Co-funded by the European Union

# QUIETMED2 – Joint programme for GES assessment on D11- noise in the Mediterranean Marine Region.

## DELIVERABLE

# D 5.1. Set of cetacean species representative at national, subregional and regional level in the Mediterranean Region.

**Deliverable:** D 5.1. Set of cetacean species representative at national, subregional and regional level in the Mediterranean Region.
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| 9 | Special Secretariat for Water-Hellenic Ministry of Environment and Energy | SSW | Greece |
| 10 | Specially Protected Areas Regional Activity Centre | SPA/RAC | Tunisia |
| 11 | International Council for the Exploration of the Sea | ICES | Denmark |

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## Abstract

This document is Deliverable 5.1 (D5.1) of the QUIETMED2 project focusing on the *"Set of cetacean species representative at national, subregional and regional level in the Mediterranean Region" (31st January 2020)* funded by the DG Environment of the European Commission within the DG ENV/MSFD 2018 call. This call funds projects to support the implementation of the second cycle of the Marine Strategy Framework Directive (MSFD) (2008/56/EC), to implement the new Commission Decision 2017/848/EU of 17th May 2017 laying down criteria and methodological standards for the Good Environmental Status (GES) of marine waters. The new specifications and standardised methods for monitoring and assessing repeal previous Commission Decision 2010/477/EU and programmes of measures, according to Article 13 of the MSFD.

The QUIETMED2 project aims to support Member States Competent Authorities in the assessment of the extent to which GES on Descriptor 11, Underwater Noise, may be achieved in the Mediterranean Sea, from national to regional scales. Practical outcomes to implement the new GES Decision would be provided by QUIETMED2 through: i) Develop a joint proposal for candidate species as impulsive noise indicator/s in the Mediterranean Region for the D11C1 Criteria, through the assessment of existing knowledge, guidelines and legal instruments for cetacean protection; ii) A common methodology for Competent Authorities to establish thresholds values, together with associated lists of elements and integration rules; iii) A data and information tool to support the implementation of the monitoring programmes, also considering the impact of impulsive noise, based on the current ACCOBAMS joint register; iv) An operational pilot of the tool developed; and v) Several activities to boost current regional cooperation efforts of the Barcelona Convention to develop new Mediterranean Region cooperation measures.

The main goal of this document is to look at cetaceans as a priority group of species found in the Mediterranean Sea that should be considered when carrying out a GES assessment. The use of specific ecological parameters related to each species (abundance, distribution or habitat selected) for GES assessment becomes necessary, as the framework for GES assessment relative to D11C1 is adapted from risk assessment methodologies (such as those used during Environmental Impact Assessment procedures).

To achieve this, a ranking table with factors (criteria) for the choice of species is developed after considering the various aspects: Present from national to subregional level; Considered in various legal instruments; Scientifically studied for noise vulnerability; Conservation status; Considered indicator species that may be effectively monitored in the Mediterranean from national to regional scale. This proposal is a guideline, allowing each MS country to consider how best and to what extent to follow the suggested methodology described.

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## List of Abbreviations

| | |
|---|---|
| **CTN** | Centro Tecnológico Naval y del Mar |
| **ACCOBAMS** | Permanent Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area |
| **DFMR** | Department of Fisheries and Marine Research |
| **IZVRS** | Inštitut za vode Republike Slovenije/Institute for water of the Republic of Slovenia |
| **HCMR** | Hellenic Centre for Marine Research |
| **IOF** | Institute of Oceanography and Fisheries |
| **CBRG-UM** | The Conservation Biology Research Group - University of Malta |
| **POLIMI-DICA** | Politecnico di Milano-Department of Civil and Environmental Engineering |
| **SSW** | Special Secretariat for Water-Hellenic Ministry of Environment and Energy |
| **SPA/RAC** | Specially Protected Areas Regional Activity Centre |
| **ICES** | International Council for the Exploration of the Sea |
| **MSFD** | Marine Strategy Framework Directive |
| **GES** | Good Environmental Status |
| **MS** | Member States |
| **MED** | Mediterranean Sea Region |
| **ES** | Spain |
| **FR** | France |
| **EL** | Greece |
| **HR** | Croatia |
| **IT** | Italy |
| **MT** | Malta |
| **SI** | Slovenia |
| **RSC** | Regional Sea Convention |
| **TG Noise** | Technical Group on Noise |

## 1. Introduction and objectives of this deliverable

The QUIETMED2 Project is funded by DG Environment of the European Commission within the call "DG ENV/MSFD Second Cycle/2018". This call funds projects to support the implementation of the second cycle of the Marine Strategy Framework Directive (MSFD) (2008/56/EC), to implement the new Commission Decision 2017/848/EU of 17th May 2017 laying down criteria and methodological standards for the Good Environmental Status (GES) of marine waters and specifications and standardised methods for monitoring and assessment and repealing previous Commission Decision 2010/477/EU and Programmes of Measures, according to Article 13 of the MSFD. The QUIETMED2 project aims to enhance cooperation among Member States (MS) in the Mediterranean Sea Region (MED) to implement the Second Cycle of the Marine Directive and in particular to assist them in the preparation of their MSFD reports through the following specific objectives:

- Develop a joint proposal for candidate species as impulsive noise indicator/s in the Mediterranean Region for the D11C1 Criteria, through the assessment of existing guidelines and tools on biodiversity protection.
- Make a joint proposal of a methodology to establish threshold values, list of elements and integration rules to implement the GES decision in reference to D11 in the Mediterranean Region.
- Build an efficient data and information tool to support the implementation of the D11C1 Criteria and the update of the monitoring programmes of Impulsive Noise according the new GES Decision.
- Perform an operational pilot of an impulsive noise impact monitoring programme implemented with the updated Joint register to demonstrate its feasibility.
- Promote Mediterranean Region Coordination by i) boosting current regional cooperation efforts of Barcelona Convention and others and ii) developing new cooperation measures.
- Enhance collaboration among a wide network of stakeholders through the dissemination of the project results, knowledge share and networking.

To achieve its objectives, the project is divided in 3 work packages around 3 priorities and 10 activities whose relationships are shown in Figure 1.

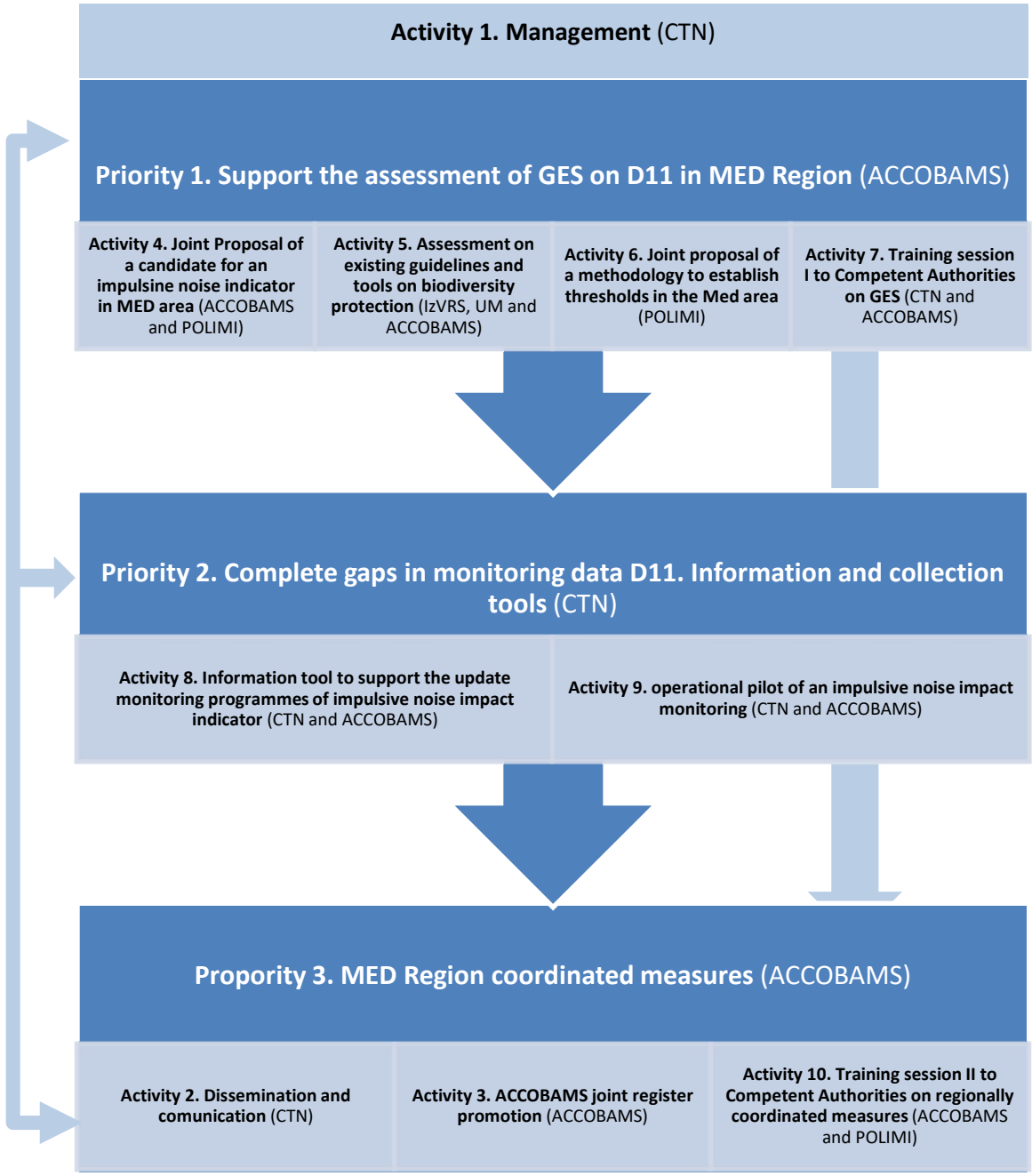


Figure 1. Work Plan Structure

The project is developed by a consortium made up of 11 entities coordinated by CTN and it has a duration of 24 months from February 2019.

This document summarizes existing literature, official documents and reports, directives, conventions and feed back of the Mediterranean MS national feedback from a questionnaire study relating to the selection of protected, endangered and noise indicator species of cetaceans. The result will be a proposal for the selection of species that is going to be crucial to assess the anthropogenic impulsive sound criterion (D11C1) in the Mediterranean Region.

The following tasks were targetted toward achieving this goal:

1. **Review and assess legal instruments** for marine biodiversity protection with a focus on their guidance concerning cetacean species conservation.
2. **Review of cetacean population monitoring projects and programmes** that may provide adequate data.
3. **Assess the availability and accessibility of data about cetacean populations** at national, sub-regional and regional level.
4. **Assess the available knowledge on effects of underwater noise on cetaceans.**
5. **Identify factors (criteria) to select indicator species** based on previous tasks**.**
6. **Establish a ranking table** with these factors.
7. **Propose a preliminary set of cetacean species to be used in the impulsive noise assessment (Criterion D11C1)**.

The methodology to carry out tasks 1, 2, 3 and 4 is based on a bibliographic review, official reports, and a dedicated questionnaire survey. The questionnaire was used to approach Mediterranean EU MS's Competent Authorities as well as other stakeholders and experts. Task 5 is built upon the information collected and assessed in the preceding tasks and is meant to extract the key factors for species selection. In task 6, key factors (selection criteria) are formalised in a table. Finally, in task 7 the selection criteria will be used to derive a species ranking and propose a preliminary list of candidate indicator species at Mediterranean region and sub-region scale.

# 2. Review the existing knowledge, guidelines and legal instruments for cetacean protection which are relevant for identifying selection criteria

This chapter focuses on data which are derived from legal frameworks or initiated by projects. Special attention is given to biodiversity protection and conservation with focus on cetacean species. Information presented here was gathered primarily through available bibliography. Also, additional knowledge and scientific information were sought in Mediterranean MS associated to the project aided by a questionnaire specifically prepared for MS feedback. Key words, including biodiversity protection and conservation, cetacean and impulsive noise, helped to narrow the collection of a set of relevant papers.

## 2.1. European Union

### 2.1.1. Habitats Directive (HD) and related annexes of protected species

Over 1.000 animal and plant species are included in the Habitats Directive, as well as 200 habitat types, listed in the Directive's annexes and protected in various ways:

- Annex II species (about 900): core areas of their habitat are designated as sites of Community Importance (SCIs) and included in the Natura 2000 network. These sites must be managed in accordance with the ecological needs of the species.
- Annex IV species (over 400, including many species of Annex II): a strict protection regime must be applied across their entire natural range within the EU, both within and outside Natura 2000 sites.
- Annex V species (over 90): MS must ensure that their exploitation and taking in the wild is compatible with maintaining them in a favourable conservation status.

