

University of Florida
FAS 6932 (4 credits)
Spatial Sciences for Marine Environmental Characterization
Fall 2020 Syllabus
Delivery Format: Online, Synchronous
Lab day: Wednesday, 1:55 PM-4:55 PM (Online OR CSE C222)
Lecture day: Thursday, 9:35 AM-11:30 AM (Online)
<https://ufl.instructure.com/courses/403112>

Instructor: Vincent Lecours, Ph.D.
Office: FAS Millhopper Facility, Room 12
Phone Number: (352) 273-3617
Email Address: vlecours@ufl.edu
Office Hours: By appointment
Preferred Course Communications: email

Prerequisites

There are no prerequisites for this course.

PURPOSE AND OUTCOME

Course Overview

An introduction to the geospatial technologies, concepts and methods required to acquire, analyze and manage geographic data used in a context of marine habitat mapping. The fields of cartography, remote sensing, and geographic information systems (GIS) will be reviewed, and students will be introduced to quantitative methods relevant to the study of marine geomorphology and biology and how they combine to provide a spatial representation of marine habitats. Emphasis is given to the understanding and appreciation of maps as a mean of communication between stakeholders with different backgrounds and expertise.

Relation to Program Outcomes

This course provides an interdisciplinary perspective on the study of marine environments. It involves concepts from biology, ecology, geomorphology, oceanography and the spatial sciences. It is meant to bridge the Geomatics Program with the Fisheries and Aquatic Sciences Program by complementing existing courses in those programs (*e.g.*, SUR6934 – Marine Geomatics, FAS6932 – Spatial Ecology and Modeling). The course is aimed at graduate students from both programs, at students from the Department of Wildlife Ecology and Conservation, and any others with an interest in using the spatial sciences to map and study the marine environment.

Overall Course Goals

In this course, students will...

1. *Learn* about marine habitats and what defines them
2. *Improve* their spatial awareness and geographic literacy
3. *Improve* their digital literacy and fluency
4. *Cultivate* critical thinking
5. *Develop* cooperative attitude and leadership skills

6. Develop oral and written communication skills

Upon successful completion of the course, students will be able to (see page 10 for a full list of student learning objectives):

- Describe data collection techniques relevant to marine habitat mapping
- Explain the different components of marine habitats and how they can be quantified and situated in a geographic context
- Prepare different types of spatial data for their inclusion in a habitat mapping workflow
- Evaluate, critically, spatial data and mapping outcomes in given contexts
- Design a suitable habitat mapping project for a given purpose

Instructional Methods

Course concepts will be introduced using real examples to demonstrate how spatial sciences can assist in answering marine sciences questions. This course has a lab and field-based components in which students will learn how to collect spatial data and to perform GIS-based marine environmental characterization. The in-class time will be focused on discussions and building skillsets like spatial critical thinking and science communication. A series of assignments and in-class tasks will provide students with the opportunity to use spatial data and maps for both interpretation and analysis.

DESCRIPTION OF COURSE CONTENT

Topical Outline/Course Schedule (subject to change)

This course plan and syllabus are subject to change in response to student and instructor needs. Any changes will be clearly communicated in advance through Canvas.

Weeks	Dates	Topics	Readings (subject to change)	Assignments
1	9/2 (Lab)	Course Introduction, Introduction to Spatial Sciences		
	9/3	Introduction to Marine Habitat Mapping, Spatial Data Characteristics, Geodatabases	Costa <i>et al.</i> (2009), Knudby <i>et al.</i> (2010)	
2	9/9 (Lab)	Introduction to GIS		
	9/10	Remote Sensing		Summary #1
3	9/16 (Lab)			Quiz #1
	9/17	Cartography	Brown <i>et al.</i> (2011), McArthur <i>et al.</i> (2010)	
4	9/23 (Lab)	Surrogacy, Habitat Mapping Approaches		Quiz #2
	9/24		Greene <i>et al.</i> (2005), Wilson <i>et al.</i> (2007)	Summary #2
5	9/30 (Lab)	Fitness-for-use, Geomorphometry		Lab #1, Quiz #3
	10/1			Summary #3
6	10/7 (Lab)	Classifiers, Species Distribution Models, Spatial Analysis of Marine Environments		Lab #2, Quiz #4
	10/8			Lecture
7	10/14 (Lab)	Visit of the Map Library and Field Trip		Lab #3, Quiz #5
	10/15			
8	10/21 (Lab)	Project Planning		Lab #4

