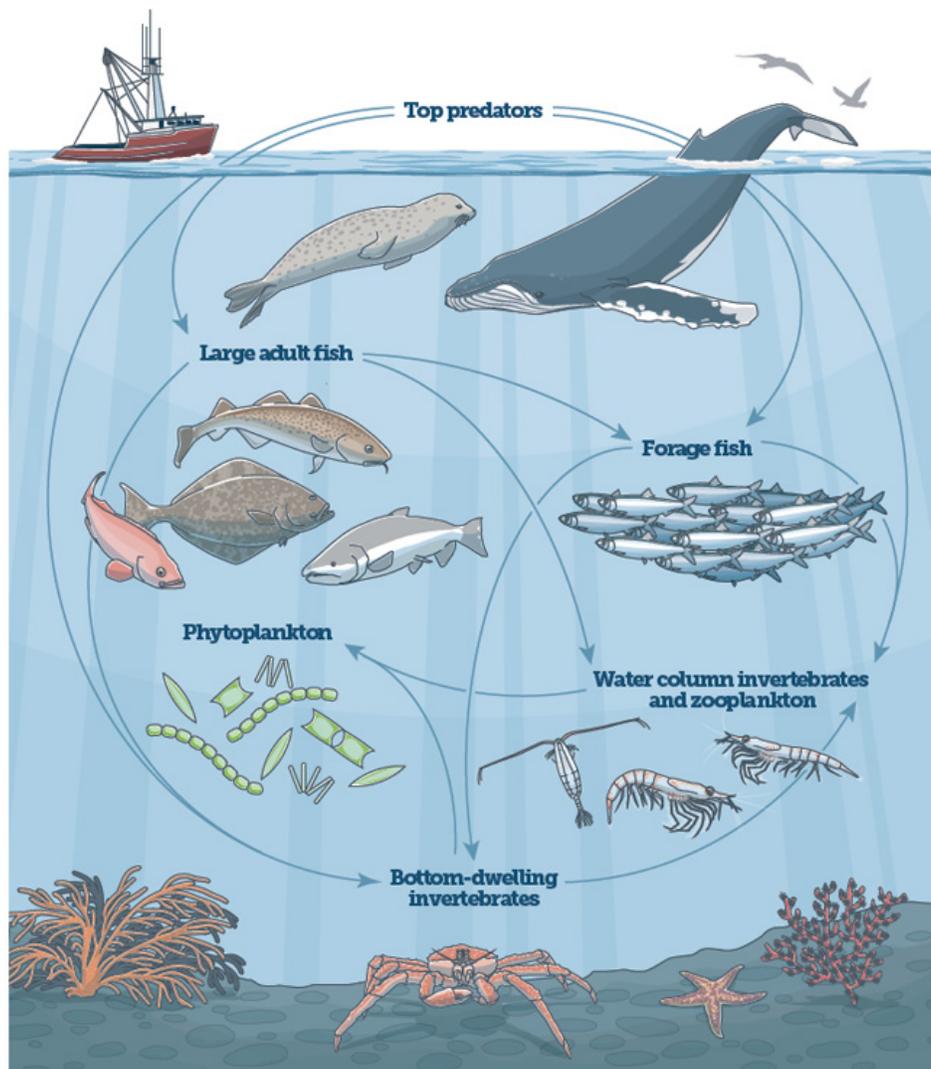


# FISH 312: Fisheries Ecology



**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:** Marta Gomez-Buckley (AA lab section; lapita@uw.edu; FTR 005C in Fish Collection Lab)  
Michaela Lowe (AB lab section; mrlowe@uw.edu; FISH 358A)

**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, 6<sup>th</sup> 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, on Saturday, 6 April. 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 in the Cedar River on the 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 Fisheries Science 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 related to the two journal-style papers and one oral presentation assigned. **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 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. knowledgeably 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 (accomplished via writing assignments and group presentation);
10. communicate ideas about ecology, in writing and speech.

## Evaluation

	<b>Assessment</b>	<b>Due</b>	<b>Proportion of your final grade</b>
<b>Exams</b>	Exam 1	in class on Wednesday, 8 May	15%
	Exam 2 (partially cumulative)	during finals week, 8:30a-10:20a on Monday, 10 June	15%
<b>Quizzes</b>	Online weekly quizzes	by 11:59pm every Monday	10%
<b>Writing projects</b>	Rock Creek paper	11:59pm on Wednesday, 24 Apr	10%
	Lake Washington paper – first draft	11:59pm on Friday, 17 May	10%
	Lake Washington paper – final draft	11:59pm on Monday, 3 June	20%
<b>Oral presentation</b>	Puget Sound group presentation	in lab on Wednesday, 29 May or Friday, 31 May	10%
<b>Participation</b>	In-class, in-lab, and online participation	n/a	10% – 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 will get 1 point for each completed quiz, regardless of how many questions you answer correctly. Answers to quizzes will not be posted – this is to encourage you to seek out the answers on your own (which will help you learn the material more deeply). You are encouraged to use the quizzes as study tools for the midterm and final.

