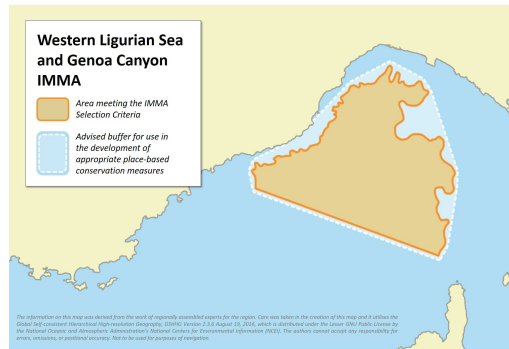


Western Ligurian Sea and Genoa Canyon Important Marine Mammal Area – IMMA

Description

Cuvier's beaked whale (*Ziphius cavirostris* G. Cuvier, 1823), is the only beaked whale regularly inhabiting the Mediterranean Sea area, where this species has been found associated with continental slope and with submarine canyons and seamounts areas. The Cuvier's beaked whale Mediterranean subpopulation was being re-assessed in early 2017 with the expectation that it would meet at least one of the Red List criteria for Vulnerable based on the results of basin-wide density surface modelling (Cañadas et al 2016). Cuvier's beaked whales have been sighted in the Ligurian Sea especially in waters over and around canyons (Azzellino et al. 2008, 2011, 2012; Azzellino et al. In press; Azzellino & Lanfredi, 2015; D'Amico et al., 2003; Lanfredi et al., 2016). In particular, the Genoa Canyon area has been identified as a high-density area for Cuvier's beaked whales (MacLeod and Mitchell, 2006; Moulins et al., 2007; Tepsich et al., 2014, Cañadas et al., 2016) with high site fidelity. The Gulf of Genoa is located in north-western portion of the Ligurian Sea and is contained within the "International Sanctuary for the Protection of Mediterranean Marine Mammals" also known as "Pelagos Sanctuary". Several canyons characterize the Gulf of Genoa with very steep slope gradients extending from the shelf break to a depth of about 2000 m. The Genoa canyon is the largest and the most northern canyon of the western Mediterranean Sea. The Genoa canyon has its axis oriented northeast-southwest, with its two main canyons, the Polcevera and Bisagno, found in the head. These two canyons exhibit a linear along-axis topographic V shaped profile, are more than 700 m deep, 20 km wide and about are 60 km in length. Their steep walls suggest they are strongly affected by land sliding



Area Size

8,526 km²

Qualifying Species and Criteria

Cuvier's beaked whale -
Ziphius cavirostris
Criterion B (i, ii); C (i, ii)

Marine Mammal Diversity

Criterion D (ii)

[*Stenella coeruleoalba*, *Physeter macrocephalus*, *Globicephala melas*, *Balaenoptera physalus*, *Grampus griseus*]

Summary

The Genoa Canyon, located in the westernmost part of the Ligurian Sea, has been identified as a high-density area for a resident population of Mediterranean Cuvier's beaked whales (*Ziphius cavirostris*). A high correlation was also observed between the presence of Cuvier's beaked whales and the underlying canyon area; this has been validated by modelling studies. The area extends to the 1000m isobath. IMMA boundaries are based on the sightings information collected by long term studies and supported by modelling.

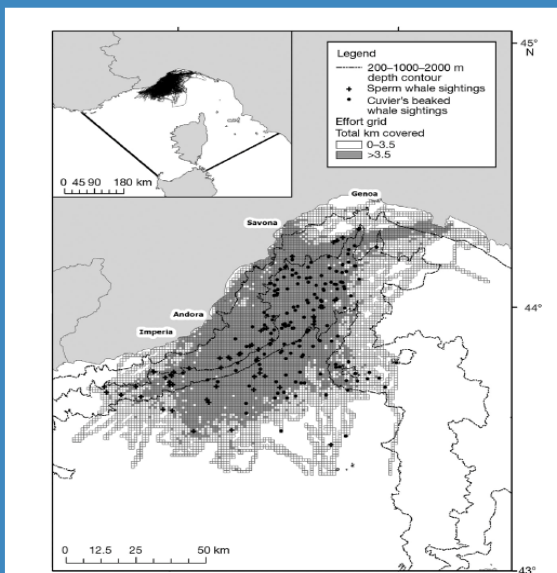
processes (Mignon et al., 2011). Directly east of this region is a wider canyon with a wide shelf to its south. The western part of the valley has a steep slope and several small canyons cut it. To the southwest, the canyon system descends into a deep abyssal plain. This large submarine valley (called “Genoa canyon area”) forms a boundary for the predominant circulation. The circulation in the Ligurian basin consists of a basin-wide cyclonic gyre (Crépon et al., 1982; Ovchinnikov M., 1966) which extends over the upper 500 m and can spread out to the west in to the Catalan Sea. Results of several modelling studies reported a high correlation of the species presence with the Genoa canyon area (Azzellino et al. 2011; Moulins et al., 2007; Tepsich et al., 2014; Lanfredi et al. 2016).

