

MED MARITIME

GRATED PROJECTS

Med-IAMER

Western Mediterranean ecoregion (WME) Maritime Transport

Definition

Maritime transport relates to the transportation of goods and/or passengers by sea by a person for commercial purposes, either in return for payment (i.e. for hire and reward) or on an organization's own account as part of its wider economic activity. Goods transportation refers to the volume of containerized, dry bulk, liquid bulk and roll on-roll off (Ro-Ro) type of cargo handled by ports and vessels (cargos, tankers, etc.) while passenger traffic refers to the number of national, international and cruise passenger volumes transported through ports by ferry, cruise or other type of vessel.

Regional context

The WME is crossed by a significant number of main routes of oil tankers and container ships crossing the Mediterranean Sea. In addition to the main shipping routes, other types of transport, mainly ferry routes, are very frequent in certain areas, either seasonally or regularly. The Mediterranean region is also important to the European cruise sector that has grown considerably in the last decade and is expecting to continue. This importance can be illustrated by the large number of Western Mediterranean ports being members of the two major cruise industry-oriented trade associations, MedCruise and Cruise Europe. The European cruise sector is, to a large extent, destination-led and the Mediterranean area is an attractive area to a significant share of cruise tourists. The figure below shows the main routes of merchant shipping and passenger ferries in the Pelagos Sanctuary region (e.g. Ligurian Sea).



Merchant shipping (a) and passenger ferry routes (b) in the Pelagos Sanctuary. Source: Policy Research Corporation based on IUCN, Maritime traffic effects on biodiversity in the Mediterranean Sea.





Four Western Mediterranean ports are listed among the twenty most important ports in Europe in 2012, handling a total of around 252 million tons. In terms of container traffic, the following figure illustrates that several Western Mediterranean container ports in Spain (i.e. Valencia, Algeciras and Barcelona), France (i.e. Marseilles) and Italy (i.e. Genoa, La Spezia, Livorno and Cagliari) are considered of importance to both the Mediterranean region and Europe. Italy as a whole accounted for the second largest country of Short Sea Shipping of goods in the EU and both Marseilles and Genoa were listed in the top-20 ranking of Short Sea Shipping ports in 2008. The high frequency of certain transport routes in the region is expected to be linked with pressure on marine environment in specific areas.

The Mediterranean region is also an important destination of the European cruise sector. The cruise sector is increasing around the world mostly due to the dynamism of the Mediterranean market, which is the second market in the world (after the Caribbean), with 21.7% of

global deployment shares in 2013. This trend indicates that, beyond the increased demand for destinations, ports and other factors have worked in an effective way to promote cruise activities increasing such demand in the region. Spain, France and Italy are the main countries enjoying the growth of this sector. Italy presented, in 2013, 28.8% of the total European expenditures generated by the cruise industry, namely 4.46 billion Euros (15.5 up).

In 2013, 7 out of 10 of the top Mediterranean cruise ports in terms of passengers belonged to the Western Mediterranean ports. Barcelona (Spain) is ranked first with 2.6 million passengers, then Civitavecchia (Italy) with 2.5 million. Balearic Islands (Spain) were number 4 with 1.5 million, and Marseilles (France) and Naples (Italy) respectively number 6 and number 7. Western Mediterranean ports were the most dynamic during the period 2009/2013, with an increase of passengers of 88% in Marseilles, 56% in Genoa, 41% in Civitavecchia and 32% in Savona.



Within the Mediterranean regions, in 2013, the WME welcomed around 71% of Mediterranean passengers (18.8 million), compared to 19% in the Adriatic (5 million) and 10% in the Eastern Mediterranean (2.8 million).

Related Pressures

The intensive maritime transport activity in the WME implies ships and port emissions, risks of accidents, sea ground damage, acute pollution events and the introduction of alien species through ballast water discharges (EC, 2012).

Abrasion

The damage caused from grounding and anchoring of ships in the sea ground (UNEP/MAP/Plan Bleu 2014). Physical adverse effects on benthic habitats and species resulting from abrasion by ship hulls and propeller scarring are mainly restricted to shallow- water areas, namely shoals, the inner reaches of harbours, bays and inlets, and navigation canals and straits. However, data on such effects are completely lacking for the Mediterranean Sea (Abdulla & Linden 2008).

Onderwater noise

Underwater noise has become a ubiquitous form of marine pollution and is a growing concern in the Mediterranean Sea due to the intensification of maritime activity in the region. Underwater noise affects communication between marine mammals and certain fish species, especially in areas of heavy maritime traffic and along developed coasts. Ship propulsion noise accounts for more than 90% of the acoustic energy that humans put into the sea.

There are three categories of impacts of underwater anthropogenic noise on cetaceans: behavioral (i.e. changes in surfacing or diving), acoustic (i.e. changes in type or timing of vocalizations as well as masking acoustic signal) and physiological (i.e. hearing loss, mortality) (UNEP/MAP, 2012).

