April 2023

Task 2.3 Technical Report – Common approach to the assessment of cetaceans in the Bay of Biscay and Iberian Coast

CetAMBICion

Coordinated Cetacean Assessment,
Monitoring and Management Strategy in the
Bay of Biscay and Iberian Coast sub-region

Workpackage 2

Drafted by:

DGRM DIRECTORATE-GENERAL FOR NATURAL RESOURCES, SAFETY AND MARITIME SERVICES

Published in the framework of the CetAMBICion project:

Coordinated Cetacean Assessment, Monitoring and Management Strategy in the Bay of Biscay and Iberian Coast sub-region (CetAMBICion).

The CetAMBICion project, coordinated by the Spanish National Research Council (CSIC) and which includes 15 partners from Spain, France and Portugal, aims to strengthen collaboration and scientific work between the three countries to estimate and reduce cetacean bycatch in the sub-region Bay of Biscay and Iberian Coast, in close collaboration with the fishing industry. Until 2023, the project will work to improve scientific knowledge on population abundance, incidental bycatch and on mitigation measures of the latter.

The project is part of the European Commission's DG ENV/MSFD 2020 (Marine Strategy Framework Directive) call and the objectives are aligned with the Habitats Directive and the Common Fisheries Policy.

DOCUMENT CONTROL SHEET

Project	CetAMBICion
Title	Coordinated Cetacean Assessment, Monitoring and Management strategy in the Bay of Biscay and Iberian Coast sub-region
Reference	GA No. 110661/2020/839610/SUB/ENV.C2
Coordinator	CSIC
WP	WP2
WP title	Coordinated sub-regional assessment, GES determination and monitoring strategy for cetaceans
Task	2.3
Task title	Common approach to threshold values, integration rules and GES determination
Document Type	Technical report
Document number	-
Document Name	Common approach to the assessment of cetaceans in the Bay of Biscay and Iberian Coast
Date prepared	05.04.2023
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TABLE OF CONTENTS

TABLES

FIGURES

GLOSSARY

Assessment area	the area within which an assessment of the environmental status of an ecosystem, or ecosystem component and a pressure element takes place. The assessment area is specified based on the geographic scale of assessment described in the GES Decision. For MSFD reporting purposes, the results for an assessment area are reported for a particular Marine Reporting Unit.
Assessment unit	assessment units can be understood as assessment areas and are defined areas for the purpose of carrying out assessment. The shape and size of assessment units will vary by assessment (OSPAR Agreement 2019-02).
Criteria element	elements of an ecosystem, particularly its biological elements (species, habitats and their communities), or aspects of pressures on the marine environment (biological, physical, substances, litter and energy), which are assessed under each criterion.
Ecosystem-based approach	is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the goods and services humans want and need (COM 2020 (259) final: pp. 3).
Favourable Reference Population	population size (abundance) in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species; favourable reference value must be at least the size of the population when the Habitats Directive came into force.
Impact	Adverse effects on the environment which are caused by pressures from human activities (i.e. resulting from these pressures) and by implication can be measured as changes in environmental state.
Indicator	in general, consists of one or several parameters chosen to represent ('indicate') a certain situation or aspect and to simplify a complex reality; for the legal purposes of the MSFD, the term 'indicator' refers only to

	environmental targets (Article 10), where they are used to monitor progress and guide management decisions achieve these targets (MSFD Annex IV: (7)); for the reporting purposes of MSFD the ‘indicator’ schema is applicable to indicators used for Article 8 assessments (including pressure and socio-economic indicators) and to indicators related to Article 10 targets (to show progress towards achievement of the targets)
Integration	combining of assessment information across different assessment aspects (e.g., combining information from two or more criteria or underlying indicators).
Minimum viable population	minimum viable population size refers to the minimum population size at which a population is likely to persist over some defined period of time with a given probability of extinction (Bijlsma *et al.* 2019).
Parameter	Physicochemical, biological or ecological characteristics monitored and assessed to estimate an indicator.
Pressure	Pressure, in the sense of the Driver-Pressure-Impact-State-Response (DPSIR) framework and MSFD, is an input, alteration or extraction, in relation to natural conditions, of physical, chemical or biological elements or properties which results directly from human activities. The pressure can be measured at its source (i.e. close to the activity generating it) or away from its source in the different parts of the environment (land, air, water, sea). When the pressure is sufficiently intense, widespread or frequent it can lead to environmental impacts (adverse effects) on particular aspects of natural ecosystems.
State	in the context of the DPSIR framework and MSFD, refers to the quality/condition of species/habitat/ecosystem elements. This can be determined through measurements in the environment of relevant parameters for such elements; such measurements, by definition, will reflect any impacts (individual and cumulative) to which the element has been subjected.
Threshold value	value or range of values that allow(s) for an assessment of the quality level achieved for a particular parameter,

	thereby contributing to the assessment of the extent to which good environmental status is being achieved.

LIST OF ACRONYMS

ABI	Bay of Biscay and the Iberian Coast sub-region
ACCOBANS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
Bern Convention	Convention on the Conservation of European Wildlife and Natural Habitats
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
CITES	Convention on Trade in Endangered Species of Wild Fauna and Flora
ES	Spain
EU	European Union
FR	France
GES	Good Environmental Status
GES Decision	Commission Decision (EU) 2017/848, of 17 May 2017
HD	Habitats Directive
ICES	International Council for the Exploration of the Sea
IUCN	International Union for Conservation of Nature and Natural Resources
IWC	International Whaling Commission
MS	Member States
MSFD	Marine Strategy Framework Directive
MU	Management Unit
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PT	Portugal
WGBYC	Working Group on Bycatch of Protected Species
WGMME	Working Group on Marine Mammal Ecology

EXECUTIVE SUMMARY

The CetAMBICion project sets up a cooperative working structure that brings together the MSFD, Natura 2000 and Fisheries competent authorities of Portugal (PT), Spain (ES) and France (FR), as well as scientific experts, to agree on a coordinated GES assessment and monitoring scheme for cetaceans in the sub-region of the Bay of Biscay and the Iberian Coast (ABI). This deliverable document the common approach developed by the three MS to assess cetaceans in the ABI sub-region.

Chapter 2 summarizes the approach taken to review scientific and legal information about species and criteria. The initial step consisted in selecting a list of species that represented each group of cetaceans and which are currently assessed under the MSFD. **Chapter 3** consists of species information sheets that compile information about the legal and conservation status, distribution, abundance, ecology, and key pressures of the 10 species selected. An extensive review of the data available at regional and national scales, current assessment methodologies, and protocols was undertaken for all criteria and species selected, which is described in **Chapter 3.1**. The methods and data that showed the most potential and/or have been used extensively in other regional assessments were described in more detail. When possible, for each group of species a broad discussion of challenges and considerations was given. **Chapter 3.2** focused on the assessment of GES for the criteria and species selected and identified common indicators and assessment methodologies that will be used in the coordinated approach in the ABI. In the context of the ABI, the use of several integration rules was evaluated and the most appropriate was selected. Information and methods presented in all these chapters were discussed in two workshops conducted under CetAMBICion project and their results are shown in **Chapter 4**.

Cetaceans are long-lived animals, with complex social lives and occurrence, and are highly mobile, crossing jurisdictional boundaries. Because of these aspects, cetaceans require long-term datasets to monitor their populations as well as efforts for international cooperation for management and conservation. The success of the implementation of a common approach to the assessment of cetaceans in the Bay of Biscay and Iberian Coast will be dependent on the close sharing of information and developments in methodologies among all MS.

1. INTRODUCTION

Cetaceans are widely distributed across European Atlantic waters occurring in coastal, shelf, deep and pelagic habitats. Because of their high mobility, cetaceans cross jurisdictional boundaries and their conservation and management require international cooperation. Despite being protected by international, European Union (EU) and national legislation, namely via the Habitats Directive (HD) and the Marine Strategy Framework Directive (MSFD), this highly vulnerable group is under pressure, particularly, from fishing, pollution and noise (Avila *et al.* 2018). Under the MSFD, Commission Decision 2017/848 (hereafter GES decision) lays down the criteria and methodological standards to assess Good Environmental Status (GES) of marine waters and of three cetacean groups of species: small toothed cetaceans, deep-diving toothed cetaceans and baleen whales. It sets common requirements across marine regions but the list of indicators and criteria to be assessed and thresholds to be applied are to be established through regional or sub-regional cooperation.

The CetAMBICion project sets up a cooperative working structure that brings together the MSFD, Natura 2000 and Fisheries competent authorities of Portugal (PT), Spain (ES) and France (FR), as well as scientific experts, to agree on a coordinated GES assessment and monitoring scheme for cetaceans in the sub-region of the Bay of Biscay and the Iberian Coast (ABI). Under Task 2.2 of Work Package 2 (WP2), the project aims to agree:

- On a list of species (and management units) representative of each species group for the ABI, considering the scientific and practical criteria established in the GES Decision.
- For each species selected, which criteria are relevant and appropriate to assess.
- On indicators to assess the status of the criteria selected for each species, as well as their ecologically relevant assessment areas, considering the habitat preferences, distribution, and population structure.

The indicators and assessment methodologies selected and integration rules for the assessment process, at the different levels are addressed under Task 2.3.

To inform both tasks, a review of the species selected, and assessment methodologies used by each MS in the update of MSFD article 8 was undertaken, as well as of the available guidance on the subject produced under OSPAR, MSFD and the HD, which was delivered under WP1 (see Deliverable 1.01). Building on this work and further reviewing the available methods and data in workshops with expert teams and competent authorities of all three MS, CetAMBICIon project aims to reach a common approach to the assessment of cetaceans in the ABI sub-region. For this purpose, a summary of the most relevant and recent information for each species identified under WP1, as well as on the main methodologies and data available for each criterion (abundance, demographic characteristics, distribution and habitat use), focusing as much as possible on information from the sub-region, is compiled (chapter 3). This background information was the basis for discussion at two workshops (WK2.1 and WK3.1) for which results are presented (chapter 4). Finally, conclusions and suggestions for further work are provided considering the background information compiled, workshop outcomes and identified gaps (chapter 5).

2. STRUCTURE AND METHODOLOGY

Information sheets (Chapter 3.1.) were produced for each of the following species previously identified as potentially relevant to assess GES of marine waters in the ABI sub-region (see Deliverable 1.01):

- **small toothed cetaceans:** harbour porpoise, short-beaked common dolphin, bottlenose dolphin, striped dolphin and killer whale;
- **deep-diving toothed cetaceans:** Cuvier's beaked whale, long-finned pilot whale, Risso's dolphin and sperm whale;
- **baleen whales:** fin whale and minke whale.

The first section of the information sheet identifies the legal protection in place for each species, providing a general assessment of the level of threat they face (conservation status and inclusion in Annexes are based on scientific information about declines and level of threat). The international and EU legislation reviewed include:

- **Habitats Directive** (92/43/EEC) which aims at ensuring the Favourable Conservation Status of the species in its Annexes:
  - Annex II - lists the species for which special areas of conservation (SACs) need to be designated to protect particularly important habitats for the species and contribute to achieving/maintaining Favourable Conservation Status (FCS).
  - Annex IV - lists the species and sub-species for which a strict protection regime must be applied across their entire natural range within the EU, both within and outside Natura 2000 sites.

- **Convention for the Protection of the Marine Environment of the North-East Atlantic** (OSPAR) which aims to prevent and eliminate pollution and shall take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected.

- **Convention on the Conservation of Migratory Species of Wild Animals** (Bonn Convention) which lays the legal foundation for internationally coordinated conservation measures throughout the migratory range of species:
  - Appendix I: lists migratory species which are endangered and must be protected by Parties by conserving or restoring the places where

    they live, mitigating obstacles to migration and controlling other factors that might endanger them.
    - Appendix II: lists migratory species which have unfavourable conservation status and which require international agreements for their conservation and management, as well as those which have a conservation status that would significantly benefit from the international cooperation that could be achieved by an international agreement.

The Convention encourages the Range States to conclude global or regional agreements. Two of these agreements for the protection of cetaceans include ABI sub-region waters:

1. **Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas"** (ASCOBANS): agreement to achieve and maintain a favourable conservation status for small cetaceans meaning any species, subspecies or population of toothed whales (Odontoceti), except the sperm whale (*Physeter macrocephalus*)
2. **Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area** (ACCOBAMS): agreement to preserve all species of cetaceans and their habitats within the aforementioned geographical area by the enforcement of more stringent measures than those defined in the texts adopted previously.

- **Convention on the Conservation of European Wildlife and Natural Habitats** (Bern Convention) which is a regional Convention aiming to conserve wild flora and fauna and their natural habitats and to promote European cooperation in this field. Relevant annexes include:
    - Appendix II - Strictly protected fauna species;
    - Appendix III - Protected fauna species.

- **Convention on International Trade in Endangered Species of Wild Fauna and Flora** (CITES) which aims to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.
    - Appendix I: species threatened with extinction that are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances;

    - Appendix II: (a) all species which, although not necessarily now threatened with extinction, may become so unless trade in specimens of such species is subject to strict regulation to avoid utilization incompatible with their survival; and (b) other species which must be subject to regulation so that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.

- **International Convention for the Regulation of Whaling** (ICRW), which established the International Whaling Commission (IWC), to develop a system of international regulations to manage whale fisheries, protect whales from overhunting and promote whale conservation. Recently, new issues have started to be addressed such as reducing bycatch, entanglement, ocean noise, chemical pollution, marine litter, ship strikes, and promoting sustainable whale watching.

Each species information sheets summarize relevant information regarding species distribution, abundance, ecology, and key pressures compiled from scientific literature, including journal articles, regional and national reports, and grey literature. For the “**distribution and abundance**” section, available literature was reviewed to obtain a description of the typical occurrence pattern and a qualitative assessment of overall abundance. Regional abundance and distribution data and estimates currently available from the large-scale surveys undertaken in European Atlantic waters were considered: SCANS-II in July 2005, which surveyed shelf waters (Hammond *et al.* 2013); CODA in 2007, which surveyed offshore waters (CODA 2009); and SCANS-III in 2016, which surveyed both shelf and offshore waters (Hammond *et al.* 2021b). Specific characteristics of population structure, habitat, feeding, and behavioural preferences are provided in the **“ecology”** section. In this report, two main terms of divisions of the species are used: 1) the term “population”, which is based on the broad definition of the IUCN of a “group of individuals of the same species living in a particular geographic area” (IUCN 2019, van Dyke 2008), and 2) "assessment unit” (AU). According to ICES and the QSR2023 Guidance from OSPAR, AUs are areas defined by genetic and ecological data of each species where an assessment of indicators is carried out (OSPAR 2019, ICES 2014a). For the species selected for GES assessment, ICES advises using the term “assessment unit” instead of “management unit” because of the uncertainty of its definition, given the use of political boundaries and/or management limits (ICES 2014a). Figures 16 to 22 of Deliverable 1.01 show the AUs established for some of the species selected. Lastly, for the **“key pressures”** section, the main anthropogenic activities and pressures were identified based on the review of the ICES ‘Threat Matrix’ developed based on work from ICES Working Group on Marine Mammal Ecology (WGMME) in 2019 (ICES 2019a).

Both the “distribution and abundance” and “ecology” sections also inform, to some extent, about data availability and feasibility and costs of monitoring, based on the knowledge and experience of the scientific teams from each MS that attended the WK2.1.

Under Chapter 3.2., and to identify the most adequate methodology to monitor and assess each criterion and species, the most used and effective methodologies to collect data are described and a list of examples of estimates based on different methods is provided.

3. Reaching a common approach to the assessment of cetaceans in the Bay of Biscay and Iberian Coast: background information

3.1. Species information sheets

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Harbour porpoise (*Phocoena phocoena*)

Legal Status	**Habitats Directive:** Annexes II and IV	
	CITES: Appendix I	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix II (concerted Action for the harbour porpoise in the Baltic sea and the Iberian Peninsula)	
	ASCOBANS: yes	**ACCOBAMS**: yes

Distribution & Abundance	Although harbour porpoise was one of the most abundant species in the European Atlantic waters when considering the entire study area surveyed during SCANS-III, the ABI sub-region showed some of the lowest abundance levels for this species, with sightings mostly recorded in Portuguese waters (Hammond *et al.* 2021). A recent study that analysed harbour porpoise abundances in Portugal confirms the low abundance rates of porpoises obtained in SCANS-III for the AB block and highlights the importance of the western Iberian coast to the Iberian porpoise population (Torres-Pereira et al. 2022a). Its cryptic and elusive behaviour and small group sizes (Carwardine 2019) can difficult visual detection.

Ecology	In the ABI sub-region, two distinct subspecies/ecotypes of harbour porpoises are proposed (Figure 1): 1) ***Phocoena phocoena phocoena***, which is continuously distributed in the European continental shelf waters from the northern Bay of Biscay up to the Arctic waters of Norway and Iceland (NAMMCO 2019); and 2) ***Phocoena phocoena meridionalis,*** proposed by Fontaine *et al.* (2014), which inhabits upwelling zones in the southern waters of the Northeast Atlantic off the coasts of Iberia and Mauritania. The new proposed subspecies/ecotypes are based on genetic evidence (Fontaine *et al.* 2014), morphological differences (Read 1999, Donovan & Bjørge 1995, Smeenk *et al.* 1992), and habitat preferences (Méndez-Fernandez *et al.* 2013, Pierce *et al.* 2010, Pinela *et al.* 2010). However, until now, no formal description has been made for the southern subspecies/ecotype (Pierce *et al.* 2020). A hybrid zone in the Bay of Biscay exists between the two ecotypes, with a sharp transition from one ecotype to the other (NAMMCO 2019). The proposed new ecotype may comprise two distinct populations, one in the Iberian waters and the other in Mauritanian waters, with a degree of mixture between them, but none with the northern ecotype (Chehida *et al.* 2021). Under the ASCOBANS, Evans & Teilmann (2009) have suggested, for the French coast of the Bay of Biscay, a separate AU from the Celtic and Irish Seas, because of a small population occurring year-round (Ridoux, pers. comm.).

Read *et al.* (2018) submitted a document to the 24th ASCOBANS Advisory Committee requesting the Iberian harbour porpoise to be listed as a separate population and included in Appendices I and II of the Convention on Migratory Species (CMS).

For conservation management purposes in the ABI sub-region, these two ecotypes should be assessed as two distinct AUs: 1) Celtic and Irish Seas (including French Atlantic waters), and 2) Iberian Peninsula (OSPAR 2017a, ICES 2014b, 2013). However, the two ecotypes cannot be distinguished from ship or aerial surveys.

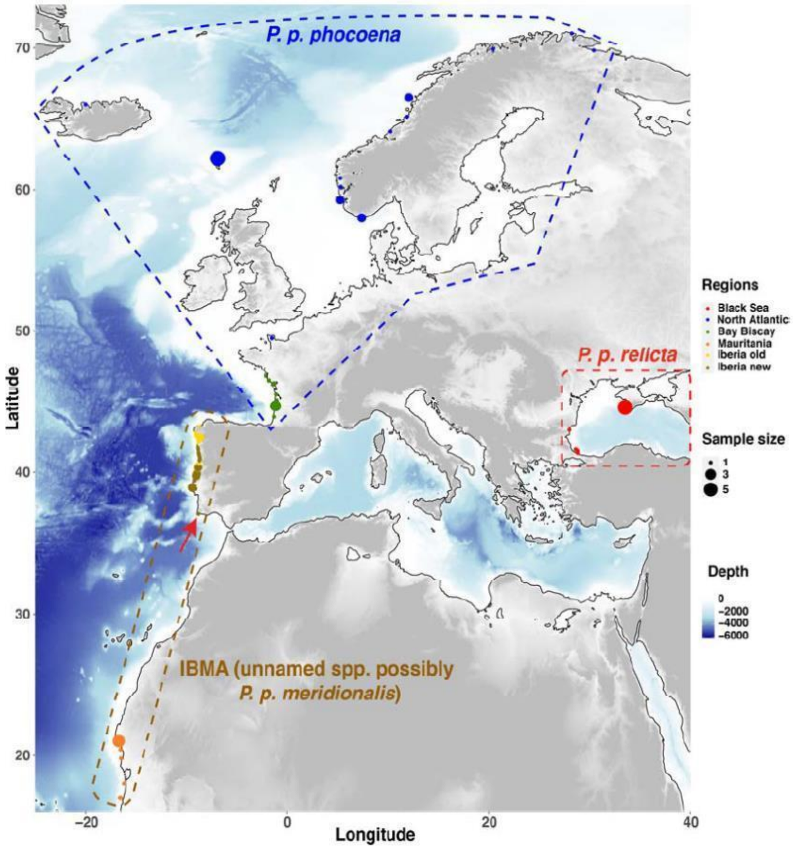

Figure 1. Map showing the sampling locations and sample sizes used for genetic analysis and divisions of harbour porpoises. Geographic locations are based on approximate GPS coordinates or reported discovery locations. From Chehida *et al.* (2021).

