

### Area Size

145,297 km<sup>2</sup>

### Qualifying Species and Criteria

Fin whale - *Balaenoptera physalus*  
Criterion A; B (ii); C (i, ii)

Sperm whale - *Physeter macrocephalus*  
Criterion A; C (i, ii)

Risso's dolphin - *Grampus griseus*  
Criterion C (i, ii)

### Marine Mammal Diversity

Criterion D (ii)

[*Stenella coeruleoalba*, *Globicephala melas*,  
*Ziphius cavirostris*, *Tursiops truncatus*]

### Summary

The North West Mediterranean has a set of geomorphological and oceanographic characteristics, including canyon systems and upwellings, which promote levels of productivity of extraordinary biological and ecological significance. The Pelagos Sanctuary area, within the Provençal-Corsican-Ligurian Basin – complemented by an extension to the West encompassing the offshore portion of the Gulf of Lion to the Balearic sub-basin – contains habitat supporting a diversity of cetacean species regularly found in the Mediterranean Sea. In particular, this area contains important habitat for Vulnerable Mediterranean fin whales (*Balaenoptera physalus*), Endangered sperm whales (*Physeter macrocephalus*), and Risso's dolphins (*Grampus griseus*).

# North Western Mediterranean Sea, Slope and Canyon System Important Marine Mammal Area - IMMA

## Description

The oceanography of the water masses in the area is at the base of its productivity and extraordinary biological and ecological richness. Although the Mediterranean is generally considered an oligotrophic sea, the north western portion of the area is marked by a relatively high mesotrophic productivity. In addition, other features in the area, both oceanographic and geomorphological (e.g., submarine canyons such as the Genoa canyons) concur with the Ligurian Front to make the areas especially suitable for hosting marine mammal species. Strong northern wind generates upwelling, mainly channelling in the canyon system and up to the shelf. In the spring, an increase of water temperatures and a stabilization of the surface of the water masses can be observed. These phenomena facilitate a higher level of spring and summer primary productivity in respect to the coastal area, particularly within the frontal zone where the observed productivity is relatively high throughout the year. The phytoplankton bloom begins in mid-April. The high level of primary productivity is critical to the structure of the upper levels of the food chain, particularly for tertiary consumers such as cetaceans, which are especially abundant in summer.

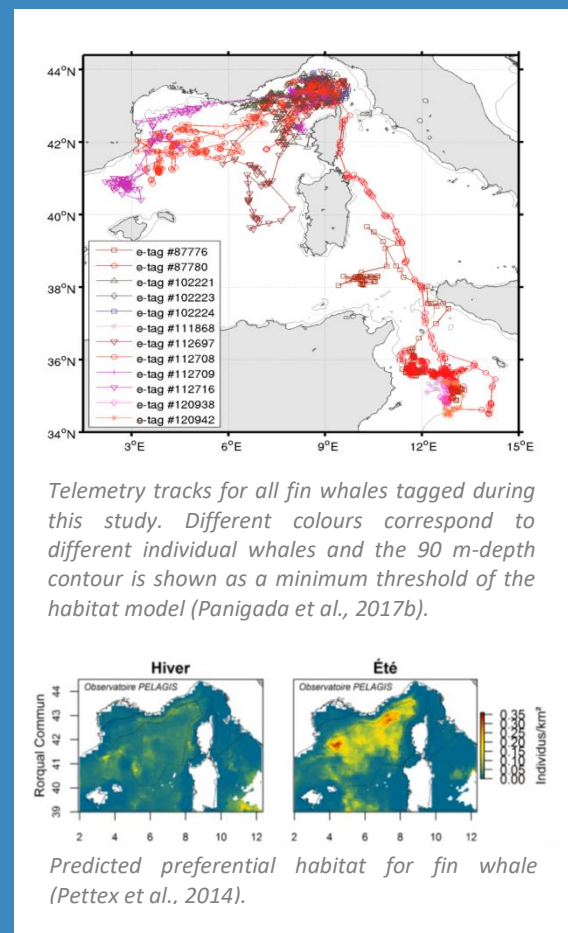
The proposed area is the western Mediterranean Basin, contained between the 200 m isobath along the Ligurian, Spanish and French coast, Corsica, and the western basin's abyssal plains (>2,000 m). It is bordered by the Catalan coast (Costa Brava, NE Spain) to the west, the European continental coastline with

the Gulf of Lion and Ligurian Sea to the north, the island of Corsica to the East, a straight line from Cape Corse to the Italian coastline, and the south border is represented by the line connecting Sardinia and the area North of the Balearic Islands. The area is located within the Italian, French, Monaco and Spanish national jurisdiction, but includes also international waters.

