



Intellectual Output 4

Curricula on Recycling

Part B

MICROPLASTICS AND MARINE LITTER

Course Outline

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1. Aim of the course

This course aims to introduce the students to the problem of microplastics in the environment and marine litter by identifying their main sources, pathways and impacts on the marine environment. Emphasis is given to the practices that are followed by participating countries to eliminate plastic in different aspects of society (e.g. reduction). Terms such as single use plastics, micro plastics and transforming plastic litter into useful products will be clarified.

2. Learning outcomes

The skills that students will be expected to acquire after the end of the course are:

- Be familiar with the term marine litter and identify their main sources
- Knowledge of plastics' role in marine littering
- Knowledge of microplastic and problems caused by them
- Knowledge of practices to eliminate plastic at the participating countries
- Acting as society members to help avoiding marine litter
- Knowledge of actions taking place in our country
- Understanding the importance of acting locally

3. Teaching and Learning Methods

3.1 Teaching approach

A comprehensive transfer of knowledge and experiences to students through mental and experiential understanding of microplastics and marine litter and their environmental impact.

3.2 Delivery method

Face-to-face, distance learning and use of audiovisual material.

3.3 Sessions

1. Human pressure on marine environment
2. Marine litter
3. Plastic in the environment
4. Microplastics
5. Environmental impacts of marine litter
6. What has already been done?
7. What can we do?
8. Activity

Description

Understanding the term of “marine ecosystem”. Marine ecosystems include: the abyssal plain (areas like deep sea coral, whale falls, and brine pools), polar regions such as the Antarctic and Arctic, coral reefs, the deep sea (such as the community found in the abyssal water column), hydrothermal vents, kelp forests, mangroves, the open ocean, rocky shores, salt marshes and mudflats, and sandy shores.

- <https://www.nationalgeographic.org/media/marine-ecosystem-illustrations-grades-3-5/>
- <https://biologydictionary.net/marine-ecosystem/>

Understanding of human pressures on the marine environment

- Fishing pressure may currently being reduced but decades of overfishing have affected ecosystems’ integrity.
- Damage to sea floor habitats is likely to increase with growth in maritime activities.
- Pollution by nutrient enrichment and contaminants remains an environmental challenge.
- Non-indigenous species are spreading and their impacts are not fully assessed.
- Marine litter and underwater noise are adding pressures but are still poorly understood.
 - <https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/marine-environmental-pressures>



Figure 1: Litter in the coastal zone

Important points that need to be stressed:

Marine ecosystem

- Different types of marine ecosystems

- Lakes
- Rivers
- Seas
- Oceans
- Different types of human pressure

Interaction 1. Use of questionnaires in order to compare their knowledge before and after the program. – an example is provided in Annex 1.

Session 2	Marine litter
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Description

Marine litter is defined as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment.

- <https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/marine-litter>
- https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

Marine litter originates from many sources and is responsible for a wide range of environmental, economic, safety, health and cultural impacts. The very slow rate of degradation of most marine litter items, mainly plastics, together with the continuously growing quantity of the litter and debris disposed, is leading to a gradual increase in litter found at sea and on the shores.

- <https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/marine-litter>
- https://www.marinelittersolutions.com/about-marine-litter/frequently-asked-questions/?gclid=Cj0KCQjwzN71BRCOARIsAF8pjfgYA1eN9IJJb--64MRpWnLjDswrzF1Ky8G9Ztc9cCNJe9rtnPBRYAaAjQpEALw_wcB