Red List	European: ‘**Vulnerable**’ (IUCN 2007a); Global: ‘Least Concern’ (Braulik *et al.* 2020)
MSFD	**MSFD latest assessment (countries):** FR, NOR-ES and PT
Key pressures	Based on the ICES ‘Threat Matrix’ (ICES 2019a), the main threats of harbour porpoises in the Bay of Biscay and the Iberian Peninsula are: a) **bycatch,** due to their coastal distribution thousands of individuals are killed accidentally by commercial fisheries, threatening local populations to a level that is still hard to quantify, but which is likely unsustainable in some areas (e.g. Pierce *et al.* 2020); Between 2000 and 2020, in Portugal and Galicia, individuals stranded due to confirmed

🟥	bycatch represented 46.98% of all analysed porpoises, and individuals stranded due to probable bycatch represented another 10.99% of all analysed porpoises (Torres-Pereira *et al.* 2022b); b) **contaminants**, which affect harbour porpoises by causing immunological and reproductive effects (Jepson *et al.* 2016). NAMMCO (2019) proposed that harbour porpoises should be used as a pollutant indicator species within Descriptor 8 of the MSFD; and c) **prey depletion**, because harbour porpoises have an intense foraging strategy throughout the day, hunting up to 550 small preys per hour (Wisniewska *et al.* 2016). Changes in harbour porpoise prey stocks have been observed in several areas of the North Atlantic, suggesting a medium threat level (ICES 2019a). In Iberia, harbour porpoises showed high levels of PCB and Hg when compared with most porpoise studies in the Northeast Atlantic (Ferreira *et al.* 2016, Méndez-Fernández *et al.* 2014a,b). ICES WGMME (ICES 2009) recommended that a high conservation priority should be given to the Iberian population, as a consequence of its "presumed small population size, low genetic diversity and likely susceptibility to habitat degradation". Genetic evidence shows a rapid decline in the population size of the Iberian population (Chehida *et al.* 2021). The provisional threshold value for anthropogenic removals for this population put forward by the OSPAR Marine Mammal Expert Group is zero (ICES, 2021). The IWC Scientific Committee recommended immediate actions to effectively reduce, and where possible eliminate, bycatch of harbour porpoise throughout Iberian Peninsula waters with particularly urgency for gillnets and trammel nets but also for beach seines along the Portuguese coast in areas of high porpoise density (IWC, 2022).

Short-beaked common dolphin (*Delphinus delphis*)

Legal Status	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix I	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS:** yes

Distribution & Abundance	The short-beaked common dolphin, hereafter common dolphin, is one of the most widespread and abundant cetacean species in the North Atlantic Ocean, occurring in the continental shelf and offshore waters (Murphy *et al.* 2021). When considering the entire SCANS-III survey area, it was the second most abundant species, after the harbour porpoise (Hammond *et al.* 2021b). However, in the ABI sub-region, the common dolphin is the most abundant species, with sightings covering evenly the coastal regions of the three MS (Hammond *et al.* 2021b).

Ecology	The distribution of the common dolphin has been modelled with geographic, physiographic, oceanographic and fishing-related variables, and several studies have identified well-defined habitat preferences related to the abundance of prey. Common dolphins have been associated with productive areas (i.e., upwelling regions), with low to medium sea-surface temperatures, mostly coastal and shallow, but often deeper waters, and/or areas that concentrate their preferred prey (e.g., Correia *et al.* 2019a, Halicka 2016, Tobeña *et al.* 2016, Goetz *et al.* 2014, Moura *et al.* 2012, Pierce *et al.* 2010, Cañadas & Hammond 2008). Their patchy distribution suggests that common dolphins, although widely distributed, have a well-defined habitat and they may be dietary specialists in the sense of feeding on schooling fish (Marçalo *et al.* 2018, Moura *et al.* 2012). Cranial morphometric and genetic analysis indicate that common dolphins constitute one large population in the NE Atlantic, ranging from Scotland to Portugal (Moura 2010, Murphy *et al.* 2009, Natoli *et al.* 2006). However, the sampling of individuals for genetic and cranial morphometric assessment has been done mostly from the continental shelf and slope waters and sampling in oceanic waters of the Bay of Biscay has been limited (Murphy *et al.* 2013). As a consequence of the low genetic differentiation over the North Atlantic, common dolphins are viewed as a single AU (OSPAR 2017a, ICES 2014a, 2013).

Red List	European: **'Data deficient'** (IUCN 2007b); Global: 'Least Concern' (Braulik *et al.* 2021)
MSFD	**MSFD latest assessment (countries):** ES, FR, and PT
Key pressures	The 'threat matrix' developed by ICES WGMME (2019) indicates **bycatch** in fishing gear as the most important threat to

🟥	common dolphins in the Celtic Seas and Bay of Biscay/Iberian Peninsula areas (Murphy *et al.* 2021, ICES 2019a). In the Bay of Biscay, bycatch has been suggested to have reached unsustainable levels, inconsistent with the maintenance of common dolphin populations at a favourable status (Peltier *et al.* 2016). In 2020, ICES recommended emergency measures to prevent the bycatch of common dolphins in the Bay of Biscay (ICES 2020). **Contaminants** are also indicated as a threat to the common dolphin (Murphy *et al.* 2021, ICES 2019a).

Bottlenose dolphin (*Tursiops truncatus*)

Legal Status	**Habitats Directive:** Annexes II and IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix II	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS:** yes

Distribution & Abundance	The bottlenose dolphin is a cosmopolitan species that occurs throughout the tropical and temperate seas, from coastal to offshore waters (Reynolds *et al.* 2000). During the SCANS-III surveys, bottlenose dolphins were not as common as other small toothed cetaceans (Hammond *et al.* 2021b), possibly because of their limited home-ranges, social structure and coastal preferences. However, in the same year as SCANS-III (2016), the survey ObSERVE recorded many sightings of the species in Irish waters, making it the most frequently sighted cetacean species in the area (Rogan *et al.* 2018). Sightings in the ABI sub-region in SCANS-III were mostly found in the coastal waters of France (Hammond *et al.* 2021b).

Ecology	Bottlenose dolphins are grouped in a fission-fusion society with individuals associating with one another for varying lengths of time. Two ecotypes of the species have been distinguished across the oceans, including the northeast Atlantic, based on genetic, morphological and ecological evidence (Louis *et al.* 2021): a coastal ecotype and an offshore ecotype (Wells & Scott 2018, Louis *et al.* 2014a,b, Torres *et al.* 2003). Each ecotype shows different ecologies, food preferences and movement patterns (Perrin *et al.* 2011, Curry & Smith 1998, Hoelzel *et al.* 1998, Mead & Potter 1995, Walker 1981). Offshore bottlenose dolphins inhabit waters over the outer continental shelf and shelf break (Certain *et al.* 2008, Reid *et al.* 2003) while coastal populations tend to stay in smaller areas close to shore, demonstrating varying levels of site fidelity, i.e., a tendency to return to a previously visited area or to remain in an area for extended periods of time. Close coastal populations of bottlenose dolphins can also show genetic differentiation that may be related to habitat borders preferences (Wiszniewski *et al.* 2009, Bilgmann *et al.* 2007, Natoli *et al.* 2005), sex-biased linked dispersal (Wiszniewski *et al.* 2010, Bilgmann *et al.* 2007, Möller *et al.* 2004), niche specialisation (Louis *et al.* 2014a), anthropogenic activities (Chilvers & Corkeron 2001), and to isolation by distance without apparent boundaries separating populations (Rosel *et al.* 2009, Krützen *et al.* 2004). As a result, bottlenose dolphins tend to be subdivided into small discrete coastal populations residing relatively close to shore and a much larger wide-ranging offshore population. The relationships both within and between those coastal and offshore

	populations often remain unclear (Louis *et al.* 2014b, Richards *et al.* 2013, Toth *et al.* 2012, Rosel *et al.* 2009). ICES has identified several small separate coastal units and one large and wide-ranging offshore population in European waters (ICES 2016, 2014a), as a result of a combination of spatial separation, lack of photo-identification matches and genetic differences (ICES 2014b). In the ABI sub-region, there is one offshore AU, and four recognized coastal AUs: Northern Spain, Southern Galicia Rias, Coastal Portugal and Gulf of Cadiz (ICES 2016, 2014a). There is no coastal AU on the French coast of the ABI sub-region and bottlenose dolphins are assessed as a single unit. ICES acknowledges that it is likely that the number of coastal AUs will change with more information in the future (ICES 2016).

Red List	European: **'Data deficient'** (IUCN 2007c); Global: 'Least Concern' (Wells *et al.* 2019)
MSFD	**MSFD latest assessment (countries):** ES, FR, and PT
Key pressures	According to the ICES WGMME 'threat matrix' developed, bottlenose dolphins are susceptible to **contaminants**, especially the coastal units (ICES 2019a). In continental Portugal, bottlenose dolphins showed high levels of Hg (Monteiro *et al.* 2016. Coastal bottlenose dolphins exposed to high levels of contaminants can show health issues and reproductive failure (Jepson *et al.* 2016, 2013). Incidental **bycatch** of both offshore and coastal bottlenose dolphins through entanglement in fishing gear (mainly gillnets and pelagic trawls) also requires careful consideration (ICES 2015a, b). Off the coasts of northern Spain (Galicia, Asturias, Cantabria and Basque Country), west Portugal, and SW Spain (Andalucia), incidental bycatch is high and potentially unsustainable (ICES, 2015a, Goetz *et al.* 2014, Vázquez *et al.* 2014, Vélez 2014, López *et al.* 2012, 2003). Changes in **prey availability** as a result of fishing activities can also affect coastal bottlenose dolphin units (ICES 2019, 2015c). **Disease**, particularly viral infections (dolphin morbillivirus, herpesvirus) with concomitant toxoplasmosis and other zoonoses may be an important pressure in the Iberian coast (Bento *et al.* 2019, 2016). In coastal areas, **human disturbance** caused by recreational activities (including commercial dolphin watching), may affect populations in the short- and long-term (Norman *et al.* 2015, Pirotta *et al.* 2015, 2014, Feingold & Evans 2014, Bejder *et al.* 2006, Bejder & Samuels 2003).

Striped dolphin (*Stenela coeruleoalba*)

Legal Status	**Habitats Directive**: Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix II	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS**: yes

Distribution & Abundance	In the SCANS-III survey area, the striped dolphin was the third most sighted species and sightings in the ABI sub-region were recorded mostly in the offshore waters of the Bay of Biscay (Hammond *et al.* 2021b).

Ecology	The striped dolphin is distributed in tropical to warm temperate waters and is commonly found in deep waters off the continental shelf (Jefferson *et al.* 1993), often associated with upwelling areas or convergence zones, where the associated high productivity creates favourable feeding opportunities (Balance *et al.* 2006, Archer II 2002). Striped dolphins may also be found in coastal areas where deep waters come close to shore. The dietary plasticity of the striped dolphins varies depending on the foraging areas being used, eating only oceanic prey taxa (Ringelstein *et al.* 2006) if foraging in oceanic waters; or including oceanic, neritic, and coastal prey species in their diet if they move around different types of areas (Marçalo *et al.* 2021, Santos *et al.* 2008, Spitz *et al.* 2006). Differences in morphological characteristics and very low gene flow among sampled individuals from the eastern North Atlantic and the Mediterranean suggest there are two well-defined populations of striped dolphins in the two areas (Gaspari 2004, Calzada & Aguilar 1995, García-Martínez *et al.* 1999, 1995). Regarding population structure in the eastern North Atlantic, there are no studies that could indicate any divisions or structuring. Therefore, in the eastern North Atlantic, striped dolphins are managed as a single AU (ICES 2014a).

Red List	European: **'Data deficient'** (IUCN 2007d); Global: 'Least Concern' (Braulik 2019)
MSFD	**MSFD latest assessment (countries):** FR, and PT
Key pressures	Even though abundant and highly mobile, striped dolphins are susceptible to the accumulation of **contaminants** and incidental **bycatch** (ICES 2019a). **Diseases**, particularly viral infections (dolphin morbillivirus, herpesvirus) may be an important pressure in the Iberian coast (Bento et al. 2016, 2018).

Killer whale (*Orcinus orca*)

LEGAL STATUS	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix II	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS:** yes

DISTRIBUTION & ABUNDANCE	The killer whale is the most widespread cetacean, as it can occur in every type of marine region, from the equator to the poles (Carwardine 2019). Although the killer whale shows an extensive distribution, it does not occur in large numbers and abundance is quite limited compared to the other small toothed cetaceans. A pilot study to obtain information on killer whale abundance in European waters, developed by the OSPAR Commission, showed that the species occurs in small groups in distinct areas (OSPAR 2017b). In the ABI sub-region, killer whales form a subpopulation in the Strait of Gibraltar, with some genetic similarity with individuals from the Canary Islands (OSPAR 2017b, Foote *et al.* 2011). In the Canary Islands, killer whales are rarely sighted (Jourdain *et al.* 2019). Despite the genetic similarity between locations, the population from the strait of Gibraltar is considered to be unique and the IUCN define it as a "subpopulation", with its conservation status (Esteban & Foote 2019). The distribution of this population was thought to be limited mainly to the Strait of Gibraltar, with few sporadic sightings in the surrounding waters (Esteban & Foote 2019). However, the most recent interactions between some individuals of this population and vessels showed that at least a part of the population is highly mobile, and travels throughout the waters of the ABI region, mostly around the Iberian Peninsula year-round (Esteban *et al.* 2022).

ECOLOGY	From the suggested list of species, the killer whale is the best representative of top predators. In all European waters, including those further south, molecular data distinguishes at least three putative populations of killer whales with a distribution that coincides with their prey distribution (Jourdain *et al.* 2019, Foote *et al.* 2011): 1. Individuals from Iceland, Norway and Scotland, which are associated with the North Atlantic herring, 2. Other individuals from Scotland, Ireland, Iceland, and the North Sea, which is associated with the North-east Atlantic mackerel, and 3. Individuals from Gibraltar and the Canary Islands (Jourdain *et al.* 2019). Regarding the population that occurs in the ABI sub-region, the assessment made by IUCN defines the movements of the individuals as not migrants (Esteban & Foote 2019). As a top predator, the movements of some individuals are extensive and cover the whole ABI sub-region (Esteban *et al.* 2022).

Red List	Iberian killer whale: **Critically Endangered** (Esteban & Foote 2019) European: **Data deficient** (IUCN 2007e); Global: Data deficient (Reeves *et al.* 2017). The reason for the Data Deficient listing globally is taxonomic uncertainty (Reeves *et al.* 2017). In both assessments, experts noted that small regional populations are likely to qualify for a threatened status because they are known to have declined significantly from threats, including prey depletion and pollutants. The Iberian killer whale is considered Critically Endangered due to the small number of adult individuals (below 50) and the fact that they heavily depend on a prey species that is still overfished, despite management efforts (the Atlantic bluefin tuna) (Esteban & Foote 2019, Collette *et al.* 2015). Also, although adult survival remains within levels known to be consistent with stable populations, the lack of recruitment combined with the recent poor recruitment suggests an inferred decline in the future unless conditions improve (Esteban & Foote 2019).
MSFD	**MSFD latest assessment (countries):** SUD-ES
Key pressures	Killer whales are vulnerable to the accumulation of **contaminants** through the food chain, a key pressure identified for this species, in several studies (e.g., Desforges *et al.* 2018, Esteban *et al.* 2016, Jepson *et al.* 2016) and in the ICES 'Threat Matrix" (ICES 2019a), with high pollutant levels possibly inhibiting reproduction (Jepson *et al.* 2016). Although the ICES 'Threat matrix' does not identify **disturbance** from human activities as a medium or high-type of threat to killer whales in the Bay of Biscay & Iberian Peninsula, the Spanish Ministry of Environment proposed two critical areas to regulate possible disturbance activities such as commercial and recreational whale watching and military exercises in the main habitat of killer whales in spring and summer (Esteban & Foote 2019, B.O.E.-A-2017-5474, 2017).

Long-finned pilot whale (*Globicephala melas*)

Legal Status	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix II	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS:** yes

Distribution & Abundance	The long-finned pilot whale, hereafter pilot whale, is found in temperate and sub-polar regions (Olson & Reilly 2002) and it prefers the continental shelf break, continental and island slope waters and areas with complex topography such as seamounts and ridges (Carwardine 2019). During SCANS-III, pilot whales showed similar abundance values to the bottlenose dolphin, but since it is a species with wide movements, its abundance may change as a response to prey availability, from one SCANS to another (Hammond *et al.* 2021b). In the ABI sub-region, most SCANS sightings were reported in the offshore waters of the Bay of Biscay (Hammond *et al.* 2021b). Most sightings are recorded in waters > 2000m deep; when searching for prey, pilot whales can dive to depths of 824m (Airoldi *et al.* 2003, Baird *et al.* 2002).

Ecology	The population structure of pilot whales in the Atlantic Ocean remains unclear because of conflicting evidence. Morphometric data show differences between pilot whales caught in the Northwest and Northeast Atlantic (ICES 1996, Bloch & Lastein 1993), possibly indicating structuring between these two areas. These results are corroborated by the low impact of the depletion of pilot whales off Newfoundland from 1947 to 1972 on global pilot whale abundance, perhaps indicating the presence of two or more populations (Sergeant 1962, Mercer 1975). Conversely, genetic analysis of mitochondrial DNA (mtDNA) shows little variability between pilot whales from the western Atlantic and the eastern Atlantic (Monteiro *et al.* 2015, Siemann 1994). Other genetic markers and biochemical evidence show significant geographical differences in the North Atlantic, with prey distribution (Monteiro *et al.* 2015) and sea temperature (Fullard *et al.* 2000) probably driving pilot whale differentiation. Pilot whales stranded in Iberia are genetically different from whales stranded in the UK and Faroe Islands (Monteiro *et al.* 2015a), revealing a long and strong segregation between these populations. A similar differentiation pattern seems to occur with ecological tracers (stable isotopes, Monteiro *et al.* 2015 a, b). In Western Iberia, there is an apparent preference for more coastal habitats and prey. These studies suggest that more than one population occurs in the North Atlantic, and possibly also in the Northeast Atlantic, and it is likely a matter of time until there is an official identification of one or more AUs for the species.

Red List	European: **'Data deficient'** (IUCN 2007f); Global: 'Least Concern' (Minton *et al.* 2018)
MSFD	**MSFD latest assessment (countries):** FR, NOR-ES
Key pressures	According to the WGMME, the most concerning threats that pilot whales face are **contaminants** and loud **anthropogenic noise**, such as those generated by navy sonar and seismic exploration (ICES 2019a). Changes in behaviour of pilot whales have been associated with exposure to military sonar pulses, including changes in vocalisations, travelling, surfacing and diving/foraging behaviours (Miller *et al.* 2015, 2012, Sivle *et al.* 2012, Rendell & Gordon 1999). High levels of Hg and Cd have been reported for pilot whales in Northern and Western Iberia, with some animals showing levels above the defined toxic thresholds, especially in short-finned pilot whales (Monteiro *et al*. 2017). Based on the reports of the ICES WGBYC, the number of bycatches of pilot whales for the period 2008-2019 was small, suggesting that bycatch is not a concern for this species (ICES 2019a).

Risso’s dolphin (*Grampus griseus*)

Legal Status	**Habitats Directive:** Annex IV **Bern Convention:** Appendix II **Bonn Convention:** Appendix II **CITES:** Appendix II **ASCOBANS:** yes **ACCOBAMS:** yes

Distribution & Abundance	Risso’s dolphins are found throughout tropical and temperate regions and in all types of habitat, from coastal to oceanic, with an overall low density throughout their distribution (Jefferson *et al.* 2014). Few sightings were recorded in the SCANS-III total area. In the ABI sub-region, sightings were mostly recorded in the coastal areas of the Iberian Peninsula and a few others in the offshore waters of the Bay of Biscay (Hammond *et al.* 2021b).