Fin whales are found mostly in deep, offshore waters (400 to 2,500 m) of the western and central portion of the basin, but can also occur in slope and even shelf waters, depending on the distribution of their prey (Gannier et al., 2002; Laran and Gannier, 2008; Notarbartolo-di-Sciara et al., 2003; Panigada et al., 2005, 2008; Azzellino et al., 2012; Azzellino et al., In press). Fin whales favour upwelling and frontal zones with high concentrations of zooplankton, which is their main prey in the region. Fin whales are observed in waters from the north and east of the Balearic Islands to the Ionian Sea, less frequently elsewhere. These whales are particularly abundant during summer months in the north-western portion of the basin, namely the Corso-Ligurian Basin and the offshore of the Gulf of Lion, where they congregate for feeding purposes (Notarbartolo-di-Sciara et al., 2016). Genetic evidence based on both mitochondrial and nuclear DNA indicated differences between fin whales from the Mediterranean and from the Atlantic coastal waters of Canada, Greenland, Iceland and Spain (Bérubé et al., 1998). The animals are also breeding (Siliart et al., 2012; Tardy et al., 2016).

Studies conducted by Gannier et al. (2002) conducting acoustic surveys showed the highest relative abundance with an average of  $2.15 \times 10^{-2}$  sperm whales heard in the offshore area of Gulf of Lion in the north-western basin. Also, Lewis et al. (2017) detected and presented a high density of 2.15 whales/1000 km<sup>2</sup>. Recently the results of an aerial survey over the French slope and offshore area obtained an estimate of 537 individuals (95% CI: 122-2,430) in winter and 314 (95% CI: 96-1,109) in summer (Laran et al., 2016). The area is also important as a feeding ground as it is stated in Drouot-Dulau and Gannier (2007) where individuals were

observed feeding in the northern areas and moving up to 500 km inside the area. It has also been recently described (since almost 10 years) that the area hosts social units in spring-summer, with pregnant females and neo-nates (Di-Méglio al., 2016). The proposed north-western area forms part of the broader range of the western Mediterranean population, and animals photo-identified in Gibraltar have been also observed in the northern Ligurian Sea (Carpinelli et al., 2014).

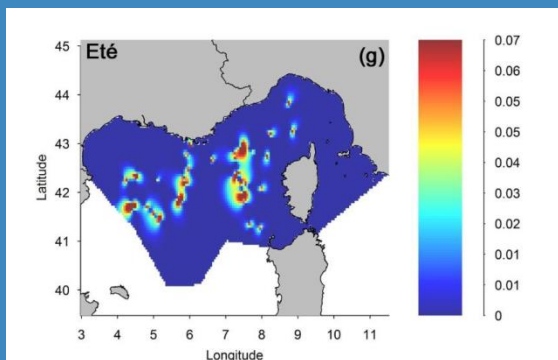


The Mediterranean subpopulation of Risso's dolphins is classified as Data Deficient by the IUCN Red List criteria (Gaspari and Natoli, 2012). The Risso's dolphin Mediterranean subpopulation is considered genetically different from the North Atlantic population (Gaspari et al., 2007). There is no baseline of abundance for Risso's dolphin for the entire Mediterranean Sea; however, high levels of knowledge about Risso's have been collected during long-term studies (1990-2016) conducted in the North-western portion of the Mediterranean Sea. Several dedicated ship-based and aerial surveys have been conducted

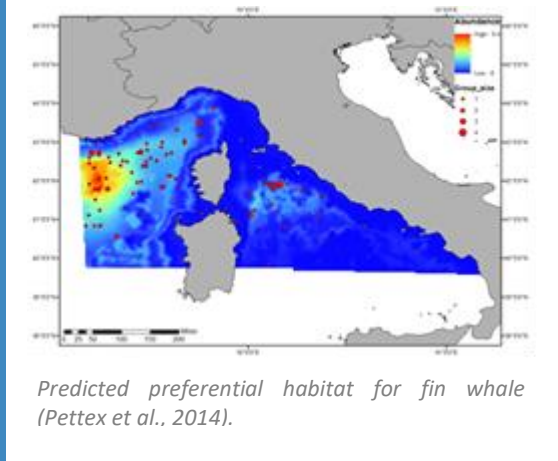
over the Ligurian Sea (Azzellino et al., 2008, 2012, 2016; Notarbartolo di Sciara et al., 1993; Panigada et al., 2011), the Provence and Gulf of Lion (Laran et al., 2016) and along the Catalan coast in order to estimate Risso's dolphin distribution and abundance.

