European MSP Platform

Conflict fiche 4: Maritime transport and area-based marine conservation

Maritime transport is an essential enabler of trade, communication and exchange between countries and continents, and of great importance economically for countries and regions. Although it is generally considered an environmentally friendly means of transport, shipping has an impact on the marine environment: through noise emission, waste water disposal, fuel emissions, oil spills, or collisions with large mammals for example. The diverse nature of these impacts influences the diversity of conflicts that can arise between the two sectors. This fiche concentrates on conflicts between shipping and area-based marine conservation, and what marine planners can do to prevent or resolve these conflicts.

1. Description of the two sectors

1.1. Maritime transport

Maritime transport is the shipment of goods (cargo) and people (passengers) by sea. The maritime transport industry is responsible for over 80% of world trade and 60% of global crude oil supply; as such it represents an important and strategic economic sector worldwide[1]. Within the European Union, the maritime transport sector directly employs 640.000 people and has a direct gross value added contribution to GDP of €57 billion[2]. On top of that, more than 400 million passengers pass through European ports each year. Short Sea Shipping (SSS) is especially important in European countries, in particular the Baltic and southern Mediterranean. 60% of total maritime transport of goods within Europe are transported via short sea shipping[3].

Maritime transport not only requires seagoing vessels, but also ports as central logistics hubs, rendering the sector complex and intimately connected to land-based infrastructure. Maritime transport is also a highly diverse sector when looking at the type of vessels involved. Container ships transport the majority of the world's manufactured goods, while bulk carriers transport unpacked cargo, mostly consisting of raw materials. Tankers carry liquids, such as crude oil, liquefied gas, and chemical products, ferries carry passengers and vehicles, and cruise ships of

[1] UNCTAD (2017a)

[2] Oxford Economics (2017)

[3] Eurostat (2018)

various size transport thousands of passengers for tourism purposes. What results is a complex web of land-sea logistics chains, each of which is associated with its own operating conditions and demands on maritime space.

The United Nations Convention on the Law of the Sea (UNCLOS) does not confine shipping to pre-determined routes. Nevertheless, due to economic reasons, commercial vessels are usually interested in taking the shortest possible route between two points. Ship routeing systems have been established by the International Maritime Organisation (IMO) in congested shipping areas of the world for safety reasons. In addition to traffic separation schemes, these include two-way routes, recommended tracks, deep water routes, precautionary areas (where ships must navigate with particular caution), and areas to be avoided for reasons of exceptional danger. Based on MARPOL, the IMO can also designate Particularly Sensitive Sea Areas (PSSAs) on the basis of ecological or environmental factors)[4] [5].

Maritime transport is a growing sector, both in terms of vessel sizes (Figure 1) and number (Figure 2). This puts increasing pressure on the marine environment. For instance, tankers use cargo pumps, and large kitchen sanitary systems are needed for ship cruises, all of which consume a large amount of energy[6]. Fuel oil used for ships contains 3,500 more times sulphur than fuels used for street vehicles and thus add to air pollution in ports[7]. Beside fuels and emission, the creation of new ports as well as their enlargement – to cope with the increasing demand for goods – often has negative impacts on the local environments and destroys important ecosystems[8].

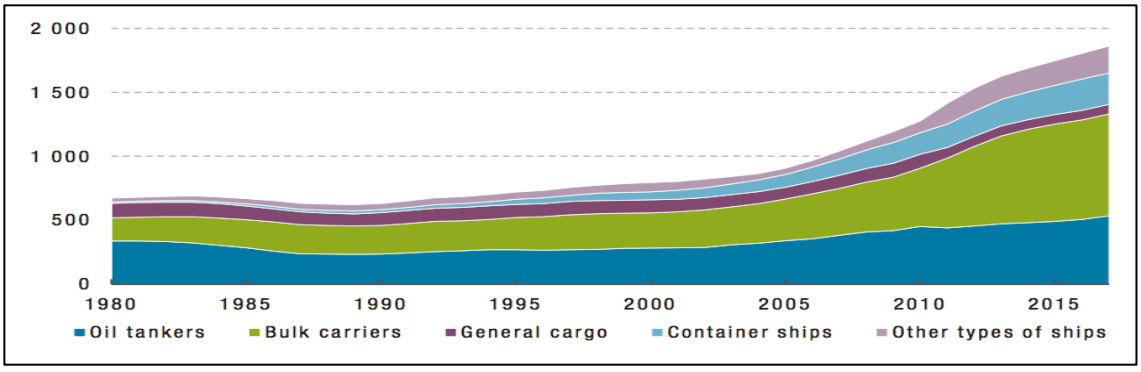


Figure 1: World fleet by principal vessel type (millions of dead-weight tons)[9]

[4] International Maritime Organization (2018a)
[5] International Maritime Organization (2018b)
[6] Anderson *et al.* (2016)
[7] Wan *et al.* (2016)
[8] Ibid.
[9] UNCTAD (2017b)

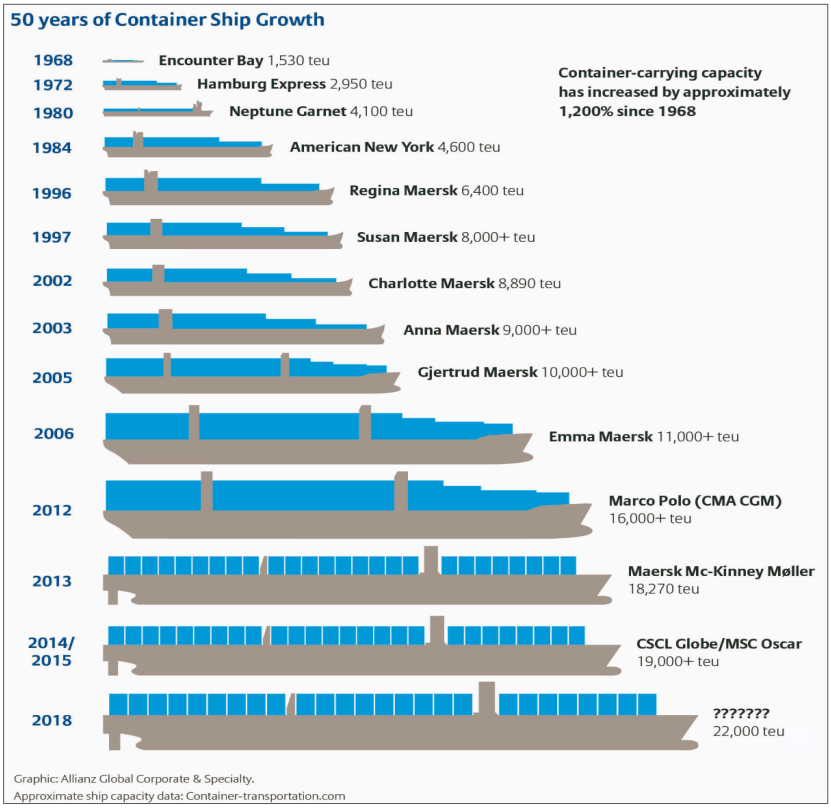


Figure 2: Container ship growth in size[10]

In response to these impacts, international regulations such as the MARPOL convention and London Protocol have been implemented with the purpose of reducing the negative environmental impacts produced by the shipping sectors[11]. Moreover, the maritime transport sector is expected to meet increasing performance criteria linked to key Sustainable Development Goals (SDGs) and in particular with SDG 14: Life below water[12].

1.2 Area-based marine conservation

Marine conservation generally is a huge field of research and policy. Operating at the international, national and sub-national level, it can be broadly differentiated into area-based approaches, as well as approaches that target overall ecosystem health or particular species, such as efforts to reduce pollution or bird protection.

The main tool for area-based marine conservation is Marine Protected Areas (MPAs), but there are other designations that fulfil the same function (such as Natura 2000 areas). There has been a tenfold increase in MPA designations around the world since 2000[13] [14]. At the same time, MPA

[10] World Shipping Council (2018)
[11] International Maritime Organization (2018c)
[12] International Maritime Organization (2018d)
[13] IUCN (2017)

designation alone does not necessarily mean successful conservation[15] [16]: Large but wrongly located and managed MPAs may potentially achieve fewer conservation outcomes than a smaller but correctly placed and managed MPAs.

