

Protecting Cuvier's beaked whale and Mediterranean monk seal critical habitat from anthropogenic noise in the Mediterranean Sea

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The Mediterranean Sea is home to two important species: the critically endangered Mediterranean monk seal (*Monachus monachus*), the most endangered pinniped species in the world, and the distinct population of Cuvier's beaked whales (*Ziphius cavirostris*).

Both species are listed on CMS Appendix I, which obligates CMS Party Range States to:

- 1. conserve and restore critical habitats of the species
- 2. prevent, remove, compensate for or minimize activities or obstacles that impede or prevent the migration of the species; and
- 3. prevent, reduce or control factors that are endangering the species.

This OceanCare statement makes the case that critical habitats for Mediterranean monk seals and Cuvier's beaked whales are compromised by anthropogenic noise in the Mediterranean Sea. Protected areas should be established to prevent anthropogenic noise from further endangering these species and their prey.

Research by the Potsdam Institute calculates that to reduce the chance of exceeding 2°C warming to 20 percent, the global carbon budget to 2050 is 565 GtCO₂. Governments and global markets are treating as assets, reserves equivalent to nearly 5 times this carbon budget. Only 20 percent of the total reserves can be used to stay below 2°C.^[2] Yet, the hydrocarbon industry ambition is to increase fossil fuel use into the future.

Government facilitation of this industry to explore for new reserves in offshore areas is profoundly irresponsible. It also stands in violation of CMS Party Range Statement commitments to the Appendix I listing of Mediterranean monk seals and Cuvier's beaked whales and the commitments of all European Member States to fully assess impacts to marine wildlife.

OceanCare's summary recommendations are that:

- 1. Marine Protected Areas should be declared to protect Mediterranean monk seal and Cuvier's beaked whale critical habitats in key regions across the Mediterranean Sea.
- 2. Environment Impact Assessments must thorough, comprehensive and mandatory for all noise producing activities in the Mediterranean Sea that might propagate into any recognised Mediterranean monk seal and Cuvier's beaked whale critical habitats or declared MPAs for these species.

Marine wildlife and anthropogenic noise

Levels of anthropogenic marine noise have doubled in at least some areas of the world, every decade, for the past 60 years.^[3, 4] This is a life-threatening trend for marine species.

The key noise producing marine activities are commercial shipping, defence-related activities, hydrocarbon exploration and development, research activities and recreational activities.

Marine wildlife rely on sound for their vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings.^[5, 6] While the ocean is certainly a sound-filled environment and many natural (or biological) sounds are very loud, wildlife are not adapted to anthropogenic noise.

Animals exposed to elevated or prolonged anthropogenic noise levels can suffer permanent or

temporary hearing threshold shifts, compromising their communication and ability to detect threats.^{[4,} ⁷¹ Noise can mask important natural sounds, such as the call of a mate, the sound made by prey or the

noise made by a predator. These mechanisms, as well as factors such as stress, distraction, confusion, and panic, can affect vital rates such as reproduction, death, and growth rates, in turn affecting the long-term welfare of the population.^[4, 8, 9]

The most commonly measured wildlife responses to noise fall into three main categories: behavioral, acoustic and physiological.

- **Behavioural** responses that include changes in 1. surfacing, diving and heading patterns and changes in feeding behaviour.
- 2. Acoustic responses that include changes in type or timing of vocalisation and communication relative to the noise source.



Adapted from: Slabbekoorn et al. 2010^[1]

3. **Physiological** responses or impacts that include physical damage, hearing threshold shifts and 'stress' in some species. Noise can also mask natural sounds the animal relies on.

These impacts are experienced by a wide range of species including fish, crustaceans and cephalopods,^[10-17] pinnipeds (seals, sea lions and walrus),^[7, 8, 18-21] sirenians (dugong and manatee),^[22] sea turtles^[23-25] and cetaceans (whales, dolphins and porpoises)–the most studied group of marine species when considering the impact of marine noise.^[4, 26-32]

Protecting Cuvier's beaked whale and Mediterranean monk seal critical habitat in the Mediterranean Sea