Marine mammals are particularly affected by underwater noise as they rely heavily on sound to communicate, to coordinate their movements, to navigate, to exploit and investigate the environment, to find prey and to avoid obstacles, predators, and other hazards. Noise pollution proved to cause marine mammals to abandon their habitat and/or alter their behavior by directly disturbing them or by masking their acoustic signals over large areas (Abdulla & Linden 2008). Nevertheless, there is also increasing concern regarding the impact of such noise on other fish, other vertebrates such as aquatic and diving birds, and marine invertebrates. where specific information of their potential impacts is still lacking.

In the WME, maritime traffic is an important source of anthropogenic noise especially in the Ligurian Sea as a consequence of the high volume of shipping limiting silent areas or refugia in this ecoregion. Excessive noise makes it harder for whales to communicate with each other or to receive acoustic cues, for example to detect approaching vessels or other hazards (UNEP/MAP/Plan Bleu 2014).

Mapping of areas affected by underwater noise due to marine transport is complex as it depends on the vessel size and motor type. Nevertheless, the indicator on pollution generated from maritime transport (map shown below) gives an approximation of the areas with highest intensity of maritime transport and, hence, most probable high pressure of underwater noise.

Marine Litter

While sea and waterway activities account for only five percent of marine litter in the Mediterranean Sea, problems still exist in relation to the operation and use of port reception facilities (UNEP/MAP 2009).

Introduction of synthetic compounds

Synthetic compounds are introduced to the sea in many ways resulting from hydrocarbon oil discharges and accidental spills. Biocides, mainly organotin



compounds such as tributyltin, known as TBT, are used in antifouling paints and polycyclic aromatic hydrocarbons (PAHs). Distribution data of synthetic compounds in the Mediterranean Sea are poor but there is enough evidence that TBT was detected in all water and sediment samples analysed in the Alboran Sea, North-western Mediterranean, the Tyrrhenian coast of Italy, the Venice lagoon, the Gulf of Saronikos (Greece), the southern coast of Turkey, the coasts of Israel and Alexandria (UNEP/MAP 2012).

Introduction of non-synthetic substances and compounds

The WME has extensive marine traffic giving access to the Middle East (and the Suez Canal), the Black Sea and Southern Europe; much of this traffic is oil tankers. The result of such traffic is a high risk of pollution and even ecological disaster, worsened by the fact that it is a nearclosed sea (UNEP, 2006). Introduction of non-synthetic substances and compounds as marine transport is a main source of petroleum hydrocarbon (oil) and PAH pollution in the Mediterranean Sea. Approximately 0.1 % of the crude oil transported ends up deliberately dumped every year in the sea as the result of tank washing operations. All other types of vessels are also a potential source of discharge of oily waste. Other releases of oil from ships include amongst others loading, bunkering, dry-docking operations and discharging of bilge oil. In the last decade, nearly half of the accidents leading to significant spills (of more than 100 tons) that were reported to REMPEC occurred in the Western Mediterranean Sea (seven accidents representing 47% of all accidents during this period). A third of the accidents occurred in the Eastern Mediterranean (five accidents representing 33% of the total) and a fifth of the accidents (20%) occurred in the Central Mediterranean.

Highlighted features

The map represents the potential intensity of pollution caused by maritime transport, based on shipping tracks, port influence, underwater noise pollution and oil spills.



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High pressures are observed in North Western Mediterranean (Gulf of Lion and Sardinia) as well as in the Southwest of the WME, especially in regions near the port of Algeciras. The main accumulations of pollution shown in the map are a result of important oil spills that occurred in the region mainly as a result of accidents. These regions are also a major source of underwater acoustic pollution due to the high intensity of maritime traffic.

Data/Indicator used

The indicators developed are based on four variables: vessels traffic, port activity, underwater noise and oil spills. The indicator shows the potential intensity of pressure originated from these pollution sources in terms of hazardous substances and underwater noise resulting from maritime transport, based on shipping tracks and port influence. Shipping data used (Halpern et al., 2008) provide an estimate of the occurrence of ships at a particular location, and therefore an estimate of the amount of pollution they produce (via fuel leaks, oil discharge, waste disposal, etc.), under the assumption that traveling ships primarily affect their immediate waters. The dispersal of portderived pollution was modeled as a diffusive plume based on Eurostat data of transport of goods (thousand tons) and passengers (thousand passengers). Pressure generated by oil spills is represented as a density layer based on data registered by the Mandate of the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) for the period 1977-2011, and also the oil spills map generated by Cinirella et al. 2012 (based on IRC 2009 data).

Gaps

The data used for the development of the indicator does not cover ports in North African and Middle Eastern countries. However, ports in Turkey are covered by Eurostat. Data for Albania and Montenegro were found in different reports (UNECE, 2014; ECOPORT8, 2012; MEDCRUISE, 2014).