Anthropogenic impacts, such as those caused by shipping, can reduce the conservation benefits of all area-based approaches to conservation[17]. Although stringent management rules are sometimes applied, such as total bans on certain activities within MPA boundaries, protected areas are still affected by pressures originating outside of the protected area. This is most obvious in the case of water or noise pollution[18]. For area-based protection to be effective, it is therefore important that its design and management includes a wide range of stakeholders – including all the sectors that will be affected by, or will themselves affect, the protected area[19]. It is also evident that spatial instruments such as MSP will not be able to achieve the full range of desired conservation benefits for the sea – other agreements and sectoral policy will also need to come into play.

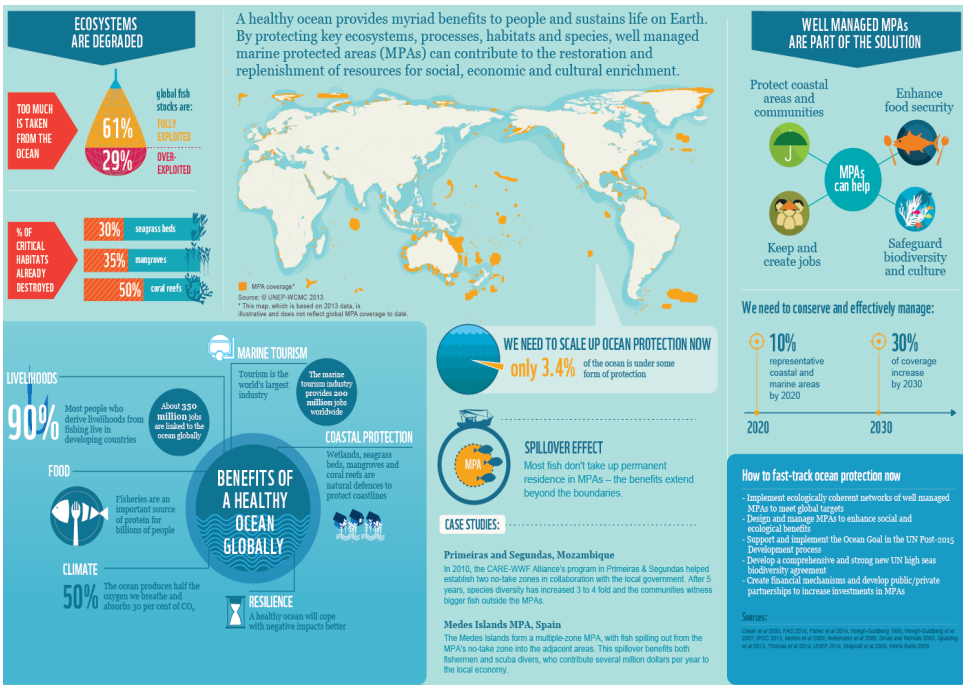


Figure 1: How marine protected areas can help marine ecosystems[20]

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[14] https://www.cbd.int/sp/targets/, accessed 3 January 2019

[15] Amengual & Alvarez-Berastegui (2018)

[16] Hossain & Morris (2017)

[17] Coomber *et al.* (2016)

[18] Blau & Green (2015)

[19] Dehens & Fanning (2018)

[20] WWF (2015)

2. Conflict description

2.1. Conflicting elements

Conflicts between the maritime transport sector and marine conservation are due to the various direct and indirect impacts of maritime shipping on marine habitats and life (see Figure 2). Impacts include, inter alia, disturbance, noise, vessels collision with marine animals, chemical pollution (e.g. through fuel combustion, through the discharge of hazardous waste waters, through the release of biocides used as antifouling paints, etc.), and the introduction of invasive species, which mostly happens through ballast water[21].

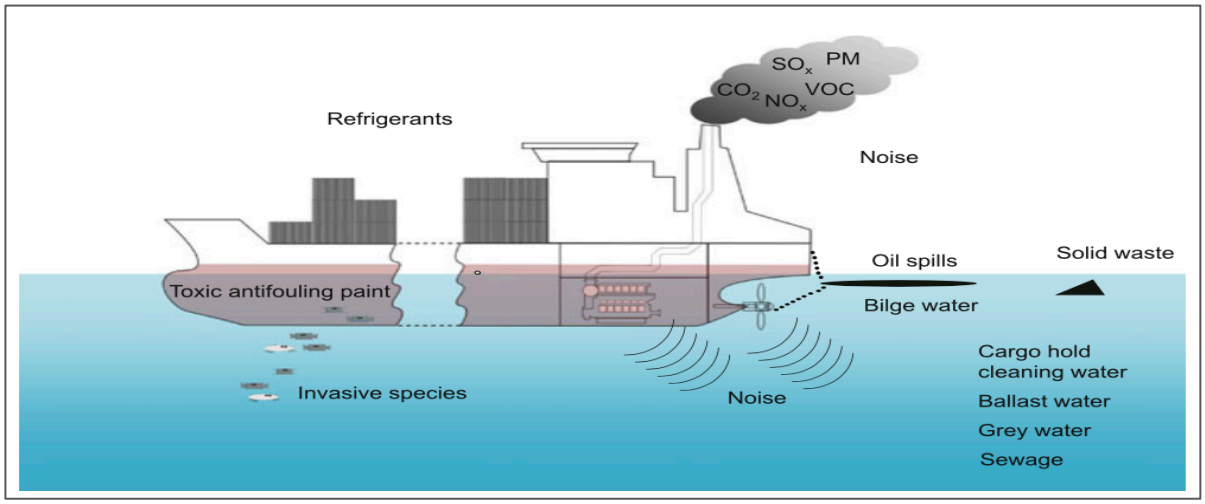


Figure 2: Environmental impacts of maritime transportation during the use of a vessel[22]

Environmental impacts of shipping can be labelled as episodic or routine and be vessel-based or port-based (see Table 1). Episodic impacts are those that do not occur regularly, such as waste dumping; these impacts are addressed by international conventions. Routine pollution always occurs as a consequence of operating vessels, such as in the case of fuel combustion[23]; these are partially addressed by international conventions or EU Directives. Shipping pressures are dispersed in the marine environment but they tend to be higher and more severe in inshore waters and in proximity of ports due to the low water exchange rate and the presence of complex ecosystems an in these areas[24].

[21] Abdula (2008); Andersson *et al.* (2016); Coomber *et al.* (2016)
[22] Andersson *et al.* (2016)
[23] OECD (2008)
[24] Abdula (2008)

Table 1: Main types of shipping pollution divided between episodic, routine vessel-based, and port-based[25]

Episodic environmental events	Routine environmental events
Vessel-based	
Oil spills	Engine air emissions
Ocean dumping	Invasive species introductions (ballast water/hull fouling)
Sewage discharges	Hull coating toxics releases
Oily wastewater	Underwater noise
Vessel collisions	
Ship-strikes with marine life	
Port-based	
Dredging	Stormwater runoff
Port expansion	Vessel wake erosion
Ship construction, breaking	Cargo-handling air emissions

The main negative impacts that the shipping sector has on both the environment and on marine habitats and ecosystems are described below.

- *Noise pollution*

Underwater acoustic noise generated by the shipping industry contributes to ambient noise in the ocean[26]. Noise affects numerous marine species in many ways (see Figure 3). Marine mammals are strongly affected as it interferes with their ability to transmit and receive acoustic information[27]. The amount of noise generated varies by vessel type: Large vessels for example tend to create louder noise with low frequency, which has the potential to be propagated for long distances. Fast ferries, which are largely present in the Mediterranean Sea, have different propulsion systems and they tend to generate broader-band noise than traditional vessels.