The species shows a preference for deep waters over steep slopes and submarine canyons where Risso's dolphin are feeding and breeding (Azzellino et al., 2008, 2012, 2016; Casacci and Gannier, 2000; Chicote et al., 2015; David and Di-Méglio, 2012; Delacourtie et al., 2012; Gannier, 2005; Moulines et al., 2008, Praca and Gannier, 2008).

In conclusion, based on those indicators, this area is recognized of great ecological importance for this species in the Mediterranean Sea.



*Density of fin whales (ind.km<sup>2</sup>) in summer (Pettex et al., 2014)*



*Predicted preferential habitat for fin whale (Pettex et al., 2014).*

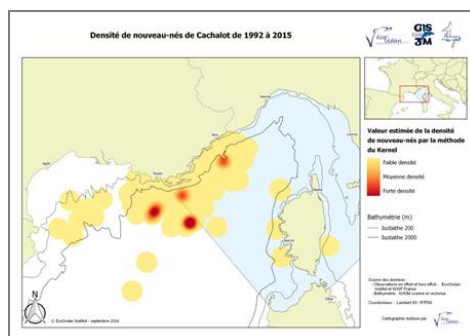
## Criterion A - Species or Population Vulnerability

In 2012 the fin whale has been assessed and has been listed as Vulnerable C2a(ii) (Regional assessment) by the IUCN Red List criteria

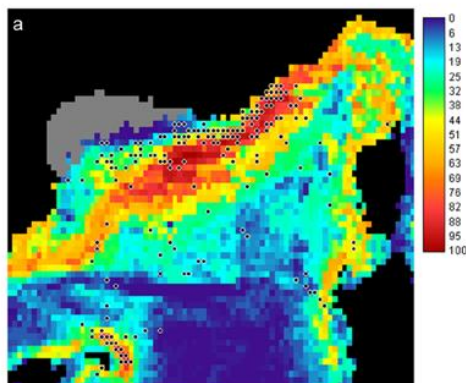
(Panigada and Notarbartolo di Sciara, 2012). No population estimate exists for the entire region of the Mediterranean Sea for the species. However, line-transect surveys in 1991 yielded fin whale estimates in excess of 3,500 individuals over a large portion of the western Mediterranean (Forcada et al., 1996), where most of the basin's fin whales are observed. It is reasonable to assume that a realistic estimate for the total basin would not exceed 5,000 individuals. For the north-western Mediterranean Sea, the recent estimates made by aerial survey (Laran et al., 2016) are 1,032 individuals (95% CI: 462-2,526) in winter and 2,500 (95% CI: 14,720-4,310) in summer. Fin whales have been described as particularly abundant during the summer months in the Corso-Ligurian-Basin, which is considered their major feeding ground in the Mediterranean Sea. A sharp decrease in fin whale abundance has been observed in the Pelagos Sanctuary over the last decades, with estimates of 900 individuals reported from the western Ligurian Sea in 1992 (Forcada et al., 1995), declining to significantly lower numbers (N=147; CV=27.04%; 95% CI=86–250) in 2009 and showing a significant decreasing trend in fin whale encounter rate over the last 25 years (Azzellino et al., In press; Panigada et al., 2017a). This may be due to whales relocating elsewhere within the Mediterranean; their decrease in prime fin whale habitat must be addressed with precaution, and a population decline in the Mediterranean cannot be discounted at this time. Fin whales in the Mediterranean are a subpopulation based on the IUCN definition. Genetic data from a sample of fin whales from the Mediterranean have not provided evidence for within-region subpopulation structure (Bérubé et al., 1998).

