PHAROS4MPAS

SAFEGUARDING MARINE PROTECTED AREAS IN THE GROWING MEDITERRANEAN BLUE ECONOMY

Interreg Mediterranean PHAROS4MPAs

RECOMMENDATIONS FOR MARITIME TRANSPORT

Front cover: Bottlenose dolphins *(Tursiops truncatus)* in the Strait of Gibraltar © Sylvain Cordier / Biosphoto

Publication

Published in May 2019 by PHAROS4MPAs.

Citation of this report: Randone, M., Bocci, M., Castellani, C., Laurent, C. (2019). *Safeguarding Marine Protected Areas in the growing Mediterranean Blue Economy.* Recommendations for Maritime Transport. PHAROS4MPAs project. 64 pages.

Lead author: Mauro Randone (WWF Mediterranean)

Our consultant Thetis Spa (Italy): Martina Bocci, Chiara Castellani, Federico Fabbri, Emiliano Ramieri with cartographic support from Angiola Fanelli

Copy editing: Evan Jeffries (Swim2Birds Ltd)

Cartography: Alessandro Mulazzani (Consiglio Nazionale delle Ricerche - ISMAR)

Design/layout: OneBigRobot

We would like to warmly thank all the people and organizations who were part of the advisory group of this publication or kindly contributed in some other way: Robert Turk and Tina Centrih Genov (Institute of the Republic of Slovenia for Nature Conservation), Catherine Piante (WWF-France), Amalia Alberini (WWF-Greece), Panagiota Maragou (WWF-Greece), Julien Le Tellier (UN Environment/ MAP), Sylvain Petit (PAP/RAC), Oscar Esparza (WWF-Spain), Theodora Papatheochari and Spyros Niavis (University of Thessaly), Atef Ouerghi (RAC/SPA), Wissem Seddik (MedPAN), Eric Charbonnel (Parc Marin de la Côte Bleue), Anthony Mastitski (WWF Mediterranean).

This report is available at:
https://pharos4mpas.interreg-med.eu

Financial support

Project co-financed by the European Regional Development Fund

CONTENTS

EXECUTIVE SUMMARY

Maritime transport is the backbone of the global economy. It's particularly important in the Mediterranean Sea – despite covering less than 1% of the world's oceans, the Mediterranean carries about 15% of global shipping.

Worldwide, ocean-related economic activity – the so-called Blue Economy – is growing; and the maritime transport sector is expected to continue increasing at a rate of 4% per annum for the next decade. In line with the global expansion of seaborne trade, shipping activity in the Mediterranean is growing in terms of the number of routes, traffic intensity and size of ships. And with this growth come increasing environmental impacts, such as chemical pollution, noise pollution and collisions with marine mammals.

These environmental impacts are an issue for the whole of the Mediterranean, but it's particularly critical that they're prevented – or at least minimized – in Marine Protected Areas (MPAs), which by definition are areas of great importance for marine biodiversity and ecosystems.

In certain sensitive MPAs, maritime transport of any kind is forbidden. In many, though, shipping activity is legally possible, so there's an urgent need for all relevant stakeholders to work together to ensure sustainable transport practices and tools are identified and adopted to minimize its impact.

This report provides key recommendations for the main actors in the maritime transport sector to help move towards a sustainable Blue Economy model for the Mediterranean.

The three stakeholder groups we focus on are MPA managers, public authorities and maritime transport companies. Each group has its own priorities, perspectives and powers, but all can make important contributions to a sustainable future for the Mediterranean.

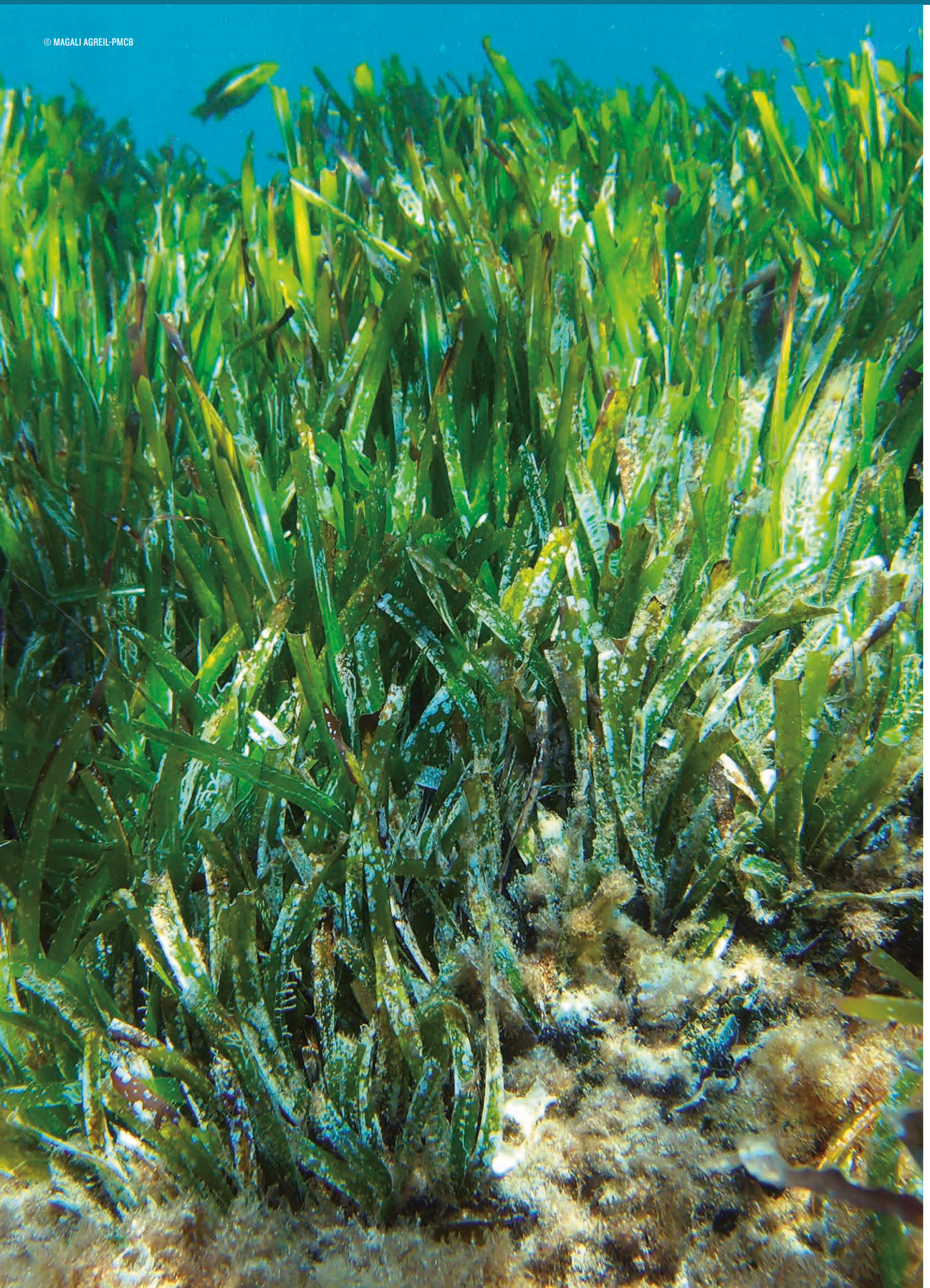
MPA managers are rarely able to impose direct regulations on maritime traffic, but they can do a great deal to promote dialogue with the industry, spread best practice, collect data, raise awareness and coordinate local actions. A strong MPA network is essential.

Public authorities – from state transport agencies to port authorities – control marine spatial planning and can impose a range of measures to prevent accidents and protect ecosystems. Authorities also provide crucial finance for research and technologies that can be widely applied. Cross-border, sub-regional and regional cooperation are particularly important given the scales over which the sector operates.

The maritime transport companies already have access to a large amount of knowledge and technology aimed at preventing or minimizing their environmental impacts, and further investments could be made to develop and support innovation. Companies need to comply with relevant regulations and should adopt environmentally responsible practices more broadly.

Cross-sectoral work is needed too: MPA managers can train vessel staff in best practices, while ships can assist research by inviting on board scientist observers and carrying out monitoring activities.

There's a lot of work to do to improve the way in which the maritime transport sector interacts with Mediterranean MPAs, but solutions do exist. Taken as a whole, this report gives a series of practical recommendations for what each stakeholder group can do to ensure increased collaboration and effort to build a new maritime transport system that respects the precious marine resources of the Mediterranean.



© MAGALI AGREIL-PMCB

INTRODUCTION

This report proposes a set of recommendations on how public and private stakeholders in the Mediterranean can work to prevent – or minimize – the impacts of maritime traffic in Marine Protected Areas (MPAs).

Maritime transport is one of the most important elements of the global Blue Economy. It includes the commercial transport of goods (bulk and non-bulk) and passengers (ferries), as well land-based activities including industrial ports and the related facilities and services allowing vessels to access them. This is a growing sector, both globally and in the Mediterranean region, with vessels that have being getting larger and more specialised, with an increasing trend towards containerization and mass transport. However, the environmental impacts of this growth – in local and more general terms – are well documented. Oil spills and vessel strikes on endangered cetaceans are perhaps the most visible effects; but underwater noise, chemical contamination, alien species and seabed disturbance are also associated with the maritime transport sector, and all affect MPA conservation objectives.

But alongside these issues, targeted policies, technological progress and advances in science and research offer valuable opportunities for improving the situation. Through the PHAROS4MPAs project we've gathered many examples of successful initiatives to resolve conflicts and mitigate environmental impacts – in the Mediterranean and worldwide. By bringing together different stakeholders and exploring the major issues experienced in MPAs, our goal is to provide examples of best practice and facilitate information exchange among MPAs affected by similar pressures.

In taking into account the different roles, interests and attitudes of MPA managers, public authorities and the maritime transport sector, we've produced practical recommendations for addressing the potential negative interactions between maritime transport and MPAs.

The PHAROS4MPAs project explores how Mediterranean MPAs are affected by activities in the growing Blue Economy, and provides a set of practical recommendations for regional stakeholders on how the environmental impacts of key sectors can be prevented or minimized.

Encouraging international collaboration across MPA networks and cooperation between state, industry and other actors, PHAROS4MPAs aims to enhance MPA management effectiveness and improve the conservation of marine ecosystems across the whole of the Mediterranean.

PHAROS4MPAs focuses on the following sectors of the Blue Economy:

- Maritime transport and industrial ports
- Cruise
- Leisure boating
- Offshore wind farms
- Aquaculture
- Recreational fisheries
- Small-scale fisheries

PART ONE
MARITIME TRANSPORT SECTOR:
BACKGROUND INFORMATION

CARGO SHIP DOCKED IN THE PORT OF ALGECIRAS (SPAIN)

MARITIME TRANSPORT

is the backbone of international trade and the global economy. Around 80% of global trade by volume and more than 70% by value is carried by sea. Worldwide, the sector is growing, and is expected to continue increasing at a rate of 4% per annum in the next decade. [1]

Despite covering less than 1% of the world's oceans, the Mediterranean Sea accounts for about 15% of global shipping activity (measured by number of port calls).[2] The maritime transport sector directly employs some 550,000 people in Mediterranean countries, generating a Gross Value Added (GVA) of €27 billion.[3]

The Mediterranean fleet is composed of about 8,000 vessels, representing 210 million tons deadweight tonnage. Average vessel size and carrying capacity is increasing, especially for tankers and bulk carriers [3]. Greece continues to be the world's largest shipowning country in terms of deadweight tonnage (with a market share of 17.3%), followed by China, Japan and Germany. Aside from Greece, there are three other Mediterranean countries – Turkey, Italy and France – among the 35 top shipowning countries of the world in terms of deadweight tonnage.[1]

The Mediterranean has more than 600 commercial ports and terminals.[3] Nine of these are among the 20 largest cargo ports in the European Union: Algeciras and Valencia (Spain), Marseille (France), Genova and Trieste (Italy), Piraeus (Greece), and Aliaga, Izmir and Botas (Turkey). Important ports in the southern Mediterranean with more than 1 million TEU [4] include Port Said and Alexandria (Egypt), Tangier (Morocco), Beirut (Lebanon) and Haifa (Israel).

In line with the global expansion of seaborne trade, shipping activity in the Mediterranean basin is expected to increase in the coming years, in terms of both number of routes and traffic intensity. The recent doubling of capacity in the Suez Canal – from 50 to 100 ships per day – is expected to nearly double the number of shipping of containers which pass through the Mediterranean.[5] The Mediterranean will also become busier as a result of the Belt and Road Initiative (BRI), the Chinese government's vast investment plan aimed at improving connectivity between China and Europe. The Chinese-owned port of Piraeus will be central to this new maritime Silk Road,[6] which will also see investments in port areas and inland logistic and industrial facilities to improve capacity and infrastructure.

Future trends in the Mediterranean are likely to be influenced by other **key drivers** which include:

- **Weak oil refining capacity in Europe**
- **Increasing demand for liquified natural gas (LNG)**
- **The implementation of trans-European networks**
- **The potential designation of the Mediterranean as an Emission Control Area (ECA)**
- **The limited renewal rate of the world fleet.[7]**

These trends also depend on global and regional economic development, the price of energy, and transport policies.[3]

SHIP BOW

© FRÉDÉRIC BASMAYOUSSE

KEY FACTS

Around **80%** of global trade by volume and more than **70%** by value is carried by sea.

550,000 | **€27** billion | **8,000** | **210** million tons

The maritime transport sector directly employs some **550,000** people in Mediterranean countries, generating a Gross Value Added (GVA) of **€27** billion.

The Mediterranean fleet is composed of about **8,000** vessels, representing **210** million tons deadweight tonnage.

The Mediterranean has more than

600

COMMERCIAL PORTS AND TERMINALS

Nine of these are among the 20 LARGEST CARGO PORTS in the European Union:

ALGECIRAS and VALENCIA (Spain)
MARSEILLE (France)
GENOVA and TRIESTE (Italy)
PIRAEUS (Greece)
ALIAGA, IZMIR and BOTAS (Turkey)

Important ports in the SOUTHERN MEDITERRANEAN with more than 1 MILLION TEU:

PORT SAID and ALEXANDRIA (Egypt)
TANGIER (Morocco)
BEIRUT (Lebanon)
HAIFA (Israel)

DEFINITIONS

Maritime transport is used to mean the shipment of people and goods by sea for commercial purposes. It includes shipping for bulk and non-bulk goods and transportation of people (passengers).

Bulk transport includes liquid (e.g. oil and gas, chemical products) and dry products (e.g. minerals, cereals), while **non-bulk transport** includes shipping of wheeled cargo, known as roll on-roll off (Ro-Ro), and containers.

For these activities different vessels are operated: oil tankers, bulk carriers, general cargo ships (e.g. multiple cargo vessels, Ro-Ro), container ships, and other vessels such as liquefied petroleum/natural gas carriers, parcel (chemical) tankers, specialized tankers, reefers, offshore supply, tugs, dredgers, and ferries[1].

Passenger traffic, as discussed in this report, only refers to **ferries** where people are carried in a shuttle-type service across relatively short distances, as opposed to cruise travel.

This report also deals with **land-based activities,** including industrial ports and the infrastructures and services related to port access by vessels, as well as the use of port facilities such as waste management and anchorage zones.

CONTAINER SHIPS PASSING THROUGH THE SUEZ CANAL (EGYPT)

In 2015, Egypt opened a major expansion of the Suez Canal, which has deepened the main waterway and provides ships with an extra 35km channel parallel to it. The original canal already handled 7% of global sea-borne trade.

On 24 February 2016, the Suez Canal Authority officially opened the new side channel allowing for two-way traffic along part of the route, as well as for larger vessels overall.

The Suez Canal set a double record in 2018, both for the number of transiting ships (over 18,000, +3.6%) and for cargo transported (983.4 million tons, +8.2%).

Sitting at the interface of three continents – Africa, Asia and Europe – the Mediterranean sees a very high level of maritime transport, from goods to energy products and passengers. The western Mediterranean and the Aegean-Levantine Sea are the busiest areas of all. [3] Major traffic routes are dominated by crude oil shipments originating in the eastern Black Sea, Northern Egypt or the Persian Gulf via the Suez Canal, and by container ship traffic. [7] Most of the Mediterranean's traffic is internal, while a small part is composed of large vessels which pass through its straits – the Straits of Gibraltar, the Dardanelles Strait, and the Suez Canal.[8] [9]

Short sea shipping in EU-Mediterranean countries is especially important, accounting for a significant share of all maritime transport of goods to and from the main EU ports – in Italy, Greece, Slovenia, Cyprus and Malta it makes up more than 75% of the total. In addition, the Mediterranean region accounts for the largest share (29%) of Europe's short sea shipping of goods, with 611 million tons in 2016.[10]

NON-BULK TRANSPORT

Except for a drop during the global financial crisis between 2009-2011, non-bulk transport in the Mediterranean has been significantly increasing. Goods transported in containers account for 24% of the short sea cargo in the region,[10] following the general growth of containerization in shipping [3]: Italy led other European nations in 2016 with 51 million tonnes, followed by Belgium, Germany and Spain.[10] large container ships mostly take an East-West direction towards North European countries, with smaller units undertaking trans-shipments to Mediterranean Sea ports (Figure 1).

The size of container ships worldwide has been steadily increasing in the last decades, with shipowners aiming to reduce transport costs per unit. A major advance occurred in the late 1990s, which saw the introduction of Maersk K-Class ships with a capacity above 6,000 TEUs. After 2008-2009 major shipowners accelerated their efforts again, the trend towards vessel gigantism leading to the deployment of 400-metre mega-vessels reaching 18,000 TEUs and beyond.[11]

The use of such enormous ships has inevitable impacts on MPAs, particularly in terms of underwater noise, collisions with cetaceans, and damage to bottom habitats on the approach to coasts and ports.