According to the information provided by MS in the Article 17 report formats of the Habitats Directive for the period 2013-2018 (http://cdr.eionet.europa.eu/help/habitats_art17), the Table 1 below shows the cetacean species included in the HD present regularly in the Mediterranean Sea Region:

| Cetacean species present regularly * reported by MS in HD (Art 17) for the period 2013-2018 | | |
|---|---|---|
| **Species name in Art 17 reporting** | Name as listed in the HD | Countries |
| ***Balaenoptera physalus*** | All other Cetacea | ES, FR, EL, HR, IT, MT |
| ***Delphinus delphis*** | All other Cetacea | ES, FR, EL, IT, MT |
| ***Globicephala melas*** | All other Cetacea | ES, FR, IT, MT |
| ***Grampus griseus*** | All other Cetacea | ES, FR, EL, IT, MT |
| ***Orcinus orca*** | All other Cetacea | ES |
| ***Phocoena phocoena*** | *Phocoena phocoena* | EL |
| ***Physeter macrocephalus*** | All other Cetacea | ES, FR, EL, IT, MT |
| ***Stenella coeruleoalba*** | All other Cetacea | ES, FR, EL, HR, IT, MT |
| ***Tursiops truncatus*** | *Tursiops truncatus* | CY, ES, FR, EL, HR, IT, MT, SI |
| ***Ziphius cavirostris*** | All other Cetacea | ES, FR, EL, HR, IT, MT |

* Present regularly (PRE) - This category applies to species which occur regularly in the region.

Table 1: Present species reported by MS in Article 17 of Habitats Directive for the period 2013-2018.

### 2.1.2. Marine Strategy Framework Directive (MSFD)

The Marine Strategy Framework Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the base of resources upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the cornerstone for achieving GES.

To help MS interpret what GES means in practice, the Directive sets out, in Annex I, eleven qualitative descriptors which describe what the environment will look like when GES has been achieved: Descriptor 1. Biodiversity is maintained, Descriptor 2. Non-indigenous species do not adversely alter the ecosystem, Descriptor 3. The population of commercial fish species is healthy, Descriptor 4. Elements of food webs ensure long-term abundance and reproduction, Descriptor 5. Eutrophication is minimized, Descriptor 6. The seafloor integrity ensures functioning of the ecosystem, Descriptor 7. Permanent alteration of hydrographical conditions does not adversely affect the ecosystem, Descriptor 8. Concentrations of contaminants give no effects, Descriptor 9. Contaminants in seafood are below safe levels, Descriptor 10. Marine litter does not cause harm, Descriptor 11. Introduction of energy (including underwater noise) does not adversely affect the ecosystem.

#### a) D1 Biodiversity

**Descriptor D1: Biological Diversity is maintained**. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

The Joint Research Centre (JRC) has provided a reference list of MSFD cetacean species, according to the directions given in the COM DEC 2017/848/EU, based on the information provided by MS in the reporting under Art. 8, 9 and 10 (2012) and Art. 11 (2014), lists from Annex II and Annex IV of the Habitat Directive, species included in the Regional Sea Conventions (RSCs) indicator assessments or in official RSCs lists and cross-checked with other sources. Table 2 below presents the results of this selection by each subregion set in the Mediterranean Sea Region.

| JRC's reference lists of MSFD cetacean species | | | | |
|---|---|---|---|---|
| **Species name** | **MWE** | **MIC** | **MAD** | **MAL** |
| ***Balaenoptera physalus*** | IT | EL, MT | EL, IT | EL |
| ***Delphinus delphis*** | ES, IT | EL, MT | EL, HR, IT | EL |
| ***Globicephala melas*** | ES, IT | MT | | |
| ***Grampus griseus*** | IT | MT | HR, IT | |
| ***Orcinus orca*** | ES | | | |
| ***Physeter macrocephalus*** | ES, IT | MT | IT | |
| ***Stenella coeruleoalba*** | IT | MT | HR, IT | |
| ***Tursiops truncatus*** | ES, IT | MT | IT | |
| ***Ziphius cavirostris*** | ES, IT | MT | HR, IT | |

Table 2: D1 species or group of species indicated in Commission Decision 2017/474 and reported by countries (Source: JRC's reference lists of MSFD species and habitats, 2018).
*MWE: Western Mediterranean Sea; MIC: Ionian Sea and the Central Mediterranean Sea; MAD: Adriatic Sea; MAL: Aegean Sea and Levantine Sea.

## b) D 11: Energy including Underwater Noise

Descriptor D11 Energy including Underwater Noise. The eleventh descriptor (D11), deals with the introduction of energy in the marine environment by human activities. It states that the "introduction, including underwater noise, must be at levels that do not adversely affect the environment". In this regard, the MSFD recognizes underwater noise as a source of marine pollution (QUIETMED, 2018).

Table 3 below, shows how the TG Noise group indicated the habitat and species approach. WG GES has advised TG Noise not to attempt to choose between these two approaches, but to consider whether a common method would enable both approaches as options.

| Approach | Description | Effect/'Hazard'/Risk | GES Decision 2017 relevance |
|---|---|---|---|
| **Habitat** | Space and time assessment of area affected by sound | *Disturbance to habitat* | *'… spatial distribution, temporal extent, and levels of anthropogenic impulsive sound'* |
| **Species** | Numbers of a given species or % population that is estimated to be exposed to underwater sound. | *Adverse exposure to individuals* | *'… spatial distribution, temporal extent, and levels of anthropogenic impulsive sound'* |

Table 3: TG Noise group indicated the habitat and species approach (TG NOISE, 2019).

TG Noise recommends consideration of the following parameters when choosing an indicator species for use in MSFD assessments of underwater noise:

- *Hearing sensitivity*. The species should be able to detect sound at the frequencies used to categorise activities that are captured in the noise registers.
- *Vulnerable to sound*. There should be evidence or sufficient indication that the species may be affected by sound in a way that could lead to negative effects at the population level.
- *Data availability*. There must be sufficient data on the chosen species distribution or important habitat in order to be able to adopt the use of this species.
- *Sensitive time period*. Certain times of the year could be more sensitive to disturbance due to important or critical life functions e.g. different life stages, spawning and mating and therefore may have a greater potential for impact on the population compared to other times.

Additional considerations

- *Compatibility with assessments under other MSFD descriptors.* Descriptors 1 and 3 of MSFD are aimed at ensuring GES of certain marine species. Assessments under Descriptor 11 may help these other assessments.
- *Threat status*. Many species are already affected by other anthropogenic activities. If an internationally-listed threatened species is suspected to be vulnerable to sound, it might be particularly considered for assessment (TG Noise, 2019).

## 2.2. UN-Environment/MAP and the Barcelona Convention

The Barcelona Convention is the juridical instrument to implement the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). The Convention has a complex organisational structure reflecting its large scope, i.e. controlling and managing the many sources of pollution and protecting Mediterranean ecosystems. This large scope is therefore covered by different components and instruments addressing specific issues and with complementary objectives. The relevant component for biodiversity protection is the RAC/SPA, i.e. Regional Activity Centre for Specially Protected Areas (RAC/SPA).

Furthermore, in 2008 the Convention adopted Decision 17/6 (2008) relative to the implementation of the Ecosystem Approach in the Convention area (Mediterranean Sea). Today, the Ecosystem Approach (EcAp) is the guiding principle to MAP Programme of Work and to all policy implementation and development undertaken under the auspices of UNEP/MAP-Barcelona Convention, with the ultimate objective of achieving the Good Environmental Status (GES) of the Mediterranean Sea and Coast.

The process has the ambition to address in an integrated manner all the possible pressures from anthropogenic activities as well as biological and ecological factors in order to achieve and maintain the good environmental status of Mediterranean waters. The implementation of the Ecosystem Approach started in 2008 and it mirrors the global structure and goals of the MSFD (which was adopted in that same year by EU).

Within the EcAp implementation process, the Integrated Monitoring and Assessment Programme (IMAP) represents the regional methodological framework that defines the indicators and the GES assessment methodology. IMAP was adopted in 2016 (COP19). The backbone of the IMAP are the 27 common indicators as presented in Decision IG 22/7: Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria. Indicators 26 and 27 address underwater impulsive and continuous noise, respectively, while Common Indicators 3 & 4 appear as the most relevant concerning the assessment of the environmental status based on ecological risk. Taking into consideration the ongoing development of QUIETMED 2 (Deliverable 4.1), the interest here is indeed in species distributional range (CI03) and species population abundance (CI04) of selected species.

MAP's initial objectives were to assist the Mediterranean Governments to assess and control pollution, as well as to formulate their national marine environmental policies. The convention also made provisions for additional legal instruments to be adopted and was soon complemented by the Protocol on pollution from land-based sources (1980), the Protocol concerning Specifically Protected Areas (1982), and the Offshore Protocol (1994). In 1995, the Convention was amended and renamed as the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean. Seven Protocols addressing specific aspects of Mediterranean environmental conservation were issued, where the most relevant concerning this Deliverable is the following:

- The Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA-BD Protocol); establishment of the List of Specially Protected Areas of Mediterranean Importance (SPAMI's List).

### 2.2.1. RAC/SPA

The *Regional Activity Centre for Specially Protected Areas (RAC/SPA)* was entrusted by parties to the convention to assist Mediterranean countries to implement the *Protocol Concerning Specially Protected Areas and Biological Diversity (SPA/BD Protocol)*, adopted in 1995 in Barcelona (replaced the Protocol concerning Mediterranean Specially Protected Areas, adopted in Geneva in 1982).

The SPA/BD Protocol has three annexes namely: the Common criteria for the choice of protected marine and coastal areas that could be included in the SPAMI list (Annex I); the List of endangered and threatened species (Annex II; see Table 4); and the List of species whose exploitation is regulated (Annex III).

The SPA-BD Protocol addresses the establishment of specially protected areas by Contracting Parties to the Protocol (which are also Contracting Parties to the Barcelona Convention). The SPA-BD Protocol also addresses the application by Parties of measures to protect and/or recover marine wildlife species listed in Annex II of the Protocol.

The list in Annex II to the SPA/BD Protocol includes the following groups that may be relevant for GES assessment relative to underwater noise (numbers in brackets are the number of species in Annex II of the SPA/BD Protocol):

- marine mammals (19 species: 18 cetaceans plus the monk seal)
- sea turtles (6 species)
- fish (15 species)
- molluscs (17 species)
- crustaceans (2 species)

Cetaceans, pinnipeds and fishes are traditionally studied for the effects of noise and many scientific references exist that demonstrate their sensitivity to underwater noise, obviously with species-specific differences. Much less effort has been done for other categories, although scientific literature has highlighted effects also on sea turtles, molluscs and crustaceans.

It is not the scope of the present document to review the available scientific literature concerning the effects of noise on the species listed in Annex II of the SPA/BD Protocol. Instead, this document highlights that Contracting Parties to the SPA/BD may find an interest in focussing the assessment of GES related to underwater noise on all species listed in Annex II to the SPA/BD Protocol, therefore not only on cetaceans. Among these, special attention could be accorded to the Mediterranean monk seal, the only representative of pinnipeds and the most endangered marine mammal in the region. However, the last available version of the Action Plan for the Conservation of Cetaceans in the Mediterranean Sea explicitly states that underwater noise is a topic relevant for the implementation of the action plan for the period 2016-2020. This Action Plan acknowledges the work carried-out by ACCOBAMS for monitoring underwater noise, and states that there is a need to pursue with the efforts of mapping noise hotspot areas and consider the distribution of cetaceans in those areas.

| SPA/BD Protocol. Annex II |
|---|
| **List of endangered and threatened species** |
| ***Balaenoptera acutorostrata*** |
| ***Balaenoptera borealis*** |
| ***Balaenoptera physalus*** |
| ***Delphinus delphis*** |
| ***Eubalaena glacialis*** |
| ***Globicephala melas*** |
| ***Grampus griseus*** |
| ***Kogia simus*** |
| ***Megaptera novaeangliae*** |
| ***Mesoplodon densirostris*** |
| ***Monachus monachus*** |
| ***Orcinus orca*** |
| ***Phocoena phocoena*** |
| ***Physeter macrocephalus*** |
| ***Pseudorca crassidens*** |
| ***Stenella coeruleoalba*** |
| ***Steno bredanensis*** |
| ***Tursiops truncatus*** |
| ***Ziphius cavirostris*** |

Table 4: SPA/BD Protocol Annex II - List of endangered and threatened species

Within the programme framework, RAC/SPA developed Action plans for the conservation of cetaceans, sea turtles and monk seals in the Mediterranean Sea.