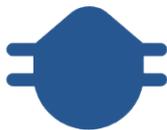
Weeks	Dates	Topics	Readings (subject to change)	Assignments
	10/22	Peer-Review, Science Communication, Proposal Preparation		
9	10/28 (Lab)	Proposal Preparation		
	10/29	Proposal Presentation		Speed Talk, Proposal
10	11/4 (Lab)	Team Work		
	11/5	Communicating with Maps, Stakeholders Involvement		
11	11/11 (No Class)			
	11/12			Peer-Review
12	11/18 (Lab)	Team Work		Report Part #1
	11/19			
13	11/25 (No Class)			
	11/26 (No Class)			Report Part #2
14	12/2 (Lab)	Team Work		
	12/3			
15	12/9 (Lab)	Project Presentation		Final Presentation, Final Report

COURSE LOGISTICS

Format

In the Fall 2020, this course will be offered synchronously online. If and only if a student prefers using the required software (*e.g.*, ArcGIS) on a university computer instead of their personal device, it will be possible to hold face-to-face sessions on Wednesdays. It is the responsibility of the students to communicate with the instructor to ask for face-to-face sessions at least two days ahead of time, as the assumption will be that everything is held online. The visit of the map library and field trip will also be held virtually.

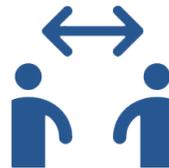
During all face-to-face activities, the following public health and safety protocols are required of all students, instructors, and teaching assistants:



Bring and wear a face mask at all times when indoors.



Wash hands (>20 sec) before and during class.



Maintain at least 6ft of distance from others.



If you feel sick or have symptoms, stay home.

Any individuals who are unable or unwilling to meet these requirements cannot participate in face-to-face activities and may be subject to progressive discipline. If you are experiencing COVID-19 symptoms please use the UF Health screening system and follow the instructions on whether you are

able to attend class. Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

Canvas and Zoom

Students may access lectures, assignments, readings, and supporting materials through the course Canvas site as they become available.

Technology Requirements:

- A computer or mobile device with high-speed internet connection.
- A webcam, headset and/or microphone, and speakers.
- Latest version of web browser. Canvas supports only the two most recent versions of any given browser.
- Installation of proctoring software may be required and will be provided if so.

Synchronous online sessions may be recorded. By sharing your video, screen, or audio during any synchronous online class sessions, you are consenting to being recorded for the benefit of students who cannot attend live as well as for class review during the current semester. If you have special circumstances or concerns about privacy, it is your responsibility to discuss it with your instructor.

Course Materials and Technology

Recommended readings: “How to lie with maps, 3rd edition”, by Mark Monmonier. 256 p.

The course will use a variety of GIS software, including open-source software that can be downloaded on any desktop computer and laptop, and the commercial ESRI ArcGIS Desktop software. ArcGIS is available by getting a license from the UF GeoPlan Center (https://www.geoplan.ufl.edu/licensed_software.shtml), in the UF computer labs (<https://labs.at.ufl.edu/>; note that the labs may be reserved for classes), or remotely from the UFApps (<https://info.apps.ufl.edu/>).

Technical support is available through the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

ACADEMIC REQUIREMENTS AND GRADING

Assignments and Exams

- Readings will be provided throughout the semester. Students are expected to write a short summary of each reading and to contrast the readings, in preparation for class discussion. Three opportunities will be provided to write such summary; students must submit at least two summaries over the course of the semester. If a student submits more than two summaries, those with the highest grades will be counted as part of the final grade.
- In lieu of comprehensive mid-term and final exams, five quizzes will be given to assess the students’ understanding of remote sensing, cartographic and GIS concepts, in addition to their ability to describe data collection and analytical techniques relevant to marine habitat mapping and explain the different components of marine habitats and how they can be quantified and situated in a geographic context. The four highest grades of the five quizzes will be counted as part of the final grade.

