality calculations
10/12	Recruitment II: Mathematical models	
10/17	Recruitment III: Maternal influence	Crib notes: Shelton
10/19	Bioenergetics I: Eco-physiological underpinnings	
10/24	Bioenergetics II: The energy budget and models	
10/26	Bioenergetics III: Yellowstone Lake case study	
10/31	**SECOND MIDTERM EXAM**	
11/02	Fisheries management fundamentals, process	
11/07	Evolutionary effects of fishing	Crib notes: Belgrano
11/09	Fisheries management practices	
11/14	Stocking and hatcheries	
11/16	Regulating harvest: Demographic principles	Crib notes: Rahel
11/21	**Fall break – no class**	
11/23	**Fall break – no class**	
11/28	Indirect effects of harvest regulations	
11/30	Suppression of invasive fishes	Crib notes: Hansen
12/05	Habitat rehabilitation	
12/07	Fishery socioeconomics	
12/15	**FINAL EXAM** Thursday 4:10-6:10 PM	

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: Tyler Swarr, Office: TBD Office hours: TBD or by appointment; Email: tswarr@rams.colostate.edu

The best way to contact us is by email to the addresses above with "FW401" in the subject line. Please do not send email from within Canvas.

Required Materials

- Calculator capable of computing basic statistics.
- There is no textbook required for this course
- FW401 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.

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 CNR CLL (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, particularly socioeconomics. 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. Group projects allow students to hone their teamwork, critical thinking and communications skills.

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 8 hours per week outside of class reading, doing lab reports and homework for this class.
- Ask questions! If something is unclear to you it probably is to others also, and 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 for academic misconduct on exams or assignments.

Using personal electronic devices in the classroom can hinder instruction and learning, not only for the student using the device but also for other students in the class. Please turn off and do not use any personal electronic devices in class, including cell phones, laptops, tablets, and other similar devices. If you have a legitimate need to use a personal electronic device during class please see me for special consideration.

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

If you must miss an exam due to sickness or personal tragedy, Dr. Johnson must be consulted before the exam begins--call, and leave a message if necessary! Otherwise, you will receive a zero on the exam. I reserve the right to base grades on a subset of course scores instead of a makeup.

Attendance at Lab sessions is required, no matter what the topic. All lab sessions have points associated with them regardless of whether there is a write-up/report required.

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 better in the course if you do the homework. Late homework will not be accepted.

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.

Letter grade	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	10%
Group project	10%
Lab assignments	40%
Quizzes, homework, participation	10%

Exams are cumulative and include lecture and laboratory material and readings. No electronic devices, except calculators, are allowed during exams.

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).

Ecology

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

Krebs, C. J. 1989. Ecological methodology. Harper Collins Publishing, New York, NY.

Smith, R.L. and T.M. Smith 2001. Ecology and field biology, 6th edition. Benjamin Cummings, New York, NY.

Fisheries Ecology and Management

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.

Hilborn, R. and C. J. Walters. 1992. Quantitative fisheries stock assessment: choice, dynamics, and uncertainty. Chapman and Hall, London.

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

King, M. 2007. Fisheries biology, assessment and management. Second edition. Blackwell Publishing, Oxford, England.

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

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

Mathematics and Statistics

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

Gotelli, N.J. and A.M. Ellison. 2013. A primer of ecological statistics. Sinauer Associates, Inc., Sunderland, MA.

Samuals, M., J. Witmer, and A. Schaffner. 2011. Statistics for the life sciences, 4th edition. Pearson.

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 technical writing and scientific graphics skills.

Grading of Lab Reports: 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. 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 c) adhere to the Guidelines for the Preparation of Scientific Reports (below).

1. Completed laboratory assignments are due in 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!
2. Late labs turned in by: Penalty
   Wednesday 5 p.m. - one day late **10% off**
   For each day thereafter (8-5 p.m.) **10% additional**
3. If there are field trips they will count toward your grade the same as one lab assignment.
4. You may drop 1 lab assignment/field trip. 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 previous years' students either.

Guidelines for the Preparation of Scientific Reports

Lab reports should be prepared on a computer using word processing software. When a written answer is required use clear, complete sentences. Staple the pages- don't use a fancy binder. Reports should have the following sections in this order: Introduction, Methods, Results and Discussion, Literature Cited, Tables, Figures, Appendices.