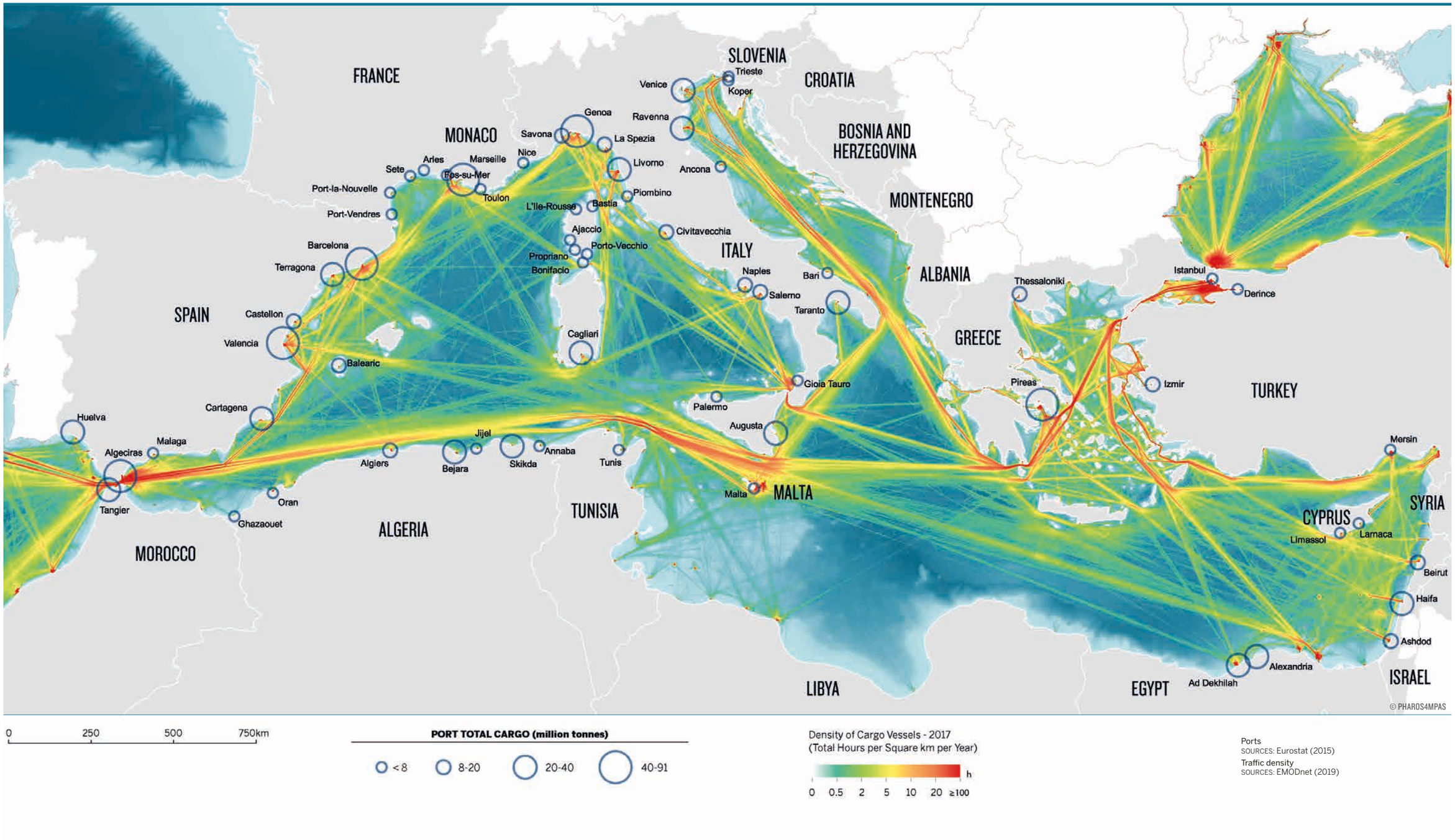


FIGURE I. Main ports and annual density of cargo vessels transiting in the Mediterranean Sea

LIQUID BULK TRANSPORT

The Mediterranean includes key load and discharge centres for crude oil, and liquid bulk goods make up a significant part of the region's maritime transport. [3] Major traffic lanes connect the eastern Black Sea and Northern Egypt to Mediterranean destinations and ports west of Gibraltar, while others lead from the Persian Gulf to the Mediterranean through the Suez Canal. It has been estimated [3] that about 18% of global seaborne crude oil shipments take place within or through the Mediterranean. Among European Mediterranean countries, liquid bulk represents about 40% of the total weight of short sea shipping goods, followed by container traffic at about 20%. [10] The risk of accidents leading to leaks of oil or other contaminants makes this type of traffic particularly relevant for MPAs.

PASSENGER TRANSPORT

The Mediterranean's many islands mean that passenger transport also represents a major component of maritime traffic in the region, especially in the Aegean Levantine Sea.[3] Italy and Greece handle the most passengers in Europe, with 67 million and 65 million respectively in 2016 – a combined share of 33% of all passengers embarking and disembarking in EU ports.[12]

Nevertheless, like other Mediterranean and non-Mediterranean EU ports, Italy and Greece have experienced a substantial decrease in seaborne passengers over time (numbers in 2016 show a reduction of 27.8% in Greece and 21.8% in Italy over the previous decade [10]): this is largely due to new infrastructure like bridges or tunnel connections and the subsequent closure of ferry links, along with the rapid growth in low-cost flights. Passenger transport also follows seasonal patterns, unlike the transport of goods – there's a general increase of traffic intensity in the summer.[13] [14]

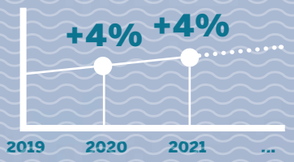
Since vessel speed and size both influence the frequency and severity of cetacean ship strikes, high speed ferries are among the most dangerous type of vessel for cetaceans, causing a large share of reported accidents.[14]

PASSENGER SHIP ENTERING THE PORT OF GENOA (ITALY)

KEY FACTS

15% of GLOBAL SHIPPING ACTIVITY is concentrated in the Mediterranean.

Mediterranean SHIPPING ACTIVITY is projected to increase by about 4% annually.



18% of the world's CRUDE OIL SHIPMENTS take place in or pass through the Mediterranean.

PART TWO
MARITIME TRANSPORT SECTOR:

INTERACTIONS WITH MPAs

SPERM WHALE IN THE STRAIT OF GIBRALTAR

2.1.
HOW COMMERCIAL TRANSPORT ACTIVITIES AFFECT MPAS

Maritime transport affects the marine environment, both in the course of routine operations and through accidental events. Its impacts can be localized (e.g. the effects of anchoring or mooring) or far-reaching (e.g. underwater noise from ship engines); and they occur during offshore navigation as well as in coastal areas.

Most of the region's MPAs and other effective area-based conservation measures (OECMs) are located in coastal and shallow areas. Mediterranean MPAs cover about 25% of the 0-15m depth zone and almost 17% of the 0-50 m depth zone;[15] while at depths of 50-200m almost 13% of sea areas fall under some kind of designation.[15] It's inevitable that major commercial traffic routes will interact with MPAs and OECMs in some locations, especially when vessels are approaching ports or passing through narrow zones (e.g. straits).

The high volumes of cargo and liquid bulk traffic which pass through the Straits of Gibraltar – especially via the central and western Mediterranean sub-region – are a good illustration of the issue. Several MPAs and Natura 2000 sites along the Spanish Mediterranean coast (e.g. Cabo de Gata) intersect with one of the busiest areas for large-tonnage maritime traffic:[16] this is one of the Mediterranean's most important Special Areas of Conservation for the bottlenose dolphin and the loggerhead turtle, so the risk of collisions is particularly serious.

The Northern Adriatic ports also play a major role in liquid bulk transport (Figure 3). Italy handles one of the largest liquid bulk volumes in Europe (186 million tonnes [12]), but the accident frequency in the Adriatic Sea is five times the world average – this is due to the elongated shape of the basin, which means its long South to North oil route is frequently crossed by other commercial ships navigating between the Western and Eastern Adriatic coasts.[17] [18] As a result oil pollution is an ever-present risk in the central and northern Adriatic, especially near main ports, potentially impacting the MPAs and Natura 2000 sites of the western and eastern coasts.

Beyond MPAs and OECMs, there are larger areas extending far offshore where conservation measures and sustainable use practices *should* be adopted to protect cetaceans from maritime traffic, whether they are classed as critical cetacean habitat areas (CCH) or important marine mammal areas (IMMAs).[22] The Convention on Biological Diversity has also identified further Ecologically or Biologically Significant Areas (EBSAs) that support the healthy functioning of the Mediterranean Sea and the many services that it provides. All three of these classifications denote areas where protection is recommended but where there is no management in place.

As the main crossroads between the western and eastern Mediterranean basins, the Strait of Sicily and the Tunisian Plateau are examples of areas of this kind. Their ecological value has been internationally recognized with the identification of two EBSAs and a possible IMMA.[23] Despite the fact that EBSAs, CCHs and IMMAs are not technically MPAs, they highlight areas of valuable and sensitive habitats, underlining the need for conservation measures.

Large areas like these intersect almost all the major traffic routes of the Mediterranean. Figure 2 provides a striking example, showing that EBSAs and CCHs cover most of the eastern part of the Aegean-Levantine sub-region of the Mediterranean – and yet this area sees 41% of the Mediterranean's total passenger traffic and 37% of total freight traffic.[3]

Only 5% of the Mediterranean Sea is covered by MPAs and OECMs at depths greater than 200m.[19] The Pelagos Sanctuary for marine mammals is one example, being both the largest and the only pelagic MPA in the region.[19] There are major commercial, touristic and industrial sites in the same area, and the resulting maritime traffic is one of the major pressures on the Sanctuary – an annual total of almost 4,000,000 km of vessel traffic from more than 80,000 transits by about 4,000 distinct vessels has been recorded.[13] The impacts this has on the cetaceans the Sanctuary is intended to protect include physical disturbance, noise, collisions and chemical pollution (antifouling, hydrocarbons, other toxic compounds, macro-waste);[20] threatening the survival of many species.[21]

KEY FACTS

Maritime traffic has a wide range of impacts, from those on a local scale (e.g. anchor damage) to those which affect much larger areas (e.g. noise pollution).

Since most MPAs and OECMs are in coastal zones, vessels most commonly enter them when they're approaching ports or straits.

The significant extension of EBSAs and other critical conservation areas (CCHs and IMMAs) increases the likelihood of vessel/protected area interactions in future.

TANKERS CROSSING THE STRAITS OF GIBRALTAR

© EVGENY ZINOVIEV / SHUTTERSTOCK

LOGGERHEAD TURTLE *(CARETTA CARETTA)*

© MICHEL GUNTHER-WWF

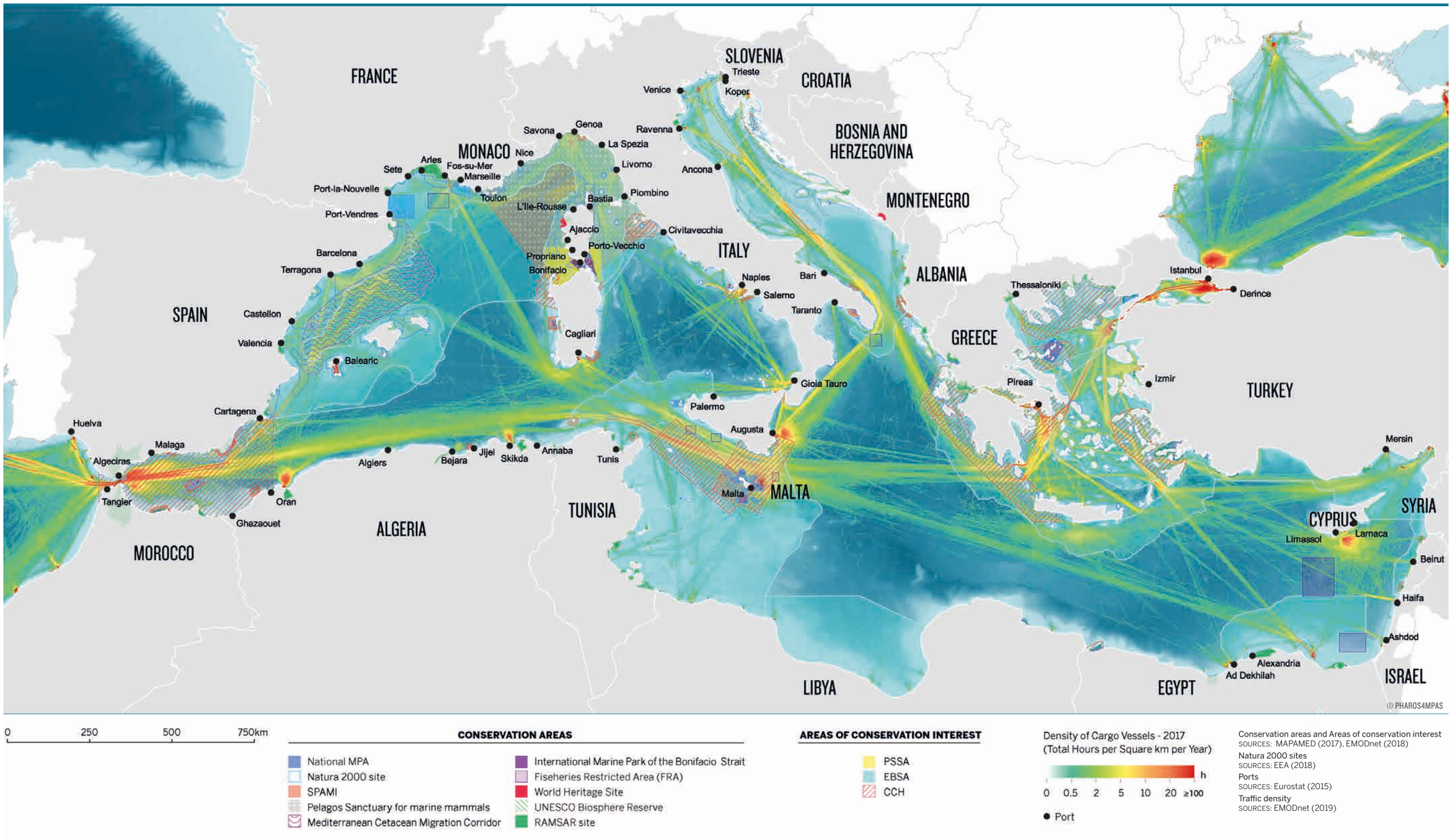


FIGURE 2. Annual density of cargo vessels, MPAs and other conservation areas

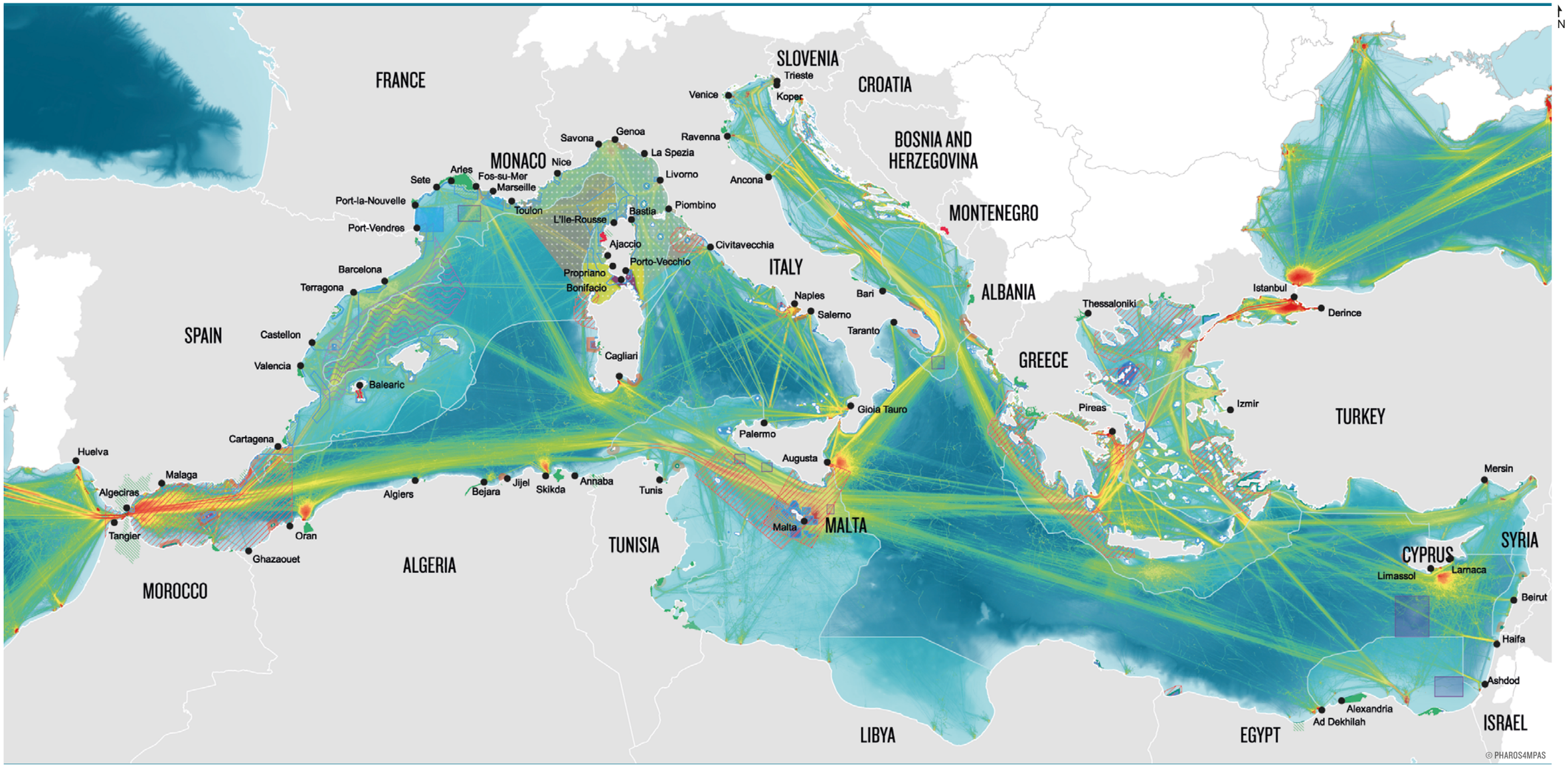


FIGURE 3. Annual density of liquid bulk vessels, MPAs and other conservation areas