[25] OECD (2008)

[26] McKenna *et al.* (2012)

[27] Williams *et al.* (2015)

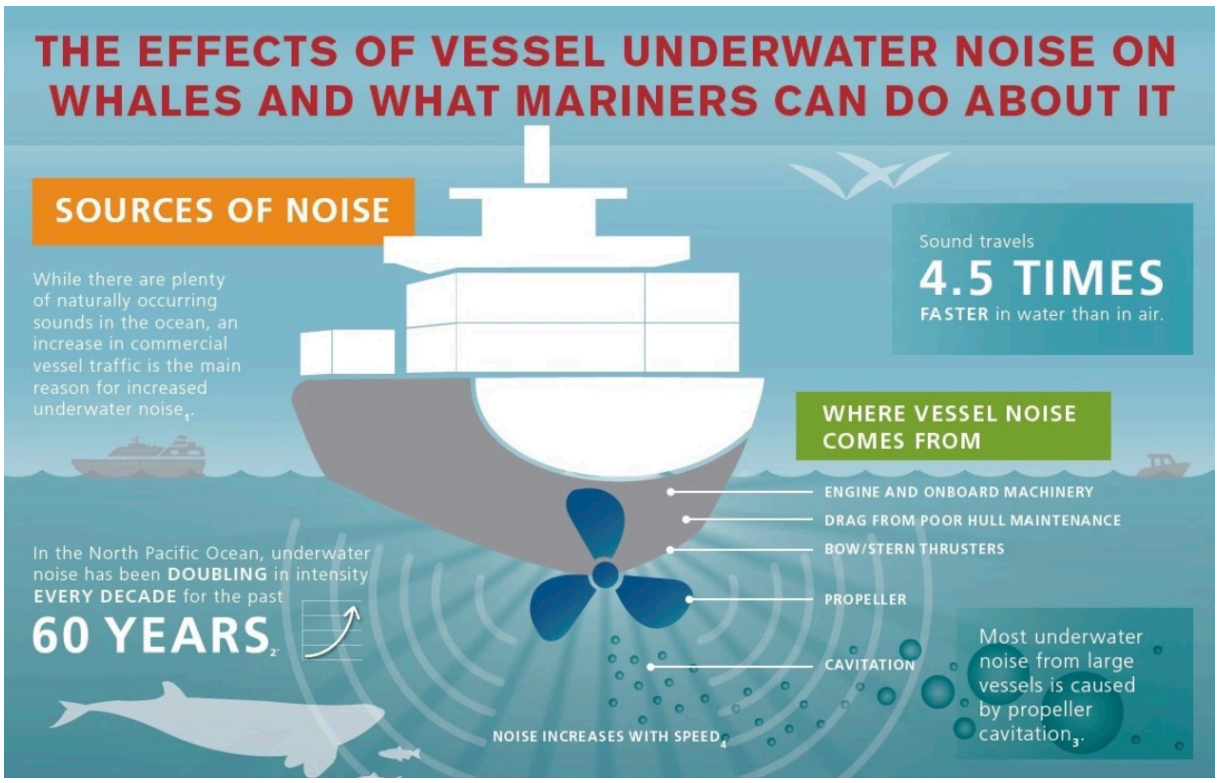


Figure 3: The effects of shipping noise on whales[28]

- *Collision*

Collisions between marine mammals and vessels are known as "ship strikes" and mostly affect large cetaceans. They can occur due to: (i) high density maritime traffic, (ii) increased anthropogenic noise, (iii) possible hearing problems in whales due to long-term exposure to high level of noise, and (iv) whales' inability to avoid the vessels due to noise pollution[29]. Collisions (see Figure 4) may seem rare but are often not detected, so the problem is most likely underreported. Ship strikes of cetaceans are an issue of growing concern internationally[30], and are likely to represent the main fatal threat for whales on global scale[31],[32]. For the Mediterranean basin, collisions with large vessels present a major conservation issue for fin whale (***Balenoptera physalus***) and sperm whale (***Physeter microcephalus***) especially in the western basin. Vessel speed plays an important role in the frequency of collisions as well as their lethality[33]. Collisions between vessels and whales at speeds

[28] Maritime Cyprus (2018)
[29] Abdula (2008)
[30] IWC (2017)
[31] Rockwood *et al.* (2017)
[32] Panigada *et al.* (2006)
[33] Coomber *et al.* (2016)

of 14 knots or higher have more than 60% possibility of being lethal; a probability that rises to 90% if the speed is equal or higher than 19 knots[34].



Figure 4: Blue whale collision with large ship[35]

The International Whaling Commission (IWC) noted that the number of reported strikes between ships and whales increased in recent years and that it is probably due to the increase in maritime traffic[36] [37]. Ship strikes also result in economic loss for the shipping companies due to costs of repair, impact on reputation, and timetabling issues[38].

- *Accidental oil spills*

Vessels can pose a threat to marine biodiversity through accidental spills of oil or other toxic substances. Accidents that lead to the release of large quantities of oil can have major environmental impacts on a wide range of species, causing damage also to coastal environments and affecting sectors such as tourism and fishing.

- *Discharge of hazardous waste and contribution to invasive species*

Vessels can pose a threat to marine biodiversity through accidental spills (of oil or other toxic substances) or through the periodic discharge of waste waters into the marine environment[39] (see Figure 5). Waste waters such as ballast water, antifouling paint, or sewage water not only cause

[34] Parrott *et al*. (2016)
[35] Russ George (2014)
[36] International Whaling Commission (2017)
[37] Abdula (2008)
[38] Coomber *et al*. (2016)
[39] Andersson *et al*. (2016)

chemical pollution, but can also contribute to the release of alien species[40]. It has been estimated that yearly, more than 3.500 million tonnes of ballast water are transferred by vessels around the world, which greatly increases the problem of alien species[41]. Among all the ship types, tankers tend to use the largest ballast water quantities, followed by container ships.



Figure 5: Waste water being discharged into the sea[42]

- ***Exhaust emissions***

Fuel oil used for maritime transport contains 3,500 times more sulphur than fuels used for onshore transport, which can impact negatively not only the oceans and its ecosystems but also humans working within ports or on vessels[43]. Shipping emissions also contribute to the formation of ground-level ozone, which has negative effects on human health. Additionally, nitrogen emitted by ships contributes to eutrophication of the marine environment, which indirectly impacts on biodiversity[44].

- ***Physical damage to habitats***

Vessels can negatively affect marine habitats and animals through the use of their anchors (Figure 6). Clearly, the size of the vessels and hence of the anchors used play a role in the magnitude of this impact, with effects particularly noticeable in the case of coral reefs or other fragile habitat structures[45]. In shallow areas, bottom sediment is resuspended, with impacts on surrounding benthic communities.

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[40] Abdula (2008)
[41] Bailey (2015)
[42] www.netwave systems.com (2018)
[43] Salo *et al.* (2016)
[44] Miola *et al.* (2009)
[45] Abdula (2008)



Figure 6: Anchor on a Posidonia oceanica *plant*[46]

- *Port expansion*

Ports are expanding in response to larger vessel sizes and number and are key players for the implementation of sustainable policy and measures for reducing environmental impacts of the shipping sector. The building of ports and their expansion exert different pressures on the natural environment. Such pressures occur in the initial construction phase with heavy dredging (called Capital dredging) of the area, which impacts the surrounding environment, as well as with maintenance dredging, which is necessary for the port to operate. Both forms of dredging remove important benthic biota, increase water turbidity, and contribute to the decline of water quality, which negatively affect marine species and contributes to the death of mega-fauna[47]. Whilst these forms of impacts can be considered acute, there are also chronic pressures such as port illumination, which has several negative impacts on biodiversity[48].

3. Spatial context

Conflicts between the maritime transport sector and marine conservation arise almost everywhere in the marine environment but it is mostly along shipping lanes and in areas with high noise pollution that the impacts increase. For instance, collisions between vessels and marine animals can only occur in the presence of vessels – which actually happens quite frequently in crowded traffic lanes in areas used by cetaceans. On the other hand, noise pollution as well as chemical pollutions (e.g. spill oil) can persist in the marine environment and can impact animals and habitats far away from the vessels of origin.

