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IDENTIFICATION AND PROTECTION OF SPECIAL AREAS, ECAS AND PSSAS

Designation of a particular sensitive sea area in the North-Western Mediterranean Sea to protect cetaceans from international shipping

Submitted by France, Italy, Monaco and Spain

SUMMARY

Executive summary:	This document suggests the designation of a particularly sensitive sea area (PSSA) in the North-Western Mediterranean Sea. The area is limited by the coastline of France, Italy, Monaco and Spain and includes areas under the jurisdiction of coastal States. Due to the significance of the ecological, socio-economic and scientific values of the area, several national and international protective measures are in place. The designation of a PSSA and the additional associated measures will contribute to protect cetaceans, minimizing the risk of ship strikes and support scientific research on the matter.
Strategic direction, if applicable:	4
Output:	4.1
Action to be taken:	Paragraph 17
Related documents:	MEPC 59/18; MEPC 69/10/3; MEPC 77/INF.27 and MEPC 77/INF.28

Introduction

1 France, Italy, Monaco and Spain propose the designation of a Particularly Sensitive Sea Area (PSSA) in the North-Western Mediterranean Sea, hereinafter referred to as "NW Med PSSA", in order to protect cetaceans from the risk of ship collisions, ship-generated pollution and to increase awareness on a critically important area for the fin whale and the sperm whale.

2 The Mediterranean Sea is strategic both for human activities at sea and for the preservation of remarkable biodiversity. The proposal is justified by the international nature of the vessels and the particular concentration of marine mammals in the area concerned, as well as by the plurality of coastal States concerned or associated. Following up on the Committee's recommendation at MEPC 77, extensive consultation with all the stakeholders impacted or

involved in the project has been organized by France, Italy, Monaco and Spain to define the geographical scope and the nature of the proposed associated protective measures.

Proposed PSSA

3 The proposed NW Med PSSA is located between the coastline of France, Italy, Monaco and Spain and, towards the South, a line defined by the coordinates set out in annex 3 to this document and shown in figure 1.

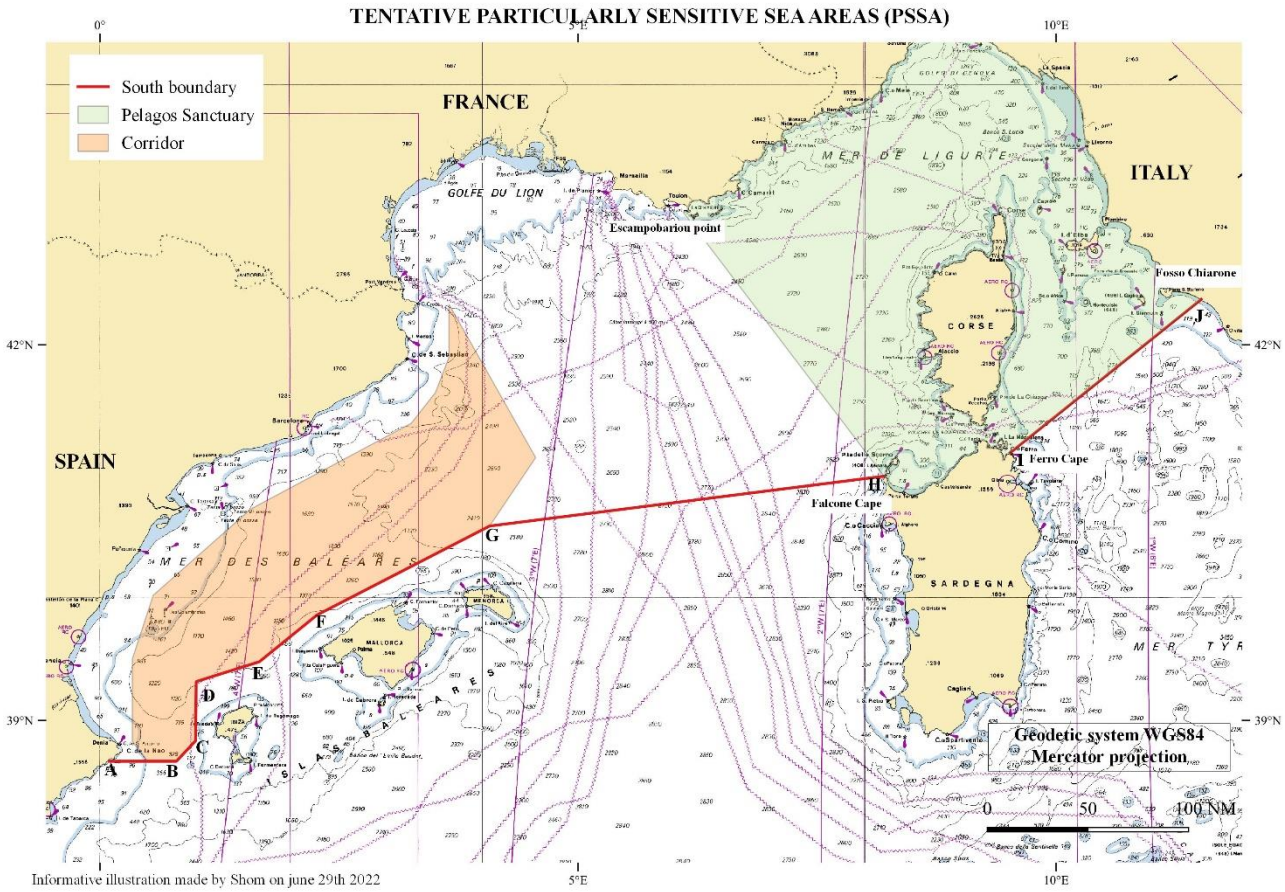

Figure 1: proposed NW Med PSSA (Source: SHOM)

4 The proposed NW Med PSSA encompasses the whole Pelagos Sanctuary and the Spanish cetacean corridor, which are already designated as Special Protected Areas of Mediterranean Importance (SPAMIs) under the Barcelona Convention and the UN Mediterranean Action Plan (section 3.9.1.1 in annex 1) dedicated to the conservation of cetaceans. It also includes two ecologically and/or biologically significant marine areas recognized by the Convention on Biological Diversity (CBD) (section 2.1.2 in annex 1).

5 The Mediterranean Sea is strategic both for human activities at sea and for the preservation of its remarkable biodiversity. It is one of the 34 "hot spots" for global biodiversity, representing 10% of global biodiversity with 28% of identified endemic species. It is a crossroads for global maritime exchanges, an attractive area for tourism and traditional activities such as fishing, and a place hosting unique natural habitats and species.

6 Ship traffic in the Mediterranean Sea area is substantial as it is navigated by more than 30,000 vessels annually, with most vessels calling on Mediterranean ports and engaging in regional commerce among the Mediterranean coastal States. The Mediterranean is also an

important region for international shipping and commercial navigation. The Mediterranean Sea represents approximately 0.7% of navigable seas and oceans, and Mediterranean ship traffic accounts for about 7% of global shipping activity, energy use and emissions. In particular, 9 of the 20 largest cargo ports of the European Union are in the Mediterranean region; 4 of these – Barcelona, Genova, Marseille and Valencia – are within the proposed PSSA.

7 Among the pressures on the marine environment, international shipping traffic has been identified as a threat to the conservation of cetaceans, particularly in terms of accidental mortality and serious injuries to large cetaceans, such as the fin whale and the sperm whale, together with chemical and acoustic threats. Based on such threats, the co-sponsors propose to the Committee the designation of the NW Med PSSA. This approach is justified by the global scale of the shipping traffic in this area, the high concentration of cetacean species in this area (figures 2 and 3 in annex 1), as well as by the diversity of coastal States concerned. The proposal is in line with the Organization commitment set out in Circular MEPC.1/Circ.674 of 31 July 2009, setting out a guidance document for minimizing the risk of ship strikes with cetaceans.

Description, significance of the area and vulnerability

8 Further details of the proposal related to the description, significance of the area and vulnerability are provided in annex 1 in accordance with the Revised guidelines for the identification and designation of particularly sensitive sea areas (resolution A.982 (24), as amended by resolution MEPC.267 (68)):

Associated protective measures

9 Annex 2 provides details on existing and proposed associated protective measures in accordance with resolution A.982 (24), as well as prospective measures for the future.

Existing associated protective measures

10 The area identified already benefits from existing protective measures consisting in the following:

.1 the designation as a Special Area (SA) of the entire Mediterranean sea under Annexes I and V of the MARPOL Convention; and

.2 other national existing associated protective measures listed in annex 2.

However, these existing protective measures allow further protection only on specific threats, such as the discharge of oil or oily mixtures and the discharge of garbage, or only in some parts of the area. Therefore, in order to complement them, and to include ship strikes mitigation, the co-sponsors propose to consider and develop additional associated protective measures.

11 Other more general associated protective measures stemming from SOLAS such as navigational warnings, navigational charts and navigational publications are further elaborated in annex 2.

Proposed associated protective measures

12 The co-sponsors propose to consider the following set of possible associated protective measures within the NW Med PSSA. These measures could significantly enhance the protection of cetaceans in the NW Med PSSA, due to the complexity of environmental issues at stake and the diverse nature of the shipping traffic in the area.

13 The following possible associated protective measures are proposed for consideration:

.1 Recommendation to seafarers/ship operators to navigate with particular caution within the NW Med PSSA, when and where large and medium cetaceans are present, and to limit their speed to between 10 and 13 knots as voluntary speed reduction, while seeking to avoid possible negative impacts of reduced speeds on manoeuvrability and underwater noise in absence of other design adaptations on the ship.

.2 Recommendation to ships to avoid large and medium cetaceans and keep an appropriate safety distance or speed reduction measure from any large and medium cetaceans observed or detected in close quarter situation. A safety distance or speed reduction measure should be adapted to the circumstances and existing conditions.

.3 Recommendation to ships to broadcast by VHF or other suitable means on the area the position of medium and large cetaceans observed or detected and to transmit the information and the position to a designed coastal Authority.

.4 Ships should report any collision and near miss collision with cetaceans to a designated coastal Authority(ies). Designed coastal Authority(ies) should forward this information to the International Whaling Commission (IWC), which holds a global cetacean ship strikes database.

.5 Recommendation to designated coastal Authority(ies) to broadcast information, when needed, to ships about the presence of large and medium cetaceans as navigational warning.

.6 Recommendation to ship masters to determine the watchkeeping arrangements taking into account the presence of large and medium cetaceans, including the use of infrared binoculars to help the detection of large and medium cetaceans by night or fixed infrared camera detection system. These systems would help to detect not only large and medium cetaceans, but also any man-overboard or castaways by night.

.7 The designated coastal Authority(ies) should prepare material and disseminate information in order to raise awareness on the crews (by means such as the publication of materials) and increase their knowledge on the protection of the marine environment on the PSSA with a particular emphasis on cetaceans.

14 To ensure their effectiveness, the measures adopted, in particular 1, 2, 3, 4 and 6 would have to be clearly indicated on nautical charts, nautical publications and nautical information.

15 In accordance with the procedure set out in Assembly resolution A.982(24) on *Revised guidelines for the identification and designation of particularly sensitive sea areas*, if the Committee agrees to designate in principle the NW Med PSSA based on the consideration of the above protective measures, the co-sponsors suggest deferring to the appropriate body/ies the task to further develop and adopt the proposed associated protective measures. The co-sponsors also suggest that the Committee invites delegations to submit concrete proposals for further consideration of any other possible prospective associated protective measures with a view to enhancing the effectiveness of the NW Med PSSA in protecting cetaceans from shipping traffic.

Prospective protective measures

16 Other associated protective measures could significantly enhance the protection of cetaceans in the NW Med PSSA:

.1 the implementation by the riparian States France, Spain, Italy and Monaco of a Memorandum of Understanding to harmonize and facilitate the collection of data within the NW Med PSSA with the aim of better informing ships on the presence of cetaceans and implementing incentive measures to ships following the PSSA's recommendations to protect cetaceans;

.2 to encourage the development of information for seafarers/ship operators through navigational warnings, in the future also in digital format through the NAVDAT system; and

.3 to encourage the riparian states to review the adopted measures after a certain time to assess their effectiveness, and the opportunity to implement new operational measures at national and international level in order to limit the pressures generated by the maritime traffic on medium and large cetaceans.

Action requested of the Committee

17 The Committee is invited to consider the proposals and information contained in this document and its annexes and take action, as appropriate.

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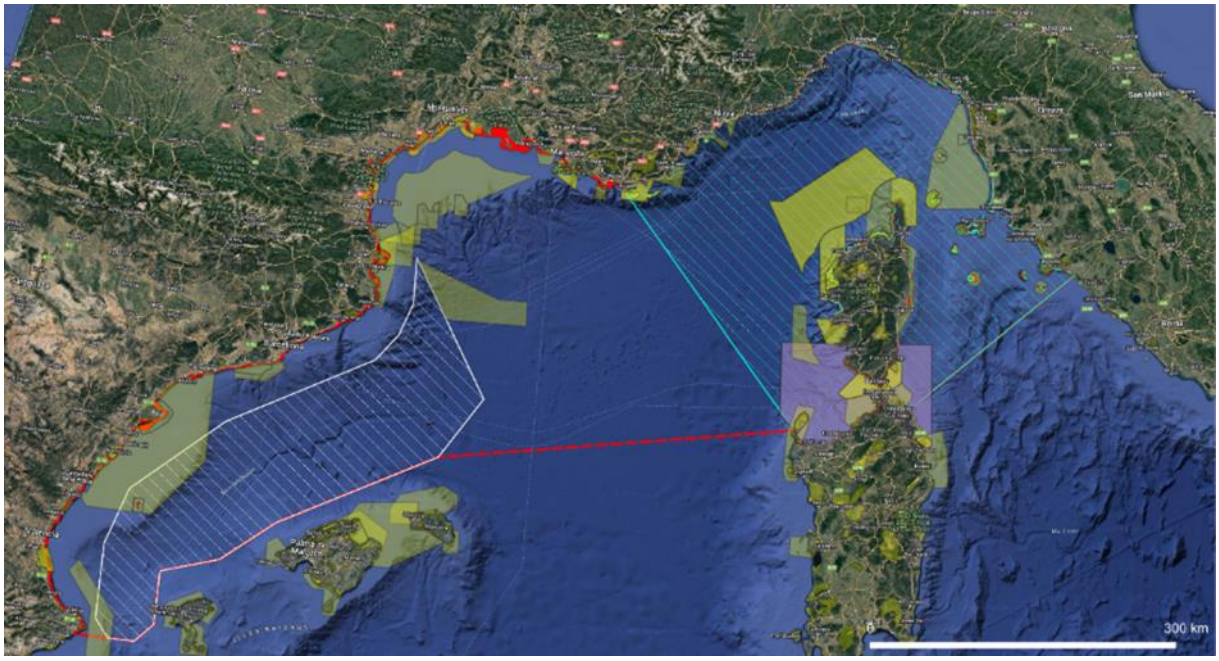
ANNEX 1

INFORMATION SUPPORTING THE PROPOSAL OF A PARTICULARLY SENSITIVE SEA AREA (PSSA) IN THE NORTH-WESTERN MEDITERRANEAN SEA

Part I – DESCRIPTION, SIGNIFICANCE OF THE AREA AND VULNERABILITY

1 DESCRIPTION OF THE AREA

The proposed area covers a perimeter corresponding to the eastern boundary of the Pelagos Sanctuary and to the west to the Spanish cetacean migration corridor. These are two specially protected areas of Mediterranean importance (SPAMI) established under the Barcelona Convention and dedicated to cetaceans including over 230 EU Natura 2000 sites (figure 1A). The proposed area fully or partly overlaps, under the Convention on Biological Diversity (CBD) framework, the two ecologically or biologically significant marine areas (EBSA) and three important marine mammal areas (IMMA) identified by the International Union for Conservation of Nature (IUCN) Marine Mammal Protected area task force. This perimeter also includes most of the Strait of Bonifacio PSSA.