Ecology	There are very few studies about the distribution, genetic diversity, and ecology of Risso’s dolphins and the potential impact of anthropogenic pressure because of the lack of sufficient data. Risso’s dolphins seem to prefer mid-temperate waters in the steep continental shelf, slope waters and submarine canyons, with depths between 400 and 1000 m, as opposed to offshore waters (Carwardine 2019, Baird 2009). Satellite tag data show that Risso’s dolphins can dive down to 400–500 m (Wells *et al.* 2009). One study analysed the population genetic structure of Risso’s dolphins in the North Atlantic, more specifically the differentiation between individuals in UK waters and in the Mediterranean (Gaspari *et al.* 2007). This study indicated significant differences between the two populations sampled, but no further studies were undertaken encompassing sampled individuals from other areas of the Atlantic. Based on the small available data and few studies on this species, it is not possible to determine AUs.

Red List	European: **‘Data deficient’** (IUCN 2007g); Global: ‘Least Concern’ (Kiszka & Braulik 2018)
MSFD	**MSFD latest assessment (countries):** FR
Key pressures	Although the WGMME ICES classifies the impact of several main threats (bycatch, contaminants, habitat loss and degradation) as low for the Risso’s dolphin (ICES 2019a) the amount of evidence for this assessment is small. As a deep-diving cetacean, Risso’s dolphins may be affected by marine litter (Puig-Lozano *et al.* 2018), noise pollution (Carwardine 2019) and disturbance due to recreational activities by decreasing individuals resting and socializing rates with the increasing number of vessels (Visser *et al.* 2011). Risso’s dolphins are also

🟥	susceptible to bycatch from longline fisheries (Macías *et al.* 2012).

Cuvier’s beaked whale (*Ziphius cavirostris*)

Legal Status	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix I	
	CITES: Appendix II	
	ASCOBANS: yes	**ACCOBAMS:** yes

Distribution & Abundance	Among the beaked whales, Cuvier’s beaked whale, hereafter Ziphius, is the most widely distributed species and it is found in polar to tropical waters (MacLeod *et al.* 2006). Because of its deep-water, oceanic distribution and limited time spent at the surface, the collection of visual data is challenging. As a result, in the past, most information about this species derived from strandings, since it strands frequently (Wojtek & Norman 2013, Culik 2011, MacLeod *et al.* 2006). The ABI sub-region, most specifically the offshore waters of the Bay of Biscay, was the area with the most sightings of Ziphius during the SCANS-III survey (Hammond *et al.* 2021b) but sightings also occurred in offshore waters of the Iberian Peninsula (Correia *et al.* 2019b, Vingada & Eira 2018). There is evidence that suggests the species is declining in parts of its range (Moore & Barlow 2013). This species distributes deeper than 200 m and mainly between 1500-3500 m, in areas with complex topography, such as canyons and shelf margins, over the continental slope or around oceanic islands or seamounts (Carwardine 2019).

Ecology	The Ziphius is capable of the deepest (2992 m) and longest (137.5 minutes) foraging dives among mammals (Schorr *et al.* 2014), with average foraging dives deeper than 1000 m and lasting one hour (Shearer *et al.* 2019). The Ziphius also performs non-foraging dives at depths of 280 m that last on average 20 minutes (Shearer *et al.* 2019). While foraging, Ziphius produce highly directional ultrasonic echolocation clicks (Zimmer *et al.* 2005, Frantzis *et al.* 2002). Some areas are identified as important habitats for Ziphius populations (Foley *et al.* 2021, Rogan *et al.* 2017, Falcone *et al.* 2009), including the Bay of Biscay (Robbins *et al.* 2022, Kiszka *et al.* 2007) and seamounts in Portuguese waters (Correia *et al.* 2021a), and other areas that can be used year-round (Arcangeli *et al.* 2016, McSweeney *et al.* 2007). Photographic data of Ziphius show re-sightings of individuals over time (Foley *et al.* 2021, Falcone *et al.* 2017, Schorr *et al.* 2014), spanning up to 11-15 years, suggesting a high degree of site fidelity (Baird 2019, Reyes 2017, McSweeney *et al.* 2007). Dalebout *et al.* (2005) used genetic data to demonstrate a high degree of isolation and low maternal gene flow among sampled individuals of Ziphus from the North Atlantic, North Pacific, and Southern Hemisphere, with a distinct subpopulation in the Mediterranean Sea. Heyning (1989) also suggested regional differences in pigmentation

	patterns and cranial osteological features, suggesting locally distinct populations. Although current data suggests the existence of some degree of differentiation among Ziphius populations, there is no substantial data and research to indicate further structuring in the ABI sub-region and surrounding European waters.

RED LIST	European: **'Data deficient'** (IUCN 2007h); Global: 'Least Concern' (Baird *et al.* 2020)
MSFD	**MSFD latest assessment (countries):** none
KEY PRESSURES	According to the 'Threat Matrix', the most concerning threats that Ziphius face in the ABI sub-region are **marine litter** and **underwater noise** (ICES 2019a). Since beaked whales use a suction-feeding strategy to capture prey, they mistakenly identify plastic bags and other types of marine debris as prey and swallow them. Several records of ingestion of marine litter by Ziphius have been documented (e.g. Bortolotto *et al.* 2016, Gomerči *et al.* 2006, Poncelet *et al.* 2000), including in the Bay of Biscay (Santos *et al.* 2001). In the extended area of the northeast Atlantic, there is a high incidence of ingestion and death from plastic bags (MacLeod 2009). Regarding underwater noise, several studies have shown an association between Unusual Mortality Events (UMEs) of this species and military sonar experiments, observed as mass stranding events (e.g. Podestà *et al.* 2016, Arbelo *et al.* 2008, Cox *et al.* 2006, Evans & Miller 2004, Waring *et al.* 2001, Frantzis 1998). In areas where military exercises have been banned (e.g. Canary Islands), because of prior association with high-intensity active naval sonars and UMEs, no further events have been recorded (Bernaldo de Quirós *et al.* 2019). According to Dolman *et al.* (2021), the northeast Atlantic is one of the areas in the world with the highest incidence of mass stranding events, which are growing throughout the years, both in magnitude and frequency. Due to the growing concerns about the exposure of beaked whales to acoustic disturbance, several research programs are on course, increasing our knowledge about the movements, feeding ecology, and diving behaviour of this group of species (Forney *et al.* 2017). During the ASCOBANS 26th Meeting of the Advisory Committee, several recommendations were made to obtain a better assessment of the populations of beaked whales, including Ziphius, and the impact of anthropogenic noise events on the populations. The recommendations included the development of visual and acoustic monitoring programs to provide baseline data about the populations and 'the development of harmonised response protocols for beaked whale strandings to ensure that the necessary datasets (e.g. pathology, meteorology prior to the stranding, oceanography, acoustic monitoring, and any information on the use of high-intensity sound sources) can be

🟥	rapidly assembled to assist with the identification of the time, location and cause of the mortality event' (Dolman *et al.* 2021).

Sperm whale (*Physeter macrocephalus*)

LEGAL STATUS	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix I and II	
	CITES: Appendix I	
	ASCOBANS: no	**ACCOBAMS:** yes
	IWC: lists sperm whale seasons, sperm whale size limits and sperm whale catch limits at 0	

DISTRIBUTION & ABUNDANCE	The sperm whale is one of the most widely distributed animals in the world, and it has the second widest distribution of any marine mammal, after the killer whale (Carwardine 2019), even though the distribution of females is limited to the 50º North and 40º South latitudes (Rice 1989). In the ABI sub-region, the sperm whale is not commonly sighted possibly due to the limited time spent at the surface and to small group sizes, sometimes reduced to one individual (Rogan *et al.* 2017). During SCANS-III, there were only a few sightings in the offshore waters of the ABI sub-region, in the Bay of Biscay and northern Spain (Hammond *et al.* 2021b).

ECOLOGY	The relative abundance of sperm whales seems to be high in rich-nutrient areas associated with upwelling events (Biggs *et al.* 2005, Jaquet *et al.* 1996), and with specific bathymetric and oceanic features that increase prey availability (Waring *et al.* 2005, Biggs *et al.* 2000). Sperm whales usually dive to depths ranging from 200 to 1200 m, during 30-50 minutes, to forage on meso- and bathypelagic organisms, especially cephalopods, including the giant squid and the jumbo squid (Clarke 1996, 1986, Kawakami 1980). Sperm whales display strong sexual segregation, with females being separated from adult males for most of their lives (Carwardine 2019, Whitehead 2003). Females and their offspring tend to stay in warm tropical and sub-tropical waters and form long-term social units of 10 to 12 individuals with only occasional movements of individuals among units (Christal *et al.* 1998, Whitehead *et al.* 1991). These groups are mostly found in deep oceanic waters, deeper than 1000 m, although on some occasions they can also be found in waters less than 300 m deep (Carwardine 2019). When young males reach puberty, they start to disperse to higher, polar, latitudes (Rice 1989) forming small 'bachelor groups' and becoming increasingly solitary, away from the females, as they mature (Whitehead, 2003, Best 1979). Adult males return to lower latitudes, possibly travelling large distances across oceans (Whitehead & Weilgart 2000, Ivashin 1981, Gaskin 1970) to breed, moving between female units in search of receptive females (Whitehead 2003). The timing and the extent of movements of adult males are still uncertain because some studies show that males can also occur

in low latitudes in small numbers for a few months throughout the year (Silva *et al.* 2014, Whitehead 1993) and the north-sound migration is less evident in tropical and subtropical regions (Whitehead 2003). In some areas, females can also travel to higher latitudes during the summer as a response to changes in food availability (Carwardine 2019).

The general extensive movements of adult males and the more limited latitudinal distribution of females result in a small microsatellite differentiation among ocean basins due to breeding outside maternal social units and male-mediated gene flow over long ranges and across oceans (Engelhaupt 2004, Lyrholm *et al.* 1999). In addition, global mitochondrial diversity is also small, but with a marked variation among ocean basins, indicating that females do not switch basins (Lyrholm & Gyllensten 1998). Currently, there is one single MU of the species for the whole North Atlantic because of unclear geographic structuring, migration patterns and habitat preferences. Research on stable isotopes of sampled individuals between Denmark and NW Spain indicates the existence of heterogeneities in the habitat, particularly in the location of their breeding grounds, suggesting the occurrence of structure in the eastern North Atlantic population of the species (Borrell *et al.* 2013). In the ABI sub-region, abundance and distribution results indicate that sightings of this species in the area are likely males (Rogan *et al.* 2017). Most sightings were recorded in deep waters off Galicia and the south-eastern part of the Bay of Biscay, which includes the Santander Canyon, previously reported as being important for the species (Kiszka *et al.* 2007). Whaling records show that females can also occur in the southern waters of ABI, most specifically along the Iberian Peninsula (Borrell *et al.* 2013, Aguilar *et al.* 2007).

Sperm whales are social animals and produce several types of clicks, produced in a rapid series of pulses that serve functions of echolocation and communication (Whitehead 2003). One type of click, coda, is highly stereotyped and it is characterized by the number of clicks and the pattern of inter-click intervals. Codas consist of culturally inherited acoustic signatures that are shared among subsets of a population which are defined as 'vocal clans' (Rendell & Whitehead 2003). Vocal clans produce codas to possibly maintain group cohesion while the animals are close to the surface (Teloni 2005, Weilgart & Whitehead 1993, Whitehead & Weilgart 1991, Watkins & Schevill 1977). Since codas show geographical variation (Antunes 2009, Rendell & Whitehead 2005, Pavan *et al.* 2000, Weilgart & Whitehead 1997, Moore *et al.* 1993), Whitehead (2018) suggests considering them as indicators of population division, for management purposes. However, it should be noted that vocal clans are mostly composed of females and their offspring, while males rarely emit codas (Gero *et al.* 2016). Males also have exclusive sounds, which are called slow clicks, and are produced in high and low latitudes, presumably as an acoustic display to

	deter other male competitors or to attract females (Oliveira *et al.* 2013, Weilgart & Whitehead 1988).

RED LIST	European: **'Vulnerable'** (IUCN 2007i); Global: **'Vulnerable'** (Taylor *et al.* 2019)
MSFD	**MSFD latest assessment (countries):** none
KEY PRESSURES	Sperm whales were one of the main target species of whaling, especially during the 18th and 19th centuries, when whalers hunted them in pelagic open-boats, launched from large vessels that could sail for several months and process whales onboard (Townsend 1935). Another intense sperm whale hunting period was the first half of the 20th century when whalers used steam-powered vessels, with harpoon guns, and returned to several land stations (Sanpera & Aguilar 1992). After the establishment of the International Whaling Commission Moratorium, in 1986, commercial whaling ceased (IWC 1983), but it is strongly suspected that the number of caught individuals resulted in a depletion of populations (IUCN 2007i, Whitehead 2002). Whaling of sperm whales and baleen whales occurred along the Iberian Peninsula (Sanpera & Aguilar 1992), and the waters from Cape Saint Vincent (PT) and the Strait of Gibraltar were a well-known whaling ground (Aguilar *et al.* 2007). Clark (1884–1887) described the relative abundance of sperm whales in the Strait of Gibraltar as high and catch records suggest a year-round presence of the species (Aguilar *et al.* 2007). Although there is no evidence of a continuing decline in the abundance of sperm whale populations in European waters, IUCN assessed the current levels of sperm whales at a 50% lower level than past abundance and strongly recommended the development of further surveys and modelling studies to better determine current and historic population size and trends (IUCN 2007i). The ICES threat matrix identifies the ingestion of marine litter and the collision with ships as the main threats that sperm whales face in the ABI sub-region (ICES 2019a). Due to their feeding habitats, i.e. the use of suction feeding to capture prey, all deep-diving toothed whales are susceptible to ingesting floating debris. Records of ingestion of marine debris by sperm whales in European waters, especially **plastic debris**, are of high concern (Unger *et al.* 2017, de Stephanis *et al.* 2013, Notarbartolo di Sciara *et al.* 2012, Mazzariol *et al.* 2011). Based on reports of **ship collisions**, sperm whales are one of the most concerning species (IWC 2008, Vanderlaan & Taggart 2007, Pesante *et al.* 2002, Laist *et al.* 2001). Although the WGMME (2019) lists **underwater noise** as a low concern to sperm whales, since the species relies a lot on acoustic signals it is still expected that this threat could impact the species.

Fin whale (*Balaenoptera physalus*)

LEGAL STATUS	**Habitats Directive:** Annex IV	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix I and II	
	CITES: Appendix I	
	ASCOBANS: yes	**ACCOBAMS:** yes

DISTRIBUTION & ABUNDANCE	The fin whale is a cosmopolitan species and it is found mostly in offshore waters (Carwardine 2019). Because of their offshore occurrence, small group sizes and extensive movements, fin whales can be challenging to monitor. During SCANS-III, almost sightings of fin whales were recorded in the offshore waters of the ABI (Hammond *et al.* 2021b).

ECOLOGY	The fin whale is the second-largest living animal, next to the blue whale. It is assumed that fin whales undertake a general seasonal latitudinal migratory movement with animals feeding during the summer in high-latitude productive areas and spending the winter in tropical or subtropical areas for reproduction (e.g., Kellogg 1929). However, this seasonal latitudinal movement seems to be oversimplistic in describing fin whale movement and several studies show a continuum of migratory strategies that seem to reflect local adaptations of different age-sex classes of whales (Geijer *et al.* 2016). In the case of the ABI sub-region, whaling records from the 20th century show that fin whales were once abundant in the seas to the southwest of Portugal (Clapham *et al.* 2008, Clapham & Hatch 2000, Sanpera & Aguilar 1992). Fin whales were found in dense concentrations, close to shore, and throughout the year, which suggested the presence of a local, nonmigratory subpopulation (Clapham & Hatch 2000, Sanpera & Aguilar 1992). Recent sightings and strandings suggest that fin whale numbers in this area are small compared to the past abundance, and there is no evidence of the presence of the suggested resident subpopulation (Clapham *et al.* 2008). In the ABI sub-region, two subpopulations occur, one from the Mediterranean and the other from the North Atlantic, identified through molecular (Palsbøll *et al.* 2008, Berube *et al.* 1998), toxicological (Aguilar *et al.* 2002), and stable isotope (Giménez *et al.* 2013) and acoustic (Pereira *et al.* 2020, Castellote *et al.* 2012) data. According to visual and acoustic evidence, only a small fraction of whales from the Mediterranean Sea may travel to the Northeast North Atlantic during the summer (Pereira *et al.* 2020, Gauffier *et al.* 2018). Fin whales are also sighted in periods of time when there are no recorded acoustic signals (Boisseau 2014, Sousa & Brito 2012, Verborgh 2012, Husum 2011), suggesting a year-round presence of the species in the southern ABI. Three AUs of fin whales were identified in the northeast north Atlantic, with an overlap with IWC stocks: 1)

	East Iceland-Faroe Islands (EL+F), Norway (N) and Spain (SP) (OSPAR Commission 2022).

Red List	European: ‘**Near Threatened**’ (IUCN 2007j); Global: ‘’Vulnerable’ (Cooke 2018) For the IUCN European assessment, qualitative comparisons with population levels of 81 years (3 generations) ago suggest current population levels are at least 30-49% lower than past abundance (IUCN SSC Cetacean Specialist Group 2007).
MSFD	**MSFD latest assessment (countries):** FR and PT
Key pressures	In the 20th century, fin whales were one of the most hunted species in the Northern hemisphere and populations were heavily reduced (Rocha *et al.* 2014). The recovery of populations in the North Atlantic is still uncertain because of different observed trends (IUCN 2007j). Currently, fin whales are especially vulnerable to **underwater noise**, mainly from low-frequency sources such as seismic surveying and shipping (ICES 2019a). Because this species uses low-frequency signals for reproduction (Croll *et al.* 2002) and possibly feeding purposes (Romagosa *et al.* 2021), anthropogenic noise in this frequency range can affect communication and vital activities. The risk of **ship collision** is also a concerning issue for fin whales (WGMME 2019), which results in injuries and death (Castro *et al.* 2022). Over the past few years, many strandings of fin whales have been registered on the Atlantic seaboard in France (Pelagis 2022).

Minke whale (*Balaenoptera acutorostrata*)

Legal Status	**Habitats Directive:** Annex IV	
	CITES: Appendix I (except for the West Greenland stock listed in Appendix II)	
	Bern Convention: Appendix II	
	Bonn Convention: Appendix I and II	
	ASCOBANS: yes	**ACCOBAMS**: yes

Distribution & Abundance	The minke whale is the smallest baleen whale from the Northern Hemisphere, and it is one of the most widely distributed species of baleen whales, occurring in both coastal and pelagic waters (Risch *et al.* 2019). It was a rare species during the SCANS-III survey and there was only one sighting for the whole ABI sub-region, in the waters of northern Spain (Hammond *et al.* 2021b).

Ecology	Knowledge of the distribution and migration patterns of minke whales is scarce for almost all populations (Risch *et al.* 2019). It is assumed that they also conduct seasonal migrations, like other baleen whale species, and in some coastal areas, individuals can show site fidelity (Carwardine 2019). Based on photo-identification studies conducted in several areas of the Pacific (Dorsey *et al.* 1990) and the North Atlantic (Bertulli *et al.* 2013, Baumgartner 2008, Gill *et al.* 2000), some individuals are resighted throughout the years, but the majority of identified individuals show low levels of site fidelity. Genetic (Andersen *et al.* 2003) and stable isotope data (Born *et al.* 2003) suggest some population structuring in the North Atlantic summering areas, possibly related to regional differences in ecological conditions and feeding preferences. However, recent studies about the genetic differentiation of minke whales in the eastern North Atlantic show an unclear structure (Quintela *et al.* 2014, Anderwald *et al.* 2011). In the eastern North Atlantic, minke whales stay around the British Isles and other coastal areas during summer and early fall to feed (Risch *et al.* 2019, Tetley *et al.* 2008, Macleod *et al.* 2004) and then disperse to unknown oceanic areas in the winter (Risch *et al.* 2019). In the ABI sub-region, minke whales are mostly sighted along the Portuguese coast (Correia *et al.* 2021, Hammond *et al.* 2021b, Vingada & Eira 2018, Hammond *et al.* 2013). Because of the uncertainty of population structure and the lack of extensive information on key aspects of their distribution, the species is managed as a single AU in European waters (ICES 2014a). The IWC established several AUs for minke whales, including in the North Atlantic, but they are based on the general occurrence of the species at the high latitude feeding areas (Donovan 1991). In the North Atlantic, minke whales produce several types of sounds, such as click-series (Beamish & Mitchell 1973), low-frequency downsweep calls

	(Edds-Walton 2000), and low-frequency pulse-trains with variable interpulse intervals (Clark & Gagnon 2004), which are the best-described signals and the most useful for acoustic monitoring of the species (e.g. Risch *et al.* 2014).

