California State University, Fullerton
Department of Biological Science
Biology 517T: Design and Analysis of Ecological Experiments

Meeting Place: MH 217 (we're meeting in 282A for the first meeting)
Meeting Time: Tuesdays from 18:30 until 21:20.

Instructor: Sean Walker
Office: MH 389, Lab MH 342
Office Hours: T 10-12 am,W 10-11 am, R 9-11 am & by appointment
Phone: (Office) 278-3610, (Lab) 278-8204
Email: swalker@fullerton.edu
Web-Site: http://biology.fullerton.edu/swalker

Course Web Site: The course web-site will be on blackboard.

Course Description

In this course we will explore advanced methods of analysis and discuss the pros and cons of different philosophies (e.g. Frequentist versus Bayesian) of statistical analysis used in ecology.

Prerequisites: Graduate Standing

Required Texts:
Design and Analysis of Ecological Experiments 2nd Ed. Edited by Sam Scheiner & Jessica Gurevitch. 2001. Oxford University Press

Recommended (but not required) especially if you're uncomfortable with statistics.
A primer of ecological statistics. Nicholas J. Gotelli & Arron M. Ellison. 2004. Sinauer.

Student Learning Goals:

1. Students will be able to utilize library resources to find appropriate literature (e.g. BasicBIOSIS, Web of Science, PubMed, JSTOR).

2. Students will be able to demonstrate effective written and oral communication skills.

3. Students will be able to do the following with regard to evaluating primary literature.
    a. Identify the research question
    b. Identify the hypotheses
    c. Evaluate the validity of the predictions made from the hypotheses
    d. Evaluate if the methodology is appropriate to test the predictions
    e. Analyze data in the form of figures or tables
    f. Identify the conclusions
    g. Evaluate the validity of the conclusions

4. Students will be able to integrate and apply concepts learned in this and previous courses to place readings in a broader context in Ecology and Evolutionary Biology.

5. Students will be able to distinguish between Bayesian methods and Frequentist methods.

6. Students will be able to properly interpret hypothesis tests.

7. Students will be able to interpret and critique statistical analyses in the primary literature.

Course Requirements

Email Assignment (5%):

I need your email. So, send an email to me by the end of the first week of classes (this means by 5 pm on Friday) answering the following questions:

1) I love/hate/am indifferent toward statistics
2) Your favorite statistical term is?
3) Without using any resources at all I want you to define what a p-value is.

Student Participation & Questions (20%)

Since this is a seminar class, participation is critical and will be a large portion of your final grade. Several articles or book chapters will be required reading for each class meeting and students are expected to have read this material and be prepared to discuss it.

On the SATURDAY prior to each class meeting every student will post three questions about the reading in the discussion section of black-board web site. This will help the presenters/discussion leaders in their preparation. Please do not post questions like: What is Bayes' theorem? The internet or the library can answer that.

Writing Assignments (25% Short + 25% Final Paper)

There are 11 short writing assignments. All writing assignments (**including the final paper**) will be typed, double-spaced and in 12 pt times or times-new-roman font. References should be cited in parenthesis (e.g. The blue ball was blue (Walker 2030)) or in text (e.g. Walker & Sungbung (2087) found that…). Don't use commas to separate the name from the date and list citations in alphabetical order. If there are multiple citations from the same author put them in ascending chronological order (e.g. Snootysnortster 2001, Snootysnortster 2004). For two authors list the last names separated by an ampersand (&), (Sillyness & Supercalifragilistic 2008) and for more than two authors use the last name of the first author followed by et al. (e.g., Poppins et al. 1965). Direct quotation is generally frowned upon (i.e., not done) in scientific writing and should be avoided. References from the world-wide web are not appropriate and should be avoided. The literature cited should be in the following format.

Books & Edited Volumes:

Sokal, R.R. & F.J. Rohlf. 1994. Biometry 3rd ed. W.H. Freeman, New York, USA.

Fox, C.W., D.A, Roff, & D.J. Fairbairn (eds). 2001 Evolutionary Ecology: Concepts and Case Studies, Oxford University Press, Oxford, U.K.

Journal Articles:

Buddle, C.M. 2002. Interactions among young stages of the wolf spiders *Pardosa moesta* and *P.*

mackenziana (Araneae, Lycosidae). Oikos 96: 130-136.

Walker, S.E. & N.B. Ford. 1996. Courtship behavior in the African Colubrid snake, *Lamprophis fuliginosis*. Journal of Herpetology 30:416-418.

