BIEB 131

MARINE INVERTEBRATE ECOLOGY LAB

WINTER 2012

Professor Kaustuv Roy

Date	Topic	Reports
January 10	Introduction to the course & Safety lecture	
January 12	Introduction to Marine macro-invertebrates	
January 17	Field Trip and Introduction to Human Exploitation of Marine Invertebrates	
January 19	Lab 1: Rocky Intertidal Molluscan Diversity (Field Work)	
January 24	Lab 1: Rocky Intertidal Molluscan Diversity (Analyses)	
January 26	Introduction to Marine Meiofauna	
January 31	Lab 2: Habitat Complexity and Diversity of Meiofauna	**Lab 1 Report Due**
February 2	Lab 3: Beach Grooming and Sandy Beach Invertebrates	
February 7	Lab 3: Beach Grooming and Sandy Beach Invertebrates	**Lab 2 Report Due**
February 9	Lab 4: Diversity of Soft Bottom Invertebrate Communities	
February 14	Lab 4: Diversity of Soft Bottom Invertebrate Communities	
February 16	Lab 5: Environmental Gradients & Local Adaptation	**Lab 3 Report Due**
February 21	Lab 5: Environmental Gradients & Local Adaptation	**Lab 4 Report Due**
February 23	Lab 6: Salt Marsh Invertebrates	
February 28	Lab 6: Salt Marsh Invertebrates	**Lab 5 Report Due**
March 1	Lab 7: Marine Biogeography	
March 6	Lab 8: Exploitation and Size change	**Lab 6 Report Due**
March 8	Lab 8: Exploitation and Size change	
March 13	Lab 8: Exploitation and Size change	
March 15	Presentations	**Lab 8 Report Due**

GEAR & TRANSPORTATION

In this course we will spend roughly half the time in the field and the other half in the lab. All of our field sampling will be in intertidal habitats along the coast of San Diego, within easy driving distance of UCSD. Field work in the intertidal is physically demanding - be prepared to get cold and wet and to do a fair bit of hard work. Since the course grades are based on the data you collect in the field, if you do not like working outdoors especially in less than ideal weather, then this course is not for you.

Different people have different preferences as to clothing for intertidal field work. In general, jeans are not the best choice since they can be uncomfortable when wet. Shorts are okay if you don't mind getting cold, especially since we will be doing a lot of work in the late afternoon. Also shorts make you particularly prone to getting scrapes and cuts from sharp rocks that we will be working on. I personally find quick dry long pants to be the best choice since they are wind resistant and dry quickly if you get wet. If you don't have those then you could use rubber rain pants – an attire of choice for some intertidal ecologists. In general it is important to dress warmly since it is very easy to get cold on the coast – yes even in San Diego. So fleece jacket/vest is a good idea. As far as footwear is concerned, Teva or similar sandals can work but again they are not very comfortable in cold water. I prefer dive booties with a heavy sole since they provide good traction on wet rocks and keep the feet warm. Always carry a small backpack for your field notebook and other equipment. Also always carry a bottle of water in your pack – it is easy to get dehydrated even though you will be working next to water! Finally, remember to use sunscreen! These are just some suggestions – the main point is to dress comfortably and warmly. If you are uncomfortable in the field then you are likely to be distracted and not concentrate on data collection.

As far as transportation to the field sites are concerned, you are responsible for getting there – we will provide directions and meeting times in class. You should consider car pooling with other members of your group/class since parking is somewhat limited at some of the places we will go to.

GRADING

Your grade for this course will be based on attendance, class participation and the 6 lab reports. Since all the analyses in this course are based on data you will collect in the field, if you fail to participate in the fieldwork for a lab (except in cases of documented illness) you will not receive any credit for that particular lab exercise. This is a 4 unit course and most of the labs in this course will require you to work outside of scheduled class time as mentioned in the course description. Each lab report is due on the date specified on the schedule. **We will not accept Labs 1 – 5 later than 4 days from the due date, and Lab 6 will not be accepted after March 21. For all late labs 10% of the points will be deducted per day.** All labs need to be handed to the professor or the T.A. during the lab period or by special appointment. The rigid schedule for lab reports is primarily for your benefit – given the amount and the nature of the work involved, if you fall behind you will never catch up. So stay on schedule and you should be fine.

All the lab exercises require you to collect data as a part of a group. However, you must do the analyses on your own – one aim of this course is to teach you how to analyze ecological data and unless you perform the analyses, you will not get a good grasp of the methods. You are free to consult with your group members about the interpretation of the results but you are responsible for writing the report and for its contents. Good teamwork is an important skill and is essential for collecting the data for the lab exercises – do your share of the work and expect your team members to do the same.

EQUIPMENT

All the field equipment that you will need except for notebooks and pens will be available in the lab. The equipment must be checked out in advance and returned when you are finished with it. To get your grade in this class you will need to return each piece of borrowed equipment in undamaged condition. You are responsible for replacing lost or damaged equipment.

DATA & STATISTICS

For this course I will assume that you are familiar with the basic statistical concepts such as frequency distributions, probability, correlation, linear regression, and t-tests. These topics are covered in BIEB 100; if these seem unfamiliar, look through your BIEB 100 notes to refresh your memory. Without the knowledge of basic statistics you will not be able to do well in this course. In addition to the basic methods we will also use randomization methods and non-parametric statistics for some of the exercises. Those methods are described under the appropriate lab exercises.