RED LIST	European: **'Least Concern''** (IUCN 2007k); Global: 'Least Concern' (Cooke 2018)
MSFD	**MSFD latest assessment (countries):** FR and PT
KEY PRESSURES	Minke whales were the last baleen whale species to be targeted by commercial whaling as other species were highly depleted, being still subject to commercial whaling by Japan, Iceland and Norway (Rocha *et al.* 2014). Other threats of concern in the ABI area, include **underwater noise** from sonar, seismic surveys and shipping, **ship collisions** (ICES 2019a), and **bycatch** (Carvalho 2018).

3.2.Criteria, parameters and indicators

3.2.1. Population abundance (D1C2)

The effective conservation and management of wildlife, including the assessment of the conservation status of a species or population, the ecological importance of an area, changes in the environment, or impacts of anthropogenic activity, involve the acquisition of estimates of animal abundance or densities in a geographical area of interest. By obtaining these estimates following a standardized method and consistently over a sufficiently long period of time it is possible to assess trends in the population abundance in a geographical area, i.e., if the population is stable, increasing or if there should be any concern. Furthermore, such information is also required to assess of the level of bycatch or the impact of other anthropogenic activities, as well as demographic parameters (Wade *et al.* 2021).

Abundance can be estimated through several methods and by using visual or acoustic data (e.g. Borchers 2021, Buckland *et al.* 2015, Marques *et al.* 2012). Since total abundance is based on a sample and then extrapolated to a larger study area, it can be defined and estimated as:

- "The estimated number of animals in a specified area during the period of time that the survey(s) took place" (Hammond *et al.* 2021a). Density is the number of animals per unit area (km^2).

Hammond *et al.* (2021)a provide an overview of the most used methods to estimate abundance for cetaceans, including details on data collection and analysis, and theoretical considerations. The most appropriate method to estimate abundance depends on the species, logistics, resources and, in some cases, the scientific rationale behind the study (Hammond *et al.* 2021a). OSPAR CEMP Guidelines describe monitoring methods for M4 assessment considering differences in the structure, distribution and behaviour of some species. For example, the Guidelines state that for large areas and wide-ranging species that can be easily detected at the surface, the most effective approach to estimate abundance consists of dedicated, i.e. focused on, line-transect surveys using ships and/or aircraft with distance sampling methodology (OSPAR Commission 2022). For species that can have individuals with natural or artificial marks that can be recognized over time, such as coastal units of bottlenose dolphins and killer whales, mark-recapture analysis based on photo-identification data is the most appropriate method, with high confidence in the estimates (OSPAR Commission 2022). These methods are not suitable for some species given their low numbers of individuals with conspicuous and stable individual markings, cryptic or evasive behaviour or pelagic distribution that does not allow for obtaining systematic data efficiently. Passive acoustic data collected from towed, static or drifting hydrophones can be used to estimate the abundance of deep-diving toothed cetaceans (Hildebrand *et al.* 2015, Marques *et al.* 2009) or acoustically active species with low densities (OSPAR Commission 2022, Hammond *et al.* 2021a, Marques *et al.* 2012).

The most used and robust method to estimate the abundance of cetaceans is distance sampling (Thomas *et al.* 2010, Buckland *et al.* 2001). This method is largely accepted and the basis for the sampling design of current cetacean surveys such as SCANS and CODA. The general approach of the method consists of using the distances from a line or a point to objects (animal or groups) or cues (whale vocalizations) to estimate a probability of detection that is then used to estimate abundance and/or density of the object/cue (Thomas *et al.* 2010, Buckland *et al.* 2001). Distances can be estimated from line-transects that are covered by ships and/or aircraft or point-transects, in which recording instruments are deployed. Based on the data collected and the probability of detection, abundance can then be estimated through design-based or model-based approaches.

The design-based approach implies that transects are placed randomly throughout the study area in a way that ensures that every point inside the area has the same probability of being sampled, i.e., an equal coverage probability design (Hammond *et al.* 2021a, Thomas *et al.* 2010). Even though data is collected with a design-based approach, the distance sampling employed is always a mixture of design-based and model-based analysis as the probability of detecting an object or a cue as a function of its distance from the transect is modelled from the fit of a detection function to the recorded distances (Buckland *et al.* 2016).

Full model-based approaches allow both the use of data collected through a design-based as well as from unequal survey sampling, such as regional non-dedicated surveys. Using this approach density is modelled along the transects as a function of covariate data (environmental, survey and temporal variables). This model-based approach is also referred to as density surface modelling (Miller *et al.* 2013) or species distribution modelling (Zurell *et al.* 2020). Although model-based estimates of abundance are less robust than design-based, they have the following advantages: they i) relax the assumption of the equi-probability coverage in geographical space; they allow ii) complex and opportunistic transect designs to be included to iii) estimate abundance at a fine spatial scale; and they allow iv) exploring how animal density varies with environmental covariates (e.g. depth, sea surface temperature, etc.), thereby providing a framework to assess the effects of habitat or experimental manipulation on density (Buckland *et al.* 2016, Johnson *et al.* 2010). WP2.1 of

CetAMBIcion included the development of novel approaches to reduce uncertainty and bias in density estimates that are obtained from different sources of data with line-transects protocols, such as dedicated (e.g. SCANS) and opportunistic (DCF surveys). Deliverable 2.2.c of CetAMBIcion (Plard & Authier 2023) provides a methodology for density estimation that includes distance sampling and infinite mixture models to reduce the heterogeneity caused by different sources, such as type of data, platforms, protocols and observers.

Table 1 lists several examples of abundance estimates obtained for all species considered in this report.

Table 1. Examples of available abundance estimates according to different survey designs and abundance methods.

Survey design	Type of data	Method	Monitoring project/programme	Area	Species	References
Dedicated line-transect (ship+aircraft) – passing mode	Visual (sightings)	Design-based distance sampling	SCANS I-III	European Atlantic waters	Harbour porpoise	Hammond *et al.* (2013, 2021b)
					Common dolphin	
					Bottlenose dolphin	
					Stripped dolphin	
					Risso's dolphin	
					Pilot whale	
					Beaked whales	
					Sperm whale	
					Minke whale	
					Fin whale	
		Design-based mark-recapture distance sampling	CODA	North Atlantic offshore waters	Common dolphin	CODA (2009)
					Striped dolphin	
					Pilot whale	
					Sperm whale	
					Fin whale	
		Model-based distance sampling	CODA	North Atlantic offshore waters	Common dolphin	
					Striped dolphin	
					Pilot whale	
					Sperm whale	
					Beaked whales	
					Fin whale	
Opportunistic line-transect survey	Visual (sightings)	Conventional distance sampling with covariates		Northwest of Spain	Common dolphin	Saavedra *et al.* (2018)

Survey design	Type of data	Method	Monitoring project/programme	Area	Species	References
Dedicated point-transect	Acoustic cue	Conventional distance sampling	CODA	North Atlantic offshore waters	Sperm whale	
			SAMBAH	Baltic Sea	Harbour porpoise	Amundin *et al.* (2021)
			Southern California Anti-Submarine Warfare Range (SOAR)	California (US)	Cuvier's beaked whale	Hildebrand *et al.* (2015)
Opportunistic point-transect	Acoustic cue	Conventional distance sampling	AUTEC range	Bahamas	Blainville's beaked whales	Marques *et al.* (2009)
Dedicated photo-ID surveys	Visual (photographs)	Mark-recapture modelling	-	Inshore waters of mainland Scotland and the Western Isles	Bottlenose dolphin	Cheney *et al.* (2013)
			Southern California Anti-Submarine Warfare Range (SOAR)	California (US)	Cuvier's beaked whale	Curtis *et al.* (2021)
		Mark-recapture analysis (no model)		Iberian Peninsula	Killer whale	Esteban *et al.* (2016)

An estimate of abundance alone is, however, insufficient to determine GES. At OSPAR, the abundance of cetaceans is assessed by the indicator M4 "Abundance and distribution of marine mammals", which, according to current CEMP guidelines, should be based on repeated abundance estimates, and the detection of trends, i.e., changes over a specific period of time, which are then related to possible human causes (OSPAR Commission 2022). It is necessary, therefore, not only to estimate abundances for a certain period, but also a percentage of change with time in relation to a baseline value (OSPAR Commission 2022). CEMP Guidelines state that at least three design-based or four capture-recapture abundance estimates are required over a relevant time scale to assess trends in abundance (OSPAR Commission 2022).

Every 11 years from 1994 until 2016, data to estimate the abundance of cetaceans in the NE Atlantic has been collected from large-scale dedicated surveys, referred to as SCANS (Small Cetaceans in European Atlantic waters and the North Sea). The first SCANS survey, in 1994, was undertaken with ships in the North and Celtic Seas to obtain comprehensive estimates of the abundance of some cetacean species, particularly the harbour porpoise, and to assess the impact of bycatch (Hammond *et al.* 2021a). The following surveys, SCANS-II in 2005 and SCANS-III in 2016, were conducted in a larger area, extending to Spanish and Portuguese waters, using ships and aircraft. SCANS-II only surveyed shelf waters while SCANS-III included offshore areas. In 2007, there was also a dedicated survey to collect data on cetacean abundance and distribution, only in offshore European waters, known as CODA (Cetacean Offshore Distribution and Abundance in the European Atlantic) (CODA 2009). Large-scale dedicated surveys, such as SCANS and CODA, have also been an important source of data on the distribution and abundance of wide-ranging cetaceans for MS to report on Favourable Conservation Status under the HD, and on GES under the MSFD (Hammond *et al.* 2021a). SCANS-surveys have not, however, been frequent enough to generate data on time for the 6-year reporting cycle (OSPAR Commission 2022). In addition, SCANS require high financial resources and campaigns are usually executed in the summer, preventing the assessment of seasonal variability in abundance and distribution. CEMP Guidelines urge the need to increase the frequency of SCANS surveys to match the reporting cycle of the MSFD and HD and suggest the use of regular regional monitoring to improve assessments, as long as data collection is standardized to match SCANS procedures. The latest large-scale survey, SCANS-IV that took place in 2022, was planned to match the reporting cycles, providing outputs for MS to report under the MSFD (Article 8:

due 2024), the HD (Article 17: 2019-2024) and OSPAR/HELCOM assessments (Scheidat 2021).

The ABI sub-region started to be included in the SCANS survey in 2005 (Table 2 and Figure 2) with two areas that covered the coastal (200 nm limits) waters of the Iberian Peninsula (zone W) and France (part of zone W and zone Z). The ABI sub-region was partially included in the CODA survey, from two offshore areas in the Bay of Biscay (zones 3 and 4). During SCANS-III, the coastal areas of the Iberian Peninsula (zones AA, AB, AC) and France (zone B, northern area excluded from ABI region) were surveyed by plane and the offshore areas of the Bay of Biscay (zones 9, 11, 12, 13) were surveyed by ship. ABI offshore zones surveyed by SCANS-III were partially similar to zones 3 and 4 of the CODA survey and all were surveyed by ship. Coastal areas surveyed by SCANS-II are partially compared with coastal areas surveyed by SCANS-III, but the former was surveyed by ship and the latter was surveyed by plane.

Table 2. European dedicated cetacean surveys including the ABI sub-region, used to assess abundance at a regional level.

Survey	Year	Platform	ABI area	Type
SCANS-II	2005	Ship	W and Z	Coastal
CODA	2007	Ship	3 and 4	Offshore
SCANS-III	2016	Plane	AA, AB, AC, B	Coastal
		Ship	9, 11, 12 and 13	Offshore

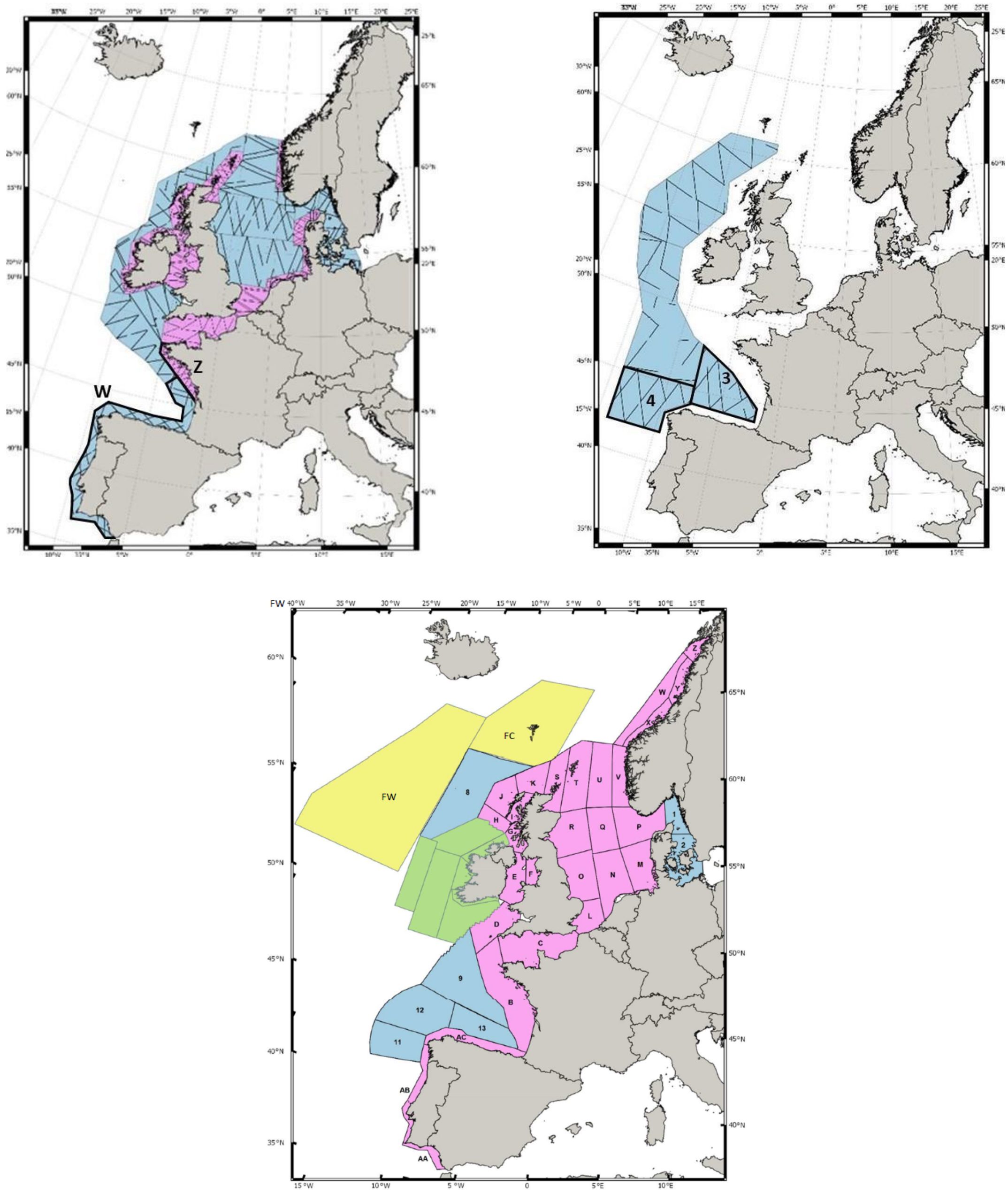

Figure 2. Area covered by large-scale surveys in the European Atlantic waters including the ABI sub-region: SCANS-II (top-left); CODA (top-right); SCANS-III (bottom). Pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship (Hammond *et al.* 2021b).

Acoustic and egg research surveys conducted under the Data Collection Framework (DCF), implemented to support the EU Common Fisheries Policy, have also been valuable platforms to obtain opportunistic data on cetacean abundance (for model-based approaches) and distribution modelling (e.g. Louzao *et al.* 2019, Authier *et al.* 2018, Saavedra *et al.* 2018, Gutiérrez-Muñoz *et al.* 2016). The primary aim of these surveys is to collect biological and oceanographical data for the assessment of small pelagic fish stocks (ICES 2019b, Doray *et al.* 2021). Pre-defined linear transects perpendicular to the coast are followed to cover the area from the coast to the shelf break uniformly. A summary and protocols of DCF acoustic and egg surveys conducted in the shelf waters of the ABI can be found in Doray *et al.* (2021) and ICES (2019b), respectively. In some of these surveys, such as the French PELGAS, Spanish PELACUS, and Portuguese PELAGO, and Iberian IBERAS, trained Marine Mammal and Seabird Observers (MMSO) carry out data collection of cetaceans, following a distance sampling protocol. In Task 2.1., data from European and national multidisciplinary, and/or dedicated cetacean surveys were collated to share current knowledge about abundance, distribution and habitat in the ABI sub-region, to assess current knowledge gaps and propose suitable solutions to ensure regional consistency in data collection and analysis. More details about the available data in each MS can be found in Deliverable 2.1. Below (Table 3) we compile exclusively previously published abundance estimates, based on SCANS and CODA surveys, which used distance sampling methodology, to minimize bias related to protocols and correction factors.

Table 3. Abundance estimates (number of individuals) per large-scale survey and per small toothed cetacean species over the ABI sub-region. Abundance estimates of the blocks surveyed in the ABI were summed to provide an estimate for the ABI sub-region: blocks W and Z, surveyed in SCANS-II; blocks 3 and 4, surveyed in CODA; blocks AA, AB, AC, B, 9, 11, 12 and 13, surveyed in SCANS-III (see Figure 2). CV, the coefficient of variation of the abundance estimates (0-1), was calculated for the abundance estimate of the ABI using the individual CVs of the blocks surveyed in the sub-region. According to Thomas (2022), abundance estimates associated with CVs higher than 0.5 are considered imprecise, because the spread of the data relative to the mean value is very large.

