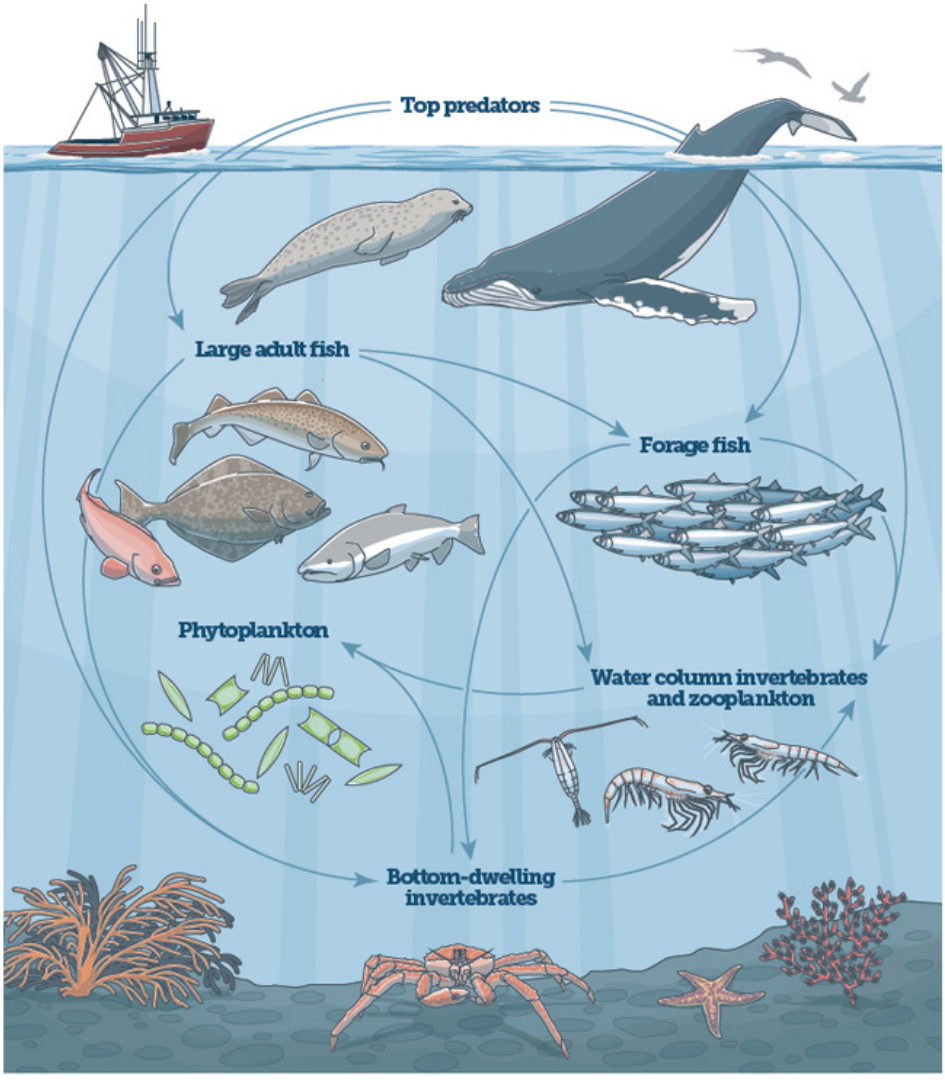
FISH 312:
Fisheries Ecology



Instructor:
Professor Chelsea Wood
office: 206-685-2163
chelwood@uw.edu

Course Outline

Lectures: MWF, 10:30am–11:20am in FISH 107
Labs: W (FISH 312AB) or F (FISH 312AA), 1:30pm–4:20pm in FISH 136

TAs: NAME (AA lab section; xxxx@uw.edu; office location)
NAME (AB lab section; xxx@uw.edu; office location)

Office hours: Chelsea and the TAs are happy to meet any time by appointment – just see us before/after class or shoot an e-mail to set up a time.

Pre-requisites: BIOL 220 or FISH 270

Credits: 5 credits + this course counts toward the UW Additional Writing (W) requirement. Note that, for 5 credits, the University of Washington expects students to devote 15 hours per week to this course (1 credit = 3 hours per week).

Website: Canvas. Look here for course information, datasets, past exams, field trip logistics, and weekly quizzes.