TOP 10 TRASH FOUND IN THE WORLD'S OCEANS

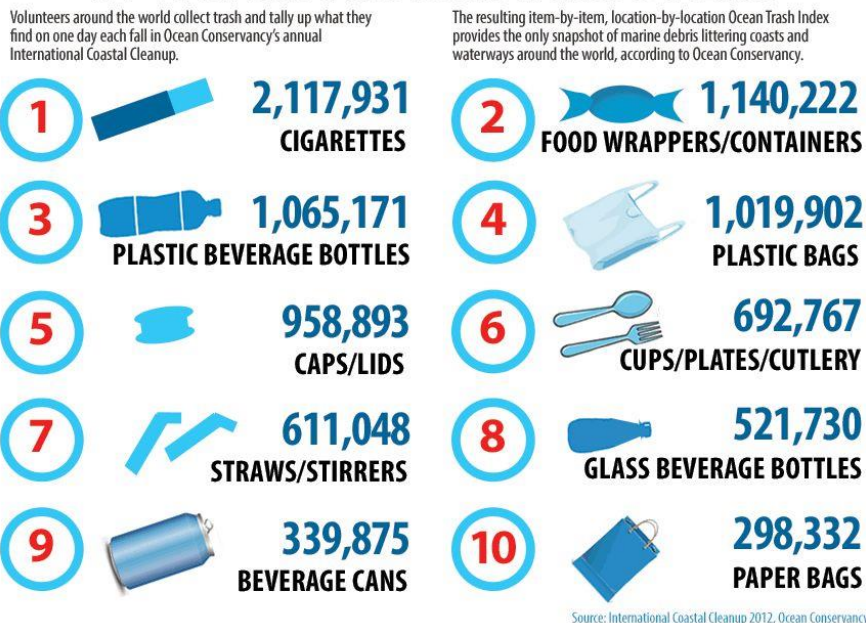


Figure 2: Top 10 trash found in the world's oceans

- <https://www.marinelittersolutions.com/about-marine-litter/what-is-marine-litter/>
- https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/MSFD_identifying_sources_of_marine_litter.pdf

Marine litter biodegradation timeline: How long does it take for a bag, a bottle, a cup? Some days, months, years or even more?



Figure 3: Estimated decomposition rates of common marine litter

- https://www.youtube.com/watch?v=4uu4cBfjFA8&feature=emb_logo

Session 3	Plastics in the environment
Description	

Understanding the meaning of plastic. Word plastic means give shape in greek language. This explains different shapes plastic products have. Knowledge of plastic evolution during time. Everywhere you look, you will find plastics. We use plastic products to help make our lives cleaner, easier, safer and more enjoyable.

<https://www.plasticseurope.org/en/about-plastics/what-are-plastics>

What did humans use before plastic?

<https://science.howstuffworks.com/plastic1.htm>



Figure 4 The lifecycle of plastic

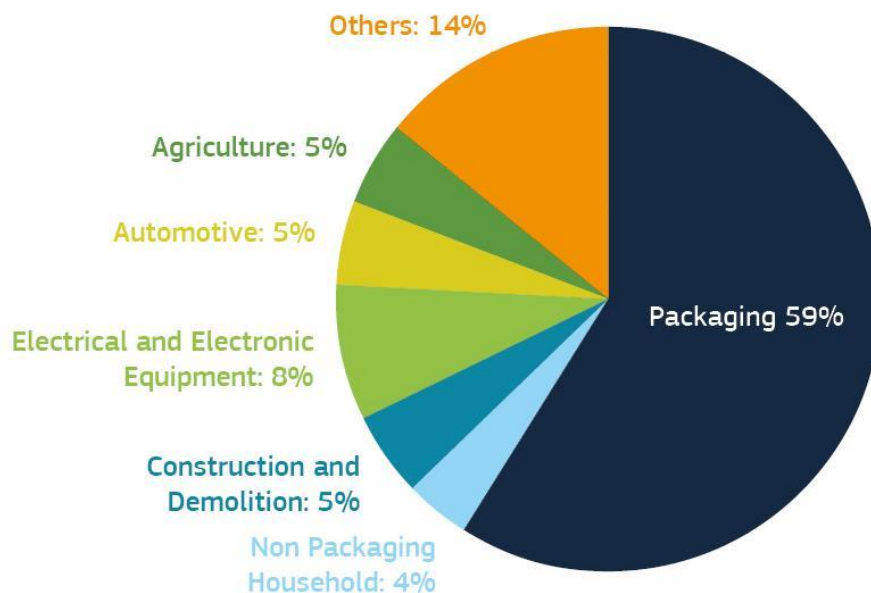
CONSIDERED SOURCES

YEARLY WORLD CONSUMPTION AND TYPE OF LOSS

SOURCES	WORLD CONSUMPTION <small>KTONS / YEAR OF PLASTIC</small>	INTENTIONAL LOSS	REFERENCES
 PLASTIC PELLETS	257,000	NO	Plastics Europe (2007)
 SYNTHETIC TEXTILES	42,534	NO	FAO/ICAC (2013)
 TYRES	6,431	NO	ETRma (2010)
 ROAD MARKINGS	588	NO	Grand View Research, Inc. (2016)
 MARINE COATINGS	452	NO	Coatings world (2012)
 PERSONAL CARE PRODUCTS	42	YES	Leslie, H.A. (2015)

Figure 5: Kinds of plastics in the marine environment

EU PLASTIC WASTE GENERATION IN 2015



Source: Eunomia (2017)

Figure 6: EU plastic waste generation in 2015

Basic topics for analysis:

- Statistics
- Kinds of plastics
- Plastic litter biodegradation time

Some videos

- <https://www.youtube.com/watch?v=6xINyWPpB8&t=4s> (What really happens to the plastic you throw away)
- <https://www.youtube.com/watch?v=XWxtlqHjxvo> (Kids against plastic)

