

DESCRIPTION:

The warm-temperate Mediterranean is one of the remnants of Tethys, the ancient ocean than once long ago allowed worldwide dispersal of tropical and subtropical marine organisms. Although most of that biodiversity vanished in the late Miocene, 5.5 million years ago, some Tethyan species still survive in the Mediterranean, as seagrasses whose closest relatives occur in Australia, and sturgeons related to those found in the Aral Sea. These survivors of Tethys share the Mediterranean with newcomers that colonized the basin after the Ice Age, like the monk seal, the loggerhead sea turtle, and the sperm whale. This course will explore the origin and characteristics of this amazing biodiversity and the dynamics of the ecosystems where these species thrive. But the Mediterranean is also one of the most densely populated areas in the world and one of the most attractive destinations for European tourists. Overfishing, pollution and destruction of coastal areas threaten the conservation of marine wildlife. The course will also consider the impact of these activities and whether sustained development can be achieved in the region.

PREREQUISITES:

None

LANGUAGE OF PRESENTATION:

English

PROFESSOR:

L. CARDONA, PHD

STUDENT OUTCOMES:

By the end of the course, the students will be able to:

- Recognise the major components of Mediterranean marine ecosystems
- Describe the dynamics of Mediterranean marine ecosystems
- Analyse the impact of human activities on Mediterranean marine ecosystems
- Value marine biodiversity and the need for sustainable development.

LEARNING MEANS:

- Readings: with the basic goal of give students an overview of the characteristics of Mediterranean marine ecosystems and the consequences of human activities.
- Homework: to identify the key points of the readings and facilitate discussion during class
- Lectures: to discuss and share different point of view and settle basic concepts
- Field-studies and classes on-site: to get some hands-on experience!
- Term paper and oral presentation: to give students the opportunity to show what they have learnt. They will have to analyse and interpret information about different topics.

METHODS OF ASSESSMENT:

The final grade will be determined as follows:

- Class participation and homework (25%): to guarantee that students are familiar with the topics covered in class, and their involvement in class activities.
- Midterm exam (20%) and Final exam (25%): a set of multiple choice and written questions to evaluate whether students are familiar with the basic topics discussed in class
- Term paper and oral presentation (30%): to assess the capacity of students to integrate analyze, compare, and present information.

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COURSE CONTENT

SESSION 1	Jan. 22, 2007	<p>Class content: Course introduction (objectives, contents and assessment). An overview of the major Mediterranean marine ecosystems and species.</p> <p>Required readings: None</p>
SESSION 2	Jan. 24, 2007	<p>Class content: Visit to Barcelona Aquarium (class on site)</p> <p>Required readings: None</p>
SESSION 3	Jan. 29, 2007	<p>Class content: Living in the water column: environmental constrains and adaptations</p> <p>Required readings: Herring (2002) pp 1-7 and Mann (1990) pp 8-11.</p>
SESSION 4	Jan. 31, 2007	<p>Class content: Living in the water column: the blue Mediterranean</p> <p>Required readings: Estrada, M. et al (1985) 148-159, 168-169 and 185-194 and Longhurst (1998) pp138-142.</p>
SESSION 5	Feb. 5, 2007	<p>Class content: The rocky shores and the subtidal rocks</p> <p>Required readings: Witman and Dayton (2001) pp 340-358 and Ros et al (1985) pp 233-257 and 263-273.</p>
SESSION 6	Feb. 7, 2007	<p>Class content: Beaches and soft bottom ecosystems</p> <p>Required readings: Little (200) pp 35-56; Peres (1985) pp 209-217 and Ros et al (1985) pp 257-260.</p>
SESSION 7	Feb. 12, 2007	<p>Class content: Seagrass meadows.</p> <p>Readings: Heminga and Duarte (2000) pp 1-23; Procaccini et al (2003) pp 48-56 and Milchakova (2003) pp 59-63.</p>
SESSION 8	Feb. 14, 2007	<p>Class content: Estuaries and coastal marshes.</p> <p>Required readings: Blondel and Aronson (1999) pp 125-130.</p>
SESSION 9	Feb. 19, 2007	<p>Class content: The deep sea.</p> <p>Required readings: Herring (2002) pp239-254 and Tudela (2004) pp 10-38.</p>
SESSION 10	Feb. 21, 2007	<p>Class content: Bathimetry, hydrography and chemistry of a semi-enclosed sea.</p>