Species	SCANS-II survey (2005)	CODA survey (2007)	SCANS-III survey (2016)	Notes
Harbour porpoise	**2,844 CV=0.7** (Revised from Hammond *et al.* 2013) *Area covered: ABI blocks W & Z. No sightings in block Z (French waters)*	*Area covered: ABI blocks 3 & 4. No sightings*	**2,898 CV=0.3** (Hammond *et al.* 2021b) *Area covered: ABI coastal blocks AA, AB, AC & B, and offshore blocks 9, 11-13. No sightings in offshore blocks.*	If harbour porpoises are sighted in the Iberian Peninsula during SCANS-IV, it will be possible to investigate a trend over time of this AU.
	• Hammond *et al.* (2021)b revised previous abundance estimates and CV from SCANS-II and stated that estimates in 2016 and 2005 were compatible. • A similar distribution of sightings between SCANS II and III within the Iberian Peninsula and very few sightings in coastal French waters.			
Bottlenose dolphin	**7,480 CV = 0.4** (SCANS-II & CODA) (abundance estimates of individual blocks can be found in Hammond *et al.* (2013) and CODA (2009)) *Area covered: ABI blocks W & Z (SCANS-II) and blocks 3 & 4 (CODA)*		**24,597 CV=0.3** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b) *Area covered: ABI coastal blocks AA, AB, AC, and B, and offshore blocks 9, 11-13. No sightings in AA and 11.*	Differences can be attributed to responses to spatial variation in prey availability (Hammond *et al.* 2021b) suggesting that abundance estimates are currently not robust enough for a regional assessment
	• Hammond *et al.* (2021)b observed a great difference between overall abundance estimates between 2016 SCANS-III, and 2005/07 SCANS-II+CODA, which was also observed for the specific abundance estimate with only blocks in the ABI sub-region			
Common dolphin	**79,510 CV = 0.4** (SCANS-II & CODA) (abundance estimates of individual blocks can be found in Hammond *et al.* (2013) and CODA (2009)) *Area covered: ABI blocks W & Z (SCANS-II) and blocks 3 & 4 (CODA)*		**439,996 CV=0.3** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b)	

Species	SCANS-II survey (2005)	CODA survey (2007)	SCANS-III survey (2016)	Notes
			Area covered: ABI coastal blocks AA, AB, AC, and B, and offshore blocks 9, 11-13.	
	- Differences between CODA+SCANS-II and SCANS-III surveys could be due to the effect of observation platforms but more regional abundance estimates are needed before making an assessment of the trend			
Striped dolphin	*Area covered: ABI blocks W & Z. Few sightings for an abundance estimate.*	**27,591 CV=0.4** (abundance estimates of individual blocks can be found in CODA 2009) *Area covered: ABI blocks 3 & 4.*	**441,049 CV=0.3** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b) *Area covered: ABI coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. No sightings in block AA.*	
	- See comment in common dolphin abundance estimates			
Killer whale	*Area covered: ABI blocks W & Z. No sightings.*	*Area covered: ABI blocks 3 & 4. No sightings.*	*Area covered: ABI coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. Insufficient sightings for an abundance estimate*	The most suitable method to obtain abundance estimates is dedicated photo-ID
Beaked whales (all species)	*Area covered: ABI blocks W & Z. Sighted in offshore waters and on the continental shelf area* (Rogan *et al.* 2017), *but sightings were insufficient to provide an abundance estimate.*	**2,694 CV=0.4** (abundance estimates of individual blocks can be found in CODA 2009) *Area covered: ABI blocks 3 & 4.*	**4,462 CV=0.3** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b) *Area covered: Coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. No sightings in blocks AA and AB.*	**2006: 841 CV=0.23** **2007: 168 CV=0.23** **2008: 277 CV=0.23** Macleod *et al.* (2011) obtained abundance estimates for Cuvier's beaked whale in the Torrelavega and Cap Breton canyons during the DIVER campaigns carried out in July 2006, 2007 and 2008. The values of estimates

Species	SCANS-II survey (2005)	CODA survey (2007)	SCANS-III survey (2016)	Notes
				corrected taking into account an availability bias estimate of 0.22 (SE = 0.03), i.e., the mean length of time animals are visible at the surface
Pilot whales	*Area covered: ABI blocks W & Z. Sightings were reported but no abundance estimates for the species were provided (Hammond et al. 2011)*	**826 CV=0.9** (abundance estimates of individual blocks can be found in CODA 2009) *Area covered: ABI blocks 3 & 4.*	**14,255 CV=0.4** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021) *Area covered: Coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. No sightings in block AB.*	High CV for the ABI CODA estimates
	• Comparing the offshore density of CODA and SCANS-III, for similar blocks, the density estimates showed an increase of 8 times between 2007 and 2016. However, the general reported trend in SCANS-III for the whole European waters was the opposite, showing a considerable decrease in abundance. Hammond *et al.* (2021)b suggest that the differences found in abundance estimates between surveys were related to the wide-ranging distribution of the species and spatial variation of prey availability			
Risso's dolphin	*Area covered: ABI blocks W & Z. Sightings were reported but no abundance estimates for the species were provided (Hammond et al. 2013)*	*Area covered: ABI blocks 3 & 4. No sightings.*	**4,766 CV=0.5** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b) *Area covered: Coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. No sightings in blocks 11-13.*	
Sperm whale	*Area covered: ABI blocks W & Z. No abundance estimates were provided.*	**969 CV=0.4** (abundance estimates of individual blocks can be found in CODA 2009)	**7,669 CV=0.4** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b)	

Species	SCANS-II survey (2005)	CODA survey (2007)	SCANS-III survey (2016)	Notes
		Area covered: ABI blocks 3 & 4.	*Area covered: Coastal blocks AA, AB, AC, & B, and offshore blocks 9, 11-13. No sightings in coastal blocks.*	
Minke whale	*Area covered: ABI blocks W & Z. No sightings*	*Area covered: ABI blocks 3 & 4. No sightings*	**453 CV=0.7** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021) *Area covered: Coastal blocks AA, AB, AC, and B. Offshore blocks 9, 11-13. Sightings in blocks AC and B. Rarely sighted in the ABI sub-region, with only a few sightings in North of Spain and France.*	High CV
Fin whale	*Area covered: ABI blocks W & Z. No abundance estimates for the species because of the small number of sightings (Hammond et al. 2011)*	**3,708 CV=0.2** (abundance estimates of individual blocks can be found in CODA 2009) *Area covered: ABI blocks 3 & 4.*	**26,472 CV=0.1** (abundance estimates of individual blocks can be found in Hammond *et al.* 2021b) *Area covered: Coastal blocks AA, AB, AC, and B. Offshore blocks 9, 11-13. No sightings in coastal blocks.*	Abundance estimates for fin whales have also been obtained with data from platforms of opportunity, such as acoustic surveys for the assessment of small pelagic fish in the Northeast Atlantic. The current variability in abundance estimates of this species shows that more data is required to accurately assess this criterion for fin whales.
		● Comparing density estimates of fin whales for similar survey blocks of project CODA (blocks 3 and 4) and SCANS-III (blocks 9, 11, 12 and 13), the density of fin whales increased five times between 2007 and 2016. ● Abundance in the ABI sub-region can be different during Winter, as fin whales from high latitudes migrate towards the lower-latitudinal regions to reproduce (Lydersen *et al.* 2020). It is possible differences found between surveys can be related to the extensive movements of the species.		

Small toothed cetaceans

For common dolphins, bottlenose dolphins and striped dolphins, acquiring visual data to estimate abundance is relatively accessible because of their widespread distribution, presence in coastal areas, distinct characteristics (e.g. dorsal fins), and behaviour at the surface (e.g. jumps). They also occur in groups large enough to be easily detected. As such, available current data suggest the feasibility of estimating abundance through visual data using distance sampling for these species. Still, current results from large-scale surveys show high variability in abundance estimates, which can possibly be partly associated with shifts in prey availability (Hammond *et al.* 2021b, 2017). For oceanic species, such as the striped dolphin, past surveys have not covered a large extension of their preferred habitat (offshore waters). In the case of the harbour porpoise, although the skittish behaviour and small group size difficult the acquisition of data, it was possible to obtain an abundance estimate for the species in the European Atlantic waters. However, the abundance of this species in the ABI sub-region is still uncertain because it is not possible to distinguish between the two ecotypes that occur in Iberian and French waters. Usually, a small number of sightings results in high coefficients of variation that are associated with imprecise estimates of abundance. For this species, since it has coastal habits and opportunistic data could be more readily available, a relative abundance (number of animals per unit effort) can be used in addition to the absolute abundance estimate, as an index of the number of individuals in an area. Relative abundance estimates can also provide information about changes in time and space and/or cover seasonality changes. However, careful consideration should be taken about the representativeness of the population and large differences in protocols and platforms for data collection and analysis. Finally, for killer whales and the well-defined coastal groups of bottlenose dolphins, abundance estimates obtained from dedicated mark-recapture photo-ID surveys, should be more robust than using distance sampling. Nevertheless, for coastal bottlenose dolphins, the efforts have not yet been focused on acquiring photo-ID data and killer whales occur in small numbers implying a greater effort to obtain data.

Deep-diving toothed cetaceans

Obtaining abundance estimates for deep-diving toothed cetaceans can be challenging because of the wide distribution ranges, low densities and short period of time spent at the surface (Virgili *et al.* 2019). Results from large-scale surveys such as SCANS and CODA suggest that further steps in data collection and analysis are needed in order to have enough information to achieve reliable abundance estimates. Virgili *et al.* (2019) suggest combining data from multiple visual surveys that have the same data collection methodology to increase sightings, but also note that this might result in an increase of variability caused by the heterogeneity in protocols and platforms. Taking advantage of current knowledge of the vocal behaviour of some species, such as beaked whales and sperm whales, Rogan *et al.* (2017) suggest a combined visual and acoustic approach to refine abundance estimates.

Baleen whales

Baleen whales are, in general, difficult to monitor because their distribution range extends to offshore areas, therefore implying challenging logistics to study them. The migrations of some baleen whales are complex because some individuals can undertake extensive migratory seasonal movements (e.g. Lydersen *et al.* 2020), while others may stay in an area for extended periods of time (e.g. Notarbartolo di Sciara *et al.* 2003). In the case of the ABI sub-region, two subpopulations of fin whales occur, the Mediterranean and the Northeast North Atlantic (e.g. Pereira *et al.* 2020, Gauffier *et al.* 2018, Geijer *et al.* 2016, Castellote *et al.* 2012), but the flux between the two populations is still uncertain, with possible limited movements from the Mediterranean individuals. Although some assumptions about the identity of the population can be made based on the movements of animals in the south of the Iberian Peninsula, it is not possible to make a visual distinction. Furthermore, the distribution of sightings of fin whales from large-scale surveys on which abundance estimates are based does not represent the known extension of the distribution of the species. In fact, SCANS III blocks, in the southern part of the ABI were within the 200m bathymetric lines, with no effort in offshore waters. Sightings of minke whales from large-scale surveys throughout the ABI sub-region have not been sufficient enough to provide robust abundance estimates for the species, but both Portugal and France, considering additional data from national surveys, have assessed this species.

3.2.2. Demographic characteristics (D1C3)

According to the GES Decision, the good status of D1C3 is achieved when "the population demographic characteristics of the species are indicative of a healthy population which is not adversely affected due to anthropogenic pressures". As it is described, this criterion assumes the use of several indicators related to the population which can include body size or age class structure, sex-ratio, fecundity, and survival rates (Palialexis *et al.* 2021). Although this criterion is secondary, some population characteristics listed under D1C3, such as reproductive rate, are crucial to understand the viability of a population and set threshold values for other criteria. However, the ability to detect changes in demographic parameters and to have insights into the fitness and survival of long-lived animals such as cetaceans may require decades of data (Arso-Civil *et al.* 2019) on growth, reproduction, mortality, immigration and emigration (IJsseldijk *et al.* 2020).

In general, information to assess this criterion is based on stranded individuals and, for some species, on photographic identification. Data from strandings is often considered biased because it depends on reporting rates, condition of the carcass, regional current and wind regimes and because individuals are mostly derived from coastal populations and the weaker segments (incapacitated, sick or old individuals) (Peltier *et al.* 2014, 2013). Nevertheless, strandings are a relatively low-cost and valuable source of long-term information for cetaceans. Efforts to improve the statistical analysis of stranding data (Authier *et al.* 2014) and methodological improvements, that consider drift conditions and the probability of detection of stranded animals (Peltier *et al.* 2014, 2013), have been made over the last decade. Strandings data provide information about diet, health (e.g. condition, diseases, parasites), causes of mortality, population structure, and life history in general (Learmonth *et al.* 2014, López *et al.* 2012, Read *et al.* 2012, Murphy *et al.* 2009, Murphy 2009, Lockyer 2003, López 2003, Lockyer *et al.* 2001). Biological parameters of stranded animals, such as sex and body length, can also give insights into population demographic structure. Then, by analysing the age-specific mortality and age-at-sexual-maturity, a life table can be constructed and a population demographic structure can be inferred, as well as mortality and survivorship curves (Saavedra *et al.* 2015, Stolen & Barlow 2003, Barlow & Boveng 1991). This life table depends on the number of data and on the representativity of the different age classes, spatial range and mortality causes. Survival and reproductive parameters can be used to develop a demographic model, that estimates the growth rate of a population and can inform about the impact of human-induced mortality (Mannocci *et al.* 2012).

For species that are naturally more abundant and/or have more common strandings, such as common dolphins, harbour porpoises, bottlenose dolphins and striped dolphins, the amount of data collected can be sufficient to estimate demographic parameters under some assumptions (Table 4). For example, one of the most detailed works about biological parameters was done for the harbour porpoise throughout its range in the North Atlantic (Lockyer 2003). In this study, an extensive list of several age-related, reproduction and growth parameters were estimated based on a combination of direct catches, bycatches and strandings. More data and research must be collected and executed about the differences in probability to strand among sex, age classes or body length. Once we would have estimated the different probabilities to strand, we may use this data to estimate demographic rates.

Demographic parameters can also be estimated directly from repeated observations of individuals with natural markings (Arso-Civil *et al.* 2019, Würsig & Jefferson 1990). The success of mark-recapture techniques based on individual photo-identification in assessing population dynamics is dependent on the time span of the effort and the proportion of identifiable individuals in a population. As such, these methods have been applied successfully to coastal communities of bottlenose dolphins (e.g. Giménez *et al.* 2018, Martinho *et al.* 2015, Urian 1999) and killer whales (e.g. Esteban *et al.* 2016, Beck *et al.* 2013), that can be surveyed regularly. By following individuals throughout the years, their natural history is collected and parameters such as age at sexual maturity, calving intervals, length of nursing, reproductive and total life span, and occasionally information on disease and mortality rates, can all be inferred (Arso-Civil *et al.* 2019, Würsig & Jefferson 1990).

In the ABI sub-region, national stranding networks provide records, measurements and samples of stranded animals. Photo-identification efforts in the sub-region have been inconsistent and dependent on opportunistic platforms such as dolphin-watching companies and non-governmental organizations, with some efforts along the Galician Coast, the coast of Portugal, and the Gulf of Cadiz (ICES 2016). The success of photo-ID data depends on a robust protocol that must be applied in the same way and at the same time each year. The robust estimates of demographic rates and abundance depend on the funding of these annual/decadal protocols. The longest collection of photographic data for a coastal bottlenose dolphin population in Europe is the one obtained for the resident population in the Sado Estuary, where an annual census is undertaken, since 1986, and is carried out by the National Institute for Nature Conservation and Forests, ICNF (ICES 2016, Lacey 2015, Gaspar 2003, Carvalho pers. comm. 2020). The sex and age of all individuals in this population are known. Besides the

Sado estuary population, there are no additional dedicated efforts for acquiring photographic data on coastal bottlenose dolphins on the coast of Portugal and the data is highly dependent on opportunistic platforms. This resident group, however, is not assessed and reported under MSFD. In Spain, dedicated photo-identification campaigns to assess the resident bottlenose dolphin population of southern Galicia and killer whales in the Strait of Gibraltar have been carried out in the last decades. For the Iberian subpopulation of killer whales, several groups of the population are known and the classification of age and sex has been achieved for most individuals from photo-ID (Esteban *et al.* 2016). Two projects comprising the elaboration of photographic catalogues of cetaceans in ABI sub-region have been funded by Fundación Biodiversidad: Cetidmed (2012-2013), aimed at the creation of a photo-ID catalogue for bottlenose dolphin, killer whale and long-finned pilot whale in the Gulf of Cadiz, the Strait of Gibraltar and Alboran Sea; and Turgasur, a project addressing the monitoring and improvement of knowledge of bottlenose dolphin in the MU Southern Galicia Rias, involving the realization of photo-identification surveys and the preparation and distribution of a photo-ID catalogue. Moreover, the Ministry for the Ecological Transition and the Demographic Challenged has awarded a tender for the elaboration of different monitoring campaigns for cetacean species, including, among others, two photo-ID campaigns in ABI sub-region, one for the killer whale in the Gulf of Cadiz and the Strait of Gibraltar and another one for the bottlenose dolphin in the MU Southern Galicia Rias. These campaigns are intended to be repeated yearly, according to the monitoring program MT-1 (coastal mammals and turtles), which is part of the second cycle of Spanish marine strategies.

Table 4. List of examples of the most common demographic parameters obtained from strandings data.

Parameter	Measure	Species	Reference
Sex-ratio	- Ratio between the number of males and females	Common dolphin	López *et al.* 2002 Saavedra *et al.* 2015 Silva & Sequeira 2003
		Harbour porpoise	Llavona, 2018 Lockyer 2003 López *et al.* 2002
		Stripped dolphin	López *et al.* 2002 Marçalo *et al.* 2021
		Bottlenose dolphin	Saavedra *et al.* 2015
Age structure[1]	- Age estimate based on Growth Layer Groups (GLGs) in teeth	Common dolphin Bottlenose dolphin	Saavedra *et al.* 2015
Sexual Maturity	- Age estimate with measurement of gonads and maturation ogives	Common dolphin	Saavedra *et al.* 2015 Mannocci *et al.* 2012
		Bottlenose dolphin	Saavedra *et al.* 2015
		Harbour porpoise	Lockyer 2003
	- Total length	Common dolphin	Silva & Sequeira 2003
Pregnancy rate	- Ratio of pregnant females in the sample of mature females	Common dolphin	Mannocci *et al.* 2012
Mortality[2]	- Number of dead animals corrected for drift conditions and floating probability	Common dolphin Harbour porpoise	Peltier *et al.* 2014, 2013

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[1] Might be biased depending on the variable probability to strand.

[2] With an abundance estimate can be converted into mortality rate. Probability to strand and mortality rates must depend on age and mortality causes, also, at least to be used in life tables.

3.2.3. Distributional range and pattern (D1C4)

As stated in the GES Decision, D1C4 is a primary criterion and is achieved when "the habitat for the species has the necessary extent and condition to support the different stages in the life history of the species". D1C4 is assessed under OSPAR together with D1C2. Although regional efforts have been made to align and standardize data collection and statistical analysis for D1C2, it has been challenging to achieve the same coherency for D1C4. OSPAR describes the distributional range of a species as: 'the outer limits of the overall area in which the species is found' (OSPAR Commission 2021). However, in the report 'Indicators for status assessment of species, relevant to MSFD Biodiversity Descriptor' by Palialexis *et al.* (2019), the definition of range not only includes the actual distribution of a species but also suitable areas, which means including areas with no actual sightings. In the 2021's OSPAR Commission updated version of the "Guidance on the Development of Status Assessments for the OSPAR List of Threatened and/or Declining Species and Habitats", the assessment of the distribution of threatened species is suggested to be map-based, with detailed additional information that should include a description of any changes over time in the geographical range and distribution of the threatened species (OSPAR 2022). Therefore, as in D1C2, the assessment of D1C4 needs more than a single point in a time series to assess trends.

Density surface models derived from large-scale and national surveys have provided spatial information on species distribution of wide-ranging and common species that have sufficient data available to develop such models (OSPAR 2022). The density surface maps are usually generated with the density estimates obtained with model-based distance sampling approaches and predict density with descriptors, i.e. covariates, such as physiographic (e.g. depth, slope) and oceanographic (sea surface temperature, primary productivity) habitat descriptors (Miller *et al.* 2013). A list of potential habitat descriptors used in modelling the distribution and abundance of cetaceans is given in Table 5 of the report of WP2.1. Other species distribution modelling approaches, including occupancy models (presence/absence) or presence only (e.g. Maxent) or other regression-based techniques (e.g. Generalized linear models, GLMs, presence/absence Generalized Additive Models, GAMs). All of these models may contribute with information and maps to describe, and possibly predict, species distribution (Correia *et al.* 2021, Becker *et al.* 2010, Elith & Leathwick 2009). Given the rigorous data collection protocols, large-scale surveys with distance sampling methodology supply the most extensive data for species distribution modelling (OSPAR 2022). However, as reported in WP2.1., sightings from smaller scales of surveys can also be used in the analysis of species distributions. The inclusion of opportunistic sightings may be feasible but largely hinges on the availability of a reliable proxy of effort, or on the potential to develop one ex-post. Other examples of distribution models have used a combination of surveys and opportunistic data. One example is the work by Waggit *et al.* (2020), who developed large-scale distribution models for several cetacean species from an extensive data archive of sightings obtained with different survey types. However, heterogeneity among survey design and protocols may lead to biased results if not accounted for properly. Another example is the new statistical approach developed in WP2.1, in which dedicated large-scale surveys and opportunistic national DCF-surveys, with distance sampling protocols, were collated to estimate cetacean species abundance and build distribution maps (see Deliverables 2.2).

For some species in which the vocal behaviour is known and included in monitoring programmes, acoustic data can also provide insights into spatial distribution, such as harbour porpoises, beaked whales, sperm whales and possibly other deep-diving toothed cetaceans and baleen whales. The uncertainty of density surface models has been evaluated with extrapolation analysis, as reported in WP2.1. and the OSPAR CEMP Guidelines (OSPAR 2022). A technical description of extrapolation analysis is given in report WP2.1.

As mentioned above and in the D1C2, the distributional ranges for some species of cetaceans in European waters can be found in large-scale survey results as density surface maps (Figure 4,Figure **7**,Figure **8**, and Figure **11**). The summer distribution maps obtained with the new methodological approach developed in WP2.1., of the species considered are also shown in Figs.**Figure 3**, **Figure 6**, and **Figure 10**. Waggit *et al.* (2020) also developed seasonal density distribution maps of cetacean species that occur regularly in North Atlantic European waters, such as harbour porpoise, bottlenose dolphin, common dolphin, striped dolphin, Risso's dolphin, killer whale, pilot whale, sperm whale, minke whale, fin whale (Figure 5,Figure **9**, and Figure **12**), and others not considered in the ABI sub-region. The density models were based on an extensive data archive of 40 years (1980-2020), from as many different sources and suppliers as possible, such as large-scale surveys, national research groups, monitoring programmes and non-government organizations (NGOs) (Evans *et al.* 2021, Waggit *et al.* 2020). Maps of density distributions of each species were modelled by season (pooling all years of data, and thus ignoring potential inter-annual changes) and incorporated environmental variables and differences among surveys (Evans *et al.* 2021, Waggit *et al.* 2020). In this report, only the period from July to September season is considered to make a broad comparison with the models from the summer surveys of SCANS. Direct comparisons between maps cannot be made because of the differences in the models, such as spatial scale, explanatory variables and data processing. Nevertheless, the consistency of the main key areas for each species was broadly evaluated. Several examples of distribution modelling can be found in Table 5.

