Waste and Pollution

Topic summary:

This chapter deals with various environmental problems encountered in the Mediterranean Basin due to the impacts of pollution in terrestrial and marine ecosystems.

Main concepts covered:

* Plastic waste
* Shipping pollution
* Spillage – sewage
* Nutrient pollution

Transversal competences acquired:

* Communicating orally / writting in mother/foreign language
* Managing information
* Getting organized and planning
* Mobilizing reasoning

Definition of key notions:

Spillage:

In industrial pollution, it is the loss of production output due to production of a serie of defective or unacceptable products which must be rejected.

Sewage:

Is a type of wastewater that is produced by a community of people. It is characterized by volume or rate of flow, the physical condition, the chemical and toxic constituents, and its bacteriologic status.

Nutrient pollution:

Is the process where too many nutrients, mainly nitrogen and phosphorus, are added to bodies of water and can act like fertilizer, causing excessive growth of algae.

Eutrophication:

Is when a body of water becomes overly enriched with minerals and nutrients which induce excessive growth of algae.

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Introduction of the topic:

The well-being of the Mediterranean Sea and its coast is affected by activities causing pollution to the marine environment and the regional resources needed for both human beings and a large variety of marine organisms 80% of the pollution in the Mediterranean Sea comes from the inland. Moreover, the excessive international sea-borne trade has significant pressures to the marine environment of the region, such as water borne diseases. This is due to the introduction of harmful aquatic organisms including human pathogens, and ads up to the already known shipping issues like CO2 emissions, and substances causing indirect pollution incidents. Finally, another extremely important threat comes from the impact of the unrestrained development and the lack of management in the Mediterranean Sea.

To enable students to understand and learn about the impacts of pollution in the Mediterranean Basin, a series of themes are presented below. These themes refer to the various types of pollution that the Mediterranean region is facing as well as other issues relevant to the pollution prevention.

The student will be able to communicate more effectively about pollution issues such as soil, water, air pollution, pollution from plastics, pressures from nutrients, waste and oil spills, pollution prevention and treatment, etc.

Sustainable development issues identified in this topic:

Environmental pollution with its health impacts is a key issue for sustainable environment. Healthy oceans are productive oceans, and resilient marine and coastal ecosystems are essential to achieve sustainable development.

1. Industrial waste and oil Spills

During the high season (from May to September), and mainly as a result of intense tourism, the Mediterranean coastlines and beaches present 250,000 pieces of rubbish per day per square kilometre. This amount increases to 316,000 pieces of rubbish per day per square kilometre during July and August, to be compared with an average of 81,000 pieces per day during low season (EFEVERDE, 2018).

It is estimated that 80% of marine contamination originates on land, and 20% comes straight from direct discharges into the sea. The main land-based sources of waste are refuse from unprocessed water and storms. More precisely they are residue from landfills located near the coast or transported through waterways, and rubbish left behind by residents and tourists.

When the waste comes from sources of discharges and spills at sea, the main source is dumping from vessels (merchant vessels, ferries, cruise ships, recreational boats, fishing boats etc.) and oil platforms.

Furthermore, abandoned fishing gear is particularly damaging, such as pieces of drift nets, long lines, and so on.

Eutrophication is a process driven by enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus. It leads to: an increased growth of primary production and biomass of algae; changes in the balance of nutrients causing changes in the balance of organisms; and the water quality degradation. Seawaters depending on nutrient loading and phytoplankton growth are classified according to their level of eutrophication. Low nutrient/ phytoplankton levels characterize oligotrophic areas; water enriched in nutrients is characterized as mesotrophic; whereas water rich in nutrients and algal biomass is characterized as eutrophic. The Mediterranean is one of the most oligotrophic seas in the world and most of its biological productivity takes place in the euphotic zone (UNEP, 1989, UNEP/MAP, 2012).

Over the last period of time, countries throughout the world have experienced an intensive trend in problems associated with Harmful Algal Blooms (HABs) commonly known as “red tides”. Such impact mainly comes from anthropogenic inputs (for EU waters) or from upwelling of nutrients (U.S. waters), both of them being associated with eutrophication phenomena (Anderson et al., 2002, Smayda, 1989, 1990). Eutrophication has two modes of ecosystem impact, primary and secondary, with the impacts of nutrient disturbance further influenced by other habitat conditions (Smayda, 2004). Direct effect of nitrification influences phytoplankton (abundance and species) and the indirect effect impacts the upper trophic level. Impacts include: mass mortalities of wild and farmed fish and shellfish; human illness and death from contaminated fish or shellfish; death of marine mammals, seabirds, and other animals; and the alteration of marine habitats or trophic structure (EU-USA Scientific Initiative on Harmful Algal Blooms). HABs species despite being able to be resistant to a large range of grazing, they are still influenced by high nutrient input (eutrophication). The most important areas in marine ecosystems are the coastal ones where pollutants are released in huge amounts often without any

control or adequate treatment. The points that need to be considered especially in the Mediterranean waters are parameters such as high temperatures, small tidal regimes, eutrophication, primary production (phosphate limited waters), freshwater inputs (limited water exchange), biodiversity, and anthropogenic pressure (tourists) (Smayda, 1989). All these parameters make the Mediterranean Sea susceptible to anthropogenically induced substances.