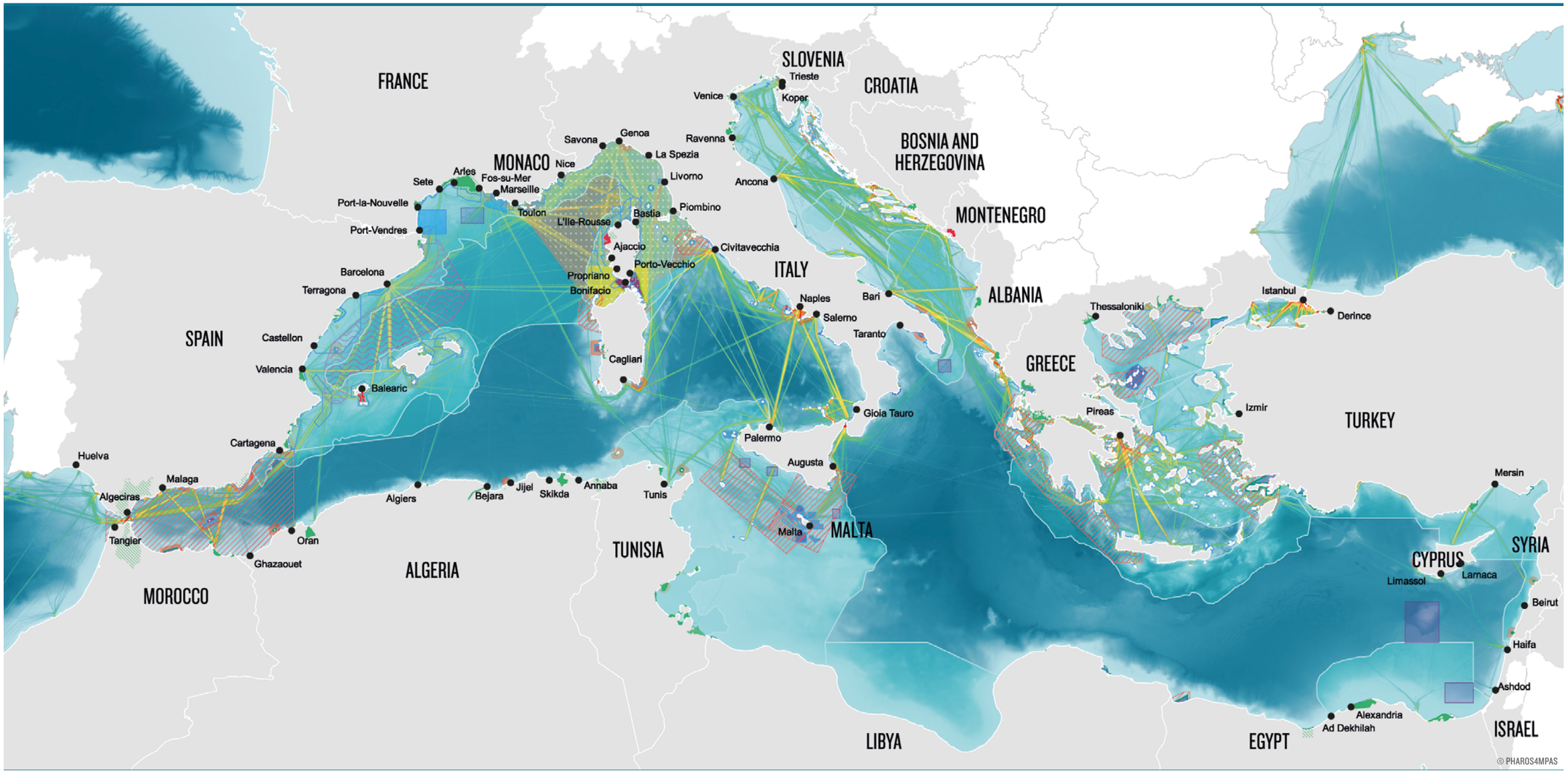


FIGURE 4. Annual density of passenger vessels, MPAs and other conservation areas

2.2.
IMPACTS OF THE MARITIME TRANSPORT SECTOR ON MARINE ECOSYSTEMS

The main impacts of maritime transport on marine ecosystems include:

UNDERWATER NOISE | **COLLISIONS WITH MARINE FAUNA** | **POLLUTION FROM OIL AND OTHER CHEMICALS** | **SEABED DISTURBANCE** | **INTRODUCTION OF ALIEN SPECIES**

These impacts can be matched to ecological state descriptors in the European Marine Strategy Framework Directive (MSFD, 2008/56/EC), as shown in Figure 5 below.

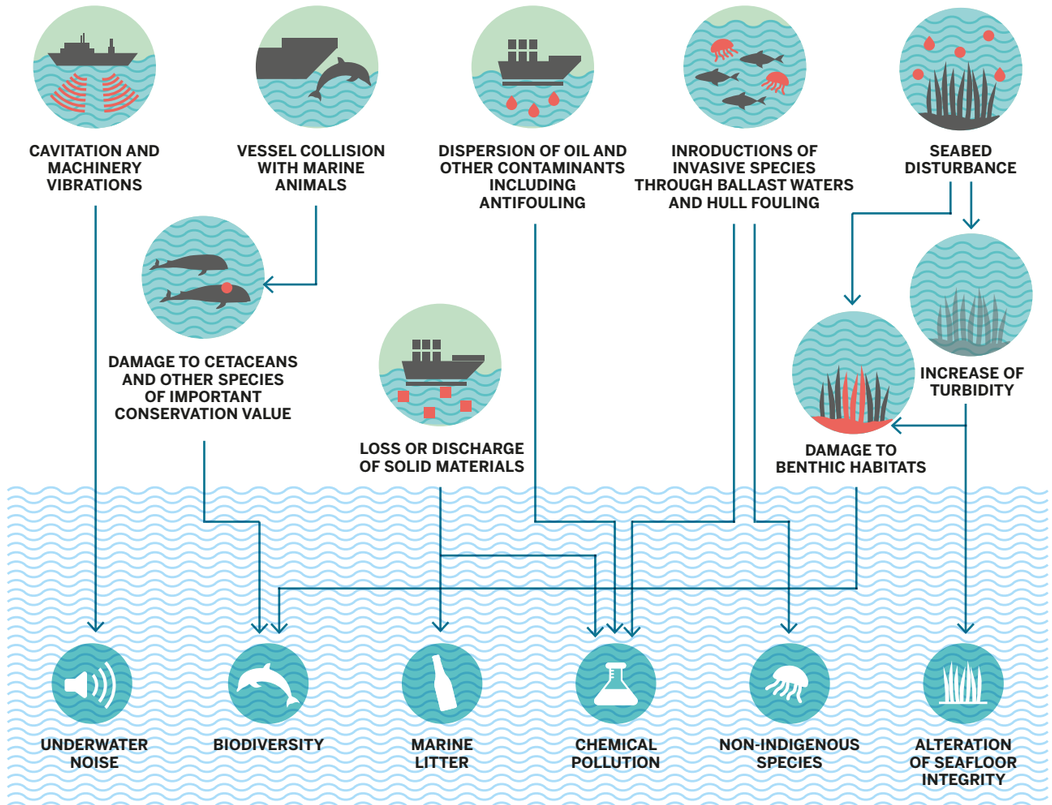


FIGURE 5. Main environmental impacts of maritime transport on MPAs shown through the ecological status descriptors of the EU Marine Strategy Framework Directive © THETIS SPA

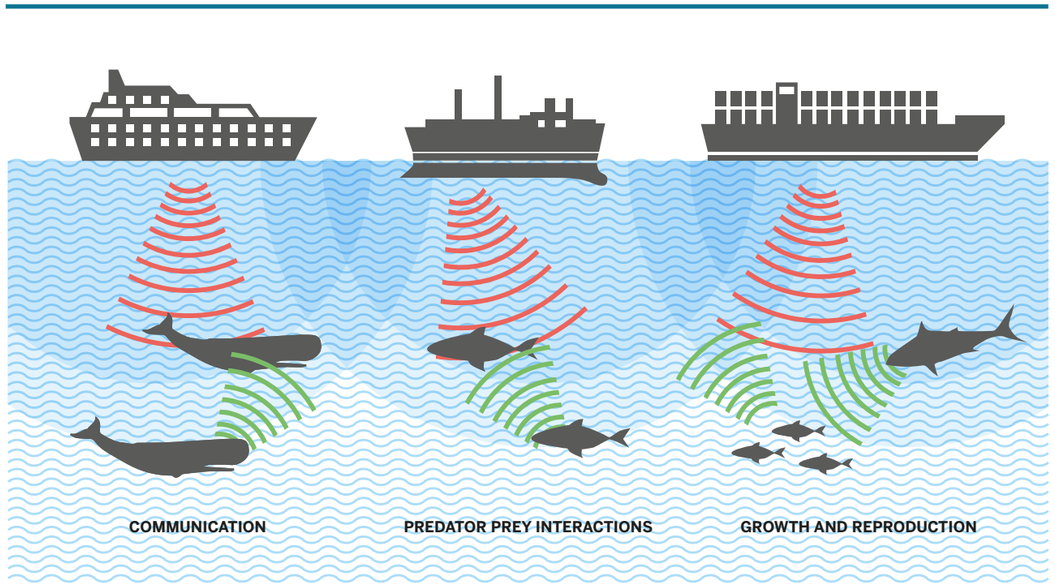


FIGURE 6. Sources of noise pollution and impacts on marine species © WWF

UNDERWATER NOISE

This is a ubiquitous form of marine pollution – it's particularly acute on busy maritime routes, in areas where sonars are heavily used, and along developed coasts. The EU's Marine Strategy Framework Directive (2008/56/EC) directly addresses the introduction of noise into marine waters, stating that noise should be limited so that the marine environment is not adversely affected.[24] Establishing an MPA can be an effective way of reducing the impact of underwater noise – restrictions on maritime activities inside or even outside MPA borders can prevent noise spreading into critical areas.[25]

While most research into the impact of underwater noise has focused on marine mammals, there's also increasing concern over what it may do to fish, [26] aquatic birds and marine invertebrates.[27] [28] Underwater noise can change the behaviour of marine organisms, possibly impairing their hearing capacity, communication and ability to detect threats.[26] [25] Some high-energy impulse noise sources have even been linked to marine mammal deaths.[28] However, the main issue is simply the continuous nature of the underwater noise marine traffic creates: chronic exposure and cumulative effects, masking biological signals, can have long-term consequences for the conservation status of cetaceans, particularly in the most sensitive species.[29]

Underwater noise hotspots in the Mediterranean overlap with several protected areas and/or with areas of importance to noise-sensitive marine mammal species. These include the Pelagos Sanctuary in the Ligurian Sea, the Strait of Sicily, parts of the Hellenic Trench, and the waters between the Balearic Islands and continental Spain.[30]

A large-scale assessment of French waters in the Pelagos Sanctuary [29] found high levels of underwater noise in whale habitats. In the noisiest zones – between continental France and Corsica – levels were above 100 dB 95% of the time, occasionally reaching more than 140 dB. It's believed that this much noise can cause behavioural disturbance and mask low frequency communicative signals between cetaceans, particularly in the most sensitive species like Cuvier's beaked whales and fin whales.

COLLISIONS WITH MARINE FAUNA

On a global scale, collisions with large vessels represent the main fatal threat for whales. [31] In the Mediterranean this is a serious conservation issue for fin whales (*Balaenoptera physalus*) and sperm whales (*Physeter macrocephalus*), especially in the western basin. [14][32][33][34] Ship strikes are made more likely by underwater noise, which can interfere with cetacean communication and prevent animals from detecting and reacting to threats.

The Pelagos Sanctuary and the waters in and around the Gulf of Lion are particularly high-risk areas, and strikes have also been reported in Spanish and southern Italian waters.[27][14] The northeastern Mediterranean basin, the central Ligurian Sea and the coast of Provence show the highest potential for collisions, with fin whale sightings occurring in areas of shipping density.[32] In the eastern basin, the Hellenic Trench southwest of Greece is a known area of high sperm whale density which is crossed by major shipping routes: the animals are at risk from ship strikes. [35]

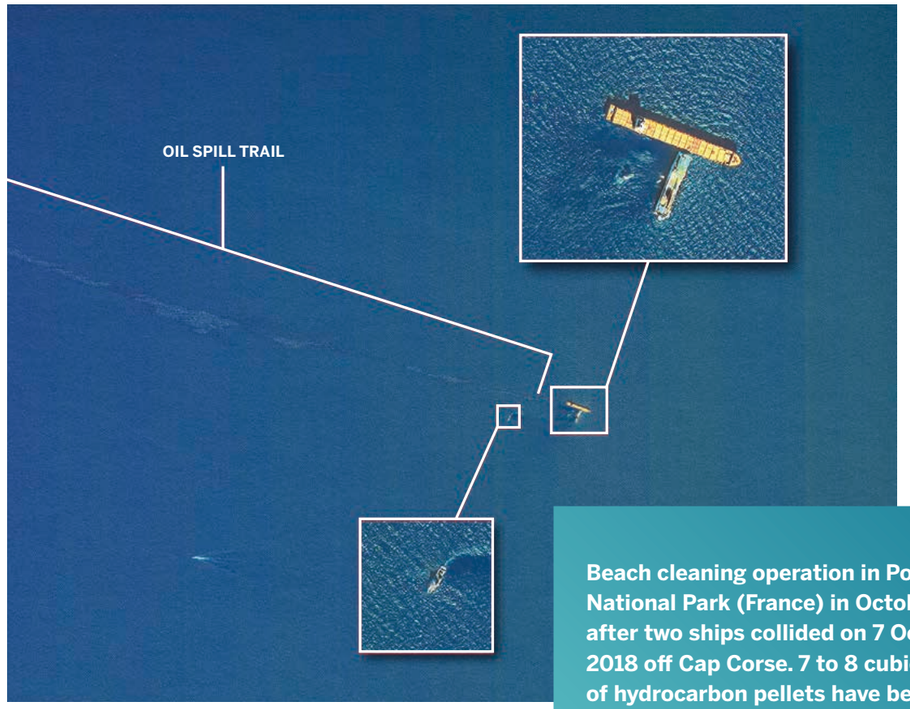
One study [14] analysed all documented ship strikes on fin whales in the Mediterranean Sea from 1972 to 2001. It found that:

- 287 fin whales were stranded, caught on the bow of a ship or found floating at sea
- 46 were confirmed to have died because of a ship strike
- Mortality rates were highest in the last decade (1991-2002)
- Lethal collisions increased between April and September, when recreational and passenger traffic is at its highest.

The real number of fatal ship strikes is probably higher than reported. Vessel speed and size affect the frequency and severity of collisions, with fast ferries involved in 43% of all accidents since the year of their introduction (1996).

FOLLOWING A SHIP STRIKE, THIS FIN WHALE *(BALAENOPTERA PHYSALUS)* REMAINED ATTACHED TO THE BOW UNTIL THE VESSEL DOCKED IN MARSEILLE (FRANCE)

© DENIS ODY



Beach cleaning operation in Porquerolles National Park (France) in October 2018 after two ships collided on 7 October 2018 off Cap Corse. 7 to 8 cubic meters of hydrocarbon pellets have been recovered in a day.

© ERIC SERANTONI

POLLUTION FROM OIL AND OTHER CHEMICALS

Oil spills are one of the most serious causes of marine pollution. They occur both in routine shipping operations (tank washing, loading/discharging, bunkering, dry-docking and discharging of bilge oil) and by accident. Oil tankers aren't the only vessels responsible: cargo ships, fishing boats and leisure craft all contribute to the overall pollution.[36] [5] [27]

The Mediterranean has been considerably affected by oil spills:

- **Since 1977:** total oil spillage approx 310,000 tons
- **Since 1988:** total spillage of other noxious substances >120,000 tons [37]
- **1970-2016:** 14 accidental oil spills by ships >10 tons, totalling about 180,000 tons
- **1991:** 144,000 tons of crude oil spilled in biggest single discharge, the MT *Haven* accident off Genoa.[5]

While major sea routes and the areas around key oil terminals are clearly most at risk, serious accidental oil spills could occur anywhere in the Mediterranean.

Potential hotspots include the Ionian Sea, the Adriatic Sea, the Messina Straits, the Sicily Channel, the Ligurian Sea, the Gulf of Lion and east of Corsica [36].

REMPEC – the Regional Marine Pollution Emergency Response Centre – estimates that the total input of oil from ships into the Mediterranean is between 100,000-150,000 tonnes per year. [38]

The release of antifouling paints (Tributyltin (TBT) and its degradation products), oil and exhaust emissions, sewage and ballast waters, and marine litter are the main sources of shipping-related contamination in the Mediterranean.

CARGO SHIP MANOEUVRING IN THE PORT OF KOPER (SLOVENIA)

KEY FACTS

Underwater noise can change the behaviour of marine organisms, impairing hearing, communication and the ability to detect threats. Many anthropogenic noise hotspots are in MPAs.

Collisions with vessels represent the number one fatal threat for whales worldwide: vessel speed, size and maneuverability all affect the probability of strikes.

Oil spills – both through routine shipping activities and accidental events – are among the most serious causes of marine pollution. Some 310,000 tonnes have been spilled in the Mediterranean since 1977.

SEABED DISTURBANCE

Maritime transport can cause general seabed disturbance which damages bottom habitats and species, especially when vessels are approaching shallow waters and ports. The anchoring and mooring of large vessels leads to abrasion and disturbance of bottom sediments,[39] while there are extensive reports of the disturbance of soft sediments during navigation by the direct abrasion of ship hulls in shallow waters, propeller scarring and groundings. [27] In addition, when bottom sediments are physically disturbed water turbidity may increase: this can harm habitats of important conservation value (e.g. *Posidonia oceanica*).

Most worldwide studies on the effects of anchoring and mooring have focused on seagrass beds and corals. Both are severely threatened by the mechanical action of anchors of vessels moored outside ports, [40] although there is less evidence of how other species and habitats are affected.[39] Nevertheless, the anchoring and mooring of large vessels is likely to have a significant impact. [41] [40] Anchors from commercial vessels penetrate deep into the sediment, below the depths at which most species live, so it's believed that most seabed habitats and species are sensitive to anchoring effects.[39]

INTRODUCTION OF ALIEN SPECIES

A steady rise in numbers of non-indigenous species introduced via shipping has been detected in all the Mediterranean basin, with a current rate (based on the last decade) of about one new species every six weeks [42]. According to the European Environmental Agency, shipping accounts for 51% of the introductions of non-indigenous marine species. [43] Ballast waters and hull fouling (when species attach to ships' hulls) are among the main vectors for these introductions, which can cause declines in abundance and local extinctions of native species.[27]

Unfortunately, there are no regulations currently in place to manage hull fouling. However, the Ballast Water Management Convention entered into force in 2017 and establishes standards and procedures for managing ships' ballast water and sediments, aiming to prevent the spread of harmful aquatic organisms from one region to another.

2.3. SHIPPING AND FERRIES IN MPAS: WHERE ARE THEY PERMITTED?

The IUCN [44] divides MPAs into six categories depending on their primary conservation objectives.[45] There are only three types where shipping (including ferries) is considered appropriate, unless it's unavoidable under international law:

- **Category IV**, aimed at *protection of particular species or habitats* (e.g. sanctuaries for marine mammals), often including active management to limit the impacts of human activities
- **Category V**, aimed at *seascape protection*, typically in coastal areas with a focus on the interaction of people and nature
- **Category VI**, aimed at *sustainable use of natural resources*, where social and economic benefits for local communities are included among secondary objectives.

Ports and related dredging are only considered appropriate in Categories V and VI, and in Category IV in some strictly controlled cases.[45]

Shipping is definitely not appropriate for **Category I** MPAs, as strictly protected areas or relatively undisturbed seascapes are to be left free of human disturbance.

In **Categories II and III**, shipping may be permitted, but only with proper approval and where no alternative is possible.[45]

In all MPAs, shipping activities with the highest potential impacts –large containers, dangerous goods, oil tankers– should be avoided altogether. Rerouting measures should be applied if needed.

Management and enforcement, however, are challenging. MPAs have multiple access points, and it's difficult to patrol remote areas. What's more, vessel passage rights through MPAs are commonly permitted by international laws.[44]

KEY FACTS

Shipping shouldn't take place at all in strictly protected areas (Category I).

Industrial ports are considered inappropriate for most Categories of MPAs.