Course meetings: There will be three lectures and one field trip or lab session per week. The class is scheduled from 10:30–11:20 on Monday, Wednesday, and Friday, followed by a 3-hour lab at 1:30 on Wednesday or Friday and/or a weekend field trip. Lab sessions will be used for examination and discussion of material and data from the field trips.

Required readings: Ecology: The Experimental Analysis of Distribution and Abundance, 6th Edition, Charles J. Krebs.

Equipment: This course involves writing, research, and data analysis and students will therefore need to make use of their personal computers or the SAFS desktop computers available in the computer lab. For students without access to a personal laptop – it is now possible to check out UW laptops for an entire quarter. See the Student Services office for details.

You will need waders (ideally chest waders) for our first field trip. If you don't own a pair, ask friends or family if they have some you can borrow (don't forget the boots). We don't provide these for you, but they are mandatory for the electrofishing we'll be doing on Rock Creek field trip.

Responsibilities:

The responsibilities of the **instructor and teaching assistant** are to:

(1) present important, relevant information and concepts in a stimulating manner,
(2) organize field and laboratory experiences that expand and enhance course topics,
(3) teach students to synthesize data and concepts into papers in scientific format.

The responsibilities of the **students** are to:

(1) attend and participate in all class and laboratory sessions,
(2) hand in assignments on time,
(3) conform with University policies regarding academic integrity (see below).

Field trips: The field trips are an essential part of the class and are not optional. Students whose schedules cannot accommodate the field trips should not enroll in the class. All students must complete an animal care exam, medical screening form, and field trip waiver prior to the field trips; this is a UW requirement. Instructions on how to complete animal care and waiver requirements will be posted on Canvas.

Labs: Lab sessions will be used for examination, analysis, and discussion of material and data from the field trips. Labs will be held in the Fishery Sciences Building. Labs will generally consist of a short lecture on the topic to be covered, followed by hands-on student work. Much of the work will involve analyzing data directly. **Computer labs will meet in FSH room 136. Wet labs on zooplankton and stomach contents will be in FTR room 113.**

Course Description

Ecologists study the abundance and distribution of species. In FISH 312, we will learn the basic principles of ecology, with a focus on the ecological processes that produce observable patterns in diversity and abundance. We will proceed from lower levels of biological organization to higher levels: from physiology and behavior to populations, communities, and ecosystems. Although the objective of the course is to teach students fundamental ecological principles that apply across all ecosystems, we will focus on the themes most relevant to marine and aquatic ecosystems, especially fisheries. Field trips and labs will illustrate principles learned in lecture using local ecosystems; we will examine a variety of local aquatic habitats and explore the physical factors (e.g., temperature, substrate, salinity), biotic factors (e.g., predation, competition, parasitism), and human-related factors (e.g., dams, pollution, water diversion, fishing, logging) that affect the diversity and abundance of species. In this way, we will explore how themes of basic and applied ecology play out in local aquatic habitats. The lab portion of FISH 312 focuses on local habitats because: (1) we have access to and expertise about these ecosystems, (2) students often have personal experience with these habitats, (3) learning about local habitats opens up professional opportunities in government, non-profit, and academic sectors.

Learning Goals

By the end of the semester, I expect you will be able to:

1. describe the major ecosystem types that occur in terrestrial, marine, and freshwater environments and explain how organisms are physiologically and behaviorally adapted to these environments;
2. describe the biotic and abiotic factors that place limits on a species' distribution and abundance;
3. describe the structure of populations using techniques from population biology, and identify the major factors that constrain population growth;
4. outline the various categories of species interactions and explain how these interactions influence species' distribution and abundance;
5. explain the differences in biodiversity among world regions;
6. trace the flow of energy through an ecosystem and describe some of the major biogeochemical cycles of terrestrial and aquatic ecosystems;
7. knowledgably discuss applied issues in ecology, including harvesting, pest control, dams, and conservation efforts;
8. analyze and critically evaluate graphical representations of data from the scientific literature;
9. interpret, evaluate, and synthesize primary literature;
10. communicate ideas about ecology, in writing and speech.

