Spatial ecology and modeling - FAS6932
Preliminary syllabus – Please check for changes and announcements

Course dates: Thursday, 6/7/2012 – Friday 6/15/2012 9.00 – 6.00 pm (no classes Sat/Sun, lunch break 12.00 -1.00 pm)

Location: Room 222, Newins – Ziegler Hall, and CALS computer room

Course description
Habitat management and restoration are potentially powerful tools for the conservation and management of dwindling fish populations, but tools to quantify and evaluate local habitat effects and interventions on fish populations are not well developed. This course examines the role of habitat in fish population dynamics and in fisheries assessment models. Process models and ecological concepts describing the role of habitat at different stage of the life cycle of fish will be introduced in student talks and morning lectures, and spatial techniques to analyze fish habitat relationships will be applied in the afternoon computer exercise. Students will develop a customized fisheries model to quantify the role of habitat in fish abundance and productivity. Using spatial concepts and models presented in the course, students will then extend the model to describe local dynamics of snook in Sarasota Bay and investigate the effects of local interventions on stock dynamics.

The purpose of this course is to 1. introduce models and methods that allow participants to investigate the relationship between local habitat-specific lifecycle processes and the observed dynamics of the fished stock, 2. to critically evaluate the importance of habitat and spatial interventions and 3. to develop, with the help of simulations, a better understanding of the processes that lead to observed relationships between habitat and fish population dynamics, and of habitat-specific fish data and their contribution to spatial and non-spatial interventions in fisheries dynamics. In hands-on modeling exercises, participants will apply concepts and spatial techniques that are relevant to a variety of fisheries and wildlife management contexts. The course is open to graduate students and professional participants.

The course will consist of morning lectures that focus on models and theoretical concepts, and afternoon exercises that involve spatial data analysis, conceptual model development and some programming. Starting from a simple population dynamics model we will look at habitat-specific life cycle processes at different levels of complexity and develop approaches to quantify the effect of local habitat interventions on to the managed population, using common snook (*Centropomus undecimalis*) as an example. Modeling exercises will be prepared in class discussions, and detailed instructions will be given for all modeling exercises. Help will be provided with programming. After implementing a model, students will investigate the behavior of the model using different types of analysis and simulation techniques.

Course goals
The students will:

1. Familiarize themselves with ecological concepts that describe the relationship between population dynamics and habitat and critically discuss how these apply to fish populations.

2. Develop appropriate modeling procedures to capture the effect of habitat changes and spatial interventions on to fish populations
3. Discuss and evaluate the role of spatial concepts and methods in fisheries management
4. Learn theoretical concepts and modeling techniques that are applicable in a wide range of fisheries and wildlife management problems.

Course outcomes
The students will:

1. Differentiate between different types of explicit and implicit spatial data and analysis in the context of fisheries management and ecology
2. Identify population processes that lead to spatial patterns of fish populations and employ models and simulations to design field data collection
3. Be able to develop, modify and apply simulation models that quantify spatial dynamics, including spatially explicit habitat effects
4. Critically evaluate the role of habitat quality and habitat restoration in relation to other factors in the dynamics of fish populations
5. Have some experience in the use of spatial modeling and analysis tools and apply them in fisheries and wildlife management

There are no specific pre-requisites, but students need to be interested in ecological modeling. Knowledge of ArcGIS and programming in R is helpful, as are experience in conducting statistical analysis, simulation of population dynamics, or quantitative approaches to fisheries and wildlife management.

Format, Evaluation and Feedback
Students will give a short (max 30 min talk, max 10 min discussion) graduate lecture in power point format on a relevant topic (list of topics with suggestions for relevant literature) will be published , and prepare a constructive peer-review of a peer lectures. Classes will consist of morning lectures with discussions and afternoon computer exercises. Lecture outlines and instructions for the exercises will be handed out very day. Course lectures and practical exercises will be prepared through assigned readings. Assigned reading will be tested through brief discussions. Students will be asked to prepare a 1-page summary of a central paper for every day of the course. Students are expected to complete and submit all practical assignments including the summaries of important papers in the form of a portfolio, and to write a brief synthesis paper after the course.