Low-impact shipping should only be allowed in national parks and habitat/species management areas (Categories II and III) when no alternative is possible.

Categories codes	Ia	Ib	II	III	IV	V	VI
Brief denomination	Strict nature reserve	Wilderness area	National park	Natural Monument or feature	Habitat/species management area	Protected landscape/ seascape	Sustainable use of natural resources
Shipping*	✗	✗	✓	✓	✓	✓	✓
Works (ports, harbours, dredging)	✗	✗	✗	✗	✳	✓	✓

✓ Only after proper approval and where no alternative is possible ✳ Depends on managing activity in line with MPA's objectives

* Except where permitted under international law

TABLE I. MPA categories and appropriate maritime transport activities [45]

PART THREE

RECOMMENDATIONS FOR MEDITERRANEAN STAKEHOLDERS:

PREVENT – OR MINIMIZE – IMPACTS OF THE MARITIME TRANSPORT SECTOR ON MPAS

This section addresses **three key groups:**

- **MPA managers**
- **Public authorities**
- **Maritime transport companies**

Recommendations for each group have been grouped in **three areas:**

1. Prevent impacts on ecosystems

These preventative measures involve regulation of vessel transit (e.g. forbidden areas, speed limits) and operations (e.g. anchoring, manoeuvring).

2. Minimize impacts on ecosystems

Some impacts cannot be entirely avoided, but they can be reduced.

3. Knowledge, training and awareness raising

The more stakeholders know about the subject, the better able they will be to identify and apply the best solutions from points 1 and 2.

3.1. MPA MANAGERS

MPA management bodies rarely have the power to regulate maritime traffic: this is generally left to public authorities. However, case studies show that MPA managers can influence public decisions. Proactively establishing a dialogue with the maritime transport sector is crucial: this may lead to agreements on more sustainable technologies and good navigation practices. In some instances MPA managers can take local actions, such as identifying and implementing measures to regulate navigation and anchoring, environmental monitoring and research, reporting violations of regulations, education and awareness-raising.

3.1.1. PREVENT IMPACTS ON MARINE ECOSYSTEMS

Spatial and technical solutions can help with all of these objectives, but the decision-makers are generally national public authorities who work through legislation, national agreements, and marine spatial planning. Nevertheless, MPA managers can influence which regulations are adopted, and monitor their implementation. Locally, MPA managers can lead initiatives.

MPAS WITH HEAVY MARINE TRAFFIC

MAIN OBJECTIVE:
Prevent accidents during vessel navigation

Marine spatial planning and transit regulations (limitation or ban) are key to achieving this objective, and MPA managers can play an important role in promoting initiatives to public authorities. It may be appropriate to establish Particularly Sensitive Sea Areas (PSSA), Areas To Be Avoided (ATBA), or Traffic Separation Schemes (TSS). These solutions are described in more detail in paragraph 4.2.

MPA managers played an important role in establishing the PSSA in the Strait of Bonifacio (France). When the French part of the area was designated as a SPAMI under the Barcelona Convention, [46] the MPAs asked the French authorities to present its management plan to the International Maritime Organization (IMO) to prove there was a joint issue of maritime security and environmental protection in the Strait. Their direct support of the process was key to the PSSA's creation.

COASTAL MPAS PROTECTING BENTHIC HABITATS

MAIN OBJECTIVE:
Prevent damage to seabed habitats

The Côte Bleue Marine Park (France) has limited bottom habitat disturbance by managing anchoring zones to avoid some critical areas, particularly the Posidonia meadows. In parallel, the MPA authority has proposed modification of the anchorage zone of the Port of Marseille, and this has been at least partially approved[1] by the port authority. Outside this anchorage zone, there is also a decree[2] in force which prohibits any French vessels larger than 20m from anchoring in depths of less than 30m in coastal waters. These regulations were only put in place as a result of dialogue between different stakeholders - MPA managers, French state departments, and the port authorities in Marseille.

[1] Inter-prefectoral decree 2012249-0002 of the prefect of Bouches-du-Rhône and Préfecture maritime Méditerranée (2012)

[2] Prefectural Decree n. 159/2016 of the Prefecture maritime Mediterranee on 1 July 2016

Particularly Sensitive Sea Area: DEFINITION

A PSSA is an area "that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities"[47]. Designating a marine area as a PSSA confirms its international importance, highlighting its sensitivity and the need to respect protection measures.[48]

Each PSSA needs its own protection regime. This may include areas to be avoided, compulsory ship routeing, ship reporting, or recommendations on how shipping should navigate through an area. PSSAs can vary in size from large marine areas and ecosystems to small biodiversity hotspots.[49]

Proposals for new PSSAs must come from coastal states, and need to be formally recognized and adopted by the International Maritime Organization (IMO). The process is coordinated between the IMO Marine Environment Protection Committee (MEPC) and state governments.

HEALTHY POSIDONIA OCEANICA IN CÔTE BLEUE MARINE PARK (FRANCE)
© FRED BACHET-PMCB

Other coastal MPAs threatened by the impacts of shipping on bottom habitats could build on this experience. The case of the Debeli rtič Landscape Park (Slovenia) is a good example. Since 1991, one part of the cape has been protected as a "natural monument", largely because of the geomorphological features of the flysch cliff and the sea bottom. In 2018, the Municipality of Ankaran acted on a proposal from the Institute of the Republic of Slovenia and established the Debeli rtič Landscape Park, which includes the natural monument but also a much larger area covering both land and sea. The Park provides a strong base for efficient management of the area's natural values and Natura 2000 sites.

The heavy maritime traffic between the ports of Trieste, Monfalcone and Koper contributes to several navigation-related impacts that are common in the Adriatic Sea: frequent accidents, [18] high levels of underwater noise and chemical contamination, [50] [51] and the spread of invasive organisms (including pathogens) through ballast water discharge. [53] A national assessment also identified the key issue of sediment resuspension in shallow areas, potentially threatening seagrass habitats and benthic fauna.[52]

In response to these threats, local experts and authorities[3] identified specific measures to include in the management plan under preparation:

- Move traffic lanes which are close to the MPA further offshore
- Move the maneuvering area in front of the port of Koper away from the MPA
- Establish a monitoring programme in the area targeting maritime traffic impacts including sediment resuspension and alien species. This programme should be run in cooperation with the other Slovenian and Italian MPAs in the north-eastern Adriatic.

[3] The proposed recommendations have emerged from interviews with local stakeholders, carried out during the preparation of the present report.

MPAS PROTECTING MARINE MAMMALS

MAIN OBJECTIVE:
Prevent collisions with large marine mammals

The Pelagos Sanctuary is the largest MPA in the Mediterranean basin. It covers 3.47% of the ocean surface, which is about half of the total area covered by MPAs in the Mediterranean. [15] Stretching between Italy, Monaco and France, it includes the Bonifacio Strait between Sardinia and Corsica, designated as a PSSA by the IMO in 2011; and 14 other MPAs, parks and reserves. The Pelagos Sanctuary has been a Specially Protected Area of Mediterranean Importance (SPAMI) within the framework of the Barcelona Convention since November 2002.

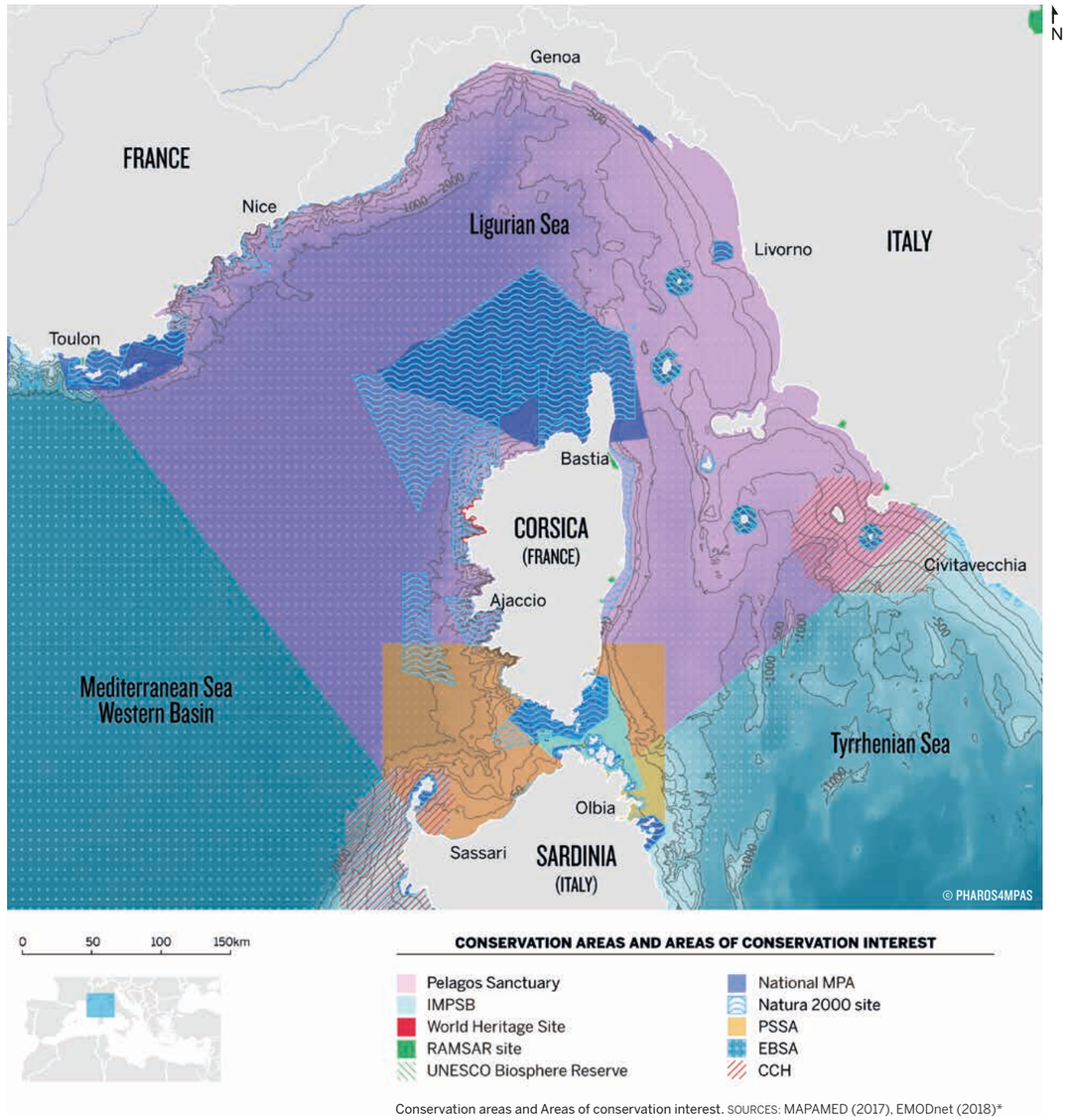
The Management Plan of the Pelagos Sanctuary[4] specifies the following objectives:

- Preventing and mitigating the elements that determine the medium-long term disturbance for marine mammals, in particular:
  - > to prevent and mitigate the risks of collision due to maritime traffic as well as from sports and recreational activities through specific measures;
  - > to identify the possible forms of intentional disturbance to cetaceans, also proposing innovative solutions for mitigation;
  - > to propose concrete measures of acoustic monitoring encouraging studies that investigate correlations between environmental noise and maritime traffic.
- Preventing and managing exceptional events that directly and/or indirectly pose a risk to the health of specimens, human health and/or environmental integrity.

As far as reducing collisions with marine mammals is concerned, management initiatives include:

- Reporting collisions to the International Whaling Commission (IWC) database
- Analysing existing measures and solutions implemented across the world
- Developing and adopting specific measures including real-time positioning of cetaceans, creation of a network to exchange data on cetacean presence, development of scientific studies, maps and models.

[4] Adopted in 2004 and then modified in 2015, for the period 2016-2022



Conservation areas and Areas of conservation interest. SOURCES: MAPAMED (2017), EMODnet (2018)*
* Integrated with 'Capo Testa - Punta Falcone" MPA (Decree of Italian Ministry of Environment, 17 May 2018, n. 102)
Natura 2000 sites. SOURCES: EEA (2018)

FIGURE 7. Environmental protection categories covering different areas of the Pelagos Sanctuary

SPERM WHALES *(PHYSETER MACROCEPHALUS)* AND STRIPED DOLPHINS *(STENELLA COERULEOALBA)* IN THE PELAGOS SANCTUARY

© F.BASSEMAYOUSSE / WWF FRANCE

A regulatory framework to address collisions is in place among member states of the Pelagos Agreement, however it only includes the following measure that specifically targets the maritime transport sector:

- French legislation on real-time positioning system

Since 1 July 2017 all French passenger and cargo vessels in the Pelagos Sanctuary have had to be equipped with a system to share sightings of marine mammals –[54] [55] REPCET (Real time Plotting of CETaceans), for example, is the most advanced technology available today. It can plot the positions of cetaceans detected from ships so they can be avoided by other vessels. Presently though this technology is limited only to these French vessels, meaning the problem of collisions with cetaceans is still largely unsolved. [55]

Unfortunately the measure doesn't go far enough on its own. This is mainly due to the weak, general nature of the Pelagos Agreement: it doesn't provide the Parties with the juridical and legislative base needed to reach its conservation objectives. The Sanctuary is not a national MPA, it's a new entity without a specific status. [55] The creation of a network of MPAs at national level between the parties would strengthen the implementation of the Pelagos Agreement – in addition, the International Whaling Commission (IWC) "recommends continued work to develop and evaluate mitigation measures, such as speed restrictions, that might be associated with the designation of a Particularly Sensitive Sea Area (PSSA) in the Pelagos Sanctuary area." [56]

RECOMMENDATIONS TO MPA MANAGERS

OBJECTIVE:
Prevent impacts on marine ecosystems

- Collect data and increase knowledge about the impacts and risks of maritime traffic. This would create the basis for impact avoidance measures.
- Advocate within planning and management processes – such as maritime spatial planning and integrated coastal zone management – for the establishment of specific spatial measures aimed at preventing accidents (e.g. establish a PSSA).
- Collaborate with the regional and sub-regional MPA manager networks (MedPAN, ADRIAPAN) to raise a stronger advocacy voice in the overall management of maritime transport, e.g by organizing specific thematic sessions in the relevant regional forums and events, or by developing regional reports and policy briefs.
- Promote the creation of local MPA networks to enhance coordination in large protected areas (national or international) like the Pelagos Sanctuary.
- Suggest practical solutions for impact avoidance at local level to competent actors, or directly implement them if under your competence.
- Promote agreements with public authorities to introduce local regulations such as navigation and anchoring restrictions.
- Monitor and report violations of national and international regulations.

3.1.2.
MINIMIZE IMPACTS ON MARINE ECOSYSTEMS

A variety of solutions are available for different types of environmental impacts, from technical measures to planning agreements and advanced legislation. The most important are those which target pollution of marine ecosystems, including oil discharges and underwater noise. MPA managers can't directly implement these measures, but they have a vital role to play in advocating for targeted environmental laws, environmentally friendly navigation and operational protocols, and improved capacity for reacting to maritime accidents.

It's worth noting that solutions aimed at preventing impact (described in section 3.1.1 above) are also relevant for impact mitigation.

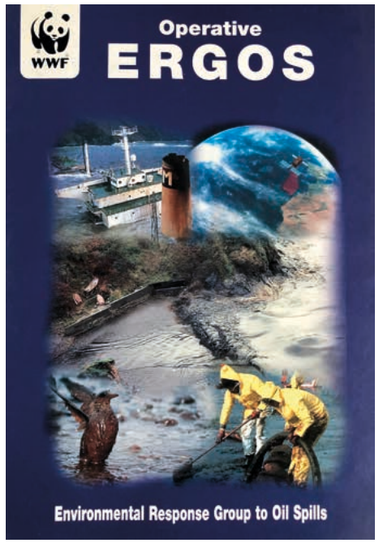
COASTAL MPAS

MAIN OBJECTIVE:
Minimize impacts of accidental marine pollution (e.g. oil spills)

Early warning and forecasting systems play a role in the mitigation of oil spills. MPAs can be fundamental actors in planning and putting them in place, in cooperation with scientists, local authorities and civil society.

For example, the Cetmar (Cetmar Centro Tecnológico del Mar) developed a forecasting system for oil spill events in Spanish marine areas where accidents are more frequent. [57] The forecasting system includes a simulation of the spill's drifts, and the probability of impacts on Spanish Natura 2000 sites.

Under the ERGOS project, [58] WWF-Spain helped to define and coordinate a protocol for direct intervention in the event of an oil spill in the Canary Islands. This protocol includes tracking the evolution of the accident; activating volunteer rescue and cleaning patrols; setting up rescue centres to treat affected wildlife; and assessing environmental impacts.



Accidental marine pollution is also being addressed by the OPENRISK project [94], which is developing **pollution preparedness and response (PPR)** and regional risk management tools and guidelines [59] for national and regional authorities.

CONTAINMENT BOOM IN PORT-CROS MARINE PARK (FRANCE)
© CLAUDE LEFEBVRE

RECOMMENDATIONS TO MPA MANAGERS

OBJECTIVE:
Minimize impacts on marine ecosystems

- Collaborate in developing contingency plans and intervention protocols to mitigate impacts of oil spill from accidents. Take an active role in implementation if needed.
- Train citizens and other actors to clean up oil pollution in the field.
- Actively engage in national and regional planning processes (MSP, ICZM) to promote the establishment of measures to mitigate the impacts of accidents (e.g. take into account forecasting tools).
- Collect data and spread knowledge on the impact of contamination from maritime traffic and port activities on MPAs, including ecosystem functioning, pollution retention capacity and vulnerability.

3.1.3.
KNOWLEDGE, TRAINING AND AWARENESS RAISING

MPAS PROTECTING MARINE MAMMALS

MAIN OBJECTIVE:
Improve knowledge on impacts of maritime traffic on MPAs

The scientific monitoring of cetacean populations and of the anthropogenic pressures they're subjected to is an essential element guiding management decisions in the Pelagos Sanctuary.

This is explicitly recognized in the 2016-2021 Management Plan, which includes ecosystem knowledge improvement as a main objective. Monitoring activities target maritime traffic (e.g. data acquisition, preparation of real-time traffic distribution and collision risk maps) and its impact on cetaceans (e.g. mapping of underwater noise sources and intensity, understanding of cetacean responses to noise exposure). Maritime traffic can also contribute to monitoring activities: ferries, for example, can be used as observation platforms, in addition to aerial surveys.

