Fish/Ocean/Bio 250 Marine Biology
MWF 9:30-10:20, Johnson Hall (JHN) 102

Instructor:
Carolyn Friedman, Professor
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Office: FSH 222B
Office Hour: Wednesday 1030-1130am
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Teaching Assistants: TBA
Laboratory Coordinator: TBA

COURSE DESCRIPTION
Our marine biology class is a lecture-laboratory course focusing on both physical and biological aspects of the marine environment. The topics we will cover include oceanography, ecology, physiology, behavior, fisheries, and conservation.

Students may enroll in Marine Biology for three OR five credits. Both options are great ways to learn about Marine Biology, so please choose the number of credits that will work best for you.

- Students enrolled for three credits will participate in the lecture component of the course.
- Students enrolled in Marine Biology for five credits will participate in the lecture component of the course, participate in one weekend field trip (may be overnight), and participate in a weekly laboratory exercise.

Textbook:
Morrissey and Sumich: Introduction to the Biology of Marine Life Text Book.
Reading material will not cover everything said in lecture, and vice versa. However, you will be responsible for both lecture material and the readings on the exams.

COURSE EXPECTATIONS
We each enter this classroom community with a unique set of experiences and different backgrounds that will inform our readings of and reactions to the subjects we study. Respect for diversity of all kinds is vital to creating a respectful, safe and stimulating intellectual environment.
You are expected to:

- Be responsible for your own learning. Attending class is a key component of taking responsibility for your learning.
- Think critically about the readings and lectures. This class will be challenging and will demand a lot from you.
- Come prepared to each class having completed the reading.
- Be engaged in each class: ask questions, answer questions and offer your point of view.
- Be present, on time, and engaged in all class engagements including lecture, exams, field trips, and labs. Talk with us ahead of time if you anticipate a problem.
- Be respectful of others.

- Give us feedback! Please tell us what you think of the class. Is it too slow or too fast? Is it clear?

You can expect us to:

- Do everything we can to engage you during lecture and labs and to assist you in learning the material.
- Respect your contributions and learning styles. Please talk with us if you have suggestions for ways that we can better facilitate your learning.
- Assign all the work that is necessary for you to understand the material and no more.
- Present material so that it is accessible.
- Grade fairly.

It is our goal to ensure that our learning environment is accessible to everyone. If you have a disability and need special accommodations for note taking or any other aspect of your coursework, please contact Disability Resources for Students, 448 Schmitz, Box 355839 (206)543-8924 (V/TTY), uwdss@u.washington.edu. If you have a letter from Disabled Student Services indicating you have a disability that requires academic accommodations, please present the letter to your instructor, Carolyn Friedman, so we can discuss the accommodations you might need for the class.
If you are an athlete on a UW fall sports team, please provide us with your travel schedule, so we can work together to ensure your success in this course.

ACADEMIC INTEGRITY

Any suspected cases of student misconduct, such as cheating or plagiarism, will be dealt with according to University policies. We will do our best to ensure a fair testing situation for all students and thus will proctor exams, distribute multiple exams and may ask students to reseat themselves.
All work submitted for this course must be an original effort. Plagiarism means presenting the words or ideas of another person as if they were your own, for example by turning in someone else's work or failing to document material you have quoted or borrowed. I encourage you to talk with others about your ideas and to get their feedback, but the work you hand in must represent your own ideas and be in your own words. If you are unsure about your use of sources or are having other difficulties with your writing, please talk to me or make an appointment with the one of the University Resources on the How to Succeed page on the left. You are responsible for understanding all aspects of University regulations regarding academic integrity. It is also YOUR responsibility to ensure that you understand what plagiarism is. Please visit the UW web site:
http://depts.washington.edu/grading/issue1/honesty.htm
Typical plagiarism oversights are:

- Copying the lab or movie information from a friend with whom you study, OR working so closely with this friend that both your assignments LOOK copied (same words and ideas in the same order).
- Copying images or whole sentences from a web site without restating in student's words or without quotation/citation.
- Paraphrasing ideas of another author without attempting to write an "original" sentence

Evaluation and Grading

How we will evaluate your learning:

Participation will be evaluated based on movie night participation and pop quizzes during class.
Midterm I: Multiple choice exam that may include questions from all lecture and reading material covered until this point.
Midterm II: Cumulative, multiple choice exam that may include questions from all lectures readings. The primary focus will be on material covered from the first midterm through to the second.
Final Exam: Cumulative, multiple choice exam that may include questions from all lectures and in the readings. The focus will be on material from the second midterm to the end of the class.
Written Assignment: There will be one written assignment that requires you to attend a relevant seminar outside of class, complete a library search activity, and answer questions about the seminar attended. The seminar assignment can be found above under Seminar Assignment.
We will schedule a make-up exam if absolutely necessary. As soon as you forsee a conflict, please talk with us and provide a compelling, documented reason.