Limits of methodology

The pollution by ships estimation is based on a global model calculated with VMS data, so it has its inherent uncertainty. No distinction is made between cruisers. ferries and commercial good ships. Hence a more regionalized modeling approach provide some more may specific information and would be recommended whenever such data are available. Eurostat data used are not actual port pollution data but an estimate based on maritime traffic. Port and oil spills pollution does not consider ocean currents and dispersion of pollution produced by them. For the noise underwater pollution, the indicator does not differentiate the distribution of biodiversity in these areas due to lack in data and therefore, it provides the potential impact in the region.

Introduction of non-indigenous species and translocations

Maritime transport and aquaculture are the main ways non-indigenous species enter the WME. Migration through the Suez Canal is the major cause most nonindigenous species in the Eastern Basin introduced from the Red Sea. Due to sea temperature rise in the last decades, these non- indigenous species are increasingly found in the western Mediterranean region. The introduction of non-indigenous species results also from ballast water discharged in the Mediterranean Sea (UNEP/MAP 2012).



Highlighted features

The pie chart shows the distribution of alien species (AS) per Mediterranean country, represented as the % of AS introduced through maritime transport in the coastal areas of the Mediterranean Sea. These percentages are based on the coastal account of AS according to the 10 km grid of the EASIN Database (JRC, 2014). In the WME, Italy presents the highest invasion levels, being a 21% of the total in the Mediterranean Sea, followed by Spain (6%) and France (5%). These percentages are lower than the AS numbers in the other ecoregions.

The map of alien species shows the number introduced through transport activities, i.e. through ships, in a grid cell of 10 km. It clarifies that the intensity of alien species introduction in the WME is concentrated at the coasts, indicating the impact of ships' ballast waters close to major ports. However, the figures reported on the distribution map of AS should be considered with great caution since the

% Alien species introduced through transport in the Mediterranean coast



information depends on the scientific investigation efforts within the countries.

Data/Indicator used

The indicator presents the total number of alien species introduced due to transport activities in the Mediterranean Sea. Species count was made by the European Alien Species Information Network (EASIN), an initiative of the Joint Research Centre of the European Commission that aggregates





data from different data providers (see Katsanevakis et al. 2014 for more details).

Gaps

N/A

Limits of methodology

Model-based approach with uncertainty, as it is based on species databases and peer-reviewed literatures. The indicator does not reflect the state of invasion and the extent of the harmful effects of alien species as it does not differentiate the degree of harm caused by specific species but rather counts the number of alien species per area (density).

Air pollution

Shipping emissions of pollutants are currently increasing and will most likely continue to do so in the future due to the increase of global-scale trade. Ship emissions have the potential to contribute to air quality degradation in coastal areas, in addition to contributing to global air Around 15% of global pollution. anthropogenic NOx and 5-8% of global SOx emissions are attributable to oceangoing ships. The contribution of maritime transport to the total emissions of pollutants in Europe (SO2, NOx, PM, etc.) can be very significant (Viana et al., 2014), with 1-7% of ambient air PM10 levels, 1-14% of PM2.5, and at least 11% of PM1. Contributions from shipping to ambient NO2 levels range between 7 and 24%.

The European Monitoring and Evaluation Programme (EMEP) is a scientifically based and policy driven programme under the Convention on Long-range Transboundary Air Pollution (CLRTAP) for international cooperation to solve transboundary air pollution problems. It provides modelled data of air concentration and deposition of main pollutants specifically related to ships.



EMEP Map of ship related SO2 concentration.

TNO-MACC-II emission data provides records on atmospheric composition for recent years, data for monitoring present conditions and forecasts for a few days ahead. lt combines state-of-the-art modelling atmospheric with Earth observation data to provide information services covering European air quality, global atmospheric composition, and emissions and surface fluxes. Along with the study of pollution at coastal level (air samples, ships emissions, etc.), it could be an effective tool for monitoring the air pollution related to maritime transport.



Map of TNO-MACC-II anthropogenic emissions of NOx for the European domain.

Both data collection provide valuable information for monitoring of air pollution related to maritime transport.



List of proposed indicators

The following table lists the indicators developed and mapped within Med-IAMER on the impacts of maritime transport on coastal (land) and marine environments. All maps, identified by the indicator ID, can be found at the project's web page:

http://www.medmaritimeprojects.eu/sec tion/med-iamer-redirect/outputs

ID	Indicator description
TP01	Marine exposure due to port activity: goods transport
TP02	Marine exposure due to port activity: passenger transport
TP03	Marine exposure due to port activity: ferry transport
TP04	Marine exposure due to port activity: cruise transport
TP05	Intensity of pollution by maritime transport
TP06	Intensity of maritime traffic
TP07	Alien species related to transport activity
TP08	Alerts and accidents between 2008 and 2014
ML02	Marine litter by transport influence

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<u>frm=1&q=&esrc=s&sa=U&ei=NmnbU6XoL6aY1AX</u> xj4HoAQ&ved=0CBIQFjAA&usg=AFQjCNGUNnvAE <u>k6CoYdDX2QesQMibQmU4A</u>

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