[46] Ibid

[47] Grech *et al.* (2013)

[48] Foster *et al.* (2010)

4. Drivers of conflict

Political support for shipping is high within the EU. On the one hand, it is considered a key maritime sector on account of the direct employment it offers and the GDP contribution it makes. On the other, it also plays a key role in intermodal transport networks across Europe, therefore indirectly supporting high-level political aims such as cohesion and free trade. Shipping is also seen as a relatively greener method of transport and it is a fundamental sector for the global supply chain of goods. The EU White Paper 2011 aims to achieve a 50% shift from road to rail and maritime transportation by 2050, likely leading to an increase in shipping in all European seas.

Increasing economies of scale result in larger ships being built. This requires deeper and wider shipping lanes, as well as larger port infrastructure. There is also increasing competition between ports, forcing them to look for new investment opportunities and expansion.

International environmental policy sets out ambitious targets. The Aichi targets for the Convention on Biological Diversity stipulate that by 2020, 10% of marine areas, especially those of high biological and ecological significance, should be managed as protected areas. Other political drivers include the UN Sustainable Development Goals, especially Goal 14 "Life under water", as well as EU-wide and national biodiversity and climate polices. In its MSFD the EU expects Member States to reach "good environmental status" of marine waters by 2020[49]. Increasingly, there is also public opinion on healthy seas, in particular reducing the problem of plastic pollution, achieving sustainable fisheries and protecting iconic species such as birds and mammals.

Story 1: Information to reduce ship strikes in the Pelagos Sanctuary for Marine Mammals

The Mediterranean Sea is one of the most navigated regions in the world with almost 222.000 vessels navigating through it yearly[50]. The Mediterranean region is also a biodiversity hotspot and hosts diverse marine mammal species which are jeopardised by the negative pressures exerted by the shipping sector[51]. In particular, the Ligurian Sea in the north-west of the Mediterranean Sea hosts significant populations of fin whales and other cetaceans which were accidentally caught in the drift net fishery during the 1980s[52]. Additionally, marine traffic such as high-speed passenger vessels, naval ships and expanding commercial whale watching were all increasing in the late 1980s, which posed increasing risks of collision and disturbance to marine mammals in the area.

[49] Borja *et al.* (2013)

[50] Panigada *et al.* (2006)

[51] Coll *et al.* (2010); Notarbartolo di Sciara (2016)

[52] Notarbartolo di Sciara (2008)

As a result of the increasing anthropogenic risks for cetaceans and also due to the growing public awareness among civil society, the Pelagos Sanctuary - a transboundary Specially Protected Area of Mediterranean Importance (SPAMI) located in the North-western part of the Mediterranean Sea was proposed by an Italian NGO called the Tethys Research Institute in 1990 (Figure 7). It was established by France, Italy, and the Principality of Monaco in 1999 with the aim to protect marine mammals from anthropogenic activities occurring in the area. It is the largest MPA in the Mediterranean, accounting for 3.5% of its total surface[53]. The sanctuary was added to the SPAMI list in 2001 and is consistent with the objectives of the EU Habitat Directive, which considers cetaceans and animals of community interest which need to be protected[54].

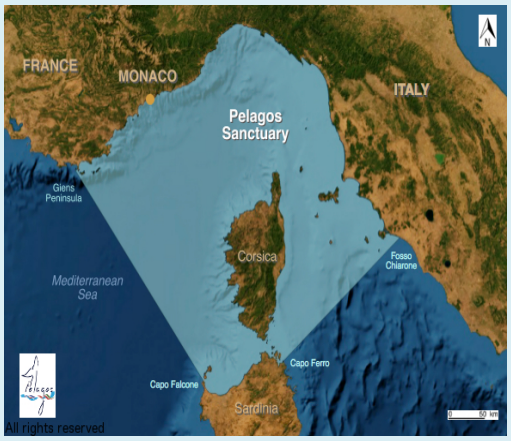


Figure 7: The Pelagos Sanctuary[55]

The Pelagos Sanctuary area contains important ports such as Genoa, Marseille, and Savona, which are visited daily by hundreds of vessels, from ferries to cargo ships and tankers (see Figure 8-10). Consequently, vessels within the sanctuary generate various forms of pollution, including noise, oil spills, ship strikes and air pollution. Many studies highlight how noise and ship strike are amongst the worst threats for marine mammals in the area[56]. Among all ship types, passenger vessels appear to travel fastest, followed by cargo and tanker vessels; the latter tend to reduce speed in proximity of ports and coastal areas compared to passengers' ferries[57].

[53] Gabrié *et al.* (2012); Bastari *et al.* (2016)
[54] Azzellino *et al.* (2012)
[55] Pelagos Sanctuary (2018a)
[56] Coomber *et al.* (2016)
[57] Ibid.

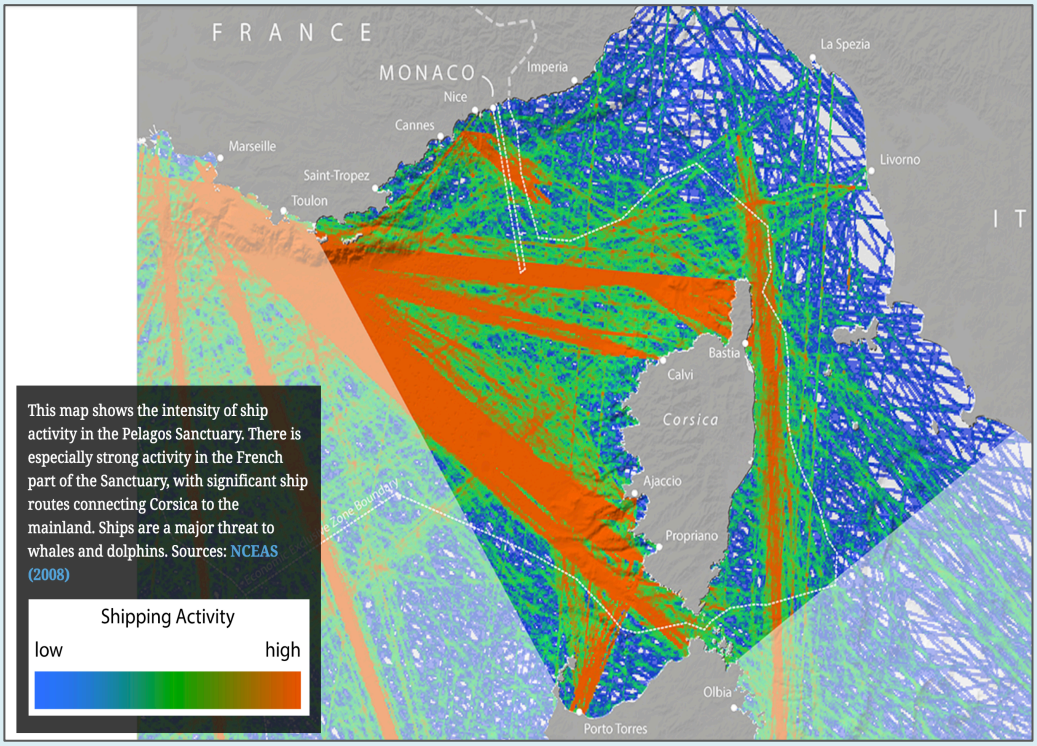


Figure 8: Intensity of ship activities within the Pelagos Sanctuary[58]