In addition, evidence of feeding has been reported by Tyack and colleagues (2006) in the area. Stomach contents from stranded animals in the Ligurian Sea confirm that the animals feed on mesopelagic cephalopod in the area (Orsi Relini, 2006). Finally, long term photo-identification studies shown the presence of juveniles, calves (Moulins et al., 2008) and newborns (Rosso personal communication) in the area. Based on these evidences this area is recognized of great ecological importance for Cuvier’s beaked whale in the Mediterranean Sea.

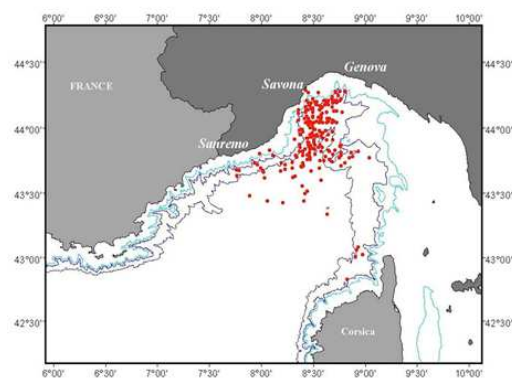
Criterion B: Distribution and Abundance

Sub-criterion Bi: Small and Resident Populations

According to Cañadas (2016) and Gannier and Epinat (2008) the area present the highest density of Cuvier's beaked whale in the Mediterranean Sea. Gannier and Epinat (2008) had their main acoustic encounter rate in this part of the Mediterranean Sea. Cañadas (2016) preformed a modelling study to map high density areas for beaked whale at Mediterranean level. The results of this study highlight the importance of the Genoa Canyon area (Ligurian Sea) for Cuvier's beaked whale as the areas with the highest predicted density. This result is supported by other studies that indicates the Genoa Canyon area as a high-density area for Cuvier’s beaked whales (MacLeod and Mitchell, 2006; Moulins et al., 2007; Tepsich et al., 2014, Cañadas et al., 2016) with high site fidelity. A long-term photo-identification study was carried out in the Ligurian Sea which highlighted high site-fidelity and residency (Coomber et al., 2016; Rosso, 2010; Rosso et al., 2011). The estimated total population size of Cuvier’s beaked whales in the Genoa Canyon was around 100 individuals: 98 individuals for the right-side dataset (CV:0.10; 95% CI ranged:81–116) and 95 individuals for the left-side dataset (CV:0.09; 95% CI:79–112) (Podestà et al., 2016). This evidence supports the identification of the IMMA for Cuvier's beaked whale under the criteria Bi.



Distribution of the Cuvier's beaked whales sighting collected during long-term study conducted by CIMA Research Foundation in the western Ligurian Sea and Genoa canyon area (Tepsich et al., 2014).