Folz, H.C., S.M. Wilder, M.H. Persons, & A.L. Rypstra. 2006. Changes in vertical habitat use and foraging of *Pardosa milvina* in response to chemical cues of the predator *Hogna helluo* (Araneae, Lycosidae). Ethology.112:1152-1158

Chapters from Edited Volumes:

Marshall, S.A., C.M. Buddle, B.J. Sinclair, & D.J. Buckle. 2001. Spiders, flies and some other arthropods of the Fathom Five Islands and the upper Bruce Peninsula. *In:* Ecology, culture, and conservation of a protected area: Fathom Five National Marine Park, Canada (S. Parker & M. Munawar, eds.). Ecovision World Monograph Series, pp. 191-229.

The due date for each writing assignment is on the schedule.

Writing Assignment #1

I'd like you to write no more than a page answering the following questions:

1) Why do you use statistics?
2) What do you feel the role of statistics is in biology?
3) What is the role of statistics in your project?

Writing Assignment #2

I'd like you to write no more than a page answering the following questions:

1) When do you think that power analysis should or shouldn't be used?
2) Do you think that misconceptions associated with statistics cause significant problems in the literature that you are familiar with (e.g. misuse of particular tests or misinterpretation of statistics)? Cite one paper as either a good or bad example (it could also be both).

Writing Assignment #3

I'd like you to come up with an experiment you would like to do and design that experiment based on the reading. Also, make a graphic that explains your design. Please make sure you discuss the layout (i.e. how things are arranged spatially), how many replicates, and the statistical analysis that you might use.

Writing Assignment #4-#9

The objective of this assignment is to become familiar with interpreting statistical results in the literature. You will present the following information:

1) The hypothesis to be tested.
2) The statistical test or tests used to evaluate the hypothesis (This should match the topic for discussion for the week).
3) How the statistical test relates to the hypothesis (i.e. how rejection of the null hypothesis is related to the hypothesis being tested).
4) The assumptions of the statistical test being used.

5) How the authors should have evaluated these assumptions (this may or may not be in the paper and **YOU** should, by utilizing the text and other resources, find the assumptions and how to evaluate them).

Since most papers have more than one statistical test, you will do this only for the statistical test we are discussing that week. For example, when we're discussing logistic regression, you'll only talk about logistic regression. The papers for this assignment will be posted on blackboard. Do this in one page or less.

Writing Assignment # 10

I'd like you to write no more than a page answering the following questions:

1)After reading these papers, what's your opinion on null-hypothesis testing (NHT)? Should it be abandoned?
2) How could some of the problems with NHT be avoided?
3) In your work, are you going to adopt a NHT approach or something else? Why?

Writing Assignment # 11

I'd like you to write no more than a page answering the following questions:

1) How might you use re-sampling methods in your own work?
2) When do you think re-sampling methods might not work well?
3) Are there assumptions to re-sampling methods (e.g. bootstrap)?

Final Paper (20%)

I'd like you to find 10 papers that utilize a particular statistical technique that we're going to discuss in class. I've listed 6 techniques below that I would choose from. You're not limited to this but anything outside of this list will require my approval.

1) ANOVA
2) ANCOVA
3) Repeated Measures ANOVA
4) MANOVA
5) Logistic Regression
6) Failure Time Analyses

In your paper I want you to:

1) Discuss the proper use of that particular test including such things as:
    a. Assumptions
    b. Interpretation of the Analysis
    c. Alternatives methodologies that could be used
2) In the 10 papers that you've found you should review their use of statistics:
    a. Is their use of this technique appropriate for their data
    b. Did they demonstrate that their data met the assumptions of the test?
    c. Is their interpretation correct
    d. Is their presentation of their data (e.g. figures & tables) adequate.
3) Rather than talk about each paper separately, you should try and summarize the problems that you notice and their frequency.

4) What recommendations would you make to improve the use of this statistical technique based on your literature survey?

A good draft of your paper will be due on the online discussion board (post as an attachment) by May 8th. Everyone in the course will be responsible for reviewing at least three of the papers (I will assign which three papers you review) and posting their criticisms and comments in the discussion board by May 14th. The final version of the paper will be due by midnight on May 18th via email to Sean (swalker@fullerton.edu).