Several other measures have been implemented in the Pelagos area to increase knowledge about impacts of maritime traffic on marine mammals: [60]

- A French Collisions Network of ports and shipping companies has been developed to accurately identify the number of collisions since 2010
- Specialist observers have been placed on ferries through the Fixed Line Transect Mediterranean Monitoring Network, [61] a project coordinated by the Italian Institute for Environmental Protection and Research (ISPRA). The continuous monitoring project has been running since 2007 to track the evolution of cetaceans in Pelagos and to learn more about how collisions occur and how they can be avoided
- Many scientific studies have taken place in the Pelagos Sanctuary – and some of the results have been used to create a model to forecast the presence of fin whales. This model was especially developed by the Joint European Research Centre, with assistance from GIS3M (French Scientific Interest Group for Mediterranean Marine Mammals).

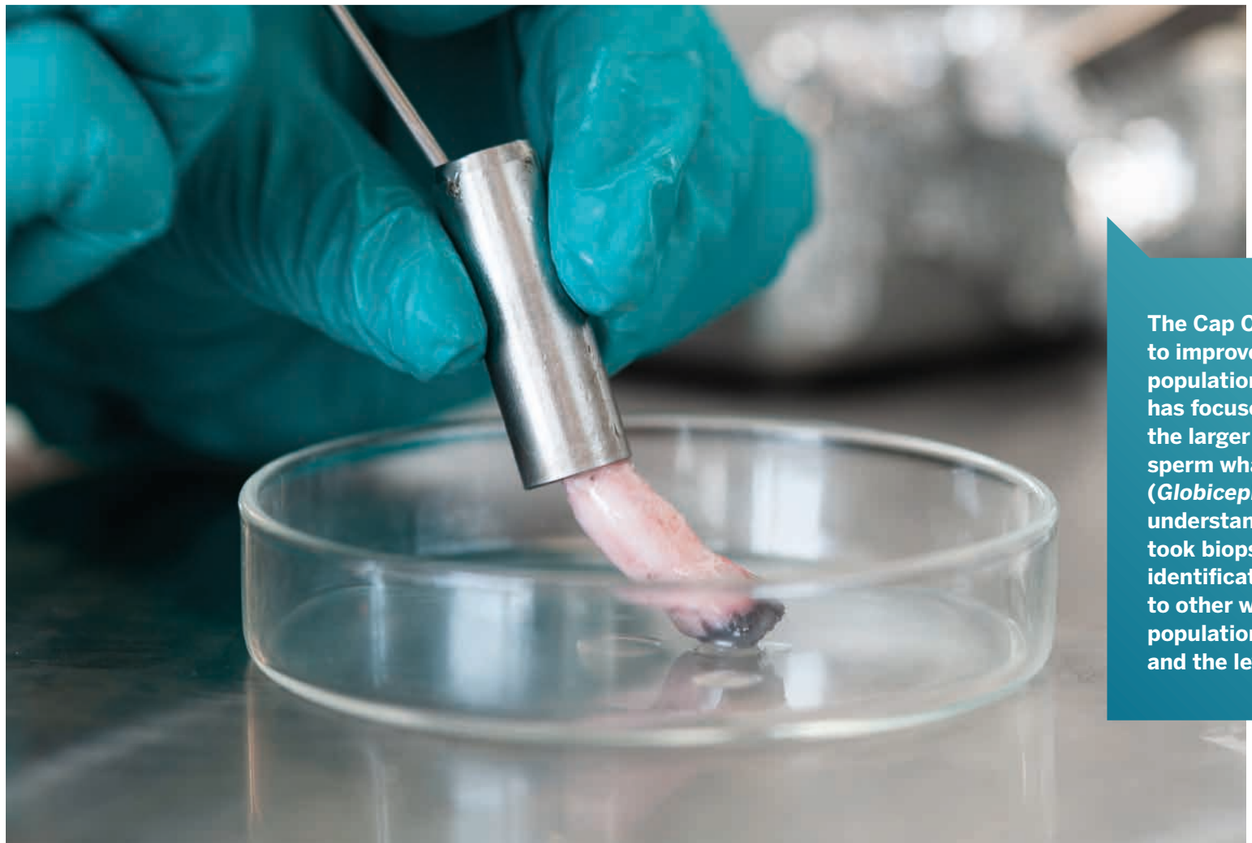
MAIN OBJECTIVE:

Increase awareness on impacts of maritime traffic on MPAs

Managers in the Pelagos Sanctuary recognize the importance of informing the general public and relevant stakeholders about its objectives. [62] A municipal charter enables local stakeholders to become partners in initiatives to protect marine mammals. In addition training is made available for maritime staff, and information campaigns target commercial shipping companies.

THE CAP CETACÉS MISSION IN THE PELAGOS SANCTUARY

© F.BASSEMAYOUSSE / WWF FRANCE



RECOMMENDATIONS FOR MPA MANAGERS

OBJECTIVE:

Knowledge, training and awareness raising

- (Co-)Design, run or participate in monitoring programmes and research studies to increase knowledge on the interactions between MPAs and the maritime transport sector, and its impacts on habitat and species.
- Collaborate with research/public institutions to develop new tools and technologies to avoid or mitigate the impact of the sector on MPAs.
- Develop agreements with the sector to engage trained observers on vessels for monitoring and research purposes.
- Offer best practice training programmes to shipping companies (e.g. speed reduction, prevention of collisions with cetaceans, reduction of underwater noise).
- Offer training to volunteers, NGOs and the public in preparing for and dealing with oil spills.
- Engage people in citizen science and participatory monitoring programmes.

The Cap Cetacés mission started in 2000, and aims to improve the conservation status of the cetacean populations of the Pelagos Sanctuary. The programme has focused on contamination and collision issues for the larger species: fin whales (*Balaenoptera physalus*), sperm whales (*Physeter macrocephalus*) and pilot whales (*Globicephala*). The mission tagged whales to better understand their behaviour in the vicinity of ships, and took biopsies of skin and blubber. Skin sampling allows identification of the animal, its gender, its relationship to other whales, its genetic structure and the size of its population. Fat gives information about pregnancy status and the level of contaminants (phthalates) in the body.

3.2.
PUBLIC AUTHORITIES

Public authorities can play a major role in minimizing the maritime transport sector's impacts on MPAs. There are a wide range of potential solutions available at different levels, from state transport agencies to port authorities. Cross-border, sub-regional and regional cooperation are particularly important given the geographical scale across which the sector operates.

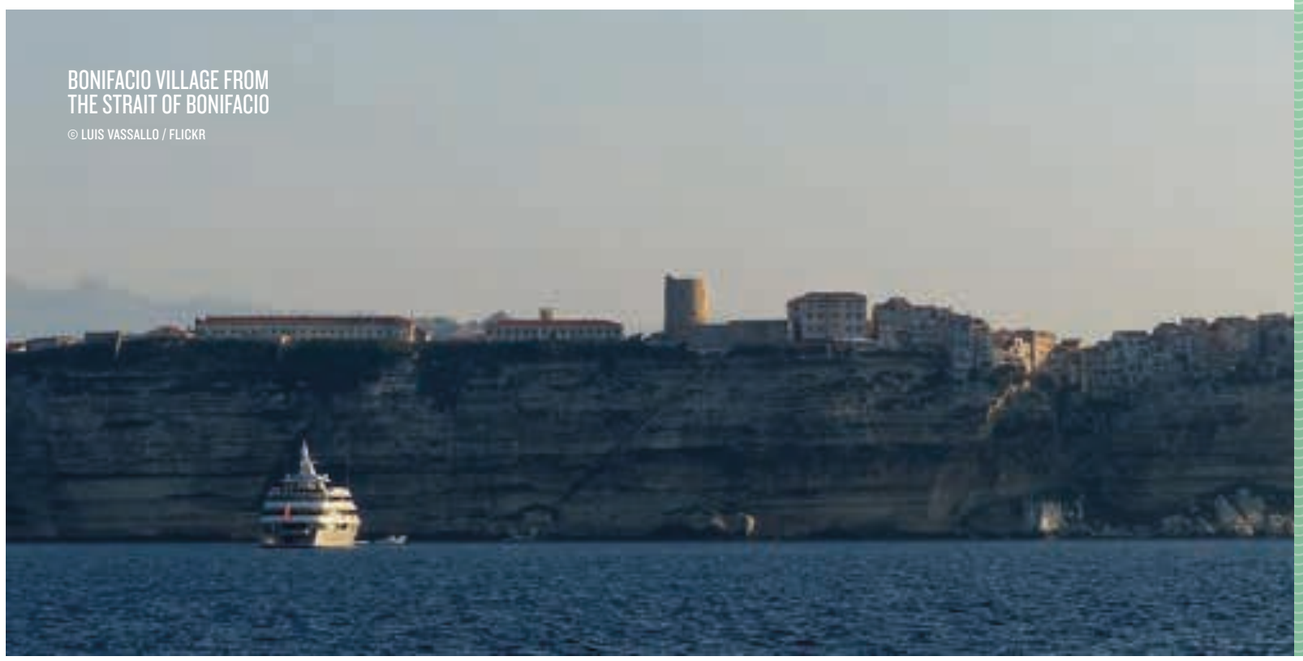
3.2.1.
PREVENT IMPACTS ON MARINE ECOSYSTEMS

National authorities planning and managing the use of sea space, including marine spatial planners, are key actors in identifying and implementing measures to avoid maritime sector impacts on ecosystems, particularly in relation to accidents. National maritime authorities, port authorities and conservation authorities can significantly contribute by defining ecosystem protection measures.

MARINE SPATIAL PLANNING (MSP) AUTHORITIES

MAIN OBJECTIVE:
Prevent accidents during vessel navigation

The establishment of a **Particularly Sensitive Sea Area (PSSA)** through the IMO can be a very powerful tool to prevent accidents and consequent environmental impacts.



BONIFACIO VILLAGE FROM THE STRAIT OF BONIFACIO

© LUIS VASSALLO / FLICKR

PARTICULARLY SENSITIVE SEA AREAS

The clear overlap among busy shipping areas and ecologically significant areas (EBSAs) in the Mediterranean makes a strong case for the designation of more PSSAs in future, especially bordering coastal states. Synergies between the two are clear: further PSSA designations could be supported both by further analysis of shipping data, particularly at the local level, and by more detailed scientific investigation of EBSAs in coastal areas.[63]

Despite the high environmental risks of maritime transport, though, the designation of PSSAs in the Mediterranean has been very limited.[63] To date, the only PSSA in the region is the **Strait of Bonifacio**, located between the islands of Corsica and Sardinia. The Strait represents one of the most significant environmental regions in the western Mediterranean, populated by many endangered and endemic species. This PSSA includes several MPAs along the French and Italian coasts.[64] [5] The Strait is also part of the Pelagos Sanctuary and, since 2001, it has been on the list of Specially Protected Areas of Mediterranean Importance (SPAMI).

LEGAL FRAMEWORK

While a coastal state has jurisdiction over the protection and preservation of the marine environment in its territorial waters and Exclusive Economic Zone (EEZ), it must allow freedom of navigation to ships from all other states. This can make it challenging to impose measures aimed at containing the environmental impacts of maritime traffic. For example, if a state imposes a ban on vessels carrying hazardous substances, the ban can only apply to vessels flying the flag of that state.

On the high seas all states are under a general obligation to cooperate for the protection and preservation of the marine environment, but no state can impose its own legislation on the others. This means even if a state unilaterally establishes an MPA, it still can't make ships flying a foreign flag abide by its provisions.

The importance of the area from both environmental socio-economic perspectives was already recognized in 1993, when both Italy and France banned the transit of tankers flying Italian or French flags carrying oil and other hazardous and noxious substances[6]. Furthermore the International Maritime Organization has adopted a resolution in 1993, recommending to all IMO Member States to prohibit, or at least to discourage transit of vessels carrying potentially toxic substances through the Strait [65].

In addition, for all EU Member states, navigation in the strait is subject to the MARPOL 73/78 Convention, which sets rules for the design and operation of tankers to prevent pollution; and to the EU adopted regulation (EC Regulation n 417/2002) to accelerate the adoption of double hull or equivalent applicable to single hull tankers and to ban the carriage of heavy grade oil in single hull tankers [66] [67].

[5] The National Park of La Maddalena Archipelagos (IT), the Marine Protected Area of Tavolara – Punta Coda Cavallo, the National Park of Asinara (IT), the Nature reserves of Bouches de Bonifacio (FR), the Nature reserve of Tre Padule de Suartone (FR), the Nature reserve of the Cerbicale islands (FR).

[6] Bilateral agreement officialized by two decrees: for Italy: Decreto del Ministero della Marina Mercantile 26/02/1993; for France: Arrêté Prefectoral n.1-93 of 15/02/1993 of the Prefecture Maritime in Toulon, 1993.

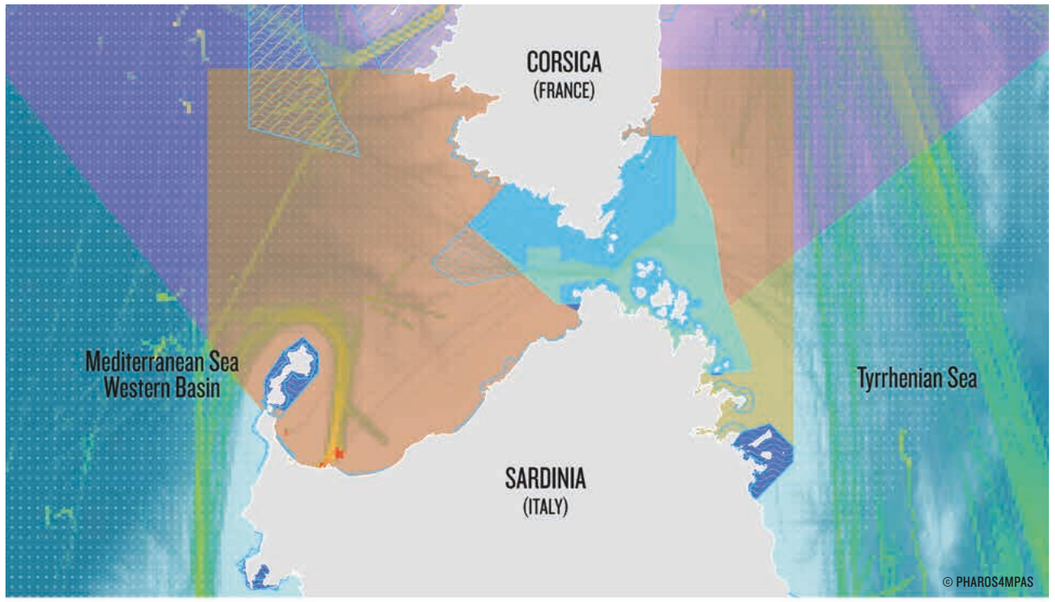


FIGURE 8. Environmental protection categories and maritime traffic regulations in the Strait of Bonifacio

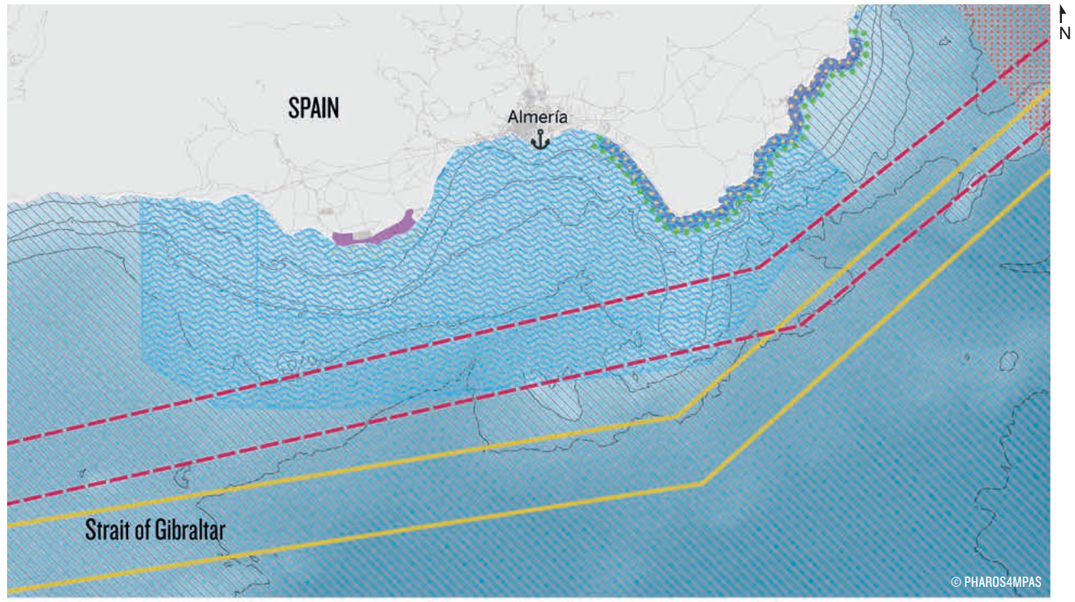


FIGURE 9. Repositioning of the Traffic Separation Scheme (TSS) in Cabo De Gata (Spain)

Designation of the Strait of **Bonifacio as a PSSA in 2011** [68] allowed the introduction of additional measures to strengthen the protection of this important and fragile region.

The following recommendations are in place for vessels in the Strait:[69]

- Follow ship routeing (existing recommended two-way route)
- Provide ship reporting and navigation information (ships of >300 GT must use the BONIFREP ship reporting system)
- Use qualified pilots. [70] The recommended pilotage for ships transiting the Strait [71] is operated by the Olbia, Porto Torres and South Corsica Pilot corporation under the La Maddalena Port Authority.

Cross-border cooperation between Italian and French authorities and local MPAs was key to achieving the designation of the PSSA from the IMO, and eventually led, in 2013, to the establishment of the International Marine Park of Bonifacio Strait under the European Grouping of Territorial Cooperation (EGTC IMPSB). The Park aims to develop cross-border solutions for issues which affect both islands, such as maritime traffic and tourism. [72]

Despite these efforts, the limits of the current legislative framework are obvious: [66]

- The Italy-France Agreement of 1993 does not apply to vessels flying flags of third countries – of the 3,500 ships crossing the Strait each year some 10% are French, 26% Italian and 64% are from other states.
- EU regulations in place controlling oil transit [73] cannot prohibit it going to ports outside the EU, so the area remains at risk from all types of vessels carrying dangerous and polluting goods that are not subject to EU rules.
- The same EU regulation applies to all vessels above 300GT, but not to single-hull vessels with a tonnage below this limit. A much larger set of smaller vessels, while holding less oil, could still represent significant environmental hazards.

Clearly, more limitations are needed to reduce the risk of accidents in the Strait. One example would be compulsory pilotage for ships >100GT in bad weather conditions. The pilots in the French department of Corse Sud have already been active in this regard, with several large ships every year making use of their services. [66]

However, guidance is only useful if vessels comply. According to WWF-Italy, about 50 ships each year ignore compulsory recommendations about routeing and reporting via VTS, while recommendations about using an expert pilot service are seldom followed. [74]

AREAS TO BE AVOIDED

The establishment of Areas To Be Avoided (ATBA) can be another useful tool in MPAs. In the words of the IMO, ATBAs are limited to areas where "either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or by certain classes of ships". [75] Marine traffic operators should apply ATBA measures – either recommended or compulsory – on a case by case basis.