Evaluation

	Assessment	Due	Proportion of your final grade
Exams	Exam 1	in class on Monday, 4 May	15%
	Exam 2 (partially cumulative)	during finals week, 8:30a-10:20a on Monday, 8 Jun	15%
Quizzes	Online weekly quizzes	by 11:59pm every Monday	5%
Research paper	You choose a research question to address using the existing datasets from our three field trips	in lab on Wednesday, 8 Apr or Friday, 10 Apr	5%
	You submit a first draft of your research paper's **Introduction** section	11:59pm on Monday, 20 Apr	5%
	You submit a first draft of your research paper's **Methods** section	11:59pm on Monday, 27 Apr	5%
	You submit a first draft of your research paper's **Results** section	11:59pm on Friday, 8 May	5%
	You submit a first draft of your research paper's **Discussion** section	11:59pm on Friday, 15 May	5%
	You submit a **first draft of your research paper** for peer review by a classmate	11:59pm on Friday, 22 May	5%
	Classmate provides **peer review** of your draft	11:59pm on Friday, 29 May	NA
	You provide **peer review** of classmate's draft	11:59pm on Friday, 29 May	5%
	You hand in the **final version of your research paper**	11:59pm on Friday, 5 Jun	15%
Scientific seminar	You deliver an **8-minute scientific seminar** (with 2 minutes for questions) describing your research paper, presented to your lab group	in lab on Wednesday, 27 May or Friday, 29 May	10%
Participation	In-class, in-lab, and in-the-field participation	n/a	5% – see below for a detailed grading breakdown.

Quizzes

Weekly quizzes are designed (1) to help you review your understanding of the material and (2) to indicate the most important materials to study for the midterm and final. You get will get 1 point for each completed quiz, regardless of how many questions you answer correctly. Answers to quizzes will be posted to Canvas. You are encouraged to use the quizzes as study tools for the midterm and final.

Research paper and scientific seminar

Your research paper and scientific seminar will describe original research conducted by you, using the long-term datasets that this class has been collecting during field trips over the course of >20 years. There are three field trips: to Rock Creek in the Cedar River Watershed, Sand Point in Lake Washington, and Port Madison in Puget Sound. For each of these field trips, the same site has been sampled using the same methods at the same time of year for over two decades. We are super lucky to have access to long-term datasets, which can tell us a lot about how these ecosystems are changing through time! All students will collect and hand in data from all three field trips, but you will base your research paper and seminar on only one of these datasets. Data from all three field trips (~two decades of data for each field trip) will be available to you starting from the first day of class. **You will benefit from the efforts of previous generations of students, and next year's students will benefit from your efforts!**

In the first lab, we will talk about all three datasets, and then you will begin the process of exploring the datasets, figuring out what scientific questions are interesting to you, and formulating a plan for using the existing data to address your question of interest. To formulate your question, you will need to think deeply about the ecosystems that have been sampled, read the literature, and talk to your colleagues, TA, and instructor. You will write your paper in scientific format, using the style of the flagship journal of the Ecological Society of America, *Ecology*. This journal has a rather standard style and you should get in the habit of writing papers in journal format. At the end of the quarter, you will give an 8-minute presentation (with 2 minutes for questions) on your findings. The seminar will also be in scientific format (i.e., introduction, methods, results, discussion, delivered via Powerpoint).

Conducting a scientific research project is a big undertaking, but your colleagues, TAs, and professor are here to help you through the process! You will write your research paper in sections, with deadlines distributed throughout the quarter to ensure that you have sufficient time to write carefully and thoughtfully. **For each section, you will receive feedback within one week from one of your TAs and your professor.** You will integrate this feedback into each section. Once all four sections are written, you will compile them into a **first draft, which you will submit for peer review by one of your classmates**. You will then integrate your classmate's feedback into the draft as you finalize the research paper for submission to me for a final grade. You will have time to consult with your colleagues and TAs during lab, and you are always welcome to seek help from your TAs and professor outside of class and lab time. All scientific papers go through multiple, iterative rounds of review before they are published, and you will get to experience this process yourself. Our goal is provide you with all the support that you need to write a stellar manuscript, so don't be afraid to reach out if you have questions or are struggling!

To help you start thinking about what scientific questions you might like to address in your research paper and seminar, here is a brief overview of the three field trips/datasets:

Rock Creek: At Rock Creek in the Cedar River watershed, we have conducted fish and habitat surveys across different habitats and reaches of the creek since 2003. Fish are surveyed using electrofishing. You might use the data to examine species–habitat relationships and relationships among habitat variables. For example, is habitat complexity related to fish abundance, diversity, or body size? How do depth, velocity and substrate vary in a small stream?