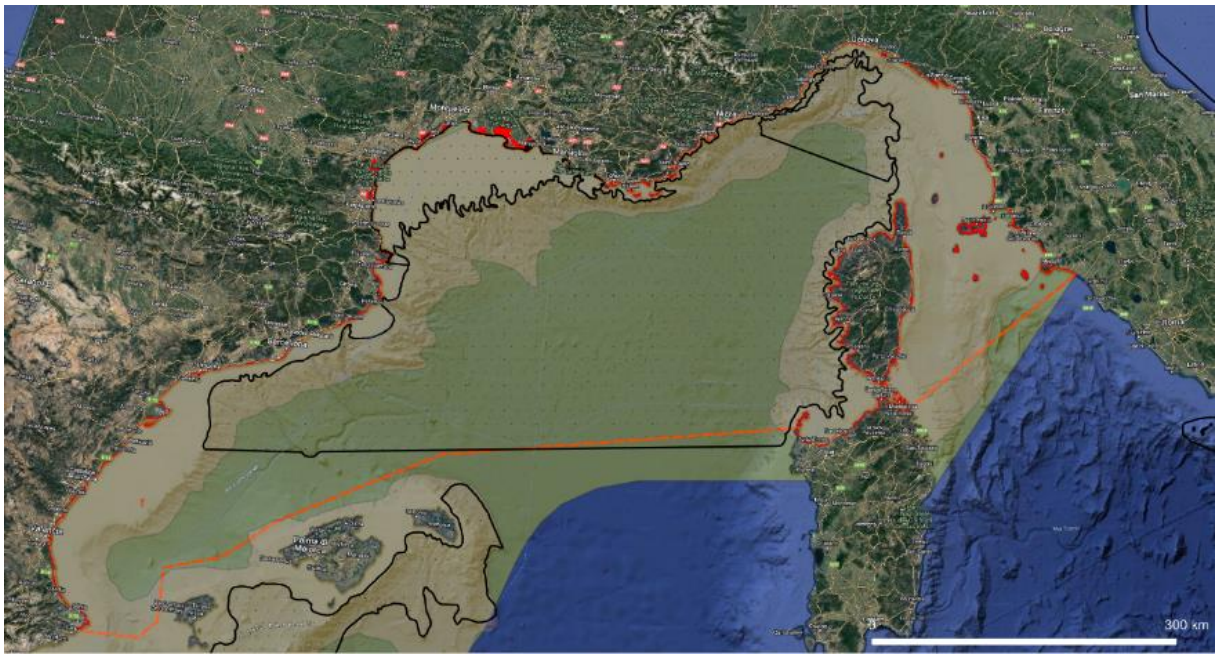


Figure 1: (A) legally binding area-based protection measures: SPAMIs (Pelagos Sanctuary and Spanish cetacean corridor), Bonifacio Strait PSSA and Natura 2000 sites; (B) international recognitions on the ecological and biological importance: EBSAs and IMMAs – source: ISPRA

1.1 Physical features

1.1.1 Bathymetry

The North-Western Mediterranean portion of the basin is characterised by the rapid plunge of its coasts towards the deep sea (up to 2,000 metres in some area) in proximity of the main islands (Corsica and Sardinia) and off the Ligurian coasts and most of the Provence-Alpes-Côte d'Azur's and Catalonia's coasts. The continental shelf is developed off Tuscan coasts (including all around the Tuscan archipelago) and Valencian coasts, with a maximum extension (about 100 km wide) within the study area in the Gulf of Lion (Occitanie).

Another notable feature of the North-West Mediterranean seabed is that is shows one of the highest densities of canyons globally, veritable submarine valleys present on the oceanic slope, generally between 300 and 600 metres deep. Canyons are usually defined from the border from the border of the continental shelf, having their "head" beginning at -200m deep, and finishing at the bottom of the oceanic bed at -2000m deep.

1.1.2 Special weather and ocean phenomena

The Mediterranean is an evaporation basin: precipitation and river inputs do not compensate for evaporation. This water deficit is made up by Atlantic water entering the surface through the Strait of Gibraltar. Less salty and therefore less dense than the Mediterranean water, this water will remain on the surface and determine the surface circulation.

The surface currents have a complex organisation, particularly around Corsica. The main horizontal marine currents have a so called cyclonic direction (counter-clockwise). The areas where they reach a higher intensity in our study area, i.e. an average annual speed of more

than 0.25 metre per second, are the Ligurian Sea and the Tyrrhenian Sea, east of Bonifacio (Corsica). Seasonal trends show an increase in speed during the summer and autumn.

Upwelling phenomena, vertical currents that allow deep water to rise to the surface, are due to a combination of horizontal currents with the wind and can be influenced by the presence of submarine canyons. The Ligurian Sea and the northern Tyrrhenian Sea are the most exposed to this phenomenon. In spring, the increase in the temperature of the marine waters leads to a vertical stabilisation of the water masses.

Thus, marine currents play a very important role in the functioning of ecosystems: through their associated horizontal and vertical movements, they accompany the export of organic matter from the coast to the open sea.

2 SIGNIFICANCE OF THE AREA

2.1 Ecological criteria

2.1.1 Rarity

The North-Western Mediterranean is part of a semi-enclosed sea with a high rate of endemism. The vast majority of its biological populations are composed of Mediterranean subpopulations, genetically isolated from the Atlantic populations and the others.

2.1.2 Critical habitat

The ecological and biological significance of the proposed PSSA is supported by the existence of two areas listed under the CBD framework of the EBSAs, which are overlapping it (figure 1):

1. the North-Western Mediterranean Benthic Ecosystems;[1] and

2. the North-Western Mediterranean Pelagic Ecosystems.[2]

In addition, over two thirds of the proposed PSSA are covered by the "North-Western Mediterranean Sea, Slope and Canyon System",[3] the "The Shelf of the Gulf of Lion"[4] and the "Western Ligurian Sea and Genoa Canyon"[5] IMMAs, identified by the IUCN Marine Mammal Protection Working Group. Moreover, the PSSA includes a candidate IMMA (the "Central Tyrrhenian Sea IMMA") and an Area of Interest (the Tuscan Archipelago), which could become soon IMMAs. It is also adjacent to the "Balearic Islands Shelf and Slope IMMA", off the southern coasts of Balearic Islands, a critical habitat for the Mediterranean sperm whale (figure 1). It also includes the Pelagos Sanctuary for marine mammals.

1 https://chm.cbd.int/database/record?documentID=204124

2 https://chm.cbd.int/database/record?documentID=204125

3 https://www.marinemammalhabitat.org/portfolio-item/north-western-mediterranean-sea-slope-canyon-system/

4 https://www.marinemammalhabitat.org/portfolio-item/shelf-gulf-lion/

5 https://www.marinemammalhabitat.org/portfolio-item/western-ligurian-sea-genoa-canyon/

These areas have a set of geomorphological and oceanographic features that favour productivity levels of extraordinary biological and ecological importance for the region. In particular, the proposed PSSA area overlaps important habitats for the endangered Mediterranean fin whales (*Balaenoptera physalus*), the endangered sperm whales (*Physeter macrocephalus*), the vulnerable Cuvier's beaked whales (*Ziphius cavirostris*), the Habitats European Directive Annex II bottlenose dolphins (*Tursiops truncatus*) and the endangered Risso's dolphins (*Grampus griseus*) (ACCOBAMS 2022). All cetacean species are also listed in Annex IV of the Habitats, Fauna and Flora European Directive 92/43/EEC (animal and plant species of Community interest that require strict protection). These species are included in the IUCN red list.

2.1.2.1 Benthic habitats: distribution and specific habitats

The theoretical biological zones concerned by the study are mainly the circalittoral stage (from 30-35 m depth to the edge of the continental shelf), the bathyal stage (from the edge of the continental shelf to the foot of the slope, i.e. 2,200 to 2,500 metres depth) and the abyssal stage (beyond 2,500 metres depth). The nature of the seabed is variable (hard bottom, soft sandy to muddy bottom) and contributes to the great variety of benthic populations observed. At the circalittoral level, the coralligenous bottoms constitute a typical Mediterranean habitat and underwater landscape, which is also a biodiversity hotspot: nearly 1700 species of invertebrates, 315 species of algae and 110 species of associated fish have been estimated (Ballesteros, 2006). At the bathyal level, certain canyons in the western Mediterranean are home to megafauna habitats, the cold water coral beds. These are areas of remarkably high biodiversity, refuges and feeding grounds for many species, including some commercial fish.

2.1.2.2 The case of cetaceans

The preservation of cetaceans is a necessity in terms of maintaining the ecological balance in the Mediterranean Sea, and contributes to the mitigation of climate change[6] their economic value must also be considered, as cetaceans play a major role in the development of tourism in the area. Finally, from the point of view of biodiversity, some of the Mediterranean cetacean subpopulations are genetically isolated from Atlantic populations and the others (e.g. fin and sperm whales), which gives them a unique value.

Numerous studies have attempted to define the habitat of cetaceans and distinguish the presence of different species by physical and hydrological factors such as surface water temperature and the different water masses present, topographical features, and currents. The presence of cetaceans is often dependent on the distribution of the prey they feed on. The continental slope is the preferred habitat of species with a specialised diet composed mainly of cephalopods: the sperm whale, the Cuvier's beaked whale, the long-finned pilot whale and the Risso's dolphin; the great abyssal plain is the preferred habitat of the fin whale. The bottlenose dolphin prefers waters to the continental shelf, usually within the 100 m isobath.

The proposed PSSA is frequented by several species of cetaceans, eight of which (fin, sperm, Cuvier's beaked and long-finned pilot whales, Risso's, bottlenose, striped and common dolphins) are regularly present all year round.

The importance of this area for fin whales is clear: the estimated abundance of this species within the proposed PSSA represents about the 67% of the whole Mediterranean population (ACCOBAMS 2021). Concerning the sperm whale, compared to the total Mediterranean

[6] Roman, J., J. Estes, L. Morissette, C. Smith, D. Costa, J. McCarthy, J. B. Nation, S. Nicol, A. Pershing, and V. Smetacek. 2014. "Whales as Marine Ecosystem Engineers" *Frontiers in Ecology and the Environment* 12 (2): 377–85.

estimate of about 1400 individuals (ACCOBAMS 2021), the estimate in half of the proposed PSSA (the whole Pelagos Sanctuary and French waters; Laran *et al*. 2017) was between 300 and 600 individuals, with higher numbers in winter. The predicted distribution of these two species is shows in figures 2 and 3.

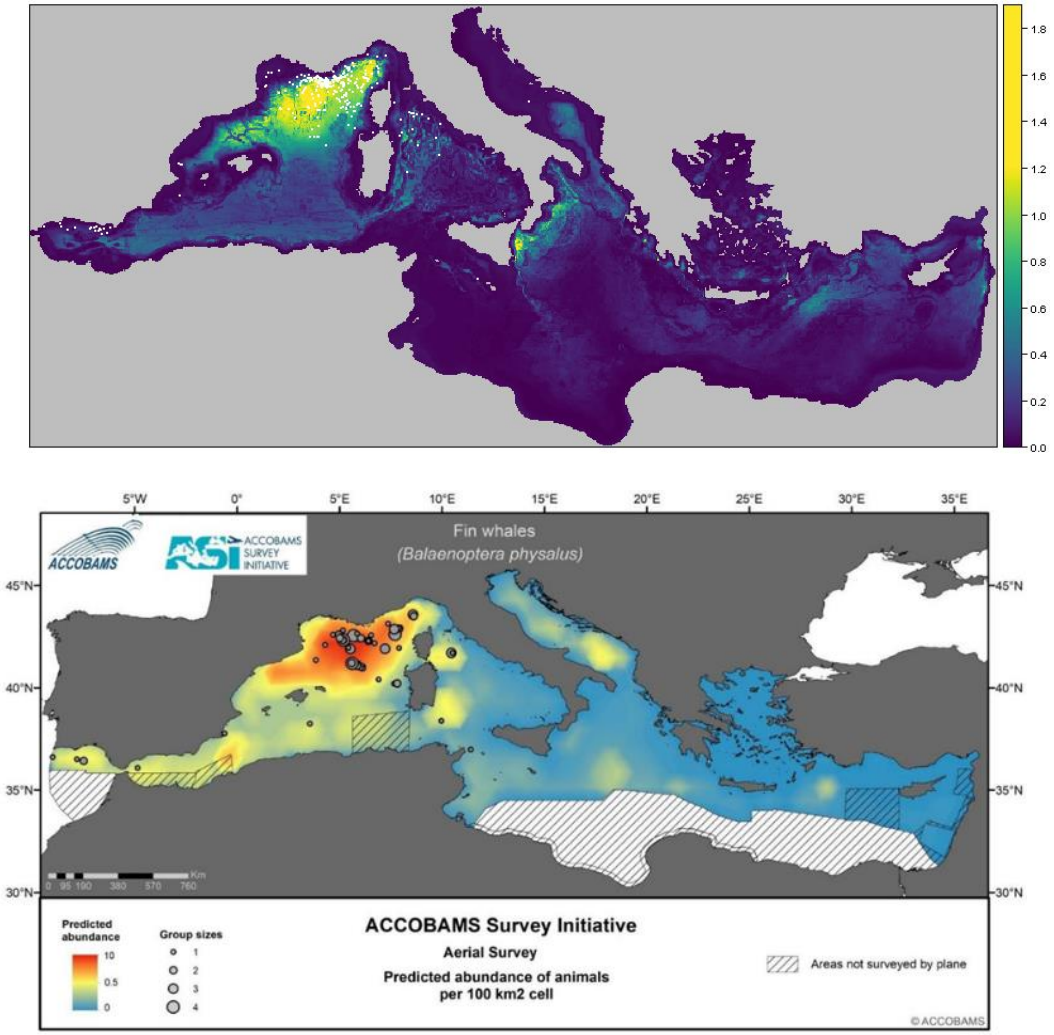


Figure 2: Above: Fin whale predicted densities (summer data: 1999-2016) (Mannocci et al., 2018);

**Below: Fin whale predicted densities (summer 2018)
(ACCOBAMS, 2021)**

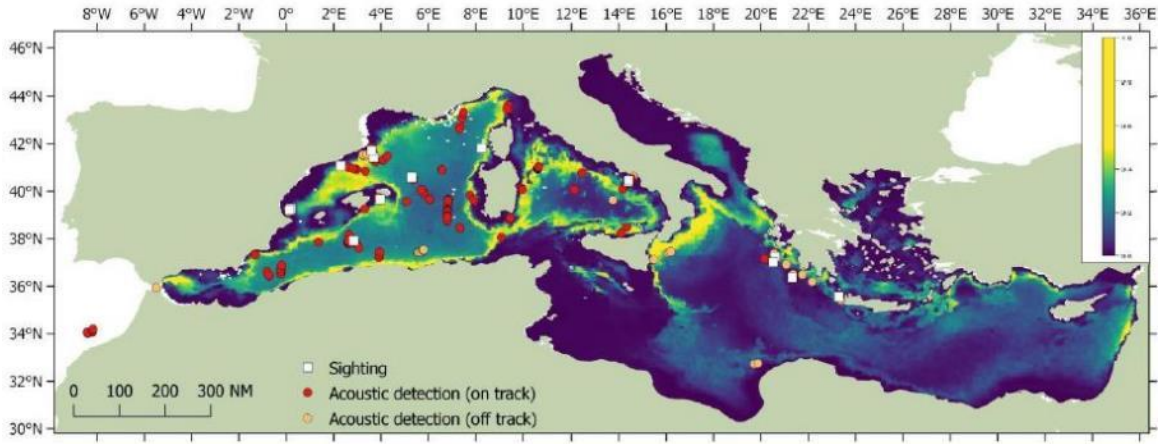


Figure 3: Sperm whale sightings and acoustic detections (ASI 2018, white squares and red/orange circles), overlaid on a predictive density map from Mannocci et al., 2018 (yellow = highest probability, blue = lowest probability) (ACCOBAMS, 2021)

To date, there is no fine-scale mapping of the preferential habitats of these cetacean species for the entire North-Western Mediterranean basin that could be used to guide a zoning approach. Thus, the identification of areas with higher risk of collision between ships and sensitive species (the fin whale and the sperm whale) within the proposed PSSA is complex.