Table 5. Distributional range modelling examples at large scales (national to regional) for the species of cetaceans considered.

Type of data	Period and sampled area	Area of the predicted model	Species	References
Count	• Summer 2005/2007, 2016: SCANS-II&CODA, SCANS-III (Lacey *et al.* 2022) • Summer 2005/2007, 2016, 2017 (NASS/T-NASS) (Rogan *et al.* 2017) • Spring 2004-2013: Bay of Biscay (Lambert *et al.* 2018) • 1998–2016: Bay of Biscay (Virgili *et al.* 2022) • 1980–2018: Northeast North Atlantic Waggit *et al.* (2020), Evans *et al.* (2021) • Autumn 2010/2014: Coastal Portugal	• Northeast North Atlantic (all references except Virgili *et al.* 2022) • Bay of Biscay (Virgili *et al.* 2022 for deep-diving cetaceans and Lambert *et al.* 2018 for common and bottlenose dolphins) • Coastal Portugal for common dolphin and minke whale (Wise *et al.* 2018)	Harbour porpoise (coastal area) Bottlenose dolphin Common dolphin Striped dolphin Long-finned pilot whale Risso's dolphin Beaked whales (group of species) Sperm whale Minke whale Fin whale	Lacey *et al.* (2022) for several species Hammond *et al.* (2017) for several species Virgili *et al.* (2022) and Rogan *et al.* (2017) specifically for deep-diving cetaceans Evans *et al.* (2021) for Risso's dolphin model Lambert *et al.* (2018) Wise *et al.* (2018)
Presence-only	• 2011-2015: Portuguese waters (Torres-Pereira *et al.* 2022) • 2012–2017: Iberian Peninsula, northwestern African coasts and the Macaronesian islands (Correia *et al.* 2021a)	• Portugal and Galicia (Torres-Pereira *et al.* 2022) • Iberian Peninsula, northwestern African coasts and the Macaronesian islands (Correia *et al.* 2021a)	Harbour porpoise (Portugal and Galicia) Bottlenose dolphin Common dolphin Striped dolphin Pilot whales Cuvier's beaked whale Sperm whale Minke whale	Correia *et al.* (2021)a for the Iberian Peninsula, northwestern African coasts and the Macaronesian islands Torres-Pereira *et al.* (2022) for the harbour porpoise
Presence-absence	• 1980–2018: Northeast North Atlantic Waggit *et al.* (2020), Evans *et al.* (2021)	• Northeast North Atlantic (Evans *et al.* 2021, Waggit *et al.* 2020)	Harbour porpoise	Evans *et al.* (2021) Waggit *et al.* (2020)

Type of data	Period and sampled area	Area of the predicted model	Species	References
	• 2014–2017: coastal waters of northern Spain (Díaz-López & Methion 2018) • 2001–2014, 2003-2006: Bay of Biscay (Certain *et al.* 2008) • 2002–2012: Gulf of Cadiz, Strait of Gibraltar and the Alboran Sea (Esteban *et al.* 2014)	• Northern Spain (Díaz-López & Methion 2018) • Bay of Biscay (Certain *et al.* 2008)	Bottlenose dolphin (offshore) Bottlenose dolphin (all, Certain *et al.* 2008) Common dolphin Striped dolphin Killer whale (Esteban *et al.* 2014) Long-finned pilot whale Risso's dolphin Sperm whale Minke whale Fin whale	Díaz-López & Methion 2018 Certain *et al.* (2008) for common and bottlenose dolphins Esteban *et al.* 2014 for killer whale

Small toothed cetaceans

Small toothed cetaceans are species with a considerable amount of data to evaluate the distributional range, given their behaviour at the surface and coastal occurrence. However, the high mobility of most species, and seasonal shifts in the distribution of some, difficult the assessment of temporal changes in the distributional range. Density surface models (Figure 3-Figure **12**) reveal the occurrence of key areas in the ABI, mostly dependent of the species, particularly offshore waters of northwest Iberia and Bay of Biscay for striped dolphins and the continental shelf of the northwest Iberia and the northern French section of the Bay of Biscay for remaining species. To note that, however, the lack of data in offshore western Iberia does not allow a complete and adequate assessment, especially for striped dolphin. Moreover, assessing changes in distributional ranges would require surveys to focus on the fringes on the distribution, whereas current surveys tend to focus on the heart of the distribution to obtain abundance estimates. This issue illustrates that data collection depends on the scientific rationale for the survey.

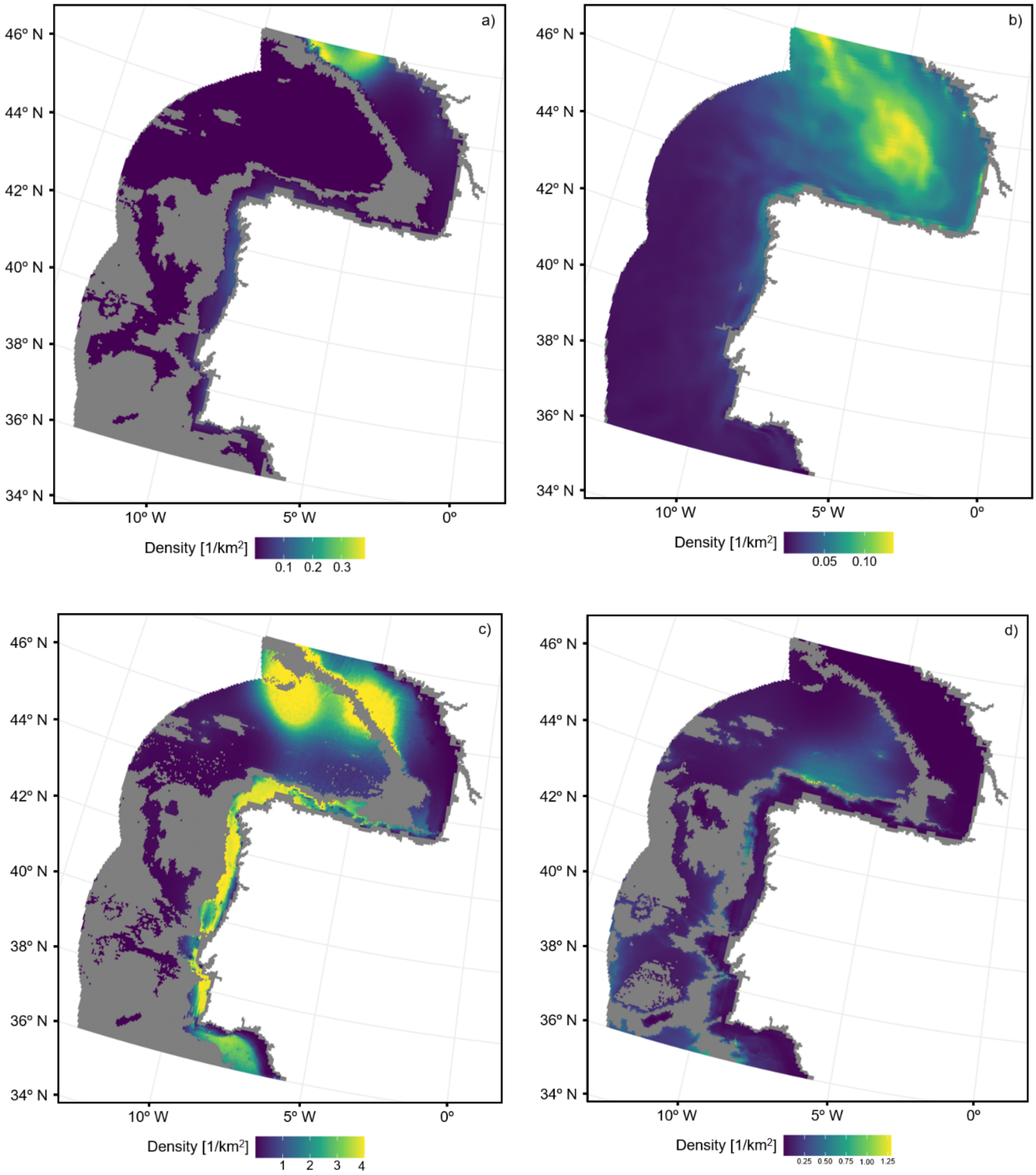
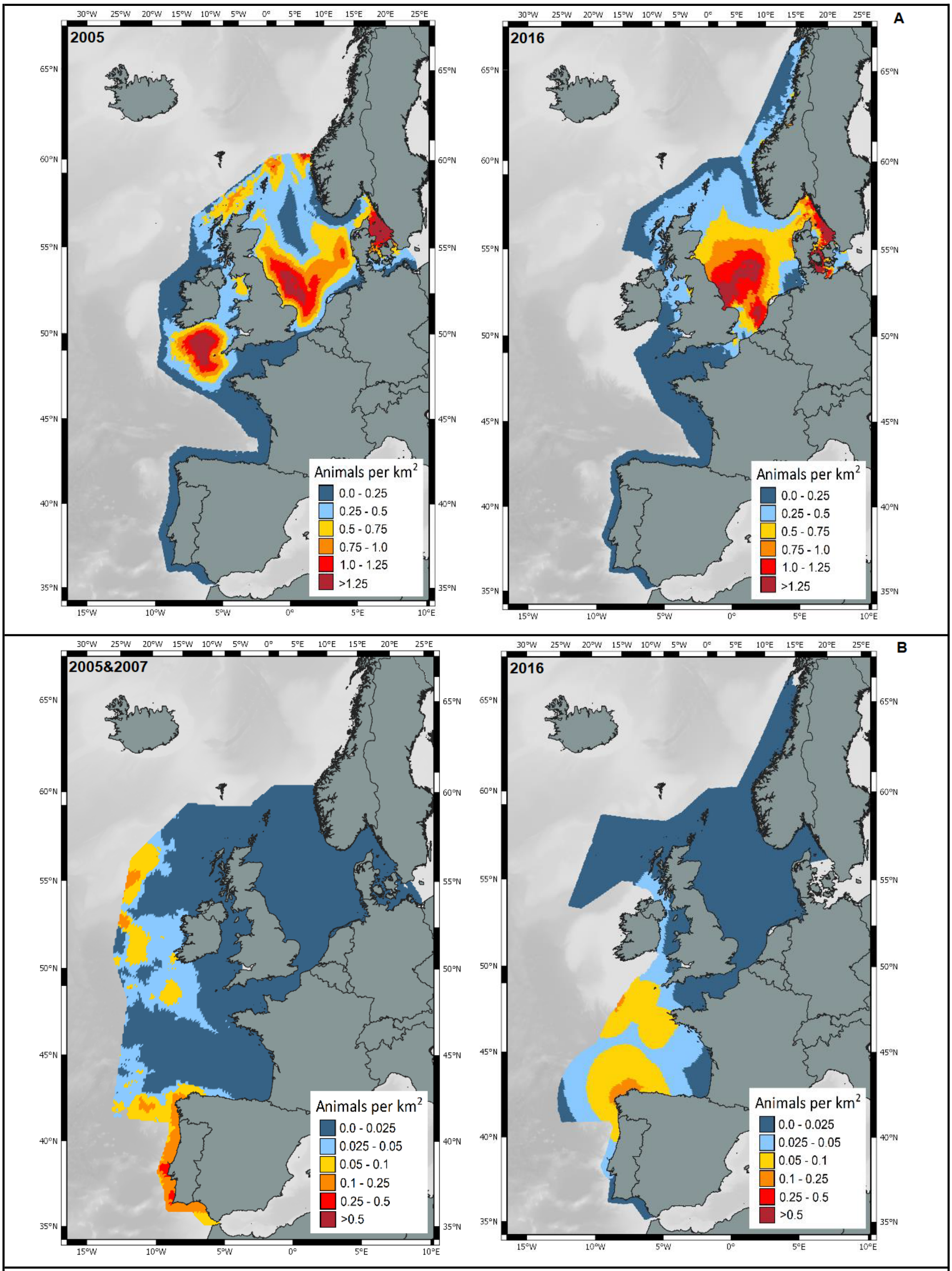


Figure 3. Predicted density surface for a) harbour porpoise, and b) bottlenose dolphin, c) common dolphin and d) striped dolphin for summer using compiled data (2005-2022) from ABI sub-region. Grey colour represents no data. More details about the models and associated CV in Deliverable 2.1.


A
2005
Animals per km²
🟦 0.0 - 0.25
🟦 0.25 - 0.5
🟨 0.5 - 0.75
🟧 0.75 - 1.0
🟥 1.0 - 1.25
🟥 >1.25
2016
Animals per km²
🟦 0.0 - 0.25
🟦 0.25 - 0.5
🟨 0.5 - 0.75
🟧 0.75 - 1.0
🟥 1.0 - 1.25
🟥 >1.25
B
2005&2007
Animals per km²
🟦 0.0 - 0.025
🟦 0.025 - 0.05
🟨 0.05 - 0.1
🟧 0.1 - 0.25
🟥 0.25 - 0.5
🟥 >0.5
2016
Animals per km²
🟦 0.0 - 0.025
🟦 0.025 - 0.05
🟨 0.05 - 0.1
🟧 0.1 - 0.25
🟥 0.25 - 0.5
🟥 >0.5
30°W 25°W 20°W 15°W 10°W 5°W 0° 5°E 10°E 15°E 20°E 25°E
65°N 60°N 55°N 50°N 45°N 40°N 35°N
15°W 10°W 5°W 0° 5°E 10°E

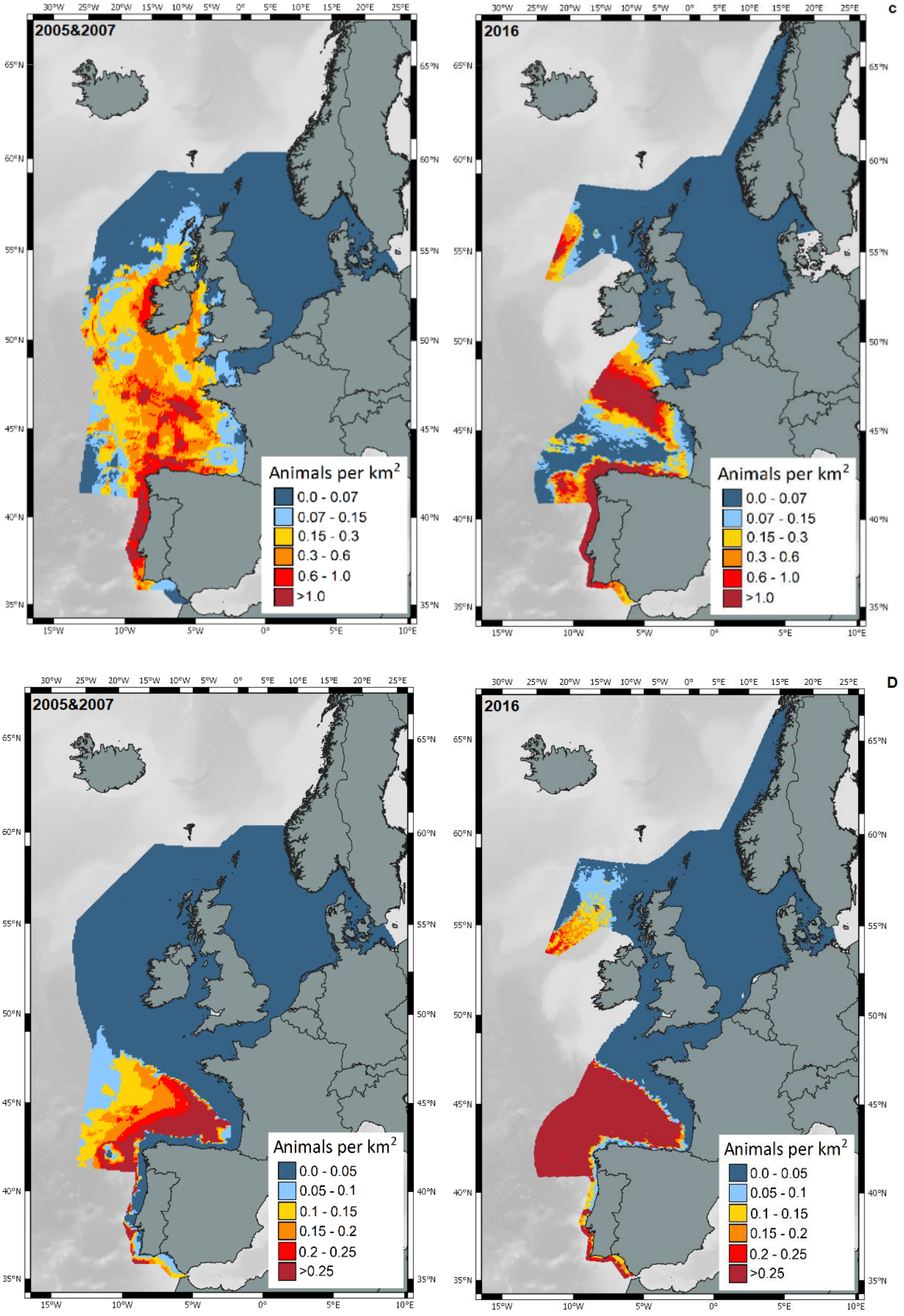


Figure 4. Predicted density surface for harbour porpoise (A) and bottlenose dolphin (B), common dolphin (C) and striped dolphin (D) for SCANS-II&CODA (left) and SCANS-III (right). Colour gradient scale represents density. From Lacey et al. (2022). CVs of the models can be found in Lacey *et al.* (2022).

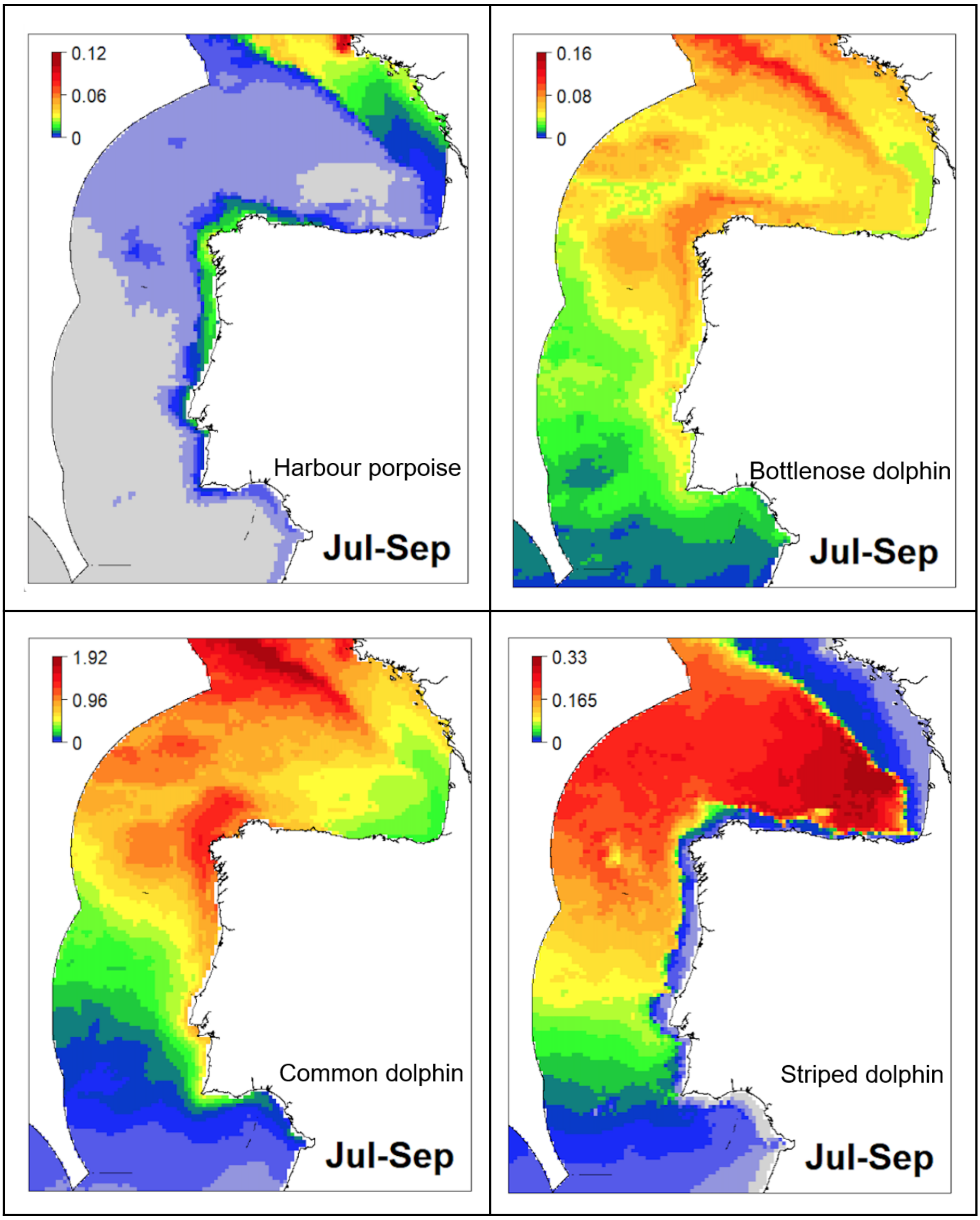


Figure 5. Predicted density (animals/km^2) surface for bottlenose dolphin, common dolphin, striped and harbour porpoise from the collation of different sighting sources for the period July-September. Colour gradient scale represents density values. From Evans *et al.* (2021).