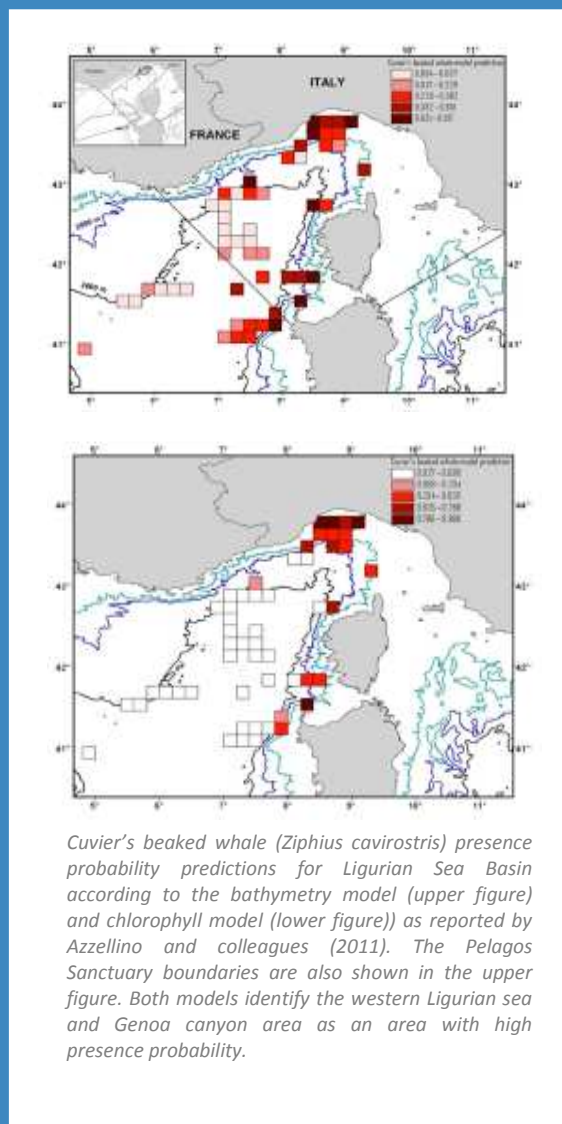


Sightings of Cuvier's beaked whale (red dots) collected by Tethys Research Institute and CIMA Research Foundation during dedicated long-term surveys. All the sightings occur within the 1000 m bathymetry (Azzellino & Lanfredi, 2015). IMMA boundaries are based on the sightings information collected by long term studies and supported by modelling.

Criterion B: Distribution and Abundance

Sub-criterion Bii: Aggregations

According to Cañadas (2016) the area indicated as IMMA is the area with the highest density of Cuvier's beaked whale in the Mediterranean Sea. Mark recapture analysis conducted on a long-term dataset report an estimation of abundance of about 100 individuals. This evidence supports the proposal of the IMMA for Cuvier's beaked whale under the criteria Bii. The known Cuvier's beaked whale high-density areas including the Alboran Sea, the Ligurian Sea, the central Tyrrhenian Sea, the southern Adriatic Sea and the Hellenic Trench, while noting other areas of possible importance.



Criterion C: Key Life Cycle Activities

Sub-criterion Ci: Reproductive Areas

Long term photo-identification studies shown the presence of both juveniles and calves in the Ligurian Sea (Moulins et al., 2008). At least 2 newborns (showing fetal folds, M. Rosso personal communication) have been photographed in 2016. According to this evidence the area is here presented as IMMA under the criteria Ci. Based on long term dataset (Moulins et al., 2008) the average group size is 2.3 ± 1.5 (range=1–11). All the specimens of the groups were photo-identified for only 40 groups. Maturity results indicate that 19 groups were mixed herds (with both immature and mature individuals), 17 groups were herds of only immature animals and 4 groups were herds of only mature animals. The 19 mixed herds were composed mainly of 4.0 ± 2.2 individuals (range=2–8) and were made up of 58% mature individuals. The 17 immature groups were composed of 2.1 ± 0.9 individuals. Mature animals were usually found alone.

Criterion C: Key Life Cycle Activities

Sub-criterion Cii: Feeding Areas

It is widely known that beaked whales are deep diving species, performing deep foraging dives to feed on deep water food resources. Cuvier's beaked whale diving profiles in the Ligurian Sea (Tyack, et al., 2006) showed foraging activity in mesopelagic to bathypelagic water depths (613–1297 m). The stomach contents of 3 Cuvier's beaked whales stranded along the Ligurian coast consisted of digested mesopelagic cephalopod beaks principally of the *Histioteuthidae* family, specifically *Histioteuthis reversa* and *H. bonnellii* and other cephalopods species such as *Octopoteuthis spp.* (Octopoteuthidae), *Galiteuthis armata* (Cranchiidae), *Chiroteuthis veranii* (Chiroteuthidae) e *Ancistroteuthis lichtensteinii* (Onychoteuthidae) (Orsi Relini, et al., 2005). Based on these evidences the

IMMA is recognized for Cuvier's beaked whale under the criterion Cii.

Criterion D: Special

Attributes

Sub-criterion Dii: Diversity

The presence of sperm whale, Risso's dolphin, fin whale, pilot whale and striped dolphin in the area have been reported by several studies (Azzellino et al. 2008, 2012; Azzellino In press; Moulines et al., 2008; Notarbartolo di Sciara et al., 2008; Tepsich et al., 2014). These species are indicated as secondary species in this proposal. Due to this evidence the IMMA is also presented under the criteria Dii.

Supporting Information

Azzellino, A., Airoidi, S., Gaspari, S., Lanfredi, C. 2008a. *Biological consequences of global warming: does sea surface temperature affect cetacean distribution in the Western Ligurian sea?* J. Mar. Biol. Assoc. UK. 88 (06), 1145-1152.