Guidelines for the Establishment and Management of Marine Protected Areas for Cetaceans (UNEP-MAP RAC/SPA, 2011) are jointly produced by RAC/SPA and the Secretariat of ACCOBAMS to help relevant national authorities in selecting, establishing and managing MPAs and respective protected species http://accobams.org/documents-resolutions/guidelines/.

**The Integrated Monitoring and Assessment Programme (IMAP) and species referred to in Ecological Objective 1**

Two biodiversity indicators of IMAP may be relevant for GES assessment related to noise:

- Common Indicator 3: Species distributional range
- Common Indicator 4: Species population abundance

Species included in CI03 and CI04 monitoring and assessment framework are marine mammals, reptiles (sea turtles), and seabirds, meaning that countries may include one or more species groups in their national marine environmental monitoring programmes. Monitoring programmes have started, or were already ongoing, in many countries around the Mediterranean Sea for the different species groups. Further, a first comprehensive survey for cetaceans, sea turtles, and seabirds on the whole basin was carried out in 2018 thanks to the ACCOBAMS programme “ACCOBAMS Survey Initiative (ASI)”.

About the usefulness of CI03 and 04 for GES assessment relative to CI26 (and CI27), we know that noise is widely acknowledged as a threat for marine mammals, but the impact of noise on sea turtles and seabirds is (far) understudied, especially for seabirds. Consequently, no mention is made in IMAP Guidance documents for CI03 & CI04 about the severity of the noise issue concerning sea turtles or seabirds, contrary to marine mammals. No mention is made about noise in the Action Plan for the Conservation of Mediterranean marine turtles. Therefore, it doesn't appear a robust approach to propose GES assessment based on the potential impact on such species groups, although the few scientific elements available say that noise may well affect them. Instead, it appears relevant to relate noise monitoring data to data on marine mammal distribution and abundance, especially based on the extended literature on impacts on this group.

The SPA-BD Protocol includes 18 cetacean species among the endangered or threatened species, while the Guidance documents on CI03 and CI04 points out that only 11 cetacean species are considered to regularly occur in the Mediterranean region, including three species with very limited Mediterranean distribution range: the Killer whale found in the Gibraltar Strait area, the Harbour porpoise found in the northern Aegean Sea, and the Rough-toothed dolphin considered to be mostly found in the easternmost part of the Levantine basin.

The 11 cetacean species are therefore considered here for the GES assessment methodology, whatever the methodology.

IMAP fixes a reference list of species and habitats to be monitored. All cetacean species occurring in the Mediterranean Sea are considered in the IMAP. Particular attention is given to the eight resident cetacean species, divided into three different functional groups:

- Baleen whales: fin whale (*Balaenoptera physalus*).
- Deep-diving cetaceans: sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*)), long-finned pilot whale (*Globicephala melas*) and Risso's dolphin (*Grampus griseus*).
- Other toothed species: short-beaked common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*).

IMAP recommends monitoring and assessing common indicators for this selection of representative species for cetaceans. Though the distribution of the harbour porpoise *(Phocoena phocoena),* and the killer whale *(Orcinus orca)* are known to be limited in the Mediterranean, little is known about the rough-toothed dolphin *(Steno bredanensis)* distribution in this region.

## 2.3. The Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Also known as Bonn Convention, the CMS was established by UNEP in 1979 and entered into force in 1983. This Convention is an international agreement that aims at conserving migratory species within their migratory ranges. A key operative function of the CMS is the creation of regional agreements for the conservation of migratory species. As of 2010, seven instruments focusing on marine mammals were developed, a selection of which are cetacean agreements, placing the CMS as the

leading global and regional convention for marine mammal conservation (For cetaceans, see Table 5 and Table 6[1]) (Hoyt, 2011).

| CMS Annex I – Migratory cetacean species in danger (Effective 26.1.2018) |
|---|
| ***Balaena mysticetus*** |
| ***Balaenoptera borealis*** * |
| ***Balaenoptera musculus*** |
| ***Balaenoptera physalus*** * |
| ***Delphinus delphis*** * **(only Mediterranean population)** |
| ***Eubalaena australis*** |
| ***Eubalaena glacialis*** **(North Atlantic)** |
| ***Eubalaena japonica*** **(North Pacific)** |
| ***Megaptera novaeangliae*** |
| ***Orcaella brevirostris*** * |
| ***Physeter macrocephalus**** |
| ***Platanista gangetica gangetica*** * |
| ***Pontoporia blainvillei*** * |
| ***Sousa teuszii*** * |
| ***Tursiops truncatus ponticus*** * |
| ***Ziphius cavirostris*** **(only Mediterranean subpopulation)** |
| **(*) species, or a separate population of that species, or a higher taxon which includes that species is included in Appendix II.** |

Table 5: CMS Annex I – Migratory species in danger (excerpt of cetacean)

| CMS Annex II – Migratory cetacean species with an unfavourable conservation status (Effective 26.1.2018) |
|---|
| ***Balaenoptera bonaerensis*** |
| ***Balaenoptera borealis*** * |
| ***Balaenoptera edeni*** |
| ***Balaenoptera omurai*** |
| ***Balaenoptera physalus*** * |
| ***Berardius bairdii*** |
| ***Caperea marginata*** |
| ***Cephalorhynchus commersonii*** **(South American population)** |
| ***Cephalorhynchus eutropia*** |
| ***Cephalorhynchus heavisidii*** |
| ***Delphinapterus leucas*** |
| ***Delphinus delphis*** * **(North and Baltic Sea, Mediterranean, Black Sea and eastern tropical Pacific populations)** |
| ***Globicephala melas*** **(only North and Baltic Sea populations)** |
| ***Grampus griseus*** **(only North Sea, Baltic Sea and Mediterranean populations)** |
| ***Hyperoodon ampullatus*** |

[1] https://www.cms.int/sites/default/files/basic_page_documents/cms_cop12_appendices_e_0.pdf

| |
|---|
| ***Inia geoffrensis*** |
| ***Lagenodelphis hosei*** **(Southeast Asian populations)** |
| ***Lagenorhynchus acutus*** **(only North and Baltic Sea populations)** |
| ***Lagenorhynchus albirostris*** **(only North and Baltic Sea populations)** |
| ***Lagenorhynchus australis*** |
| ***Lagenorhynchus obscurus*** |
| **Monodon Monoceros** |
| ***Neophocaena asiaeorientalis*** |
| ***Neophocaena phocaenoides*** |
| ***Orcaella brevirostris**** |
| ***Orcaella heinsohni*** |
| ***Orcinus orca*** |
| ***Phocoena dioptrica*** |
| ***Phocoena phocoena*** **(North and Baltic Sea, western North Atlantic, Black Sea and North West African populations)** |
| ***Phocoena spinipinnis*** |
| ***Phocoenoides dalli*** |
| ***Physeter 18runcates18lus**** |
| ***Platanista gangetica gangetica**** |
| ***Pontoporia blainvillei**** |
| ***Sotalia fluviatilis*** |
| ***Sotalia guianensis*** |
| ***Sousa chinensis*** |
| ***Sousa teuszii**** |
| ***Stenella frontalis*** **(eastern tropical Pacific population, Southeast Asian populations)** |
| ***Stenella clymene*** **(West African population)** |
| ***Stenella coeruleoalba*** **(eastern tropical Pacific population, Mediterranean population)** |
| ***Stenella longirostris*** **(eastern tropical Pacific populations, Southeast Asian populations)** |
| ***Tursiops aduncus*** **(Arafura/Timor Sea populations)** |
| ***Tursiops truncatus**** **(North Sea, Baltic Sea, Mediterranean and Black Sea populations)** |
| **(*) species, or a separate population of that species, or one or more species included in that higher taxon is included in Appendix I.** |

Table 6: CMS Annex II – Migratory species with an unfavourable conservation status requiring international cooperation for conservation and management (Excerpt of cetacean).

## 2.4. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union). The text of the Convention was finally agreed at a meeting of representatives of 80 countries in Washington, D.C., the United States of America, on 3rd March 1973, and on the 1st of July 1975 CITES

entered into force. Although CITES is legally binding on the Parties – in other words, they have to implement the Convention – it does not take the place of national laws.

Annexes I, II and III to the Convention are lists of species afforded different levels or types of protection from over-exploitation represented in Table 7.

| Convention on International Trade in Endangered Species of Wild Fauna and Flora: Appendices I, II and III |
|---|
| ***Balaena mysticetus*** |
| ***Balaenoptera acutorostrata*** |
| ***Balaenoptera bonaerensis*** |
| ***Balaenoptera borealis*** |
| ***Balaenoptera edeni*** |
| ***Balaenoptera musculus*** |
| ***Balaenoptera omurai*** |
| ***Balaenoptera physalus*** |
| ***Berardius spp.*** |
| ***Eschrichtius robustus*** |
| ***Eubalaena spp.*** |
| ***Lipotes vexillifer*** |
| ***Megaptera novaeangliae*** |
| ***Neophocaena asiaeorientalis*** |
| ***Neophocaena phocaenoides*** |
| ***Orcaella brevirostris*** |
| ***Orcaella heinsohni*** |
| ***Phocoena sinus*** |
| ***Physeter macrocephalus*** |
| ***Platanista spp.*** |
| ***Sotalia spp.*** |
| ***Sousa spp.*** |

Table 7: Convention on International Trade in Endangered Species of Wild Fauna and Flora: Appendices I, II and III

## 2.5. The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)

ACCOBAMS was signed in 1996, under the auspices of the Bonn Convention (*CMS*), the Barcelona Convention and the Bucharest Convention, and entered into force in 2001. It applies to the Mediterranean Sea and Black Sea.

### 2.5.1. Cetacean species of the Mediterranean Region protected under ACCOBAMS

ACCOBAMS is an Agreement that applies to all cetaceans that have a range which lies entirely or partly within the Agreement area or that accidentally or occasionally frequent the Agreement area. A list of cetacean species for the Mediterranean Sea (and contiguous Atlantic area), according to Annex I to the ACCOBAMS agreement, is presented in Table 8.

| List of species in Mediterranean region according to Annex I to ACCOBAMS agreement. |
|---|
| ***Balaenoptera acutorostrata*** |
| ***Balaenoptera borealis*** |
| ***Balaenoptera physalus*** |
| ***Delphinus delphis*** |
| ***Eubalaena glacialis*** |
| ***Globicephala melas*** |
| ***Grampus griseus*** |
| ***Kogia simus*** |
| ***Megaptera novaeangliae*** |
| ***Mesoplodon densirostris*** |
| ***Orcinus orca*** |
| ***Phocoena phocoena*** |
| ***Physeter macrocephalus*** |
| ***Pseudorca crassidens*** |
| ***Stenella coeruleoalba*** |
| ***Steno bredanensis*** |
| ***Tursiops truncatus*** |
| ***Ziphius cavirostris*** |

Table 8: List of species in Mediterranean region according to Annex I to ACCOBAMS agreement.

### 2.5.2. Instruments of ACCOBAMS relevant for species selection criteria

The following are initiatives to be considered when selecting indicator species for D11C1 assessment:

- ACCOBAMS is working on the identification of Cetacean Critical Habitats (CCH)
- CCH are meant to propose appropriate measures for management of threats to cetaceans and their habitats (http://accobams.org/conservations-action/protected-areas.)
- Two Conservation Plans have been elaborated:
  - Short-beaked common dolphin in the Mediterranean Sea (Bearzi G. et al., 2004)
  - Short-beaked common Dolphin in the Black Sea Cetaceans (Birkun A., Jr. et al., 2006)
- Four Conservation Management Plans are developing for the following species:
  - Fin whale
  - Risso's dolphin
  - Bottlenose dolphin
  - Common dolphin

### 2.5.3. Med strategy on underwater noise monitoring by ACCOBAMS for IMAP

An ACCOBAMS strategy for the Mediterranean Underwater Noise Monitoring provides a reference for the implementation of the Ecological Objective 11 under the EcAp framework of the Barcelona Convention. In the biennium 2015-2016 this document was: drafted and approved by technical bodies of the Barcelona Convention, such as the EcAp Coordination Unit and the EcAp Correspondence Group on Monitoring; Presented to the European Commission technical body on underwater noise (TG-Noise); Approved by political bodies such as the MEDPOL Focal Point Meeting and the MAP Focal Point Meeting; Included in the Integrated Monitoring and Assessment Programme (IMAP) and in the Integrated Monitoring and Assessment Guidance (IMAG), both adopted by the 19th Ordinary Meeting of Contracting Parties to the Barcelona Convention. In the same COP the Secretariats of ACCOBAMS and UNEP/MAP signed a Memorandum of Understanding that formalized the cooperation between the two Secretariats on matters regarding noise and cetaceans.