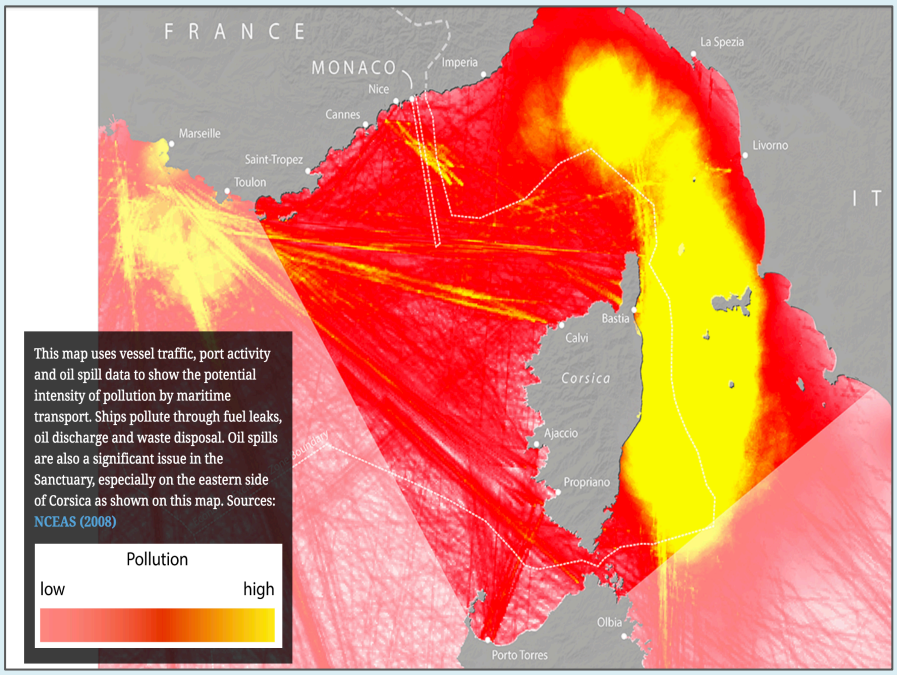


Figure 9: Potential intensity of maritime transport within the Pelagos Sanctuary[59]

[58] Pelagos Sanctuary (2018a)

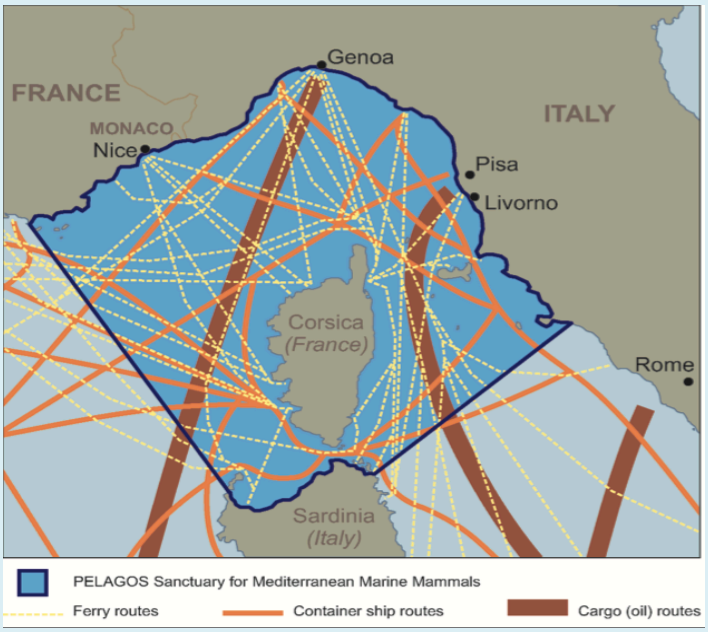


Figure 10: Major shipping lanes within the Pelagos Sanctuary[60]

To limit possible negative impacts on cetaceans within the sanctuary, specific restrictions have been implemented such as the prohibition to intentionally disturb marine mammals, the regulation of research activities and whale watching, the prohibition of pelagic driftnets, and the limitation of speedboat racing activities within the Sanctuary, which are prohibited in the Italian waters and strictly limited in the Basque and French waters[61]. Additionally, a code of good conduct is available on the Pelagos webpage, which provides guidelines for whale watching activities in order to reduce disturbances to the minimum[62].

Strategies to protect marine mammals from strikes are not limited to command and control instruments but they are also based on technology. For instance, the REPCET project created a software system (REPCET tool) which has the aim to reduce the risk of collision between cetaceans and vessels within the Pelagos sanctuary[63]. It is a software that with the use of a computer network, it allows commercial vessels in real-time regarding the position of whales. Information on the location of whales are sent to the server by whale watchers and watch keeping personnel on board of vessels. The location of whales is displayed cartographically on a dedicated screen on board of

[59] Ibid.

[60] Agardy *et al.* (2007)

[61] Pelagos Sanctuary (2018b)

[62] Pelagos Sanctuary (2018c)

[63] REPCET (2017)

the vessels in order to allow the captain to reduce speed and change[64]. REPCET is also available as a mobile app and professionals at sea can use it to communicate to the server the position of sighted cetaceans, which increase the efficiency of the system.

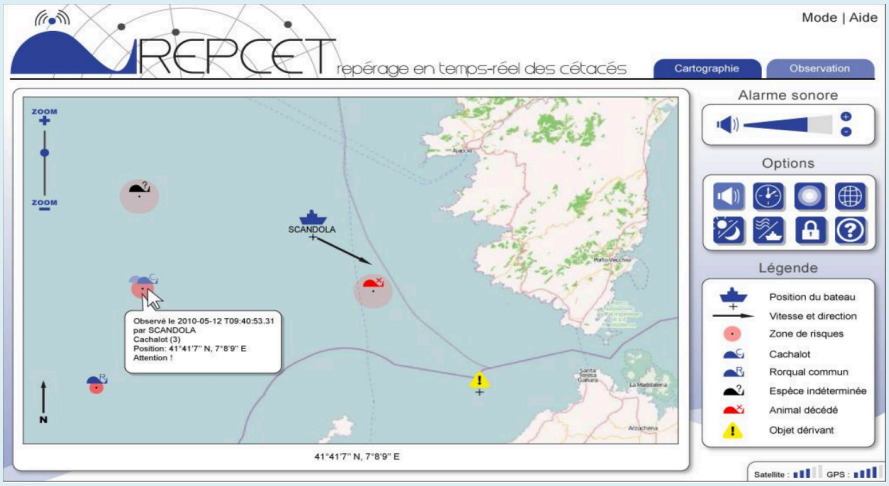


Figure 11: Map interface of the REPCET software tool[65]

Although the Pelagos sanctuary also raises public awareness regarding marine mammals and introduced the mentioned measures, strikes between marine mammals and vessels still occur and noise pollution is still present in the sanctuary[66]. Fin whales and sperm whales are particularly affected by vessels strikes and it has been estimated that 6% of all the marine mammals sighted within the Pelagos Sanctuary showed traces of collisions[67]. Because of the numerous important ports within the sanctuary and industrialised coasts, it is not possible to prohibit navigation to ships and boats. However, the implementation of traffic impact mitigation measures such as speed limits in certain areas, new routes far from marine mammals' populations, and a better implementation of software for the communication of whales' sight could reduce some of the negative impacts that the shipping sector has on marine animals and ecosystems within the Pelagos Sanctuary.

[64] REPCET (2016)
[65] Ibid
[66] Panigada *et al.* (2006)
[67] Pelagos Sanctuary (2018d)

Story 2: Shipping routes in Swedish waters under investigation

Swedish waters are crossed by some of the most important shipping routes in the Baltic (Figure 12). These serve numerous ports and are of vital importance to the economy of the countries in the region. Some of these routes go through or near shallow banks of high ecological value, such as those in the central Baltic Sea south of Gotland. The coexistence of shipping and those high natural values is something Swedish MSP is presently dealing with.

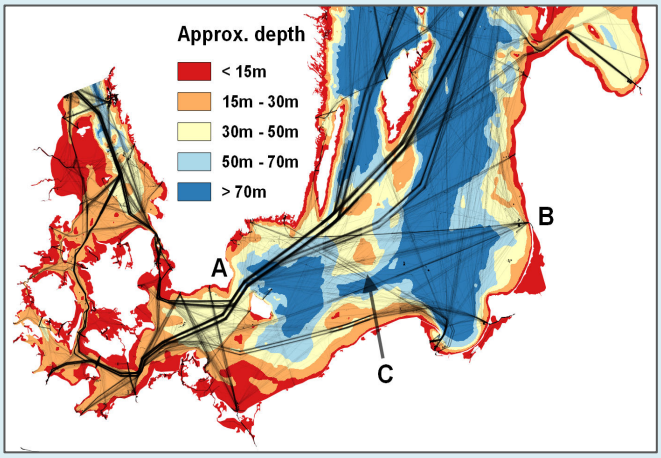


Figure 12: Major shipping routes through and depth contours in the central and southern Baltic and the Belt Seas[68]

However, the area is also important from an environmental point of view. The Midsjöbankarna and Hoburg's bank represent the most important wintering habitat for European long-tailed duck, a red listed species; it is also one of very few areas used for reproduction by Baltic Sea harbour porpoises. Hoburg's bank and part of the Northern Midsjöbank are classed as Natura 2000 and HELCOM Baltic Sea Protected Areas.

