

## DESCRIPTIF DE L'UE

<b>MU5MR28</b>	<b>TITRE DE L'UE GESTION &amp; CONSERVATION DES ECOSYSTÈMES MARINS - GECOMAR - MANAGEMENT &amp; CONSERVATION OF MARINE ECOSYSTEMS</b>
<b>6 ECTS</b>	<b>MOTS CLÉS</b> : Marine pollutions, Imposex, Eutrophication, Bio-indicators, Marine-Protected Areas, Good environmental status
<b>M2</b>	<b>RESPONSABLES</b> : Ann ANDERSEN & Pascal RIERA, Station Biologique de Roscoff
	<b>AUTRES INTERVENANTS</b> : Nathalie Simon, Christophe Six, Éric Thiébaud de la Station Biologique de Roscoff, et de Philippe Koubbi (Sorbonne Université, UFR TEB).

## FORMAT DE L'UE

### MODALITÉS D'ENSEIGNEMENT.

This course is open to students from Sorbonne University, but also to students from the International Marine Biological Research on the Sea (IMBRSea), therefore all teaching will be given in English.

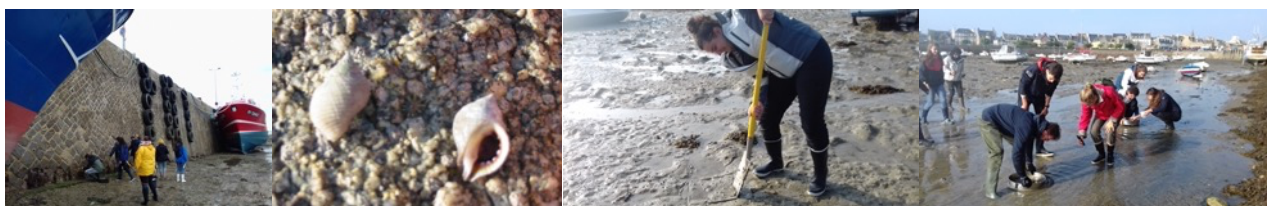
- **Lectures:** 24h dispatched in 3 topics : (1) Sea Pollution / (2) Biotic Indices / (3) Marine Protected Areas (MPA)
- **Practical work:** 36h, from fieldwork-sampling at low tide to the assessment of coastal pollution levels using biotic index calculations from individual to community level (TBT imposex, I2EC, AMBI, harmful phytoplankton assessment...).
- **Seminars by non-academic professionals:** 2 or 3 according to their schedule availabilities, on topics concerning: the implementation of the Water framework Directive and of the Marine Strategy Framework Directive, the Daily work in a Marine Protected Area.

### MODALITÉS D'ÉVALUATION

Assessment type	% Quotation	Modality	Nature
<b>Oral</b>	<b>40%</b>	Work in groups of 3-5 students	Analysis on a given time series (about biotic indices or harmful blooms etc..) presented as a ppt for the class. Each student from each group presents a part of the ppt orally.
<b>Written exam</b>	<b>60%</b>	Individual work	On 2 out of 3 topics proposed about the lectures and the practical work done during the course.

## RÉSUMÉ DE L'UE

This course on management and conservation of marine ecosystems aims to (1) give an overview on the hazardous substances at sea; (2) show how to assess various anthropogenic effects including pollutions on coastal systems, and (3) identify the efficiency and the way to design Marine Protected Areas (MPA), both in coastal and open seas. Lectures are given on these 3 topics, but the main time of the course is devoted to fieldwork and practical assessments of local harbor pollution, eutrophication, and harmful algal bloom. Seminars by non-academic professionals constitute a real opportunity for the students to get in touch with people, who daily works with implementation of the European framework directives and/or manage a MPA. Students will also be trained to use scientific literature to argument pro- & contra- Large Scale MPA, as done by international commissions e.g. for Antarctica.