ATBAs are only appropriate in places where one of the following conditions applies:

- Inadequate surveys or insufficient navigation aids may lead to vessel stranding
- Local knowledge is considered essential for safe passage
- A casualty could cause unacceptable damage to the environment.[76]

The establishment of an ATBA follows the submission of a proposal by local authorities responsible for marine traffic to the IMO, which then takes charge of reviewing and approving the proposal, and gaining it official recognition at international level. Once the ATBA is established, its limits and related measures are mainly communicated to maritime users by local authorities and through nautical charts.

TRAFFIC SEPARATION SCHEME

A Traffic Separation Scheme (TSS) is defined by the IMO as a routeing measure aimed at the separation of opposing streams of traffic by appropriate means and by the establishment of traffic lanes. Vessels passing through a TSS need to comply with specific rules and to follow routing coordinates. This allows marine traffic flow to be directed in a coordinated and organized way to reduce the risk of incidents and increase the efficiency of traffic management. TSS are typically implemented in areas where marine traffic is heavy (e.g. in straits). [75]

The Cabo de Gata-Níjar Natural Park (Alboran Sea, Spain) provides a good example of how a TSS can work in conjunction with an MPA. A TSS was approved here by the IMO in 1998, after consultation with stakeholders from the fisheries, commercial and recreational sectors. In 2006 the IMO approved the repositioning of the TSS from 5 to 20 nautical miles off the coast, to make navigation safer and protect the ecological value of the Cabo de Gata Natural Park. [77] This was achieved through a proposal from the Spanish Directorate General of Merchant Marine to the IMO, and was supported by UNESCO.[78]

It's worth noting that the primary goal of this type of measure is to improve maritime traffic flows and avoid collisions between ships, rather than to avoid risks to protected areas. However, it can still prove to be an effective way of reducing environmental impacts and providing conservation benefits.[79]

MAIN OBJECTIVE:

Prevent collisions with large marine mammals

PSSAs, ATBAs and TSSs can also contribute to preventing collisions with cetaceans.

In 2008, an ATBA was established to protect a key habitat of the endangered North Atlantic right whale (*Eubalaena glacialis*) in the Roseway Basin (Canada). This area is crossed by vessels transiting to and from New York City and other large US ports, posing a serious risk to the whales. The Roseway Basin ATBA was officially recognized by the IMO in 2007 and implemented by the Government of Canada in June 2008 following a proposal from Transport Canada, petitioned by members of the North Atlantic Right Whale Recovery Implementation Team. [80]

This ATBA is recommended for all vessels of >300 GT and lasts from 1 June to 31 December, in line with the presence of whales in the area. The Canadian Hydrographic Service has incorporated the ATBA into nautical charts, the standard notifications to mariners were issued, and Caution-to-Mariners placards were distributed to relevant stakeholders by the Canadian Whale Institute. [80] This measure was intended to reduce the risk of vessel strikes on right whales by 80% [81] – and in fact, studies demonstrated an 82% reduction was achieved. [82] Marine traffic intensity decreased remarkably within a year of the ATBA's establishment.

NORTH ATLANTIC RIGHT WHALE *(EUBALAENA GLACIALIS)* CRITICAL HABITAT HAS BEEN IDENTIFIED IN THE GRAND MANAN BASIN (BAY OF FUNDY) AND ROSEWAY BASIN (OFF SOUTHWESTERN NOVA SCOTIA)

© BARRETT&MACKAY / WWF-CANADA

LARGE CRUDE OIL TANKER NAVIGATING ACROSS THE MEDITERRANEAN SEA

© STOCKSTUDIO/SHUTTERSTOCK

NATIONAL MARITIME AUTHORITIES, PORT AUTHORITIES, NATIONAL ENVIRONMENTAL PROTECTION AUTHORITIES

MAIN OBJECTIVE:

Prevent accidental marine pollution

The legal framework for protecting Mediterranean marine environments (including MPAs) from the impacts of navigation is provided under the Barcelona Convention through the **Protocol on the Prevention of Pollution in the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal** (19 January 2008). This protocol bans, or subjects to certain conditions, the importation, exportation and/or transit of hazardous or radioactive waste, as well as products such as pesticides. The protocol complements global legislation on hazardous waste (the Basel Convention) and the international law of the sea (UNCLOS).

Banning dangerous goods is also an option in national legislation. For example, the Italian Merchant Marine decree of 26 February 1993 (although applicable to Italian ships only) forbids tankers carrying petroleum products or ships carrying dangerous or toxic substances from using the Strait of Bonifacio.

Alongside this measure, a decree issued by the French maritime prefect for the Mediterranean[7] regulates navigation in the Strait of Bonifacio with a view to preventing accidental marine pollution: it puts in place precautionary areas at the sides of a two-way recommended route, as well as a mandatory reporting system. Lastly, a Franco-Italian agreement on operational procedures for a ship reporting system in the Strait of Bonifacio (Bonifacio Traffic VTS (vessel traffic services)) was signed in Rome on 3 June 1999.[8] However, there's only a recommendation that third-country flagged ships should ask for an expert pilot to cross the Strait: the measure is not compulsory.

Joint, cross-border actions for navigation monitoring and safety, as developed by Italy and France through the SICOMAR Plus project also contribute to identifying best practice in environmental impact prevention, such as coordinated governance systems (a joint action plan), innovative surveillance methods (new high-frequency radar antennae, data sharing and interoperability), and new safety services at sea.

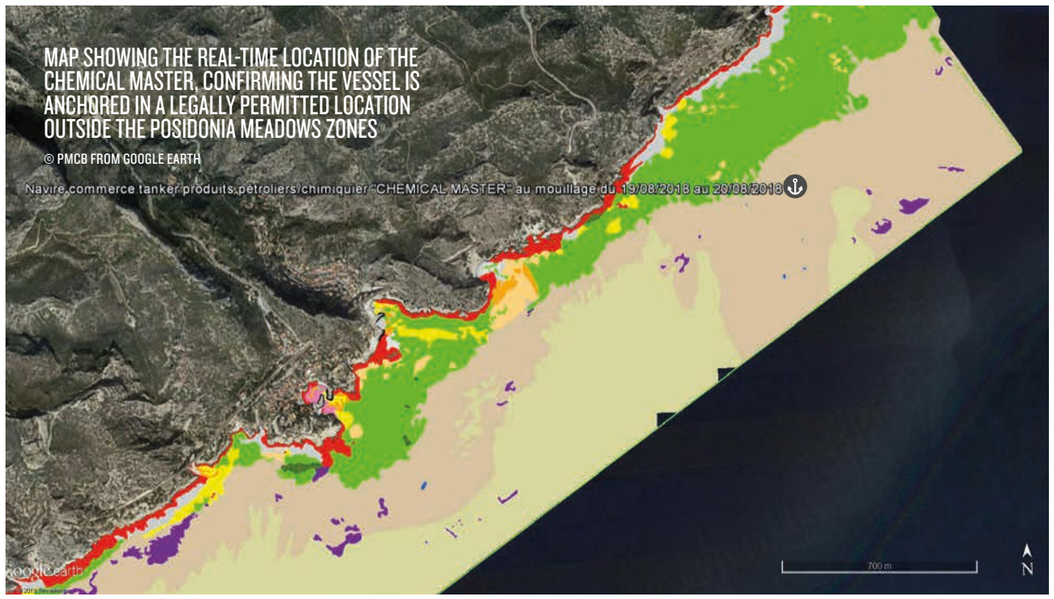
Finally, rerouting measures can be put in place in particular locations to avoid accidents. For example, in France's Côte Bleue Marine Park a decree of the

[7] Decree No. 84/98 of 3 November 1998, as amended by decree No. 56/2003

[8] Signed in Rome on 3 June 1999 Network of Strait (NOSTRA) www.nostraproject.eu

VESSEL LEGALLY ANCHORED IN THE ESTAQUE ZONE WITHIN CÔTE BLEUE MARINE PARK

© ERIC CHARBONNEL



MAP SHOWING THE REAL-TIME LOCATION OF THE CHEMICAL MASTER, CONFIRMING THE VESSEL IS ANCHORED IN A LEGALLY PERMITTED LOCATION OUTSIDE THE POSIDONIA MEADOWS ZONES

© PMCB FROM GOOGLE EARTH

French Maritime Prefecture of the Mediterranean (n. 76/2000) obliges ships carrying hydrocarbons and other industry supply vessels navigating from Marseille to Fos-sur-Mer or from Fos-sur-Mer to Marseille to shift their routes from 1 to 2 miles offshore.

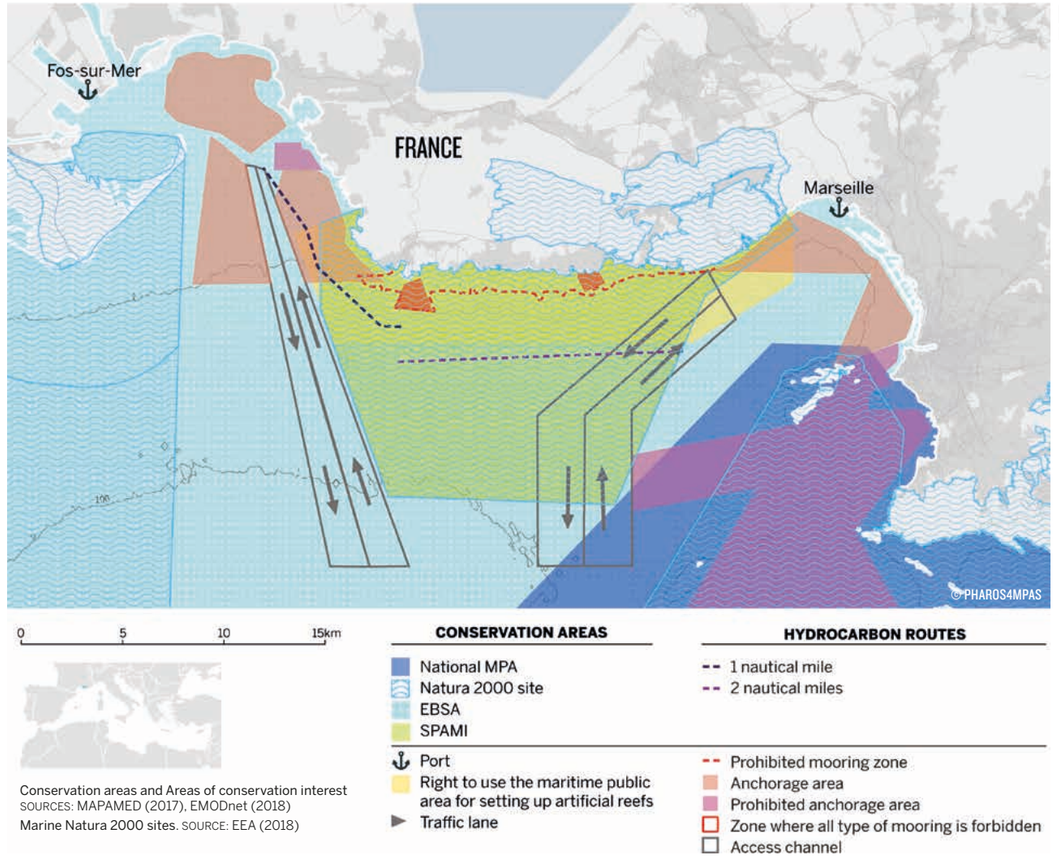
MAIN OBJECTIVE:

Prevent damage to important benthic habitats

Several measures can contribute to preserving benthic habitats. These include:

- No-anchoring zones
- Zoning plans (MSP measures)
- Dialogue/agreements (codes of conducts, protocols)
- Advanced legal regulations (laws prohibiting anchoring)
- Technical solutions (eco-moorings)
- Knowledge improvement/awareness raising [40] [39] [14].

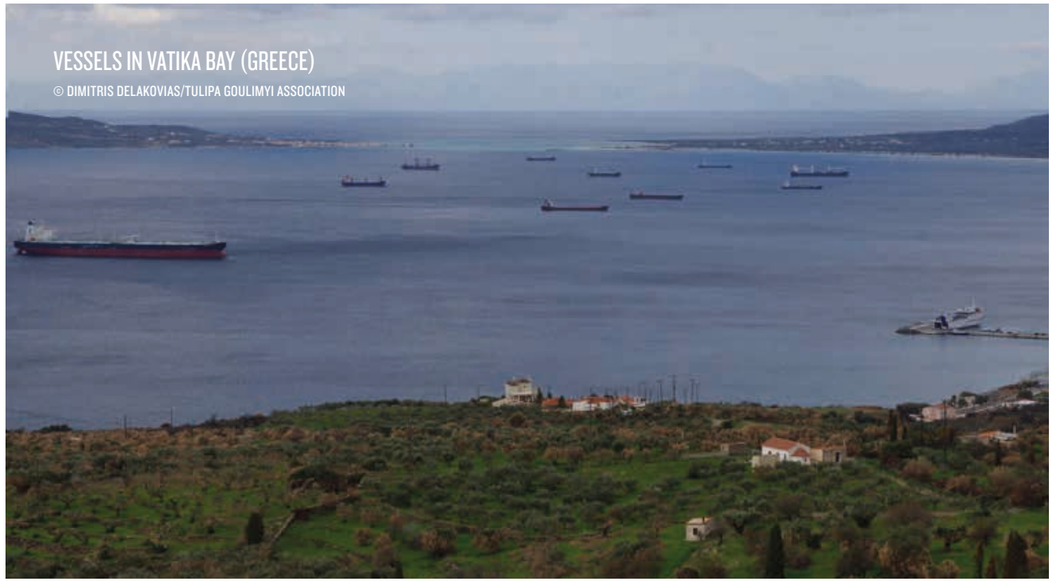
Authorized anchoring zones exist within the "regulated maritime and fluvial zones of [the French] Grand Port of Marseille (Zone Maritime et Fluviale de Régulation, ZMFR)". The management team of Côte Bleue Marine Park (France) identifies potential modifications to these zones which would avoid damage to *Posidonia oceanica* and *Coralligenous habitats*. These measures, proposed in the MPA management plan, [84] need to be fine-tuned in cooperation with the port authority of Marseille before they are put into practice.



Conservation areas and Areas of conservation interest SOURCES: MAPAMED (2017), EMODnet (2018)
Marine Natura 2000 sites. SOURCE: EEA (2018)

FIGURE 10. Hydrocarbon tankers routes and anchoring interdiction zones in Côte Bleue Marine Park (France).*

*Access Channels, Anchorage area, Prohibited anchorage area, Traffic lane: Arrete interprefectoral n: 07/2012. Hydrocarbon routes: Comité de Pilotage Natura 2000 du site Côte Bleue Marine (Réunion du 11 juillet 2012)Zone where the mooring of ships longer than 20m is forbidden, Zone where all types of mooring is forbidden: Rapport d'activité 2016 Syndicat Mixte – PARC MARIN DE LA CÔTE BLEUE.



VESSELS IN VATIKA BAY (GREECE)

© DIMITRIS DELAKOVIAS/TULIPA GOULIMYI ASSOCIATION

The case of Vatika Bay in the Southern Peloponnese, Greece, demonstrates the importance and also the complexity of a bottom-up approach to protecting the marine environment from the impacts of anchoring and accidental pollution. The Southern Peloponnese is included in the Greek Natura 2000 network, part of it is designated as an Ecological and Biologically Significant Area (EBSA), and it's also included among the Important Marine Mammal Areas (IMMAs). [85] However, the area is a very busy route for most categories of shipping and ferry services. The Vatika Bay is illegally used as a stop-over and anchorage area for tankers, for refueling and repairs – and the pulling of anchors and drag of ships' chains has devastated the local *Posidonia oceanica* meadows. [86] A draft proposal that would allow a maximum of two large commercial ships per day (730 ships per year) to anchor in Vatika Bay has been produced but never endorsed – numerous local authorities and stakeholders are strongly opposed to formally establishing an anchorage through a port regulation in this way, since even limited anchoring activity will still damage the seabed. Local efforts were also supported by the inclusion of the Underwater Cultural Heritage site of Pavlopetri (next to the sandy beach of Vatika Bay) in the 2016 World Monuments Watch, promoting a proactive set of regulations that would partially protect the site.[87] However, despite these crucial bottom-up efforts the authorities have still not taken meaningful steps to regulate the issues affecting the bay, which remains extremely vulnerable to shipping impacts.

MAIN OBJECTIVE:

Prevent collisions with large marine mammals

Taking a **Dynamic Ocean Management** (DOM) approach – adopting adaptable measures in response to the shifting nature of the ocean and its users – can be an effective way of preventing collisions with cetaceans. [88] Three elements should be considered:

- A method to assess the distribution of the animals
- A real-time way for managers to communicate this information to mariners in the area
- An effective monitoring strategy to ensure vessel compliance with regulations.

A DOM approach to marine traffic usually involves the use of closed areas or speed limits. A good example is the Whale Watch dynamic system used to protect blue whales from ship strikes in the California Current. [89] Whale Watch uses advanced technologies to predict where blue whales are likely to be in near real-time. Maps of blue whale occurrences and likely densities are derived from monitored whale position data and environmental data collected via satellites, including water temperature, chlorophyll concentrations, and other ocean features. The maps warn mariners if they're crossing an area with a high probability of whale presence, enabling them to adopt (voluntary) precautionary measures, such as reducing speed.

RECOMMENDATIONS FOR **PUBLIC AUTHORITIES**

OBJECTIVE:

Prevent impacts on marine ecosystems

- **MSP authorities:** Make use of PSSAs, ATBAs and TSSs to protect MPAs from the risks of maritime traffic accidents and reduce the chances of collisions with cetaceans. In the case of transboundary MPAs, states should coordinate joint proposals to the IMO for routeing systems and PSSAs.
- **MSP authorities:** Use MSP processes to prevent anchoring impacts, introduce voluntary no-anchoring zones, adopt zoning plans indicating sensitive areas as well as suitable anchoring areas, include MPA boundaries and anchor-sensitive areas on nautical charts.
- **States:** Develop regulations to prevent accidents in important marine areas, including the establishment of PSSAs, a ban on the shipping of dangerous goods, and other initiatives.
- **States (environmental authorities):** Cooperate on bilateral or regional agreements to establish transboundary MPAs. This cooperation is fundamental to ensure a cohesive and coherent network of MPAs, providing consistent rules for navigation and maritime transport.
- **States:** Develop advanced regulations mandating the use of technical solutions to prevent collisions with cetaceans (e.g. real-time positioning systems).
- **Port authorities:** Collaborate with local pilot companies to identify and implement piloting solutions in key marine areas.
- **State and port authorities:** Promote cross-border cooperation by defining agreements between national authorities and/or port authorities for navigation safety and pollution response.