Research has shown that intensively used shipping routes can have negative impacts (disturbance, oil spills etc.) on these species because of physical and noise disturbance and chemical pollution from oil spills. Harbour porpoise reproduction in particular is believed to be disturbed by ship noise from vessels traversing the bank areas. Although no large oil spills have occurred in the area so far, researchers believe that the current oiling of diving sea birds is due to operational oil discharge that goes largely unnoticed[69].

[68] Forsman (2017)

Due to the importance of these routes for Swedish and international maritime traffic, they Swedish Transport Administration claimed them as 'areas of national interest' in line with the Swedish environmental code. This implies that shipping is given priority over other uses in any planning that might affect those areas. However, given the high ecological value of the banks, the Swedish Agency for Marine and Water Management (SwAM) considered ways of reducing the impact of shipping on the banks and the species that depend on them. Two IMO "areas to be avoided" and three traffic separation schemes already existed in this area 500GT or above (Figure 13). For the Swedish planning authority engaged in MSP for the EEZ, the question was whether additional spatial measures need to be taken, in particular rerouting maritime traffic to the deep-water passages south and east of the banks.

However, resolving this conflict soon proved to be difficult. A number of obstacles were identified:

- Rerouting maritime traffic, even if only for certain types of vessels, requires convincing evidence on the impacts of passing ships on the ecosystem and the benefits accruing from any changes. Even with such evidence there is likely to be resistance by the many stakeholders affected by such change.
- The Swedish Transport Administration might object to any rerouting proposal that is contrary to the national interest claim.
- The alternative route to the south and east of the banks is longer than the currently used one, resulting in slightly longer sailing times, higher fuel cost and exhaust emissions, and potentially pollution in a new area. These impacts also need to be weighted when considering alternatives, as do other management measures that fall outside the remit of maritime spatial planning.
- Any rerouting measures affecting international traffic need to be endorsed by the IMO, something that might take several years and require Sweden to engage in negotiations with partners in the region and beyond.

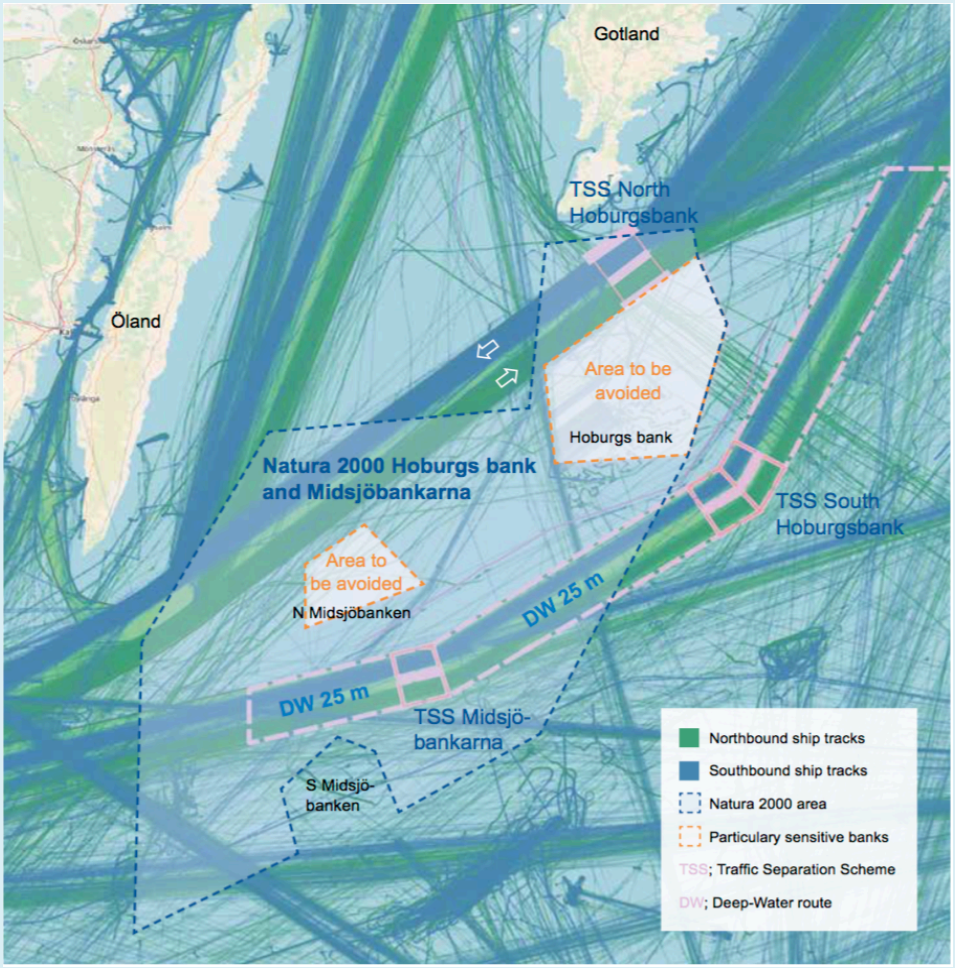


Figure 13: Maritime traffic patterns over the Hoburg's and Midsjö banks[70]

The solution put forward by SwAM in the current MSP process was to designate those areas as 'investigation areas shipping' (Figure 14). Three such areas have been designated to the south and north of Gotland, where not only SwAM but also other stakeholders see a need to reassess the conditions under which shipping could coexist with high natural values in general, and threatened species in particular. The designation indicates that the issue cannot be dealt with by maritime spatial planning alone given the Swedish planning system and the current level of knowledge about the area and the impacts of shipping. It also signals to the Swedish government that a broader investigation of alternatives and consequences is needed involving other agencies and stakeholders, including at the international level both in the Baltic Sea Region and with the IMO. As pointed out in the strategic environment assessment of the plan for the Swedish Baltic Sea, "The problems must be studied further […]. A possible future adjustment of shipping movements

[70] Forsman (2018)

through the area needs to be rooted and negotiated internationally, which sets high standards on documentation."[71]