2. Plastics waste

The Mediterranean Sea is the cradle of civilization and one of the most culturally diversified places on Earth. It is also characterized by one of the highest rates of plastic contamination found worldwide.

In the Mediterranean Sea, plastic accounts for 95% of waste found in the open sea, on the seabed and on the beaches. This amount of rubbish mainly comes from Turkey and Spain, followed by Italy, Egypt and France.

Even if the Mediterranean Sea only represents 1% of the water on the planet, it is a semi-enclosed sea that supports a large amount of human activity. As a result, it becomes a trap for plastic and holds 7% of all the microplastics present in the world (according to the WWF).

Larger pieces of plastic damage, choke and kill marine animals, including protected species and those near extinction, such as sea turtles. However, microplastics, being much smaller and treacherous, have reached a record level in the Mediterranean Sea. The concentration of microplastics is at least four times as high as in the rubbish island located in Northern Pacific. As these fragments enter into the food chain, they become a threat for an ever-increasing number of species as well as human beings.

These minuscule microplastics are ingested by fish and other organisms being later consumed by humans. On average, it is estimated that a European might eat some 11,000 pieces of microplastics in one year.

Finally, plastic is not biodegradable and consequently it remains in the environment for millions of years. Thus, this issue is considered as a global emergency.

3. Shipping and pollution in ports

Speaking of the global maritime transport, statistics on the international fleet state that there are about 100,000 vessels in 45,000 harbours around the world. This generates 900 million tons of CO2 emissions, corresponding to those of 200 coal-fired power plants – nearly 7% of the total CO2 emissions. However, they also emit SOx (sulphur oxide), NOx (nitrogen oxide) and particles into the atmosphere, substances that are highly toxic for the public health and dangerous for the environment.

Ships are the main producers of sulphur emissions, as they come from fuel. In fact, during the last 20 years they have produced more than twice the amount of greenhouse gases derived from airplanes. A study from ANSA revealed that air pollution produced by ships is responsible for the death of 6,000 people every year, while causing environmental damage (which is fatal in many cases). Adding to this, it is also responsible for the deterioration of our cultural heritage as it accelerates the acidification process.

Contamination of water in harbours and on the seabed, is caused by debris and oily sludge (heavy metals, petroleum hydrocarbons, nutrients, bacteria, chemical matter etc.) produced around ships at berth, repair and maintenance areas, loading and unloading areas, and so on.

Moreover, we also need to be take into account vibrations and noises associated with port works, such as boat engines running, shipyard activities, loading and unloading docks, among others. This creates an environment not hospitable and unpleasant for employees working there and the nearby residents. There is also to consider the traffic surrounding the harbours, apart from the high noise level which characterizes them.

Another big problem concerns the large cruise ships. They generate an enormous amount of solid waste to be added to the emissions mentioned previously.

The international legislation on the treatment and disposal of these wastes barely regulates the activities of cruise ships. That means that tonnes of waste end up in the ocean waters. Cruise ships can dump various kinds of organic waste and untreated waters when they are more than four miles from the coast.

Position of the topic in the school program:

	11	12	13	14	15	16	17
Mother / Foreign language / Litterature							
History							
Geography		X	X				
Mathematics							
Biology / Geology		X	X	X	X	X	
Physic / Chemistry		X	X	X			
Social Science / Economy / Law						X	X
Art / Musics							
Technology / Computer science							

Ressources:

- Mediterranean plastic report-LR.pdf: https://archivo-es.greenpeace.org/espana/Global/espana/2017/documentos/oceanos/Mediterranean%20plastic%20report-LR.pdf
- https://archivo-es.greenpeace.org/espana/Global/espana/2017/documentos/oceanos/Mediterranean%20plastic%20report-engLR.pdf
- Cruise ships: https://www.transportenvironment.org/what-we-do/shipping-and-environment/cruise-ships
- Reportaje: Vertidos rutinarios de hidrocarburos: https://eu.oceana.org/es/eu/prensa-e-informes/reportajes/vertidos-de-hidrocarburos