EFB 796 Fisheries and Natural Resource Modeling in R

Instructors: Dr. Elizabeth Duskey
149 Illick Hall
eduskey@esf.edu
937-248-5202

Dr. Karin Limburg
249 Illick Hall
klimburg@esf.edu
315-470-6741

Lecture/Lab: Mondays 2-4 PM Illick 11

Office Hours: T/W 1-2 PM 7 Illick
OR by appointment

By appointment

References:

Hilborn, R. and Walters, C.J. eds., 2013. *Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty*. Springer Science & Business Media.

Cooper, Andrew. 2006. A Guide to Fisheries Stock Assessment: From Data to Recommendations. https://repository.library.noaa.gov/view/noaa/38414

Crawley, M.J., 2014. The R Book. 2nd edition. John Wiley & Sons. https://www.cs.upc.edu/~robert/teaching/estadistica/TheRBook.pdf

Ogle, D.H., 2018. Introductory Fisheries Analyses with R. Chapman and Hall/CRC. https://fishr-core-team.github.io/fishR/

Haddon, M., 2020. *Using R for Modelling and Quantitative Methods in Fisheries*. CRC Press. https://haddonm.github.io/URMQMF/

Software:

R: https://cran.r-project.org/

RStudio (optional): https://posit.co/

Stan: https://mc-stan.org/cmdstanr/

Course Objectives: This course is offered to grad students with an interest in using R for understanding natural resource management problems. (Remember, we are managing our own behaviors with respect to the resources!) We are emphasizing fisheries because that's our background, but we can easily generalize to other systems. No background in R is needed, though if you have some it is a plus. We will teach you what you need. Once we're up to speed on R, we will explore several broadly applicable population models and statistical methods. Our goal is that each student leaves our course with at least a basic understanding of cutting edge quantitative tools used by professionals working in the field of ecosystem and natural resource management.

Motivation: There are many interesting problems to solve in natural systems. Luckily for us, this often involves field work in wonderful locations. Whether knowingly or unknowingly, trouble may arise when we are planning our studies, or afterwards when we are analyzing our data. Tools like R, and the mathematical methods therein, can feel intimidating. This is true whether we are trying to choose which method to use, or if we are attempting to apply them properly to our own data. But this is a science like any other! As such, we are all capable of progressing. We want each of you to feel comfortable and confident while working in R, and while trying out new quantitative techniques to answer questions about our world's natural resources.

Lecture/Lab Schedule:

Week	Date	Topic	Due	Remarks
1	1/23	Course Introduction		*Liz may not appear today*
2	1/30	Introduction to R		
3	2/6	Population Growth	HW1	
4	2/13	Theory of Harvest	HW2	
5	2/20	Linear and Nonlinear Estimation	HW3	
6	2/27	Recruitment	HW4	
7	3/6	Individual Growth and Bioenergetics	HW5	
8	3/13	*Spring Break*		
9	3/20	Cohort Dynamics		
10	3/27	Bayesian Estimation	HW6	
11	4/3	Size-based Models	HW7	
12	4/10	Animal Movement	HW8	*KL very likely away*
13	4/17	Ecosystem Models	HW9	*KL definitely away*
14	4/24	Population Assessment Part 1		
15	5/1	Population Assessment Part 2		

Grade: 50% homework, 25% class participation, 25% population assessment project

Course structure: By and large, the class will begin with a 40-50 minute lecture, followed by a lab period during which we will work through some R code. The code will build on what we've discussed during the lecture, and allow us to apply what we're learning to some real data sets.

Homework: Handed out on Monday, due the following Monday. These will primarily consist of readings, as well as R code which we have written and which we expect you to work through and modify. You will also create some of your own code as the course progresses.

Population Assessment: The last two weeks are reserved for a so-called mock stock or population assessment. In the style of mock trials, we will evaluate one or more living populations in order to provide advice to management and stakeholders. This will include at least one fish population, and perhaps one or more additional fish/other animal/plant population, as students prefer.