### **Papers and presentations:**

There will be three field trips, to Rock Creek in the Cedar River Watershed, Lake Washington, and Port Madison in Puget Sound. All students will collect and hand in data from these trips, and will write papers in scientific format on the datasets for two of these (Rock Creek and Lake Washington). Papers will be based on datasets that include the data that your class collects as well as data collected by past students in previous years; some of these datasets started in the 1980s, so we will be able to make some interesting observations about long-term change in these ecosystems! You will write papers 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.

**Rock Creek paper:** Fish and habitat surveys will be conducted in different habitats and reaches of Rock Creek. We will 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? Length: 6–7 pages, not including references, tables and figures.

**Lake Washington paper:** This project will examine the diel vertical migrations and food habits of Lake Washington fishes, emphasizing sockeye salmon and longfin smelt. We will 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. We will also discuss the relationships between predators, prey, and their respective distributions. Length: 8–10 written pages, not including references, tables and figures.

**Puget Sound group presentation:** For your final assignment, you will give a group oral presentation in which you discuss interesting patterns in data from the Puget Sound trawl field trip. Oral presentations are a common form of communication in the field of ecology, and public speaking is an excellent skill for an ecologist to have. In addition, scientists (and lots of other folks) often need to collaborate with colleagues, and working with others is another important skill in the field of ecology. Your group will select one question to answer in your presentation. The presentations should be about 12 minutes long using PowerPoint. They should follow the outline of a scientific paper: introduction, methods, results, and discussion.

## 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](mailto: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 (exams and essays) 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:

<b>Component</b>	<b>Requirement</b>
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](mailto: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	1 Apr M	<b>Lecture 1:</b> What is ecology?	<input type="checkbox"/> Krebs Chapter 1	
1	3 Apr W	<b>Lecture 2:</b> Nothing in ecology makes sense except in light of evolution	<input type="checkbox"/> Krebs Chapter 2	<input type="checkbox"/> Complete field trip forms (animal care exam, medical screening form, and field trip waiver, all on Canvas) <input type="checkbox"/> Bring your waders into class for decontamination (make sure they are labeled with your name in Sharpie)
1	5 Apr F	<b>Lecture 3:</b> Behavioral ecology	<input type="checkbox"/> Krebs Chapter 3	
1	LAB: 3 Apr W 5 Apr F	<b>Intro to data analysis + prep for Rock Creek field trip</b>	<input type="checkbox"/> Lab overview	<input type="checkbox"/> Before the end of lab, upload your Week 1 Lab Exercise
1	FIELD TRIP: 6 Apr Sa	<b>Rock Creek field trip:</b> 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.	<input type="checkbox"/> Lab overview	
2	8 Apr M	<b>Lecture 4:</b> Biogeography	<input type="checkbox"/> Krebs Chapter 4 + pp. 62–70	<input type="checkbox"/> Complete week 1 quiz by 11:59pm tonight
2	10 Apr W	<b>Lecture 5:</b> Biotic factors that limit species' distributions	<input type="checkbox"/> the rest of Krebs Chapter 5	
2	12 Apr F	<b>LECTURE CANCELLED</b> – please use this time to review what you've learned in the past two weeks, get ahead on		

		your Krebs readings, and begin preparing for your midterm, which is coming up on 8 May		
2	LAB: 10 Apr W 12 Apr F	Distribute and discuss habitat and fish data from Rock Creek. Discuss expectations for Rock Creek paper and begin data analysis. Preview of Lake Washington field trip.	<input type="checkbox"/> Lab overview	
3	15 Apr M	<b>LECTURE CANCELLED</b> – please use this time to review what you’ve learned in the past two weeks, get ahead on your Krebs readings, and begin preparing for your midterm, which is coming up on 8 May		<input type="checkbox"/> Complete week 2 quiz by 11:59pm tonight
3	17 Apr W	<b>Lecture 6:</b> Abiotic factors that limit species’ distributions	<input type="checkbox"/> Krebs Chapter 6	
3	19 Apr F	<b>Lecture 7:</b> Species’ geographic range size and abundance	<input type="checkbox"/> Krebs Chapter 7	
3	LAB: 17 Apr W 19 Apr F	<b>NO LAB THIS WEEK</b> – please use this time to work on your Rock Creek paper or study for the midterm		
3	FIELD TRIP: 19 Apr F 20 Apr Sa	<b>Lake Washington field trip:</b> 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).	<input type="checkbox"/> Lab overview	
4	22 Apr M	<b>Lecture 8:</b> Population parameters and demographic techniques	<input type="checkbox"/> Krebs Chapter 8	<input type="checkbox"/> Complete week 3 quiz by 11:59pm tonight
4	24 Apr W	<b>Lecture 9:</b> Population growth	<input type="checkbox"/> Krebs Chapter 9	<input type="checkbox"/> Rock Creek paper due <input type="checkbox"/> download <i>Populus</i> software to your laptop and bring it to class: <a href="https://cbs.umn.edu/populus/download-populus">https://cbs.umn.edu/populus/download-populus</a>
4	26 Apr F	<b>Lecture 10:</b> How does competition affect species abundance (part 1)?	<input type="checkbox"/> Krebs Chapter 10	
4	LAB:	Identify zooplankton from Lake Washington (room FTR	<input type="checkbox"/> Lab overview	