Key points about the Strategy document which are worth citing here are the following: It laid down the first methodological framework for monitoring impulsive and continuous noise (Common Indicator 26 and 27, respectively) for Mediterranean countries non members of EU; It was adapted from latest available guidance from the European Task Group on Underwater Noise (TG-Noise) and therefore it was conceived to be consistent with Descriptor 11 of the MSFD.

With regards to impulsive noise, it is indicated two cetacean species as a relevant ecological link with the noise monitoring methodology: the fin whale for both impulsive and continuous noise and the Cuvier's beaked whale, especially concerning impulsive noise. The part related to GES assessment methodology was just roughly outlined. The Strategy document proposed to set threshold values, however, the scientific reasoning was not mature enough and no clear guidance was given on how to define such thresholds. With regards to Common Indicator 26 (impulsive noise), the same parameters that TG-Noise have set to be monitored were suggested, i.e. pulse-block days.

At the time of developing this noise monitoring strategy, the predominant idea within the expert group on noise of ACCOBAMS (likewise in TG-Noise) was that the methodology built for noise monitoring should contribute directly to GES assessment. Therefore, the monitoring of impulsive noise was just set to be the recording of the occurrence of noise events with a potential for causing impact on sensitive species. This way, a threshold could be set directly to the occurrence of such noise events, and the GES assessment process didn't need a link to distribution, abundance and other bio/ecological data. However, since 2015 the discussions in expert groups have progressed. At the time of writing, there is increasing consensus that GES assessment relative to noise needs further steps, including the use of ecological data on sensitive species into a risk-based approach.

In conclusion: the two species cited above, the **Fin whale** and the **Cuvier's beaked whale**, may be considered in the species selection process, not at the exclusion of other cetacean species considerations, especially as data and knowledge on their noise vulnerability has been increasing and is considered in depth in this QUIETMED2 Deliverable 5.1 report.

## 2.6 The Convention on the Conservation of European Wildlife and Natural Habitats (The Bern Convention)

The Bern Convention is particularly relevant in the Mediterranean area for countries that are not members of the European Union since the provisions and objectives of the Bern Convention are implemented into European Union legislation via the EU's Habitats Directive (Štrbenac A., 2017). Simmonds et al. (2014) note that the European Commission Habitats Directive (92/43/EEC), which came into force in 1992, requires EU member states to protect harbour porpoises (*Phocoena phocoena*) and common bottlenose dolphin (*Tursiops truncatus*) via the establishment of Special Areas of Conservation and that the Directive is intended for all cetaceans to be strictly protected throughout their entire range in EU waters (Ross et al., 2011). In Table 9 and in Table 10 list strictly protected species from Appendix II & III of the Bern Convention are represented.

| List of strictly protected species according Bern Convention. Appendix II |
|---|
| ***Balaena mysticetus*** |
| ***Balænoptera acutorostrata (in Med.)*** |
| ***Balænoptera borealis (in Med.)*** |
| ***Balaenoptera edeni*** |
| ***Balaenoptera physalus*** |
| ***Delphinus delphis*** |
| ***Eubalaena glacialis*** |
| ***Globicephala macrorhynchus*** |
| ***Globicephala melas*** |
| ***Grampus griseus*** |
| ***Hyperoodon rostratus*** |
| ***Kogia breviceps*** |
| ***Kogia simus (Med.)*** |
| ***Lagenorhynchus acutus*** |
| ***Lagenorhynchus albirostris*** |
| ***Megaptera novaeangliae (longimana, nodosa)*** |
| ***Mesoplodon bidens*** |
| ***Mesoplodon densirostris (in Med.)*** |
| ***Mesoplodon mirus*** |
| ***Monodon Monoceros*** |
| ***Orcinus orca*** |
| ***Phocoena phocoena*** |
| ***Physeter macrocephalus (in Med.)*** |
| ***Pseudorca crassidens*** |
| ***Sibbaldus (Balaenoptera) musculus*** |
| ***Stenella coeruleoalba*** |
| ***Stenella frontalis*** |
| ***Steno bredanensis*** |
| ***Tursiops truncatus (tursio)*** |
| ***Ziphius cavirostris*** |

Table 9: List of species according to Annex II to Bern Convention.

| List of species according Bern Convention. Appendix II | |
|---|---|
| **CETACEA** | All species not mentioned in Appendix II |

Table 10: List of species according to Annex III to Bern Convention

## 2.7 The General Fisheries Commission for the Mediterranean (GFCM)

The GFCM is a regional fisheries management organization (RFMO) established under the provisions of the Food and Agriculture Organisation of the United Nations (FAO) Constitution. The GFCM initially started its activities as a Council in 1952, when the Agreement for its establishment came into force, it became a Commission in 1997. The main objective of the GFCM is to ensure the conservation and sustainable use (at biological, social, economic and environmental level) of living marine resources as well as the sustainable development of aquaculture in the Mediterranean and in the Black Sea. The Commission has the authority to adopt binding recommendations for fisheries conservation and management in its area of application and plays a critical role in fisheries governance in the region. In particular, its measures can relate for instance to the regulation of fishing methods, fishing gear and minimum landing size, the establishment of open and closed fishing seasons and areas, and fishing effort control. GFCM also issues recommendations, such as GFCM/36/2012/2, on the mitigation of incidental catches of cetaceans in the GFCM area of application.

GFCM has the advantage of carrying greater power on management plans, enforcement of resolutions and reaching out to all Mediterranean countries (MS and non). With increasing GFCM research projects aimed at better identifying stocks, species and their respective distribution and status in relation to exploitation, the data gathered may be used to relate to prey species of cetaceans, that move about in relation to these prey species abundance and migrations. Additionally, the presence of fishing vessels and their noise added to present ambient noise has not been considered but as fleets have increased and vessels enlarged, such impacts may need to be considered in critical areas for fisheries and cetaceans. Thus, collaborative work between GFCM and other conservation agreements and conventions may facilitate this process aiding GES to be achieved in offshore international waters, as much as, in national territorial waters.

GFCM has compiled a list of priority commercial species (by GFCM subregion) for which stock assessment and management measures are considered a priority. These measures can include the protection of nursery areas if the case may be. For some species, GFCM has already established Fisheries Restricted Areas (FRAs) (http://www.fao.org/gfcm/data/maps/fras) in which relevant fishing activities are prohibited to protect key nursery areas. For example, the FRA of the Adriatic Sea and the FRAs in the Strait of Sicily.

On February 2019, was celebrated the Joint GFCM/OceanCare Workshop on anthropogenic underwater noise and impacts on fish, invertebrates and fish resources[2]. Although there has been some preliminary work done to identify some areas in which a high level of noise may overlap with GFCM FRAs, however, no scientific results on noise-sensitive fish species have been produced by GFCM yet. Restricted GFCM Areas could be beneficial for the cetacean conservation as well and

[2] http://www.fao.org/gfcm/technical-meetings/detail/en/c/1194253/

therefore could be assessed and monitored for noise levels as well through the MSFD and the EcAp process implementation.

## 2.8 The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention)

The OSPAR Commission carried out an intermediate assessment of the status of the marine environment in the OSPAR region, which included for the first time a part dedicated to underwater noise. The report, named *Assessment on Distribution of Reported Impulsive Sounds for MSFD Descriptor 11; Criterion 11.1 – Distribution in time and place of loud, low and mid frequency impulsive sound* is available at: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/distribution-reported-impulsive-sounds-sea/.

This report considered data for 2015, which were provided by Belgium, Denmark, Germany, the Netherlands, Sweden and the UK for four sound sources: seismic surveys, pile driving, explosions, and sonar/acoustic deterrents. However, this report was not meant to assess, but only to show the reported distribution of noise-producing human activities.

Subsequent initiatives targeting the development of an Exposure Index would include the use of biological data to assess biological risk to marine species. Harbour porpoise and herring have been used in practical exercises carried out to describe the methodology (Merchant et al. 2017). These species were selected for their acoustic sensitivity and importance to management in that area.

## 2.9 The International Union for Conservation of Nature (IUCN)

Expert groups of the IUCN periodically assess the Conservation Status of species which are assigned a category (see

| **Cetacean species included in the IUCN Red List -Mediterranean** | |
|---|---|
| **Mediterranean Sea Cetacean residents** | **Status** |
| *Balaenoptera physalus* | Vulnerable |
| *Delphinus delphis* | Endangered |
| *Globicephala melas* | Data deficient |
| *Grampus griseus* | Data deficient |
| *Phocoena phocoena relicta* | Endangered |
| *Physeter macrocephalus* | Endangered |
| *Stenella coeruleoalba* | Vulnerable |
| *Tursiops truncatus* | Vulnerable |
| *Ziphius cavirostris* | Vulnerable |
| **Visitors and vagrants** | |
| *Balaenoptera acutorostrata* | Least concern |
| *Balaenoptera borealis* | Endangered |
| *Eschrichtius robustus* | Regionally extinct |
| *Eubalaena glacialis* | Critically endangered |
| *Kogia sima* | Not applicable |

| | |
|---|---|
| *Megaptera novaeangliae* | Least concern |
| *Mesoplodon densirostris* | Data deficient |
| *Mesoplodon europaeus* | Data deficient |
| *Orcinus orca* | Data deficient |
| *Pseudorca crassidens* | Not applicable |
| *Steno bredanensis* | Not applicable |

Table 11 and Table 12). The vulnerable and the endangered species are on the priority list for greater protection and it is therefore crucial to list these species in this Deliverable. The Vulnerable and Endangered species categories would need to be prioritised in the scoring table. However, the Data Deficient species should not be ignored, especially as preliminary data is expanding in the Mediterranean region with clear indications of cetacean vulnerability to noise.

The IUCN requires extensive population and species data prior to ranking conservation status and these rankings are not updated frequently. For this reason, while this ranking should be considered as a valuable criterion for candidate selection, it may need to be considered side by side with other information that relates to the needs of and risks to cetacean populations and species.

| **Cetacean species included in the IUCN Red List -Mediterranean** | |
|---|---|
| **Mediterranean Sea Cetacean residents** | **Status** |
| *Balaenoptera physalus* | Vulnerable |
| *Delphinus delphis* | Endangered |
| *Globicephala melas* | Data deficient |
| *Grampus griseus* | Data deficient |
| *Phocoena phocoena relicta* | Endangered |
| *Physeter macrocephalus* | Endangered |
| *Stenella coeruleoalba* | Vulnerable |
| *Tursiops truncatus* | Vulnerable |
| *Ziphius cavirostris* | Vulnerable |
| **Visitors and vagrants** | |
| *Balaenoptera acutorostrata* | Least concern |
| *Balaenoptera borealis* | Endangered |
| *Eschrichtius robustus* | Regionally extinct |
| *Eubalaena glacialis* | Critically endangered |
| *Kogia sima* | Not applicable |
| *Megaptera novaeangliae* | Least concern |
| *Mesoplodon densirostris* | Data deficient |
| *Mesoplodon europaeus* | Data deficient |
| *Orcinus orca* | Data deficient |
| *Pseudorca crassidens* | Not applicable |
| *Steno bredanensis* | Not applicable |

Table 11: IUCN Red list Mediterranean – Cetacean.

In Table 12 below the ranking scale for the IUCN Red list is shown:

| IUCN Red List Categories | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Not evaluated** | Not applicable | Data deficient | Least concern | Near threatened | Vulnerable | Endangered | Critically endangered | Regionally extinct | Extinct in the wild | Extinct |
| NE | NA | DD | LC | NT | VU | EN | CR | RE | EW | EX |

Table 12: IUCN Red List Categories

## 2.10 International Whaling Commission (IWC)

Events such as mass whale stranding's related to anthropogenic activities, eventually led the IWC Scientific Committee to note that "*there is now compelling evidence implicating military sonar as a direct impact on beaked whales in particular*" (IWC, 2004; Simmonds et al., 2014).

The IWC has been dealing also with underwater anthropogenic noise and has an important role in raising the profile of this issue in other international fora, including the United Nations consultative process on Oceans and the Law of the Sea (UNCLOS). The IWC issued a Resolution on Anthropogenic Underwater Noise in 2018 (Resolution 2018-4) stating (among other things) that:

1. In line with the precautionary approach, the lack of full scientific certainty shall not be used as a reason for postponing costs effective measures to address the effects of anthropogenic underwater noise (or other potential threats);

2. Support the adoption of measures, such as noise standards, by relevant national and international authorities that reduce the risk of harmful impacts occurring on cetaceans from the introduction of anthropogenic underwater noise;

3. Instructs the Conservation Committee to review progress in implementing of IWC Recommendations on the mitigation and management of anthropogenic underwater noise and, based on this review, develop advice on priority actions to implement to address the impacts of anthropogenic underwater noise on cetaceans;

4. Instructs the Scientific Committee to continue its work regarding anthropogenic underwater noise and cetaceans, with a particular focus on: (1) Evaluation of the extent and degree of exposure of cetaceans to different types of noise; (2) Obtaining a better understanding of the effects of noise on cetaceans at the individual and population level, including chronic and acute effects; (3) Reviewing the effectiveness of different approaches to reducing cetacean exposure to noise; and (4) Reviewing work on the impacts of noise on cetacean prey and considering any implications of this for cetacean populations via the food-chain.

