



DG ENV/MSFD Second Cycle/2016

BIODIVERSITY, MARINE NOISE, MARINE LITTER

Background material-scientific game



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This booklet serves as background material to be used in the context of MEDCIS project - Activity 5: Promotion and dissemination. The editorial project has been produced by Salento University.

Find more information on the project website www.medcis.eu.



Table of contents

Part I: Biodiversity



- What is biodiversity?
- Loss of biodiversity
- Marine biodiversity

Part II: Marine noise

- Acoustic noise
- What are the main sources of energy in the marine environment?
- Why should we pay attention to the introduction of energy?
- What kind of damage does underwater noise cause?



Part III: marine litter



- Overview on marine litter
- Main sources of marine litter
- Plastics - The Ocean menace

BIODIVERSITY

Have you ever been in a forest, populated by different species of plants and animals? Think for a moment to be there, take a look around, the land, the trees, listen to the sounds of the animals, imagine if you could be a part of that forest ... well, actually you are part of it! This way it will be easier to understand what we are about to tell.



What is biodiversity?

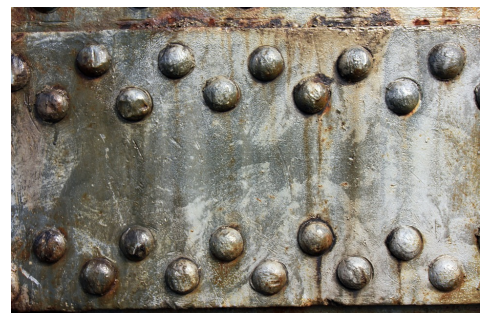
Life on Earth is in an amazing wonderful spectrum of sizes, colors, shapes, life cycles and interactions. As we all know, we share the planet with other truly remarkable diverse plentiful organisms: each one contributes to increase the variety of the world in which we live. It is a great experience starting an explorative journey to discover the different species of organisms and find out the ecological relationships that give the biosphere its productive features. However all ecological systems have to be able to support

themselves in order to keep their species' variety. Biological diversity is one of the most valuable goods of our planet. It is the richness of nature that provides us with food, clothes, and medicines, with clean water and protection from natural hazards. Neglecting biodiversity, however, could provoke crop collapses, thirst, diseases and disasters. Think about it and you will understand that protecting biodiversity is critical to maintaining and improving our quality of life.

Loss of diversity - The ecologists Paul and Anne Ehrlich have compared the loss of biodiversity to the removal thousand rivets (the nails that hold the panels together) from the wings and fuselage of an airplane (HYPOTHESIS OF RIVET).



If one begins to take them off, convinced that there are thousands more than necessary, it may happen that, at a certain point, the wings break down and the aircraft crashes suddenly. In a similar way, many human activities bring



species to the brink of extinction, without even giving the me to realize which role they play in the ecosystems. Generally speaking more alterations of important processes and functions take place in the same ecosystems, higher becomes the risk of ending up like that reckless guy who had taken o too many rivets from the wings of the plane!

What are the causes of the loss of biodiversity? The cause of loss of biodiversity are essentially five (Barbiero, 2017):

- ✓ destruction of natural habitats of the species;
- ✓ the invasion of alien species;
- ✓ the pollution;
- ✓ the human overpopulation;
- ✓ the exploitation of resources.

Marine biodiversity

The range of marine biological life is hard to imagine. Some marine organisms can live in extremely cold environments, such as in sub-zero waters in polar regions, or within sea-ice, whereas others live in extremely hot habitats, such as

hydrothermal vents, where cracks in the earth's crust cause geothermal heating of bottom seawater, up to 400°C. Some organisms live in shallow waters, where there is high exposure to sunlight, whereas others thrive in the deep sea, where there is no light at all.

We often see underwater images showing extremely colourful coral reefs, fish and invertebrates. However, marine life starts with tiny bacteria, viruses and single-celled plants, or plankton, which convert energy from the sun and transform it into food for other small animals in the water column.

Plankton are preyed upon by larger animals, such as small fish and other invertebrates. These in turn constitute the food of mammals, large fish, such as sharks, and reptiles, such as sea turtles.

With Descriptor 1, the Marine Directive aims to ensure that biodiversity is "maintained", that is, kept in line with the natural state appropriate to the area in question, and also corresponding to the large-scale, on-going climatic changes, which we are unable to regulate.

MARINE NOISE



The EU's Marine Strategy Framework Directive (2008/56/EC) requires the setting of objectives ensure that the "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment."

When we speak about introduction of energy, we refer to light, electricity, heat, noise, electromagnetic radiation, radio waves or vibrations. Building the foundations of an offshore platform using pile driving for instance is the source of a lot of energy releases, whether in the form of noise or vibrations.

Although energy is a natural process, it does not always have a positive effect on other natural processes. Human activities can take a disproportional amount of energy out of a system or add to it. This can have a negative impact on the marine environment.

Acoustic noise

From an ecological perspective, noise can be defined a sound characterized by poor information (high level of vibrational disorder) that masks other sounds and that affects in such a way the active space used by terrestrial and aquatic animals for acoustic communication. From a human perspective, noise is defined an unwanted/unpleasant sound and considered a type of environmental pollution (A. Farina, 2015).



What are the main sources of energy in the marine environment?

Human sources of energy in the marine environment are commonly related to transport, mining and fishing and construction. The effects of recreation and industries can also be experienced in coastal waters.