Azzellino, A., Airoidi, S., Gaspari, S., Nani, B., 2008b. *Habitat use of cetaceans along the Continental Slope and adjacent waters in the Western Ligurian Sea.* Deep Sea Res. I, 55, 296-323.

Azzellino, A. & Lanfredi, C., 2015. *Analisi di distribuzione e abbondanza assoluta e relativa delle specie capodoglio (Physeter macrocephalus), grampo (Grampus griseus) e zifio (Ziphius cavirostris) nel Santuario Pelagos alla luce dei cambiamenti ambientali e dei fattori di pressione antropica. Report of Project financed by Ministero dell'Ambiente e della Tutela del Territorio e del Mare (N.0003302/PNM 19/02/2014) (In Italian).*

Azzellino, A., Panigada, S., Lanfredi, C., Zanardelli, M., Airoidi, S. and Notarbartolo di Sciara, G., 2012. *Predictive Habitat Models for Managing Marine Areas: Spatial and Temporal Distribution of Marine Mammals Within The Pelagos Sanctuary (Northwestern Mediterranean Sea).* Ocean Coast. Manage. 67, 63-74.

Azzellino A., Airoidi S., Lanfredi C., Podestà M., Zanardelli M. In press. *Cetacean response to environmental and anthropogenic drivers of change: Results of a 25-year distribution study in the northwestern Mediterranean Sea.* Deep Sea Res. Part II DOI: 10.1016/j.dsr2.2017.02.004

Cañadas, A. et al. 2016. ACCOBAMS COLLABORATIVE EFFORT TO MAP HIGH-USE AREAS BY BEAKED WHALES IN THE MEDITERRANEAN. ACCOBAMS Report (available on request from ACCOBAMS)

Coomber, F., Azaelino, A., David, L., Di-Meglio, N., Labach, H., Origne, L., Amar, D., Agliati, P.O, Rosso, M., Tepsich, P. and Moulins, A., 2015. *Noise impact on sperm whale (P. macrocephalus) and Cuvier's beaked whale (Z. cavirostris), estimated from the marine traffic.* Convention PELAGOS Sanctuary No.2014-01. pp.140.

Coomber, F., Moulins, A., Tepsich, P., Rosso, M., 2016. *Sexing free-ranging adult Cuvier's beaked whales (Ziphius cavirostris) using natural marking thresholds and pigmentation patterns.* J. Mammal. 97, 879–890. <http://dx.doi.org/10.1093/jmammal/gyw033>.

Crépon, M., Wald, L., Monget, J.M. 1982. *Low-frequency waves in the Ligurian Sea during December 1977.* J Geophys Res 87: 595-600.

D'Amico, A., Bergamasco, A., Zanasca, P., Carniel, E., Portunato, N., et al. 2003. *Qualitative Correlation of Marine Mammals with Physical and Biological parameters in the Ligurian Sea.* IEEE J Ocean Eng 28: 29-43.

Gannier, A. and Epinat, J. 2008. *Cuvier's beaked whale distribution in the Mediterranean Sea: results from small boat surveys 1996–2007.* Journal of the Marine Biological Association of the United Kingdom, 2008, 88(6), 1245–1251.

Lanfredi, C., Azzellino, A., D'Amico, A., Centurioni, L., Ampolo Rella, M., et al. 2016. *Key Oceanographic Characteristics of Cuvier's Beaked (Ziphius cavirostris) Habitat in the Gulf of Genoa (Ligurian Sea, NW Mediterranean).* J .Oceanogr Mar Res 4:145.

Moulins, A., Rosso, M., Nani, B., Wurtz, M. 2007. Aspects of the distribution of Cuvier's beaked whale (*Ziphius cavirostris*) in relation to topographic features in the Pelagos Sanctuary (north-western Mediterranean Sea). *J Mar Biol Assoc UK* 87: 177-186.

Moulins, A., Rosso, M., Ballardini, M., Wurtz, M. 2008. Partitioning of the Pelagos Sanctuary (north-western Mediterranean Sea) into hotspots and coldspots of cetacean distributions. *J. Mar. Biol. Assoc. UK* 88, 1273–1281.

Notarbartolo di Sciara, G., Agardy, T., Hyrenbach, D., Scorazzi, T., Van Klaveren, P. 2008. The Pelagos sanctuary for Mediterranean marine mammals. *Aquat. Conserv.* 18, 367–391.