The latest cetacean research campaigns in the Mediterranean carried out as part of the *ACCOBAMS Survey Initiative* (ASI) have confirmed the knowledge on preferential presence of fin whales within the proposed PSSA (figure 2), particularly from off the Gulf of Lion to the coastal and offshore waters off Catalonia. Concerning the offshore areas, this may be linked to the presence of cyclonic eddies that are the main reason for the high productivity of the area, as canyons play more a local role.

A zone with one of the highest densities of marine canyons recorded globally and regionally, which probably strongly contributes to make it highly productive (see section 2.3.1). Concerning the Spanish offshore and coastal areas, this has been recently confirmed as a core feeding habitat for fin whales, especially in shallow coastal waters, through satellite tagging. Interestingly, these coastal waters coincide with areas of higher density within the North-West Mediterranean for European sardines (*Sardina pilchardus*) and European anchovies (*European anchovy*). Their occurrence extends to the edge of the continental shelf and their distribution generally overlaps, although sardines are distributed closer to the coast and reach larger sizes (EC *et al*. 2020).

Concerning the sperm whale, the predicted distribution by Mannocci and colleagues (2018) (figure 3) shows higher densities in the area within the PSSA between the Balearic Islands the Spanish continental coast.

A synthesis of distribution of both species has also been carried out for the Pelagos Sanctuary and adjacent waters (Laran *et al.*, 2012). Based on multiple datasets over 15 years, gathering more than 6,000 opportunistic observations, this study highlighted a number of important features on species' spatial and temporal distribution, including:

- The fin whale regularly frequents both the Pelagos Sanctuary and the adjacent waters of the Provençal area and southern Gulf of Lion.

- Within the Sanctuary, the fin whale seems to be present mainly in the western part.

- The distribution of fin whales in spring seems to be mainly related to permanent frontal structures,[7] while from June to September it is also related to temporary frontal structures. At the end of the summer, the distribution of fin whales is more related to permanent frontal zones located closer to the coast in the *Liguro-Provençal* area or certain upwelling zones such as the one to the East of Bonifacio.

- The sperm whale is particularly frequent on the continental slope but can also be found in certain restricted areas offshore.

- The highest sperm whale encounter rates are in areas with lower fin whale encounter rates, demonstrating very distinct ecological niches likely due to their very different diets (planktonophagous the fin whale, teutophagous the sperm whale).

2.1.3 Dependency

The proposed area and particularly the Pelagos Sanctuary is an essential feeding ground for several cetacean species in the North-Western Mediterranean; here, meteorological and oceanic conditions allow primary productivity in spring and summer to be higher than in the coastal area. For example, Atlantic krill (*Meganyctiphanes norvegica*), a zooplankton species that is exceptionally abundant in the Sanctuary in summer and autumn, is the only identified source of food for fin whales in summer in the Ligurian-Provençal basin.

Cuvier's beaked whales, long-finned pilot whales, sperm whales and Risso's dolphins also take advantage of the Sanctuary's high productivity, particularly on the slope and in the canyons, but with a time lag compared to fin whales, since the peak abundance of their prey (mainly cephalopods) is observed later in the season. Bottlenose dolphins or striped dolphins are permanently present in the waters of the Sanctuary thanks to less specific diets consisting of cephalopods or fish.

The proposed PSSA also includes cetacean corridors. Of particular importance are the Spanish cetacean migration corridor, north of the Balearic Archipelago, which is also an important feeding area for striped dolphins, Risso's dolphins, sperm whales and beaked whales (mainly a three-month period, between April and June). This corridor is also used by fin whales during their migration from the African coasts of the Mediterranean to the Gulf of Lion and the Ligurian Sea, in June and July.

The North-West Mediterranean is characterised by a very high density of submarine canyons. Canyons are important habitats for some cetacean species (e.g. Cuvier's beaked whales) and they also contribute to upwelling phenomena enhancing local primary productivity with the effects extending up the food chain to include birds, marine mammals and fisheries. Commercially important pelagic and demersal fisheries and unique benthic habitats are commonly associated with the heads of shelf-incising submarine canyons that are characterised by steep bedrock exposures. Submarine canyons that extend across the continental shelf and approach the coast are known to intercept organic-matter-rich sediments being transported along the inner shelf zone. This process causes organic-rich material to be

[7] Hydrological discrepancies corresponding to areas of high horizontal density gradient, which are very often the site of increased biological productivity.

supplied and transported downslope, where it provides nourishment to feed a diverse and abundant macro fauna (Wurtz 2012).

Other unique habitats that highly vulnerable to shipping accidents are present in the region surrounding the PSSA. For example, the Camargue wetlands – a Ramsar site of about 135,00 ha, the largest French wetland and the second largest Mediterranean wetland after the Nile Delta region. This is a key site of international importance for nesting, staging and wintering of several species of waterbirds. It harbours breeding populations (Greater Flamingo, Collared Pratincole, Squacco Heron, Glossy Ibis, Eurasian Bittern), wintering populations (Mallard, Gadwall, Red-crested Pochard, Common Teal, Bewick's Swan, Greater Spotted Eagle) and stopover populations (Pied Avocet, Kentish Plover, Curlew Sandpiper, Black Tern).

2.1.4 Productivity

Although the Mediterranean is generally considered to be an oligotrophic sea, i.e. low in nutrients, its North-Western basin is characterised by relatively high mesotrophic productivity throughout the year, due in part to the physical characteristics mentioned above (see sections 1.1.1 and 2.1.3). The phytoplankton bloom begins in mid-April. This high level of primary productivity conditions the structuring of the upper levels of the food web, in particular the presence of tertiary consumers such as cetaceans, which are particularly abundant in summer.

2.1.5 Spawning and breeding grounds

Mediterranean cetaceans do not show specific breeding grounds. However, a high percentage of juvenile whales are reported in the study area. Biopsy sampling analyses determined that at least one third of the individuals sampled were breeding females and the remaining two thirds were active breeding males (Siliart *et al*., 2012), supporting the hypothesis of this as an area favourable to the reproduction of the species. Similarly, the analysis of the structure and composition of the groups and their sex ratio have shown that this area is favourable for sperm whales and long-finned pilot whales too (Di-Méglio *et al*., 2016).

Sardines' persistent spawning habitats are identified along Spanish and French waters, especially surrounding the river mouth areas of Ebro and Rhone, with persistent nursery habitats in the coastal areas and over the continental shelf edge of the Gulf of Lion and in the northern part of the Ebro delta. Concerning anchovies, persistent spawning areas are described along the continental shelf of the same region, with persistent nursery habitats found mainly over the Spanish continental shelf and in a localised area of the central part of the French waters (EC *et al*., 2020).

2.1.6 Fragility

The semi-enclosed nature of the Mediterranean Sea and its high level of endemism, already mentioned, as well as the near absence of tides, make it particularly vulnerable to any change. The constant increase in human activities at sea, in particular maritime traffic, combined with phenomena linked to climate change (warming, acidification, eutrophication and bioaccumulation of marine waters in particular) are weakening the natural balance of the North-Western Mediterranean zone.

As far as cetaceans are concerned, all the species frequenting the area are particularly vulnerable because of their slow growth, their high longevity (up to 100 years for some individuals) and their low reproduction rate: for these species in particular, human exploitation

of the area at high levels (maritime traffic, but also fishing and leisure activities) is a permanent challenge (Reeves and Notarbartolo, 2006).

The importance and fragility of this region is clearly demonstrated by the large and consistent amount of official international deliberations and recognitions (Pelagos Agreement, Bonifacio Strait PSSA, 11 SPAMIs, two EBSAs) and expert recognitions (three IMMAs) and the national implementations of area-based protection measures (7 National Parks, 230 Natura 2000 sites and other marine protected areas). See all details in sections 3.9.2 and 3.9.3.

2.1.7 Bio-geographic criteria

The particular qualities of the North-Western Mediterranean Sea have already been mentioned and make it singular in biogeographic terms. This singularity is particularly marked in the Ligurian Sea with the presence of the *Ligurian-Provençal* front, a region of rapid transition between the light waters of the Ligurian current and the denser waters of the central zone of this front, in the shape of a horseshoe. It runs about twenty nautical miles along the western coast of Corsica, the Italian coast of Liguria and the French Riviera in a cyclonic movement. The permanent nature of this front, as well as its interannual stability in terms of hydrology, gives it a dominant role in the organisation of phytoplankton communities and ensures the maintenance of a zone that is richer in nutrients than the adjacent regions, particularly in spring (Goffart *et al.*, 1994).

2.1.7.1 A remarkable and rich marine fauna

The North-Western Mediterranean is of particular importance from an ornithological point of view. It is the most important area in the world for the conservation of the Balearic Shearwater (*Puffinus mauretanicus*), a species endemic to the North-Western Mediterranean whose status is considered critically endangered in Europe. The area is also essential for Audouin's Gull (*Larus audouinii*), whose conservation status in Europe is said to be "localised" as more than 90% of the breeding population is clustered in less than ten sites. The colony in the Ebro Delta (Spain) alone accounts for 67% of the world population of this species (Gutierrez *et al.*, 2008). The area is also used extensively by the Mediterranean endemic subspecies of the crested cormorant (*Phalacrocorax aritotelis desmarestii*) and storm-petrel (*Hydrobates pelagicus melitensis*).

This area hosts Mediterranean subpopulations of tropical, subtropical or boreal fish species or coastal invertebrates, but also top predators such as fin whales, sperm whales or bottlenose dolphins. This allows the existence of a naturally balanced and functional food web.

The importance of biodiversity within the study area and the genetic specificity of its populations makes it a special area, whose deterioration could lead to the disappearance of entire sub-populations.

2.2 Social, cultural and economic criteria

2.2.1 Social or economic dependency

The Mediterranean coasts welcome an ever increasing number of travellers and are a stronghold of world tourism. Seaside tourism, favoured by an exceptional marine environment, is one of the main economic resources of this region. The proximity of several beautiful islands (Corsica, Sardinia, the Tuscan archipelago, Balearic Islands, etc.) makes this region particularly attractive and, to a large extent, economically dependent on tourism.

Commercial whale-watching (a tourist service that allows visitors to observe cetaceans in their natural environment) has been a fast-growing activity since the 1990s. A study conducted in the French Mediterranean identified 32 operators (with a capacity of 1,075 places). Between the 1980s and the early 2000s, the annual growth rate in the number of operators was estimated at 3.5% (Mayol *et al*., 2014). This activity is mainly carried out between June and September.

Professional fishing is an integral part of the Mediterranean landscape, despite a relative economic weight and decreases in the number of vessels, sailors, sales in value and volume. It contributes to the dynamism and survival of the Mediterranean coastal economic fabric as well as to its reputation. Fishing activity is constrained in several ways, particularly with the decline in fish stocks and the management measures implemented to remedy this (MTES, 2019).

2.3 Scientific and educational criteria

2.3.1 Research

It is essential to study Mediterranean cetaceans in order to gain a better understanding of them and then define the most effective management and conservation rules. The Pelagos Sanctuary, which includes France, Italy and Monaco, is a pilot area in which a number of international research programmes are already being conducted to improve knowledge not only of cetacean populations in the North-Western Mediterranean, but also of the main anthropogenic threats to which they are exposed, both at sea and on land. The establishment of the Spanish cetacean migration corridor also makes it possible to promote research on these populations, embracing an even wider diversity of habitats.

2.3.2 Education

Knowledge of cetacean populations must continue to progress, but it must also be disseminated to as many people as possible. The existence of marine protected areas contributes effectively to this and promotes collective awareness of the rich and fragile nature of marine areas and the populations they shelter, through the awareness-raising and communication activities they implement.

The development of whale-watching activities in situ also contributes to this, when properly supervised. The emblematic nature of cetaceans makes it possible to communicate more widely with the general public on ecological issues that concern the entire marine environment and the impacts it is suffering, particularly as a result of direct human action and climate change. The training of marine professionals is also an important lever for raising awareness, which can be deployed in different formats: initial and ongoing training, courses, webinars, etc.

3 VULNERABILITIES OF THE AREA TO DAMAGE BY INTERNATIONAL SHIPPING ACTIVITIES

3.1 Vessel traffic characteristics

The Mediterranean Sea is one of the busiest shipping areas in the world, being the gateway between the European continent and Asia via the Suez Canal. With an estimated 220,000 merchant ships per year,[8] commercial shipping is particularly intense in the Western Mediterranean, especially in relation to passenger transport. Commercial activity concerns the

[8] Source: https://www.sanctuaire-pelagos.org/fr/?Itemid=260, consulted 8 January 2021.

transport of passengers or goods by ships often exceeding 100 metres in size, sailing at between 14 and over 20 knots (ferries, cargo ships, tankers, container ships, etc.) and up to more than 35 knots for high-speed craft (HSC), which are mainly used to serve the islands.

From the mid-1990s to the mid-2000s, the Mediterranean Sea has seen a 58% increase in transit capacity, coupled with a 30% increase in vessel size since 1997. Maritime transport in the Mediterranean basin is expected to increase in the coming years, both in number of routes and in intensity, especially in connection with the enlargement of the Suez Canal.[9] Marine Mammal Observers working within the Fix Line Transect Mediterranean Network (FLT) aboard ferries, at the command deck, raise awareness of the navigating staff of ferries.

An analysis of Automatic Identification System (AIS[10]) data by the Centre for studies and expertise on risks, environment, mobility and urban and country planning (Cerema – France) shows a gradual trend towards an increase in the number of vessels equipped with this identification system using the area and in the number of voyages[11] made in the area (figure 4).

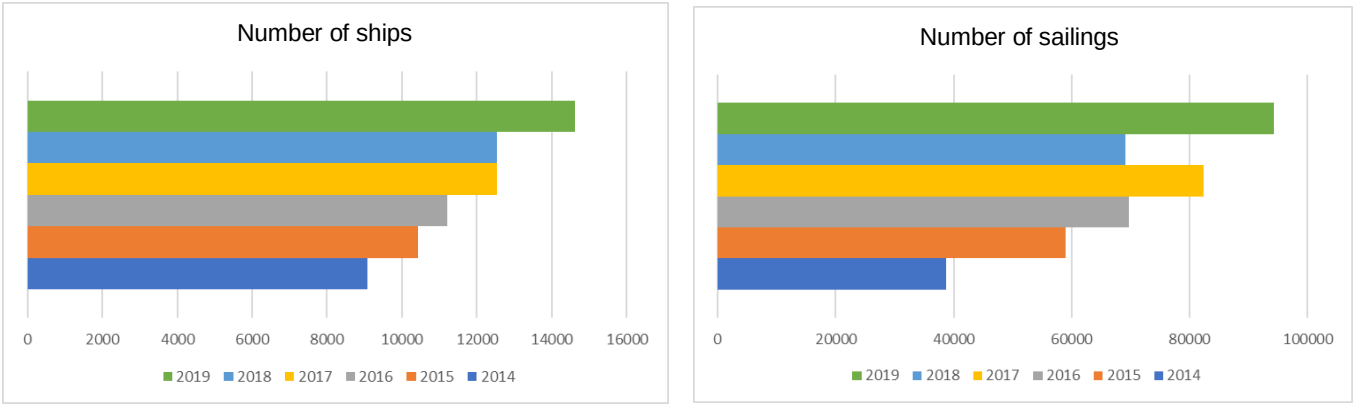


Figure 4: Number of ships and sailings in the study area (based on AIS data)

3.1.1 Operational factors

In the North-Western Mediterranean, shipping traffic is mainly structured towards or from the ports of Valencia, Tarragona, Barcelona, Marseille, Genoa, La Spezia and Livorno for goods traffic, to which are added the ports of Toulon, Sète, Nice, Savona and all ports in the islands of Corsica, Sardinia, the Tuscan archipelago, Sicily and the Balearic Islands for passenger transport. This geographical situation of proximity to the islands, combined with commercial port infrastructures, promotes maritime ferry traffic. Moreover, the cruise activity has largely developed in the Mediterranean, benefiting from favourable weather conditions and dedicated infrastructures: the region represents the second world market for this sector, after the Caribbean (Di Méglio *et al*., 2010). Finally, more than 700 marinas are listed in the Mediterranean basin (*Invest in Med* study, published in 2010[12]).

9 Source: https://www.medqsr.org/fr/node/235, consulted 8 January 2021.

10 This ship identification system is mandatory for all ships of 300 gross tonnage or more in international service, cargo ships of 500 gross tonnage or more not engaged in international voyages and all passenger ships, irrespective of their size.