Session 4

Microplastics

Definition of Microplastics: The term is generally referring to **plastic particles between 0.33 mm and 5 mm in size**. Microplastics can originate from a variety of sources including: microbeads from personal care products; fibers from synthetic clothing; pre-production pellets and powders; and fragments degraded from larger plastic products. https://www.marinelittersolutions.com/about-marine-litter/what-are-microplastics/?gclid=Cj0KCQjwzN71BRCOARIsAF8pjfg5LtsI9vK9mRrNnxT4V37IRFSp17qHCwdS1vKZobv3qAF4F-EauQaAgMHEALw_wcB

Types of microplastics:

- **Primary microplastics** are manufactured as microbeads, capsules, fibers or pellets. Examples include microbeads used in cosmetics and personal care products, industrial scrubbers used for abrasive blast cleaning, microfibers used in textiles, and virgin resin pellets used in plastic manufacturing processes.
- **Secondary microplastics** are the result of larger pieces of plastic breaking down into smaller pieces. This occurs when plastic debris is exposed to sunlight and the plastic begins to weather and fragment.

https://marinedebris.noaa.gov/sites/default/files/MicroplasticsOnePager_0.pdf

Impacts of microplastics:

1. Marine environment
2. Food & Health
3. Climate change
4. Tourism

<https://www.iucn.org/resources/issues-briefs/marine-plastics>

Pathways: A path, root or way litter reaches the marine environment

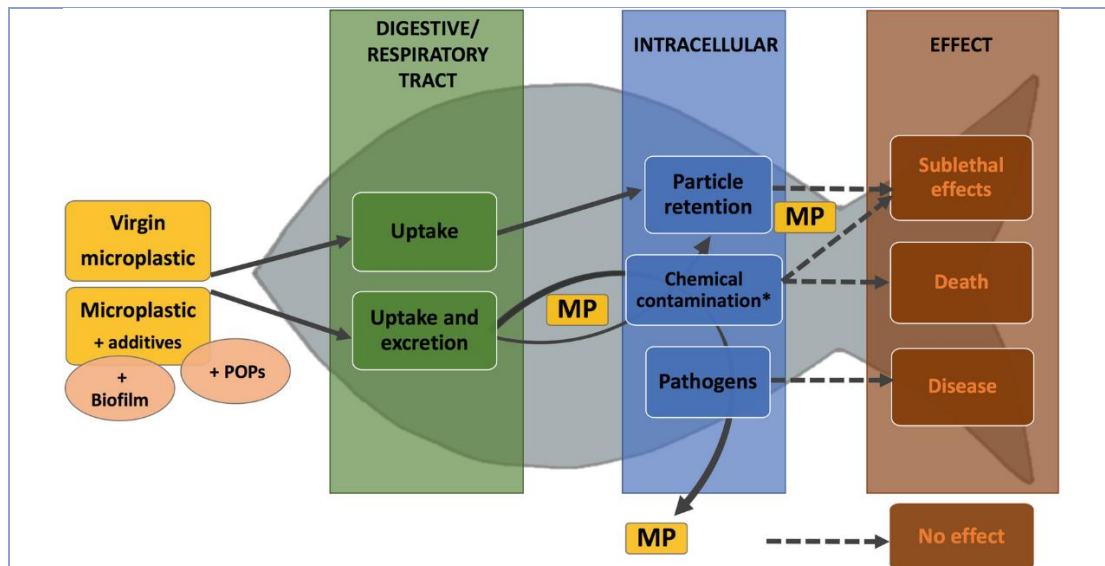


Figure 7: Microplastic's pathway

https://link.springer.com/chapter/10.1007/978-3-030-20389-4_6

Youtube video:

- <https://www.youtube.com/watch?v=ijsrmFUmyh4>
- <https://www.youtube.com/watch?v=Hh1cGaVZL2s&t=17s>

Session 5	Environmental effects of marine litter
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Marine litter has an impact on:

- Impacts on fisheries and aquaculture
- Impacts on shipping and ports
- Clean-up costs of floating, seafloor litter and beach
- Reduction of aesthetic value and beauty of the coast
- Perceptions of society about marine litter
- Human health risks
- Ecosystem services
- Harm to biota
- Socioeconomic harm

<https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104308/lbna28317enn.pdf>

Videos:

- <https://www.youtube.com/watch?v=IQQajO5yIUe> (How plastic in the Ocean impacts your health)
- <https://www.youtube.com/watch?v=017bBeXhYz4>
- <https://www.youtube.com/watch?v=017bBeXhYz4>
- <https://www.youtube.com/watch?v=dfY30uNXkvo> (A Plastic Ocean)
- <https://www.youtube.com/watch?v=xFPoIU5iiYQ>
- <https://www.youtube.com/watch?v=UXnTRgddvGY>