# 3 Availability and accessibility of data and information on species and their habitats

This chapter focuses on data and databases which are available and accessible, either from web portals or other means. The goal of this chapter is to discuss whether data on indicator species are being collected through any means, and if these might be sufficient or adequate to implement GES assessment for D11C1. It is worth noting that assessing to what extent data are adequate is a matter to be discussed by D1/EO experts as well. As a first approach, a list of web portals gathering data and information on species is provided. Then, national monitoring programmes of cetacean populations are briefly presented, as described by national stakeholders approached through the questionnaire and additional reports from countries. Finally, relevant regional initiatives are presented.

National research efforts still remain the most detailed contributions for assessing cetacean presence, abundance and distribution. Biological data from web portals could help to assess to a certain extent the criteria for the proposed list of cetaceans with data of marine mammal abundance and distribution. EMODnet Physics map also contains the data about the monitoring of low and mid frequency impulsive noise and it is expressed as pulse block days per area of 1/3° longitude by 1/6° latitude. But there are areas with still large gaps in monitoring and data are heterogeneous and fragmented.

Analysis of the data available on the web portals showed that data are presented on visual maps and are available in shp formats and in .xslx, .xlm and other excel and comma-separated files which are suitable for downloading and useful for the further analyses and creations of new maps. Most of them provide data about designated conservation sites, species and habitat types. Some of them are also providing the information and data about human activities besides the Biological, Chemistry and Physical data. One of the portals, the IMAP Pilot Info System (PIS), aims to collect, manage and share data from monitoring programs under the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) in the framework of Barcelona Convention. Most of the portals are now being updated and have a tendency to combine all the data that are publically available and will in the future contribute towards less fragmented data and more

## 3.1 Web portals

1. **IUCN Red List of Threatened Species** is an inventory of the global conservation status of biological species. Database offers information for each species regarding taxonomy, assessment information, geographic range (map and description), population, habitat and ecology, threats, use and trade, conservation actions and evidence, bibliography, images and external links. (https://www.iucnredlist.org/).

2. **EMODnet** provides access to European marine data across seven discipline-based themes: Bathymetry / Geology / Seabed habitats / Chemistry / Biology / Physics / Human activities. The EMODnet biology data portal provides free access to data on temporal and spatial distribution of marine species and species traits from all European regional seas. EMODnet Biology is part of the EU funded European Marine Observation and Data Network and is built upon the World Register of Marine Species and the European Ocean Biogeographic Information System (OBIS). As part of its

Marine Strategy Framework Directive (MSFD), the European Union aims to monitor and limit impulsive noise to a level where it is not harmful to the marine environment. The map of the EMODnet Physics for the monitoring of low and mid frequency impulsive noise is expressed as pulse block days per area of 1/3° longitude by 1/6° latitude. It represents the number of calendar days during which impulsive noise was registered in each area. Notice the many noise hotspots in the Mediterranean Sea which occur near harbours and oil drilling platforms. While the noise in the northern North Sea mainly resulted from seismic surveys, the southern North Sea noise originated from explosions and pile driving for wind farm construction. Biology data from EMODnet could help to assess criteria for the proposed list of cetaceans with data of marine mammal abundance and distribution. https://www.iucnredlist.org/

3. **EUNIS** is European nature information system, which brings together European data from several databases and organisations into three interlinked modules on sites, species and habitat types. The EUNIS information system is part of the European Biodiversity data centre (BDC) and it is a contribution to the knowledge base for implementing the EU and global biodiversity strategies and the 7th Environmental Action Programme. The EUNIS information system provides access to the publicly available data in the EUNIS database.

The information includes: Data on species, habitat types and designated sites compiled in the framework of Natura 2000 (EU Habitats and Birds Directives), designated sites mentioned in relevant international conventions and in the IUCN Red Lists and other resources. (https://eunis.eea.europa.eu/species/1567).

4. **IMMA Web Portal**. The Marine Mammal Protected Area Task Force (MMPATF) was created in 2013 by the International Committee on Marine Mammal Protected Areas (ICMMPA), the International Union for the Conservation of Nature's (IUCN) World Commission on Protected Areas (WCPA) Marine Vice Chair, and the Chair of IUCN's Species Survival Commission (SSC) to help support a stronger global profile and to provide a stronger voice for the MMPA constituency within IUCN. The goal of the MMPATF is to facilitate mechanisms to encourage collaboration, sharing information and experience to access and disseminate knowledge and tools for establishing, monitoring, and managing MMPAs and promoting effective spatial solutions and best practices for marine mammal conservation. The Global IMMAs Network is currently in a process of development. IMMAs e-Atlas will allow users quick access to information about many habitats (reproductive areas, feeding areas) and species (distribution and abundance) within Important Marine Mammal Areas (IMMA). (https://www.marinemammalhabitat.org/immas/imma-eatlas/)

5. **IMAP Pilot Info System**. This portal is one of the main inputs to the InfoMAP System (Figure 2) INFO/RAC is leading this work in the framework of the Programme of Work and Budget for 2018–2019 of UN Environment/MAP (Decision IG.23/14). InfoMAP represents the Information System to archive, manage and share environmental data and information in the Mediterranean Sea area, and also to support the Barcelona Convention. In the framework of the Programme of Work and Budget for 2018–2019 of UN Environment/MAP (Decision IG.23/14), INFO/RAC is leading the work on the development of the "InfoMAP platform and platform for the implementation of IMAP fully operative and further developed, connected to MAP components' information systems and other relevant

regional knowledge platforms, to facilitate access to knowledge for managers and decision-makers, as well as stakeholders and the general public" (output 1.5.1). (http://imappilot.info-rac.org).

6. **The InfoMAP System**. This system (Figure 2), available at http://infomapnode.info-rac.org/, is the UN Mediterranean knowledge platform conceived to provide and share data, information services and knowledge for the benefit of the Mediterranean Action Plan components and Contracting Parties. It is also able to support the Mediterranean Quality Status and the State of Environment Report. Its scope is to: Provide access to Reporting system; Harmonise data structure and models; Create a common catalogue of resources; Integrate data with interoperability layer; Create a common platform to view, query and analyse data; Produce tools to support data & Information dissemination.

The Figure 2 hereafter summarises the data management system which is being built by UNEP/MAP.

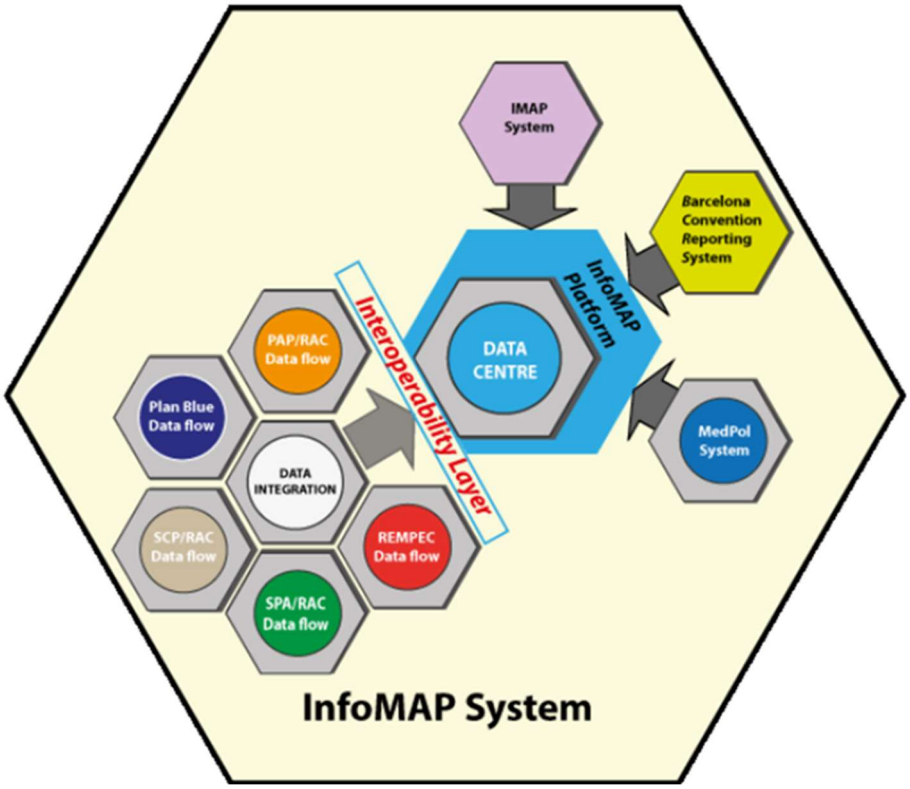


Figure 2: Overview of the InfoMAP System developed by INFO/RAC (source: http://QUIETMED2.info-rac.org)

## 3.2 National marine mammal population research and monitoring: summary from the questionnaire survey feedback.

One part of the questionnaire was dedicated to obtaining information on national monitoring programmes for cetaceans in order to get an overview of monitoring coverage in Mediterranean Sea region. The following sections give an overview of national information on cetacean species monitoring efforts as made available from the questionnaires' feedback relating to types of monitoring, species monitored, period of monitoring. As regards Greece, apart from the questionnaire, relative information was received as a "Report on the current knowledge of

distribution and abundance of cetacean populations in the Greek Seas" (Frantzis, 2019), subcontracted by HCMR. The supplementary material supplied with the deliverable D5.1 includes the questionnaire template, the Greek report case example of national feedback received

**Italy** has been conducting monitoring activities at sub-regions level. The monitoring activities are performed by ARPAs, the CNRs and the MPAs (Directorial Decree n. 24833 of 2015).

The Italian Ministry of the Environment financially supported an aerial survey programme conducted by "*Istituto Superiore per la Protezione e la Ricerca Ambientale*" (ISPRA) in collaboration with the Tethys Research Institute. First two aerial surveys covered the Pelagos Sanctuary completely in winter and summer 2009. Between 2009 and 2014, the Italian Ministry of the Environment has sponsored a series of multispecies aerial surveys to monitor mega vertebrates in the seas around Italy (Ligurian, Thyrrenian Ionian and Adriatic Sea) and to assess their density, abundance and distribution, as well as to identify potential critical habitats for the species of interest. In addition to the national initiatives, several Institutes and NGOs (more than 20) operate in Italian waters to research and monitor cetacean populations, often with a summer seasonal bias. New areas are increasingly added to research and monitoring around the Italian peninsula and islands.

**Croatia** has not established systematic monitoring of cetaceans at national level. Systematic monitoring around four Natura 2000 sites has been undertaken by Blue World Institute (NGO); Cres – Lošinj since 1999, Vis since 2007 and North Dalmatia since 2013. Aerial surveys on the distribution and abundance of bottlenose dolphins (*Tursiops truncatus*) and other species of conservation interest in the entire Adriatic Sea have been carried out in 2010, 2013, 2018 and 2019 by the Blue World Institute in collaboration with international partners aimed at identifying areas important for the establishment of the Natura 2000 sites.

**Slovenia** has no institutionally established monitoring for cetaceans. A Slovenian Marine Mammal Society (Morigenos, NGO), which is an independent, scientific organisation, has been conducting a long-term research, monitoring and conservation programme focusing on bottlenose dolphins (*Tursiops truncatus)* in Slovenian and adjacent waters in the northern Adriatic Sea. It is the first systematic and long-term study of any cetaceans (whales, dolphins and porpoises) in Slovenia since 2002 and has documented the presence of a resident population of bottlenose dolphins in the area.