11 The term navigation is understood here in the sense of Article R334-39 of the French environment code: "any movement of a vessel within the perimeter of the marine protected area, including from or to a port, an offshore installation or structure, a pilot station or any other point located within that perimeter".

12 Study directed by the Chamber of Commerce and Industry of Marseille Provence, in partnership with the CCI of Malaga. https://www.econostrum.info/La-Mediterranee-est-la-premiere-destination-mondiale-de-tourisme-nautique_a3720.html, consulted 8 January 2021.

3.1.2 Vessel types

A recent study conducted by the Quiet Oceans consultancy on behalf of WWF (Gallou and Folegot, 2020) analysed shipping traffic in the North-Western Mediterranean, using AIS data from 2019. In terms of distance travelled in this area, passenger ships and cargo ships travel by far the greatest distance, followed by motorised pleasure craft and fishing vessels.

3.1.3 Traffic characteristics

Freight traffic is higher in winter, in the northern part of the study area, along the coasts of the Gulf of Lion, towards Barcelona and with Corsica and Sardinia. Passenger traffic is highly structured around links between the main ports of France, Spain and Italy on the one hand, and Corsica, the Balearic Islands, Sardinia and the Tuscan archipelago on the other. Traffic intensity increases significantly during the summer months for passenger transport between the Mediterranean islands and the mainland, as well as with additional connections to North Africa and Barcelona and with cruise activity (figure 5).

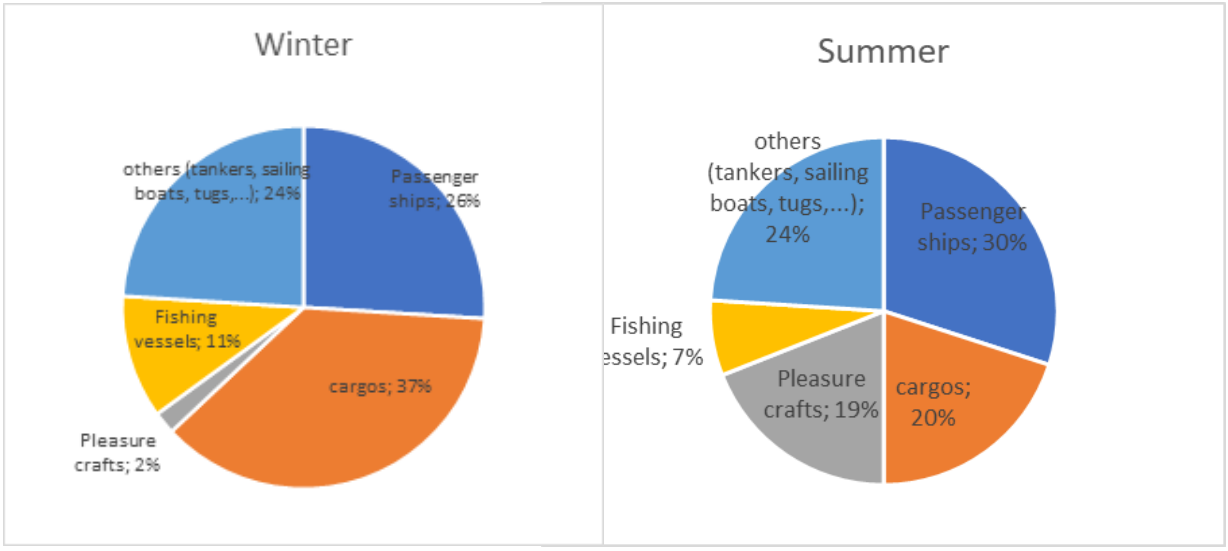


Figure 5: Percentage of distance travelled in the NW Mediterranean Sea, by ship type and season (AIS data 2019, analysed by Quiet Oceans)

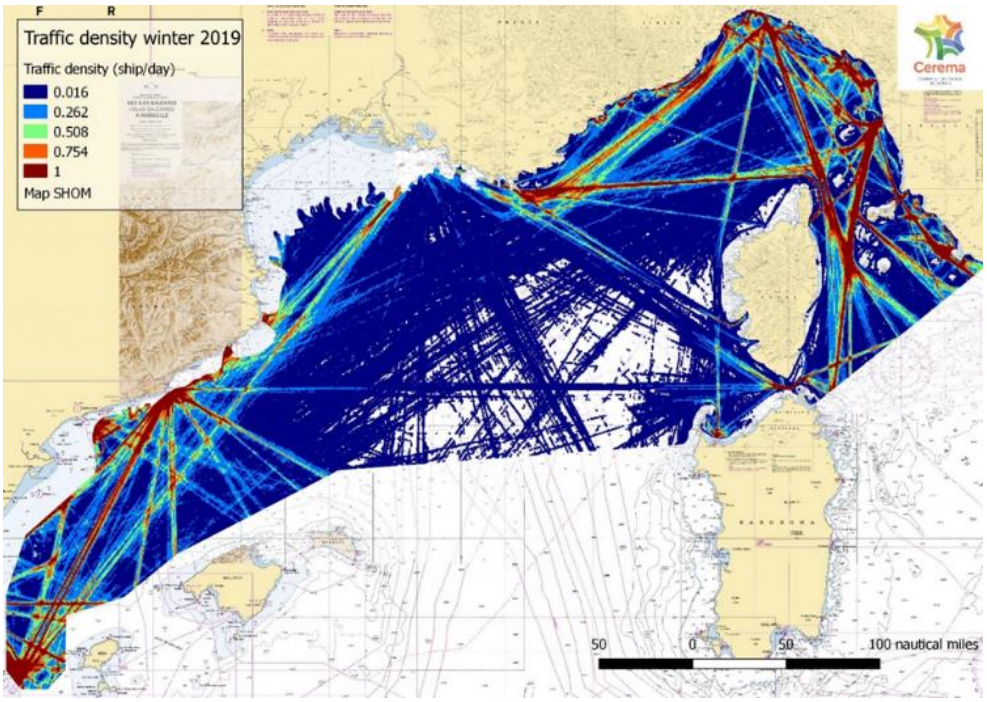
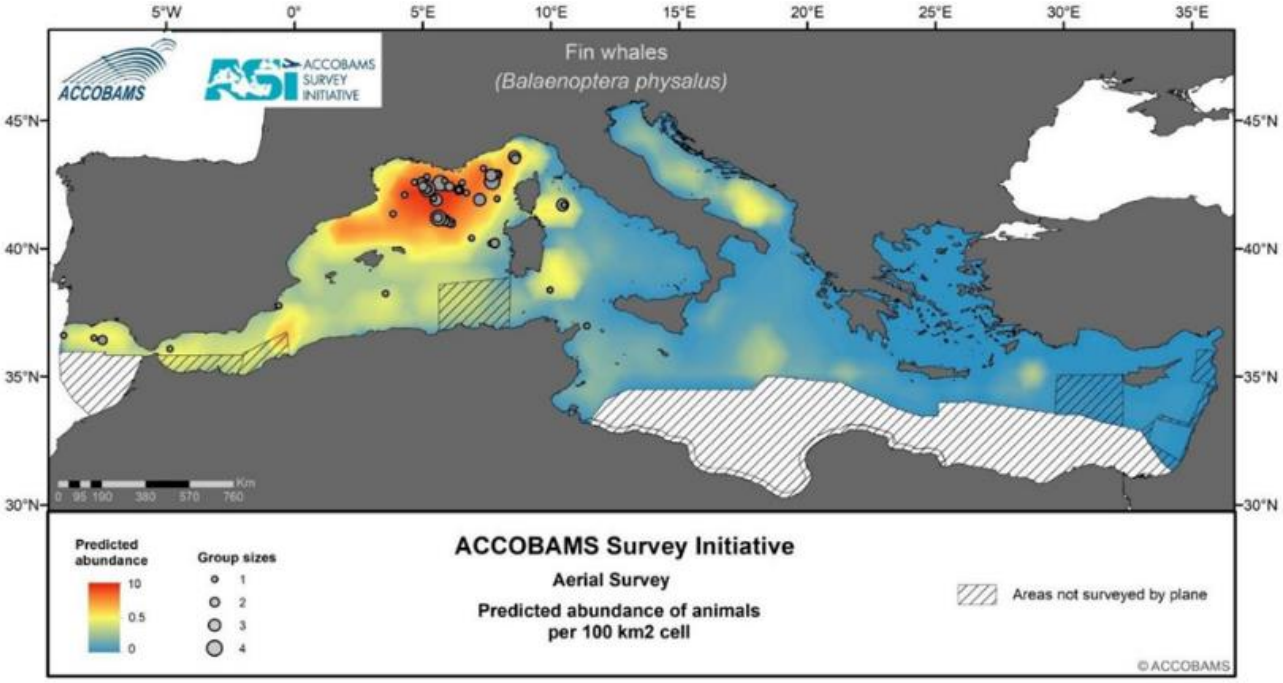


Figure 6: Representation of the maritime traffic during the winter period (2019, AIS source)



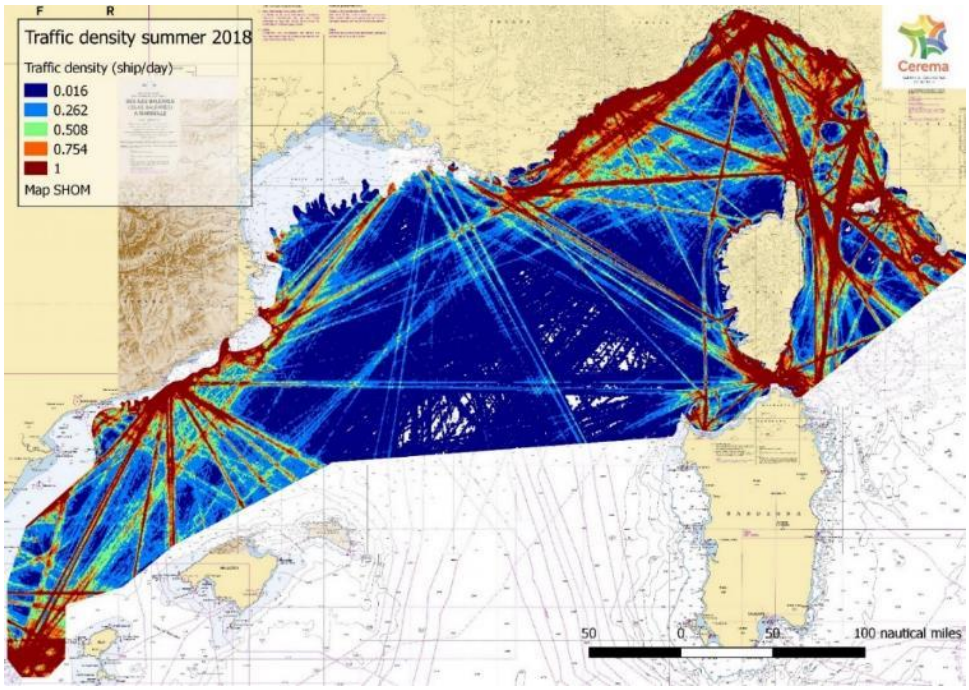


Figure 7: Representation of the maritime traffic during the summer period (2018, AIS source)

More than two thirds of the vessels using the study area (68% in winter and 71% in summer) fly the European flag, representing more than 70% of the cumulative distances travelled, whatever the season.

3.1.4 Harmful substances carried

The rules on the transport of harmful substances are derived from the International Convention for the Prevention of Pollution from Ships, known as the *MARPOL* Convention. These rules are contained in different international codes, depending on the nature and mode of transport of these substances. The Mediterranean is an important transport route, but also a major oil loading and unloading centre. It is also a major route for tankers.

3.1.4.1 Oil

In 2006, about 18% of the world's crude oil shipping, representing 4,224 voyages and 421 million tonnes, took place in the Mediterranean (MIU, 2008). Of the 10 main ports of discharge identified in 2006, four are located in the study area: Fos and Port-de-bouc (Marseille region), Genoa and Savona (Italy).

3.1.4.2 Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG)

In 2006, LNG and LPG loadings amounted to 31 and 19 million tonnes respectively and unloading to 25 and 20 million tonnes for the whole Mediterranean (MIU, 2008).

3.1.4.3 Chemical Products

Chemicals include organic compounds, animal oils and fats, inorganic compounds and other miscellaneous products. The transport of chemicals in liquid and gaseous form represents a

relatively small share of international maritime trade (about 2%)[13] but remains a very dynamic and important sector in terms of value of goods; however, their accidental release would be harmful to the marine environment.

3.2 Natural factors

3.2.1 Hydrographical

Some areas are known to present risks to navigation, due to the presence of the narrowness of the passage or sectors with numerous islands and islets. This is particularly the case of the Strait of Bonifacio, which is 15 to 20 km wide and 100 metres deep at its deepest point between southern Corsica and northern Sardinia. At its eastern mouth, it also contains the islands of the archipelagos of La Maddalena, Lavezzi and the island of Cavallo. This passage is considered dangerous due to the presence of numerous rocks and strong currents that can increase the risk of grounding and other accidents. These characteristics prompted the establishment of the Bonifacio Strait PSSA.

The small pass of the islands of Hyères is also a potentially dangerous area for large vessels. Located between the Giens peninsula and the island of Porquerolles, its narrowest part extends over less than one mile, with depths of less than 20 metres. The traffic of passenger HSC is very important in the summer season. Cruise ships and ro-ro passenger ships also use it, generally in an east-west direction in heavy westerly weather (GIS3M, 2010).

3.2.2 Meteorological

The Mediterranean climate is characterised by hot, dry summers under the influence of the Azores anticyclone, and mild, relatively rainy winters. Local winds are variable, in both direction and strength, and become stronger in winter with gusts that can exceed 100 km/h. North and north-west winds (Tramontane and Mistral) create the most violent storms.

3.2.3 Oceanographic

In the Mediterranean, the influence of the tides is weak; the tidal range does not exceed 40 cm on average near the coast. Tidal currents are weak and negligible compared to wind-induced currents. Generally, they are not felt near the coast in wide open areas, but they can be rapid in some narrow passages or shallow areas. The average sea waves and swell are generally weak, due to the small size of the Mediterranean basin where swells are infrequent and not very developed. The strongest states of the sea, in terms of height, are generated by north to north-west winds.

3.3 Impacts of shipping traffic on the area

3.3.1 Collisions between ships and large cetaceans

Long underestimated, this impact is now internationally recognised as an important threat to cetaceans, especially as shipping traffic, vessel size and speed continue to increase. Collisions involve a wide variety of vessels, with the risk of collision increasing with vessel speed (as does the severity of injury to the animal), although there is currently insufficient data to adequately quantify this risk (Leaper, 2019).

[13] Source: https://www.lantenne.com/Les-chimiquiers_a14360.html, consulted 19 February 2021.

The actual total number of collisions between large cetaceans and ships and the consequent impact at population level are difficult to be assessed. Accidents generally take place offshore and are rarely noticed by seafarers (this is particularly true when the vessels are large). Nevertheless, scientific work carried out over the last fifteen years, sometimes in collaboration with shipping companies, has shown that two species are mainly concerned in the Mediterranean: the fin whale (*Balaenoptera physalus*) and the sperm whale (*Physeter macrocephalus*). The latter spends long periods of rest floating at the surface, usually about 10 minutes, between deep dives: this behaviour makes it very vulnerable to ship strikes (UNEP/MAP-RAC/PSA, 2016).

Analysis of records of collisions between ships and the Mediterranean fin whale population over the period 1971-2001 showed that more than 80% of fatal ship strikes occurred in the North-West Mediterranean (Panigada *et al*., 2006). During the period 2012-2018, the annual number of deadly collisions within the proposed PSSA perimeter was up to 25.38 (Standard Deviation (SD) =5.97) fin whales per year. Based on recognized management rules, this value means that collisions alone prevent the restoration of the fin whale subpopulation within 100 years. Furthermore, there are almost 10% chance that ship strike mortality triggers a subpopulation decline.