- This course has a lab component during which the students will apply theoretical concepts in a practical, GIS environment using real data. Four of the lab assignments will be graded, and the three highest grades of those assignments will count towards the final grade.
- Graduate students will be asked to coordinate and give a lecture on the different classifiers and species distribution models that can be used in habitat mapping. Their presentation will be worth 10% of their final grade.
- A team project will be assigned in the second half of the semester. Students will be asked to conduct a habitat mapping project in order to assess their ability to prepare different types of spatial data for their inclusion in a habitat mapping workflow, critically evaluate spatial data and mapping outcomes, and design a proper habitat mapping project. The evaluation of the project will be based on an oral (two presentations, 15% of the overall grade) and a written component (two reports, 40% of the overall grade). The final report will be submitted in sections, on which students will receive feedback and have the opportunity to get back partial grades if the feedback is integrated into the final version of the report. As part of the project proposal, students will also be asked to provide constructive review of their colleagues' work.
- All assignments will be submitted on the course website. Presentation of the assignments must be neat, logical, organized and appropriately referenced. Poor presentation will be penalized up to a maximum of 20% of the value of assignments and exams.

Grading

Requirement	% of final grade
Reading Summaries (2 best of 3)	5% each (10%)
Quizzes (4 best of 5)	2.5% each (10%)
Labs (3 best of 4)	5% each (15%)
Lecture	10%
2-Pages Project Proposal	10%
Lightning Talk (Individual)	5%
Final Report (Team)	30%
Final Presentation (Team)	10%

Points earned	93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	Below 60
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at:
<http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Late Policy

Due dates are indicated in the calendar above. Any modifications to these dates will be announced by the instructor when assignments are given. A deduction of 10% will be made for each day that an assignment is late, with the first 10% being removed immediately after the due time.

Policy Related to Make-up Exams, Other Work, and Required Class Attendance

It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory progress in the course. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Computer or other hardware failures, except failure of the UF e-Learning system, will not excuse students for missing assignments. Any late submissions due to technical issues **MUST** be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You **MUST** e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration. For computer, software compatibility, or access problems call the HELP DESK phone number—352-392-HELP = 352- 392-4357 (option 2).

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior

You are expected to actively engage in the course throughout the semester. You must come to the online discussions (live or not) prepared by completing all out-of-class assignments. This preparation gives you the knowledge or practice needed to engage in higher levels of learning during the live discussion sessions. If you are not prepared, you may struggle to keep pace with the activities occurring in the course, and it is unlikely that you will reach the higher learning goals of the course. Your participation fosters a rich course experience for you and your peers that facilitates overall mastery of the course objectives.

In order to facilitate the creation of a functional learning community and out of respect for the instructor and the other students, it is expected that all cell phones be either set on silent mode or turned off, except when authorized by the instructor. Please mute your microphone when not speaking. Recording devices are strictly prohibited.

Just as in any professional environment, meaningful and constructive dialogue is expected in this class and requires a degree of mutual respect, willingness to listen, and tolerance of opposing points of view. Respect for individual differences and alternative viewpoints will be maintained in this class at all times. All members of the class are expected to follow rules of common courtesy, decency, and civility in all interactions. Failure to do so will not be tolerated and may result in loss of participation points and/or referral to the Dean of Students' Office.

Netiquette Guide for Online Courses

It is important to recognize that the online classroom is in fact a classroom, and certain behaviors are expected when you communicate with both your peers and your instructors. All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions

and chats. Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office. These guidelines for online behavior and interaction are known as netiquette.

Remember that your password is the only thing protecting you from pranks or more serious harm.

- Don't share your password with anyone .
- Change your password if you think someone else might know it.
- Always log out when you are finished using the system.

When communicating online, you should always:

- Treat your instructor and classmates with respect in email or any other communication.
- Use clear and concise language.
- Remember that all college level communication should have correct spelling and grammar (this includes discussion boards).
- Avoid slang terms such as “wassup?” and texting abbreviations such as “u” instead of “you.”
- Use standard fonts such as Ariel, Calibri or Times new Roman and use a size 10 or 12 pt. font.
- Avoid using the caps lock feature AS IT CAN BE INTERPRETTED AS YELLING.
- Limit and possibly avoid the use of emoticons.
- Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post and your message might be taken seriously or sound offensive.
- Be careful with personal information (both yours and other's).
- Do not send confidential information via e-mail.

When you send an email to your instructor, teaching assistant, or classmates, you should:

- Use a descriptive subject line.
- Be brief.
- Avoid attachments unless you are sure your recipients can open them.
- Avoid HTML in favor of plain text.
- Sign your message with your name and return e-mail address.
- Think before you send the e-mail to more than one person. Does everyone really need to see your message?
- Be sure you REALLY want everyone to receive your response when you click, “reply all.”
- Be sure that the message author intended for the information to be passed along before you click the “forward” button.

