DESCRIPTION:
The primary aim of this course is to provide a current and comprehensive overview on issues related to plastic pollution at a global level, focusing on plastic accumulation in the Mediterranean Sea. The course explores the many open questions concerning the accumulation, distribution and fate of plastic litter and implications for marine wildlife and humans. A historical synopsis of marine pollution research is provided to appreciate the rapid development of this research field, especially in relation to microplastics. The various primary and secondary sources on microplastics and the pathways through the environment to the ecosystem are examined. Due to the small size and variety of plastic polymers, the detection, identification, and quantification of microplastics are challenging at present; for this purpose, a critical appraisal of the main methods and procedures for the sampling of plastic litter and its composition are evaluated and applied to a specific case study. Chemical, biological, and ecological implications of plastic pollution are also analyzed to allow students to evaluate the deleterious effects on marine wildlife.

The course prepares students to read scientific literature in a critical and objective way, considering the comparability of results obtained from different studies. It provides a deep understanding of the magnitude of plastic pollution in surface waters of the Mediterranean basin as well as a comparison with plastic accumulation in open oceans. The course also covers other specific topics such as plastic aging and degradation; propagation over trophic levels of the marine food web; toxicants associated with plastic debris and how they may affect marine life and human health. The course also considers how plastics compare with other anthropogenic pollutants in terms of ecological risk and the role of society in tackling this matter, with a special focus on procedures to reduce the input of litter into oceans.

CREDITS: 3

CONTACT HOURS: 45

LANGUAGE OF PRESENTATION: English

INSTRUCTOR: Valentina Sciutteri, Ph.D.

PREREQUISITES: None

METHOD OF PRESENTATION:
Lessons include lectures (using slides and videos), class discussions, case studies and field studies.

REQUIRED WORK AND FORM OF ASSESSMENT:
- Class participation 10%
- Short essay 20%
- Presentation 10%
- Reflection paper: 15%
- Midterm exam 20%
- Final exam 25%

Course Participation
A rubric for course participation will be posted on Moodle and shared with students at the beginning of the term.

Short essay
Students will prepare a research essay on one of the topics covered in the course. The essay should be concise yet informative. The written assignment is due on week 5, session 2, by 6.00pm. Students who submit their papers after the deadline will lose 4 percentage points from the essay’s grade. The paper should be a maximum of 1000 words in length (3-4 pages), Times New Roman font (12pt) and should be submitted both electronically (to the Professor’s e-mail) and in paper format to the instructor in class.
Presentation
Students are requested to give a presentation to the class on their research topic (maximum of 5 minutes per student).

Reflection paper
Students will analyse and reflect on a specific topic, supporting it with their observations as well as using scientific concepts acquired during the course. The reflection paper is due on week 8, session 1, by 6.00pm. Students who submit their papers after the deadline will lose 4 percentage points from the paper’s grade. The reflection paper should be a maximum of 800 words in length (2-3 pages), Times New Roman font (12pt) and should be submitted both electronically (to the Professor’s e–mail) and in paper format to the instructor in class.

Midterm exam
Written test with both multiple-choice and open-ended questions.

Final exam
Written test with both multiple-choice and open-ended questions.

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

- Develop the concept of plastic as a complex and dynamic structure that changes its bioavailability
- Outline and discuss scientific concepts and methodological approaches concerning plastic sampling
- Identify the chemical, biological, and ecological factors that may affect marine ecosystems and human health
- Define the plastic pollution issue in areas with high human pressure, such as the Mediterranean Sea
- Analyze and evaluate data from scientific outputs
- Define and appreciate the specific contribution of Italian researchers to the international field of plastic characterization
- Discuss and critically evaluate the ecological risks associated with plastic pollution
- Identify the initiatives in tackling this global issue

ATTENDANCE POLICY:
Attendance is mandatory for all IES Abroad Rome classes, including field studies. If a student misses more than one class in this course, 2 percentage points will be deducted from the final grade for every additional absence. Any exams, tests, presentations, or other work missed due to student absences can only be rescheduled in cases of documented medical or family emergencies. IES Abroad Rome will only consider extreme emergency cases and will strictly adhere to this policy. Do plan your semester accordingly.