**Greece** Several species and areas have been surveyed more or less systematically in Greek waters (Hellenic Trench, Gulf of Corinth, Amvrakikos Gulf, Inner Ionian Sea), by dedicated surveys targeting abundance estimates (eg. in the Thracian Sea, Milani et al. 2017). Thirteen cetacean species have been recorded in Greek waters (Table 13). Six species are present year-round in all or many of the Greek Seas: striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*) and Risso's dolphin (*Grampus griseus*) (Frantzis, 2009). Two species, the harbour porpoise (*Phocoena phocoena*) and the fin whale (*Balaenoptera physalus*), have been recorded locally in all seasons and at least the former is present year round (Frantzis, 2009; Cucknell et al., 2016). Finally, the rough-toothed dolphin

(*Steno bredanensis*) has been recorded, although the available data are very limited, because of its purely pelagic nature far offshore. The remaining four species are only occasionally or rarely visiting Greek waters. The rate and location of the false killer whale (*Pseudorca crassidens*) records in this century suggest a resident population in the south-eastern Mediterranean (Kerem et al., 2016; Ryan et al., 2014), which may explain the occasional records of individuals or groups in the Greek waters. The Indian Ocean humpback dolphin has been recently recorded in Greek Seas as well. It has come in from the Red Sea or from a very small population that may have been established in the south-eastern Mediterranean (Frantzis, 2018). The humpback whale (*Megaptera novaeangliae*) and the common minke whale (*Balaenoptera acutorostrata*) of Atlantic origin through the Gibraltar Straits have rarely been recorded in the Greek waters (Frantzis et al., 2004; Frantzis, 2009).

Six species have been erroneously included in the Greek cetacean fauna in the past, due to wrong assumptions, false identifications or lack of minimal supporting evidence: white whale (*Delphinapterus leuca*), Sowerby's beaked whale (*Mesoplodon bidens*), Blainville's beaked whale (*Mesoplodon densirostris*), long-finned pilot whale (*Globicephala melas*), killer whale (*Orcinus orca*), and blue whale (*Balaenoptera musculus*) (Frantzis, 2009).

| Geographic area | Species monitored | Frequency of surveys | Main methods used to estimate abundance |
|---|---|---|---|
| **Hellenic Trench** | *P. macrocephalus*<br>*Z. cavirostris*<br>*S. coeruleoalba* | Almost yearly | Photo-identification<br>Distance sampling<br>Acoustics<br>Modelling |
| **Amvrakikos Gulf** | *T. truncatus* | Yearly | Photo-identification |
| **Inner Ionian Sea** | *T. truncatus*<br>*D. delphis* | Almost yearly | Photo-identification |
| **Corfu & Paxoi** | *T. truncatus*<br>*D. delphis* | Every 5 years | Photo-identification |
| **Gulf of Corinth** | *S. coeruleoalba*<br>*G. griseus*<br>*D. delphis*<br>*T. truncatus* | Every 2 years | Photo-identification,<br>Distance sampling |
| **Myrtoon Sea** | *P. macrocephalus*<br>*Z. cavirostris*<br>*G. griseus*<br>*S. coeruleoalba*<br>*D. delphis* | Every 5 years | Photo-identification |
| **Thracian Sea** | *P. phocoena*<br>*T. truncatus*<br>*D. delphis* | Every 7 years | Distance sampling,<br>Acoustics |

Table 13: Geographical sub-areas of the Greek Seas where cetacean species are monitored more or less systematically. The frequency is given indicatively as a rough average. The last column indicates the main methods used to estimate abundance. Methods are not the same for all species.

**Malta** has been reporting dedicated cetacean aerial and marine scientific research surveys by the Conservation Biology Research Group, University of Malta (CBRG-UM) and the Biological Conservation Research Foundation (NGO BICREF) since 1997. Both

these entities are ACCOBAMS partners. The study covers an area of over 100,000Km$^2$ in the central Mediterranean around the Maltese Islands, and has been running throughout the year to sample different seasons (Vella and Vella et al. 1998 to 2019). This long-term effort has allowed the confirmation of various species in these waters including: Bottlenose dolphins, Common dolphins, Striped dolphin, Risso's dolphins, Sperm whales, Fin whales on a regular basis, while some other species have been observed less commonly (various references by Vella and Vella with co-authors between 1998 – 2018). Such work has also collected other records of species diversity out at sea including turtles, giant devil rays, sea birds, large and migratory fish, gelatinous species and other invertebrates), while important sea-user and stakeholder participation and awareness including work with fishermen, Armed Forces of Malta and sailing crews were developed for the first time. Through such national and international scale of awareness, other research efforts at sea were set-up by a couple of other entities. In fact, Malta has subsequently seen some short-term research efforts through LIFE funding run by Birdlife and ERA, Malta. The former has reported their results in LIFE project reports that focused on seabirds, while the latter reported their results for proposed bottlenose and turtle areas of conservation. On the other side the awareness that bottlenose approach fish farms and tuna pens around these Islands have also triggered dolphin watching activities and dolphin feeding behaviours to encourage such presence in these areas for money-making targets. The latter would also need to be monitored by local authorities to avoid increasing vessel disturbance and noise in areas already exploited by fishermen, aquaculture, tuna penners and various ferries and bankering zones for large vessels. Malta (through ERA) has been reporting the setting-up and planning for the implementation of monitoring programmes for cetaceans for both the MSFD and the Habitats Directive. However, these programmes have not been implemented yet.

Through the QuietMED project, Malta (CBRG-UM) has additionally undertaken a first pilot project on noise monitoring using a state of the art passive acoustic set-up which allowed the collection of MSDF Descriptor 11 relevant sound monitoring data in the Maltese waters. This work is also providing an additional means of monitoring cetacean presence acoustically (Vella et al. 2018, 2019).

**Spain** has been reporting that a set of monitoring programmes for cetaceans has been designed and planned for the implementation of both the MSFD and the Habitats Directive. However, these programmes have not been fully implemented yet. The organisation/institutions in Spain which implement systematic monitoring of the cetacean species and their habitats are ANSE (NGO), CIRCE (NGO), TURSIOPS (NGO), EDMAKTUB (NGO), SUBMON (NGO) and University of Valencia (Regional Government). The monitoring programmes carried out by the organizations mentioned above have been funded, so far, using different sources (e.g. public and private funds, EU projects, voluntary work, etc.). Monitoring of cetacean populations already carried out depended on each management unit concerned. Spain has two sub-regional marine areas where monitoring of the cetaceans is present: the Alborán Sea/Strait of Gibraltar and the Algero-Provençal Basin. There are no species monitored together with neighbourhood

countries, although sometimes some collaboration among research teams from different countries exists. Spain does not perform monitoring in the international waters. Species of cetaceans which are are monitored in national waters are: Fin whale, Sperm whale, Orca, Long-finned Pilot whale, Cuvier's Beaked whale, Risso's dolphin, Common Bottlenose dolphin, Striped dolphin, Short-beaked Common dolphin and the Harbour porpoise. The following management units are monitored by the organizations mentioned above on a regular basis: Sperm whales in the Balearic Islands, Fin whales in the Spanish Mediterranean waters, Common Bottlenose dolphins in the Balearic islands, Common Bottlenose dolphins in the Alboran sea, Common Bottlenose dolphins in the Strait of Gibraltar, Common Bottlenose dolphins in the Mediterranean coastal waters of the Iberian Peninsula, Striped dolphins in the Spanish Mediterranean waters, Common dolphins in the Alboran Sea, Long-Finned Pilot whales in the Strait of Gibraltar, Long-Finned Pilot whales in the Alboran sea and Gulf of Vera, Killer whales in the Strait of Gibraltar, Risso's dolphins in the Spanish Mediterranean waters, Cuvier's beaked whales in the Alboran sea and Gulf of Vera. All the population units mentioned above are regularly present (resident or regular migratory populations) in the observed area.

**Mediterranean region consideration:** Large gaps in knowledge on marine species distributions are a result of heterogeneous data collection. As part of a regional-scale collaboration, Mannocci et al. (2018) assembled, for the first time, line-transect survey data collected across the Mediterranean Sea to identify gaps in the geographic, temporal, and environmental coverage of research survey effort. The objective was to evaluate the feasibility of mapping cetacean densities in the entire Mediterranean Sea by using models calibrated on available survey data and various environmental covariates. The approach gives novel insights on traditional gap analyses, solely based on spatiotemporal coverage, helps prioritise future survey efforts in the Mediterranean Sea, and is widely applicable to other marine regions and taxa; see Figure 3.

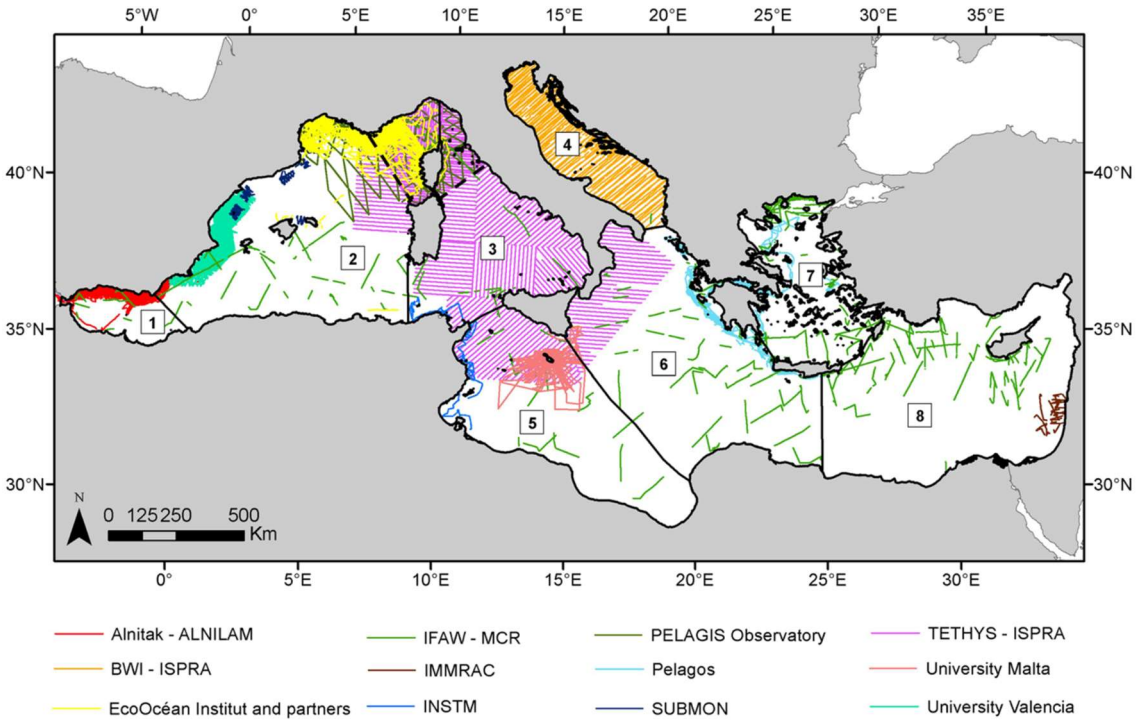


Figure 3: Line transect surveys in the Mediterranean Sea. Colours represent entities responsible for these surveys. Mediterranean subregions following Notarbartolo di Sciara (2016) and UNEP-MAP-RAC/SPA (2010)18,56: (1) Alborán Sea/Strait of Gibraltar, (2) Algero-Provençal Basin, (3) Tyrrhenian Sea/eastern Ligurian Sea, (4) Adriatic Sea, (5) Strait of Sicily/Tunisian Plateau/Gulf of Sirte, (6) Ionian Sea/Central Mediterranean, (7) Aegean Sea, (8) Levantine Sea. The location of the Pelagos Sanctuary34 is indicated with black dashed lines. Surveying entities: BWI = Blue World Institute of Marine Research and Conservation; ISPRA = Italian National Institute for Environmental Protection and Research; IMMRAC = Israel Marine Mammal Research and Assistance Center; INSTM = Institut National des Sciences et Technologies de la Mer; IFAW = International Fund for Animal Welfare; MCR = Marine Conservation Research. The map was generated with ArcGIS (http://desktop.arcgis.com/en/) (version 10.2.2) (Mannocci et all, 208).

## 3.3. Regional and sub-regional monitoring initiatives

### ACCOBAMS Survey initiative (ASI)

Project was launched in Mediterranean in June 2018. This initiative, coordinated by ACCOBAMS deploys acoustic and visual monitoring methods using five research vessels, 10 aircrafts, as well as scientific teams who will evaluate the abundance and distribution of local cetaceans (http://accobams.org/main-activites/accobams-survey-initiative-2/accobams-survey-initiative/). The research effort was undertaken once in summer 2018 and with different survey effort coverage in different parts of the Mediterranean. The South Eastern region of the Mediterranean was not covered thus still leaving gaps in research effort. The ASI therefore cannot be taken to supply the much needed detailed spatio-temporal distribution of cetaceans throughout the Mediterranean in summer and surely not in any other season. Thus national efforts still remain the most detailed contributions to cetacean presence, abundance and distribution with respective risks these species may be already facing over and above noise pollution.