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		<p>Required readings: Papathanassiou and Gabrielides (1999) pp 30-34 and 39-41, Longhurst (1998) pp134-138 and Salat (1996) pp 21-32, and Cruzado (1985) pp 126-146.</p>
SESSION 11	Feb. 26, 2007	<p>Class content: From Tethys to the Mediterranean, a convulse geological history.</p> <p>Required readings: Blondel and Aronson (1999) pp 1-7 and Peres (1985) pp 198-209.</p>
SESSION 12	Feb. 28, 2007	<p>Midterm exam</p> <p>Required readings: topics covered in sessions 2-12</p>
SESSION 13	Mar. 4, 2007	<p>Class content: The biodiversity crisis.</p> <p>Required readings: Leakey and Lewin (1995) pp 246-254 and Papathanassiou and Gabrielides (1999) pp 110-111.</p>
SESSION 14	Mar. 6, 2007	<p>Class content: Overfishing I.</p> <p>Required readings: Papathanassiou and Gabrielides (1999) pp 56-59, Worm et al (2006) pp 787-790 and Jackson et al (2001) pp 629-636.</p>
SESSION 15	Mar. 11, 2007	<p>Class content: Overfishing II. Case study: the anchovy and the dusky grouper fisheries .</p> <p>Required readings: Pertierra and Leonart (1996) pp 257-267, Cingolani et al. (1996) pp 269-277 and Reñones, et al (2000) pp 155-164.</p>
SESSION 16	Mar. 13, 2007	<p>Class content: The relevance of recreational fishing.</p> <p>Required readings: Picket and Pawson (1994) pp. 229-237.</p>
	SPRING BREAK	
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SESSION 17	Mar. 25, 2007	<p>Class content: New management strategies: artificial reefs and marine reserves .</p> <p>Required readings: Coll et al. (1998) 139-152, Hall (1999): 230-240 and Guidetti and Sala (2007): 43-56</p>
SESSION 18	Mar. 27, 2007	<p>Class content: pollution.</p> <p>Required readings: Papathanassiou and Gabrielides (1999) pp 76-81, 85-90 and 95-97.</p>
SESSION 19	Apr. 1, 2007	<p>Class content: Class presentation and discussion.</p> <p>Required readings: None.</p>

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SESSION 20	Apr. 3, 2007	Class content: Class presentation and discussion. Required readings: None.
SESSION 21	Apr. 8, 2007	Class content: Climate change. Film viewing. Required readings: None.
SESSION 22	Apr. 10, 2007	Class content: Climate change. Required readings: Blondel and Aronson (1999) pp 25-29 and Papathanassiou and Gabrielides (1999) pp 105-107.
SESSION 23	Apr. 15, 2007	Class content: Biological invasions. Required readings: Papathanassiou and Gabrielides (1999) pp 111-115, Williamson (1996): pp 131-134 and 189-190 and Meinesz (1999) pp 295-308.
SESSION 24	Apr. 17, 2007	Class content: Tourism and the management of the coastline. Visit to Barcelona beaches (class on site) Required readings: Papathanassiou and Gabrielides (1999) pp 47-52 and 82-85.
FINAL EXAM*	Apr. 24, 2008	Final Exam

LIST OF SELF-GUIDED VISITS, FIELD STUDIES, CLASSES ON SITE, GUEST SPEAKERS OR FILM VIEWINGS

SESSION	DATE	ACTIVITY	DESCRIPTION
2	Jan. 24, 2008	Visit to Barcelona Aquarium	Class on site to get an overview of the Mediterranean marine biodiversity
-	Feb. 15, 2008	Visit to Ebro Delta	Day trip to one of the largest deltas in the Mediterranean
-	Mar. 7, 2008	Visit to Palamos	Day trip to a fishing village and visit to the Fishing Museum. Seafood lunch included.
21	Apr. 8, 2008	Film viewing	Film: "An inconvenient truth"
24	Apr. 17, 2008	Visit to the Barcelona beaches	Class on site to understand how tourism development modifies the seashore

REQUIRED READINGS

Blondel, J. and Aronson, J. (1999) Biology and wildlife of the Mediterranean region. Oxford: Oxford University Press.

Cingolani, N., Giannetti, G., and Arneri, E. (1996). Anchovy fisheries in the Adriatic Sea. *Scientia Marina* 60, supl. 2: 269-277.