A SPERM WHALE (*PHYSETER MACROCEPHALUS*) IN THE PELAGOS SANCTUARY SHOWING THE SCARS OF A COLLISION WITH A SHIP

© DENIS ODY

3.2.2. MINIMIZE IMPACTS ON MARINE ECOSYSTEMS

Laws, regulations and contingency plans are powerful tools to tackle this objective, so public authorities can play a particularly important role. Given the spatial scope of the activities of the sector, harmonized regulations, coordinated responses to accidents, and shared best practice at cross-border, sub-regional and regional levels are all essential.

SPILLED OIL SPREADS TO THE ATHENS RIVIERA FOLLOWING THE SINKING OF A TANKER IN THE SARONIC GULF (GREECE, SEPTEMBER 14 2017)

© THEASTOCK / SHUTTERSTOCK

NATIONAL MARITIME AUTHORITIES, PORT AUTHORITIES, NATIONAL ENVIRONMENTAL PROTECTION AUTHORITIES

MAIN OBJECTIVE:

Minimize impacts of accidental marine pollution (e.g. oil spills)

While reducing the number of accidents is often considered the most cost-efficient option for risk mitigation, it's a complex issue involving many actors. A complete elimination of maritime accidents is not a realistic prospect, so the ability to respond effectively to marine pollution is an essential aspect of ensuring clean marine environments. An appropriate level of state response capacity needs to be defined, including how decisions on allocating response resources will be made, their placement, the mechanical response capacity (e.g. booms, skimmers and brushes to collect oil), application of dispersants (aircraft, vessels, dispersant types), and the degree of inter-reliance on resources of neighbouring countries, as well as sub-regional, regional and international resources. [59]

Contingency plans, early warning systems and Decision Support Systems can all contribute to addressing the issue. [90] [91] [92] The designation of the Mediterranean Sea as a Special area under the MARPOL 73/78 Convention and the increase of surveillance at sea (using aerial surveys and radar satellite imagery) are both important elements in attempts to control oil spills in the Mediterranean Sea. [5]

The **Regional Marine Pollution Emergency Response Centre (REMPEC)** coordinates responses to oil spills in the Mediterranean, having developed a set of guidelines, decision support tools and a database to assist decision-makers. At present, almost all Mediterranean coastal states have national preparedness and response systems, and subregional systems also exist.

The **RAMOGEPol Plan** is a good example. This is an intervention plan to combat accidental marine pollution in the Mediterranean Sea, established through the RAMOGE International Agreement between France, Italy and the Principality of Monaco. It applies from the mouth of the Rhône in the west to Capo d'Anzio in the east, including Sardinia and Corsica. The plan sets out operational procedures, available resources and intervention timescales, providing a structure for co-operation in cases of serious accidental pollution.

Countries which share the same sea areas need to be able to work together to tackle the impacts of pollution. The **HAZADR project** [93] aims to strengthen states' shared capacity to fight pollution from oil, toxic and hazardous substances in the Adriatic Sea. Its AdriaCOAST system provides a 72-hour forecast of oil spill dynamics on the sea surface and predicts where oil may come ashore; while a shared database shows the state of readiness and spatial distribution of pollution prevention equipment along the Adriatic coasts. The project also uses a joint radar monitoring programme.

The **OPENRISK project** [94] produced a Guideline for Regional Risk Management to Improve European Pollution Preparedness and Response at Sea. [59] The Guideline includes a wide collection of risk assessment methods, known as the Openrisk Toolbox.

The earlier pollution events are detected, the more effective the response can be. In this regard, and given the vastness of the sea, the question of where best to concentrate surveillance is crucial. Modelling tools can help. In Italy's **Egadi Islands MPA**, for example, Lagrangian tracer modelling identified segments of the main tanker routes south and north of Sicily, and a third route close to the Tunisian shore, as key areas for surveillance. [95]

MAIN OBJECTIVE:

Minimize the impact of pollution and invasive marine species from port and shipping activities

The **IMPACT project solutions** [96] include the implementation of a cross-border coastal radar network, measurements of surface marine currents, the creation of geospatial datasets with potential vulnerability and risk maps, and improved knowledge on water quality and contaminant dispersion, as well as on MPAs' contaminant retention capacity.

The **MERMAID project** [96] established a state-of-the art environmental monitoring system (EMS) for urban ports. The project reviewed best practices and set up a list of environmental parameters that need to be monitored: air pollution, noise, water quality, etc. It identified a collection of technological solutions for EMS in ports, and made recommendations to port authorities. A guide to encourage European ports to deploy these best practices is available, [96] including the steps to follow to implement an EMS.

The **MONALISA 2.0** [97] project develops the 'Motorways of the Sea' concept, exploring new maritime services and processes. Three case studies in the Baltic Sea, Balearic Sea and Ionian Sea suggest that smart green routes – which cross sensitive areas at low speeds – help avoid collisions with marine mammals and lead to large reductions in emissions, while increasing transition times by only a small (and likely acceptable) amount.

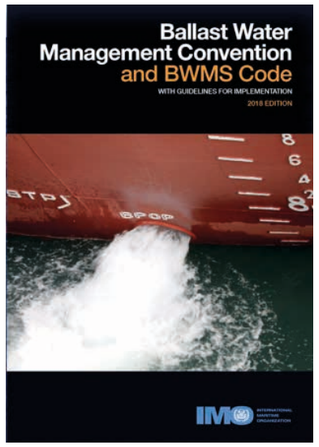
BALLAST WATERS

Ballast waters are known to be a source of pollution, pathogens and invasive marine species. The IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) sets global standards and requires all ships to implement a Ballast Water and Sediments Management Plan. All ships must carry a Ballast Water Record Book and are required to carry out specific BWM procedures. Eventually most ships will need to install an on-board ballast water treatment system. [98] The BWM Convention was adopted in 2004 and entered into force on 8 September 2017: national authorities should ensure that the Convention's regulations are fully implemented.

RECOMMENDATIONS FOR PUBLIC AUTHORITIES

OBJECTIVE:
Minimize impacts on marine ecosystems

- **States:** Promote and actively participate in coordinated response and contingency plans for oil spills and other pollution events at cross-border, sub-regional and regional levels.
- **States, Coastguards, Maritime authorities, Environmental authorities:** Use innovative procedures, tools and technologies to minimize impacts from oil spills (e.g. OPENRISK project toolbox, HAZADR Project's AdriaCOAST forecasting system).
- **States:** Ensure implementation of the BWM Convention, particularly through inspections and monitoring activities.
- **Port authorities:** Develop joint solutions with MPAs – including monitoring, modelling and vulnerability assessments – to mitigate the impact of pollution from port operational activities (e.g. IMPACT Project).



3.2.3. KNOWLEDGE, TRAINING AND AWARENESS RAISING

Public authorities can play a fundamental role in implementing these measures, by creating a climate of learning and providing the necessary resources. Research institutes, public environmental protection departments, NGOs and MPA managers themselves can also directly contribute.

RECOMMENDATIONS FOR PUBLIC AUTHORITIES

OBJECTIVE:
Knowledge, training and awareness raising on the impacts

- **State:** Promote and finance research and monitoring initiatives.
- **State:** Promote and finance innovative technologies geared to pollution preparedness and response, real-time cetacean positioning, pollutant emissions reduction, noise emission reduction.
- **State:** Promote and finance initiatives to raise awareness of impacts of maritime transport on MPAs.

3.3. MARITIME TRANSPORT COMPANIES

Shipping companies already have access to a variety of knowledge and technological solutions to minimize their impacts on the marine environment – and putting in place environmentally friendly practices has clear benefits for corporate image. Nevertheless, despite the legislation and policies currently in place, more dialogue is needed between the maritime transport industry and MPAs.

3.3.1. PREVENT IMPACTS ON MARINE ECOSYSTEMS

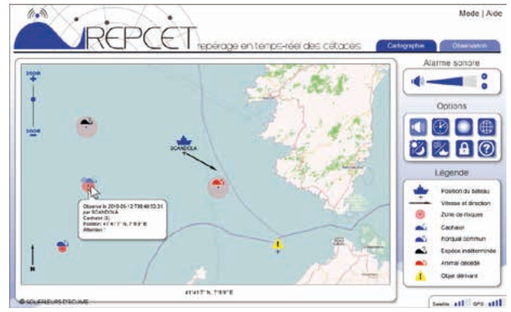
Maritime transport companies should carefully comply with current prohibitions (e.g. no access areas, no anchoring zones) and limitations (e.g. speed regulations, recommended pilotage).

MAIN OBJECTIVE:
Prevent collisions with large marine mammals

Shipping companies can take a big step towards preventing collisions with large marine mammals by adopting real-time cetacean positioning systems. For example, in 2010 the REPCET (Real time Plotting of CETaceans) tool was established in the Pelagos Sanctuary. Through this navigation software, every sighting of a large cetacean from a REPCET-equipped vessel is transmitted to a server which centralizes the data and sends out an alert to other REPCET-equipped vessels that are likely to be affected. Alerts are displayed on a map on a dedicated onboard screen. [99] In France 29 vessels (all sailing under the French flag) are currently equipped with REPCET [100], following a legislative decree imposing the system on certain types of vessels.[101]

The **WHALESAFE project** [102] recently developed a warning system to protect sperm whales in the Pelagos Sanctuary, based on detection units which reconstruct their acoustic signals. A code of conduct to reduce strike risk has also been developed in cooperation with the Italian Coastguard.

FIGURE II. REPCET software screenshot
© Souffleurs D'Ecume



RECOMMENDATIONS FOR MARITIME TRANSPORT COMPANIES

OBJECTIVE:
Prevent impact on marine ecosystems

- Develop agreements with MPAs on the protection of marine macrofauna.
- Respect national legislation concerning real-time cetacean positioning systems or detection technologies.
- Participate in training to spot and report cetaceans during navigation.

3.3.2. MINIMIZE IMPACTS ON MARINE ECOSYSTEMS

Maritime transport companies should strictly respect all relevant laws and regulations. Because of the diverse nature of the sector's environmental impacts, a variety of technical solutions and best practice protocols can be voluntarily adopted as required.

SHIP OWNERS

MAIN OBJECTIVE:

Minimize impacts of pollution from operational activities

The charter of eco-responsibility signed in September 2018 between WWF-France, French ferry company **la Méridionale**, the French Agency for Biodiversity (AFB) and some French MPAs (Calanques National Park, Port-Cros National Park and the Natural Marine Park of Cap Corse and Agriate) is a good example of how this issue can be approached.

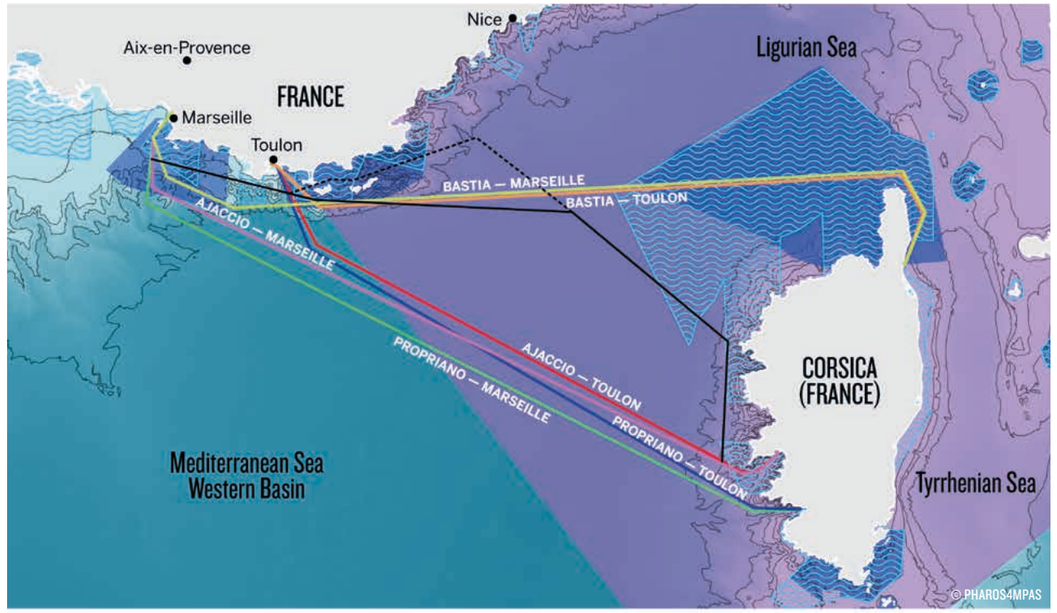
La Méridionale runs a year-round ferry service from Marseille to Ajaccio, Bastia and Propriano in Corsica and Porto Torres in Sardinia, crossing the Pelagos Sanctuary and various MPAs. The charter aims to mitigate the ferries' impact on marine wildlife, but it also goes further. The company has specifically committed [103]:

- To reduce consumption of fossil fuels (e.g. by reducing ships' speeds)
- To prevent pollution
- To reduce the impact of waste of all kinds (e.g. by adopting Bilan Carbone – similar to the UK's Carbon Trust, optimizing engine tuning)
- To sort and re-use waste and reduce over-consumption
- To collaborate on improving knowledge and protection of marine fauna in the Pelagos Sanctuary (e.g. by hosting observation and monitoring devices on board, transmitting data, etc).

The MPA network, meanwhile, has made commitments to train crew members in monitoring techniques, and to increase awareness of the subject among crew, land-based personnel and passengers. La Méridionale has also become the first shipping company to equip its entire fleet with the REPCET system.

LA MÉRIDIONALE FERRY

© JP.FABRE



Conservation areas and Areas of conservation interest. SOURCE: MAPAMED (2017), EMODnet (2018)

Natura 2000 sites. SOURCE: EEA (2018)

Itineraries. SOURCE: DREAL (2012) - La Méridionale

FIGURE 12. Routes of the French ferry company La Méridionale in relation to MPAs and Natura 2000 sites

MAIN OBJECTIVE:

Minimize impacts of underwater noise

The IMO Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life provide general, non-mandatory advice to designers, shipbuilders and ship operators. The guidelines apply to existing and new commercial ships, focussing on primary sources of underwater noise, mainly related to propellers, hull form, onboard machinery, and operational aspects. The main recommendations concern knowledge improvement (use computational models and reference standard measurement methods) and ecosystem impact mitigation (design, machinery and operational improvements).

The Guidance on regulation of underwater noise from commercial shipping prepared under the AQUO project [104] highlights several technical solutions: [105] these include ship concept and power requirements, reduction of propeller noise and reduction of machinery noise; as well as measures that can be taken at operational and ship traffic control level.

RECOMMENDATIONS FOR MARITIME TRANSPORT COMPANIES

OBJECTIVE:

Minimize impacts on marine ecosystems

- Adopt best available technology to avoid marine and atmospheric pollution emissions, to improve waste management, and to avoid waste dispersion at sea.
- Adopt best available technologies – based on IMO Guidelines and others (e.g. AQUO project results) – to minimize underwater noise, including ship concepts, power requirements, propeller and machinery design (e.g. reducing cavitation, wake and propulsion improvement devices, reduction of machinery noise).
- Adopt best operational and navigation practices to minimize underwater noise, including operation of propellers, trims, acoustic emissions, propeller cleaning, underwater hull surface smoothing, selection of ship speed, and re-routeing.

3.3.3.
KNOWLEDGE, TRAINING AND AWARENESS RAISING

These solutions aim to increase understanding of the interactions between MPAs and the maritime sector. Important solutions also include knowledge transfer to key actors through specific training programmes. The shipping industry and shipping operators are fundamental target groups for these initiatives.

RECOMMENDATIONS FOR **MARITIME TRANSPORT COMPANIES**

OBJECTIVE:
Knowledge, training and awareness raising

- Invite on board scientists/experts to perform monitoring/research activities
- Train pilots and crews to adopt the latest best practices for impact prevention
- Spread awareness of initiatives to other companies in the sector.

Souffleurs d'Ecume trains the bridge crew of each ship equipped with REPCET on how to use the system, as well as how to identify cetaceans by their colors, fin shape and breath pattern. Today, 36 ships are equipped with REPCET software.

REPCET TRAINING FOR BRIDGE CREW MEMBERS
© PATRICK BLANCHARD

ACRONYMS

ACCOBAMS	Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area
ATBA	Area To Be Avoided
AFB	French Agency for Biodiversity
BWM	Ballast Water Management
CCH	Cetaceans Critical Habitats
DOM	Dynamic Ocean Management
EBSA	Ecologically or Biologically Significant Marine Area
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EGTC	European Group of Territorial Cooperation
EMS	Environmental Monitoring System
EU	European Union
FRA	Fishery Restricted Area
GVA	Gross Value Added
IMMA	Important Marine Mammals Area
IMO	International Maritime Organization
IMPSB	International Marine Park of Bonifacio Strait
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
LNG	Liquified Natural Gas
MEPC	Marine Environment Protection Committee
MPA	Marine Protected Area
MSP	Maritime Spatial Planning
OECM	Other Effective area-based Conservation Measure
PIPA	Phoenix Islands Protected Area
PPR	Pollution Preparedness and Response
PSSA	Particularly Sensitive Sea Area
REPCET	Real time Plotting of CETaceans
REMPEC	Regional Marine Pollution Emergency Response Centre
RO-RO	Roll-on roll-off
SECA	Sulphur-Emission Control Area
SPAMI	Specially Protected Area of Mediterranean Importance
TBT	Tributyltin
TEU	Twenty Foot Equivalent Unit
TSS	Traffic Separation Scheme
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWF	World Wide Fund for Nature
VHF	Very High Frequency
VTS	Vessel Traffic Service
ZMFR	Zone Maritime et Fluviale de Régulation

BIBLIOGRAPHY

[1] UNCTAD, 2018. Review of Maritime Transport. UNCTAD/RMT/2018.

[2] REMPEC, 2008. Study of Maritime Traffic Flows in the Mediterranean Sea. Final Report – Unrestricted Version. Prepared by Lloyd's Marine Intelligence Unit.

[3] Plan Bleu, 2014. Economic and social analysis of the uses of the coastal and marine waters in the Mediterranean, characterization and impacts for the Fisheries, Aquaculture, Tourism and recreational activities, Maritime transport and Offshore extraction of oil and gas sectors. Technical Report, Pan Bleu, Valbonne.

[4] Grifoll, M., Karlis, T., Ortegol, M.I., 2018. Characterizing the Evolution of the Container Traffic Share in the Mediterranean Sea Using Hierarchical Clustering.Mar. Sci. Eng. 2018, 6, 121.

[5] Girin, M., Carpenter, A., 2017. Shipping and PIL Transportation in the Mediterranean Sea. In Carpenter and Kostianoy (eds.), 2017. Oil pollution in the Mediterranean Sea: Part I – The International Context, Hdb Env Chem.

[6] Casarini, N., 2015. Is Europe to Benefit from China's Belt and Road Initiative? IAI Working paper 15 | 40.