Grades

Your grade for the lecture component of the course (this is the full course for students enrolled in Marine Biology for three credits) will be based on the following assignments and point distributions:

Marine Biology 250 Lecture - Point Breakdown

Assignment/Exam	Points
Participation, Quizzes, and Surveys	50
Written Assignment (based on seminar attended)	30
Mid-Term Exam I	150
Mid-Term Exam II	150
Final Exam	220
Total Points Available	**600**

Extra Credit will be awarded for wearing a Marine Biology inspired costume on Halloween (Wednesday, October 31st) (5 points).

Here is how point scores will be translated into course grades:

Translating point scores into grade point scores:

%	grade point	%	grade point	%	grade point
95-100	4.0	83	3.0	71	1.8
94	3.9	82	2.9	70	1.7
93	3.9	81	2.8	69	1.6
92	3.8	80	2.7	68	1.5
91	3.8	79	2.6	67	1.4
90	3.7	78	2.5	66	1.3
89	3.6	77	2.4	65	1.2
88	3.5	76	2.3	64	1.1
87	3.4	75	2.2	63	1.0
86	3.3	74	2.1	62	0.9
85	3.2	73	2.0	61	0.8
84	3.1	72	1.9	60	0.7

You can always figure out your grade by:

1. Adding up all the points you have received to date
2. Dividing your score by the total points available
3. Multiplying by 100 (this gives you a percentage score)
4. Looking up the grade point in this table.

Re-grades

This class is not graded on a curve. This means that it is possible for everyone to get an A!

If you feel that an exam or assignment has been graded unfairly or that a mistake has been made, you may submit a regrade request WITHIN ONE WEEK of being handed back the assignment or exam. Requests must be submitted in writing and must be handed in at lecture. Requests should be stapled to the original assignment. E-mails and conversations cannot substitute for a written request

Marine Biology 250 Syllabus for Fall, 2014:

WEEK 1	W 24 Sep F 26 Sep	Introduction & Scientific Method Ecological and Evolutionary Principles
WEEK 2	M 29 Sept W 01 Oct F 03 Oct	Oceanography 1 Oceanography 2 **HOMEWORK: watch videos for friday lec (See reading tab for link)** Oceanography 3: a good recap of ENSO: https://web.duke.edu/nicholas/bio217/knt3/enso.html
WEEK 3	M 06 Oct W 08 Oct F 10 Oct	Plankton I Plankton II Adaptations, Evolution & Marine Biodiversity
WEEK 4	M 13 Oct W 15 Oct F 17 Oct	TEST Marine Mammals – VanBlaricom Guest Lec The Open Ocean I
WEEK 5	M 20 Oct W 22 Oct F 24 Oct	The Open Ocean II The Deep Sea I The Deep Sea II
WEEK 6	M 27 Oct W 29 Oct F 31 Oct	Food Webs: Kelp Forests and Polar Seas Food webs/ Unique ecosystems: Mangroves & Coral Reefs The Rocky Intertidal I (Halloween Parade)
WEEK 7	M 03 Nov W 05 Nov F 07 Nov	The Rocky Intertidal II:Soft Bottom Intertidal Review for test TEST
WEEK 8	M 10 Nov W 12 Nov F 14 Nov	Sensory systems Breathing and Eating Getting There: Locomotion
WEEK 9	M 17 Nov W 19 Nov F 21 Nov	Life History Strategies I Life History Strategies II Marine Conservation
WEEK 10	M 24 Nov W 26 Nov F 28 Nov	Introduced Species and Disease THANKSGIVING HOLIDAY- NO CLASS THANKSGIVING HOLIDAY- NO CLASS
WEEK 11	M 01 Dec W 03 Dec F 05 Decc	Current Issues: Fisheries and Aquaculture Current issues: Anthropogenic Impacts Final Review
WEEK 12	W 10 Dec	FINAL EXAM 8:30-10:20 a.m.