Lake Washington: Just off Sand Point in Lake Washington, we have examined the diel vertical migrations and food habits of Lake Washington fishes, emphasizing sockeye salmon and longfin smelt, since 1990. Fish are surveyed with a midwater trawl in 4 shifts that span ~24 hours. You can use the data to look at the changing distribution of fish from afternoon to evening to night, the relative abundance of zooplankton species, and the extent to which the fish have eaten the most abundant prey items. You might also examine the relationships between predators and prey, as revealed through their respective distributions.

Puget Sound: Near Port Madison in Puget Sound, we have examined the distribution of various fish species across different depths and times of day since 1991. Fish are surveyed with a bottom trawl in 5 shifts that span ~24 hours. You might choose to examine long-term change in the abundance of different species, the diel migration patterns of a particular species, or the habitat affinities of a particular species.

Grading scale*

LETTER	PERCENT	GPA	NOTES
A	≥95	4.0	
A	94	3.9	
A–	93	3.8	
A–	92	3.7	
A–	91	3.6	
A–	90	3.5	
B+	89	3.4	
B+	88	3.3	
B+	87	3.2	
B	86	3.1	
B	85	3.0	
B	84	2.9	
B–	83	2.8	
B–	82	2.7	
B–	81	2.6	
B–	80	2.5	
C+	79	2.4	
C+	78	2.3	
C+	77	2.2	
C	76	2.1	
C	75	2.0	
C	74	1.9	
C–	73	1.8	
C–	72	1.7	
C–	71	1.6	
C–	70	1.5	
D+	69	1.4	
D+	68	1.3	
D+	67	1.2	
D	66	1.1	
D	65	1.0	
D	64	0.9	
D–	63	0.8	
D–	62	0.7	Lowest passing grade
E	<62	0.0	Academic failure, no credit earned

*Note that there will be no curve.

Exam policy
If you have a conflict with an exam time, please let Dr. Wood know as soon as possible so that accommodations can be arranged. For unscheduled conflicts with exam times (e.g., medical emergency), make-ups will be available only if the emergency can be verified. If you miss an exam due to illness or other emergency, make sure that you or a friend contacts the instructor, Dr. Wood, by email at chelwood@uw.edu within 24 hours of the exam. Documentation of illness will be required for any missed exam. To preserve the academic integrity of the course, the instructor reserves the right to alter the content and/or format of the original test in creating a make-up exam.

Regrade policy
If you believe that an exam or assignment has been graded incorrectly, or that the grade entered is incorrect, you must contact me within one week of when the assignment is returned to you. Such a request must be submitted in writing (e-mail is fine) and must be accompanied by the original, unaltered assignment.

Academic integrity
Students at the University of Washington are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). I expect you to know and follow the university's policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

I don't expect anyone in this class to engage in academic misconduct – ecology is a window into a new and exciting world, and cheating robs the cheater of the opportunity to explore and know that world. But just in case, I will state up front my policy for addressing academic misconduct: if you are caught cheating, falsifying data, plagiarizing, collaborating on assignments in a manner that is prohibited, or committing any other kind of academic misconduct as defined in the Student Conduct Code, the case will be referred to the College of the Environment for a Student Conduct Process hearing. If the hearing identifies academic misconduct, you will receive an automatic zero on the assignment.

Posting of grades
You will be able to access your grades via Canvas. All graded material will be returned promptly during scheduled class or lab times. If you find that there is a clerical error in a posted score, please contact me as soon as you notice the error. Exam scores will be posted no more than 10 days after the exam date.

Participation
Science education research has demonstrated that students who take an active role in their learning learn more and retain that knowledge longer; therefore, it is in your best interest to prepare for and actively participate in class meetings – including small group activities and

whole-class discussions. This is a relatively easy way to earn points toward your final grade. ***One thing that may help you participate in class is bringing questions you have written out ahead of time***. I will sometimes use a random name generator to call on students at random. Your participation grade will be determined by how often you contribute in class, as well as the quality of those contributions. 10 points (of 10) = student goes beyond required reading, bringing in outside examples and knowledge beyond the scope of the course or connecting concepts across lectures, 8 points = regular participation, usually well thought-out, useful contributions; 6 points = regular participation, sometimes useful, sometimes not; 4 points = occasional participation that is generally useful; 2 points = occasional participation, but generally non-substantive, adding little new information; 0 points = rarely contributed. I can provide feedback on your participation at any point in the semester, at your request.

