UNIVERSIDAD SAN FRANCISCO DE QUITO
SCHOOL: CIENCIAS BIOLÓGICAS Y AMBIENTALES
COURSE: ECL 0396E - MARINE ECOLOGY
Semester: 201910 – First Semester 2019/2020 - **NRC:** 1012
Schedule: MTWTHF 09:00 - 11:50 (Aula 2 - GAIAS)

PROFESSOR INFORMATION

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COURSE INFORMATION

COURSE: ECL-0396E - MARINE ECOLOGY
NRC: 1012
Credits: 4
Pre-requisites: Techniques of Marine Research 1, or one Biology class, or one Ecology class.
Co-requisites: ECL 0396L

COURSE DESCRIPTION

Students will learn about the properties of marine communities and about the processes that affect the abundance and distribution of marine organisms. Students will be introduced to the most important topics in marine ecology, such as larval supply, succession, disturbance, trophic cascades, facilitation and, biodiversity and ecosystem functioning. In addition, we will discuss the influence of upwelling, climate change and other threats to marine communities. We will also review the ecology of the main marine habitats present in the Galápagos, such as seamounts and hydrothermal vents, rocky subtidal communities, coral reefs, mangals and rocky shores. Another crucial component of this class is the readings. Each day, students will be responsible to read one article and be prepared to critically discuss its content.

COURSE LEARNING OUTCOMES

Number	Learning Outcome
1	Gain a broad understanding of the relevant processes and properties of marine communities with particular emphasis on the Galápagos Islands
2	Empower students to do science and think independently over a short period of time based on original observations in nature
3	Empower students to be synthesizers and critical thinkers
4	Empower students to effectively convey their scientific thoughts and analyses in oral and writing

COURSE CONTENTS

Larval supply, succession, disturbance, trophic cascades, facilitation, biodiversity and ecosystem functioning, upwelling, climate change, threats, seamounts, hydrothermal vents, rocky shores, rocky subtidal communities, coral reefs, angals, marine mammals, and sea turtles.

METHODOLOGY FOR THE INTEGRATION OF THEORETICAL AND PRACTICAL CONTENT

The teaching methodologies used to teach USFQ courses, following the philosophy of Liberal Arts, foster dialogue and facilitate the construction of knowledge through the continuous exchange of ideas and experiences between professors and students. It is expected that in all courses the theoretical concepts will be linked to the professional practice and work contexts where students will perform in the future, with the intent to integrate activities and simulations of a diverse nature that promote the understanding of practical and realistic contexts.

HOURS DESCRIPTION OF APPLIED PRACTICE

This class has a strong field component to see in situ how different processes affect the structure and function of marine communities. During the first week, we will some field sites, where we will identify the key players of our communities and get inspired for undertaking independent research projects. In addition, we will snorkel/scuba at three additional sites to get exposed to additional marine habitats such as coral communities and vertical rock walls. The description and form of evaluation of these practices have been described in the next two sections.

ASSESMENT

Type	Percentage of the final grade
Leading discussion of articles (2; 8 points each)	16
Field report on La Lobería	5
Field reports on León Dormido, Punta Pitt, Rosa Blanca (8 points each)	24
Oral presentation of research statement	8
Written report of independent research project	8
Oral presentation of independent research project	8
Exams	16
Assistance, punctuality, engagement in class and field excursions	5
Contribution to paper discussions	6.5
Quizzes on articles	3.5
Total	**100**

A = 100-91; B = 90 – 81, C = 80 – 71, D = 70 – 61, F = 60

DESCRIPTION OF ASSESSMENT CATEGORIES

GUIDELINES FOR THE DISCUSSION SECTION

The goal of the discussion section is to encourage you to more fully explore the primary literature than is possible in lecture. Each day, 1 student per discussion section (2 each day), will facilitate the discussion on papers that are chosen from the assigned readings list. Students should sign up for their articles during our first meeting. All students are required to read the articles prior to class and should be prepared to discuss the paper and topic. In addition, they should be prepared to take a quiz.

As discussion leaders, students will use the article to identify and explore issues in ecology. A brief introduction and appropriate background information on the organisms and systems may be helpful. Students are welcome to use slides, but they are *not* to give a lecture about the paper. Instead, they should come prepared with questions (related to the paper) that address issues and concepts of the topic of the day. Types of questions include: what are the authors trying to accomplish? What is the overall significance of the paper? What were the authors' hypotheses? How did they test them? What are the implications for future work? Students may wish to **follow up on additional papers** in the same topic area to see how the field has advanced, opinions have changed, or if there is disagreement within the scientific community. Ideally students should make explicit the connections between the readings and the material covered during lectures.