The FINAL EXAM will be held on WEDNESDAY DECEMBER 10th, 2014 from 8:30-10:20 in the morning, JHN 102.

Marine Biology 250 Readings for Fall, 2014:

All readings should be completed before class on the date they are assigned

WEEK 1	W F	NONE see pdf below or use link: Schoener 2011: This is a tough read for your first week but don't worry as you will read this again in week 4.
WEEK 2	M W F	**Chapter 1** "The Ocean as Habitat" pages 1-27 and section 2.4 "The General Nature of Marine Life" (p. 57). AND Coriolis Effect video. If desired see **Murray reading (pdf below)** **Chapter 1 (p 27 - 36) AND** view the FOUR El Nino videos at 1:https://www.youtube.com/watch?v=EjlIeQFxdlE 2:https://www.youtube.com/watch?v=hbeWmP0FQOg 3:https://www.youtube.com/watch?v=GvtTARitSQo 4:https://www.youtube.com/watch?v=YgWVxk4kdLo
WEEK 3	M W F	**Chapter 3 (p 64-92)** AND **section 4.4 - 4.5**:Marine Primary Production (p 117-126) and **9.3** (Larval Dispersal, 286-289) in Morrissey and Sumich (2010). AND Plankton Revealed Video and read the text also **Ch 2:** pages 39-49 and for more information: Williams et al. 2000
WEEK 4	M W F	None-exam I Chapter 7: pages 219-253 and for those interested: Schoener 2011 **Scroll down for PDF file.** Chapter 11: The Open Sea (pages 344-366) as well as pages 194-196 about schooling (For today and Monday lectures)
WEEK 5	M W F	For those interested: Johnson 2000. Transparent Animals. **Scroll down for PDF file.** and Philips & Bavendam. 1995. School Riddles. International Wildlife 25(2) Chapter 12: pages 368-386 for Wed and Friday plus optional reading below: For those interested: Widder 2010 **(Scroll down for PDF file)** and Bosveld. 2009. Earth's own aliens: They light up and live in the deep. Discover Magazine. There is a cool Brink Video embedded in this article as well.
WEEK 6	M W F	Class text: Chapter 2: trophic relationships and food webs (pages 52-56) and Chapter 4: about seaweed and kelp forests (pages 105-117). Chapter 4 about marine flowering plants, including Mangroves (98-105) and Chapter 10 about coral reefs (pages 312-328). optional Roberts et al. 2002**see pdf below** Chapter 1: about tides on pages 30-33 and Chapter 9 about Coastal Seas(282-309). You can skip the portion on larval dispersal if you read it for the plantkon lecture! Also see Paine Keystone species debate (**PDF below**)
WEEK 7	M W F	Chapter 8 Estuaries pages 257-275 Stephenson. 1996. When fish bite. **Scroll down for PDF file.**
WEEK 8	M W	Morrissey and Sumich: pages 200-207. Morrissey and Sumich (2010): Respiration in fish (181-186), marine mammals (248-

	F	253) and feeding in whales (235-239). fish and fish movement on pages 163-177; 186-194; 196-199 as well as about dolphin movement on page 244-245 and for those interested: Nevitt. 1999. Foraging by seabirds in an olfactory landscape. American Scientist 87 (1) **see pdf below**
WEEK 9	M W F	Morrissey and Sumich: sex in fish (pages 170-176; 335-342) and in marine mammals (pages 225-234; 239-241) Luer and Gilbert. 1991. Elasmobranch Fish: Oviparous, Viviparous, and Ovoviviparous and Chapman et al 2007: Virgin birth in a shark. **Scroll down for PDF files.** Kostigan. 2008. The world's largest dump" The great Pacific garbage patch
WEEK 10	M W F	Elston et al. 2008. **Scroll down for PDF file for Elston.** THANKSGIVING HOLIDAY - NO CLASS THANKSGIVING HOLIDAY - NO CLASS
WEEK 11	M W F	Morrissey and Sumich: Chapter 13 (pages 391-413). Wilcox 2012; Spaulding 2013; Mooney 2010 The Acid Sea by Elizabeth Kolbert (2011) None
WEEK 12	W	FINAL EXAM

Laboratory Overview

General Things to Know about the Lab

Attire. Do *not* wear sandals and avoid wearing shorts in the lab. Wear closed toed shoes for all laboratory sessions; this is a safety issue.
Working in Groups. For most of the labs, you will be working in groups. Depending on the lab, the size of the group will vary.
Groups will work through the lab together, generating one set of data. Sometimes the section will combine data for analysis, while on other occasions you will only analyze the data collected by your team.
TAKE NOTE - although you work as a team to collect the data, the lab write-up is each individual's responsibility. Make sure you have all of the information you need before you leave lab.