We will use multiple software packages in this course, including Microsoft Excel, EcoSim and JMP/Statview. All the software are available on the machines in the computer lab.

Excel will be our primary spreadsheet software – all the raw data that you collect should be entered and saved as Excel spreadsheets. We will export data from Excel into the other software, as necessary, to do the statistical analyses. A few important things to keep in mind regarding data handling:

- Always make sure you take detailed notes in the field and label samples clearly. Good field notes can help immensely in interpreting the results of your analyses; the lack of good field notes can easily compromise a study.

- You can enter data for different labs into separate files or into separate "sheets" in one master file. In either case use file/sheet names that are unambiguous as to what that data represent. Feel free to also add notes in a separate column in each file/sheet. The point is that we will be using multiple datasets and it is very easy to confuse data collected on different days or from different places unless you organize them carefully. Careful organization of data as you enter it will save you a lot of headache and extra work later.

- For this lab I suggest not using any space between words in column headings or in column entries. One of the software we are using (EcoSim) is very sensitive to

spaces, it treats spaces as delimiters between data and labels; if you have extra spaces then you will have trouble importing data into this software. So instead of "Bird Rock" use either "Bird_Rock" or "BirdRock". Also make sure that there are no spaces in species names – use "Acanthinucella_spirata" instead of "Acanthinucella spirata".

- Make sure you save your data files frequently as you are entering data and always make multiple back-ups of the files.

HOW TO WRITE THE LAB REPORTS

Since the grading for this course is based on the lab reports, your write-up should look professional (no hand written reports will be accepted), be well written and provide a succinct description of what you did, how you did it and the purpose of the exercise. Being able to convey to others the meaning and importance of your work is an integral part of being a successful scientist so in your reports please pay attention to grammar and spelling. Here are a few suggestions about writing the reports:

(a) As a general rule, active voice is preferable – use "we sampled the intertidal" rather than "the intertidal was sampled". This does not mean that you should never use passive voice – just that you need to do it judiciously.

(b) It is best to use the past tense for the methods and results sections of your report (e.g. "we used a random number generator to determine the location of the quadrats") but use the present tense for the conclusions (e.g. "my results show that site A is more diverse than site B") as well as for general statements in the discussion section.

(c) Always italicize names of species with the first letter of the genus in capitals (e.g. *Acanthinucella spirata*).

(d) Cite references in the following format: within a sentence Joe (1993); at the end of a sentence (Bill, 1998; Bob, 2001). In case of multiple citations the order is from the oldest to the youngest, and alphabetically for those from the same year.

(e) Remember your lab report should be a unique document that presents your insights and conclusions about the work you did. In this class I will require you to work in groups to collect and analyze data but it is not acceptable to copy or plagiarize text or conclusions from the published literature or from other members of your group/class. **Any instance of plagiarism will automatically result in a 0 for the lab in question.**

Please use the following format for all reports

Title in bold. It should be short and does not necessarily have to be a complete sentence. But it should convey to the reader the topic of the study

Your Name
BIEB 131, Winter 2004

Group members:
Names of all the group members

Introduction

This section should start with a brief introduction to the general topic of the study and previous work, if any, on this subject. Feel free to state why the topic is of scientific interest. This should be followed by a short description of the specific aims of your study and the particular hypotheses that you are planning to test. This section should not exceed half a page in most cases.

Materials and Methods

Provide details of what you did and how. Do not simply restate the handout for the lab, instead discuss the place where you conducted the research (e.g. "the intertidal benches at the end of Bird Rock avenue in La Jolla, California"), the species or groups you looked at (e.g. "we focused on *Tegula funebralis*" or "we measured all mollusks present in each quadrat") and provide details about measurements, and equipment (e.g. "we used 25 cm^2 quadrats made out of pvc pipe"). Be explicit about your methods - another researcher reading your report many years later should be able to duplicate your study easily. For some of the labs you may want to use subheadings in this section using bold italics:

Field sampling

Laboratory analyses

Statistical methods

Results

Present your findings in this section. Describe in qualitative terms, if relevant, and then present the statistical results supporting those conclusions (e.g. "individuals of *Lottia gigantea* were larger at site A compared to site B ($p<0.001$, t-test, see Table 1 for details)"). For the statistical tests present all the parameters that the reader would need to evaluate your results (e.g. sample size, the value of the test statistic, p-value etc.). Cite the relevant figures and tables in the text (e.g. Figure 1B) and either paste them in this section or put all of the figures and tables at the end of the report.

Discussion

This section should start with a brief synopsis of your findings listed in the results section. Then present your interpretations of the results. State if they support or refute the hypotheses you are testing. If alternative interpretations are possible then mention them and provide a clear argument about why the reader should prefer your interpretation over the others. Briefly discuss how the results of your study relate to those from previous ones – are they consistent with what we already know or do they refute the conclusion of previous studies? End the report with specific suggestions about further work that might provide additional insights into the problem. This is the place where you can really present your insights about the problem and demonstrate that you understood the point of the exercise. **Remember, a well written and insightful discussion section is what separates good reports from excellent ones.**

References

All the references you cite in the text, including software used, should be listed here in alphabetical order. Use the format used by the journal American Naturalist.