Strandings data may complement the information on these accidents. A study carried out on strandings on the French coast since 1972 (Peltier *et al*., 2019) gave the following results:

- collisions are the main human cause of death for fin whales in the western Mediterranean (22.5% of stranding causes analysed on average; they are the cause of one in five strandings for all species combined);
- evidence of collision could only be found for the period 2005-2017 for the sperm whale in the Mediterranean;
- the majority of fin whales fatally struck by ships had not yet reached the reproductive stage; and
- the small size of the fin whale population in Mediterranean waters makes it particularly vulnerable to anthropogenic pressures.

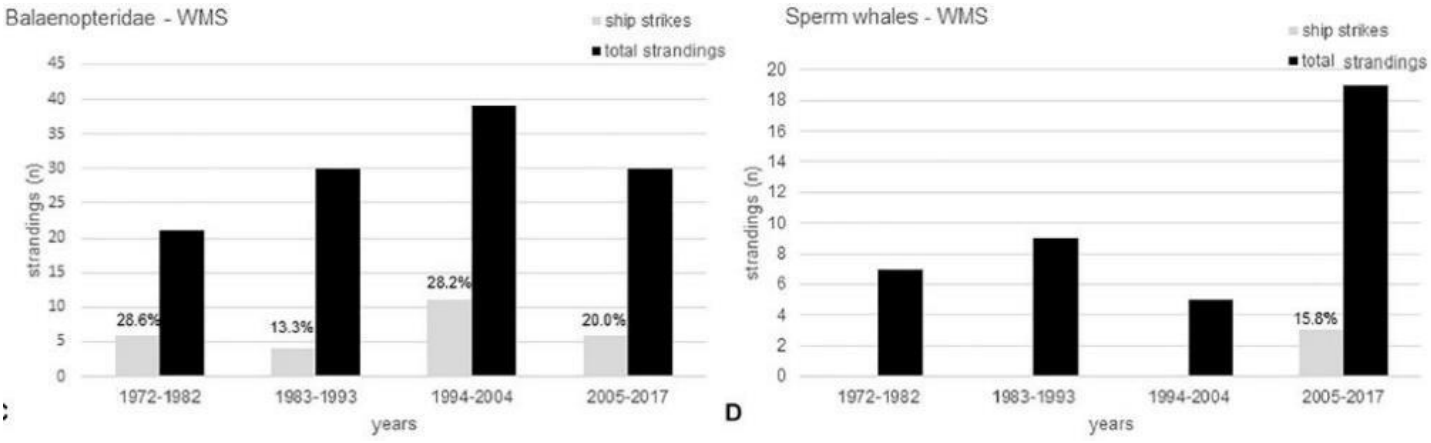


Figure 8: Number of fin and sperm whale strandings with evidence of a fatal ship strike (grey bars) and total number of strandings (black bars), by decade, in the western Mediterranean (Peltier et al., 2019)

An assessment carried out by France as part of the implementation of the European Marine Strategy Framework Directive (MSFD), in 2018, reports that in the western Mediterranean collisions are a cause for concern for fin whales, accounting for 80% of recorded events, compared to 10% for sperm whales (Spitz *et al*., 2018). Other work indicates that collisions and incidental catches alone may be responsible for the decline of the Mediterranean fin whale sub-population, and points to the need for further research to determine how indirect anthropogenic mortalities (pollution, prey depletion) affect the sperm whale population (Sèbe *et al*., 2020).

Another approach to assessing the risk of collision is theoretical statistical analysis. Thus, the processing of data concerning shipping traffic with those mentioning the presence of cetaceans makes it possible to calculate a theoretical ship-whale encounter rate ("near miss event" or NME). This approach was implemented for the study area (excluding the Spanish corridor), and gives the following results for fin whales (Gallou and Folegot, 2020):

- seasonal differences are mainly due to the variability in the number of ships using the area, which doubles in summer compared to winter; and
- passenger ships and cargo ships have the highest cumulative risk of collision (84% NME in winter, 72% in summer).

The method uses the Tregenza equation,[14] with the following working assumptions:

- the whole animal is vulnerable and represented by a straight line of the same length as the animal itself;
- the orientation of this line with respect to the direction of the ship is random;
- the animal does not try to move towards or away from the ship's path; and
- the vessel does not change its course.

The theoretical number of collision situations is calculated by integrating five parameters: the length of the individual, the time spent at the surface by the animal, the width of the ship's hull, the density of the whale populations and the distance travelled in the area by the ship.

The assumptions of this model do not necessarily reflect the behaviour of animals or vessels in real life, but these data are considered a basis for quantifying this risk, in the absence of more realistic data.

This work could not be carried out for sperm whales due to the lack of sufficient biological data.

In a similar manner the Spanish experience focuses on a study carried out in the MPA Cetacean Migration Corridor in the Mediterranean (CEDEX, 2021), where the presence of fin whales (*Balaenoptera physalus*) and sperm whales (*Physeter macrocephalus*) has been confirmed. For this purpose, a spatial qualitative indicator of "potential risk of collision" has been used considering, on the one hand, data related to maritime traffic, based on AIS data, and on the other hand, the available information related to sightings of the species under study, cited above.

[14] N. Tregenza, N. Aguilar, M. Carillo, I. Delgado, F. Diaz, A. Brito and V. Martin, "Potential impact of fast ferries on whale populations a simple model with examples from the Canary Islands.," in Proceedings of the Fourteenth Annual Conference of the European Cetacean Society. Cork, Ireland, 2-5 April. 2000. http://www.chelonia.co.uk/collision_prediction.htm, 2000.

The analysis carried out for the period of Oct 2018-Sep 2019 showed that up to 4,552 ships (including high-speed crafts, passenger ships, cargos and tankers) have transited this marine protected area, making a total of 5,81 million km travelled with an average route per ship of 132 km.

In order to obtain this spatial distribution of collision risk, a hazard analysis has been carried out, based on the logistic curve that relates the ship's speed and mortality (Vanderlaan and Taggart, 2007) (figure 9) and an approximation to an hazard index based on Vaes and Druon (2013). This index includes not only the traffic involved, but also the characteristics of the ship and its navigation features (i.e. distance travelled), which can affect the fate of the cetacean after the collision. This concept of risk represents a further step, since it combines the hazard of maritime traffic with the exposure associated with the presence of cetaceans.

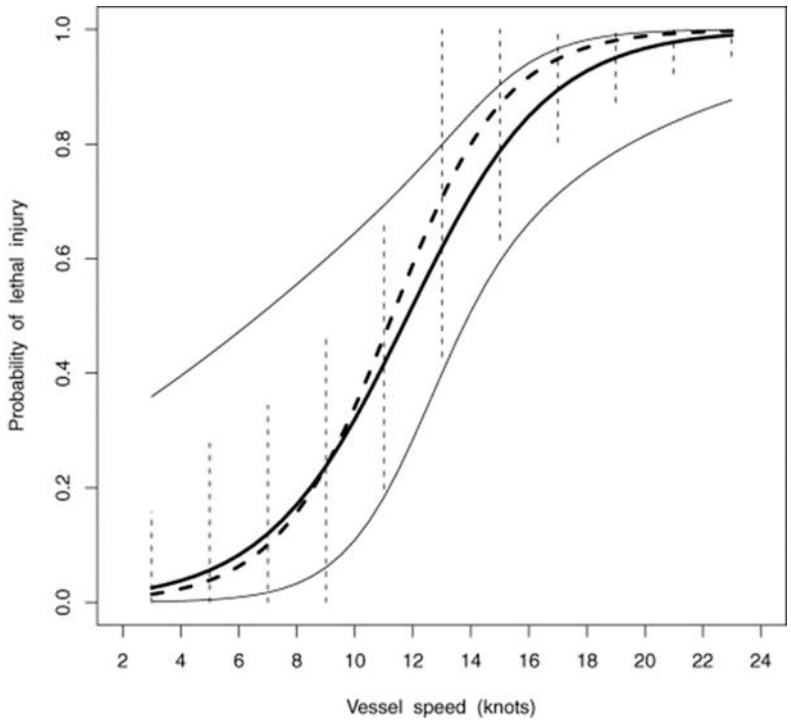
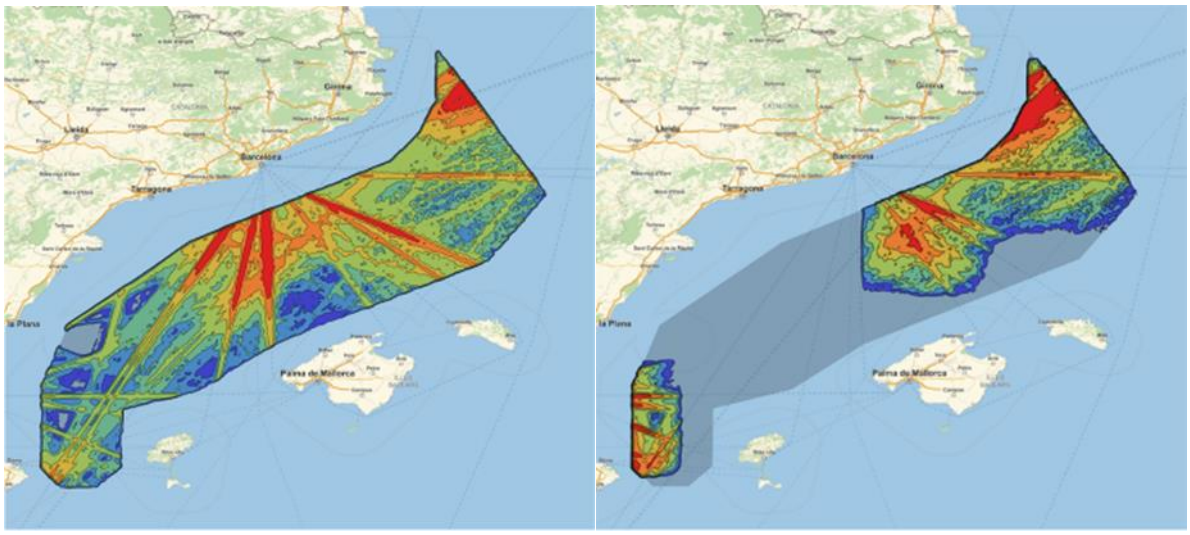


Figure 9: Vessel collisions with whales: the probability of lethal injury based on vessel speed (Vanderlaan, A.S. and Taggart, C.T. 2007)

The final objective is to identify those zones within the study area where the concentration of individuals and overall risk is higher. Within the cetacean migration corridor, for the total traffic analysed, these areas were identified with the north-western end of the corridor and the area affected by the routes starting from the port of Barcelona, as shown in figure 10. A more detailed analysis (not included in this document) makes it possible to quantify the contribution to this risk indicator of the different categories of ships or the incidence of the seasonal effects of traffic.



Balaenoptera physalus *Physeter macrocephalus*

Figure 10: Potential collision risk index associated with the presence of the cetaceans and maritime traffic in the CCM Oct 2018-September 2019 (CEDEX, 2021)

In order to help the decision-making process this analysis allows focusing on where and when taking measures (i.e. depending on the availability of data related to a temporal distribution of cetaceans). Currently a similar risk analysis is being carried out in the proximities of the Catalan coasts, given the high presence of the fin whale, to serve as support to define future measures to mitigate the risk of collisions with large cetaceans to be included in the corridor management plan.

The advantage of this methodology lies in its flexibility to adapt to different spatial and temporal scenarios, a measure that can gradually introduce improvements in the data it feeds. In this regard, it should be added that while the treatment of information related to maritime traffic is quite consistent, due to the robustness of the data, the same does not occur with the information from sightings of the species. Added to the difficulties of field work in the marine environment are the environmental conditions that are very important when it comes to having more or less probability of observing cetaceans and limiting being able to know the status and distribution of populations.

Based on the above it is concluded that the whale population has suffered ship strikes in the region and therefore the cetacean population is at risk. Without associated protective measures to mitigate the risk of collision within the perimeter of the PSSA, a decline in the populations of medium and large cetaceans is to be expected. Implementing a speed reduction strategy will allow a significant decrease in the likelihood of collision and fatal wildlife-related injuries.

The IWC Scientific Committee has identified the need for a better understanding of the relationship between vessel speed, the risk of death or injury to the whale and damage to the vessel. It has considered a number of studies and approaches since 2009 when MEPC.1/Circ.674 was adopted. All the studies considered have confirmed an increased risk with increased speed, supporting the use of speed restrictions as a way of reducing risk. Some studies have attempted to quantify the speed-risk relationship for specific whale species (Conn and Silber, 2013) or the hydrodynamic forces in relation to speed (Silber et al., 2014). Others (e.g. Wiley et al., 2011) have evaluated the relative risk reduction that might be achieved by speed restrictions. In addition to studies based on collisions, studies based on

observations of whales close to vessels have inferred greater collision risks with increases in speed (Gende et al., 2011; Harris et al., 2012).

At its last meeting (2022) IWC Scientific Committee, recommended that '*action needs to be taken to reduce ship strike risks to the Mediterranean populations of fin and sperm whales*'. The Committee also recognised that, '*in line with its previous recommendations, since routing options do not seem to be possible in the area, the most effective way to reduce risk is through speed reductions*'. Finally, the Committee recommended that '*any measures that are implemented are fully monitored and evaluated in terms of the risk reduction that is expected to be achieved, including through the use of AIS data to assess levels of industry cooperation, and that measures can be adapted based on this*'.

The most recent example of voluntary speed reduction to mitigate cetacean ship strikes is given by the case of the endangered Bryde's whales in the Hauraki Gulf, New Zealand (Constantine et al., 2015). Since the introduction of a speed limit of 10 knots in 2013, no collision events were recorded after an average of 2.4 whales per annum recorded in the period 1996-2014 (Ebdon et al., 2019).

Along the Atlantic coast of the United States, in the five years after the enactment of mandatory 10 knots speed restrictions in several Seasonal Management Areas, there were no right whale mortalities attributed to ship strikes either in or within 45 NM of these areas. These results indicate a statistically significant reduction in right whale ship lethal strikes in these areas suggesting that the speed limits have been effective (Laist et al., 2014).

Several models have shown that speeds between 10 and 13 knots drastically decrease the probability of lethal injuries in case of collisions between ships and cetaceans (Vanderlaan & Taggart 2007; Gende et al., 2011; Conn & Siliber 2013). There is strong support to identify 12 knots (11.8 knots or 6.1 m/s) as Bayesian change point of probability for the relationship between ship speed and encounter distance. Average encounter distances above and below the 11.8 knots change point vary from 448 m (95%CrI, 398-485) to 562 m (95%CrI, 468-676) (Gende et al., 2011).

3.3.2 Physical disturbance of cetaceans by ships

The presence of ships may influence cetaceans: attraction, flight or no apparent reaction, depending on species and individuals (Di-Méglio *et al*., 2010). It is likely to generate behavioural responses causing individuals to move to less favourable habitats, altering the normal course of functions such as foraging, social functioning, reproduction, suckling, resting or migration. This state of stress alters the health status of individuals and demographic parameters may be degraded. If changes in cetacean behaviour have been observed (notably in the case of the bottlenose dolphin in the Mediterranean[15]) and disturbance distances have sometimes been inferred, it is difficult in the current state of knowledge to quantify the impacts of this pressure in terms of population ecology.

3.3.3 Underwater noise from commercial shipping

Underwater noise generated by human activities is one of the pressures identified and assessed in the framework of the implementation of the Marine Strategy Framework Directive (descriptor 11 of the Directive) and its complementary process at the Mediterranean level (Ecosystem Approach Process (EcAp) led by the Barcelona Convention). Among the activities concerned is shipping, where the main contributor to the noise generated by a merchant ship is the movement of the engine propeller. The noise level increases with the shape of the

[15] Bearzi *et al.*, 2008.

propeller, the state of wear of the ship, its size, speed and loading. The literature shows a direct relationship between speed and noise (McKenna et al., 2013; Zobell et al., 2021). Leaper (2019) concluded that a 10% speed reduction would reduce the total sound energy from shipping by around 40% on the global scale.