Lab Work and Writing Up the Exercises

It is a good idea to have some form of notebook to take notes in during the lab (and field trip). Be sure to record all data, observations, and any other pertinent information before leaving the lab. See the Laboratory Manual and Grading headings below for more information.
Lab write-ups will be due in the electronic drop boxes (see drop box tab on your left sidebar of this class web page) It is your responsibility to turn your lab write-up in on time. If it is turned in late, you will lose points (see below for policy).
Your TA will be grading your lab reports weekly:

Day of Lab	Day Labs Due
Tuesday AM & PM	Saturday by 5:00pm
Wednesday	Sunday by 5:00pm
Thursday AM & PM	Monday by 5:00pm
Friday	Tuesday by 5:00pm

Labs posted to the Dropbox after 5:00pm are considered LATE! See below for late policy.

Laboratory Manual

There is no formal lab manual that needs to be purchased for this course. Instead, all of the lab exercises will be available in .pdf form on the course website. It will be your choice to either store them on your laptop and bring that to lab or print out a copy. *Either way, we expect that you will have read the exercise before your lab begins.* Your TA may check out this expectation by giving you a quiz at the beginning of your lab, so:

- Read it before hand
- Show up on time (there will be no make-up of quizzes)

Each lab protocol will be structured similarly. The main body of each lab protocol explains how to perform the laboratory in step-by-step instructions. If you get to CAPITAL LETTERS or bold print, pay careful attention and MAKE SURE you are following instructions correctly. At the end, there will be the parts you will be responsible for turning in. Read it carefully, and make sure you understand what you are required to do before leaving lab.

Grading
Your grade will depend on your participation in lab (which includes your score on any pop quizzes), your labs and your field trip. Participation is worth 30 points. Each lab is worth 35 points. You may drop the lowest score (for a total of 7 completed labs, or 245 points). The 35 points are roughly divided into:

- All elements on the lab checklist are present
- Thinking and synthesis

The five minute oral presentation on a marine organism or issue of your choice is worth 35 points. Your grade is determined from your oral and visual presentation which will incorporate *current* research in your topic of choice.
Your oral presentation will be graded on the following:

1. 10 points - incorporating recent literature
2. 10 points - powerpoint style (clarity, relevance, style)
3. 10 points - oral presentation style (clarity, brevity, style)
4. 5 points - length (-1 point for every 30 seconds less than/more than five minutes)

The field trip will be worth 90 points. Your grade will depend on your participation, data collection, data analysis, and communication skills.

Assignment/Exercise	Maximum Points
Participation	30
Lab Writeups	245
Oral Presentation	35
Field Trip	90
Total Possible Points	400

Late Policy
Written assignments submitted 0-24 hours after the due date will be penalized 20% of the maximum points available. If a report is more than 24 hours late, a further 20% will be deducted for each 24 hours or fraction thereof. Some due dates are on the weekend, so pay attention to your due date! For example, if an assignment is worth 100 points, is due in class on a Wednesday, but is submitted at 4 PM the following Friday, the penalty is 40 points. Please note - computer problems are not an accepted excuse for lateness. Labs are due before CLASS in the Drop Box for your lab section by the time specified by your TA. Lab reports handed in after class or the Drop Box deadline are considered late**.**

Weekly Laboratory Activities
Week 1 Half week - No lab
Week 2 Oceanography & Water Stratification
Week 3 Population Variation, Introduction to Excel, and UW Libraries
Week 4 Dichotomous Keys Oral Presentations Begin

Week 5 Testing Taxis
Week 6 Bivalve Feeding
Week 7 Anatomy
Week 8 Intertidal Zonation - Measuring Diversity
Week 9 Human Impacts Oral Presentations Finish
Week 10 No Lab - Thanksgiving
Week 11 No Lab

Field Trip Overview

As you already know, each lab student (students enrolled in Marine Biology for **FIVE CREDITS**) is required to participate in one field trip. There are six separate trips, each described here on the course website. Which trip you participate in will be decided by a combination of preference and lottery. We will attempt to accommodate each of you to the best of our abilities. If you can not make any of the field trips, you should consider dropping the lab portion of this course.