The Mediterranean sub-population of sperm whales is classified as Endangered (C2a(ii) (Regional assessment) by the IUCN Red List criteria and is probably declining (Notarbartolo di Sciara et al., 2012). Although no past or present abundance estimate is available for the entire range of the subpopulation, some data are available for limited areas within the region. Lewis et al. (2007) estimated overall abundance of sperm whales in the Ionian Sea to be 62 animals

(95% CI = 24–165), and zero animals in the Strait of Sicily. By contrast, results from a survey of a large portion of the western basin (from Gibraltar to Sicily and bounded on the north by a line from the Balearics east to Sardinia) in summer 2003 indicate a sperm whale detection rate roughly eight times that in the Ionian Sea (Lewis et al., 2007). This is in agreement with the north-western Mediterranean Sea been described and proved to be an important habitat for sperm whale (Gannier et al., 2002; Lewis et al., 2017; Praca and Gannier, 2008). An increasing trend in sperm whale encounter rate has been described in North-western portion of the Pelagos Sanctuary (Azzellino et al., In press). Genetic data from a sample of sperm whales across the Mediterranean have not provided evidence for within-region population structure (Drouot et al., 2004; Engelhaupt et al., 2009). It is assumed that sperm whales form a single subpopulation within the Mediterranean, as they are thought to roam widely across the basin.



*Density of neonates of sperm whale (Di-Méglio et al., 2016)*

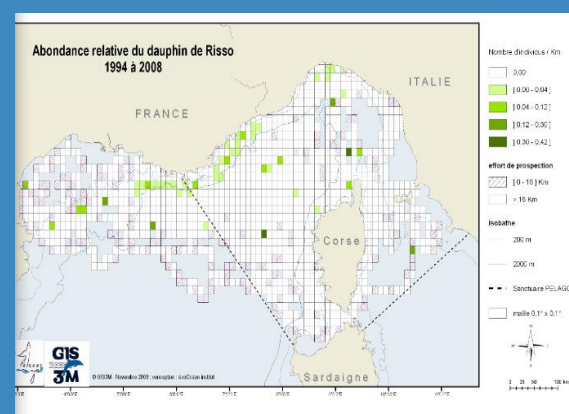


*Habitat suitability map for sperm whales (Praca and Gannier, 2008)*

## Criterion B: Distribution and Abundance

### Sub-criterion Bi: Small and Resident Populations

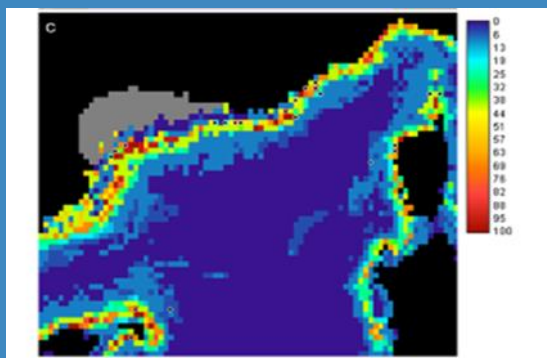
Evidence of a resident population of Risso's dolphin has been reported by long-term (1990-2014) studies conducted in the Ligurian Sea, and the Gulf of Lion with exchanges between both areas. Even if a decreasing trend in encounter rate has been observed in the Pelagos Sanctuary (Azzellino et al., In press) recent abundance estimate obtained by a French aerial survey (Laran et al., 2016) provided a total of 76 individuals in summer (95% CI: 15–393) and 741 individuals (95% CI: 2,582-2,128) in winter. Mark-recapture models based on the closed population assumption provided abundance estimates and included: with only Italian data, Risso's dolphin population size in the period from 1998 to 2012, averaged approximately 100 individuals (95% CI: 60–220), with a peak of an estimated 212 individuals (95% CI: 146–345) in 2005 (Azzellino et al., 2016); with French-Italian study over the Pelagos Sanctuary the estimates reached 130 individuals (95% CI of 90 – 230 individuals) (Airolidi et al., 2015); and with a French-Italian estimates over the slope from Ligurian Sea to the west border of the Gulf of Lion slope, the best estimate reached 123 individuals (95% CI : 86-189) (Polo, 2006).