Presentations (25%)

Weekly Presentations (20%)
Each student (probably group of students) is required to give an oral presentation during one of the class meeting times. Students will be responsible for giving a 40-45 minute presentation that provides a basic review of the topic, summarizes the required reading, and provides a critical and in depth analysis of the reading. Basically your job as a presenter(s) will be to teach the class about the topic for the day. Students are encouraged to use visual aids to help get their points across (hand-outs, chalkboard, overheads, power-point presentations etc.). Students **WILL** schedule a time on the Friday afternoon or Monday (most of the day) before their presentation to meet with Sean and go over their presentation.

Following the presentation we will have a discussion of the presented topic. This will be led by the presenters and one randomly (using excel) picked individual. Everyone starts out with one pass. Since that's the only one that you get, use it wisely. During the discussion portion of the class period, we should discuss questions about the topic that were posted and if applicable, the paper for that class periods writing assignment.

Graphics Presentation (5%)
On Feb. 13th everyone will give a 2-3 minute presentation in which they will show a poor figure (i.e., something that is graphically displeasing and does not help explain data) and a good figure (i.e., something that is graphically pleasing and does help to explain data). You are welcome to use your own data and you can also find examples from the literature and use them. Just make sure that you can explain what's going on with each figure.

Grading Scale

Score	Letter Grade	Assigned G.P.A.
>95%	A+	4
≥ 90%	A	4
≥ 87%	A-	3.7
≥ 83%	B+	3.3
≥ 80%	B	3
≥ 77%	B-	2.7
≥ 73%	C+	2.3
≥ 70%	C	2
≥ 60%	D	1
< 59%	F	0

Course Policies

Attendance
Students are expected to attend and participate in lectures, laboratories and mandatory field trips. If you miss class YOU ARE RESPONSIBLE for obtaining the information from classmates NOT from the graduate assistant or instructor.

Exam, Lab and Assignment Make Up Policy
If you cannot take a test at the scheduled time, you should contact Sean (Dr. Walker) as soon as possible with appropriate documentation verifying the circumstances. **PLEASE NOTE** make ups will only be given in the case of documented emergencies or unavoidable conflicts (these must be approved by Sean in advance). Please note, it is **YOUR RESPONSIBILITY** to contact Sean regarding make up assignments, labs, or exams.

Late Assignments
Late work will not be accepted except under exceptional circumstances.

Academic Integrity
I take all issues regarding academic honesty very seriously. **ALL WORK HANDED IN SHOULD BE YOUR OWN**. Incidents of cheating, turning in work that is not your own or is cited improperly (plagiarism) will result in a zero grade for the course. If plagiarism is suspected you may be asked to submit an electronic version of the assignment in question for checking with one of the available anti-plagiarism software packages. All incidences of academic dishonesty will be reported to the Associate Dean of Student Affairs.

Withdrawl from courses: CSUF policy regarding withdrawal from classes (UPS 300.016) will be followed. After the first two weeks of the semester, students may be granted withdrawal ONLY by presenting compelling evidence outlining a physical, medical, or emotional condition that prevents completion of the course. **POOR ACADEMIC PERFORMANCE IS NOT EVIDENCE OF A SERIOUS REASON FOR WITHDRAWAL**. Students unable to produce official documentation will be required to take the grade they have earned in the class. Please refer to the course schedule for information on the last day to withdraw with a W grade. Important dates concerning registration or drops are on the inside cover of the CSUF **Spring 2007** Class Schedule or at:http://www.fullerton.edu/admissions/policy_and_deadline_information_.htm.

Tentative Schedule (all reading material for student presentations is TBA)

Week	Topic / Reading	Assignment
January 23rd	Introduction & Mechanics	**Email Sean by the end of the week (5% of Grade)**
January 30th	Statistics **Ch 4 PES & Ch 1 DAEE**	Writing #1
February 6th	Power & The Abuse of Power **Ch 2 DAEE & Hoenig & Heisey 2001**	Writing #2
February 13th	Exploratory Data Analysis, Figures **Ch 3 DAEE**	Graphics Presentation
February 20th	Experimental Designs **Ch 6 & 7 PES**	Writing #3
February 27th	ANOVA **Ch 4 DAEE**	Writing #4 Reading: **Oufiero et al. 2006**
March 6th	ANCOVA **Ch 5 DAEE**	Writing #5 Reading: **Gustafson et al. 2004.**
March 13th	Repeated Measures ANOVA **Ch 8 DAEE**	Writing #6 Reading: **Beck et al. 2004**
March 20th	Time Series Intervention Analysis **Ch 9 DAEE**	Writing #7 Reading: **Zimmer et al. 2001**
March 27th	**NO CLASS-SPRING BREAK**	**SPRING BREAK**
April 3rd	Logistic Regression **Ch 11 DAEE**	Writing #8 Reading: **Brodie, 2005**
April 10th	Failure Time Analysis **Ch 13 DAEE**	Writing #9 Reading: **Fox, 2006**
April 17th	Null Hypothesis Testing in Ecology, Is it the only way? **Ch 5 PES**** **Fidler et al 2006** **Stephens et al. 2005** **Ellison 2004**	Writing #10