Students enrolled in Marine Biology for three credits may not participate in the field trips.
All field trips meet early (7:00 or 8:00am) Saturday or Sunday morning and return around 8 PM forday trips. All Friday Harbor trips are overnight. They will leave on Saturday and return on Sunday. You will receive specific instructions the week of the trip. There will be 20-25 of you on each trip, plus one or two TAs, instructors, and other expert guests as required. We will be providing all necessary scientific gear. You will need to provide adequate clothing and personal items. Scroll down for a specific list of required personal gear.
Field Trip activities will vary widely by trip. In general, we will be learning about a specific habitat and how to sample the organisms in that habitat. All students will be collecting data, which we will examine as a group. Depending on the trip, we may have lectures from on-site experts, or from guests assisting us.
There will be a written assignment (90 points) specific to each trip, which will be due a maximum of two weeks after your trip. You will find out the specifics on these assignments the week of the trip, but you can click the "Field Trip Assignment" link to the left for details of assignment format and grading.

What to Bring on ALL Field Trips

List of Things All Students are REQUIRED to Bring

1. Something suitable for writing in the field with appropriate writing implements.
2. Daypack - to put your notebook, pencils, etc. in when we're out and about.
3. Rubber boots or shoes you can get (very) wet (and maybe muddy) in.
4. Second pair of shoes for shore-based activities.
5. Extra socks.
6. Rain gear - including a water-proof jacket AND rain pants. Good places to look for inexpensive rain gear and rubber boots include the Outdoor Emporium, a block north of

REI at 420 N Pontius, or Federal Army & Navy Surplus, at 2112 1st Ave., just north of Pike Place Market.

7. WARM clothes, including a fleece jacket or pullover. We will be outside for HOURS, regardless of the weather conditions. It is ESSENTIAL that you have warm clothing.
8. A hat or two. A stiff-brimmed hat (like a baseball cap) in case it is sunny (also good for keeping the bird poop out of your hair), and a warm hat (like a stocking cap or ski hat) in case it is windy and cold, should both be in your day pack.
9. Warm gloves.
10. Clothes to change into once we get off the beach.
11. Alarm clock. We will wake up EARLY on Sunday.
12. Necessary medications - please let your TA know in advance if you have ANY medical condition which requires medication.
13. **LUNCH FOR SATURDAY.** Don't forget a bag lunch for Saturday or you'll be hungry...

List of Things NO Student Should Bring

1. Alcohol.
2. Hairdryer, curling iron. This is a field trip, not a beauty contest.
3. Sleeping bag. Beds and linens are provided.
4. Anything extraneous. We have VERY LIMITED cargo space in the vans. Students with large bags will be asked to open them so we can leave unnecessary items behind in the lab. Unless you want everyone to see what we choose to leave behind, **pack light!**

List of Things You MAY Wish to Bring

1. Binoculars
2. Sunglasses
3. Camera
4. Water bottle
5. Powerbars, trail mix, or other munchies
6. Earplugs (you'll be sharing rooms)

Your Field Trip Assignment:
General expectations and how it will be graded

Field Trip Assignment (90 points)

As part of the field trip experience, the group will divide into smaller groups to collect data. You will receive details on what data to collect and how to collect it during the trip. Collect all of your data legibly, as your data will be shared with the rest of the group as an Excel file at the end of the trip.

At the end of the trip, we will meet as a large group to talk about what we found. Are there apparent patterns in the data? What are they? What forces could have caused these patterns? Choices might range from physical forces - like waves or tides - to biological forces - like predation, competition, or species invasion - to human forces - like disturbance, development, or fishing.

Your job - TO BE COMPLETED INDIVIDUALLY - will be to write a lab report based on ALL of the data we collected during the trip.

The report will be due two weeks after the trip - on the THIRD Monday following the weekend of the trip.

