

MS 233: GLOBAL KELP SYSTEMS SPRING 2012

COURSE TITLE: MS 233 – Advanced Topics in Marine Ecology: Global Kelps Systems

INSTRUCTORS:

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COORDINATOR:

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WHAT THIS COURSE IS ABOUT: Kelp forests represent some of the most diverse, productive, and dynamic ecosystems on the planet, and the distributions of many organisms are known to be linked tightly to the presence of kelp due to a variety of trophic and habitat associations. The presence of kelp populations in nearshore regions also significantly enhances the diversity and productivity of coastal ecosystems. Despite early interest in how kelp forests function, however, little is known about the temporal and spatial scales at which kelp forest communities respond to variability in kelp distribution and abundance. Such information is not only vital to basic studies of community assembly but also to more applied questions of societal concern, for example the prediction of ecosystem consequences due to global climate change, habitat modification, and human exploitation of kelp forest resources.

This course will touch on three themes that can be summed up by the following questions: *(1) What is the role of kelps in nearshore systems? (2) Can kelp trophic and habitat associations be untangled? (3) What are the ecosystem consequences of kelp addition to a system?* These research questions are challenging and the global scientific community studying kelp ecology is divided into provincial research programs demarcated by political, social, and economic boundaries. Kelp forests, however, are structured by processes that are ignorant of these sorts of boundaries. As such, scientific provincialism can impede the study and understanding of kelp ecosystem functioning at regional to global scales ... the scales at which such functioning is ultimately expressed. **The goal of this course is to develop an integrated education-research curriculum that addresses the functioning of global kelp systems.**

COURSE STRUCTURE: The course is organized around morning “challenge” lectures in which the instructors present a brief background (2 hours) on ecological concepts in order to stimulate student discussion. The lectures are complimented by extensive reading of the primary literature and round-table discussions of key concepts, methodologies, and research directions. Intensive laboratory will follow each lecture, so that students can immediately apply their new concepts and skills. All exercises will utilize real data resulting from a field experiment to be conducted by the students. Understanding of the

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role of kelp abundance in regulating the structure and functioning of global kelp systems requires knowledge of processes spanning various fields, and spatial, temporal, and taxonomic scales. As such, we have compiled a group of US and Chilean instructors with expertise in: (1) physiology, ecology, molecular biology, and experimental design; (2) organisms, populations, and communities; and (3) algae, invertebrates, and vertebrates.

CLASS EXPERIMENT: In addition to lectures and laboratories, the will conduct a field experiment in southern Chile to test the organismal, population, and community-level responses of kelp systems to the functional addition of kelp. We will be sampling areas near Chiloe Island that have large aquaculture facilities. These systems are part of a larger project to integrate kelp aquaculture into large-scale salmon and oyster farming. We will be sampling (1) natural kelp populations, (2) kelp populations growth in conjunction with animal aquaculture and (3) aquaculture systems in the absence of kelp. The sampling will be conducted by the students and instructors to estimate (a) the physiology and health of the kelp, (b) the abundance of algae, invertebrates, and fishes, (c) the size and biomass of the animals, and (d) impact of kelps on the flow of carbon and nitrogen through these systems. We will be testing the following hypotheses:

- Plankton composition differs when kelps are present
- Grazers are more abundant when kelps are present
- Kelp growth and nutrient uptake is higher in the presence of aquaculture
- Predators are more abundant when kelps are present
- Herbivore and predator diets are more diverse when kelps are present
- Herbivores and predators are larger when kelps are present
- Species richness and diversity are higher when kelps are present
- Kelps contribute significantly to C and N budgets when kelps are present

EXAMS & GRADING:

Final exam:	25%
Assignments:	25%
Class participation:	50%

Final exam: A written exam will be handed out after the last laboratory exercise to be completed in 24 hours. All students must turn in the exam in order to receive a grade. Students *may not* work together on the exam.

Assignments: Three laboratory assignments will be due the morning after they are assigned. All students must turn in the assignments in order to receive a grade. Students *can* work together on the assignments.