### OBJECTIFS D'APPRENTISSAGE

At the end of GECOMAR course, the student will be able to:

- give an overview of pollutants at sea, how they circulate and threaten marine ecosystems and human health
- monitor human impacts on marine communities using bioindicators from the Water Framework Directive, and the Marine Strategy Framework Directive.
- assess a pollution level of a harbor from TBT-antifouling paint, eutrophication and phytoplankton bloom
- design a Marine Protected Area with respect to scientific knowledge, and assess its efficiency.
- scientifically argument about MPAs

### PRÉREQUIS

To follow this course, the students must master the bases in oceanography and marine ecosystems, i.e. have followed a course on oceanography and on marine ecology during their first master degree. It is a true advantage if the students are able to identify common species of macrofauna from the shore.

### BIBLIOGRAPHIE / SITOGRAPHIE

#### (1) Sea pollutions: book

- Monaco A & Prouzet P. (2014) Mer et Océans : Vulnérabilité du système océanique. Editions ISTE, 373 pages (in french!)

#### (2) Biotic indices:

- Rombouts I, Beaugrand G, Artigas L F *et al.*, (2013) Evaluating Marine Ecosystem Health: Case studies of indicators using direct observations and modelling methods. Review. Ecological Indicators 24: 353-365.

#### (3) Marine Protected areas:

- Balbar AC, Metaxas A, (2019) The current application of ecological connectivity in the design of marine protected areas. Global Ecology & Conservation 17, e00569.
- **Grorud-Colvert K., Sullivan-Stack J., Roberts C., Constant V. et al.** (2021) the MPA guide: a framework to achieve global goals for the ocean. Science, 373, **eabf0861**, doi: **10.1126/science.abf0861**
- Humphreys J., Clark R.W.E. (2019) Marine Protected Areas. Science, policy and management. Elsevier.

#### Dedicated Websites:

- [www.ospar.org](http://www.ospar.org) for annuals reports on protecting and conserving the North-East Atlantic and its Ressources.
- [www.ccamlr.org](http://www.ccamlr.org) for publication on the Commission for the Conservation of Antarctic Marine Living Ressources.

## FONCTIONNEMENT DE L'UE

The course on Management & Conservation of Marine Ecosystems (GECOMAR) presents lecture overviews, practical works, from the field to the final assessments, and seminars by non-academic professionals to fulfil its three main goals:

- (1) give an overview of pollutions at sea
- (2) assess local environmental status using various biotic indices
- (3) learn how to design Marine Protected Areas and how to assess their efficiency.

- The pollutions overview (1) concerns mainly the threats of the marine ecosystems and human health by hazardous substances: heavy metals, radionuclids, persistent organic pollutants (PAH, PCB, ...), plastics and litter, but also noise etc... How these pollutions evolve and disperse in the environment and through the food-webs, and how various national and international authorities monitor their levels in the seawater and biota.

- The practical works (2) consist in a monitoring of gastropod imposex due to remnant TBT antifouling paint, an assessment of the harbor's eutrophication index, and an assessment of harmful phytoplankton blooms, all using official protocols, as those provided by the monitoring authorities.

- The conservation part (3) deals with an efficient design of Marine Protected Areas both in coastal areas and at high seas, and how this can be assessed. Moreover, one of the teachers (Pr. P Koubbi) has a direct and yearly updated experience in the processes required to implement a Large Marine Protected Area in Antarctica.

As training, the students will have both individual practical work for assessing pollution levels, as well as work in small groups, when analyzing timeseries on biotic indexes, but also a kind of autonomous team management, e.g. when searching scientific arguments for and against MPA implementation. Finally, the seminars by non-academic professionals give them an opportunity to discuss and get a further insight in work with management and conservation of marine ecosystems.

**The teachers and the Biological Marine of Roscoff provides to the students:**

- **Lectures and practical works** are given with duplicated lecture notes containing illustrations to annotate, or with pdf on Moodle, sometimes with text/pictures/videos for further information.

- **A dedicated classroom**, to which students have free access 24h/24h, with microscopes et binoculars for the practical work (1 set per student) and internet connection.