	24 Apr W 26 Apr F	113).		
5	29 Apr M	<b>Lecture 11:</b> How does competition affect species abundance (part 2)?	<input type="checkbox"/> review Krebs Chapter 10	<input type="checkbox"/> Complete week 4 quiz by 11:59pm tonight
5	1 May W	<b>Lecture 12:</b> How does predation affect species abundance?	<input type="checkbox"/> Krebs Chapter 11	
5	3 May F	<b>Lecture 13:</b> How does parasitism affect species abundance?	<input type="checkbox"/> Krebs Chapter 13	
5	LAB: 1 May W 3 May F	Identify and quantify prey items from Lake Washington sockeye and smelt (room FTR 113). Preview of Puget Sound field trip.	<input type="checkbox"/> Lab overview	
6	6 May M	<b>Lecture 14:</b> Regulation of population size	<input type="checkbox"/> Krebs Chapter 14	<input type="checkbox"/> Complete week 5 quiz by 11:59pm tonight
6	8 May W	<b>MIDTERM</b> – in our usual room during our usual lecture period		
6	10 May F	<b>Special Guest Lecture from Jim West (WDFW)</b> – Introduction to the fishes of Puget Sound		
6	LAB: 8 May W 10 May F	<b>NO LAB</b> – please use this time to work on your Lake Washington paper		
6	FIELD TRIP: 10 May F 11 May Sa	<b>Puget Sound field trip:</b> 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.	<input type="checkbox"/> Lab overview	
7	13 May M	<b>Lecture 15:</b> Applied problems I – harvesting populations	<input type="checkbox"/> Krebs Chapter 15	<input type="checkbox"/> Complete week 6 quiz by 11:59pm tonight
7	15 May W	<b>Lecture 16:</b> Community structure in time – succession	<input type="checkbox"/> Krebs Chapter 18	
7	17 May F	<b>Special Guest Lecture from Erin Ashe and Rob Williams (Oceans Initiative)</b> – Herring and salmon, dolphins and killer whales: The role of two ecologically	<input type="checkbox"/> Krebs Chapter 17	<input type="checkbox"/> Lake Washington paper first draft due

		important fish in the conservation of two top predators		
7	LAB: 15 May W 17 May F	Analysis of Puget Sound trawl data.	<input type="checkbox"/> Lab overview	
8	20 May M	<b>Lecture 17:</b> Community structure in space – biodiversity	<input type="checkbox"/> Krebs Chapter 19	<input type="checkbox"/> Complete week 7 quiz by 11:59pm tonight
8	22 May W	<b>Lecture 18:</b> Community dynamics I – predation and competition in equilibril communities	<input type="checkbox"/> Krebs Chapter 20	
8	24 May F	<b>Lecture 19:</b> Community dynamics II – disturbance and nonequilibril communities	<input type="checkbox"/> Krebs Chapter 21	<input type="checkbox"/> Instructor/TA comments on your Lake Washington paper first draft will be returned today
8	LAB: 22 May W 24 May F	Analysis of Puget Sound trawl data	<input type="checkbox"/> Lab overview	
9	27 May M	<b>MEMORIAL DAY – NO LECTURE</b>		<input type="checkbox"/> Complete week 8 quiz by 11:59pm tonight
9	29 May W	<b>Lecture 20:</b> Ecosystem metabolism I – primary production	<input type="checkbox"/> Krebs Chapter 22	
9	31 May F	<b>Lecture 21:</b> Ecosystem metabolism II – secondary production	<input type="checkbox"/> Krebs Chapter 23	
9	LAB: 29 May W 31 May F	Oral presentations of Puget Sound trawl data	<input type="checkbox"/> Lab overview	<input type="checkbox"/> Puget Sound group oral presentation
10	3 Jun M	<b>Special Guest Lecture from Jameal Samhouri (NOAA NWFSC) – Using insights from community ecology to rebuild fisheries</b>		<input type="checkbox"/> Final Lake Washington paper due <input type="checkbox"/> Complete week 9 quiz by 11:59pm tonight
10	5 Jun W	<b>Lecture 22:</b> Ecosystem metabolism III – nutrient cycles	<input type="checkbox"/> Krebs Chapter 24	
10	7 Jun F	<b>Lecture 23:</b> Ecosystem health – human impacts	<input type="checkbox"/> Krebs Chapters 25 & 26	<input type="checkbox"/> Complete week 10 quiz by 11:59pm tonight

10	LAB: 5 Jun W 7 Jun F	<b>EXAM REVIEW</b>		
11	10 Jun M 8:30a–10:20a	<b>FINAL EXAM</b>		