Course Number:	**MAR 580**
Course Title:	**Models for Marine Ecosystem-Based Management**
Instructor:	Gavin Fay, Assistant Professor
Contacts:	School for Marine Science and Technology SMAST II 325, (508) 910-6363; gfay@umassd.edu
Class Location:	**SMAST II** Fairhaven, Room 157
Class Time:	Fridays 10:30-1:00, Lecture/Lab
Office Hours:	By appointment
Website:	UMD myCourses

Course Description: This course provides instruction, demonstration, and exercises in quantitative modeling tools used for Ecosystem Based Management (EBM) of living marine resources. There is an increasing need for fisheries and wildlife professionals to provide scientific advice for management in an ecosystem context. Part 1 of the course will provide students with hands on experience applying fisheries stock assessment and population models that include ecosystem effects, and consider the policy implications of including this information. Part 2 of the course will focus on broader multiple-use and human dimensions and include economic and behavioral models and models for marine spatial planning. The final section of the course will introduce whole-of-ecosystem models and demonstrate how these can be used to provide strategic advice for marine management and consider a broad suite of objectives. Although the examples used will be in a marine context, the types of models and methods discussed in the course have application in other systems.

Course Objectives:
1. Familiarity with a range of models used for ecosystem-based management and experience using some of them.
2. Understanding of the benefits, challenges, and limitations of using these models to provide scientific advice for management.

Prerequisites:
Students should have taken coursework in applied statistics (e.g. MAR 535, Biological Statistics), or equivalent. Students should also be familiar with modeling and estimation approaches for fisheries assessment and conservation management (e.g. MAR544), or seek permission from the instructor. While MAR530 (ecosystem-based fisheries management) provides useful background material for this class, it is not required.

Credits: 3

Evaluation procedures:
1. Five homework assignments (12% each). 10 points (out of a 100) will be deducted for each day that an assignment is late. Submissions of all analytical assignments should include:
    a. A brief report with text, tables and figures stating the problem, modeling approach, and interpretation of model results,
    b. Documentation of complete analytical results (e.g., model code and output files).
2. Final project (40%). The aim of the project will be to apply some of the modeling methods covered during the course to a research-related task, and can be carried out individually or in

small groups (2-3). For group projects, all group members must have readily-identifiable tasks and the same grade for the project will be assigned to all members of a group. Students are encouraged to select topics which are relevant to their thesis research and/or could form the basis for a short publication. The project involves:

   a. Selection of topic (two-page report to be submitted to Gavin Fay by the end of the 5th week of the semester).
   b. A brief meeting with Gavin Fay to discuss the proposed project.
   c. Verbal presentation of the methods and results of the project at the end of semester (15 minutes per student).
   d. Written description of the methods and results of the project in the form of a draft scientific manuscript (Introduction, Methods, Results, Discussion).

3. Failure to complete any of these requirements for evaluation will result in a score of zero for missing components. A final grade of 'incomplete' may be recorded at the request of the student and the discretion of the professor.
4. No academic dishonesty, including plagiarism, will be tolerated and the University Academic Integrity policy applies: http://www.umassd.edu/studentaffairs/studenthandbook/academicregulationsandprocedures/

Computing Requirements: Students will be expected to have access to a computer (e.g. a laptop) during class. Students are expected to have some familiarity with R (e.g. by having taken MAR 535). Assignments will make use of freely available software, links to which will be made available through the course website.

Course Reading: A recommended reading list covering the individual lecture topics will be posted on the course website and distributed in lecture notes. There is no required text for this class, though students will find sections of the following books useful.

Link, J. 2010. Ecosystem-based fisheries management: confronting tradeoffs. Cambridge Univ. Press, Cambridge.

Walters, C. J., & S.J. Martell. 2004. Fisheries ecology and management. Princeton University Press.

The following technical report provides a good overview of fisheries ecosystem models.

Plaganyi, E.E. 2007. Models for an ecosystem approach to fisheries. FAO Fisheries Technical Paper. No. 477. Rome, FAO. 108p.

Title IX statement: The purpose of a university is to disseminate information, as well as to explore a universe of ideas, to encourage diverse perspectives and robust expression, and to foster the development of critical and analytical thinking skills. In many classes, including this one, students and faculty examine and analyze challenging and controversial topics.

If a topic covered in this class triggers post-traumatic stress or other emotional distress, please discuss the matter with the professor or seek out confidential resources available from the Counseling Center, http://www.umassd.edu/counselling/, 508-999-8648 or -8650, or the Victim

Advocate in the Center for Women, Gender and Sexuality, http://www.umassd.edu/sexualviolence/, 508-910-4584. In an emergency contact the Department of Public Safety at 508-999-9191 24 hrs./day.

UMass Dartmouth, following national guidance from the Office of Civil Rights, requires that faculty follow UMass Dartmouth policy as a "mandated reporter" of any disclosure of sexual harassment, abuse, and/or violence shared with the faculty member in person and/or via email. These disclosures include but are not limited to reports of sexual assault, relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus, disclosure by the student to the faculty member requires that the faculty member inform the University's Title IX Coordinator in the Office of Diversity, Equity and Inclusion at 508-999-8008 to help ensure that the student's safety and welfare is being addressed, even if the student requests that the disclosure not be shared.

For confidential counseling support and assistance, please go to http://www.umassd.edu/sexualviolence/

Course outline and schedule of lectures and assignment

Week	Topic	Assignment schedule
29-Jan	Intro to EBM, fisheries assessment methods review	
5-Feb	No Class – Weather	
12-Feb	Stock assessment models with ecosystem processes	
19-Feb	Food web models I	Homework 1 due (extended stock assessment)
26-Feb	Food web models II	Project descriptions due
4-Mar	Multispecies models, estimating species interactions, multispecies policy advice	
11-Mar	Marine spatial planning models, marine reserve design	Homework 2 due (multispecies modeling and policy evaluation)
18-Mar	No Class - Spring Break	
25-Mar	No Class – IMS Symposium	Homework 3 due (spatial planning using Marxan)
1-Apr	Valuation of ecosystem services	
8-Apr	No Class - SS course.	Homework 4 due (finish InVEST lab)
15-Apr	Whole of system models, coupling ecologic and economic models, Management Strategy Evaluation for ecosystems	
22-Apr	Qualitative modeling, model structure uncertainty	Homework 5 due (multiple objective analysis using Atlantis output)
29-Apr	Participatory modeling, multicriteria decision analysis	
06-May	Project presentations	Project reports due

Subject to change