E-mail
Any e-mail sent to me will receive a response within 48 hours. Detailed questions should be addressed to me in person – either after class or during office hours.

Late assignments
Late assignments will not be accepted and will receive a grade of 0%. If you anticipate having trouble meeting one of the deadlines set out in this syllabus, please discuss with me beforehand.

Incomplete (I)
From UW's Faculty Resource on Grading: "An *Incomplete* is given only when the student has been in attendance and has done satisfactory work until within two weeks of the end of the quarter and has furnished proof satisfactory to the instructor that the work cannot be completed because of illness or other circumstances beyond the student's control… To obtain credit for the course, an undergraduate student must convert an *Incomplete* into a passing grade no later than the last day of the next quarter… An Incomplete grade not made up by the end of the next quarter is converted to the grade of 0.0 by the Office of the University Registrar… An *Incomplete* grade does not count for registered hours nor in computation of grade-point averages."

Classroom climate
Diverse backgrounds, embodiments, and experiences are essential to the critical thinking endeavor at the heart of higher education. I expect you to follow the UW Student Conduct Code in your interactions with your colleagues and me in this course by respecting the many social and cultural differences among us, which may include, but are not limited to: age, cultural background, disability, ethnicity, family status, gender identity and presentation, citizenship and immigration status, national origin, race, religious and political beliefs, sex, sexual orientation, socioeconomic status, and veteran status. Please talk with me right away if you experience disrespect in this class, and I will work to address it. DCinfo@uw.edu is a resource for students with classroom climate concerns.

Access and accommodations for persons with disabilities

It is crucial that all students in this class have access to the full range of learning experiences. At the University of Washington, it is policy and practice to create inclusive and accessible learning environments consistent with federal and state law. Full participation in this course requires the following types of engagement:

Component	Requirement
Lecture	the ability to attend 3 hour-long lectures per week with up to 60 other students; the ability to complete two written and timed exams; the ability to compose research papers; the ability to give an oral presentation before the class
Lab	the ability to participate in weekly 3-hour lab sessions and 5–10 hour field trips that may involve several hours in a vehicle, climbing over rough terrain, wading in streams, recording data while in the field, cold and wet conditions, standing on the deck of a boat, handling live fish and invertebrates; the ability to participate in group discussions; the ability to stand and sit for extended periods of time, engage in repetitive motion activities, and manipulate lab and field equipment

If you anticipate or experience barriers to your learning or full participation in this course based on a physical, learning, or mental health disability, please immediately contact the instructor to discuss possible accommodation(s). A more complete description of the disability policy of the College of the Environment can be found here: https://environment.uw.edu/intranet/academics/teaching/disability-accommodation/. If you have, or think you have, a temporary or permanent disability that impacts your participation in any course, please also contact Disability Resources for Students (DRS) at: 206-543-8924 V / 206-543-8925 TDD / uwdss@uw.edu e-mail / http://www.uw.edu/students/drs.

Roles and responsibilities

- *Student*: inform the instructor no later than the first week of the quarter of any accommodation(s) you will or may potentially require.
- *Instructor and TA*: maintain strict confidentiality of any student's disability and accommodation(s); help all students meet the learning objectives of this course.

Accommodations for religious observances

Students who expect to miss class or assignments as a consequence of their religious observance will be provided with a reasonable alternative opportunity to fulfill their academic responsibilities. Absence from class for religious reasons does not relieve students from responsibility for the course work required during the period of absence. It is the responsibility of the student to provide the instructor with advance notice of the dates of religious holidays on which they will be absent. Students who are absent will be offered an opportunity to make up the work, without penalty, within a reasonable time, as long as the student has made prior arrangements. Pre-arranged absences for religious observances will not be counted against class participation.

FISH 312: Fisheries Ecology

Schedule of Lectures and Labs

You are expected to have read these materials *before* each lecture. You are also expected to have read each lab overview before lab (available on the course website). This schedule is subject to change.