Grades will be allocated as: A (93 - 100 %), A- (90 - 92 %), B+ (86 - 89 %), B (82 - 85 %), B- (78 - 81 %), C+ (74 -77 %), C (67 - 73 %), C- (63 - 66 %), D+ (59 - 62 %), D (55 - 58 %), D- (51 - 54 %), E (< 50 %).

Activities and due Dates:

Due Date	Activity	% of total grade
5/18/2012 5.00 pm	Select lecture topic	1
6/01/2012 5.00 pm	Upload presentation	3
6/07/2012	Give presentation	15
6/08/2012	Submit peer review	6 %
6/08/2012	Attend intro R	5 %
6/11/2012	Space, habitat, matrix models	7 %
6/12/2012	Space and habitat in recruitment models	7 %
6/13/2012	Density-dependent habitat selection	7 %
6/14/2012	Dispersion and movement	7 %
6/15/2012	Space and habitat in fisheries management	7 %
6/18/2012	Submit Portfolio of course exercises, summaries, discussions	[35 %]
6/22/2012	Submit Synthesis paper	35 %
Total		100

Click here for UF grading information for students: http://www.registrar.ufl.edu/hubstudents.html

The student lecture will be graded on preparation and clarity of the presented material, peer reviews will be evaluated for preparation of topic and constructive criticism. Topics for the lecture will be distributed by the instructor from the list below. The portfolio of class assignments will be graded on completeness. The portfolio should contain a brief description of objectives, theoretical background, method and results of assignments and an informative graph for each assignment. The portfolio may also include short summary-style notes of presented material and student discussions. The synthesis paper may not exceed 2000 words and will be evaluated on the scope of analysis and originality of thought. Students are expected to submit individual portfolios, graduate lectures and synthesis papers, but there will be opportunities for group work during the course. Instructions will be given on every day of the course. Instructions will describe the background of each exercises, what is required to complete it and the expected output. Modeling exercises, assignments and their results will be discussed in class at the end of each day.

Instructor: Dr. Juliane Struve
SFRC - Fisheries and Aquatic Sciences
7922 NW 71st Street
352-273-3632 (tel)
e-mail: jstruve@ufl.edu
Office Hours: Between 2.00 and 5.00 pm by appointment

Textbook: None, most reading materials can be found at https://lss.at.ufl.edu/
Topics for summer C 2012

Day	Morning 9.00 am – 12.00 pm		Afternoon 1.00 pm – 6.00 pm
1	Introductory meeting and student presentations		Student presentations
2	Introduction to R Spatial R		Spatial R
	Weekend no classes		Weekend no classes
3	Spatial data and spatial processes Relationships between populations and habitats Space and habitat in the life cycle of fish Simple population models Stage /age-based matrix population models		Development of a simple matrix population model for common snook Model Synthesis: Effects of habitat on survival and recruitment Group work: Experimental design to estimate habitat-dependent survival and recruitment
4	Space and habitat in fisheries models Population and recruitment models Age and stage structured matrix models Matrix operations in R Pseudo-code for an age-structured model	Guest speaker Kai Lorenzen (UF): Spatial management for recreational fisheries ?	Development of an age-structured density dependent population dynamics model Modeling exercise: Habitat effects in recruitment models Group work – simulation: Implications of habitat effects for local abundance and productivity
5	Density-dependent habitat selection, movement and the IFD Spatial abundance in fish models	Guest speaker Bill Lindberg (UF): "Artificial Reefs for Spatial Management in Fisheries. "	Intro ArcGIS – Spatial analyst Development of a habitat preference index for common snook Modeling exercise: Spatial redistribution of the simulated population in real space Group discussion: Short-falls of spatial abundance indicators
6	Life cycle dispersion and movement in fish populations	*Guest speaker Alec MacCall (NOAA): "Learned*	Modeling exercise: Estimating habitat use and Kernel density distributions from tracking data

	Tools to analyze movement data	*Migratory Behavior in Fish"*	Group discussion: Impact of habitat restoration – Redistribution or increase in productivity ?
7	Examples of habitat interventions Habitat in stock assessment models Quantifying the impact of habitat alteration on a fished population		Development of a spatially explicit population dynamics model and its link to stock assessment Synthesis: Evaluating the effects of spatial closures and habitat restoration

Participation and attendance:

Participation and attendance is expected for all lectures and exercises. Please contact me as early as possible if you must legitimately miss a day. Make-up work will not be given except for excused absences with written substantiation (e.g. official University event, illness, family emergency etc.).