Orsi Relini, L., Garibaldi, F. 2005. Mesopelagic cephalopods biodiversity in the Cetacean Sanctuary as a result of direct sampling and observations on the diet of the Cuvier's Beaked whale, *Ziphius cavirostris*. *Biol Mar Medit* 12: 106-115.

Ovchinnikov, M. 1966. Circulation in the surface and intermediate layers of the Mediterranean Oceanology 6: 48-59.

Rosso, M. 2010. Population size, residency patterns and energy demand of Cuvier's beaked whales (*Ziphius cavirostris*) in the

north western Mediterranean Sea. PhD thesis, University of Basilicata, Potenza, Italy.

Rosso, M., Ballardini, M., Moulins, A., Wurtz, M. 2011. Natural markings of Cuvier's beaked whale *Ziphius cavirostris* in the Mediterranean Sea. *Afr. J. Mar. Sci.* 33 (1), 45–57.

Tepsich, P., Rosso, M., Halpin, P.N., Moulins, A. 2014. Habitat preferences of two deep-diving cetacean species in the northern Ligurian Sea. *Mar. Ecol. Prog. Ser.* 508, 247–260.

Tyack, P.L., Johnson, M., Aguilar Soto, N., Sturlese, A., Madsen, P.T. 2006. Extreme diving of beaked whales. *J Exp Biol* 209: 4238-4253.

Acknowledgements

The participants of the 2016 IMMA Regional Expert Workshop held in Chania, Crete, for the Identification of IMMAs in the Mediterranean Sea. Caterina Lanfredi.



MARINE MAMMAL PROTECTED AREAS TASK FORCE

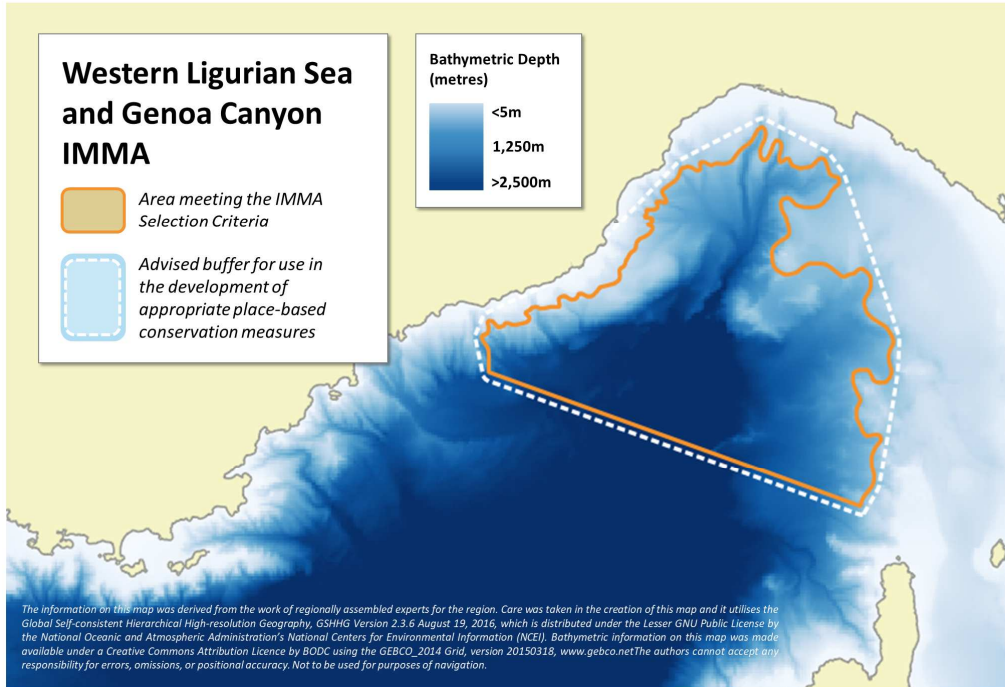


Suggested Citation: IUCN-MMPATF (2017) Western Ligurian Sea and Genoa Canyon IMMA Factsheet. IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, 2017.

PDF made available for download at
<https://www.marinemammalhabitat.org/portfolio-item/western-ligurian-sea-genoa-canyon/>

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>Ziphius cavirostris</i>	Cuvier's beaked whale	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>Stenella coeruleoalba</i>	Striped dolphin	Mediterranean Subpopulation	Vulnerable
<i>Grampus griseus</i>	Risso's dolphin	Mediterranean Subpopulation	Data Deficient
<i>Globicephala melas</i>	Pilot whale	Mediterranean Subpopulation	Data Deficient
<i>Physeter macrocephalus</i>	Sperm whale	Mediterranean Subpopulation	Endangered