# 4 Criteria for the selection of indicator species

As indicated earlier, the main goal of this report is to consider a set of cetacean species representatives at national, subregional and regional level in the Mediterranean Region in order to propose candidate species for the assessment of MSFD impulsive noise criterion (D11C1) assessment.Therefore, the following tasks were targeted:

- **Review and assess legal instruments for marine biodiversity protection with a focus on their guidance concerning cetacean species conservation**: MSFD including D1/EO1 (D3/EO3 for sensitive fish), Habitat Directive, CMS, IUCN red List, etc.;
- **Review of cetacean population monitoring projects and programmes that may provide adequate data**;
- **Assess the availability and accessibility of data about cetacean populations** at national, sub-regional and regional level;
- **Assess the available knowledge on effects of underwater noise on cetaceans**;
- **Identify factors (criteria) to select indicator species** based on previous tasks;
- **Establish a ranking table** with these factors;
- **Propose a preliminary set of cetacean species** as candidate species for the assessment of the MSFD impulsive noise criterion (D11C1).

As a result of the previous analysis, 5 criteria have been defined to consider cetacean species as representatives in the Mediterranean Sea Region:

1. Conventions / Agreements / Legal instruments. If the specie is included in any of the international convention/agreement or legal instrument.
2. Habitat Directive Art. 17 - MS Reporting (Present Species). If the specie was reported by MS.
3. ACCOBAMS National reports for species representativeness. If the specie was reported and according to occurrencel.
4. QUIETMED2 Questionnaires' national feedback on species monitoring effort were also used to score each species. The species representativeness and monitoring/research consideration in each MS.
5. Marine noise sensitivity, according to effects of impulsive noise on each specie documented in the scientific literature. Sensitivity and vulnerability to noise is one of the criteria suggested by both the ACCOBAMS/ASCOBANS/CMS JNWG and by TG-Noise.

Table 14 summarizes the main outcomes of the first three tasks, while Table 15 and Table 16: Proposed marine mammal hearing groups, applicable auditory weighting functions, genera or species within each proposed group, and the associated appendix within which available data on hearing, auditory anatomy, and sound production are reviewed (Southall et al., 2019). summarise outcomes on the various effects of noise on cetaceans. Additional summary tables or future updates of these tables may be added as future supplementary material to this Deliverable.

| | CITES | | CMS | | Bern | | IUCN Red Li | SPA BD | IMAP | ACCOBAMS | Habitat Directive | | MSFD e-reported Art. 8, 9, 10 & 11 | | | | | HD Art. 17 MS Rep. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scientific name | Annex I | Annex II | Annex I | Annex II | Annex II | Annex III | Residents | Annex II | EO 1 | Annex I | Annex II | Annex IV | MWE | MIC | MAD | MAL | ACCOBAMS Nat. Rep. | (Present Species) | Questionnaire |
| *Balaenoptera acutorstrata* | x | | | | x | | | x | | x | | x | | | | | FR "R"; EL "O"; IT "R" | | |
| *Balaenoptera borealis* | x | | x | x | x | | | x | | x | | x | | | | | | | |
| *Balaenoptera edeni* | x | | | | x | | | | | | | x | | | | | | | |
| *Balaenoptera musculus* | x | | x | | x | | | | | | | x | | | | | | | |
| *Balaenoptera physalus* | x | | x | x | x | | x | x | x | x | | x | IT | EL | EL, IT | EL | FR "O"; EL "O"; IT "O"; MT "O"; MC "C"; ME "R"; SI "O"; ES "C" | ES; FR; EL; IT; MT | IT "O"; EL "C"; ES "C"; MT "C" |
| *Delphinus delphis* | | x | x | x | x | | x | x | x | x | | x | ES, IT | EL | EL, HR, IT | EL | FR "R"; EL "C"; IT "R"; MT "R"; MC "R"; ME "R"ES "C" | ES; FR; EL; IT; MT | IT "R"; EL "C"; ES "C"; MT "C" |
| *ELampus ELiseus* | | x | | x | x | | x | x | x | x | | x | IT | | HR, IT | | FR "C"; EL "C"; IT "C"; ME "R"; ES "C" | ES; FR; EL; IT | IT "R"; EL "C"; ES "C"; MT "C" |
| *Erignathus barbatus* | | x | | | | x | | | | | | x | | | | | | | |
| *Eubalaena glacialis* | x | | x | | x | | | x | | x | | x | | | | | IT "O" | | |
| *Globicephala macrorhynchus* | | x | | | x | | | | | | | x | | | | | | | |
| *Globicephala melas* | | x | | | x | | x | x | x | x | | x | ES, IT | | | | FR "C"; IT "C"; MT "O"; MC "C"; ES "C" | ES; FR; IT | IT "C"; ES "C" |
| *Halichoerus Grypus* | | x | | x | | x | | | | | | x | | | | | | | |
| *Hyperoodon ampullatus* | x | | | | | x | | | | | | x | | | | | | | |
| *Kogia breviceps* | | x | | | x | | | | | | | x | | | | | | | |
| *Kogia simus* | | x | | | x | | | x | | x | | x | | | | | IT "R" and "O" | | |
| *Lagenorhynchus acutus* | | x | | x | x | | | | | | | x | | | | | | | |
| *Lagenorhynchus albirostris* | | x | | x | x | | | | | | | x | | | | | | | |
| *Megaptera novaeangliae* | x | | x | | x | | | x | | x | | x | | | | | FR "O"; EL "O"; IT "O"; ME "R"; SI "R" | | |
| *Mesoplodon bidens* | | x | | | x | | | | | | | x | | | | | | | |
| *Mesoplodon densirostris* | | x | | | x | | | x | | x | | x | | | | | EL "O"; IT "R" and "O" | | |
| *Mesoplodon mirus* | | x | | | x | | | | | | | x | | | | | | | |
| *Monachus monachus* | x | x | x | x | x | | | x | | x | x | x | | EL | EL | EL | EL "C"; S "O" | | |
| *Orcinus orca* | | x | | | x | | | x | x | x | | x | ES | | | | IT "R"; ES "C" | ES | ES "C" |
| *Pagophilus Groenlandicus* | | x | x | x | | x | | | | | | x | | | | | | | |
| *Phoca hispida* | | x | | | | x | | | | | | x | | | | | | | |
| *Phoca vitulina* | | x | | x | | x | | | | | | x | | | | | | | |
| *Phocoena phocoena* | | x | | x | x | | | x | x | | x | x | | | | | | EL | EL "C"; ES "C" |
| *Physeter macrocephalus* | x | | x | x | x | | x | x | x | x | | x | ES, IT | | IT | | CR "R"; FR "C"; EL "C"; IT "C"; MT "O"; MC "C"; ME "R"; SI "R"; ES "C" | ES; FR; EL; IT | IT "O"; EL "C"; ES "C"; MT "C" |
| *Pseudorca crassidens* | | x | | | x | | | x | | x | | x | | | | | EL "O"; IT "R"; MT "O" | | |
| *Stenella coeruleoalba* | | x | | | x | | x | x | x | x | | x | IT | | HR, IT | | FR "C"; EL "C"; IT "C"; MT "C"; MC "C"; ME "R"; ES "C"; SI "O" | ES; FR; EL; IT; MT | IT "R"; EL "C"; ES "C"; MT "C" |
| *Stenella frontalis* | | x | | | x | | | | | | | x | | | | | | | |
| *Steno bredanensis* | | x | | | x | | | x | x | x | | x | | | | | EL "O"; I "R"; MT "O" | | EL "C"; ES "C" |
| *Tursiops truncatus* | | x | x | x | x | | x | x | x | | x | x | ES, IT | | IT, SI | | CR "C"; FR "C"; IT "C"; MT "R"; MC "C"; ME "R"; ES "C" | CY; ES; FR; EL; HR; IT; MT; SI | IT "O"; SI "O"; CR "O"; EL "C"; ES "C"; MT "C" |
| *Ziphius cavirostris* | | | | | x | | x | x | x | x | | x | ES, IT | | HR, IT | | FR "C"; EL "C"; IT "C"; MT "O"; ME "R"; ES "C" and "O" | ES; FR; EL; IT; MT | IT "O"; EL "C"; ES "C" |

Table 14: Summary of species protected by various conventions, agreements, directives, national feedback including questionnaire (QUIETMED2) and reports.

| Type of effect | Type of anthropogenic noise | Species affected | Reference |
|---|---|---|---|
| **Physiological Non auditory** | | | |
| Damage to body tissue: e.g., massive internal haemorrhages with secondary lesions, ossicular fractures or dislocation, leakage of cerebro-spinal liquid into the middle ear, rupture of lung tissue | 1. Intense low or mid-frequency (Naval) sonar, 2. Seismic airgun arrays, 3. Explosions | Beaked whales<br>Humpback whale | Evans DL, England GR (2001)<br>Fernández, A., 2005<br>Guerra, A., 2006 |
| Induction of gas embolism (Gas Embolic Syndrome, Decompression Sickness/DCS, 'the bends', Caisson syndrome) | Intense mid-frequency (Naval) sonar | Beaked whales<br>odontocete cetaceans | Fernandez et al., 2005<br>Hooker et al., 2009<br>Jepson et al., 2003 |
| Induction of fat embolism | Intense mid-frequency (Naval) sonar | Beaked whales | Fernández et al. 2005 |
| Endochrinological stress responses | Seismic airguns | Bottlenose dolphin and Beluga (simulated) | 1Romano, T.A. et al. 2004 |
| **Auditory (Sound induced hearing loss)** | | | |
| Gross damage to the auditory system e.g., resulting in rupture of the oval or round window or rupture of the ear drum | Intense mid-frequency sonar, 2. Explosions | Beaked whales<br>Humpback whale | Evans DL, England GR (2001)<br>Ketten, D.R., Lien, J. & Todd, S. 1993 |
| Vestibular trauma e.g., resulting in: vertigo, dysfunction of coordination and equilibrium | Explosions, Air guns (naval sonar, pile driving, other sonars, drilling) | Humpback whaleSpotted dolphin | Todd, S et al. 1996<br>Gray & Van Waerebeek 2011 |
| Permanent hearing threshold shift (PTS) i.e. a permanent elevation of the level at which a sound can be detected | Air guns (modelled) | Baleen whales | Gedamke et al. 2011 |
| Temporary hearing threshold shift (TTS) i.e. a temporary elevation of the level at which a sound can be detected | Air guns (modelled),Mid-frequency sonar (simulated), | Baleen whales, Harbour porpoise<br>Bottlenose dolphin | Gedamke et al. 2011<br>Lucke, K. et al., 2009<br>Finneran, J.J. et al.,2005 |
| **Perceptual** | | | |
| Masking of communication with conspecifics | Shipping<br>Recreational vessels<br>Low-frequency sonar | Cuvier's beaked whale<br>Delphinid cetaceans<br>Killer whale (modelled)<br>Pacific humpback dolphin<br>Humpback whale | Aguilar Soto, N. et al., 2006<br>Jensen, F.QUIETMED2., 2009<br>Erbe, C. 2018<br>Van Parijs, S.M et al., 2001<br>Miller, P.J.O. et al., 2000 |
| **Behavioural** | | | |
| Stranding or beaching | Intense low or mid-frequency (Naval) sonar | Beaked whales | Frantzis, A. 1998<br>Balcomb, K. C. III et al., 2001<br>Fernández, A. et al., 2005<br>Brownell, R. L. et al., 2004<br>Wang, J.QUIETMED2. et al., 2004, 2005<br>Yang, QUIETMED2.-C. et al., 2008 |
| | | Short finned pilot whale | Ibid<br>Hohn, A.A. et al., 2006 |
| Behaviourally-mediated effects including avoidance | Acoustic deterrents,<br>Recreational vessels,<br>Over flying aircraft,<br>Explosions,<br>Bottom towed fishing gear,<br>Drilling,<br>Dredging,<br>High-frequency sonar,<br>Intense low or mid-frequency sonar,<br>Air guns,<br>Pile driving,<br>Icebreakers | Harbour porpoise<br>Bottlenose dolphin<br>Killer whale<br>Humpback whale<br>Killer whales<br>Gray Whales<br>Bowhead whales<br>humpback whales,<br>turtles, fish and squid<br>Various Cetaceans<br>Harbour porpoises | Kastelein, R.A. et al., 2006<br>Olesiuk, P.F. et al., 2002<br>Goodwin, L. et al., 2004<br>Lemon, M. et al., 2006<br>Noren, D.P. et al., 2009<br>Au, QUIETMED2. QUIETMED2. L. et al., 2000<br>Kvadsheim, P. et al., 2007<br>Tyack, P. et al., 1998<br>Ljungblad, D.K. et al., 1988<br>McCauley, R.D. et al., 2000<br>Stone, C.J. et al., 2006<br>Thomsen, F. et al., 2006 |
| Adaptive shifting of vocalisation intensity and/or frequency including cessation of calls | Shipping,<br>Recreational vessels,<br>Air guns,<br>Intense low or mid-frequency sonar, | Right whale<br>Killer whale Fin whale<br>sperm whale<br>Fin whale<br>Long finned pilot whale, | Parks, S.E. et al., 2007<br>Holt, M.M. et al., 2009<br>Watkins, QUIETMED2. QUIETMED2. 1986<br>Bowles, A.E. et al., 1994<br>(IWC/SC). 2007 |