Spatio-temporal restrictions, such as marine protected areas (MPAs), offer one of the most effective means to protect marine wildlife and their habitats from the impact of noise.^[33-35] MPAs either need to be sufficiently large to provide sanctuary, or their existence needs to trigger a prescribed limit of activities outside the MPA to prevent noise propagating into the MPA.^[34, 36, 37]

The estimated total population of Mediterranean monk seals is only 350-450 animals, with 250-300 of these in the eastern Mediterranean. (See map1) The closed and genetically isolated population in the Cabo Blanco area (Western Sahara-Mauritania) may have slightly increased.^[38, 39] Monk seal critical habitats are well known. The species is listed by the IUCN as 'Critically Endangered' and is included on CMS Appendix I. Mediterranean monk seals are known to remain close to their haul out and pupping grounds, but like all pinnipeds, regularly travel 100km or more from shore to feed.^[40]



Map 1: Mediterranean monk seal critical habitat

Map adapted from: Google Earth and Matthias Schnellmann/ The Monachus Guardian, 2006 [41]

The Mediterranean population of the Cuvier's beaked whales is genetically distinct, containing fewer than 10,000 mature individuals. Cuvier's beaked whales are regular inhabitants of the Hellenic Trench, the southern Adriatic Sea based on frequency of strandings, the northern Thyrrenian Sea and the eastern section of the Alboran Sea. (See map 2) A recent regional assessment by the IUCN has provisionally classified the Mediterranean population as Vulnerable.^[42] This population is also included on CMS Appendix I as an endangered species.





Adapted from: Google Earth and Ana Cañadas/ACCOBAMS^[43]

In 2008, the Conference of the Parties to the Convention on Biological Diversity (CBD) adopted a list of seven scientific criteria for to identify Ecologically or Biologically Significant Marine Areas (EBSAs) in need of protection in open-ocean waters and deep-sea habitats. These criteria were completed, in 2010 and are:

- 1. Uniqueness or rarity
- 2. Special importance for life history of species
- 3. Importance for threatened, endangered or declining species and/or habitats
- 4. Vulnerability, fragility, sensitivity, slow recovery
- 5. Biological productivity
- 6. Biological diversity
- 7. Naturalness^[44]

In paragraph 3 of 'Decision XII/22: Marine and coastal biodiversity: ecologically or biologically significant marine areas (EBSAs)', CBD Parties commit that EBSAs may require strengthened conservation and management measures, and that this can be achieved through marine protected areas and impact assessments. In paragraph 9 they are encouraged to:

"... make use, as appropriate, of the scientific information regarding the description of areas meeting EBSA criteria ... when carrying out marine spatial planning, development of representative networks of marine protected areas ... and application of other area-based management measures in marine and coastal areas, with a view to contributing to national efforts to achieve the Aichi Biodiversity Targets;"

CBD Parties have declared fifteen EBSAs for the Mediterranean region.^[45] (See map 3) These are:

- 1. Northern Adriatic
- 2. Jabuka/Pomo Pit
- 3. South Adriatic Ionian Straight
- 4. North-western Mediterranean Pelagic Ecosystems
- 5. North-western Mediterranean Benthic Ecosystems
- 6. Le Golfe de Gabès
- 7. Gulf of Sirte
- 8. Nile Delta Fan

- 9. East Levantine Canyons (ELCA)
- 10. North-East Levantine Sea
- 11. Akamas and Chrysochou Bay
- 12. Hellenic Trench
- 13. Central Aegean Sea
- 14. North Aegean
- 15. Sicilian Channel

Map 3: Mediterranean EBSAs (benthic and pelagic combined)



Adapted from: Google Earth and CBD Document XII:22 $^{\rm [46]}$

Of these declared EBSAs, five specifically reference their importance for Mediterranean monk seal and Cuvier's beaked whales: South Adriatic Ionian Straight; North-East Levantine Sea; Akamas and Chrysochou Bay; Central Aegean Sea; and North Aegean.

When the broader knowledge about Mediterranean monk seal and Cuvier's beaked whale critical habitat with Mediterranean EBSAs is considered together, it becomes clearly clear which regions should be considered for immediate protection. (See map 4)

Map 4: Overlay of Mediterranean monk seal and Cuvier's beaked whale critical habitat with Mediterranean EBSAs



Adapted from: Google Earth, Matthias Schnellmann/ The Monachus Guardian, Ana Cañadas/ACCOBAMS and CBD Document XII:22

Protecting these key areas as MPAs is one part of what must done. The other part is ensuring the protection is effective.