List of suggested student presentations (under construction):

1. Use of habitat preferences for in-situ spatio-temporal management Hobday, A. and Hartmann, K. (2006): Near real-time spatial management based on habitat predictions for a longline bycatch species. Fisheries Management and Ecology, Vol. 13(6), pp. 365-380. Dell., J., Wilcox, C. and Hobday, A. (2009): Estimation of yellowfin tuna (Thunnus albacares) habitat in waters adjacent to Australia's East Coast: making the most of commercial catch data

2. How to (and how not to) interpret spatial catch data

Myers, R.A., and Worm, B. 2003. Rapid world-wide depletion of predatory fish communities. Nature (Lond.), 423: 280–283.

Walters, C. (2003): Folly and fantasy in the analysis of spatial catch rate data.

3. Do stock-recruitment relationships allows us to jump easily between local populations and the unit stock ?

White, J. (2010): Adapting the steepness parameter from stock–recruit curves for use in spatially explicit models

4. Spatial population models and their role in the design of MPAs

Gerber, L. R., Botsford, L. W., Hastings, A., Possingham, H. P., Gaines, S. D., Palumbi, S. R., and Andelman, S. 2003. Population models for marine reserve design: a retrospective and prospective synthesis. Ecological Applications, 13: S47eS64.

Botsford L. W., Micheli F., Hastings A. Principles for the design of marine reserves. Ecological Applications 2003;13:S25-S31.

Kristensen, A., Moosegaard, H. and Jensen, H. (2009): Spatially resolved fish population analysis for designing MPAs: influence on inside and neighbouring habitats. ICES J. Mar. Sci. (2009) 66 (1): 56-63. doi: 10.1093/icesjms/fsn191

5. Population viability analysis and its role in spatial fisheries management

McCarthy, M.A., Keith, D., Tietjen, J., Burgman, M.A., Maunder, M.N., Master, L., Brook, B.,Mace, G., Possingham, H.P., Medellin, R., Andelman, S., Regan, H., Regan, T., Ruckelshaus, M., 2004. Comparing predictions of extinction risk using models and subjective judgement. Acta Oecologica 26 (2004)

Perry, G. and Bond, N. (2009): Spatially explicit modeling of habitat dynamics and fish population persistence in an intermittent lowland stream. Ecological Applications 19(3) 731-746.

6. Migrations and their effects on long-term population viability and persistence

Joergensen, C., Dunlop, E., Opdal, A.F., and Fiksen, O (2008): The evolution of spawning migrations. State dependence and fishing induced changes. Ecology, 89(12), 2008, pp. 3436–3448

Kerr, L. et al (2010): The role of spatial dynamics in the stability, resilience, and productivity of an estuarine fish population. Ecological Applications, 20(2), 2010, pp. 497–507.

7. The meta population concept – How does it apply to fish and fisheries ?

Thorrold, S., Latkoczy, C., Swart, P.K., and Jones, C.M. (2001): Natal Homing in a Marine Fish Metapopulation. Science Vol. 291. Pp. 297-299.

Smedbol, R.K. MacPhearson, A., Hansen, M. and Kenchington, E. (2001): Myths and moderation in marine 'metapopulations'? FISH and FISHERIES, 2002, 3, 20-35.

Schickzelle, N. and Quinn, T. (2007): A metapopulation perspective for salmon and other anadromous fish. FISH and F I SHERIES , 2007, 8, 297–314.

Background Reading (under construction)

Day 1:

An introduction to R. W. N. Venables, D. M. Smith and the R Development Core Team. Available at http://cran.r-project.org/doc/manuals/R-intro.html

Day 3:

Tyler, J. and Rose, K. (1994): Individual variability and spatial heterogeneity in fish population models. Reviews in Fish Biology and Fisheries, 4, 91-123 (1994)

Rose, K. (2000): Why are quantitative relationships between environmental quality and fish populations so elusive. Ecological applications, 10(2), 367-385.

Levin, P. S. and Strunz, G.W. (2005): Habitat triage for exploited fishes: Can we identify "essential fish habitat ?" Estuarine, Coastal and Shelf Science 64, 70-84.