Week	Date	Lecture or lab topic	Required reading	Assignments due
1	30 Mar M	**Lecture 1:** What is ecology?	☐ Krebs Chapter 1	
1	1 Apr W	**Lecture 2:** Nothing in ecology makes sense except in light of evolution	☐ Krebs Chapter 2	
1	3 Apr F	**Lecture 3:** Behavioral ecology	☐ Krebs Chapter 3	☐ Complete field trip forms (animal care exam, medical screening form, and field trip waiver, all on Canvas) ☐ Bring your waders in to class for decontamination (make sure they are labeled with your name in Sharpie)
1	LAB: 1 Apr W 3 Apr F	**Welcome to FISH 312 lab:** We will give an intro to the process of scientific inquiry as we will practice it in this class, go over the basic data analysis skills you will need to succeed, and discuss the three field trips + expectations for the research paper and seminar. We will also talk briefly about logistics for next week's Rock Creek field trip.	☐ Lab overview	☐ Before the end of lab, upload your Week 1 Lab Exercise
2	6 Apr M	**Lecture 4:** Biogeography	☐ Krebs Chapter 4 + pp. 62–70	☐ Complete week 1 quiz by 11:59pm tonight
2	8 Apr W	**Lecture 5:** Biotic factors that limit species' distributions	☐ the rest of Krebs Chapter 5	
2	10 Apr F	**Lecture 6:** Abiotic factors that limit species' distributions	☐ Krebs Chapter 6	
2	LAB: 8 Apr W	**Brainstorming session:** We will talk in small groups about your ideas for the scientific question you will	☐ Arrive at lab with at least one scientific	

	10 Apr F	address in your research paper, with the goal that each student will leave class with a clear scientific question to pursue.	question you might like to address in your research paper and seminar	
1	FIELD TRIP: 11 Apr Sa (could also do previous week)	**Rock Creek field trip:** assess how habitat influences fish diversity and abundance. Meet in the SAFS parking lot at 7:45am and travel to Rock Creek in UW vans.	☐ Lab overview	
3	13 Apr M	**Lecture 7:** Species' geographic range size and abundance	☐ Krebs Chapter 7	☐ Complete week 2 quiz by 11:59pm tonight
3	15 Apr W	**Lecture 8:** Population parameters and demographic techniques	☐ Krebs Chapter 8	
3	17 Apr F	**Lecture 9:** Population growth	☐ Krebs Chapter 9	
3	LAB: 15 Apr W 17 Apr F	**LAB CANCELLED –** Please use this time to work on the Introduction section of your research paper		
4	20 Apr M	**Lecture 10:** How does competition affect species abundance (part 1)?	☐ Krebs Chapter 10	☐ Introduction section of research paper due by 11:59pm tonight ☐ Complete week 3 quiz by 11:59pm tonight
4	22 Apr W	**Lecture 11:** How does competition affect species abundance (part 2)?	☐ review Krebs Chapter 10	
4	24 Apr F	**Lecture 12:** How does predation affect species abundance?	☐ Krebs Chapter 11	
4	LAB: 22 Apr W 24 Apr F	**LAB CANCELLED –** Please use this time to work on the Methods section of your research paper		
4	FIELD TRIP: 24 Apr F 25 Apr Sa	**Lake Washington field trip:** sample pelagic fish and zooplankton. The class will go out in shifts, including afternoon, evening, and night. The boat will leave from the Oceanography Dock (behind the South Campus Center, on NE San Juan Rd).	☐ Lab overview	
5	27 Apr M	**Lecture 13:** How does parasitism affect species abundance?	☐ Krebs Chapter 13	☐ Methods section of research paper due by 11:59pm tonight ☐ Complete week 4 quiz by 11:59pm tonight