The complexities of sound in water

Sound in the marine environment behaves differently to sound in air. The extent and way that sound travels (propagation) is affected by the frequency of the sound, water depth and density differences within the water column. These vary with temperature, salinity and pressure. Moreover, the ocean

bottom substrate affects propagation as well.^[47-50] Consequently, assessing noise propagation is complex.^[49, 51-53]

The temperature of seawater at different depths is important to modelling ^[54-56] and the way sound propagates is also important. Seawater is roughly 800–1500 times denser than air and sound travels around five times faster in this medium.^[49] Sound waves moving through water, at 22° C, travel at around 1484ms⁻¹.^[54-56] Transmission loss- the decrease in the sound intensity levels- happens uniformly in all directions during spherical spreading. In cylindrical spreading the sound waves are effectively contained between the sea surface and the sea floor, while the radius still expands uniformly. As the height is now fixed, the sound intensity level decreases more slowly.^[49, 57] Horizontal layers of water in the ocean at which depth, the speed of sound is at its minimum- Sound Fixing and Ranging Channels (SOFAR) or deep sound channels (DSC) – are created through the interactive effect of temperature and water pressure (and, to a smaller extent, salinity). The speed gradient above and below the sound channel axis- the depth where the sound speed is at a minimum-acts like a lens, bending sound towards the depth of minimum speeds. Sound within the channel meets no acoustic loss from reflection of the sea surface and sea floor and travels very long distances with little transmission loss.^[49, 57] The seabed is rarely, if ever, flat and parallel to the sea surface, modelling propagation in the marine environment is complex. Modelling must accommodate the water depth as well as the rise and fall of the seabed.^[49]

All of these complexities require professional modelling to fully understand noise propagation characteristics. It is not acceptable for any noise producing industry to provide generalised assurances.

Environmental Impact Assessments providing defensible information

There is considerable debate about the appropriate buffer zone distance surrounding MPAs, to ensure that anthropogenic noise does not propagate into the area, impacting the species being protected. While such buffer zone distances continue to be debated, regulations should use an established tool that is legislatively available in almost all jurisdictions of the world: Environment Impact Assessments (EIAs).

It is broadly accepted the basic intent of EIAs is to anticipate the significant environmental impacts of development proposals before any commitment to a particular course of action. The purpose of EIAs for anthropogenic noise industries should determine the level of impact on populations of marine wildlife and the wider ecosystem,^[6] yet many EIAs are insufficiently researched, drawing heavily from previous assessments. In a significant number of cases, approvals are given without careful consideration of the detail presented in the assessments. Instances of duplicated information or missing species are not uncommon. Topics are dealt with by dismissal, often ignoring recent scientific literature, perpetuating misconceptions and containing analytical flaws. Discussions about wildlife often focused on lethal impact, with little or no consideration of sublethal impacts. Objective assessment of impact on neighbouring MPAs is rarely performed.^[58, 59]

While professional noise modelling is common for land-based anthropogenic noise producing activities, it is less common for proposals in the marine environment. This lack of rigorous noise modelling contained in EIAs in the marine setting needs to be urgently addressed.^[59]

Exposure criteria for single individuals and short-term (not chronic) exposure events are inadequate to describe the cumulative and ecosystem-level effects likely to result from repeated and/or sustained noise exposure.^[7] EIAs should provide a clear indication of the sound propagation features across the full area the noise will impact. Proponents should be required to contract professional modelling of the noise propagation of their proposed activity; in the region and under the conditions they plan to operate. They should be required to verify this modelling in the field. Their documentation should demonstrate a clear understanding of the species present, necessary species exclusion zones and how the transmission into MPAs can be managed.

Given the strong commitment of governments to reducing anthropogenic marine noise, this information, if transparently supplied, will provide regulators and decision makers with robust, defensible and impartial information on which to base their decisions. Only with this level of information can the risks of the proposed activity be weighed against alternatives.