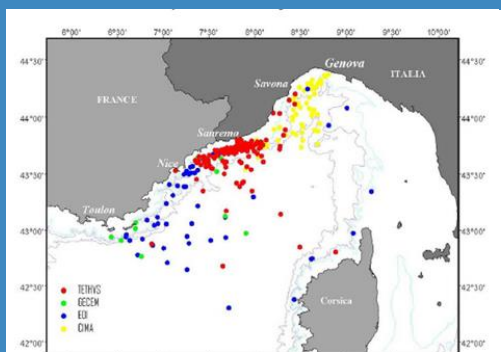
*Relative abundance of Risso's dolphin 1994-2008 (Laran et al., 2012).*



All photo-identification studies conducted in the area reported a strong site fidelity in the slope area for the species with high numbers of recapture (Azzellino et al., 2008, 2012, 2016; Chicote et al., 2015; Moulines et al., 2008; Praca and Gannier, 2008), and also that animals seen in the Gulf of Lion (west part of the area) have been re-sighted in the Ligurian Sea (east part of the area) (Labach et al., 2012). In the Maresme canyon, 43 individuals have been photo-identified; among them 7 recaptures were found up to 14 years (Chicote et al., 2012).



*Habitat suitability map for Risso's dolphins, along the slope and canyon system (Praca and Gannier, 2008).*



*Risso's dolphin sighting collected by different research institutes in the Ligurian Sea during long terms projects (Airoldi, 2015).*

## Sub-criterion Bii: Aggregations

The fin whales occur throughout the Mediterranean, from the Balearic Islands to the Levantine Sea, although they are in large part found in the area between the Gulf of Lion and western Ligurian Sea. Fin whales have been described as particularly abundant during the summer months in the Corso-Ligurian-Basin, which is considered their major feeding ground in the Mediterranean Sea (Pettex et al., 2014). A density of 0,014

ind./km<sup>2</sup> has been calculated for the north-western Mediterranean Sea in summer (Laran et al., 2016). Systematic surveys (both by boat or by airplane) over the last 30 years from several research groups in the area have provided evidence of large aggregations of fin whales. Between 500 and 1,000 individuals are described as present in the Pelagos Sanctuary area only. Photo-identification data point to seasonal residence and to a persistent site fidelity over the years (Zanardelli et al., 2011).

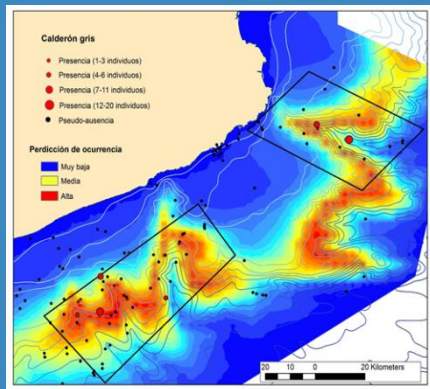
## Criterion C: Key Life Cycle Activities

### Sub-criterion Ci: Reproductive Areas

Information on fin whale is lacking about the existence of localized calving grounds in the Mediterranean; the wide geographical distribution of the overall record of neonate fin whales in the Basin (and the strandings of neonates too) argue against any precise calving location for fin whales in the Mediterranean Sea; however, high percentage of calves are reported for the North-western Mediterranean area. Evidence from biopsy sampling analyses (n = 150) in that north-western portion of the Mediterranean Sea further support the hypothesis of a reproductive area there, with at least one third of sampled individuals being pregnant females and two thirds of males with a status of active stallion (Siliart et al., 2012).

For sperm whale, 23 years of data have been gathered to analyze the presence of neonates; during several years 24 biopsies have been collected and genetic analysis revealed the sex of the animals and their reproductive status through the hormones (Di-Méglio et al., 2016). It appears that only recently, since the mid-2000s, encounters with social units and neonates have increased: for the decade 2005-2015 the % of neonates is 1,79% of all individuals, mainly in spring and summer. Biopsies revealed that at least one female was pregnant (Di-Méglio et al., 2016), and in August 2016, offshore Toulon, the birth of a sperm whale has been observed and documented (Ody D. pers. comm.).

The area where the new-borns are mainly seen is smaller of the entire area where other sperm whales occur.



*Model prediction for the Risso's dolphin based on long term studies conducted by Tethys Research Institute highlights the habitat preference for the slope area (Azzellino et al., 2008).*

Risso's dolphins are resident all year round and observed across multiple years. Regular sightings of new-borns and calves presence are reported during long term studies (Airoldi et al., 2015) mostly in summer each year. The canyons of the north-western Mediterranean Sea are the sectors where groups with new-borns are mostly been seen (David and Di-Méglio, 2012).