GUIDELINES FOR THE FIELD EXCURSIONS

A) (Low tide) La Lobería: This report will be due the next day and should be written individually. The reason of this tight schedule is to motivate students to become familiar with the marine organisms and to start thinking on their research projects. No specific format should be followed for writing this report, however it should include the species observed during the excursion and any interesting information about them, for example: in what type of habitat were they found, or if they saw the species interacting in any way with another one. Latin names (e.g. *Eucidaris galapagensis*) are required for mollusks, crustaceans, echinoderms, corals and fishes. For all other groups (sponges, tunicates, algae, hydroids, etc) it is acceptable to refer to them by broader taxonomic nomenclatures, e.g. red sponge 1, red filamentous algae 1, etc.

B) León Dormido, Scuba Diving: We will head to León Dormido and make one immersion. During this dive, we will do the normal touristic dive: we will enjoy the dive and look for sharks and sea turtles . This will be achieved by reaching the sea bottom at around 20 m in the middle of the canal and then coming up. During the second dive, we will swim with the current from around 20 m up to the surface **by the vertical wall**. I want you to observe how the community structure changes with depth. 1) What **sessile** species are dominant at 20,15, 10, 5 and 0 m? Can you think of the reasons for this zonation? 2) What **mobile** species are associated at the different depths? 2a) Do sea urchins occur on equal abundances across all depths? 2b) Do planktivore fish species (e.g. Gringos, *Paranthias colonus*) occur in equal amounts across depths or are there any differences? 2c) Are demersal fishes found across all depths?

C) León Dormido, Snorkeling**:** Although you won't be able to see how the dominance of organisms changes with depth up to 20 m, you are still going to be able to see some zonation patterns right from the surface up to a maximum of 3-10 m depth (depending on the visibility). What band of organisms can you identify from the high tide mark to the deepest part you can see? Does this pattern change at different parts of the rock? To do that you will swim around the islet, trying to cover as much area as possible. Are the headlands covered by more organisms than the sheltered parts of the rock? Why? What are the dominant organisms on each part of the islet?

D) Punta Pitt: The purpose of this field trip is to expose you to some patches of hermatypic coral communities, which is another important subtidal habitat in the Galápagos. We will probably go hiking first, to look for the red-footed boobies. During this hike, in addition of learning about sea birds, take advantage of the spectacular view of Punta Pitt. Try to get an understanding of the conformation of the bay and maybe ask your naturalist guide if he knows about its bathymetry. From the top of the hill, we will point out where we'll be snorkeling, thus make sure you see the differences of the substrate type and depth where the corals are located. Once in the water, you'll take semi-quantitative data on the health status of the coral colonies based on the abnormal conditions reported in Fig. 2 of Vera & Banks (2009). You will use the following scale to estimate the extent of the abnormal conditions: condition absent; 1–5 % of cover; 5–25 % of cover; 25–75 % of cover; 75–100 % of cover. Make sure to identify the coral species of each colony by consulting the Cnidarian Field Guide of Hickman (please read the descriptions, not only look at the pictures), and take pictures of them to build your own catalogue. I will be collecting everyone's pictures before grading the reports.

E) Rosa Blanca: We will visit this site for the first time in this class. Ideally we will repeat the coral surveys as in Punta Pitt, however, this task is tentative as the location of the corals is currently unknown. It's an explorative field trip!. This area is a high energy zone the windward part of the island in this context have a tendency of receive high amounts of plastic pollution . We will perform a Standardized Marine debris Survey that will help to feed a large collaboration project in order to understand the effects of plastic pollution at the Galápagos Marine Reserve.

Format for field reports on León Dormido, Punta Pitt and *Rosa Blanca* (please email reports on .doc or .docx format, groups of maximum 3 students/report)

1) Introduction: Briefly introduce the study site and the objectives of the field excursion.

2) Methods: Describe what you did for accomplishing the goal of the field excursion.

3) Results and Discussion (one single section). For León Dormido: answer the questions in **B** and **C**, and elaborate on three aspects covered during lecture or on any reading that was relevant to your observations (cite sources both in the text as in the Literature Cited section). For Punta Pitt/Rosa Blanca report the tasks

requested in **D.**
4) Cited Literature: Cite your sources of information.