In the Mediterranean basin, anthropogenic noise levels have been steadily increasing over the past 50 years as shipping traffic has increased. According to the first EU maritime transport first environmental impact report (EMTER report) published in 2021, for EU waters the total accumulated underwater radiated noise energy more than doubled between 2014 and 2019. The underwater-radiated noise (URN) from shipping, both in IMO and EU is now recognised as a significant environmental issue with regional and global impact. The European Maritime Safety Agency (EMSA) conducted a study in 2021, focusing on a number of key aspects related to URN: the existing policy and current understanding about sources of continuous URN from different types of ships, its impacts on the marine environment, and mitigation actions. The study was carried out by "WavEC Offshore Renewables" and "Maritime Research Institute Netherlands" (MARIN) on behalf of EMSA. Commercial vessels can have short- and long-term negative consequences for marine life, in particular marine mammals (IMO, 2014, MEPC.1/Circ.833): the diffuse increase by maritime traffic in ambient noise levels, especially in the low frequencies, reduces the communication range of cetaceans, making it difficult for them to find mates or establish social relationships, as well as foraging and orientation. Furthermore, repeated shallow dives to cope with persistent acoustic disturbance are likely to increase the risk of decompression illness in marine mammals (GIS3M, 2010).

To be noted, ships concerned with speed reductions should be chosen carefully, as these measures can also have opposite effects on underwater noise and gas emissions depending on propeller designs (Leaper, 2019), and the technical criteria of the electrical distribution and the type of propulsion of the ship. As the aim of this project is not to increase the impact of maritime traffic on cetaceans, consideration should be given to the equipment of vessels to reduce noise. For example, changing the propellers during maintenance, having a certificate of conformity, equipping with a noise self-estimation and cavitation detection system. The designation of the PSSA will allow to carry out further studies in the matter.

3.4 Chemical pollutions

3.4.1 Hydrocarbons

Accidental oil spills have become rare in the Mediterranean, the last major accident being the MT Heaven in the Gulf of Genoa in 1991, but they can cause considerable damage to the marine environment given the quantities of oil spilled and the length of time it takes for the impacted habitats to recover.

With regard to illegal discharges, the use of satellite imagery can contribute to the estimation of the number of oil spills from ships, without providing proof that the discharge is illegal or that it is from a ship. In 2016, EMSA's CleanSeaNet platform recorded a total of 1073 detections of likely polluting incidents and a total of 1060 detections of potentially polluting incidents in the Mediterranean region and off the Atlantic coasts of Morocco, Portugal, Spain and France (figure 11). Although these data remain to be confirmed, both in terms of the nature of the pollution and its origin, they clearly indicate that oil pollution incidents caused by ships remain a concern in the Mediterranean.[16]

[16] Source: https://www.medqsr.org/fr/resultats-et-etat-y-compris-les-tendances-ic19, consulted 18 January 2021.

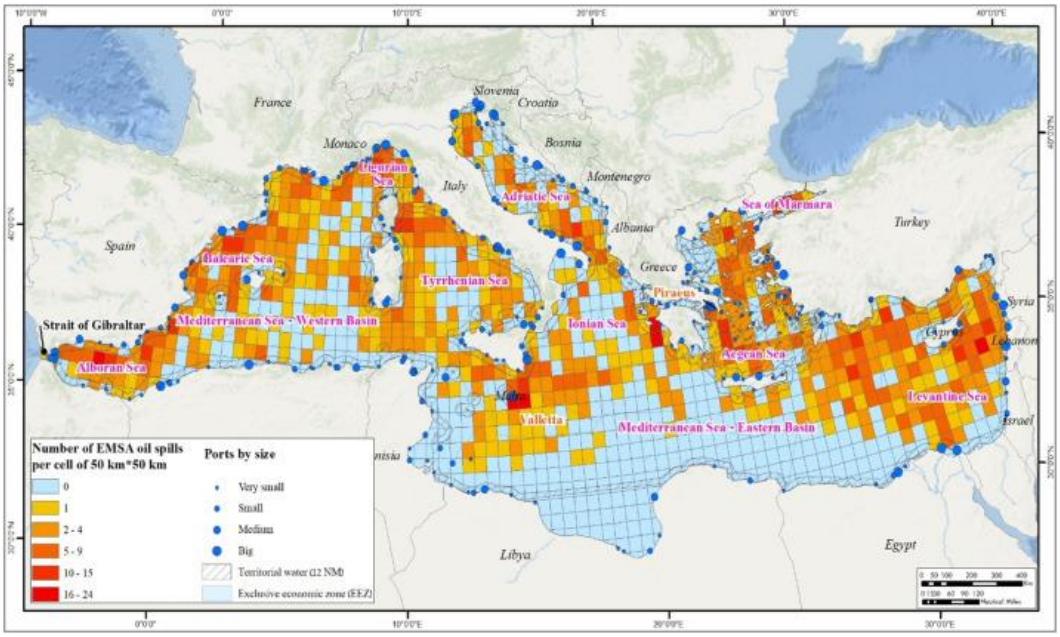


Figure 11: Number of oil spill incidents recorded by EMSA in the Mediterranean in 2016

Polycyclic aromatic hydrocarbons (PAHs) can bioaccumulate in the tissues of marine mammals. The viscous crude oil spilled during an oil spill can cover the surface of the cetacean's body for a long period of time, which can reduce its filtering capacity: this can be the case for fin whales. The deterioration of zooplankton by an oil spill can also generate an indirect negative impact on some whales, as it is the main food for them.

3.4.2 Antifouling paints

These paints are one of the sources of heavy metals and biocides in Mediterranean waters, particularly off the coast of port areas. Through bioaccumulation, marine mammals can be sensitive to this type of pollution, which can disrupt their immune system and even lead to death.

3.4.3 Other toxic products

In addition to oil, hazardous and noxious substances (HNS) accidentally spilled into the marine environment can threaten marine species such as cetaceans. HNS include bulk liquid cargoes (petrochemicals, solvents and liquefied gases, etc.), bulk solid cargoes (fertilisers, etc.) and packaged chemicals. The quantities of HNS accidentally spilled have decreased considerably between 1994 and 2013 in the Mediterranean. Since 2003, the discharge of HNS has become insignificant compared to the period from 1994 to 2002.

3.5 Marine litter

The Mediterranean Sea is one of the most affected areas by marine litter in the world and by plastic in particular, (it can constitute up to 90% of the seabed litter). The study from Arcangeli *et al.,* 2020 shows that there is a gradient x10 in density if marine litters from offshore, to coastal and to river. Meaning that marine litters are coming from land through rivers (highest densities) and then are spread over the vast oceanic surface. Its origin is mainly land-based, but it is estimated that ships are the source of almost a quarter of this litter (Koutsodendris *et al*., 2008; Ioakeimidis *et al*., 2014).

Accumulation rates vary greatly and are influenced by several factors, such as the proximity of large cities, coastal artificialisation and frequentation, hydrodynamics and maritime activities. The semi-enclosed nature of the Mediterranean basin also explains the high accumulation rates observed. The analysis of this waste shows a great variability *in* its nature and origin, with the highest quantities located mainly near large cities, river mouths and coastal canyons where currents are slower and strong sedimentation occurs.

In the French part of the study area, accumulation rates of 290 objects/km² can be reached on the continental shelf, with plastic waste found at different depths. The majority of plastic waste found in this area originates from fishing activities, with ferry traffic around Corsica also representing a considerable source of waste, particularly bottles and cans thrown overboard (Gerigny *et al*., 2019). The presence of marine litter in increasing quantities is a serious threat to marine ecosystems, particularly for turtles and marine mammals (risk of entanglement, suffocation by ingestion).

3.6 Biological pollutions

Shipping transport is considered to be the most important vector for the import of exogenous marine species in the world, *via* ballast water or biofouling accumulated on the surface of ships' hulls, respectively managed by the IMO through the Ballast Water Management Convention and the Anti-Fouling System Convention. The semi-enclosed nature of the Mediterranean Sea and the importance of shipping traffic, particularly in its North-Western basin, make it very sensitive to this risk. Invasive species can cause the restructuring of entire habitats to the detriment of native species, with the risk of reducing biological and genetic diversity within populations. However, this risk is only likely to affect very indirectly cetacean populations in the Mediterranean.

3.7 Greenhouse gas and air pollutant emissions

Greenhouse gas emissions have a global impact and are generated by various sectors of activity, including transport. Shipping traffic contributes to this, but only to a limited extent: in 2017, 3.15% of total EU greenhouse gas emissions were attributable to international shipping. However, with a significant increase of 32% over the last 20 years and an estimated projection of 50-250% by 2050, despite reductions in fuel consumption, the European Parliament voted on 16 September 2020 to include shipping in the EU Emissions Trading Scheme (EU ETS) and to set binding standards for shipping companies to reduce their CO_2 emissions by at least 40% by 2030.[17] Negotiations are still ongoing on the EU's Fit for 55 legislative package.

[17] Source: https://www.europarl.europa.eu/news/fr/headlines/society/20191129STO67756/emissions-de-co2-des-avions-et-des-navires-faits-et-chiffres-infographie, consulted 18 February 2021.

CO_2 emissions from maritime transport are estimated at about 10% of the total CO_2 inventories emitted by the 21 Mediterranean countries that are signatories to the Barcelona Convention. These emissions also contribute to increased acidification and eutrophication of the marine environment.

The consequences of the increase in greenhouse gases on the marine environment are known and include the increase in temperature and acidification of marine waters. This may have consequences for cetaceans in terms of the distribution of their prey and their vulnerability to pathogens, which could thus find more favourable conditions for their development.

The Mediterranean States have jointly committed, within the framework of the IMO, in a landmark initiative on the greening of maritime transport. They have submitted to the IMO a joint and coordinated proposal to establish a SO_x Emission Control Area (SECA) in the whole Mediterranean Sea at the seventy-eighth session of the Committee for the Protection of the Marine Environment (MEPC), which approved its creation. The designation of this area entails the obligation for all ships entering the Mediterranean to use fuel with sulphur content not exceeding 0.10% by mass, i.e. fuel five times less polluting than the international standard in non-SECA. Pending the adoption by the next session of MEPC in December 2022, the amendments to the Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL) will enter into force in 2024 with a possible entry into effect of the area in 2025. This new SECA will significantly improve air quality in the area and protect health of millions of Mediterranean citizens and their fragile environment.

3.8 Summary of groundings, collisions or spills in the area

The Mediterranean Integrated Geographic Information System for Risk Assessment and Response to Marine Pollution (MEDGIS-MAR), administered by REMPEC,[18] lists 82 events that occurred in the study area between 1977 and 2017. However, as no data is available for the study area between 2002 and 2011, it is likely that some information is missing or not published.

Of the events listed, 8 resulted in the release of more than 700 tonnes of hazardous substances into the environment (6 involving oil pollution), 8 resulted in the release of between 7 and 700 tonnes, 42 resulted in the release of less than 7 tonnes of hazardous substances.

The most dramatic event for the marine environment in the area was the accident off Genoa on 11 April 1991, when an explosion followed by a fire on the Cypriot tanker *MT Haven* resulted in the loss of 144,000 tonnes of heavy oil at sea. In terms of media coverage, the sinking of the cruise ship Costa Concordia in 2012 is widely remembered, mainly for the loss of life, although its impact on the marine environment was limited.

On Sunday October 7, 2018 in the morning, the Cap Corse semaphore reports to CROSS La Garde the collision between the Tunisian ro-ro ship ULYSSE and the container ship CSL VIRGINIA. The collision has resulted in pollution of around 530 m^3 of hydrocarbons from the holds of the container ship.

During the night of Saturday 12 to Sunday 13 October 2019, *RHODANUS*, a small cargo vessel flying the flag of Antigua and Barbuda, was heading straight for the *Cappiciolu* peninsula on the south coast of *Corsica*. Called by the MRCC on several occasions by VHF, the vessel did not answer. She stranded in the *Bonifacio* nature reserve, at the place called "*Cala Longa*". Alone on the bridge, the mate in charge of the watch fell asleep. The vessel was refloated on

[18] Source: https://medgismar.rempec.org/, consulted 22 January 2021.

Friday 19 October and towed with her seven crew members to *Fos-sur-Mer*. There were no casualties nor pollution.

On June 11, 2021, air traffic control at Solenzara air base relayed the detection of an oil slick eight nautical miles long by an Air Force plane about ten kilometres from the east coast of Corsica. A Falcon from the French Navy carried out the relocation of two slicks then by the Customs launch "DF 25", whose samples confirmed that they were heavy hydrocarbons. In the evening, the means of combating pollution in Corsica and Toulon were mobilized by the maritime prefecture of the Mediterranean, while the POLMAR-land plan was activated. It could correspond to the discharge by a ship of oily waters.

In relation to collisions between ships and cetaceans, a very recent collision event can be cited. The vessel Hypatia de Alexandria, from the Balearia fleet, brushed against two fin whales that were 15 miles off the coast of the Llobregat Delta on 26 May 2022. One of the individuals made an emergency dive about 50 metres from the vessel and the other is believed to have grazed the keel of the vessel.

3.9 Measures taken to protect the area and their positive effects

The wealth and plurality of environmental issues in the study area, as already described, have prompted the Coastal States or local authorities concerned to take specific protection measures by creating various marine protected areas. In total, almost 145,000 km² of the study area has a special status.

3.9.1 Measures already adopted by the Organization

Adoption on 2 November 1973 of a special area (SA) covering the entire Mediterranean under Annexes I (Regulation for the Prevention of Pollution by oil) and V (Regulation for the Prevention of Pollution by garbage from ships) of the MARPOL Convention. This measure came into force on 2 October 1983.

Adoption on 15 July 2011 of a PSSA for the strait of Bonifacio by Resolution MEPC 204(62) which refers to protective measures previously adopted by Res.A.766(18) on 4 November 1993. In particular, IMO has adopted a mandatory ship reporting for ships of ≥300 GT. In addition, vessels continue to use the existing recommended two-way route and any ships containing hazardous materials must require a pilot service.

Adoption of the creation of a sulphur oxide and particulate emission control area (SECA area) covering the entire Mediterranean Sea at the seventy-eighth Marine Environment Protection Committee of the International Maritime Organization (IMO) on June 10, 2022.

3.9.2 Measures taken for the protection of cetaceans

3.9.2.1 International Pelagos Sanctuary

The Pelagos Trilateral Agreement (November 1999) for the protection of marine mammals within the Pelagos Sanctuary entered into force on 21 February 2002, after ratification by the three concerned countries (France, Italy, Monaco). The Sanctuary covers a total area of 87,500 km². The objective of the agreement is to maintain a favourable conservation status for marine mammal populations within the Sanctuary, and to this end, to monitor cetacean populations, to reinforce the application of existing legislation on certain fishing activities, to reduce pollution, to regulate tourist observation of cetaceans and to improve the dissemination of information to the public. Since November 2002, the Pelagos Sanctuary has also been

recognized by the Barcelona Convention Contracting Parties as a Specially Protected Areas of Mediterranean Importance (SPAMI).

3.9.2.2 The MPA cetacean migration corridor in the Mediterranean (Spain)

The Spanish government has designated a 46,385 km² corridor between Valencia, Catalonia and the Balearic Islands as a Marine Protected Area, to protect cetaceans present and migrating in the area. The Barcelona Convention, allowing the area to be designated as a SPAMI, validated this in December 2019.

3.9.3 Measures taken for the wider protection of environments

3.9.3.1 The Calanques National Park (France)

Created by decree on 18 April 2012, the Calanques National Park is both terrestrial and maritime. The marine core of the park covers 435 km^2 and benefits from the strongest protection measures. The adjacent maritime area (977 km^2) also expresses sustainable development guidelines and ends at the limit of French territorial waters. It is recognised as a SPAMI.

3.9.3.2 Port-Cros National Park (France)

Created on 14 December 1963, this National Park has a marine area of 29 km^2 (heart of the park), to which are added 1230 km^2 of adjacent marine area. It is the oldest marine park in Europe. It is also recognised as a SPAMI.

3.9.3.3 The National Park of the Tuscan Archipelago (Italy)

Arcipelago Toscano National Park, established in 1989, is the largest marine park in Europe: it safeguards 567.66 km^2 of sea and 178.87 km^2 of land. It includes the seven main islands of the Archipelago, as well as some minor islands and rocks. Each island and islet preserve traces of its history, each of them is unique. This Archipelago has always represented an important shelter and connection area between the Sardinian-Corsican system and the peninsula. This history has led to the presence in the Archipelago of extremely specialized animal and vegetal species, which formed during the periods of isolation, and species, which only live in Corsica and Sardinia. There are colonies of sea birds, like shearwaters and seagulls, among which the rare Audouin's Gull, a Mediterranean endemic species which in Italy lives in a few places. The presence of the Mediterranean monk seal has also been sporadically recorded, and it also possible to sight cetaceans. UNESCO as a Tuscan Islands Biosphere Reserve has also recognized the park since 2003.