Deep-diving toothed cetaceans

The available data and published studies about the distribution of deep-diving toothed cetaceans in the sub-region are patchy, and none included the deep waters of Portugal. Although the density surface maps produced by Evans *et al.* (2021) show a higher density of sperm whales in the deep waters of the Bay of Biscay (Figure 9), the lack of data from the deep waters of Portugal may be biasing the distribution pattern of this species. Given the extensive movements, the intrinsic small density, the limited time spent at the surface, and the elusive nature of some species, it is necessary to collect data from other platforms and sources other than large-scale surveys. Under the CETUS monitoring programme based on opportunistic platforms of observation, sightings within the Portuguese waters are also few and only in the southernmost offshore seamounts. Acoustic data is recommended to be used in the assessment of the geographical and temporal occurrence of beaked whales (Barlow *et al.* 2021, Berrow *et al.* 2018, Kowarski *et al.*, 2018) and could be extended to at least sperm whales (Solsona-Berga *et al.* 2022). The spatial density represented in the models (Figs. Figure **6**-Figure **9**) shows that the continental slope in the ABI is a key area for this group of species, and it is shared by some small toothed cetaceans as well.

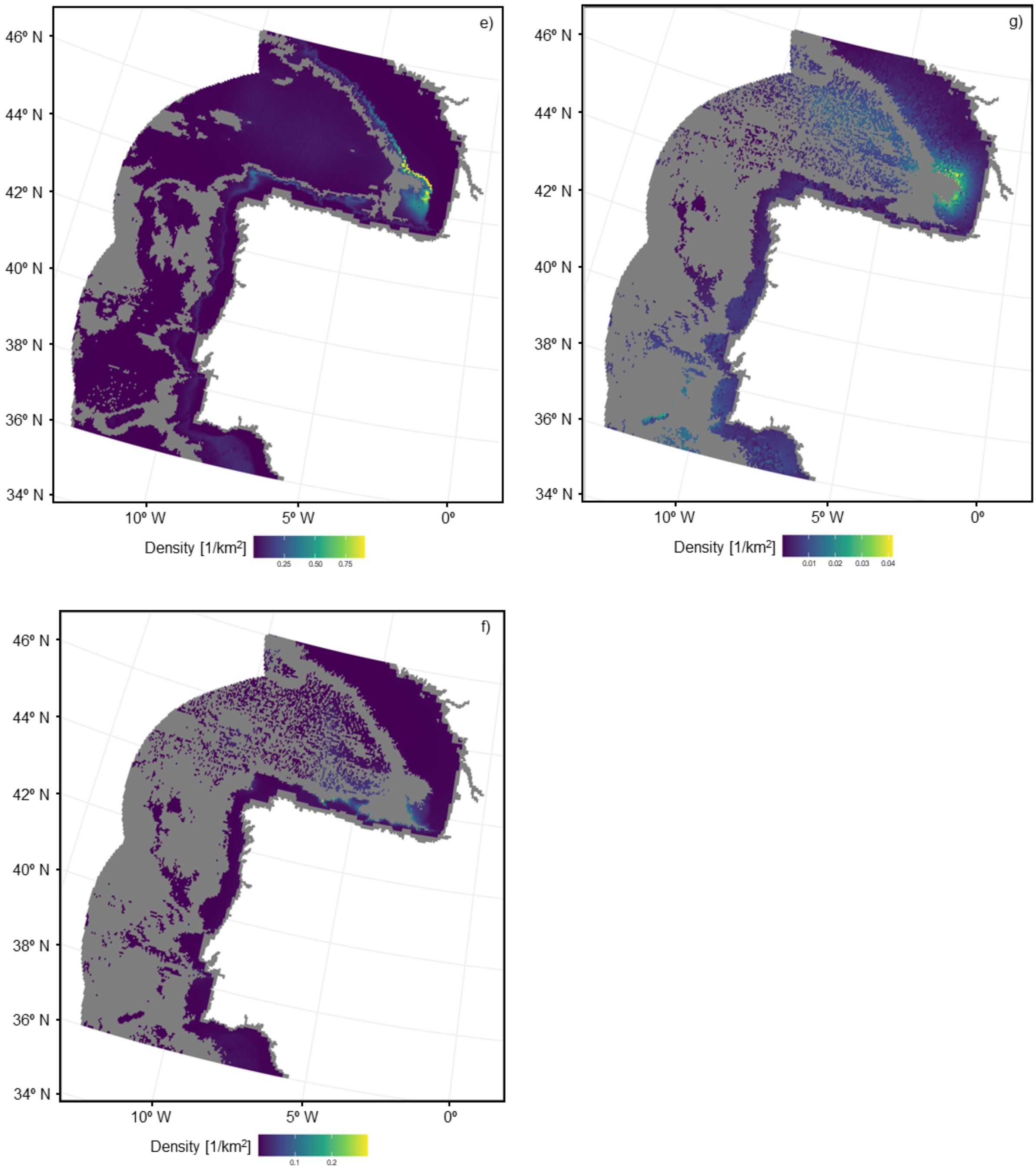


Figure 6. Predicted density surface for e) long-finned pilot whale, f) Risso's dolphin, and g) Cuvier's beaked whale for summer using compiled data (2005-2022) from ABI sub-region. Grey colour represents no data. More details about the models and associated CV in Deliverable 2.1.

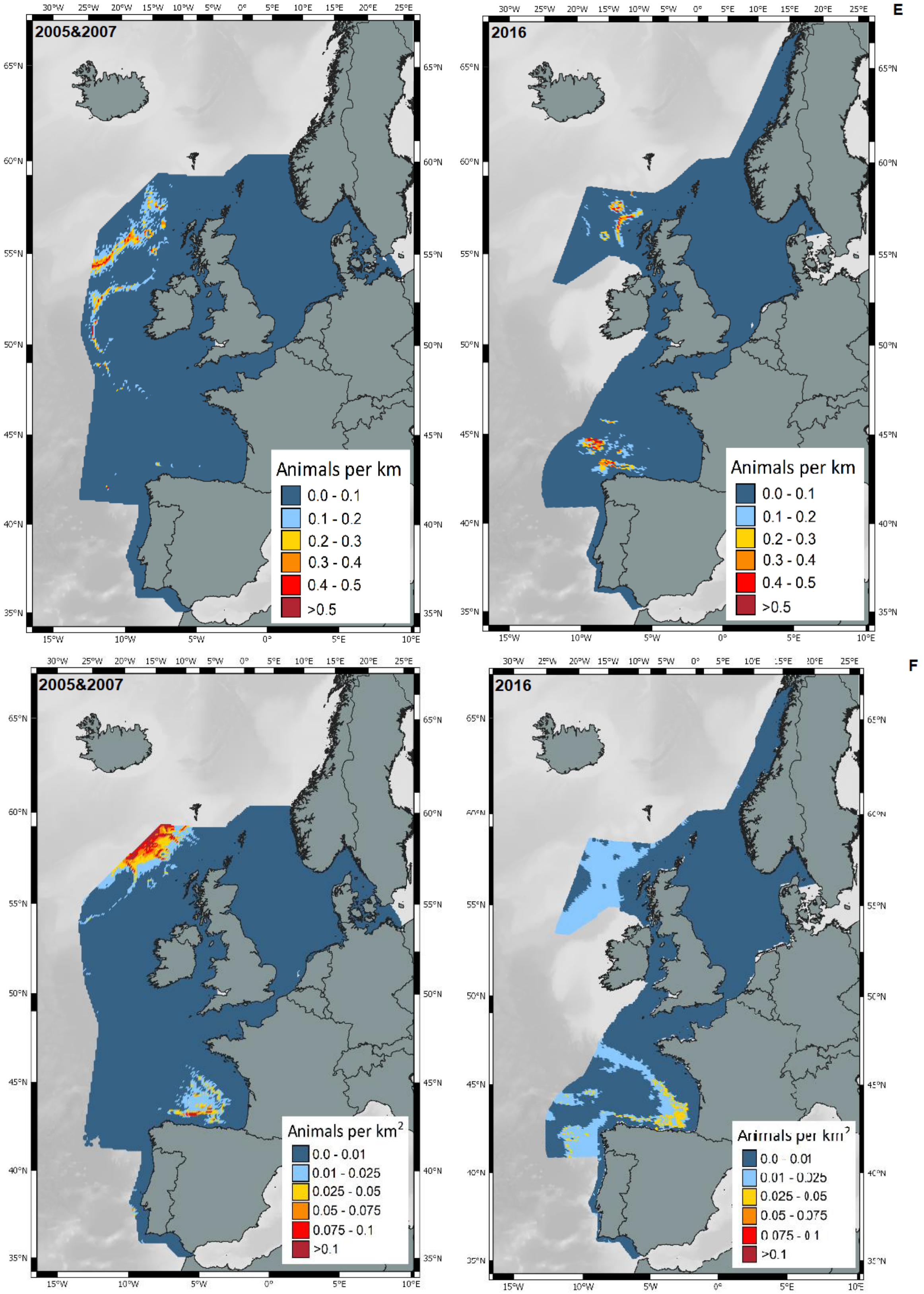


Figure 7. Predicted density surface for long-finned pilot whale (E) and beaked whales group (D) for SCANS-II&CODA (left) and SCANS-III (right). Colour gradient scale represents density. From Lacey et al. (2022). CVs of the models can be found in Lacey *et al.* (2022).

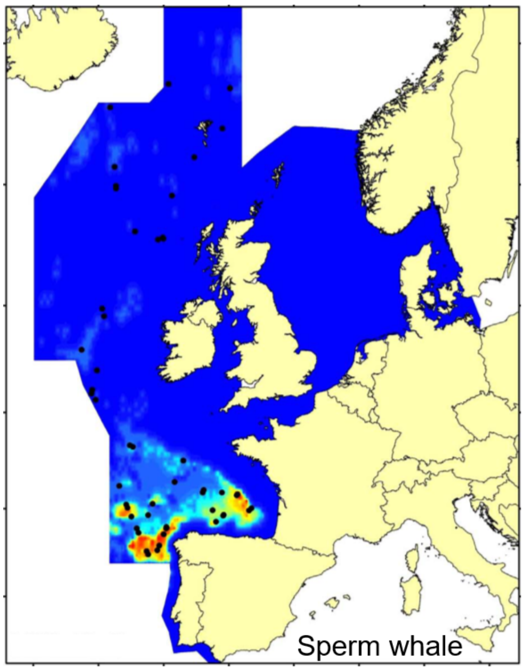


Figure 8. Predicted density surface for sperm whale CODA, SCANS-II and T-NASS data in summer 2005 and 2007. Colour gradient scale represents density (number of individuals/km^2) and black circles represent sightings. From Rogan *et al.* (2017).

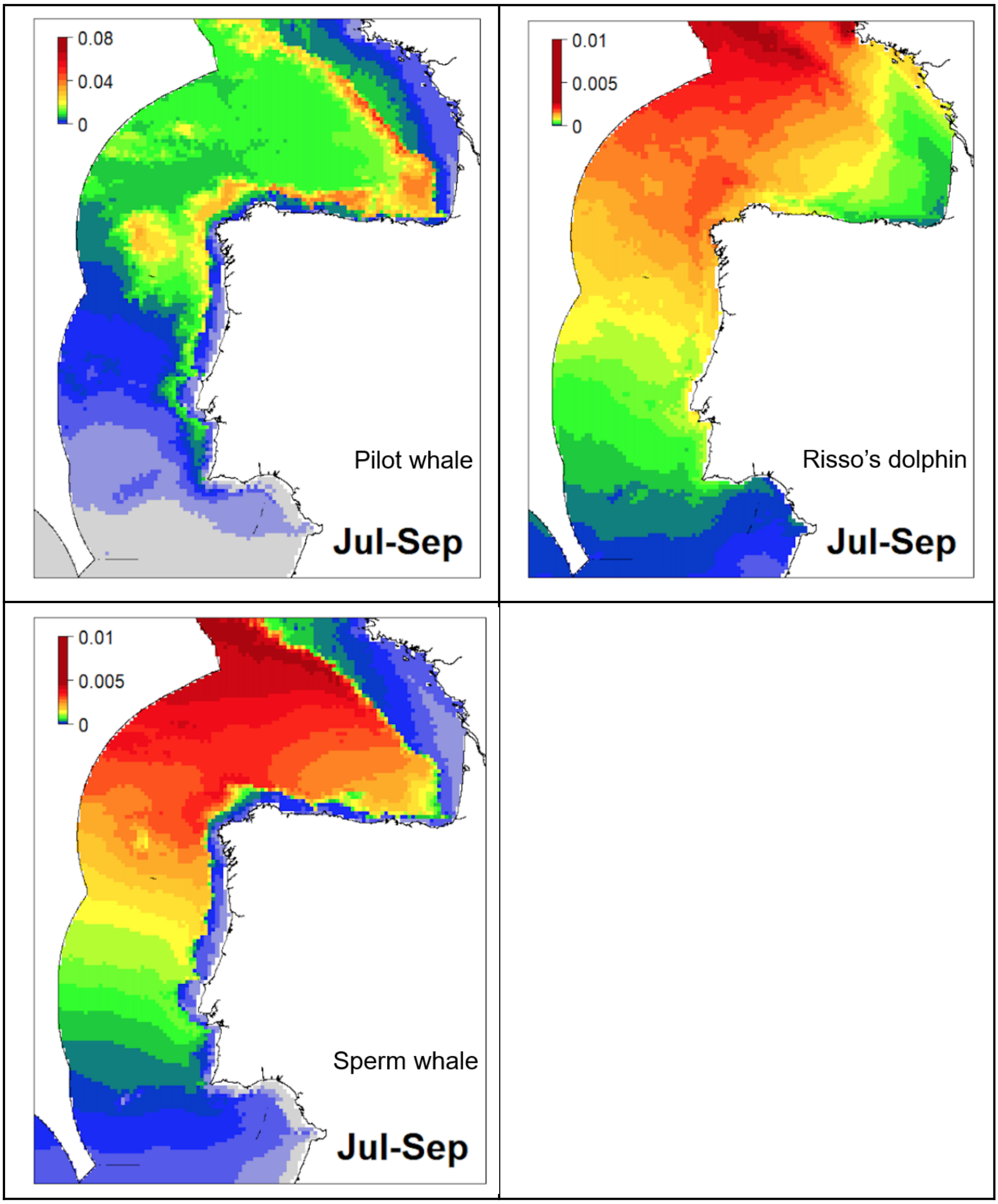


Figure 9. Predicted density surface for long-finned pilot whale, Risso's dolphin, and sperm whale from the collation of different sighting sources for the period July-September. Colour gradient scale represents density values. From Evans *et al.* (2021).

Baleen whales

As with deep-diving toothed cetaceans, the information available to assess the distributional range of baleen whales in the ABI is insufficient, when focusing solely on large- scale surveys such as SCANS, since the offshore Portuguese waters were not surveyed which may result in misleading conclusions. Density maps from the three models for fin whale, show a single common area with higher density, the offshore waters of the Bay of Biscay, which based on recent literature is incomplete (the offshore south of Portugal is potentially a high density area for fin whale). This is due to the under sampling of the offshore waters of Portugal (Figs. Figure **10**-Figure **12**). The high-density area of minke whale obtained from the work in WP2.1. (Figure 10) and Evans *et al.* (2021) (Figure 12) are more coastal than the one shown from SCANS data, which is located In the offshore areas of the Bay of Biscay (Figure 11).

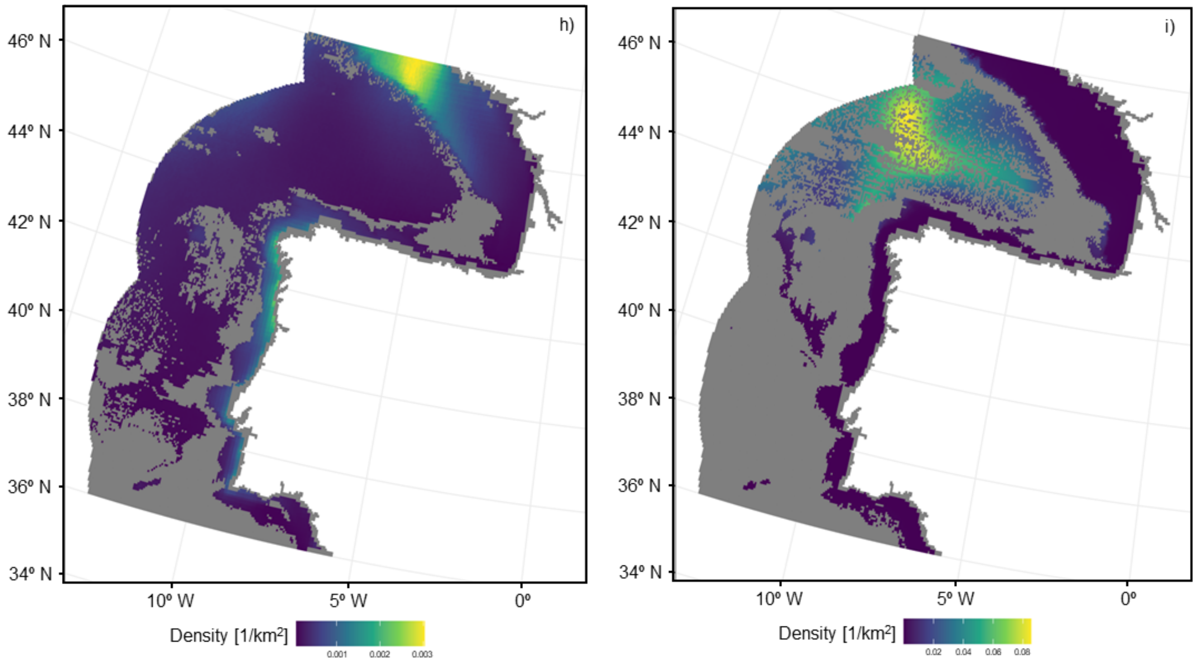


Figure 10. Predicted density surface for h) minke whale, and i) fin whale for summer using compiled data (2005-2022) from ABI region. Grey colour represents no data. More details about the models and associated CV in Deliverable 2.1.