Because this is a large portion of your lab grade, you should take advantage of your TA office hours to go over any questions you have, including turning in sample graphs or writing, or even just hashing out ideas.
During the field trip, you should be thinking about three critical factors essential for a good lab report:

1. **Question.** Choose a question to 'ask' of the data. We will try to review many potential questions during our wrap-up meeting. You may choose one of these, or you may come up with one of your own. If you have lingering doubts about whether your question is appropriate ask your TA or one of the trip leaders.
2. **Data Analysis.** You will need to select which data you will use. NOTE: you MUST use data collected by all students - you may not, for example, only use your own group's data. Choosing means *which* dataset. For instance, if you are asking a question about relative abundance, you may choose to focus on one particular species. If you are asking a question about diversity (which includes both abundance AND the number of different species), you may choose to use data on all species.
   You will need to decide how to analyze your data - exactly what are you going to do with all of the numbers in the spreadsheet? Again, we will try to cover this briefly during the wrap-up meeting. There is also a section on the website about data analysis, including simple statistics and graphing.
   The trick is to make sure that you are using the data to address your question. All calculations, and TWO graphics, at least one of which results from your analysis, are due as part of your report.
3. **Critical Thinking.** Consider: What might some of the difficulties be when analyzing your data? What factors may skew your interpretation? What larger factors (possibly not addressed in the field trip) may affect your observations and conclusions? Be ready to do a literature search to help address some of these issues.

Report Format:

Question (one sentence ending in a question mark) (5 points)

Your question should be a specific example of an issue of interest to you. For instance, if your issue is invasive species in marine environments, your question might be: how is species diversity in intertidal environments affected by the abundance of introduced species?

Methods Section (10 points)

The first part should describe what data were collected, and how they were collected. Remember, a methods section should read almost like a cookbook or other manual describing how to do something. Someone who didn't go on the trip (your roommate, your mother) should be able to read your methods and REPRODUCE your data collection by following the instructions. You don't need to include information on how we got to the field site, but you do need to include information on what types of equipment or supplies we used, where we collected data, etc.
The second part should describe how you analyzed the data. Did you sum all of the numbers? Did you calculate averages? Did you calculate any measure of variation? Did you choose to exclude any particular data (usually referred to as outliers). If so, you MUST describe - and defend - the rule

you used. Again, your roommate or your mother should be able to sit down with the trip data and this section, and reproduce your analysis by following the instructions.

Figures (2 minimum) (8+4 = 12 points)

At least one figure will be a data graph which displays the analyzed data and directly addresses your question. For instance, if your question is about the influence of invasive species on intertidal diversity, you might want to graph diversity as a function of the number of a specific invasive species we counted. You would NOT want to graph total diversity on Saturday versus Sunday, because this graph would NOT address your question.
Your second figure is up to you. If a second data graph is needed, make one. However, you may also choose other types of figures, including:

- map
- flowchart
- table of data (but NOT the raw - or unanalyzed - data)
- diagram
- photograph

The only requirement is that this second graphic also ADDRESS YOUR QUESTION. A beautiful picture of the site we visited would not fulfill this requirement, and not be acceptable.

Results (10 points)

The results will describe the patterns or relationships you discovered in your analysis, relating to your question. This is also the place where you will include and refer to your figures. For instance, did diversity go up or down - what was the pattern? What other measured factors appear to be related to this pattern? Remember, a results section is "Just the facts ma'am." You are merely describing any patterns you found, and *want to avoid interpretation of the data in the results section*. **The interpretation of data is left for the discussion section.**

Discussion (18 points)

Now you will interpret your results - here is the Discussion where you will answer your question. In your expert opinion, what is/are the most likely causes of the pattern you found? If you did not find any pattern, speculate on why not. Remember, you will need to defend your opinion; you may not merely say, "In my opinion, the pattern was caused by invasive species." You must explain what facts have lead you to your conclusions. Think of a mystery novel - what are the clues? Cite specific examples from your results.
The final portion of your Discussion should relate your findings to the question at the beginning of your report. Expand your comments beyond the narrow scope of your question by comparing your results with those from another study published in the scientific literature. You may choose a study which describes the same species or habitat you are working in, the same type of question you are asking, or the same general issue you are considering. This is where the literature search will help.

Literature Cited

At least one reference from a peer-reviewed scientific journal found in the University of Washington library should be used. Ideally, four or five primary literature sources should be used. Please include the first page (with the abstract) of one of the articles cited at the end of your report.

Grading

Participation in field trip activities:	10
Data analysis:	10
Lab Report	
Question:	5
Methods:	10
First Figure:	8
Second Figure:	4
Results:	10
Discussion:	18
Literature Cited:	6
Writing:	9
TOTAL:	**90**