Sources of energy include:

- Shipping for trade or tourism, like ferries or cruise ships, recreation boats and fishing boats, which all produce noise;
- The use of sonar systems by all kinds of vessels;
- Construction (especially through piling) of offshore oil and gas platforms and wind parks;
- Dredging for shipping lanes, sand mining and for laying pipes and cables;
- Operation of platforms and their lights;
- Cable connections between offshore activities, the main land and between power stations, causing electromagnetic radiation;
- Cooling water systems for industry, which raise water temperature;
- Military activities, which produce noise.

Why should we pay attention to the introduction of energy?

Generally, the strongest effects from these activities on the marine environment are caused by underwater noise. Heat can also be an issue in the case of cooling water systems. Finally, electromagnetic radiation can be expected in the case of activities related to electricity. Yet, there is very little information on the effects of electromagnetic fields on marine life. Most studies have dealt with underwater noise.

Impacts of man-made energy on the marine environment are related to the prevalence and timing of any

activity as well as the distribution and abundance of sensitive marine life. For instance, in the case of offshore construction, shipping activities and pile driving (i.e. foundation building) add noise to the already established ambient noise levels. The disturbance from shipping (from fishing and recreational vessels) lies in particular in the fact that the noise



input from these activities can be continuous. Loud impulse noise and

ambient (continuous) noise should therefore be distinguished.

What kind of damage does underwater noise cause?

Attention has been raised on the topic of underwater noise and its effects on marine life. Yet, the effects of underwater noise are not fully understood. One reason for this is that only for a few species of mammals and fish, tests have been performed to identify hearing range and sensitivity.

But even if an individual hears the noise, we are not sure how it will react or what damage will be done. It could avoid the source and be chased out of important areas, for example

spawning grounds. It might influence its ability to detect food. Its hearing could get damaged at close ranges with further effects on communication about food, danger and reproduction. Research proved that marine fauna certainly do experience effects from noise exposure. It has been established for example that stranding incidents in beaked whales were caused by underwater noise from military activities.

MARINE LITTER



Would you throw your rubbish on the street? We don't think so! The rubbish that ends up in the marine environment is dangerous for all the animals, including birds. They can get entangled in lost or abandoned fishing nets and some species of birds mistake bottle caps for food and eat them!

Overview on marine litter

The Marine Strategy Framework Directive (MSFD) sets the framework for Member States to achieve by 2020 Good Environmental Status (GES) for their marine waters, considering 11 descriptors. One of these descriptors (descriptor 10) focuses on marine litter, stating that GES is achieved only when "properties and quantities of marine litter do not cause harm to the coastal and marine environment".



Turtle ingesting plastic.

Photo: Ron Prendergast, Melbourne Zoo

Over 80% of marine pollution comes from land-based activities. From plastic bags to pesticides - most of the waste we produce on land eventually reaches the oceans, either through deliberate dumping or from run-off through drains and rivers.

Marine debris or marine litter has long been a problem and threat to marine life. Marine mammals, seabirds and fish die each year from being entangled in or ingesting marine litter.

Often the marine litter is derelict nets and ropes or plastic packaging material and containers. Plastic strapping bands can also be dangerous for inquisitive marine animals like seals and dolphins causing cuts in their skin around their necks or fins. Many marine animals and seabirds can also mistake litter items for prey that can lead to choking and blocking the breathing passages and stomach. (wwf.panda.org)

Main sources of marine litter are (e.u):

Land-based:

- ✚ land-fills
- ✚ rivers and floodwaters
- ✚ industrial outfalls
- ✚ discharge from storm water drains
- ✚ untreated municipal sewerage
- ✚ littering of beaches, coastal areas (tourism)

Sea-based:

- ✚ fishing industry
- ✚ shipping (e.g. transport, tourism, fishing)
- ✚ offshore mining and extraction
- ✚ illegal dumping at sea
- ✚ discarded fishing gear

Plastics - The Ocean menace

For the natural environment, plastic is a foreign body and does not biodegrade.

Pieces smaller than 5mm in size are called microplastic. Sources for microplastics in the ocean include cosmetic products, textiles such as fleece jackets, rubbish washed from land and ships that dump their plastic waste in the ocean (even though it is prohibited).

The fishing industry accounts for 10% of marine debris. Nets and fishing gear get lost or are thrown away into the ocean. These "ghost nets" continue trapping fish for many decades. Plastic can transport plant and animal species across great distances to other regions.



These passengers unsettle the balance of the sensitive ecosystems of their destinations. Plastic can also cover coral, marine sponges and mussel beds, preventing species from populating them and cutting off marine organisms from the exchange of oxygen.

Useful link

BIODIVERSITY: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-1/index_en.htm

MARINE NOISE: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-11/index_en.htm

MARINE LITTER: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

Riferimenti

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., ... Nykvist, B. (2009). A safe operating space for humanity. *nature*, 461 (7263), 472-475.

Barbiero, G. (2017). *Ecologia affettiva. Come trarre benessere fisico e mentale dal contatto con la natura*. Milano, Mondadori.

Link utili

www.medcis.eu

www.ec.europa.eu



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SUPPORT MEDITERRANEAN MEMBER STATES TOWARDS COHERENT
AND COORDINATED IMPLEMENTATION OF THE SECOND PHASE OF THE MSFD



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