The existing EIA commitment of European Member States

These suggestions are not without precedent and governmental commitment. A series of important intergovernmental decisions have already determined the direction for regulating anthropogenic marine noise. The most recent of these are the following:

European Union Directive

The 2014/52/EU Directive introduction now directs European Union Member States:

"[w]ith a view to ensuring a high level of protection of the marine environment, especially species and habitats, environmental impact assessment and screening procedures for projects in the marine environment should take into account the characteristics of those projects with particular regard to the technologies used (for example seismic surveys using active sonars)."^{60]}

ACCOBAMS

The Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) 'Resolution 5.13: Conservation of Cuvier's beaked whales in the Mediterranean⁴⁶¹¹ and 'Resolution 5.15: Addressing the impact of anthropogenic noise⁴⁶²¹ reinforces the commitments made in 'Resolution 4.17: Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)' that urges ACCOBAMS Parties to:

"[r]ecogniz[e] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death".^[63]

This Resolution also encourages ACCOBAMS Parties to:

"... address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities".^[63]

The ACCOBAMS Noise Guidelines provide further comprehensive detail relating to each of the marine noise producing activities.

Espoo (EIA) Convention

Principle 17 of the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo (EIA) Convention) states that:

"Environmental impact assessment[s], as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."^[64]

CBD

The Convention on Biological Diversity (CBD) 'Decision XII/23: Marine and coastal biodiversity: Impacts on marine and coastal biodiversity of anthropogenic underwater noise' encourages CBD Parties:

"... to take appropriate measures... to avoid, minimize and mitigate the potential significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity".^[65]

In Decision XII/23, CBD Parties have agreed to a significant list of technical commitments, including gathering additional data about noise intensity and noise types; and building capacity in developing regions where scientific ability can be strengthened.

Decision XII/23 urges the transfer to quieter technologies and applying the best available practice in all relevant activities. The CBD Parties advocate for mapping spatial and temporal distribution of sound through EIAs and combining this acoustic mapping with habitat mapping of sound-sensitive species with regard to spatial risk assessments to identify areas where species may be exposed to noise impacts. They also advocate the use of spatio-temporal management of activities.

CMS

The Convention on Migratory Species (CMS) 'Resolution 10.24: Further Steps to Abate Underwater Noise Pollution for the Protection of Cetaceans and Other Migratory Species' encourages CMS Parties to:

"... prevent adverse effects on cetaceans and on other migratory marine species by restricting the emission of underwater noise, understood as keeping it to the lowest necessary level with particular priority given to situations where the impacts on cetaceans are known to be heavy" and "[u]rges Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on cetaceans and to consider potential impacts on marine biota and their migration routes ... "^{166]}

Resolution 10.24 further articulates that CMS Parties should ensure that EIAs take full account of the impact of anthropogenic marine noise on marine species; apply Best Available Techniques (BAT) and Best Environmental Practice (BEP); and to integrate the issue of anthropogenic noise into the management plans of marine protected areas.

Recommendations

OceanCare recommends that:

- 1. MPA should be declared to protect Mediterranean monk seal and Cuvier's beaked whale critical habitats in key regions of the Mediterranean.
- 2. ElAs for any noise producing activities in the Mediterranean Sea must be thorough, comprehensive and mandatory. At a minimum, ElAs should:
 - a. collect baseline biological and environmental information to describe the area being impacted;^[59, 67-69]
 - b. fully characterise operations, including describing the sound source in some detail, professionally modelling the sound propagation features and spatial area that will experience anthropogenic noise above natural ambient sound levels, including transmission into any declared MPAs, and verifying this modelling in the field,^[59]
 - c. assess the impact to species within this area and consider the potential cumulative effects from other sound sources as well as other human activities that add to the pressures on wildlife;^[59, 67-69]
 - d. describe how the impacts will be monitored before, during and after the operation,^[59, 67-69] and
 - e. provide an objective consideration of the risk posed by the proposed activity against alternatives.

OceanCare and anthropogenic marine noise

For more than a decade OceanCare has raised concern about marine noise pollution through intergovernmental meetings, urging governments and the United Nations to take action to reduce marine noise.

OceanCare has been active in this regard through the United Nations General Assembly, the Convention on Migratory Species of Wild Animals (CMS), the Food and Agriculture Organization Committee on Fisheries (FAO/COFI), the International Whaling Commission (IWC) and the European Union. We have also focused our advocacy voice with technical information in the two regional Agreements on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS).

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