Gdamke et al. (2007): Using Demographic Models to Determine Intrinsic Rate of Increase and Sustainable Fishing for Elasmobranchs: Pitfalls, Advances, and Applications. North American Journal of Fisheries Management 27:605–618, 2007

Kerckhove, D.T., Smorowski, K.E. and Randall, R.G. (2008): A primer on fish habitat models. Canadian Technical report of Fisheries and Aquatic Sciences 2817.

Habitat Assessment Improvement Plan May 2010: Report of the National Marine Fisheries Service

Habitat Assessment Improvement Plan Team Mary Yoklavich (Chair), Kristan Blackhart, Stephen K. Brown, Correigh Greene, Thomas Minello, Thomas Noji, Michael Parke, Frank Parrish, Katherine Smith, Robert Stone, and W. Waldo Wakefield

Day 4:

J Sabo et al. (2004): EFFICACY OF SIMPLE VIABILITY MODELS IN ECOLOGICAL RISK ASSESSMENT: DOES DENSITY DEPENDENCE MATTER? Ecology, 85(2), 2004, pp. 328–341

Johnson, D. (2007): Habitat complexity modifies post-settlement mortality and recruitment dynamics of a marine fish. Ecology 88(7), pp. 1716-1725.

Perry, G. and Bond, N. (2009): Spatially explicit modeling of habitat dynamics and fish population persistence in an intermittent lowland stream. Ecological Applications 19(3) 731-746.

Kerr, L. et al (2010): The role of spatial dynamics in the stability, resilience, and productivity of an estuarine fish population. Ecological Applications, 20(2), 2010, pp. 497–507

Day 5:

MacCall, A. (1990): Dynamic Geography of marine fish populations. ISBN 0-295-96911-3

Optional - Shepherd & Litvak (2004): Density-dependent habitat selection and the ideal free distribution in marine fish spatial dynamics: considerations and cautions. Fish and Fisheries, 2004, 5, 141–152

Day 6:

Garvey et al. (2003): SCALE-DEPENDENT ASSOCIATIONS AMONG FISH PREDATION, LITTORAL HABITAT, AND DISTRIBUTIONS OF CRAYFISH SPECIES. Ecology 84:3339–3348.

Bradbury et al. (2008): Discrete spatial dynamics in a marine broadcast spawner: Re-evaluating scales of connectivity and habitat associations in Atlantic cod (Gadus morhua L.) in coastal Newfoundland. Fisheries Research 91 (2008) 299–309
Stockhausen (2007): Modeling Larval Dispersion of Rockfish: A Tool for Marine Reserve Design? Biology, Assessment, and Management of North Pacific Rockfishes 251 Alaska Sea Grant College Program • AK-SG-07-01, 2007
Cianelli et al. (2008): Spatial fisheries ecology: Recent progress and future prospects. Journal of marine systems 71, pp. 223-236.

Day 7:

Caddy, J.F., and Defeo, O. (2003): Enhancing or restoring the productivity of natural populations of shellfish and other marine invertebrate resources. FAO FISHERIES TECHNICAL PAPER 448
Maunder et al. (2008): INTER-AMERICAN TROPICAL TUNA COMMISSION WORKSHOP ON SPATIAL ANALYSIS FOR STOCK ASSESSMENT La Jolla, California (USA) 14-17 October 2008 REPORT.
Lehodey, P., Senina, I., Murtugudde, R., 2008, A spatial ecosystem and population dynamics model (SEAPODYM) - Modeling of tuna and tuna-like populations. Progress in Oceanography 78 (4), 304-318.

Academic Honesty and Plagiarism:

As a result of completing the registration form at the University of Florida, every student has signed the following statement: “I understand that the University of Florida expects it students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.”

Plagiarism is defined in dictionaries as the "wrongful appropriation," "close imitation," or "purloining and publication" of another author's "language, thoughts, ideas, or expressions," and the representation of them as one's own original work (Wikipedia, 1012). Students may lose marks if plagiarism is detected.

UF Counseling Services:

Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include:
1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling;
2. Student Mental Health, Student Health Care Center, 392-1171, personal counseling;
3. Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual assault counseling; and
4. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Accommodations for Students with Disabilities:

Students requesting classroom or laboratory accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

Software Use:

All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.