Week	Topic / Reading	Assignment
April 24th	Mark Recaapture Data-Dr. Paul Stapp **Reading TBA**	
May 1st	Boostrap and Jacknife Methods **Ch 14 DAEE**	Writing #11
May 8th	Special Topic#2 Multivariate Analysis of Communities/Diversity Data (Dr. Steven Murray) **Ch 12 PES**** **READING TBA**	
May 15th	**NO CLASS-FINALS WEEK**	**Final Report Due via Email to Sean by Midnight**

**** These readings are not mandatory but may really help your understanding of the topic**

CLASSROOM SAFETY BRIEFING

- In the event of an emergency such as earthquake or fire:
    - Take all your personal belongings and leave the classroom (or lab). Use the stairways located at the east, west, or center of the building.
    - Do not use the elevator. They may not be working once the alarm sounds.
    - Go to the lawn area towards Nutwood Avenue. Stay with class members for further instruction.
    - For additional information on exits, fire alarms and telephones, **Building Evacuation Maps** are located near each elevator.
    - Anyone who may have difficulty evacuating the building, please see me after class.
- Dial 911 on any campus phone, pay phone, or blue emergency phones to connect directly to University Police. Dialing 911 on your cell phone will connect with the Highway Patrol. Tell CHP dispatcher that CSUF Police are the responding agency. Stay on the line until asked to hang up.
- If you want to bring visitors to the classroom, you must obtain permission from the instructor in advance and must sign a volunteer form.
- Visitors to the lab must obtain permission from the Chair and must sign a volunteer form.
- There is no smoking within 20 feet of every campus building. This includes the MH balcony.
- **FOR LAB CLASSES:** Specific hazards or risks in the lab will be discussed prior to each experiment. If you have any questions about the safety of an experiment, please contact me or the lab instructor.
    - If there is a spill of a hazardous chemical, notify your TA immediately.
    - Report all injuries to me or the TA immediately.
    - All students must read and sign the departmental, “Laboratory safety procedures” form at the beginning of each semester.
- **FOR CLASSES WITH FIELD TRIPS:**

- Make sure you submit an Academic Field Trip Waiver and sign the Participant List for each field trip.
- Students must comply with all State laws regarding possession, sale and use of alcohol or controlled substances while participating in CSUF related activities.

Readings (Please note these are not in the correct literature cited format for our class ☺)

Beck, H. et al. 2004. Comparative dynamics of small mammal populations in treefall gaps and surrounding understorey within Amazonian rainforest. Oikos 106:27-38.

Brodie, R.J. 2005. Desiccation resistance in megalopae of the terrestrial hermit crab *Coenobita compressus*: water loss and the role of the shell. Invertebrate Biology 124:265-272.

Fidler, F. et al. 2006. Impact of criticism of null-hypothesis significance testing on statistical reporting practices in conservation biology. Conservation Biology 20:1539-1544.

Fox, G.A. et al. 2006. Consequences of heterogeneity in survival probability in a population of Florida scrub-jays. Journal of Animal Ecology 75: 921-927.

Gustafson D.J. et al. 2004. Competitive relationships of *Andropogon gerardii* (Big Bluestem) from remnant and restored native populations and select cultivated varieties. Functional Ecology 18: 451-457.

Hoenig, J.M. & D.M. Heisey. 2001. The abuse of power: The pervasive fallacy of power calculations for data analysis. The American Statistician 55:19-24.

Oufiero, C. E. et al. 2006. Convergent evolution of embryonic growth and development in the eastern fence lizard (*Sceloporus undulates*). Evolution 60: 1066-1075.

Stephens, P.A. et al. 2005. Information theory and hypothesis testing: a call for pluralism. Journal of Animal Ecology 42:4-12.

Ellison, A.M. 2004. Bayesian inference in ecology. Ecology Letters 7: 509-520.

Zimmer, K.D. et al. 2001. Effects of Fathead minnow colonization and removal on a prairie wetland ecosystem. Ecosystems (2001):346-357.