## Criterion C: Key Life Cycle Activities

### Sub-criterion Cii: Feeding Areas

About 3,500 fin whales are found in the western Mediterranean, most of which concentrate in the Corsican-Ligurian-Provençal Basin in summer to feed on krill, although whales can be observed in the area year-round. Potential fin whale feeding habitat in the Western Mediterranean Sea undergoes considerable seasonal variation, ranging from a highly-diffused condition in winter and spring to extreme summer concentration in the Ligurian Sea and Gulf of Lion area. Fin whales have long been thought to concentrate in summer in the Ligurian Sea and Gulf of Lions for feeding reasons; however, observations of fin whales engaging in feeding, frequent on many feeding grounds in the world, are very rare in the Ligurian-Corsican-Provençal Basin. This is likely related

to the vertical distribution and movement pattern of the whales' main prey in the area. *M. norvegica* in the Mediterranean is known to spend the daylight hours at depths often in excess of 1000 m, and to migrate to about 30-50 m from the surface only during the night. Fin whales have been described to perform in the Ligurian Sea the deepest dives known for the species, exceeding 470 m (Panigada et al., 1999), and their behaviour was attributed to deep feeding activity. Feeding was also inferred from swimming behaviour (Jahoda et al., 2003) and frequently observed defecation episodes (Orsi Relini and Cappello, 1992).

For sperm whales, it is known that they are feeding on mesopelagic squids; several acoustic studies supported feeding behaviour in sperm whales (Drouot-Dulau and Gannier, 2007). Geomorphological features as canyons, slope, seamounts are known to be place of aggregation of squids, and sperm whales are regularly seen around such features. The presence of sperm whales in these areas for several months or even year-round, supports the feeding activity there. This is also largely supported by several acoustic studies and also stomach content of stranded animals that were found full of prey remains.

Risso's dolphin is a species that worldwide feeds almost exclusively on neritic and oceanic cephalopods (Clarke and Pascoe, 1985; Würtz et al., 1992). Blanco et al. (2006) reported that the species in the western Mediterranean feeds mainly on oceanic cephalopods; pelagic octopods were the most abundant along with *Ommaestrophidae*, *Histioteuthidae* and *Onychoteuthidae* families. The evidence of long-term presence of the species associated with the slope and canyon system, and the evidence of feeding behaviour in the groups confirm that the area is globally used for foraging by the species. Results of a study by David and Di-Méglio (2012) show that feeding Risso's dolphin groups were mostly encountered inside canyons (92% of the sightings of feeding animals over the slope) rather than outside canyons.

## Criterion D: Special Attributes

## Sub-criterion Dii: Diversity

The North western Mediterranean Sea is one of the richest areas in the Mediterranean Sea, attracting all the Mediterranean species of cetaceans in high numbers; all seven common and also other rare cetacean species can be observed in the area. This high level of diversity lead to the creation of a cetacean Sanctuary (called Pelagos Sanctuary for Mediterranean Marine Mammals) encompassing its western portion. However, its eastern part is of high importance for cetaceans as well. In the last 30 years, the western part of the area has been deeply studied, and dozens of published scientific papers support the knowledge of a high diversity area.