Extension: Minimum three and maximum five pages (double-spaced).

GUIDELINES FOR THE ORAL PRESENTATION OF THE RESEARCH STATEMENT
The research statement should state the question of interest and the hypothesis and should propose a project to test them. The presentation must include the following sections:
1) Introduction: What it is known about the topic you will study?
2) Hypothesis: The explicit question and hypothesis your research project will address.
3) Significance: Why is your research project important? Please avoid conservation reasons.
4) Methods: Describe the design of your project in sufficient detail so that someone else could perform it. Make sure to include information on the number of replicates.
5) Timeline: this is important for reporting to the Galápagos National Park.

GUIDELINES FOR THE WRITTEN REPORT ON THE INDEPENDENT RESEARCH PROJECTS (please email
report on .doc or .docx format)
The report of your independent research project should include the same sections of the Statement, plus Results, Discussion and Literature Cited. The latter should include at least **five** peer-reviewed articles pertaining the topic of your project that have not been assigned as a reading for this class. The report should be no more than seven pages long doubled-spaced (without Literature Cited, Figures and Tables).

GUIDELINES FOR THE ORAL PRESENTATION OF THE INDEPENDENT RESEARCH PROJECTS
The purpose of this oral presentation is to share with your class the findings of your project. Each group will have 10 min to do it, plus 2 minutes to answer questions. All group members are expected to talk and answer questions evenly.

LIBRARY BIBLIOGRAPHY

No textbook is required for this class; however, the following books were used to prepare the lectures and will be available at the Library for general consults:

1. Bertness MD, Gaines SD and ME Hay (eds). 2001. Marine Community Ecology. Sinauer Associates, Inc. Sunderland, MA. 550 pg.
2. Levington JS. 2011. Marine Biology. Oxford University Press, Inc. New York, NY. 588 pg.
3. Bertness MD, Bruno JF, Silliman BR and JJ Stachowicz. 2014. Marine Community Ecology and Conservation. Sinauer Associates, Inc. Sunderland, MA. 566 pg.

In addition, the following field guides, available at the Library, *should* be consulted for generating the field trip reports:

1. Hickman CP. 1998. A field guide to sea stars and other echinoderms of Galápagos. Sugar Spring Press, Lexington, Virginia, p 83.
2. Hickman CP. 1999. A field guide to marine molluscs of Galápagos. Sugar Spring Press, Lexington, Virginia, p 150.
3. Hickman CP. 2008. A field guide to corals and other radiates of Galápagos. Sugar Spring Press, Lexington, Virginia, p 172.
4. Hickman CP and TL Zimmerman. 2000. A field guide to crustaceans of Galápagos. Sugar Spring Press, Lexington, Virginia p 156.

COURSE BIBLIOGRAPHY (Readings discussion)

Valdivia N, González AE, Manzur T, Broitman BR (2013) Mesoscale variation of mechanisms contributing to stability in rocky shore communities. PloS one 8:e54159.

Anderson AB, Batista MB, Gibran FZ, Félix-Hackradt FC, Hackradt CW, García-Charton JA, Floeter SR (2019) Habitat use of five key species of reef fish in rocky reef systems of southern Brazil: evidences of MPA effectiveness. Marine Biodiversity 49:1027–1036.

Chaves, J., M. Peña, J. Valdés-Uribe, J.P. Muñoz-Pérez, F. Vallejo, M. Heidemeyer, and O. Torres-Carvajal. 2017. Connectivity, population structure, and conservation of Ecuadorian green sea turtles. Endangered Species Research 32:251–264.

Sousa WP. 1979. Disturbance in marine intertidal boulder fields: the nonequilibrium maintenance of species diversity. Ecology 60(6): 1225-1239.

Sebille, E., P. Delandmeter, J. Schofield, D. Hardesty, J. Jones, and A. Donnelly. 2019. Basin-scale sources and pathways of microplastic that ends up in the Galápagos Archipelago. Ocean Science Discussions:1–15.

Kingsford MJ, Finn M, O'Callaghan M, Atema J, Gerlach G (2014) Planktonic larval duration, age and growth of Ostorhinchus doederleini (Pisces: Apogonidae) on the southern Great Barrier Reef, Australia. Marine biology 161:245–259.

Fisher JA, Frank KT, Leggett WC (2010) Global variation in marine fish body size and its role in biodiversity-ecosystem functioning. Marine Ecology Progress Series 405:1–13.