Coll, J., Moranta, J., Reñones, O., García-Rubies, A. and Moreno, I. (1998). Influence of substrate and deployment time on fish assemblages on an artificial reef at Formentera Island (Balearic Islands,

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- Cruzado, A. (1985). Chemistry of Mediterranean water. In R. Margalef (ed.) *The Western Mediterranean*: 126-146. London: Pergamon Press.
- Estrada, M., Vives, F. and Alcaraz, M. (1985). Life and productivity in the open sea. In R. Margalef (ed.) *The Western Mediterranean*: 148-197. London: Pergamon Press.
- Guidetti, P. and Sala, E. (2007). Community-wide effects of marine reserves in the Mediterranean sea. *Marine Ecology Progress Series* 335: 43-56.
- Hall, S.J. (1999). *The effects of fishing on marine ecosystems and ecommunities*. London: Blackwell Science.
- Hemminga, M.A., and Duarte, C.M. (2000). *Seagrass ecology*. Cambridge: Cambridge University Press.
- Herring, P. (2002). *The biology of the deep ocean*. Oxford: Oxford University Press.
- Jackson, J.B.C., et al. (2001). Historical overfishing and the recent collapse of coastal ecosystems. *Science* 293: 629-638.
- Leakey, R. and Lewin, R. (1995). *The sixth extinction*. London: Phoenix.
- Little, C. (2000). *The biology of soft shores and estuaries*. Oxford: Oxford University Press.
- Longhurst, A. (1998). *Ecological geography of the sea*. Now York: Academic Press.
- Maldonado, A. (1985). Evolution of the Mediterranean basins and a detailed reconstruction of the Cenozoic paleoenography. In R. Margalef (ed.) *The Western Mediterranean*: 17-59. London: Pergamon.
- Mann, K.N. (1991). Organisms and ecosystems, In R.S.K. Barnes and K.H. Mann (eds.). *Fundamentals of aquatic ecology*. London: Blackwell.
- Meinesz, A. (1999). *The killer algae*. Chicago: The University of Chicago Press.
- Milchakova, N.A. (2003). The seagrasses of the Black, Azov, Caspian and Aral seas. In E.P. Green and F.T. Short (eds.) *World Atlas of seagrasses*: 59-63. Berkley: University of California Press.
- Papathanassiou, E. and Gabrielides, G.P. (1999). *State and pressures of the marine and coastal Mediterranean environment*. Copenhagen: European Environment Agency.
- Peres, J. (1985). History of the Mediterranean biota and the colonization of the depths. In R. Margalef (ed.) *The Western Mediterranean*: 198-232. London: Pergamon Press.
- Pertierra, J.P. and Leonart, J. (1996). NW Mediterranean anchovy fisheries. *Scientia Marina* 60, supl. 2: 257-267.
- Procaccini, G, Buia, M.C. Buia, Gambi, M.C., Perez, M., Pergent, G. Pergent-Martini, C., and Romero, J. (2002). The seagrasses of the western Mediterranean. In E.P. Green and F.T. Short (eds.) *World Atlas of seagrasses*: 48-56. Berkley, University of California.
- Reñones, O., Goñi, R., Pozo, M., Deudero, S., and Moranta, J. (2000). Effects of protection on the demographic structure and abundance of *Epinephelus marginatus* (Lowe, 1834). Evidence from Cabrera Archipelago National Park (West-central Mediterranean). In J.-P. Quignard (ed.) *Symposium international sur les mérours de Méditerranée*: 155-164. Montecarlo: Mémoires de l'Institut océanographique Paul Ricard.
- Ros, J.D., Romero, J., Ballesteros, E. and Gili, J.M. (1985). Diving in the blue water. The benthos. In R. Margalef (ed.) *The Western Mediterranean*: 233-295. London: Pergamon Press.
- Salat, J. (1996). Review of hydrographic environmental factors that may influence anchovy habitats in the northwestern Mediterranean. *Scientia Marina* 60, supl. 2: 21-32.
- Tudela, S. (2004). *The Mediterranean deep-sea ecosystems*. Barcelona: IUCN and WWF.
- Williamson, M. (1996). *Biological invasions*. London: Chapman and Hall.
- Witman, J.D. and Dayton, P.K. (2001). Rocky subtidal communities. In M.D. Bertness, S.D. Gaines and M.E. Hay (eds.) *Marine community ecology*: 339-366. Sunderland: Sinauer.
- Worm, B. Et al (2006). Impacts of biodiversity loss on ocean ecosystem services. *Science* 314: 787-790