Class participation: Most of the grade will be based on class participation. This includes discussions in class and helping with laboratory and fieldwork. It is assumed that the students will work together to learn the material, conduct analyses, and discuss the readings.

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SCHEDULE:

Students arrive on Jan 18/19 at housing site in Puerto Montt.

Date	Morning	Afternoon	Assignment*
Jan 19 (Thurs)	1. Brief introduction to the goals of the course, the experiment, and the methods (Graham) 10 - 12 p lecture room	2. Carbon and nitrogen physiology of kelps (Varela) 1 - 3 p lecture room 3 - 5 p physiology lab	Welcome BBQ 6 p Cabanas
Jan 20 (Fri)	3. Population biology overview of algae, inverts, vertebrates (Buschmann) 10 - 12 lecture room	4. Flow of C and N using stable isotopes (Newsome) 1 - 3 p lecture room 3 - 5 p physiology lab	Compare kelp physiology within and between treatments.
Jan 21 (Sat)	FIELD STUDIES	FIELD STUDIES	
Jan 22 (Sun)	FIELD STUDIES	FIELD STUDIES	
Jan 23 (Mon)	5. Population genetics (Macaya) 10 - 12 lecture room	Calculate species abundance differences 1 - 3 p computer lab Calculate molecular indices 3 - 5 p computer lab	Compare species abundances within and between treatments.
Jan 24 (Tues)	6. Species interactions and community structure (Hamilton) 10 - 12 lecture room	Multivariate/community analyses, diet analyses 1 - 5 p computer lab (tutorial ~1 - 3)	Compare communities and food webs between treatments.
Jan 25 (Wed)	7. Ecosystem processes and energy flow (Graham) 10 - 12 lecture room	Estimate total biomass of species, calculate primary and secondary productivity 1 - 5 p computer lab (tutorial ~1 - 3)	Conceptual Final Exam

- All assignments are due the morning after they are assigned. Final exam is take-home and due the following morning (Jan 26, Thursday).

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De Puerto Montt, Concepción, Antofagasta, Estados Unidos, Francia y Perú

Centro i-mar congrega a destacados científicos especialistas en algas kelps

El curso de verano se extenderá hasta el 25 de enero, en una metodología de trabajo que combinará clases teóricas, con actividades en el laboratorio y toma de muestras en terreno en la zona de Ancud



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Investigadores de Puerto Montt, Concepción, Antofagasta, Estados Unidos, Francia y Perú se congregan en el Centro i-mar de la Universidad de Los Lagos, para asistir al curso de verano "Advanced Topics in Marine Ecology: Global kelps Systems", que congrega a destacados científicos especialistas en el tema de los bosques de algas kelps, como el huiro, que son particularmente abundantes en la Región Sur Austral de Chile.

En la partida del curso el investigador Michael Graham, del Moss Landing Marine Labs de Estados Unidos, destacó la importancia de estudiar esta especie, en virtud de su potencial de cultivo para la producción de biocombustibles y para alimento humano, entre otros usos. "Queremos estudiar los bosques de algas que existen en la zona, particularmente en Chiloé y comparar su ecosistema con los de otros puntos del planeta. Nos interesa hacer un curso dinámico y hacernos toda clases de preguntas, por ejemplo, preguntarnos si los herbívoros o los predadores son más abundantes cuando en un ecosistema existe esta especie, entre otras variables", explicó Graham.

El curso de verano se extenderá hasta el 25 de enero, en una metodología de trabajo que combinará clases teóricas, con actividades en el laboratorio y toma de muestras en terreno en la zona de Ancud.

Durante este curso intensivo se analizarán los actuales desafíos para la comunidad científica que estudia estos ecosistemas, con la finalidad de desarrollar un plan de trabajo de investigación orientado hacia el conocimiento integral del funcionamiento global de estos bosques.

El equipo de profesores lo integran los doctores Alejandro Buschmann y Daniel Varela del Centro i-mar; Scott Hamilton del Moss Landing Marine Labs de Estados Unidos; Erasmo Macaya de la Universidad de Concepción y Seth Newsome de la Universidad de Wyoming, Estados Unidos.

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