When posting on the Discussion Board in your online class, you should:

- Make posts that are on topic and within the scope of the course material.
- Take your posts seriously and review and edit your posts before sending.
- Be as brief as possible while still making a thorough comment.
- Always give proper credit when referencing or quoting another source.
- Be sure to read all messages in a thread before replying.
- Don't repeat someone else's post without adding something of your own to it.
- Avoid short, generic replies such as, “I agree.” You should include why you agree or add to the previous point.
- Always be respectful of others' opinions even when they differ from your own.
- When you disagree with someone, you should express your differing opinion in a respectful, non-critical way.
- Do not make personal or insulting remarks.
- Be open-minded.

Opportunities for Input and Online Faculty Course Evaluation Process

Your comments are very valuable to the instructor. They will be used by the instructor to make specific improvements to the course (e.g., assignments) and teaching style. The instructor will be providing opportunities throughout the semester for students to provide direct feedback on the course. However, students are encouraged to email the instructor at any time if they have concerns or comments to share with the instructor.

In addition, at approximately the mid-point of the semester, the School of Forest Resources & Conservation will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required, but encouraged. This is not the UF Faculty Evaluation!

Finally, at the end of the semester, students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

Academic Integrity

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."*

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g., assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

Inclusive Learning Environment

This course embraces the University of Florida's Non-Discrimination Policy, which reads,

The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act.

If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see the instructor or refer to the Office of Multicultural & Diversity Affairs website: <http://multicultural.ufl.edu>.

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.

SUPPORT SERVICES

Accommodations for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office within the first week of class. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor of the course to receive accommodations. Please make sure you provide this letter to the instructor by the end of the second week of the course. The College is committed to providing reasonable accommodations to assist students in their coursework.

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Student Life, Wellness, and Counseling Help

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- The Counseling and Wellness Center (352-392-1575) offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. Online and in person assistance is available.
- U Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the U Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the website at: <https://shcc.ufl.edu/>
- Crisis intervention is always available 24/7 from the Alachua County Crisis Center (352-264-6789) <http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>
- Career Connections Center <http://career.ufl.edu/>
- Other resources are available at <http://www.distance.ufl.edu/getting-help> for online students.

Do not wait until you reach a crisis to come in and talk with us. You are not alone so do not be afraid to ask for assistance.

Student Complaint Process

The School of Forest Resources & Conservation cares about your experience and we will make every effort to address course concerns. We request that all of our online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered.

If you have a more urgent concern, your first point of contact should be the SFRC Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration: <http://www.distance.ufl.edu/student-complaint-process>.

READING LIST

Brown, C.J., Smith, S.J., Lawton, P., and J.T. Anderson (2011) Benthic habitat mapping: a review of progress towards improved understanding of the spatial ecology of the seafloor using acoustic techniques. *Estuarine, Coastal and Shelf Science*, 92, 502-520.

Costa, B.M., Battista, T.A., and S.J. Pittman (2009) Comparative evaluation of airborne LiDAR and ship-based multibeam SoNAR bathymetry and intensity for mapping coral reef ecosystem. *Remote Sensing of Environment*, 113, 1082-1100.

Greene, G.H., Bizarro, J.J., Tilden, J.E., Lopez, H.L., and M.D. Erdey (2005) The benefits and pitfalls of geographic information systems in marine benthic habitat mapping. In: Wright, D.J. and A.J. Scholz (eds.) *Place matters: Geospatial tools for marine science, conservation, and management in the Pacific northwest*, pp. 34–46. Corvallis: Oregon State University Press.

Knudby, A., LeDrew, E., and A. Brenning (2010) Predictive mapping of reef fish species richness, diversity and biomass in Zanzibar using IKONOS imagery and machine-learning techniques. *Remote Sensing of Environment*, 114(6), 1230-1241.

McArthur, M.A., Brooke, B.P., Przeslawski, R., Ryan, D.A., Lucieer, V.L., Nichol, S., McCallum, A.W., Mellin, C., Cresswell, I.D., and L.C. Radke (2010) On the use of abiotic surrogates to describe marine benthic biodiversity. *Estuarine, Coastal and Shelf Science*, 88, 21-32.

Wilson, M.F.J., O’Connell, B., Brown, C., Guinan, J.C., and A.J. Grehan (2007) Multiscale terrain analysis of multibeam bathymetry data for habitat mapping on the continental slope. *Marine Geodesy*, 30, 3-35.