3.9.3.4 The Maddalena Archipelago National Park (Italy)

This park, created in 1994, covers approximately 51 km^2 on land and 150 km^2 at sea. Fin whales, sperm whales and bottlenose dolphins but also sea turtles (*Caretta caretta*), are frequently seen within this Archipelago.

3.9.3.5 National Park of Asinara and Marine Protected Area of the Asinara Island (Italy)

Designated in 1997, it extends for 52 km^2 on land and 108km^2 at sea. The marine environment is an element of considerable scientific and naturalistic interest for Asinara. Throughout the western side there are some unique plant landscapes, dominated by large brown algae of Atlantic origin, such as *Cystoseira*, *Sargassum*, *Dictyopteris* and *Phyllariopsis*.

3.9.3.6 National Park of Cinque Terre and Marine Protected Area of Cinque Terre (Italy)

Designated in 1999, the Cinque Terre National Park is a Unesco World Heritage site with priceless environmental and cultural features. It is a naturalistic oasis which preserved the features of an uncontaminated nature. The landscape, formed by rocks of different origin and age, is marked by a particular steepness and by the lack of plain stretches.

The coast, high and jagged, is linear, with a few inlets and promontories, dug by the sea in suggestive caves. There are a few sandy and pebbly beaches which are the result of the detritus of the watercourses, of landslides, or of accumulation of materials left by man.

Cinque Terre National Park is also the habitat for several faunistic species which find here the ideal conditions to live and reproduce. The Marine Protected Area extends for about 39 km^2.

3.9.3.7 Natural reserve of Bouches de Bonifacio (France)

The largest nature reserve in mainland France, created in September 1999, the *Bouches of Bonifacio* covers 800 km^2, mainly maritime, between Corsica and Sardinia. More than 98 km^2 of the sea are under so-called enhanced protection. This reserve is part of the PSSA of the Strait of Bonifacio, recognised as such in July 2011 by IMO, which concerns maritime areas under French and Italian jurisdiction (MEPC, 2011); it is also recognised as a SPAMI.

3.9.3.8 Cape Corsica and Agriate Marine Natural Park (France)

Created in 2016, the Cape Corsica and Agriate Marine Natural Park covers an area of 6,830 km^2, of which 4,282 km^2 is located in the French EEZ.

3.9.3.9 Gulf of Lion Natural Marine Park (France)

Created in 2011, the Gulf of Lion Natural Marine Park has an area of 4,010 km^2. Its offshore limit is set at 35 miles, or approximately 60 km, where the depths reach 1,200 m. The Park aims to meet three fundamental objectives:

- Knowledge of the marine environment,
- The protection of this environment and the species it shelters, and
- To contribute to the sustainable development of maritime activities.

3.9.3.10 Portofino Marine Protected Area (Italy)

With a surface area of about 4 km^2, it is delimited at sea by 11 luminous buoys in the near coastal area. Also recognised by the SPAMI, it is home to rich and diverse underwater landscapes, and in particular to red coral (*Corallium rubrum*), a species essentially endemic to the Mediterranean.

3.9.3.11 Capo Testa - Punta Falcone Marine Protected Area (Italy)

The Capo Testa – Punta Falcone Marine Protected Area, established in 2018, leans over the Strait of Bonifacio over 51.6 km^2 and is characterized by a landscape of white sands and imposing granite rocks which represent true natural monuments.

3.9.3.12 Bergeggi Island Marine Protected Area (Italy)

Bergeggi Regional Nature Reserve and the Bergeggi Island Marine Protected Area cover about 3 km^2. The coastal stretch between Bergeggi and Spotorno alternates small beaches

and short promontories to overhanging cliffs, in which the sea dug some small caves. In front of it, not too far from the mainland, there is the small Bergeggi Island. The island and the rocky coast facing it are part of Bergeggi Regional Nature Reserve since 1985; whereas the MPA was established in 2007.

3.9.3.13 Secche della Meloria (Meloria's shallows) Marine Protected Area (Italy)

At 3 miles far from the coast near Livorno, you could see on the horizon the Lighthouse and Meloria Tower, bulwarks of one of the most peculiar Marine Protected Areas in the Mediterranean Sea.

The Secche della Meloria Marine Protected Area covers more than 9 km², delimiting an area of exceptional historical, archaeological and natural interest. Its high biodiversity, thanks to its variety of habitats, makes it an important ecological conservation site, and also an exceptional destination for snorkelers and divers. The Tower and the Lighthouse of Secchie della Meloria could really be considered as Marine (or maritime) Monuments, since they represented a natural fortress against the enemies, and many shipwrecks occurred there. This Marine Protected Area is thus a site of significant historical importance and a "paradise" of underwater archaeology.

3.9.3.14 Blue Coast Marine Park (France)

Recognized as a SPAMI, it includes the marine protected areas of Carry le Rouet (about 1 km^2) and Cap Couronne (about 2km^2) in the near coast.

3.9.3.15 Marine natural reserve of Cerbère Banyuls (France)

It covers 6.5 km^2 of sea, up to about one and a half miles offshore. It is recognized as a SPAMI.

3.9.3.16 Embiez Archipelagos (France)

It covers a marine area of about 3 km^2 in the very close coastal zone. It is recognized as a SPAMI.

3.9.3.17 Cap de Creus Natural Park (Spain)

Created by law on 12 March 1998, Cap de Creus Natural Park is both terrestrial and maritime. This park, which lies between land and sea, is an area of great beauty and a remarkable geological ensemble with structures and outcrops that make it unique in the world. The impact of the tramontane wind has generated whimsically eroded shapes and transformed its landscape. The marine part of the park covers 2054, 19ha. One of the most remarkable attributes of the seabed of Cap de Creus is its great diversity of communities and species. From the coast to more than 80 m deep, almost everything is possible: rocky bottom and muddy bottom; coves with calm waters and places exposed to strong currents, waves or the tramontana; flat bottoms and rocky walls; well-lit places and shady places. It is recognized as a SPAMI.

3.9.3.18 Parque Naural de Montgri les iles Medes e Baix ter (Spain)

Created by law on 28 May 2010, Montgrí, Medes islands and Baix Ter Natural Park is both terrestrial and maritime. The park has a coastline with cliffs, coves and beaches and seabeds with an undeniable ecological value. It also features a mountain massif that rises from alluvial plans and wetlands formed by the River TER when it runs into the bay of Pals. The marine part of the park covers 2038, 98ha and the Medes Islands with a higher level of protection covers 100,56ha, contemplating their seabed is like going back in time and enjoying the flora, fauna and landscape of a stable and complete ecosystem. Medes Islands are recognized as a SPAMI.

3.9.3.19 Columbretes Islands (Spain)

Recognised as SPAMI

3.9.3.20 Natura 2000 sites

The proposed NW Mediterranean PSSA encompasses over 230 Natura 2000 coastal and marine sites.

3.9.4 Future measures proposed for the wider protection of environments

At the twenty-second meeting of the Conference of Parties to the Barcelona Convention (COP 22), the Contracting Parties agreed to submit to the Organization a proposal for the designation of the Mediterranean Sea, as a whole, as an Emission Control Area (ECA). The goal is to prevent, reduce and control emissions of sulphur oxides (SO_x) and particulate matter (PM) from ships pursuant to regulation 14 and Appendix III to Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL). Hereinafter referred to as the proposed "Med SOX ECA".

The submission set out in document MEPC 78/11 was presented and approved at the seventy-eighth session of the Committee in view of its adoption at the following session (MEPC 79), with an entry into effect in 2025.

Conclusion of the first part:

The elements presented in this first part allow a number of observations:

- Firstly, the proposed NW Med PSSA is particularly frequented by ships, whether for the transport of goods, passengers, pleasure craft or fishing. The area is a crossroads for trade and a major tourist destination, with a high level of frequentation in all seasons. In addition, the maritime traffic trends observed are upwards and economies of scale by increasingly large ships transiting within the PSSA.

- Secondly, this area is particularly important from an ecological point of view, at the level of the Mediterranean Sea but more widely at the global level. The area is particularly frequented with marine mammals, including two species that are particularly vulnerable to the risk of ships strikes because of their size: the fin whale (the second largest mammal in the world and vulnerable species according to the IUCN) and the sperm whale (a species in danger of extinction). It is recognized worldwide that the target speed of 10 knots would significantly limits the risk of fatal ship strikes in case of collision between ships and cetaceans. Moreover, it is highlighted the decrease in the probability of encounter between ships and large and medium cetaceans and therefore the mitigation of the risk of collision below 12 knots.

In view of this threat to marine mammal populations and the international commitments made to protect these species, it is essential to propose effective measures to mitigate the risk of ship strikes with cetaceans and to address in the future other ship-generated pollution to protect cetaceans in the area.

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ANNEX 2

INFORMATION SUPPORTING THE PROPOSITION OF A PARTICULARLY SENSITIVE SEA AREA (PSSA) IN THE NORTH-WESTERN MEDITERRANEAN SEA

Part II – APPROPRIATE ASSOCIATED PROTECTIVE MEASURES AND IMO's COMPETENCE TO APPROVE OR ADOPT SUCH MEASURES

Introduction

France, Italy, Monaco and Spain made a joint statement in favour of the creation of a PSSA at the annual meeting of the ACCOBAMS[1] in November 2019.

1 ASSOCIATED PROTECTIVE MEASURES

Different associated protective measures were considered to protect cetaceans from any adverse effect generated by ships. These include prevention of pollution from ships but also action to minimize ship strikes with cetaceans. The latter is particularly difficult to manage in a large area and needs some thorough considerations.

Circular MEPC.1/Circ.674 of 31 July 2009, guidance document for minimizing the risk of ship strikes with cetaceans, sets out a number of measures to reduce the risk of collision between large cetaceans and ships. A document presented by the IWC in February 2016 (MEPC 69/10/3) summarises the results obtained in terms of reducing the risk of collision between ships and cetaceans since the adoption of the IMO circular. The measures or recommendations already implemented worldwide are of various types:

- traffic management measures (permanent or seasonal);
- recommendations for specific routes;
- prohibited areas;
- reduction in the speed of ships and in the propeller cavitation (permanent or seasonal); and
- mandatory ship notification systems to trigger anti-collision manoeuvres.

As indicated in MEPC.1/Circ.674, "*collisions between cetaceans and ships occur worldwide where there is an overlap between cetaceans and vessel activities. Such collisions involve a wide variety of vessel types, including recreational, commercial and governmental vessels. Damage to vessels, ranging from minor to extreme, has resulted from ship strikes of cetaceans. Such damage includes cracked hulls; damaged propellers, propeller shafts, and rudders; damaged port and starboard aft strut actuators; broken steering arms; and ruptured seawater piping. In some cases, in particular involving large vessels, captains may be unaware that a collision with a cetacean has occurred*."

Collision of HSC with a cetacean will be fatal for the marine mammal but can also result in damage to the HSC and serious injury to passengers.[2] In that respect, it is proposed the following appropriate measures to prevent ship strikes with cetaceans as basic safety measures to all ships.

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1 ACCOBAMS: Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area.

2 https://people.com/pets/japan-high-speed-ferry-hits-whale/

In that respect, France, Italy, Monaco and Spain propose associated protective measures that should benefit to the preservation of cetaceans but the safety of navigation as well.

1.1 Existing associated protective measures

1.1.1 International existing measures

- *Adoption on 2 November 1973 of a special area (SA) covering the entire Mediterranean under Annexes I (Regulation for the Prevention of Pollution by oil) and V (Regulation for the Prevention of Pollution by garbage from ships) of the MARPOL Convention. This measure came into force on 2 October 1983*.

  SA under MARPOL Annex I prevents the viscous oil during an oil spill to cover the surface of the cetacean's body for a long period which can reduce its filtering capacity.

  SA under MARPOL Annex V prevents the presence of marine litter in increasing quantities, which is a serious threat to marine ecosystems, particularly for turtles and marine mammals (risk of entanglement, suffocation by ingestion).

- *SOLAS V/4 Navigational warnings and Res.MSC.469(101) amendments to world-wide navigational warning service (WWNWS).*

  WWNWS includes coastal warnings broadcast information, which is necessary for safe navigation within areas seaward of the fairway buoy or pilot station, should not be restricted to main shipping lanes. Where the area is served by International NAVTEX, it should provide navigational warnings for the entire NAVTEX service area. Coastal warnings should include different subjects, in particular drifting hazards (including derelict ships, ice, mines, containers, other large items over six metres in length, etc.).

  Today the NAVTEX is one of the principal components of MSI within GMDSS in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974. Moreover, it should be noted that this solution is inexpensive and does not require material adaptation on board ships and for coastal States.

  Large and medium cetaceans can be considered as a dangerous drifting object, which, in the event of a ship strike, can be a cause of death for the cetacean but can also cause significant damage to the structure of the ship or to the hull appendix. Information in real or near real time is relevant for maritime safety as well as the preservation of cetaceans. The proposed NW Med PSSA is covered by three international NAVTEX stations in La Garde (France), La Maddalena (Italy) and Cabo La Nao (Spain).

  For instance, navigational warning broadcasted on NAVTEX could be used for "Dynamic Management Areas" (DMA) whereby temporary zones are created aggregations of cetaceans. Ships would be asked to avoid DMA or travel through them with caution at reduced speed. If that was the case, it would only be necessary to establish an information transmission chain to the different NAVTEX coordinators from the source of information generally coming from ships at sea at it is the case for any navigational warnings.

- *SOLAS V/27 Nautical Chart and nautical publication. Nautical charts and Nautical publications, such as sailing directions, notices to mariners and other nautical publication are necessary to inform the danger of navigation.*

These measures may assist to reduce and mitigate ship strikes with cetaceans and ship generated pollution, which may severely affect cetaceans, but additional measures are needed.

1.1.2 Existing measures in France, Italy, Monaco and Spain

France:

- The only specific measure implemented to reduce the risk of collision of a certain type of vessels with cetaceans concerns the obligation to equip a position-sharing device to avoid strike with cetaceans in the Pelagos marine sanctuary. This provision was introduced for certain types of French vessels by Law 2016-1087 of 8 August 2016 for the reconquest of biodiversity, nature and landscapes.[3]

- Law 2016-1087 also introduces liability and compensation for "*pure environmental damage"*, or "*ecological damage"* into the French Civil Code.

Spain:

- **The Mediterranean Cetacean Migration Corridor (CMC) Marine Protected Area (MPA) established by Royal Decree 699/2018 on 29 June 2018 by the Spanish government:**

  The protected area covers 46.385,7 km² and is characterised by its concentration of significant numbers of many cetacean species (including fin whale and sperm whale), having special relevance for the fin whale that uses it as a migratory route towards its breeding and feeding areas in the Northern Mediterranean.

  - Underground geological research by means of active systems (probes, compressed air or controlled explosions, or underground drilling) are forbidden, except for permits for research or exploitation in force.

  - Any type of hydrocarbon extractive activity is prohibited, except for research or exploitation permits in force.

- **The marine reserve of Islas Columbretes created under Ministerial Order of 19 April 1990.**

  The marine reserve has a total area of 5.543 hectare. Its Management Plan (Ministerial Order ARM/384/2008) reflects its updated zoning and allowed uses. The marine reserve encompasses two no-take marine reserves, prohibits discharges into the sea, the introduction of exotic species and sets a maximum speed of three knots for recreational vessels.

  - In addition, an exclusion zone for maritime navigation was established around the Columbretes Islands marine reserve in 2004, by the Spanish Directorate-General for Merchant Shipping. This exclusion area covers a circular area of eight miles, centred around the Racon of the Isla

[3] https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000033029052/

Grande, and is mandatory for ships over 1,000 GT transporting dangerous or polluting goods. It is included in Nautical Charts.

