

SIO 272: Special Topics/Marine Biology
Advanced Statistical Techniques
Winter 2016

Course Instructor:

Stuart Sandin, Scripps Institution of Oceanography

Office: Hubbs Hall 4150 Phone: (858) 534 4150

email: ssandin@ucsd.edu

Key Contributors:

Yoan Eynaud, Postdoctoral Scholar

Office: Hubbs Hall 4165

email: yeynaud@ucsd.edu

Clinton Edwards, Biologist

Office: Hubbs Hall 4230

email: clint@ucsd.edu

Schedule:

Time: 11:00am – 12:20pm, Tues/Thurs

Location: Nierenberg 101

Textbooks:

Required

Crawley, MJ (2015) *Statistics: an introduction using R*. John Wiley & Sons Ltd.

(abbreviated below as ‘C’)

Underwood, AJ (1997) [*Experiments in ecology: their logical design and interpretation using analysis of variance*](#). Cambridge University Press. (abbreviated below as ‘U’; available as an e-book through the UCSD Library [hyper-linked to title])

Recommended

Zar, JH (2010) *Biostatistical Analysis* (5th ed). Prentice Hall. (abbreviated below as ‘Z’)

Note: Added readings from the literature will be scattered throughout

Grading:

Students will be graded on one final exam (30%), bi-weekly exercises (50%), and participation (20%).

Note that this course will be graded upon a mixture of performance, effort, and personal advancement.

SIO 272: Lecture schedule (Winter 2016)

Weeks 1 & 2 – Expectations from random sampling

5-Jan	Overview; theory & philosophy of statistical testing
7-Jan	Introduction to sampling distributions
12-Jan	<i>Generating distributions through simulation</i>
14-Jan	Descriptive statistics and mathematical expectations

Readings

Ch. 1-5 (U)
Ch. 1-3, Appendix (C)
Ch. 1-9 (Z), <i>as needed</i>

Weeks 3 & 4 – Analysis of (simple?) experiments

19-Jan	Experimental design and differences of means
21-Jan	Analysis of variance (ANOVA)
26-Jan	<i>Permutations of the ANOVA in R</i>
27-Jan	Permutations of the ANOVA in theory

Ch. 6-10 (U)
Ch. 4-6, 8 (C)
Ch. 10-12 (Z), <i>as needed</i>

Weeks 5 & 6 – Analysis of (some) natural experiments

2-Feb	Handling relationships among continuous data
4-Feb	Patterns of association of two or more variables
9-Feb	<i>Exploring continuous data and assessing fits of assumptions</i>
11-Feb	Linking continuous and discrete factors – ANCOVA

Ch. 8-10 (U),
Ch. 7 & 9 (C)
Ch. 17-20 (Z), <i>as needed</i>

Week 7 & 8 – Describing more complex patterns

16-Feb	Handling multiple predictors
18-Feb	Handling non-normal data in models
23-Feb	<i>Convincing a computer that all error is not necessarily normal</i>
25-Feb	The slippery slope away from being frequentist – GLM

Ch. 13 (U)
Ch. 11-16 (C)

Week 9 & 10 – Simplifying more complex data

1-Mar	Testing for (and coping with) autocorrelation
3-Mar	Considering multiple response variables (parametric)
8-Mar	<i>Diving deeper into ‘the matrix’</i>
10-Mar	Considering multiple response variables (non-parametric)

Ch. 20-21 (Z), <i>as needed</i>

Week 11

EXAM WEEK