5	29 Apr W	**Lecture 14:** Regulation of population size	☐ Krebs Chapter 14	
5	1 May F	**Catch up day + bring your questions from the practice mid-term**	☐ bring your questions from the practice midterm!	
5	LAB: 29 Apr W 1 May F	**Identify zooplankton from Lake Washington** (room FTR 113)	☐ Lab overview	
6	4 May M	**MIDTERM –** in our usual room during our usual lecture period		☐ Complete week 5 quiz by 11:59pm tonight
6	6 May W	**Lecture 15:** Applied problems I – harvesting populations	☐ Krebs Chapter 15	
6	8 May F	**Lecture 16:** Community structure in time – succession	☐ Krebs Chapter 18	☐ Results section of research paper due by 11:59pm tonight
6	LAB: 6 May W 8 May F	**Identify and quantify prey items from Lake Washington sockeye and smelt** (room FTR 113); preview of Puget Sound field trip.	☐ Lab overview	
7	11 May M	**LECTURE CANCELLED** – Please use this time to work on the Discussion section of your research paper		☐ Complete week 6 quiz by 11:59pm tonight
7	13 May W	**Special Guest Lecture from Jim West (WDFW)** – Introduction to the fishes of Puget Sound	☐ Krebs Chapter 17	
7	15 May F	**LECTURE CANCELLED** – Your professor and TAs will be loading up the R/V Rachel Carson in preparation for our Puget Sound field trip! Please use this time to work on the Discussion section of your research paper		☐ Discussion section of research paper due by 11:59pm tonight
7	LAB: 13 May W 15 May F	**LAB CANCELLED –** Please use this time to work on the Discussion section of your research paper		
7	FIELD TRIP: 15 May F 16 May Sa	**Puget Sound field trip:** patterns of marine fish and invertebrates related to depth and time of day. The class will go out in shifts, from Friday afternoon through mid-day on Saturday. The boat will leave from and return to the boat launching ramp at Shilshole Bay marina.	☐ Lab overview	
8	18 May M	**Lecture 17:** Community structure in space – biodiversity	☐ Krebs Chapter 19	☐ Complete week 7 quiz by 11:59pm tonight
8	20 May W	**Lecture 18:** Community dynamics I – predation and competition in equilibrial communities	☐ Krebs Chapter 20	

8	22 May F	**Lecture 19:** Community dynamics II – disturbance and nonequilibrial communities	☐ Krebs Chapter 21	☐ Submit first draft of research paper for your colleagues to peer review by 11:59pm tonight
8	LAB: 20 May W 22 May F	**Finalize your research paper and seminar**: With help from your colleagues and your TA, finish up the parts of your research paper and seminar that still need work. For example, now is a good time to come with statistical questions, questions about the format of your presentation, questions about how to structure your introduction, etc.	☐ Lab overview	
9	25 May M	**MEMORIAL DAY – LECTURE CANCELLED**		☐ Complete week 8 quiz by 11:59pm tonight
9	27 May W	**Lecture 20:** Ecosystem metabolism I – primary production	☐ Krebs Chapter 22	
9	29 May F	**Lecture 21:** Ecosystem metabolism II – secondary production	☐ Krebs Chapter 23	☐ Submit your peer review of your colleague's research paper by 11:59pm tonight
9	LAB: 27 May W 29 May F	**Present your seminar to the lab group**	☐ Lab overview	☐ Arrive ready to give a 10-minute seminar on your research project
10	1 Jun M	**Special Guest Lecture from Jameal Samhouri (NOAA NWFSC) –** Using insights from community ecology to rebuild fisheries		☐ Complete week 9 quiz by 11:59pm tonight
10	3 Jun W	**Lecture 22:** Ecosystem metabolism III – nutrient cycles	☐ Krebs Chapter 24	
10	5 Jun F	**Lecture 23:** Ecosystem health – human impacts	☐ Krebs Chapters 25 & 26	☐ Final research paper due ☐ Complete week 10 quiz by 11:59pm tonight
10	LAB: 3 Jun W 5 Jun F	**EXAM REVIEW**		
11	8 Jun M 8:30a–10:20a	**FINAL EXAM**		