| | | | |
|---|---|---|---|
| | coustic devices.<br>Acoustic experiments | Blue and fin whale<br>Humpback whale Sperm whale Blainville's beaked whales<br>Sperm whale<br>Humpback whale | Rendell, L.E. et al., 1999<br>Clark, C.QUIETMED2. et al., 1998<br>Clark, C.QUIETMED2. et al., 1998<br>Miller, P.J.O. et al., 2000<br>Watkins, QUIETMED2.A. et al., 1985<br>McCarthy E. et al., 2011<br>Watkins, QUIETMED2.QUIETMED2. et al., 1975<br>Risch D. et al., 2012 |
| Interruption of normal behaviour such as feeding, breeding or nursing | Recreational or other vessels,<br>Air guns,<br>intense low or mid-frequency sonar,<br>(drilling, explosions, dredging, high-frequency sonar, pile driving, shipping) | Killer whale<br>Cuvier's beaked whale<br>Sperm whale<br>Blainville's beaked whales | Lusseau, D. et al., 2009<br>Aguilar Soto, N., N. Et al., 2006 (IWC/SC). 2007<br>Miller, P.J.O. et al., 2006<br>Tyack PL et al., 2011 |
| Short-term or long-term displacement from area (habitat displacement) | Tourism vessels,<br>Acoustic deterrents,<br>Shipping and/or drilling (Bottom-towed fishing gear, dredging, air guns) | Bottlenose dolphin<br>Killer whale<br>Gray whale<br>Bowhead whale | Lusseau, D. 2004.<br>Morton, A.B. et al., 2001<br>Bryant, P.J. et al., 1984<br>Schick, R.S et al., 2000 |

Table 15: Overview of observed effects of noise on marine mammals (extract from UNEP/CBD Annex 1).

| Marine mammal hearing group | Auditory weighting function | Genera (or species) included |
|---|---|---|
| **Low-frequency cetaceans** | **LF** | *Balaenidae (Balaena, Eubalaenidae spp.), Balaenopteridae (Balaenoptera physalus, B. musculus), Balaenopteridae (Balaenoptera acutorostrata, B. bonaerensis, B. borealis, B. edeni, B. omurai; Megaptera novaeangliae), Neobalenidae (Caperea); Eschrichtiidae (Eschrichtius)* |
| **High-frequency cetaceans** | **HF** | *Physeteridae (Physeter); Ziphiidae (Berardius spp., Hyperoodon spp., Indopacetus, Mesoplodon spp., Tasmacetus, Ziphius); Delphinidae (Orcinus), Delphinidae (Delphinus, Feresa, Globicephala spp., Grampus, Lagenodelphis, Lagenorhynchus acutus, L. albirostris, L. obliquidens, L. obscurus, Lissodelphis spp., Orcaella spp., Peponocephala, Pseudorca, Sotalia spp., Sousa spp., Stenella spp., Steno, Tursiops spp.); Montodontidae (Delphinapterus, Monodon); Plantanistidae (Plantanista)* |
| **Very high frequency cetaceans** | **VHF** | *Delphinidae (Cephalorhynchus spp.; Lagenorhynchus cruciger, L. australis); Phocoenidae (Neophocaena spp., Phocoena spp., Phocoenoides); Iniidae (Inia); Kogiidae (Kogia); Lipotidae (Lipotes); Pontoporiidae (Pontoporia)* |

Table 16: Proposed marine mammal hearing groups, applicable auditory weighting functions, genera or species within each proposed group, and the associated appendix within which available data on hearing, auditory anatomy, and sound production are reviewed (Southall et al., 2019).

## 5. Scoring table and species proposal

The result of the scoring table includes the five criteria mentioned before. Each species is assigned a certain number of points according to the number of times the species appears in different declarations and studies.

For scoring table (list RESULTS) the methodology is following:

1. Conventions / Agreements / Legal instruments – if the species is included in any of the international convention/agreement or legal instrument than one point was assigned to the species for each instrument considering it important.

2. Habitat Directive Art. 17 - MS Reporting (Present Species) one point was assigned to the species if the species was reported by MS.

3&4. ACCOBAMS National reports for species representativeness and QUIETMED2 Questionnaire national feedback on species monitoring effort were also used to score each species. The species representativeness and monitoring/research consideration in each MS was categorized into three classes: common – assigned three points, occasional - assigned two points, rare - assigned one point.

5. Marine noise sensitivity, one point was assigned to each of the different types of effects of impulsive noise on each species that was found documented in the scientific literature.

The result is a sum of all the assigned points from all the categories described above.

Table 17 below, shows the number of assigned points for each category and total sum result for each species. Regular or resident Mediterranean cetacean species/populations found distributed around the region throughout are listed in yellow background. Subregional cetacean species found only in subregions of the Mediterranean, such as close to the Straits of Gibraltar or close to the Black Sea, are listed next in ochre background, and visiting cetacean species which may occasionally enter the Mediterranean Sea but have not been found to stay long are listed in blue background. For the species *Steno bredanensis* it is not possible to confirm the full extent of its distribution in the Mediterranean due to lack of data.

For regional/sub-regional purposes, this guideline can also be adapted down to national level per Country.

| Scientific name | Conventions / Agreements / Legal instruments | HD Score | ACCOBAMS National Reports | Questionnaire score | Sensitivity to impulsive noise | | Scoring result |
|---|---|---|---|---|---|---|---|
| ***Tursiops truncatus*** | 9 | 8 | 17 | 15 | 7 | Finneran, 2000; Jepson, 2003; Romano, 2004; Finneran, 2005; Mann, 2010; Henderson, 2014; Paul, 2014; Finneran, 2015; Chen, 2018; Isla, 2019 | **56** |
| ***Physeter macrocephalus*** | 9 | 4 | 20 | 11 | **7** | Watkins, 1975; Watkins, 1985; Bowles, 1994; Jepson, 2003; Miller, 2006; IWC/SC 2007; Mann, 2010; Miller, 2012; Miller, 2012 | **51** |
| ***Balaenoptera physalus*** | 9 | 5 | 17 | 11 | 4 | IWC/SC 2007; Borsani, 2008; Gedamke, 2011; Gedamke, 2011 Castellote, 2012 | **46** |
| ***Stenella coeruleoalba*** | 7 | 5 | 21 | 10 | 3 | Finneran, 2000; Jepson, 2003; Mann, 2010; Henderson, 2014 | **46** |
| ***Ziphius cavirostris*** | 6 | 5 | 17 | 8 | 8 | Frantzis, 1998; Balcomb, 2001; Evans, 2001; Jepson, 2003; Brownell, 2004; Fernandez, 2005; Wang, 2006; Yang, 2008; Hooker 2009; Mann, 2010; De Ruiter, 2013 | **44** |
| ***Delphinus delphis*** | 9 | 5 | 11 | 10 | 3 | Finneran, 2000; Jepson, 2003; Mann, 2010; Henderson, 2014 | **38** |
| ***Grampus griseus*** | 8 | 4 | 13 | 10 | 3 | Finneran, 2000; Jepson, 2003; Mann, 2010; Henderson, 2014 | **38** |
| ***Globicephala melas*** | 7 | 3 | 14 | 6 | 4 | Rendell, 1999; Jepson, 2003; Mann, 2010; Miller, 2012 | **34** |
| ***Steno bredanensis*** | 6 | 0 | 5 | 6 | 2 | Jepson, 2003; Mann, 2010 | **19** |
| ***Phocoena phocoena*** | 7 | 1 | 0 | 6 | 8 | Olesiuk, 2002; Jepson, 2003; Kastelein, 2006; Thomsen, 2006; Lucke, 2009; Mann, 2010; Tougaard, 2012; Siebert, 2013; Pirotta, 2014; Kastelein, 2015 | **22** |
| ***Orcinus orca*** | 6 | 1 | 4 | 3 | 5 | Morton, 2001; Jepson, 2003; Kvadsheim, 2007; Mann, 2010; Miller, 2012; Miller, 2012; Kastelein, 2015 | **19** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Megaptera novaeangliae*** | 6 | 0 | 8 | 0 | 9 | Ketten, 1993; Ketten, 1995; Todd, 1996; Clark, 1998; McCauley, 2000; Miller, 2000; Gedamke, 2011; Risch, 2012 | **23** |
| ***Mesoplodon densirostris*** | 5 | 0 | 5 | 0 | 10 | Frantzis, 1998; Balcomb, 2001; Evans, 2001; Jepson, 2003; Brownell, 2004; Fernandez, 2005; Fernández, 2005; Wang, 2006; Yang, 2008; Hooker 2009; Mann, 2010; McCarthy, 2011; Tyack, 2011; Pirotta, 2012 | **20** |
| ***Pseudorca crassidens*** | 5 | 0 | 5 | 0 | 0 | | **10** |
| ***Balaenoptera acutorstrata*** | 5 | 0 | 4 | 0 | 0 | | **9** |
| ***Eubalaena glacialis*** | 6 | 0 | 2 | 0 | 0 | | **8** |
| ***Kogia simus*** | 5 | 0 | 3 | 0 | 0 | | **8** |

Table 17: Scoring table toward selecting suitable candidate species targeted by D5.1 QUIETMED2.

**Legend:**

| |
|---|
| MEDITERRANEAN SPECIES |
| SubRegional MED SPECIES |
| Visiting MED SPECIES |
| Lack of data |

## 6. Conclusion and directions

After assessing the knowledge and its application in legal instruments, policymaking, conservation status ranking and risks due to noise pollution for each cetacean species found to be found in the Mediterranean, it became possible to suggest candidate species as indicators requiring monitoring for GES - D11 over and above the GES – D1.

From Table 18, such candidates include:

- The **Bottlenose Dolphin** (*Tursiops truncatus*) is a species needing protection in shallower coastal waters in the Mediterranean and found to be a suitable flagship and umbrella species also in its role in promoting noise pollution avoidance in this habitat and in areas of the Mediterranean where biodiversity and its risks are high. Literature also clearly indicates the vulnerability of this species to both noise and vessel traffic, which would therefore add more risks to the survival of this species where many other sources of impacts are found such as other forms of pollution, impoverishment of prey resources, exposure to alien species and climatic changes effects and increasing disturbance from tourism.

- The **Sperm Whale** (*Physeter macrocephalus*) is a vulnerable species that inhabits deep waters and pelagic habitat offshore and is therefore found to be particularly susceptible to suffer from noise pollution that has been reaching this habitat dramatically altering the conditions in which the species may hunt and communicate.

- The **Fin Whale** (Balaenoptera physalus) is endangered under the Endangered Species Act since 1970 as well as under the IUCN Red List since 1996. Increasing levels of low frequency ambient noise from shipping, seismic exploration, and military sonar have been identified, through research and new data, as a major threat to the recovery of Fin whales in Mediterranean sea, as it may mask their vocalizations and displace them from their critical habitat.

- The **Cuvier's Beaked Whale** (*Ziphius cavirostris*) similarly has been noted to suffer from harsh marine acoustic conditions affecting its habitat and communication apart from directly affecting the species' health and survival. The increasing number of strandings of this elusive and Data deficient species stresses the need to consider its vulnerabilities in the Mediterranean.

- The **Striped dolphin** (Stenella coeruleoalba) the Mediterranean subpopulation of Striped Dolphins is currently listed as Vulnerable on the

IUCN Red List because of a suspended population decrease of> 30% that has occurred over the last three generations. It occurs mainly offshore and, when found close to land, usually in deep water. It is a very social species; school sizes range from a few tens to a few thousand. For all, that reason literature indicates that species are under much greater threat of impulsive underwater noise coming from the ground and offshore exploitations and sonar investigations.

Additionally, other endangered species populations, such as the **Common dolphin** (*Delphinus delphis)*, side by side with species rated by IUCN as Data deficient, such as **Risso's dolphins** (*Grampus griseus*), also deserve consideration and should be included as additional candidates wherever these species are found at national to subregional scales as well. Besides the species that were provided by the JRC shown earlier in table 2, there is another species *Phocoena phocoena* that is a permanent resident in part of the Greek waters (Thracian Sea) and it is also listed in the IUCN Red List.

On the opposite western end of the Mediterranean close to the Straits of Gibraltar, *Orcinus orca* is limited to that subregion.

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