- The proposed NW MED PSSA covers part of the Traffic Separation Scheme (TSS) established 6 nm off Cabo de la Nao, in the southern part of the area. This TSS is part of the three TSS (Cabo de Gata and Cabo de Palos) established around the Spanish Mediterranean coastline to regulate traffic flows from/ to the Gibraltar strait towards/from NW Mediterranean ports.

- Notice to Mariners to protect cetaceans from the risk of ship collisions in the Strait of Gibraltar and the new location for the "Cabo de Gata" Traffic Separation Scheme. In the Gibraltar Strait, a Notice to Mariners has been published in January 2007 by the "*Instituto Hidrográfico de la Marina*" (Spanish Navy Hydrographic Institute under the Ministry of Defence). This Notice establishes a security area characterized by high densities of sperm whales, where crossing ships are recommended to limit their speed to a maximum of 13 knots, and to navigate with particular caution. The same notice will be broadcasted regularly by VHF radio from April to August and included in the Nautical Charts.

Italy:

- **Environmental protection in the Constitution of the Italian Republic (Articles 9 and 41)**

  On 8 February 2022, the Italian parliament approved the amendment to articles 9 and 41 of the Constitution regarding the protection of animals. The edited articles now read as follows: "*Article 9: The Republic promotes the development of culture and scientific and technical research. It protects the landscape and the historical and artistic heritage of the nation. It protects the environment, biodiversity and ecosystems, also in the interest of future generations. State law regulates the methods and forms of animal protection*". "*Article 41: Private economic initiative is free. It cannot take place in conflict with social utility or in a way that could damage safety, freedom, human dignity, health, the environment. The law determines the appropriate programs and controls so that public and private economic activity can be directed and coordinated for social and environmental purposes*".

- **Italian ratification law of the Agreement for the Pelagos Sanctuary – Law no. 391 of 11 October 2001 and prohibition of high-speed motorboats competitions/racings within the Pelagos Sanctuary.**

  In addition to the ratification of the trilateral Agreement for the protection of marine mammals (Pelagos Agreement), while transposing the text of the Agreement into its own legal system, Italy has provided for the prohibition of carrying out competitions of high-speed motorboats in territorial waters, therein including inland waters (article 5 of the Italian ratification law of the Agreement for the Pelagos Sanctuary – Law no. 391 of 11 October 2001). This prohibition is duly applied by competent authorities for different types of fast motorboats including jet skis, under the control of the Port Authority – Coast Guard.

- **Prohibition of hydrocarbon exploration and exploitation (Legislative Decree 3 April 2006, n. 152 Environmental regulations, Article 6 paragraph 17 amended by Law Decree 22 June 2012 n. 83 Urgent measures for the growth of the country, article 35)**.

Article 35 of Law Decree 83/2012 establishes the following: "*For the purposes of protecting the environment and the ecosystem, within the perimeter of marine and coastal areas protected […], by virtue of laws national, regional or in implementation of international acts and conventions, the activities of research, prospecting and cultivation of liquid and gaseous hydrocarbons are prohibited"* in various Italian sites of national importance*. "The prohibition is also established in the sea areas located within twelve miles of the coastlines along the entire national coastal perimeter and from the external perimeter of the aforementioned marine and coastal protected areas,* […]*"*.

– **Rules for the enforcement and organization of the Portofino Marine Protected Area (G.U. N°181 of 04.08.2008)**[4]

The Marine Protected Area of Portofino has a number of restrictions for boaters since 2008 (Article 16 – Discipline of pleasure boating; Article 17 – Rules of mooring activity; Article 18 – Discipline of anchoring activity), including a general speed limit of five knots and anti-pollution requirements (entry allowed only units equipped with boxes for the collection of sewage; engine compliant with Directive 2003/44/EC relating to gaseous and acoustic emissions (electric outboard motors, inboard engines compliant with the directive, four-stroke outboard engines with unleaded petrol, two-stroke outboard engines with direct injection); use of zero release antifouling paints).

– **Regulation governing the activities permitted in the Cinque Terre Marine Protected Area (Decree of the Ministry of the Environment of 12 December 1997).**

Various rules on pleasure crafts, including speed limits depending on the areas (five knots "zone B" and in "zone C" within 300m from the coast; 10 knots in "zone C" over 300m from the coast).

1.2 Proposed associated protective measures (APM)

In order to better assist to prevent ship strikes with cetaceans, the following is also proposed:

.1 recommendation to seafarers/ship operators to navigate with particular caution within the NW Med PSSA, when and where large and medium cetaceans are present, and to limit their speed to between 10 and 13 knots as voluntary speed reduction, while seeking to avoid possible negative impacts of reduced speeds on manoeuvrability and underwater noise in absence of other design adaptations on the ship;

.2 recommendation to ships to avoid large and medium cetaceans and keep an appropriate safety distance or speed reduction measure from any large and medium cetaceans observed or detected in close quarter situation. A safety distance or speed reduction measure should be adapted to the circumstances and existing conditions;

.3 recommendation to ships to broadcast by VHF or other suitable means on the area the position of medium and large cetaceans observed or detected and to transmit the information and the position to a designed coastal Authority;

[4] https://www.portofinoamp.it/chi/statuto-e-regolamenti/regolamentoAMPinglese.pdf

.4 ships should report any collision and near miss collision with cetaceans to a designated coastal Authority(ies). Designed coastal Authority(ies) should forward this information to the International Whaling Commission (IWC), which holds a global cetacean ship strikes database. This can be done by using the IWC web-base interface: https://crm.iwc.int/data/databases or by emailing the IWC Secretariat at: shipstrikes@iwcoffice.org; and

.5 recommendation to designated coastal Authority(ies) to broadcast information, when needed, to ships about the presence of large and medium cetaceans as navigational warning.

Large and medium cetaceans can be considered as a dangerous drifting object, which, in the event of a ship strike, can be a cause of death for the cetacean but can also cause significant damage to the structure of the ship or to the hull appendix. Information in real or near real time is relevant for maritime safety as well as the preservation of cetaceans. In order to support the broadcasting of navigational warning it is recalled that the proposed NW Med PSSA is covered by three international NAVTEX stations in La Garde (France), La Maddalena (Italy) and Cabo La Nao (Spain). The coverage areas of the NAVTEX stations indicated in the GMDSS master plan module of the Organization's Global Integrated Shipping Information System (GISIS) are represented on figure 1 below, with the following values:

.1 Cabo La Nao NAVTEX station : 220 NM
.2 La Garde NAVTEX station : 250 NM
.3 La Maddalena NAVTEX station : 320 NM

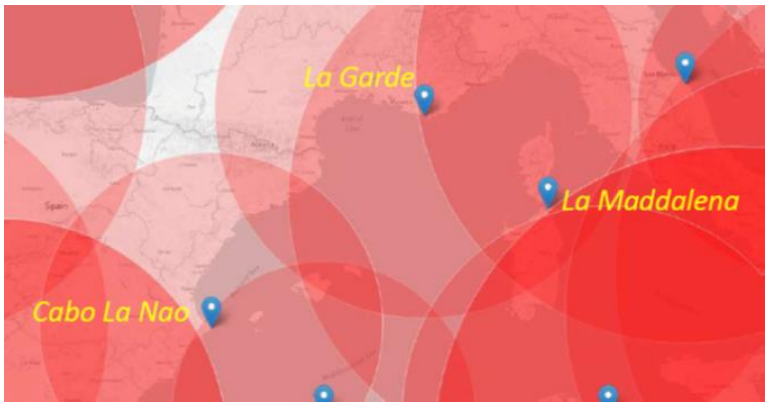

Figure 1: NAVTEX coverage in NW Mediterranean

.6 Recommendation to shipmasters to determine the watchkeeping arrangements taking into account the presence of large and medium cetaceans, including the use of infrared binoculars to help the detection of large and medium cetaceans by night or fixed infrared camera detection system. These systems would help to detect not only large and medium cetaceans, but also any man-overboard or castaways by night; and

.7 The designated coastal authorities should prepare material, and disseminate information in order to raising awareness on the crews (by means such as the publication of materials) and increase their knowledge on the protection of the marine environment on the PSSA with a particular emphasis on cetaceans.

To ensure their effectiveness, the measures adopted, in particular 1, 2, 3, 4 and 6 would have to be clearly indicated on nautical charts, nautical publications and nautical information.

1.3 Prospective protective measures

Navigational warnings:

Information to navigators by navigational warnings could be enhance in the future in digital format by the NAVDAT system.

At its 102nd session, the Maritime Safety Committee (MSC) agreed to include in its post-biennial agenda an output on "Development of performance standards for a digital navigational data system (NAVDAT)".

The proposed output will introduce a new high-speed digital system capable of delivering a higher volume of information at a higher rate than the present NAVTEX system, including graphical data. In areas where it would become available, ships can choose to receive this information optionally via NAVDAT rather than NAVTEX.

"Dynamic Management Areas" (DMA) would be transmitted in an easier way to ships and could be displayed on ECDIS or ENC. Digital information will hence facilitate the change in the voyage planning by navigators in order to avoid area of aggregations of cetaceans or travel through them with caution at reduced speed.

Regional governance:

France, Spain, Italy and Monaco should sign a Memorandum of Understanding to harmonize and facilitate the collection of data within the NW Med PSSA with the aim of better informing ships on the presence of cetaceans and implementing incentive measures to ships following the PSSA's recommendations to protect cetaceans.

This Memorandum of Understanding should also make it possible to create synergies between the riparian States in order to support the development of new technologies for detection at sea and thus reducing ship strikes of cetaceans, as well as the implementation of incentive measures. The riparian States should consider fund research activities in connection with industry and the scientific and research community, actions to raise the awareness of shipping stakeholders on the protection of cetaceans and the implementation of incentive measures to ensure compliance with the recommendations. Emerging devices in the future could, for example, include passive acoustic monitoring, predictive modelling or tagging of cetaceans. There are currently known methods providing such information on a scale that could be of interest to minimize the risk of collision which deserves to be deployed and integrated into the chain of navigational warning broadcast to inform navigators in due time.

A share governance in the detection of cetaceans in the PSSA will facilitate the collection of information on the presence of cetaceans within the PSSA by:

- direct observation from navigators on ships;
- detection by any shipborne system; and
- detection by a network of acoustics buoys monitored by riparian States.

The riparian states should encourage the review of the adopted measures after a certain time to assess their effectiveness, the opportunity to implement new operational measures at national and international level in order to limit the pressures generated by the maritime traffic on medium and large cetaceans.

1.4 Category of ships to which the proposed APM would apply

The proposed associated protective measures would apply to any commercial ships and to pleasure yachts of gross tonnage >300 UMS. Exempted vessels are those not subject to measures defined in these annexes and include war ships and state law enforcement vessels engaged in enforcement or in search and rescue activities.

2 POLITICAL IMPLICATIONS

Proposed associated protective measures are win-win measures for cetaceans and ships and in line with the Organization's instruments.

3 ECONOMIC IMPLICATIONS AND EXPECTED IMPACT ON SHIPPING

The costs of development and maintenance in operational condition of a detection network based on emerging technologies should be address in the future between coastal States involved in the NW Med PSSA in order to reduce the economic impact via the Memorandum of Understanding.

The implementation of local and temporary avoidance and slow down measures is likely to have both positive and negative economic impacts. (*Analysis of the maritime traffic and the risk of collision in North-West Mediterranean Sea. WWF 2021*).

The proposed associated protective measures only recommended and by their nature do not have any significant economic impact for shipping. Voluntary speed reduction measures (VSR) can have economic implications unless it is associated with an incentive system to reward virtuous ships.

3.1 Positive impact

Among the positive effects are:

- The relationship between the ship speed and fuel consumption – and the related emissions – is almost cubic (i.e. consumption is proportional to speed cubed; Leaper, 2019). Reducing speed is, therefore, one of the most effective solutions to reduce emissions (Aronietis et al., 2014; Psaraftis et al., 2009; Seediek and Transport, 2015) and fuel consumption.

- In addition, by reducing speeds, the trip becomes safer, which can have financial benefits in the form of lower insurance costs. Measures can also differentiate a marketing proposition and increase customer satisfaction. Environmental excellence and respect for good practices by ships in favour of biodiversity that can be certified by eco-labels.

- Permanent measures facilitate understanding by operators and avoid a regulatory watch by the shipowner that would be linked to a dynamic management of the area and reduce the administrative burden and the impact on the management of the vessel within the PSSA.

3.2 Impacts to be mitigated

Among the negative effects are:

- The lengthening of journey times due to avoidance manoeuvres linked to a cumulative effect between a lengthening of the trajectory (avoidance) or a slowing down on a portion of the trajectory; leading to a longer trajectory or a slower vessel speed.

- Increased uncertainty about arrival times, at destination which is likely to generate management costs relating to the organization of the activity and access to port facilities; keeping the same arrival time is an important criterion for some activities, but less critical for others. Ferry companies have built their economic models on crossing schedules, taking into account the requirements of their customers, and can hardly afford to extend the transit time to comply with their business model.

- The dissemination of cetacean location data sharing should be optimized so as not to overload crews with information.

4 ACTION TAKEN PURSUANT TO DOMESTIC LAW

France, Italy, Monaco and Spain should take the necessary measures to promote compliance by ships flying their flag with rules adopted by the Organization to reduce and minimize ship strikes of cetaceans. Enforcement and police measures are in the hands of coastal States depending on their national law and the location of the offense, which may expose offenders to administrative and/or criminal sanctions.

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ANNEX 3

Description of the proposed NW Med PSSA (France-Italy-Monaco and Spain)

The proposed NW Med PSSA is located between the coastline of France, Italy, Monaco and Spain and a line with the following coordinates:

A	38° 39' 59.379" N	000° 6'0.000" E
B	38° 39' 59.379" N	000° 47' 59.476" E
C	38° 50' 03.331" N	001° 00' 00.398" E
D	39° 19' 01.812" N	001° 00' 25.212" E
E	39° 28' 42.075" N	001° 40' 02.495" E
F	39° 51' 21.986" N	002° 16' 09.853" E
G	40° 34' 13.067" N	004° 04' 31.926" E
H	40° 58'0.000" N	008° 12'0.000" E
I	41° 09'10.800" N	009° 31'10.800" E
J	42° 21'14.400" N	011° 31'0.000" E

To be noted, from H (Falcoe Cape) to I (Ferro Cape) the South boundary follows the coastline of Sardinia.
Coordinates are provided by the European Terrestrial Reference System 89 (ETRS-89).

This area encompasses the existing Spanish "Mediterranean Cetacean Migration Corridor" and the Pelagos Sanctuary defined as such:

A – "Mediterranean Cetacean Migration Corridor"

ID	Longitude (ETRS-89)	Latitude (ETRS-89)
1.	003° 39' 02.002"E	42° 18' 57.294" N
2.	003° 39' 02.026"E	41° 54' 15.252" N
3.	003° 30' 32.060"E	41° 37' 36.567" N
4.	003° 15' 18.370"E	41° 23' 05.374" N
5.	001° 34' 43.766"E	40° 42' 21.785" N
6.	000° 33' 27.757"E	40° 00' 55.698" N
7.	000° 20' 21.559"E	39° 30' 07.070" N
8.	000° 20' 21.559"E	38° 49' 44.729" N
9.	000° 30' 05.254"E	38° 39' 59.379" N
10.	000° 47' 59.476"E	38° 39' 59.379" N
11.	001° 00' 00.398"E	38° 50' 03.331" N
12.	001° 00' 25.212"E	39° 19' 01.812" N
13.	001° 40' 02.495"E	39° 28' 42.075" N
14.	002° 16' 09.853"E	39° 51' 21.986" N
15.	004° 04' 31.926"E	40° 34' 13.067" N
16.	004° 33' 24.766"E	41° 06' 51.050" N

B – Pelagos Sanctuary

Boundary	Description	Longitude	Latitude
Western	*A line extending from the Escampobariou Point (on the western edge of the Giens peninsula)*	N 43°01,70'	E 06°05,90'
	to the Falcone Cape (the westernmost part of the Gulf of Asinara)	N 40°58'00	E 08°12'00
Eastern	*A line extending from the Ferro Cape (on Sardinia's north-eastern coast)*	N 41°09'18	E 09°31'18
	to Fosso Chiarone (on the west coast of Italy)	N 42°21'24	E 11°31'00

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ANNEX 4

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