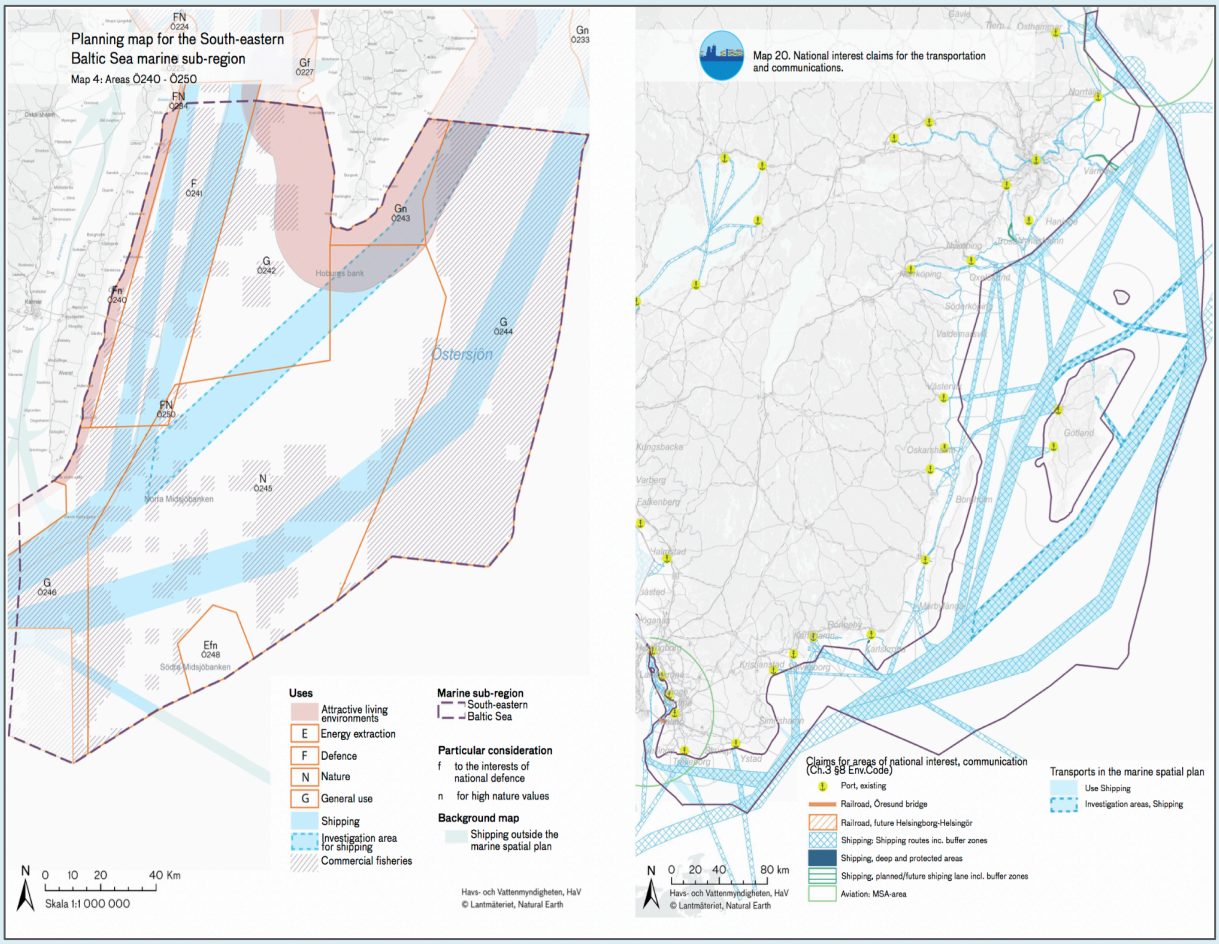


Figure 14:On the left investigation areas for shipping purposes in the South-eastern Baltic Sea. On the right investigation areas around Gotland for transport and communication purposes[7273]

[71] SwAM (2018a)

[72] Ibid.

[73] SwAM (2018b)

5. MSP solutions

Trade-offs between conservation objectives and the economics of shipping are varied and complex. Measures aimed at reducing collisions, for example, such as alternative routes or the implementation of speed limits, result in extra economic costs to the shipping companies due to increased transit times. As a result, solutions such as alternative routes and speed limits would need to be implemented by considering all the possible scenarios.

Below solutions are presented that have been developed by various countries for different elements of this conflict. Preventative solutions are designed to stop the conflict from becoming acute in the first place, such as preventing collisions from occurring. Mitigation is designed to alleviate the various impacts of shipping on marine conservation, both in terms of species, habitats or the wider marine ecosystem. Both spatial and more technical solutions are included. In terms of the latter, the MSP process can represent an important platform for awareness-raising and for stakeholders to come together and develop joint solutions.

5.1. Preventative solutions

Solution 1: Develop sea basin maps of areas with high ecological values

Sea basin maps depicting areas of high ecological value greatly help in planning shipping routes[74]. Ideally, such maps provide detailed insights on the most vulnerable species and habitats and can therefore be used to minimize the impacts caused by shipping accidents and oil spills. Plans can also take into account the ecologically sensitive areas when allocating space for rescue operations. South Africa, Namibia and Angola for example have produced transboundary maps of ecologically and biologically sensitive areas to guide planning decisions based on the EBSA criteria (Figure 15). Such criteria are: a) Uniqueness or Rarity; b) Special importance for life history stages of species; c) Importance for threatened, endangered or declining species and/or habitats; d) Vulnerability, Fragility, Sensitivity, or Slow recovery; e) Biological Productivity; f) Biological Diversity; g) Naturalness[75].

[74] BalticScope (2017)

[75] CBD (2018)

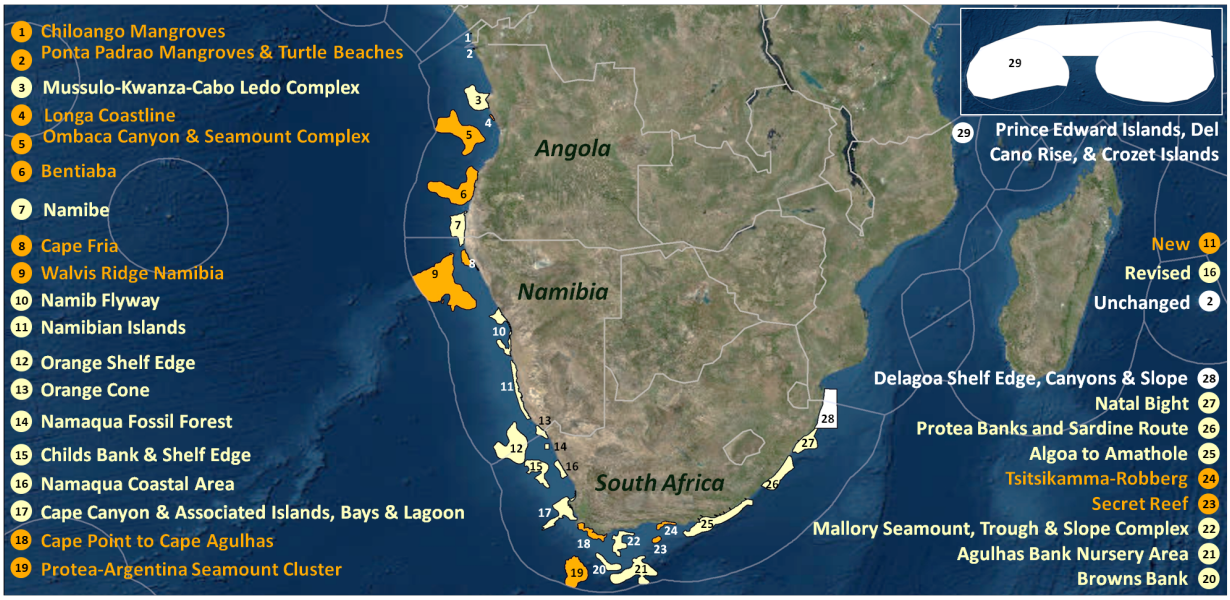


Figure 15: Angolan, Namibian and South African sites meeting the criteria for EBSAs[76]

Solution 2: Use PSSAs for broader marine areas

A more strategic solution could be to use the PSSA designation to cover broader marine areas. In the Mediterranean for example, the Bonifacio Strait is the only PSSA. PSSA shipping rules would therefore apply more broadly, making it easier to implement regulations such as speed restrictions.

Solution 3: Design new shipping routes or re-route shipping lanes

The designation of alternative routes for shipping could be an effective and feasible strategy to reduce whale strikes within an area. This approach has already been successfully introduced for the protection of whales along the East coast of the United States as well as off the coast of Canada[77]. It has also been introduced in Massachusetts Bay thanks to the collaboration between various stakeholders and the IMO, which redesigned shipping routes to avoid known areas with high concentrations of endangered whales. This reduced the risk of collision by an estimates 58 percent and increased shipping travel times by only 10-20 minutes[78].

[76] BCC-GIZ (2018)

[77] WWF (2017)

[78] Blau & Green (2015)

Solution 4: Develop investigation areas for shipping

Developing so-called investigation areas for shipping, as was done in the Swedish MSP, is a way of indicating political intentions and providing a transparent information base further discussion. An investigation area does not imply any direct consequences for shipping, but is designed to lead to a better understanding of the problem at a specific location. It thereby provides arguments for developing spatial measures at a later stage, such as closing down a shipping lane for certain types of vessels or speed restrictions. It could also lead to the implementation of non-spatial measures, such as strengthening environmental legislation for particular sites.