CONTENT:

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<tr>
<th>Week</th>
<th>Content</th>
<th>Assignments</th>
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<tbody>
<tr>
<td>Session 1</td>
<td>Introducing plastic pollution: an insight into the issue Distribution and composition</td>
<td>• Galgani F., Hanke G., Maes T. (2015) <em>Global Distribution, Composition and Abundance of Marine Litter</em>. In: Bergmann M., Gutow L., Klages M. (eds) Marine Anthropogenic Litter, pp. 29-56 <a href="https://doi.org/10.1007/978-3-319-16510-3_2">https://doi.org/10.1007/978-3-319-16510-3_2</a> (21 pages)</td>
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<td>Session 5</td>
<td>Physical, Chemical, and Biological Effects of Microplastics</td>
<td>• Duis and Coors (2016) <em>Microplastics in the aquatic and terrestrial environment: sources (with a specific focus on personal care products), fate and effects</em>. Environmental Sciences Europe, 28:2 DOI 10.1186/s12302-015-0069-y (36 pages)</td>
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</table>
• J. Wang et al. (2016) *The behaviors of microplastics in the marine environment*. Marine Environmental Research, Volume 113 (2016) pp 7-17 (10 pages) http://dx.doi.org/10.1016/j.marenvres.2015.10.014

**Session 6**

**Ingestion of Plastics: A Critical Appraisal on a Case Study**


**Session 7**

**The Role of Plastics as Vector for Pollutants**


**Session 8**

**An Experimental Approach to Study the Chemical Behavior of Plastics**


• F. Rendell-Bhatti et al. (2021) *Developmental toxicity of plastic leachates on the sea urchin Paracentrotus lividus*. Environmental Pollution, Volume 269, 115744, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2020.115744 (17 pages)

| Session 10 | Class presentations | Deadline for short essay submission |

• Galloway, T., Cole, M. & Lewis, C. *Interactions of microplastic debris throughout the marine ecosystem*. Nature Ecology & Evolution, Volume 1, 0116 [https://doi.org/10.1038/s41559-017-0116] (8 pages)

| Session 12 | Midterm exam |


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<td>Deadline for reflection paper submission</td>
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https://doi.org/10.1007/978-3-319-16510-3_15  
DOI: 10.2305/IUCN.CH.2014.03.en |
https://doi.org/10.1007/978-3-319-61615-5_13 (25 pages) |
| Session 20 | Project description: #Pescaplastica, whose aim is to develop a virtuous model for the management and use of marine waste, fully implementing the concept of circular economy. | • https://www.ismed.cnr.it/en/pescaplastica |
| Session 22 | Course-related trip:  
A PLASTIC FREE BEACH DAY in Fiumicino |
|-----------|---------------------------------------------------|
| Session 23 | Discovery of Biopolymers and Their Biodegradable Applications  
| Session 24 | Screening of Videos on Bioplastics and Discussion  
Final review  
Final exam  
[https://www.youtube.com/watch?v=_eGOyAInIQ](https://www.youtube.com/watch?v=_eGOyAInIQ) |

**COURSE-RELATED TRIPS:**
- REMAPLAST s.r.l.: students will visit this plastic recycling plant and learn about the plastic recycling process.
- PLASTIC FREE BEACH DAY (Fiumicino): students will participate in a beach clean-up daytrip to Fiumicino.

**REQUIRED READINGS:**


• J. Wang et al. (2016) The behaviors of microplastics in the marine environment. Marine Environmental Research 113 (2016) 7-17 http://dx.doi.org/10.1016/j.marenvres.2015.10.014


• Rochman C.M. (2015) *The Complex Mixture, Fate and Toxicity of Chemicals Associated with Plastic Debris in the Marine Environment*. In: Bergmann M., Gutow L., Klages M. (eds) Marine Anthropogenic Litter. Springer, Cham. [https://doi.org/10.1007/978-3-319-16510-3_5](https://doi.org/10.1007/978-3-319-16510-3_5)