[7] Piante & Ody, 2015. Blue Growth in the Mediterranean Sea: the challenge of Good Environmental status. MedTrends project. WWW France. 192 pages

[8] Plan Bleu, 2010. Mediterranean transport of goods in the Mediterranean outlook 2015. Blue Plan Papers 7. Plan Bleu. Valbonne

[9] UNEP/MAP, 2012: State of the Mediterranean Marine and Coastal Environment, UNEP/MAP – Barcelona Convention, Athens, 2012

[10] Eurostat, 2018a. Maritime transport statistics – short sea shipping of goods. Statistics Explained. http://ec.europa.eu/eurostat/statisticsexplained/ – 02/05/2018

[11] Parola F., Risitano M. Tutore I., Ferretti M., 2014. Analysing maritime economy in the Mediterranean: a focus on the Campania Region. Rivista italiana di economia, demografia e statistica. Vol. LXVIII n.2 April-June 2014

[12] Eurostat, 2018b. Maritime ports freight and passenger statistics. Statistics Explained http://ec.europa.eu/eurostat/statisticsexplained/ – 16/10/2018

[13] Coomber, F.G., D'Incà, M., osso, M., Tepsich, P., Notarbartolo di Sciara, G., Moulins, A., 2016. Description of the vessel traffic within the north Pelagos Sanctuary: Inputs for Marine Spatial Planning and management implications within an existing international Marine Protected Area. Marine Policy, Volume 69: 102-113.

[14] Panigada, S., Pesante, G., Zanardelli, M., Capoulade, F., Gannier, A., Mason Weinrich, T., 2006. Mediterranean fin whales at risk from fatal ship strikes. Marine Pollution Bulletin 52: 1287-1298

[15] MedPan, 2016. The 2016 status of marine protected areas in the Mediterranean. Main findings.

[16] Tejedor Arceredillo, A., Sagarminaga, R., de Stephanis, R., Cañadas, A., Lago, A., 2009. Management of MPAs: options and challenges for the maritime transport sector. Spanish case studies. In: Proceedings of the ECS/ASCOBANS/ACCOBAMS Workshop on Selection Criteria for Marine Protected Areas for Cetaceans

[17] Med-Iamer Project, 2014. Maritime Transport Factsheet for the Adriatic-Ionian Ecoregion www.medmaritimeprojects.eu/download/ProjectMediamer/Final_factsheets/AIo_Transport_factsheet.pdf

[18] Thana, E., Patuzi, D., 2013. Toward a Protected Maritime Environment of Adriatic Region. Mediterranean Journal of Social Sciences 4(9):223-229

[19] Fossi, M.C., Panti, C., Marsili, L., Maltese, S., Spinsanti, G., Casini, S., Caliani, I., Gaspari, S., Muñoz-Arnanz, J., Jimenez, B., Finoia, M.G., 2013. The Pelagos Sanctuary for Mediterranean marine mammals: Marine Protected Area (MPA) or marine polluted area? The case study of the striped dolphin (Stenella coeruleoalba). Mar Pollut Bull. 70(1-2): 64-72

[20] Pelagos, 2013. Resoconto di decisioni della V conferenza delle parti contraenti all'Accordo Pelagos. PELAGOS_COP5_Doc20

[21] Jacob, T. and Ody, D. 2016. Characteristics of maritime traffic in the Pelagos Sanctuary and analysis of collisions risk with large cetaceans. From the report of Quiet Oceans and Institut EcoOcéans

[22] www.accobams.org/conservations-action/protected-areas/

[23] Notarbartolo di Sciara, G.,Panigada, S., Lanfredi, C.,Hoyt, E., 2017. Towards a Transboundary Managed Area in the Strait of Sicily: Challenges and Opportunities. Report to MAVA, Fondation pour l'Environnement. 85pp.

[24] EC, 2010. On Criteria and Methodological Standards on Good Environmental Status of Marine Waters, s.l.: Office Journal of the European Union, L232/14-24

[25] Lüber, S., Frey, S. Prideaux, M., Prideaux, G., 2015. 2015. Creating 'quiet zones': Protecting Cuvier's beaked whale and Mediterranean monk seal critical habitat from anthropogenic noise in the Mediterranean Sea. Oceancare, Switzerland.

[26] Bracciali, C, Campobello, D, Giacoma, C, Sara`, G., 2012. Effects of Nautical Traffic and Noise on Foraging Patterns of Mediterranean Damselfish (Chromis chromis). PLoS ONE 7(7): e40582.

[27] Abdulla, A., Linden, O., 2008. Maritime effects on biodiversity and potential mitigation measures. Chapter 5. In Abdulla, A., Linden, O., (editors), 2008. Maritime traffic effects on biodiversity in the Mediterranean Sea Malaga, Spain: IUCN Centre for Mediterranean Cooperation. 184 pp.

[28] Azzellino, A., Lanfredi, C.; D'Amico, A.; Pavan, G.; Podestà, M., Haun, J., 2011. Risk mapping for sensitive species to underwater anthropogenic sound emissions: Model development and validation in two Mediterranean areas. U.S. Navy Research.

[29] Maglio, A., Soares, C., Bouzidi, M., Zabel, F., Souami, Y., Pavan, G., 2015. Mapping shipping noise in the Pelagos Sanctuary (French part) through acoustic modelling to assess potential impacts on marine mammals. Sci. Rep. Port-Cros national. Park, 29: 167-185.

[30] Maglio, A., Pavan, G., Castellote, M., Frey, S., 2016. Overview of the noise hotspots in the Accobams area. Part I – Mediterranean Sea. Final report. https://oceancare.org/wp-content/uploads/2016/07/Report_L%c3%a4rm_Maglio-et-al_Noise-Hot-Spots_EN_2016.pdf

[31] IWC, 2017 (eds. Cates, K., Demaster, R.L., Silber, G., Gende, S., Leaper, R., Ritetr, F, Panigada, S.). Strategic Plan to mitigate the impacts of ship strikes on cetacean population: 2017-2020.

[32] David, L., Alleaume, Guinet, C., 2011. Evaluation of the potential of collision between fin whales and maritime traffic in the north-western Mediterranean Sea in summer, and mitigation solutions. Journal of Marine Animals and Their Ecology Vol 4, No 1: 17-28.

[33] Lewis, T., Boisseau, O., Danbolt, M., Gillespie, D., Lacey, C., Leaper, R., Matthews, JN., McLanaghan, R., Moscrop, A., 2017. Abundance estimates for sperm whales in the Mediterranean Sea from acoustic line-transect surveys. Journal of Cetacean Research and Management.

[34] Notarbartolo di Sciara, G. 2014. Sperm whales, Physeter macrocephalus, in the Mediterranean Sea: a summary of status, threats, and conservation recommendations. Aquatic Conserv: Mar. Freshw. Ecosyst. 24(Suppl. 1): 4–10.

[35] Frantzis, A., 1 , Leaper, R., Paraskevi, A., Lekkas, D., Distribution patterns of sperm whales in relation to shipping density in the Hellenic Trench, Greece. Paper presented to IWC Scientific Committee, Bled, Slovenia.12-24 may 2014. SC/65b/HIM 07

[36] Galdis, C., 2008. Ship-generated oil discharges and exhaust emissions in the Mediterranean basin: their distribution and impact Chapter 4. In Abdulla, A., Linden, O., (editors), 2008. Maritime traffic effects on biodiversity in the Mediterranean Sea Malaga, Spain: IUCN Centre for Mediterranean Cooperation. 184 pp.

[37] REMPEC, 2011. Regional information system; part c2, statistical analysis -alerts and accidents database. Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea.

[38] REMPEC (2002) Protecting the Mediterranean against Accidents and illegal discharges from Ships. Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea. Malta.

[39] Griffiths, C.A., Langmead, O.A., Readman, J.A.J., Tillin, H.M. 2017 Anchoring and Mooring Impacts in English and Welsh Marine Protected Areas: Reviewing sensitivity, activity, risk and management. A report to Defra Impacts Evidence Group.

[40] Boudouresque C. F., Bernard G., Bonhomme P., Charbonnel E., Diviacco G., Meinesz A., Pergent G.,Pergent-Martini C., Ruitton S., Tunesi L., 2012. Protection and conservation of Posidonia oceanica meadows. RAMOGE and RAC/SPA publisher, Tunis: 1-202

[41] ROY D., DIVETAIN N., BERNARD G., COQUILLARD Y., BONHOMME P., GRAVEZ V., 1999. Prospection de trois systèmes de mouillage en rade d'Hyères – Analyse et recommandations pour une éventuelle installation en baie de Port-Cros. Parc national de Port-Cros & GIS Posidonie, GIS Posidonie publ., Fr.: 1-32.

[42] Zenetos, A. et al. Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways. Mediterranean Marine Science, [S.l.], v. 13, n. 2, p. 328-352, dec. 2012. ISSN 1791-6763.

[43] www.eea.europa.eu/data-and-maps/indicators/trends-in-marine-alien-species/assessment

[44] Doudley, N., 2008. Guidelines for apply protected area management categories. Gland, Switzerland. IUCN.

[45] Day, J., Doudley, N., 2012, Hockings, M., Holmes, C., Laffoley, D., Stolton, S., Wells, S., 2012. Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Area. Gland, Switzerland: IUCN: 36 pp.

[46] www.rac-spa.org/spami

[47] IMO, 2006. Revised Guidelines for the identification and designation of particularly sensitive areas. Resolution A.982(24).

[48] Roberts, J.P., & Siân Pullen, J.H., 2008.Chapter 2. A review of global experience with particularly sensitive sea areas (PSSAs). In Oral, Nilüfer and Simard, François (editors). 2008. Legal mechanisms to address maritime impacts on Mediterranean biodiversity. Malaga, Spain: IUCN Centre for Mediterranean Cooperation. 136 pp.

[49] pssa.imo.org

[50] Bajt, O. 2014. Aliphatic and polycyclic aromatic hydrocarbons in Gulf of Trieste sediments (northern Adriatic): potential impacts of maritime traffic. Bulletin of environmental contamination and toxicology, 93(3), 299-305.

[51] Nemanič T. M., & Milačič R & Ščančar J.,2009.A Survey of Organotin Compounds in the Northern Adriatic Sea.Water Air Soil Pollut 196:211–224.

[52] The National institute of Biology of Slovenia. Impact of circulation in wide open bays and maritime transport on transport of sediment 2011-2014.

[53] Med-Iamer Project, 2014. Med-IAMER Project, 2014. Maritime Transport factsheet, 2014 www.medmaritimeprojects.eu/section/med-iamer.

[54] www.legifrance.gouv.fr/eli/loi/2016/8/8/2016-1087/jo/article_106

[55] WWF 2015. Analysis and evaluation of the present state of Pelagos Sanctuary.

[56] IWC, 2018. Report of the Scientific Committee. IWC/67/Rep01(2018)

[57] visorwwf.cetmar.org

[58] Ajala B., 2015. Operation ERGOS, a Pilot Project to fight against marine oil pollution. Journal of maritime research. XII(I): 7–12.

[59] OpenRisk Guidelines for Regional Risk Management to Improve European Pollution Preparedness and Response at Sea © OpenRisk (2018)

[60] Pelagos Agreement, 2013. www.sanctuaire-pelagos.org

[61] Arcangeli, A., Cominelli, S., David, L., Di-Meglio, N., Moulins, A., Mayol, P., Marini, L., Rosso, M., Tepsich, P., 2013. Monitoring ferry: suivi saisonnier des populations de cétacés et validation de l'intérêt de Repcet en terms de monitoring. Convention n°11-011-83400. RAPPORT FINAL www.sanctuaire-pelagos.org/en/scientific-research/completed-or-on-going-studies#cetaces

[62] Pelagos Sanctuary Management Plan 2016-2021. Part III. https://www.sanctuaire-pelagos.org

[63] Butt. N, Wright, P. 2015. Protecting EBSAs and opportunities for the IMO: The use of EBSAs for informing designation of IMO PSSAs.

[64] Mackelworth, P., 2016. Marine Transboundary Conservation and Protected Areas.

[65] Resolution A.766(18) of 17 November 1993

[66] Sorgente, B. Sorgente, R. Olita, A. Fazioli, L. Cucco, A. Perilli, A. Sinerchia, M. Ribotti, A.2012. Effects of protection rules and measures in an important international strait area: the Bonifacio Strait.Journal of Operational Oceanography 5(1): 35-44

[67] https://puc.overheid.nl/nsi/doc/PUC_1557_14/1/

[68] Resolution IMO-MEPC 204(62) 2011. Designation of the Strait of Bonifacio as Particularly Sensitive Sea Area. MEPC 62/24/Add.1, Annex 22, 19pp.

[69] Resolution IMO MSC 90/28 2012.

[70] www.bonifaciostraitpilots.eu/

[71] Nostra Project, 2014. Perspective Paper for the Future of the Cooperation. http://www.nostraproject.eu/News/Perspectives-for-the-cooperation-after-NOSTRA

[72] https://portal.cor.europa.eu/egtc/CoRActivities/Pages/PMIBB.aspx

[73] Commission Regulation (EC) No 417/2002 of the European Parliament and of the Council of 18/02/2002. Accelerated phasing-in of double hull or equivalent design requirements for single hull oil tankers and repealing Council Regulation (EC) No 2978/94. Official Journal of the European Communities. 7 March 2002. L64/1, 45: 1–5.

[74] www.wwf.it/news/notizie/?uNewsID=42820

[75] www.imo.org/en/ourwork/safety/navigation/pages/shipsrouteing.aspx

[76] Caminos, H., Cogliati-Bantz, V.P., 2014. The Legal Regime of Straits: Contemporary Challenges and Solutions. Cambridge University Press.

[77] Ministero de Fomento, 2006. Nota de prensa. Fomento pone en servicio el Nuevo Dispositivo de Separación de Tráfico de Buques en cabo de Gata.

[78] Policy Research Corporation, 2011. The potential of Maritime Spatial Planning in the Mediterranean Sea. Case study report: The Alboran Sea. Study carried out on behalf of the European Commission. Directorate-General for Maritime Affairs and Fisheries. MARE.E.1 "Maritime Policy in the Baltic, North Sea and Landlocked Member States"

[79] INDEMARES project www.indemares.es

[80] Silber, G.K., Vanderlaan, A.S.M., Tejedor Arceredillo, A., Johnson, L., Taggart, .T., Brown, M.W., Bettridge, S., Sagarminaga, R., 2012. The role of the International Maritime Organization in reducing vessel threat to whales: Process, options, action and effectiveness, Marine Policy, Volume 36, Issue 6, 2012: 1221-1233

[81] www.canadianwhaleinstitute.ca/changing-marine-policy-to-protect-right-whales

[82] Vanderlaan, A. S. and Taggart, C. T. (2009), Efficacy of a Voluntary Area to Be Avoided to Reduce Risk of Lethal Vessel Strikes to Endangered Whales. Conservation Biology, 23: 1467-1474. doi:10.1111/j.1523-1739.2009.01329.x

[83] Decree No. 84/98 of 3 November 1998, as amended by decree No. 56/2003

[84] Parc Marin de la Côte Bleue, 2013. Document d'objectifs of Natura Site 2000 (DOCOB)

[85] https://www.cbd.int/ebsa/

[86] Hellenic Center for Marine Research 2015. Impact assessment of the anchorage of tankers on the seabed of Vatika Bay, Final Technical Report.

[87] www.wmf.org/project/pavlopetri

[88] Hobday, A. J., Maxwell, S. M., Forgie, J., Mcdonald, J., Darby, M., Sesto, K., Powers, A. (2014). Dynamic Ocean Management: Integrating Scientific and Technological Capacity with Law, Policy and Management. Stanford Environmental Law Journal, 33, 125–165.

[89] www.westcoast.fisheries.noaa.gov/whalewatch

[90] Liubartseva, S., et al, 2016. Decision support system for emergency management of oil spill accidents in the Mediterranean Sea. Nat. Hazards Earth Syst. Sci., 16, 2009–2020;

[91] Zodiatis and Kirkos, 2017. Projects on Oil Spill Response in the Mediterranean Sea. In Carpenter and Kostianoy (eds.), 2017. Oil pollution in the Mediterranean Sea: Part I – The International Context, Hdb Env Chem.;

[92] García-Olivares, A., et al, 2017. A system of containment to prevent oil spills from sunken tankers, Science of The Total Environment, Volumes 593–594, 2017, Pages 242-252.

[93] www.hazadr.eu

[94] openrisk-ppr.org

[95] Ciappa A. & Costabile. S. 2014. Oil spill hazard assessment using a reverse trajectory method for the Egadi marine protected area (Central Mediterranean Sea). Marine Pollution Bulletin 84 (1–2): 44-55. ISSN 0025-326X

[96] interreg-maritime.eu/web/impact

[96] www.medmaritimeprojects.eu/section/mermaid

[97] www.sjofartsverket.se/en/MonaLisa/

[98] www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx

[99] http://www.souffleursdecume.com

[100] Pelagos Agreement - Annual Report 2017. Available at: https://www.sanctuaire-pelagos.org/en/tous-les-telechargements/files-for-partners/1247-pelagos-2015-2016-2017-report-activities/file

[101] Decree n.2017-300 of 8 march 2017

[102] www.whalesafe.eu/index.php/en/

[103] http://www.lameridionale.com/page/our-commitments/environment-charter-113.html

[104] www.aquo.eu

[105] Bureau Veritas, DNV GL, 2015. AQUO-SONIC common guidelines – AQUO Project. Guidelines for Regulation on UW Noise from Commercial Shipping. Available at: www.aquo.eu/downloads/AQUO-SONIC%20Guidelines_v4.3.pdf

THE PHAROS4MPAs PROJECT IN NUMBERS

7.14% of the Mediterranean Sea is under some form of **protection,** 1,231 MPAs and OECMs covering **179,798** km²

With **€395** bn Gross Marine Product (GMP) the Mediterranean Sea economy is the **5th** largest in the region

7
MARITIME SECTORS

17 PARTNERS / **10** COUNTRIES

- MARITIME TRANSPORT
- LEISURE BOATING
- RECREATIONAL FISHERIES
- CRUISE
- OFFSHORE WIND FARMS
- AQUACULTURE
- SMALL SCALE FISHERIES

PHAROS4MPAs' core partners

WWF · PAP/RAC · REGIONAL DEVELOPMENT FUNDS of the N. AEGEAN REGION · AKZM NATIONAL AGENCY OF PROTECTED AREAS · INSTITUTE OF THE REPUBLIC OF SLOVENIA FOR NATURE CONSERVATION · CNR Consiglio Nazionale delle Ricerche · ISMAR Istituto di Scienze Marine · Universitat de Girona

PHAROS4MPAs' associated partners

WWF · MedPAN · France Energie Eolienne · UN environment · MAP · SPA/RAC · REMPEC · EUROPEAN BOATING INDUSTRY · AGENCE FRANÇAISE POUR LA BIODIVERSITÉ ÉTABLISSEMENT PUBLIC DE L'ÉTAT · CPMR INTERMEDITERRANEAN COMMISSION

Interreg Mediterranean PHAROS4MPAs