## Supporting Information

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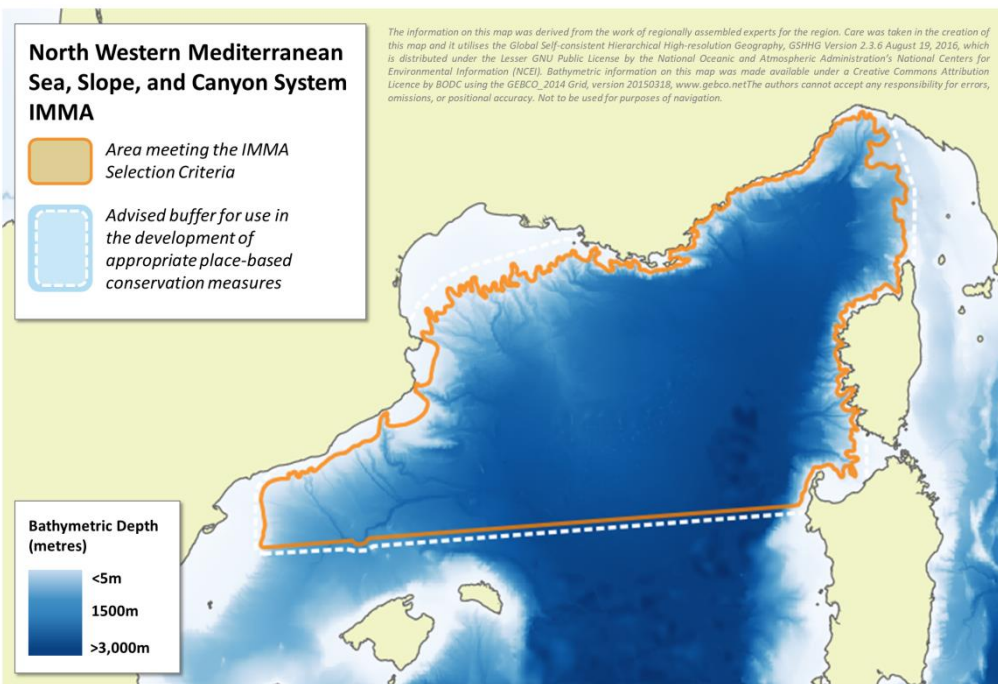
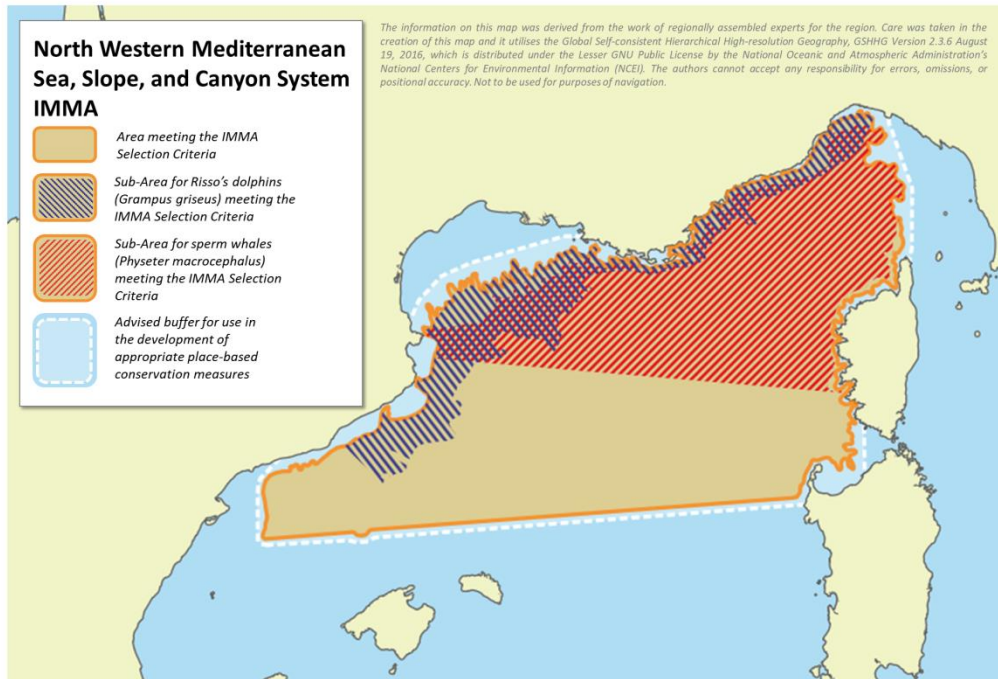


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# Annex I

## Supplementary Maps



# Annex II

## List of Primary and Secondary Species

### Primary Species – Meet the IMMA Selection Criteria

Scientific Name	Common Name of Species	Population / Subpopulation Name	IUCN Red List Status
<i>Balaenoptera physalus</i>	Fin whale	Mediterranean subpopulation	Vulnerable
<i>Physeter macrocephalus</i>	Sperm whale	Mediterranean Subpopulation	Endangered
<i>Grampus griseus</i>	Risso's dolphin	Mediterranean Subpopulation	Data Deficient

### Secondary Species – Do not individually meet the IMMA Selection Criteria but are present within the area

Scientific Name	Common Name of Species	Population / Subpopulation Name	IUCN Red List Status
<i>Tursiops truncatus</i>	Common bottlenose dolphin	Mediterranean Subpopulation	Vulnerable
<i>Stenella coeruleoalba</i>	Striped dolphin	Mediterranean Subpopulation	Vulnerable
<i>Globicephala melas</i>	Long-finned pilot whale	Mediterranean subpopulation	Data Deficient
<i>Ziphius cavirostris</i>	Cuvier's beaked whale	Mediterranean Subpopulation	Data Deficient