Scientific paper grading rubric

Category	Exceeds expectations (9–10)	Meets expectations (7–8)	Nearly meets expectations (5–6)	Does not meet expectations (3–4)	Incomplete (0–1)
Required elements present?	All required elements are present.	One required element is missing.	Two required elements are missing.	Several required elements are missing.	
Introduction	The introduction successfully "funnels" by providing a broad context and narrowing in to the purpose of the paper.	The introduction provides appropriate background context but does not "funnel".	The introduction states the main topic but does not provide appropriate background context.	There is no clear introduction or main topic and no background context.	Absent
Research question/ hypothesis	Research question and predicted results are stated, the explanation is clear and accurate based on what has been studied.	Research question and predicted results are stated, but the explanation is unclear or not quite logical.	Research question and predicted results are stated, but not explained.	No research question or predicted results stated.	Absent
Methods	Methods are reported clearly, accurately, and in logical order.	Methods are reported mostly accurately and somewhat clearly, but may lack logical order or are difficult to follow.	Methods are reported but do not accurately represent the steps of the study or are missing important pieces.	Methods are missing.	n/a
Results	Concise, clear, and accurate statement of results.	Accurate statement of results.	Statement of results included.	No results included.	n/a
Graphs	Clear, accurate graphs illustrate the results well and are labeled neatly and accurately.	Clear, accurate graphs are included and labeled.	Graphs are included and are labeled but may be missing important labels or have some inaccuracies.	Graphs are missing or mostly inaccurate.	n/a
Discussion	Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.	Paragraph development present but not perfected.	Logical organization; organization of ideas not fully developed.	No evidence of structure or organization.	n/a
Conclusion	The conclusion is engaging and explains the outcome of the reported test of the research question.	The conclusion explains the outcome of the reported test of the research question.	The conclusion does not adequately explain the outcome of the reported test of the research question.	Incomplete and/or unfocused.	Absent
Mechanics	No errors in punctuation, capitalization, spelling, sentence structure, or word usage.	Almost no errors in punctuation, capitalization, spelling, sentence structure, or word usage.	Many errors in punctuation, capitalization, spelling, sentence structure, or word usage.	Numerous and distracting errors in punctuation, capitalization, spelling, sentence structure, or word usage.	n/a
References	All references are cited in the correct format with no errors. All sources are legitimate.	Some references are cited in the correct format. All sources are legitimate.	Few references are cited in the correct format. Some illegitimate sources (e.g., websites).	No references are cited in the correct format. Reference list contains illegitimate sources.	Absent

Scientific seminar grading rubric

Category	Exceeds expectations (9–10)	Meets expectations (7–8)	Nearly meets expectations (5–6)	Does not meet expectations (3–4)	Incomplete (0–1)
Required elements present?	All required elements are present.	One required element is missing.	Two required elements are missing.	Several required elements are missing.	NA
Introduction	The introduction successfully "funnels" by providing a broad context and narrowing in to the purpose of the research.	The introduction provides appropriate background context but does not "funnel".	The introduction states the main topic but does not provide appropriate background context.	There is no clear introduction or main topic and no background context.	Absent
Research question/ hypothesis	Research question and predicted results are stated, the explanation is clear and accurate based on what has been studied.	Research question and predicted results are stated, but the explanation is unclear or not quite logical.	Research question and predicted results are stated, but not explained.	No research question or predicted results stated.	Absent
Methods	Methods are reported clearly, accurately, and in logical order.	Methods are reported mostly accurately and somewhat clearly, but may lack logical order or are difficult to follow.	Methods are reported but do not accurately represent the steps of the study or are missing important pieces.	Methods are missing.	NA
Results	Concise, clear, and accurate statement of results.	Accurate statement of results.	Statement of results included.	No results included.	NA
Graphs	Clear, accurate graphs illustrate the results well and are labeled neatly and accurately.	Clear, accurate graphs are included and labeled.	Graphs are included and are labeled but may be missing important labels or have some inaccuracies.	Graphs are missing or mostly inaccurate.	NA
Discussion	Speaker demonstrates logical and subtle sequencing of ideas; transitions are used to enhance organization.	Logical development present but not perfected.	Organization of ideas not fully developed.	No evidence of structure or organization.	NA
Conclusion	The conclusion is engaging and explains the outcome of the reported test of the research question.	The conclusion explains the outcome of the reported test of the research question.	The conclusion does not adequately explain the outcome of the reported test of the research question.	Incomplete and/or unfocused.	Absent
Mechanics	Powerpoint slides are visually appealing, organized, have minimal text, make use of diagrams and plots to convey information instead of words.	Powerpoint slides are organized, but text-heavy. Points that could be made with plots of data are instead made with text or speech.	Powerpoint slides are disorganized, text-heavy, difficult to understand.	Numerous and distracting errors in plots or text that make Powerpoint slides very difficult to understand.	NA
Preparation	Presentation indicates intensive preparation.	Presentation indicates adequate preparation.	Presentation indicates minimal preparation.	Presentation indicates a lack of preparation.	NA