Student Learning Outcomes

Classes	Student Learning Objectives	Course Goals					
		1	2	3	4	5	6
Lab 1	Describe spatial sciences		✓				
	Explain how maps can be used to communicate		✓				
	Compare different mapping outcomes		✓				
	Identify sources of differences in mapping outcomes		✓				
Lecture 1	Define habitats and marine habitat mapping	✓					
	Explain the different components of marine habitats	✓					
	Recognize different types of spatial data		✓				
Lab 2	Memorize the different components of a GIS			✓			

	Manipulate spatial data in GIS		✓	✓				
Lecture 2	Summarize and contrast two pieces of the scientific literature	✓	✓		✓			✓
	Define remote sensing		✓					
	Contrast optical and acoustic remote sensing		✓					
	Define wavelength, frequency, and wave velocity		✓					
	Explain the electromagnetic spectrum and its relevance to habitat mapping	✓	✓					
	Contrast different types of sensors and platforms		✓					
	Describe data collection techniques relevant to marine habitat mapping	✓	✓					
Lab 3	Locate satellite imagery and bathymetric data		✓	✓				
	Manipulate satellite imagery and bathymetric data		✓	✓				
Lecture 3	Summarize and contrast two pieces of the scientific literature	✓	✓		✓			✓
	Recognize different types of maps		✓					
	Memorize different cartographic concepts, norms, and conventions		✓					
	Explain geographic reference systems and map projections		✓					
Lab 4	Prepare different types of spatial data for their inclusion in a habitat mapping workflow	✓	✓	✓				
	Design different types of maps		✓	✓				
Lecture 4	Summarize and contrast two pieces of the scientific literature	✓	✓		✓			✓
	Define surrogacy	✓						
	Recognize potential surrogates of species/habitat distributions	✓						
	Contrast the different approaches to habitat mapping	✓						
Lab 5	Locate different types of data for habitat mapping	✓	✓	✓				
	Apply unsupervised and supervised approaches to habitat mapping	✓	✓	✓				
Lecture 5	Summarize and contrast two pieces of the scientific literature	✓	✓		✓			✓
	Describe issues of data quality relevant to habitat mapping	✓	✓					
	Describe the concept of fitness-for-use	✓	✓		✓			
	Explain what is geomorphometry and its relevance for marine habitat mapping	✓	✓					
Lab 6	Locate bathymetric data			✓				
	Manipulate bathymetric data to derive a suite of terrain attributes		✓	✓				
	Apply an unsupervised approach to habitat characterization		✓	✓				
	Design a multi-paneled map		✓	✓				
Lecture 6	Summarize and contrast two pieces of the scientific literature	✓	✓		✓			✓
	Summarize different unsupervised and supervised approaches to habitat mapping		✓		✓	✓	✓	✓
	Contrast different types of additional spatial analyses that can be performed from habitat maps (e.g., seascape analyses, hotspot analyses, connectivity analyses)	✓	✓					
Lab 7	Evaluate different types of additional spatial analyses that can be performed from habitat maps	✓	✓	✓	✓			
Lab 8	Locate existing spatial data and their associated metadata	✓	✓	✓				
	Evaluate, critically, spatial data for a given context	✓	✓		✓			
Lecture 8	Design a suitable habitat mapping project for a given purpose	✓	✓		✓			✓
Lab 9	Design a suitable habitat mapping project for a given purpose	✓	✓		✓			✓

	Design a locational map with environmental data		✓	✓				
Lecture 9	Critique (peer-review) other students' research idea				✓			✓
	Defend a project idea on paper	✓	✓					✓
	Defend a project idea orally and efficiently (speed talk)							✓
Lab 10-14	Cooperate to complete a habitat mapping project	✓	✓	✓			✓	
	Coordinate a team to complete a habitat mapping project	✓	✓	✓			✓	
	Design habitat maps	✓	✓	✓			✓	
	Assemble a scientific article	✓	✓	✓			✓	✓
Lectures 10-14	Cooperate to complete a habitat mapping project	✓	✓	✓			✓	
	Coordinate a team to complete a habitat mapping project	✓	✓	✓			✓	
	Design habitat maps	✓	✓	✓			✓	
	Assemble a scientific article	✓	✓	✓			✓	✓
Lab 15	Cooperate to complete a habitat mapping project	✓	✓	✓			✓	
	Coordinate a team to complete a habitat mapping project	✓	✓	✓			✓	
Lecture 15	Defend a habitat mapping project orally							✓
	Defend a habitat mapping project on paper							✓