Carr LA, Gittman RK and JF Bruno. 2018. Temperature influences herbivory and algal biomass in the Galápagos Islands. *Frontiers in Marine Science* 5:279, doi: 10.3389/fmars.2018.00279.

POLICIES:

All courses are governed by the USFQ Student Manual, which can be downloaded

ABOUT ELECTRONIC EQUIPMENT: Cell phones, Ipods and other devices have to be switched off in class. You're allowed to use IPAD/computers only for taking notes.

ASSISTANCE: Come to class on time. Plus, field excursions are mandatory**.** In the case of illness or any other justified cause, students can be relieved from the excursion and cover the qualification with additional tasks.

MATERIALS: For excursions bring notebooks/slates, snorkeling gear, wetsuit, camera, hat, sunblock, water bottle.

SCHEDULE OF ACTIVITIES

WEEK	DATE	TOPIC	READINGS	SPECIAL ACTIVITIES
1	SEP 30	Syllabus review. Introduction to Marine Ecology. Review of Marine Invertebrate Phyla. (J.M Alava and J.P. Munoz)		
	OCT 1	14:00 to 16:00 Intertidal Habitats: Mangals and Rocky Shores (J.M. Alava).	**1.**Valdivia et al. 2013	09:00 – 12:00 Intertidal: La Lobería
	OCT 2	06:00 am to 8:00 (Group 1 Sea Turtle Conservation and Research Program field trip to Carola Beach) 09:00 to 11:00 Coastal Subtidal Habitats: Coral Reefs, Rocky Reefs, Vertical Walls (J.M. Alava)	**2.** Anderson et al. 2019	11-11h50: Brainstorming on IRP's
	OCT 3	06:00 am to 8:00 (Group 2 Sea Turtle Conservation and Research Program field trip to Carola Beach) 09:00 Open Water Habitats and the importance of : Seamounts, Hydrothermal Vents, MPAs and Sea Turtles in Galápagos (J.P. Munoz)	**3.**Chaves et al. 2017	11-11h50: Brainstorming on IRP's **Report on Lobería Due, 23h30**
	OCT 4	Snorkel / Scuba at León Dormido (zonation on vertical walls) 1 boat and half of 11 students + J. P. Munoz 1 boat and half of 11 students + J.M. Alava		
	OCT 5	Plastic Pollution Field Trip (Jardin de las Opuntias)		
2	OCT 7	**Exam 1** Oral Presentations of Research Statements (Group Independent Projects)		
	OCT 8	Disturbance, Succession, Trophic Cascades (J.P. Munoz)	**4.** Sousa 1979	Work on IRP's
	OCT 9	Plastic Pollution in Our Oceans. Galápagos is not an exception. (J.P. Munoz) Whales in the Galápagos (D. Alarcón)	**5.** Sebille et al. 2019	Work on IRP's **Report on León Dormido Due, 23h30**
	OCT 10	Snorkel at Punta Pitt (coral surveys) / Snorkel at Rosa Blanca (coral surveys/intertidal lagoon) Rosa Blanca: Group 1: 1 boat and half of 11 students + J. P. Munoz Pta. Pitt: Group 2: 1 boat and half of 11 students + J.M. Alava		
	OCT 11	Snorkel at Punta Pitt (coral surveys) / Snorkel at Rosa Blanca* (coral surveys/intertidal lagoon) Rosa Blanca: Group 1: 1 boat and half of 11 students + J. P. Munoz Pta. Pitt: Group 2: 1 boat and half of 11 students + J.M. Alava		
3	OCT 14	Supply-side Ecology (J.M.Alava)	**6.** Kingsford et al. 2014	Work on IRP's
	OCT 15	Marine Biodiversity: Origin, maintenance and functional consequences (J.M. Alava)	**7.** Fisher et al. 2010	Work on IRP's/ **Reports Pta. Pitt and Rosa Blanca due at 23h30 PM**
	OCT 16	Effects of Climate Change in Marine Communities (J.P. Munoz)	**8.** Carr et al. 2018	Work on IRP's
	OCT 17	**Exam 2** / Work on IRP's		
	OCT 18	Oral presentations of independent research projects		
	OCT 20	**Final Report due at 23h30 PM**		

IRP's: Independent Research Projects

This syllabus was reviewed and approved by the coordination of the respective academic area or department. All sections of this course must follow this syllabus. Any changes or adjustments to this syllabus must be approved by the coordinator responsible for this academic area or department and must be reflected in the Curricular Design system.