Solution 5: Designate anchorage areas

To reduce problems related to anchoring, such as habitat destruction, it can be helpful to designate dedicated anchoring areas also considering the safety of vessels. This can be a good measure to protect vulnerable and valuable marine areas whilst at the same time also ensuring the safety of shipping[79]. Anchorage areas close to ports could also be linked with other, non-spatial measures, such as rules for disposing of waste water and other ship-based waste.

5.2. Mitigation

Solution 6: Impose ship speed restrictions within certain areas

As part of developing maritime spatial plans, speed restrictions could be agreed for ecologically sensitive areas to reduce the risk of ship strike. Certain MPAs already impose speed restrictions on ships; some even have a complete ban on navigation. In fact, speed restrictions and in particular mode, seasonal speed restriction, can greatly reduce impacts and risks. Moreover, the probability of death from vessel strikes also decreases when ships navigate at a lower speed. [80] [81] Navigating at a speed between 10 and 13 knots greatly reduce the risk of collisions and also reduce costs fuel costs for shipping companies82. Agreeing speed restrictions would require major stakeholders to work together with IMO and related parties; MSP could provide a platform for such collaboration.

[79] Davis *et al*. (2016)

[80] Laist *et al*. (2001)

[81] Notarbartolo di Sciara *et al*. (2016)

[82] WWF (2017)

Solution 7: Promote the use of the REPCET or similar software

REPCET is a software system which helps reduce the risk of collision between large cetaceans and vessels during daytime. Vessels equipped with the REPCET tool can note each sighting of large cetaceans to a centralised server, which then sends out an alarm to other ships equipped with REPCET that are likely to encounter the cetacean83. REPCET has been used by several vessels navigating periodically inside the Pelagos Sanctuary, for example, and it is currently regarded as the most advanced technology for reducing collision in daytime84. Such system could be implemented in more vessels through strategic partnership between interested MPAs, the IMO and maritime transport companies. Spatial data on cetaceans collected through the REPCET system could then be used in the MSP process. Another technical solution is to operationalise early warning systems and decision support system for accidental oil spills, ideally at regional sea level.

Solution 8: Use the MSP process to promote ship-quieting techniques

To address the problem of noise pollution generated by the shipping industry, shipping companies together with stakeholders and the IMO are already promoting the use of ship-quieting technologies (Figure 16). MSP could act as a platform to encourage the use of such techniques and highlight advantages that could result to the shipping sector when doing so (e.g. potentially fewer restrictions).

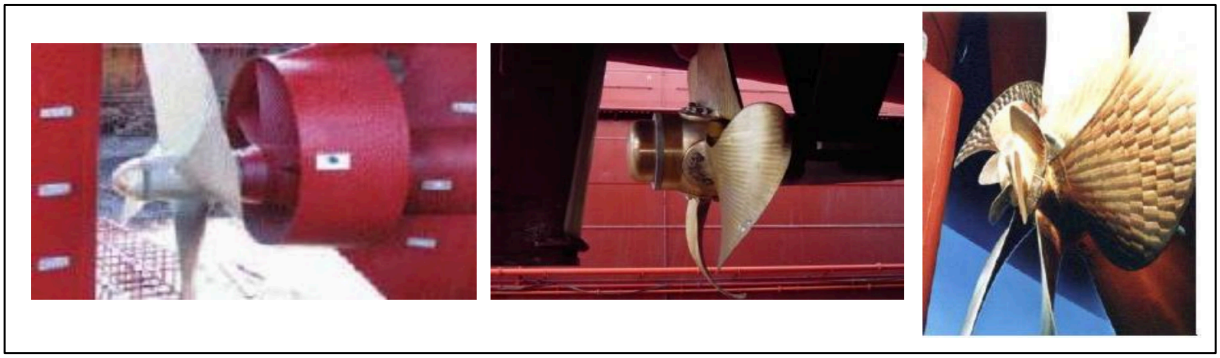


Figure 16: Ship-quieting technologies[85]

[83] REPCET (2017)

[84] WWF (2017)

[85] Jasny (2014)

Solution 9: Involve the sector in developing joint solutions

The shipping sector should be involved in developing joint solutions to mitigate impacts on the marine environment. Agreements can be made between shipping companies and MPAs or other authority to jointly implement good practices[86]. It is important to increase public awareness regarding the impacts of the shipping industry on marine habitats and animals. Increasing awareness and training efforts for vessels crews is important as without their understanding of the problem and compliance, even the most advanced technologies will not resolve the issue. Tools that inform and engage stakeholders may help to improve compliance with mandatory and voluntary measures that are implemented to protect vulnerable species and populations[87].

6. Outlook: Future trends and developments in the sectors (with a view to the likelihood of conflicts arising in the future)

6.1. Future trends in the maritime transport sector

Shipping volumes in European seas are ultimately determined by import and export flows. These in turn are driven by consumers' purchasing power, as well as the status and strength of the European economy versus the rest of the world. It is difficult to forecast developments as they are dependent on the wider political situation and economic development, both at the global and regional level. Nevertheless, the volumes transported by ship are expected to remain stable as a minimum and are very likely to grow. The trend towards larger ships is also set to continue. Another trend is towards larger ships no longer entering port. Cargo may increasingly be loaded onto smaller vessels to ferry it in and out of port. This will require new spaces in the sea and also create new environmental impacts while minimising others.

An important aspect is that shipping routes can shift in response to external events. These may be economic or political changes, but also infrastructure-related, such as the availability of new ports. With respect to cruising, for example, the geopolitical instability within the Middle East has benefited EU destinations in the Mediterranean[88]. Shifting shipping routes can lead to new conflicts with marine conservation, or alleviate or exacerbate existing conflicts. A long-term example is the potential North West passage in the Arctic.

[86] European MSP Platform (2018)
[87] Silber *et al*. (2012)
[88] UNWTO (2017)

Requirements have been introduced by international organisations to help reduce the environmental impact of shipping, in particular sulphur emissions. At the same time, the shipping industry regards requirements to introduce cleaner fuels and other technological innovation as a great challenge on account of tight cost margins in the sector. Some of the new technical solutions which are being implemented by the shipping industry are: a) the optimisation of the shipping hulls with new designs and low resistant coating, which improve the energy of propulsion and reduce the production of CO2; b) the optimisation of the propulsion with the implementation of a larger propeller effectively contribute to improve efficiency and thus reduce fuel consumption and CO2 emissions; c) the adoption of new hull designs which do not need ballast water. Such new concepts not only improve energy consumption but they also eliminate the problem of ballast water, hence eradicating the impact relative to alien species due to the discharge of ballast water[89]. Another future trend is the implementation of engines which will use Liquified Natural Gas (LNG) as this will reduce CO2 emissions by about 15-30%, NOX emissions 45-85%, and SOX emissions will be almost completely eliminated[90].

6.2. Future trends in area-based marine conservation

Those calling for increased protection of the marine environment will most likely call for the establishment of more MPAs as well as request re-routes in sensitive areas. Technology will also play an increasing critical role in the protection of marine biodiversity as proven with the use of new satellite systems such as the REPCET software. Additionally, as Member States are required to implement measures to achieve the Good Environmental Status (GES) of the marine environment, as required by the Marine Strategy Framework Directive (MSFD), is it expected that new measures will be taken by European countries for improving the quality of the marine environment and at the same time reduce impacts on the fragile ecosystems and animals. The future of most MPAs will also see an increasing implementation of the Ecosystem-based Approach (EBA), which will improve the management of MPAs such as the Pelagos sanctuary and will thus be able to deliver better protection for cetaceans and other threatened species. Finally, the increasing use of technology and the availability of new instruments will contribute to data collection of endangered species and will enable policy-makers and related players to make decisions based on scientific data with the aim to reduce anthropogenic pressures on the ecosystems.

[89] Ait Allal *et al.* (2018)

[90] Ghadikolaei *et al.* (2016)

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