1. Introduction- Include some background information 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. (~½ page)

2. Methods- Briefly describe the mathematical, statistical, sampling and other procedures used. Cite other literature as necessary. (<1 page)

3. Results and Discussion- Describe what you found, refer to appropriate tables and figures (see below), 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). You may also include "Management Implications" if appropriate. Hand written calculations should be included as an "Appendix" and referenced as such in the Results and Discussion section. (~ ¾ - 1.5 pages)

4. Literature Cited- your laboratory reports must have a "Literature Cited" section wherein you document any information sources used in your report. Each report must include at least three appropriate/relevant sources from the primary literature (peer-reviewed scientific journal articles) and you may also include books and book chapters, agency reports, contract reports, theses and dissertations, and internet web sites. You may not use references provided in the course- do your own literature search!

   We will follow American Fisheries Society scientific journal style for bibliographic information in lab reports. Consult the TAFS "Guide for Authors" at http://fisheries.org/ or see a 2014 issue of the journal Transactions of The American Fisheries Society for examples of proper bibliographic format.

5. Tables- Tables come after the Literature Cited 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. The Table below (Rand et al. 1993) is a good one.

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..

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.

6. Figures- Figures come after the tables. Graphs should be computer-generated (in spreadsheet or graphics software) and imported into your word processing document. 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, the equation, and sample size.

Example (Rand et al. 1993) of appropriately labeled and captioned figure, suitable for scientific publications and technical reports:

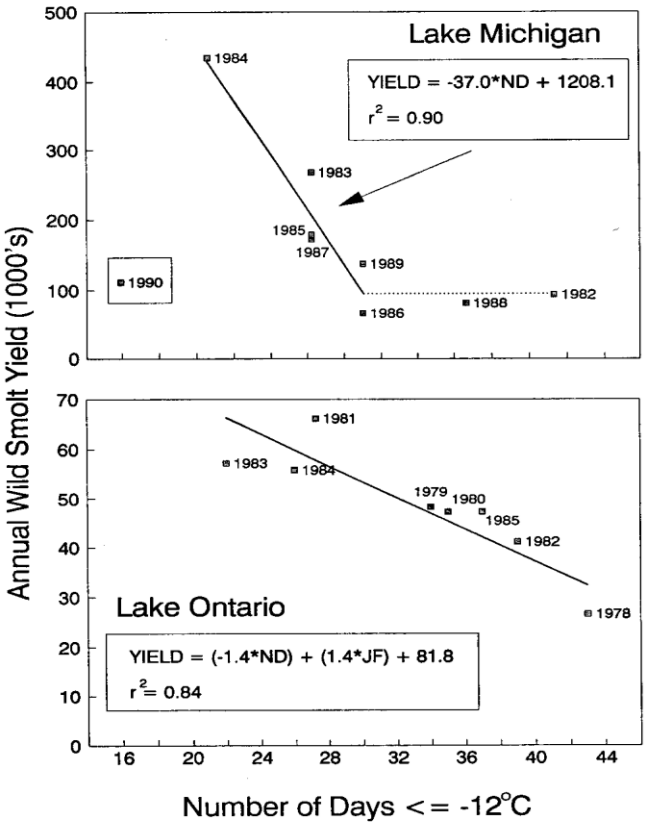

FIGURE 3.—Estimates of annual steelhead smolt yield in Lakes Michigan and Ontario based on an examination of scales taken from adults caught in the sport fishery. The data were regressed against a winter severity index (ND, number of days with air temperatures of −12°C or below). The estimate for the 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.

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.

LABORATORY SCHEDULE - 2016

Lab	Date	Topic	Assignments DUE	Location
1	08/23	Lab Overview https://vimeo.com/146687589		107 Wagar
2	08/30	Review Math/Stats		107 Wagar
3	09/06	Statistical and graphing methods in Excel	Lab 2 report	2:00 107 Wag. 3:00 CLL
4	09/13	Age and growth I: age estimation	Lab 3 report	107 Wagar
5	09/20	Age and growth II: age-length keys, age structure	Lab 4 report	CLL
6	09/27	Reservoir limnology and fisheries	Lab 5 report	107 Wagar
7	10/04	Biological statistics of fish populations		CLL
8	10/11	Mortality rates	Lab 7 report	CLL
9	10/18	Sustainability of commercial fisheries		107 Wagar
10	10/25	Career prep		107 Wagar
11	11/01	Simulation modeling for fisheries ecology	Résumé, cover letter	CLL
12	11/08	Work on projects in class	Lab 11 report	107 Wagar
13	11/15	Harvest regulations		CLL
--	11/22	FALL BREAK – NO CLASS		--
14	11/29	Lost Lake Management	Lab 13 report	CLL
15	12/06	Project presentations		107 Wagar

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