Session 6	What has already been done?
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- a) **Presentation of EU laws against plastic pollution** (Directive (EU)/2015/720) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32015L0720>
- b) **Project's Presentation**
 - i. PTwist (transforming plastic Aristotle University) <https://ptwist.eu/>
 - ii. In Europe AZORES PROJECT- collection of marine litter and finding ways to transform it into a product <https://www.wastefreeoceans.org/transforming>
- c) **Companies activity against plastic pollution**

- i. Barilla cutting plastic from its packaging
https://circulareconomy.europa.eu/platform/sites/default/files/plastic_pl edge_statement_barilla.pdf, <https://www.barillagroup.com/en/groups-position/barilla-principles-sustainable-packaging>
- ii. Print your city COCA COLA 3D printing from plastics
<https://www.coca-cola.gr/zero-waste-future/print-your-city-ta-skoupidia-sou-o-thisauros-mou>
- iii. 1st ski resort in Italy banning plastic
<https://edition.cnn.com/travel/article/italy-plastic-free-ski-resort-trnd/index.html>
- iv. Plastic free flights Portugal
<https://en.reset.org/blog/portuguese-airline-starts-trialling-plastic-free-flights-01242019>

d) Organizations

- i. Greece Aegean Rebreath: clean seas <https://www.aegeanrebreath.org/en/>
- ii. Greek action against plastic cups meaning “In my cup” promoting reusable cups against single-use plastic <http://stopotirimou.gr/>
- iii. <https://www.aclcf.org/>
- iv. <https://www.letsdoitworld.org/>
- v. Reducing our environmental footprint
https://cest2019.gnest.org/sites/default/files/NEWSLETTER4-2_FINAL.pdf

Session 7

What can we do?

A drop in a plastic ocean: how one person can make a difference

<https://www.youtube.com/watch?v=3UqkgRGPqsk&t=607s>



Figure 8: Basic triangle

Basic steps to success

1. Get informed about plastic pollution and its impact on their own community, the country and the world.
2. Promote internalization of concepts and environmental values associated to the problem of plastic pollution.
3. Empower your community with the civic engagement skills necessary to take action to help end plastic pollution.

<https://www.earthday.org/what-you-can-do-to-end-plastic-pollution/>

<https://www.earthday.org/plastic-pollution-calculator-2/>

Session 8

Activity

Students search in the web and find out what is the current situation in their countries about plastic waste and marine litter. Contact Let's do it Greece, Italy and Portugal for a cleanup of a beach. (Links are provided below)

<https://www.letsdoitaly.org/>

<https://www.letsdoitgreece.org/>

<http://www.amoportugal.org/>

The schools with their students could organize a day (a campaign) (open to the public) and inform as many people as possible about the great significance of replacing single use plastics in their everyday life and reducing marine litter in general. They could have a logo saying something like "Say no to single use plastic but say yes to a healthier ocean"



Figure 9: Cleanup marine environment with kids

Discussion

Description

Evaluation questionnaire to compare the knowledge they gained with the knowledge they already had. *

Discuss with kids what they learn after all sessions

4. Educational material (materials / sources / resources required to complete the course)

- ❖ Websites
- ❖ Course material

The reference material, the literature review, the proposed supplementary literature and everything else concerning the educational material will be uploaded on the platform and will be available to the public.

4.1 Keywords

Marine Pollution, Marine litter, Microplastics, Impacts, Sources, Pathways

4.2 "Flow Chart of Teaching"

In order to evaluate teaching, trainers should take into account the relevance of the goals they have set with the available time dedicated for the completion of the lessons.

They are called, in a limited time, to balance between the teaching objectives that the curricula requires and the pupils' educational needs. In order to respond to this double obligation it is necessary to make a planning of the steps they intend to follow in teaching.

In any case, the "Flow Chart of Teaching" is presented below:

Introduction → Human pressure on marine environment

Marine litter → Definition & Main Sources

Plastic in the environment → Kinds of plastics & Biodegradation time line

Microplastics → Definition & Pathways

Environmental effects of marine litter → What is the impact of marine litter in every aspect of life

What has already been done → Presentation of EU legislation, companies' activities & organizations

What can we do → Basic steps to success

Activities → Beach clean-up & school campaign

Discussion → Assessment of teaching

***Sample of questionnaire**

Gender:

Age:

- 1) Do you know what marine litter is? Yes or No
- 2) Which of the following items are commonly found on seas? (Choose more than 1)
 - Paper
 - Plastic bottles
 - Straws
 - Cigarettes
 - Batteries
 - Fish net
- 3) Have you ever throw your litter in the street? Yes or No or Sometimes
- 4) Do you believe that marine litter has effects on your health? Yes or No or Sometimes
- 5) How important do you think clean ocean for plastic is? Not at all or A little or Quite or Very much