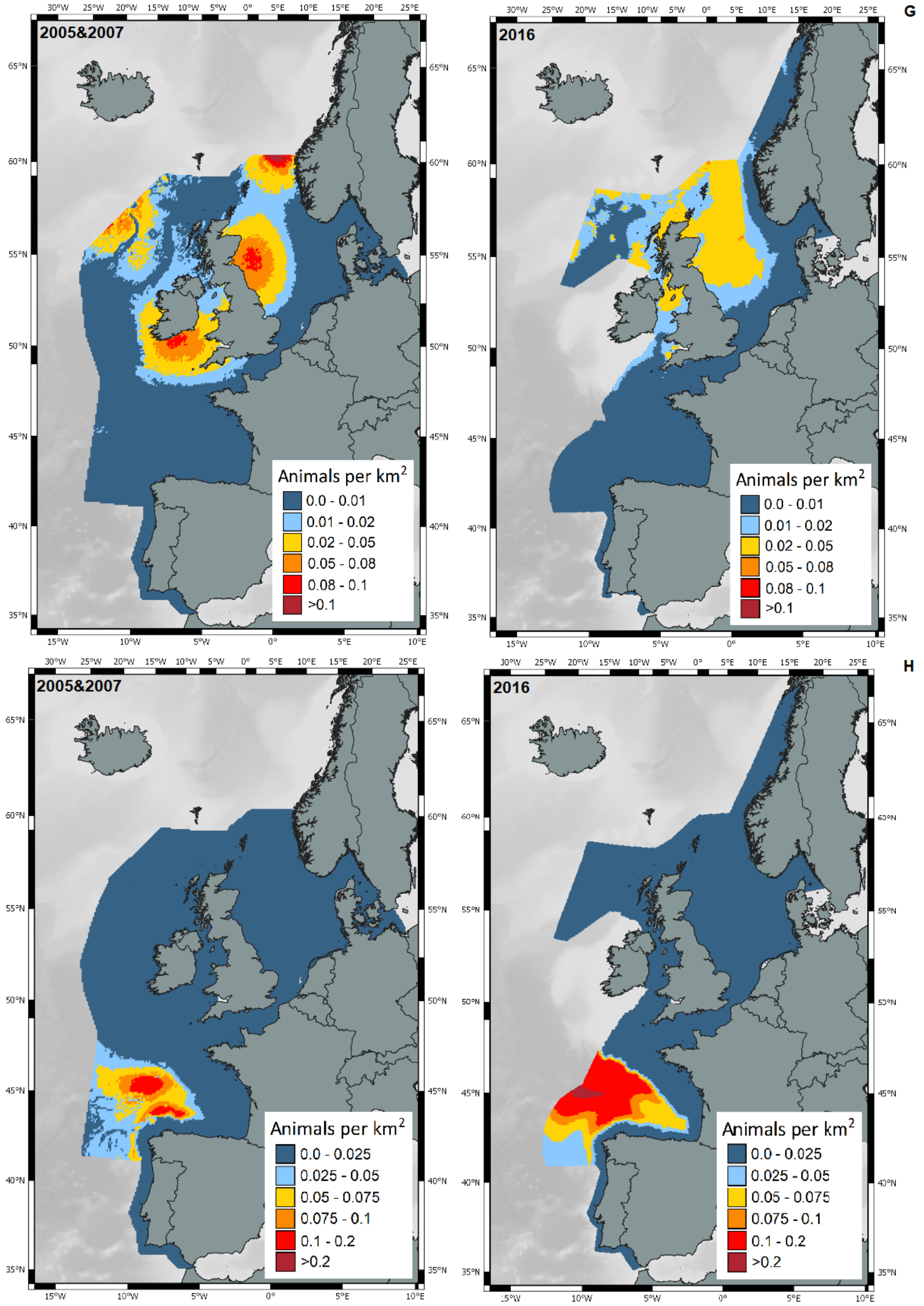


Figure 11. Predicted density surface for minke whale (G), and fin whale (H) for SCANS-II&CODA (left) and SCANS-III (right). Colour gradient scale represents density. From Lacey et al. (2022). CVs of the models can be found in Lacey *et al.* (2022).

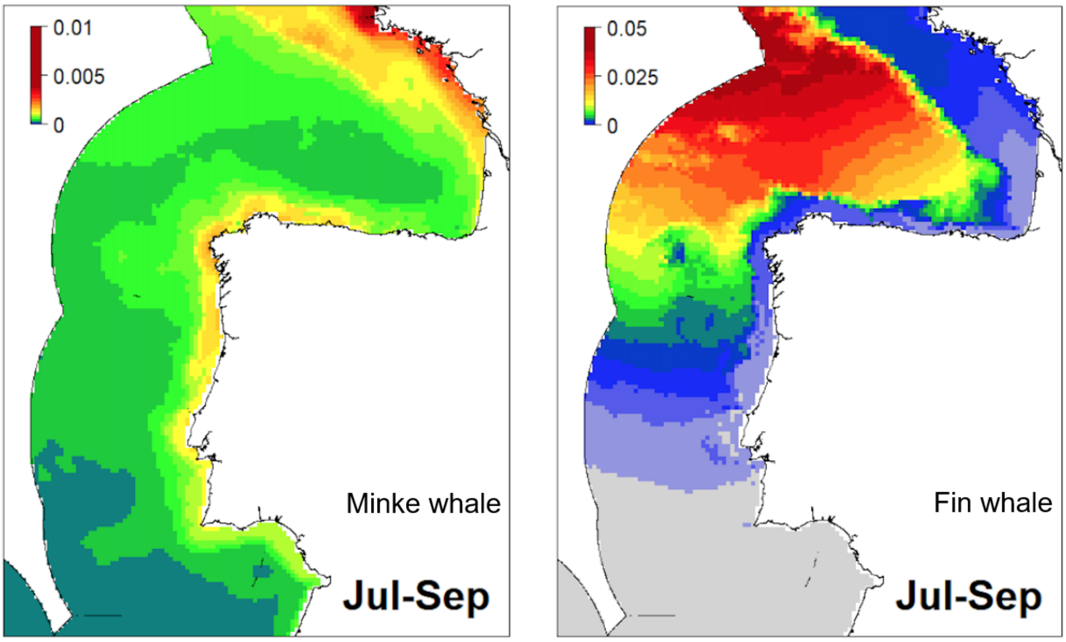


Figure 12. Predicted density surface for minke whale and fin whale from the collation of different sighting sources for the period July-September. Colour gradient scale represents density values. From Evans *et al.* (2021).

3.2.4. Habitat (D1C5)

According to the GES decision, the good status of D1C5 is achieved when 'the habitat for the species has the necessary extent and condition to support the different stages in the life history of the species. Since this criterion needs a large amount of information on habitat parameters, anthropogenic pressure, and distribution and ecology at different stages of a species' life cycle, it remains the less reported and assessed criterion (Vasilakopoulos *et al.* 2022). Furthermore, the relationship between natural and anthropogenic effects and the distribution and behaviour of a species is usually difficult to establish, particularly for highly mobile species such as cetaceans (Figure 13). Currently, there is no quantitative indicator or threshold values to assess D1C5 and baselines of an acceptable status of anthropogenic pressure are difficult to define because of gaps in data and knowledge (Vasilakopoulos *et al.* 2022).

Article 1(f) of the HD (European Union 1992) defines the habitat of a species as '(...) an environment defined by specific abiotic or biotic factors, in which the species lives at any stage of its biological cycle'.

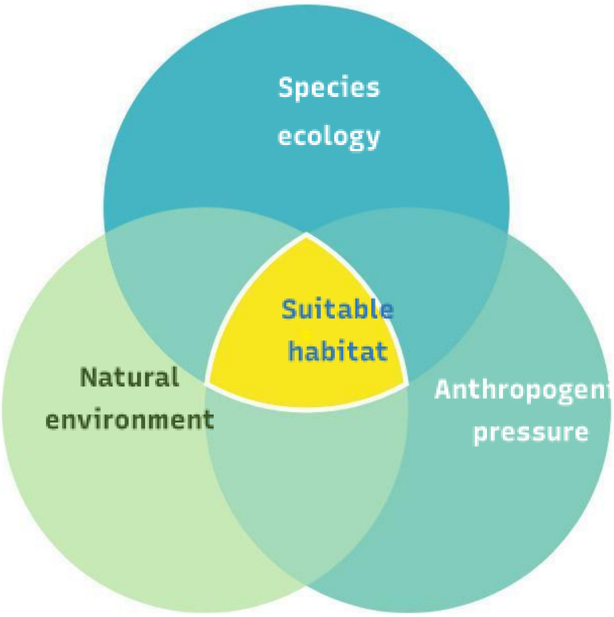


Figure 13. Simple representation of the factors that influence habitat suitability.

Although the extent of a habitat can be assumed to be assessed by a measure of area, the meaning of 'condition to support' is not clear in the GES Decision or existing guidelines. It could be associated with the carrying capacity of the area, i.e., the number of individuals at a particular stage of the life cycle of the species without degradation of the environment, or it could be only a matter of the presence of the species in the specific habitat. The simplest interpretation of

D1C5 can be assumed to be habitat suitability, which is defined as 'the potential of a habitat to support a particular species' (Kellner *et al.* 1992) and has been a focus of studies on ecological modelling that relates occurrence and/or density of a species with a set of features from the habitat. The suitable area and conditions of a habitat depend not only on the natural variability of the environment but also on the effects of human activities. As such, the assessment of D1C5 constitutes an effort of integrating biological-related and anthropogenic-related descriptors of the MSFD into ecological models. The same types of modelling described in D1C4 can be used to assess D1C5 (providing data on anthropogenic activities are available to include in the modelling), as they model the density and occurrence of a species in space and give insights into the importance and impact of environmental and human variables on the distribution of the animals. Although the underlying processes between the occurrence of a species and the parameters that define them might not always be completely understood, the potential impact of human activities can be considered to some extent. This could correspond to a degree of loss of habitat conditions to support the considered species. Risk assessment methods are tools that have been applied to address the risk of exposure to different types of human factors of several marine species, such as turtles (Wilcox *et al.* 2012), birds (Wilcox *et al.* 2015) and cetaceans (Evans *et al.* 2021, Guerrini *et al.* 2019, Breen *et al.* 2017). An exposure index is calculated across the habitat of a species by the spatiotemporal overlap between known human activities to cause mortality or some kind of disturbance and the density and/or the distribution of species (example in Figure 14). In the case of cetaceans, maps that represent the risk of interactions with fisheries (Breen *et al.* 2017; Brown *et al.* 2015), bycatch (Evans *et al.* 2021, Brown *et al.* 2013), ship collision (EMSA 2021, Ham *et al.* 2021), anthropogenic sound emissions (Azzellino *et al.* 2011) and microplastics (Guerrini *et al.* 2019), have been developed. Although these maps can be very informative for species with well-defined ranges and clear interactions with human activities, their development is not so straightforward. There are still efforts to be made on the harmonisation of the interpretation of habitat models between the MS including the indicators used to assess habitat suitability. The inclusion of risk based-approaches in the MSFD is being considered (Verling *et al.* 2021, Sardà *et al.* 2014), since it is a valuable tool for ecosystem management (Keith 1995). However, these approaches only provide a basis for more strategic inspection and monitoring, and there is no current standard methodology for their application under the MSFD (Verling *et al.* 2021).

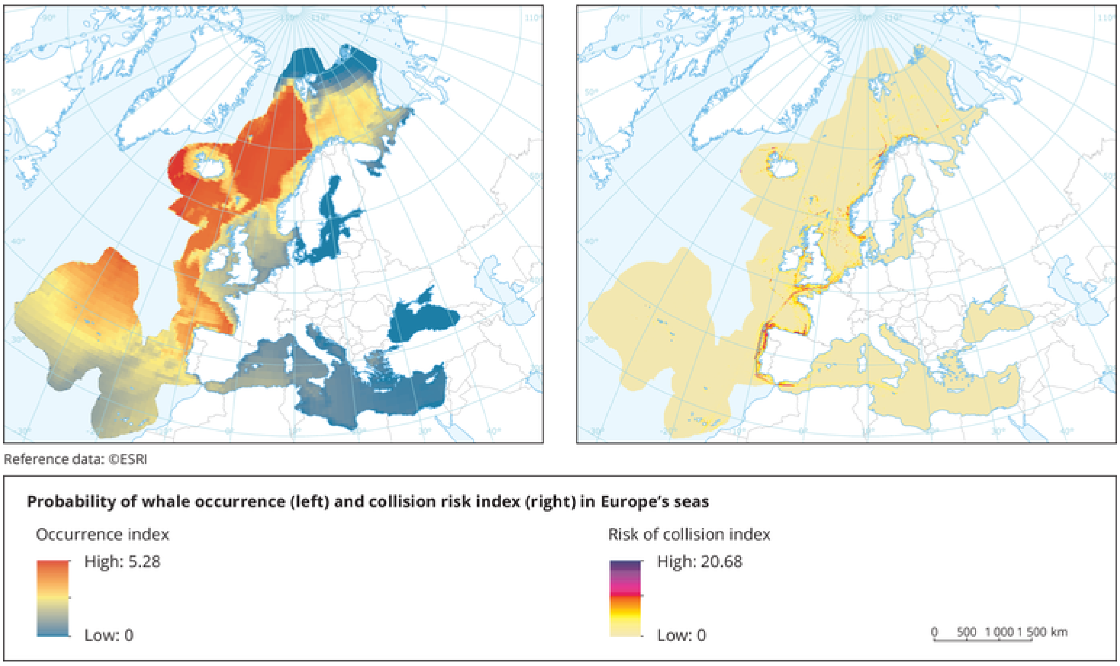


Figure 14. Probability of whale occurrence (left) and the ship/whales collision risk index (right) in Europe's seas. Species included are: Blue whale, Sei whale, Humpback whale, Sperm whale, Fin whale and Northern right whale. From: EMSA (2021).

In OSPAR, a candidate common indicator of persistent organic pollutants (POPs) in marine mammals is being developed, which focuses on the measurement of PCB levels in species tissues (OSPAR Commission 2022). Several studies show that PCBs have well-established dose-dependent toxicities which can result in immunosuppression, endocrine disruption, reproductive impairment, and reduced life length (Law *et al.* 2012, Jepson *et al.* 2005, Kannan *et al.* 2000, Helle *et al.* 1976). Although the quantitative impact of PCB levels on the demography and abundance of cetaceans is difficult to establish, it is widely accepted that these pollutants cause the degradation of habitat and living conditions. The assessment of this candidate indicator includes two approaches: a 'trend assessment', which focuses on the analysis of relative differences and changes in time and space of PCBs, and a 'status assessment' that analyses the levels of exposure that become hazardous (OSPAR Commission 2022). Samples to measure PCBs are mostly obtained in stranded animals, but they can also be obtained in free-living animals that are biopsied (e.g. Jepson *et al.* 2016). The number of samples and the species sampled are highly dependent on stranding data. As a consequence, the largest set of PCB data comes from small toothed cetaceans, specifically harbour porpoises, common dolphins, and coastal bottlenose dolphins (OSPAR Commission 2022). Killer whales also have a set of samples that cover most of their distribution (OSPAR Commission 2022). While several samples can be obtained for baleen whales, PCB data is extremely rare for this group of species (OSPAR Commission 2022). A pilot assessment of this indicator will be included in the Quality Status Report 2023 of OSPAR.

3.3.Assessing GES: assessment methodologies and integration rules

The growing anthropogenic pressures on the natural environment have led to the development of more holistic management strategies, such as ecosystem-based management approaches (Arkema *et al.* 2006, UNCED 1992, Leopold 1949). This approach considers that to maintain or to restore the integrity of an ecosystem, and to have a sustainable use of its resources, the management of the ecosystem needs to acknowledge and integrate all its elements and the complex spatial-temporal processes between them, including all human activities and their cumulative impacts on the environment (Kirkfeldt 2019, Rosenberg & McLeod 2005). Over the last decades, the ecosystem-based approach has been established as the main framework to apply towards sustainable planning of maritime activities and the management of marine ecosystems (Kirkfeldt 2019, Levin *et al.* 2009, ICES 2002).

Under the MSFD, all MS are required to take an ecosystem-based approach in their marine strategies and plans to achieve or maintain GES. The MSFD focus on a set of 11 descriptors which together summarize how the whole ecosystem functions. Several quality elements of the ecosystem (biological, hydrodynamical and chemical), that are relevant to each region and ecosystem type, are selected to characterize responses to changes in the processes of these descriptors, and therefore to assess GES (Gray & Elliott 2009). Although MS have some flexibility to determine their criteria and environmental targets to achieve GES, an ecosystem-based management approach involves the coordination and cooperation among MS of regions/sub-regions and the use of consistent approaches and methodologies among them, to ensure that the strategy is effective (which is why CetAMBICion was developed for the ABI). Following the identification of the representative species of each group, the determination of the criteria to assess them and the respective parameters to measure for each criterion (which were done in the previous chapters), the next steps to decide on GES include the establishment of "threshold values" (TV) for each parameter (Walmsley *et al.* 2016, also check Fig. 13 and 14 of CetAMBICion Deliverable 1.01). A TV is defined as "a value or a range of values that allows for an assessment of the quality level achieved for a particular criterion, thereby contributing to the assessment of the extent to which GES is being achieved" (European Commission 2022). For example, the Joint Research Centre Analysis (JRC), as mentioned in CetAMBICion Deliverable 1.01, as well as the most recent MSFD Assessment Guidance (2022) suggests the use of common indicators for D1C2 and D1C4 developed through regional cooperation, such as the ones developed for species covered by Directive 92/43/EEC, and associated TV Favourable Reference population values. Walmsley *et al.* (2016) mention that for the assessment of

D1C3, the adverse effects on the health of species derived from D8C2, D8C4 and other relevant pressures should be considered.

A summary of the selected indicators to assess cetaceans in the ABI sub-region is shown in **Table 6**. The methodologies of the assessment GES and associated TVs are discussed below.

Table 6. Summary of the indicators selected to assess GES of cetaceans in the ABI sub-region.

Criteria	Indicator designation	Estimate/measure	Methodological and sampling approach	Data requirements	Species
D1C1	M6_OSPAR (common indicator)	Mortality rate from incidental capture	Management Strategy Evaluation (MSE)	Bycatch monitoring data from observer programmes Population abundance Demographic parameters	Common dolphin Harbour porpoise
	ABI-CET-MOR	Percentage of stranded animals with evidence of by-catch	No. of stranded individuals with by-catch/ No. of stranded fresh carcasses	Strandings records	All* Common dolphin Harbour porpoise
D1C2	M4_Ospar (common indicator)	Trend in abundance	Dedicated large-scale surveys with distance sampling methodology	Large-scale dedicated visual data	Common dolphin Harbour porpoise Bottlenose dolphin Striped dolphin Long-finned pilot whale Minke whale Fin whale
			Mark-recapture methods with photographic data	Photographic data of dorsal fins or other body parts with individual markings	Bottlenose dolphin Killer whale
	ABI-CET-abundance	Trend in abundance	Opportunistic (DCF) national surveys with distance sampling methodology	National-scale opportunistic visual data	Common dolphin
D1C3	ABI-CET-maxstrandings	Extreme at-sea mortality (ASME)	Extreme Value Theory (EVT)	Strandings data	Common dolphin
	ABI-CET-pregnancyrate	Ratio of pregnant females	Ratio of pregnant females in the sample of mature females	Strandings data	Common dolphin

Criteria	Indicator designation	Estimate/measure	Methodological and sampling approach	Data requirements	Species
	ABI-CET-agematurity	Age estimates	Age estimates with measurement of gonads and maturation ogives	Strandings data	Common dolphin
	ABI-CET-birthrate	Fecundity rate	Mark-recapture methods with generalized linear mixed-effects models	Photographic data of dorsal fins or other body parts with individual markings and sex identification of the individuals	Bottlenose dolphin Killer whale

* By-catch evidence for all species is reported, but due to the lack of data, no quantitative assessment is possible

- **D1C1 – Fishery by-catch mortality:**

D1C1 focuses on determining the impact of the most predominant anthropogenic cause of mortality of marine mammals, which is bycatch. Although bycatch is a serious cause of death for some small cetacean species, such as the common dolphin and harbour porpoise, there are other human sources of mortality, direct and indirect, that should be accounted for. For example, there is a growing amount of evidence of injuries and deaths of fin whales caused by ship collisions (Castro *et al.* 2022). There are, however, current discussions on integrating other anthropogenic drivers of mortality and having a more comprehensive assessment of anthropogenic direct mortality in D1C1. CetAMBICIon WP3 analysed bycatch sampling schemes and monitoring programmes currently employed in the ABI region and suggested a common approach to GES determination and threshold calculation for D1C1. The assessment methodologies and regional thresholds for by-catch are listed in the report of **subtask 3.3**.

- **D1C2 – Trends in abundance:**

When quantifying the changes in population size, different drivers of decline can be considered such as direct human-caused mortality (e.g., ship strike, bycatch, entanglements), disease, predation, reduced prey availability, ecosystem change, and habitat degradation (Avila *et al.* 2018, Lotze *et al.* 2011, Magera *et al.* 2013, Taylor *et al.* 2007). The decision on whether the change in population size is acceptable in terms of management and potential viability of the population can be assessed through a **trend analysis of abundance** (either a rate of change or a minimum population size). However, although assessing trends in abundance is an attractive approach to managing wildlife populations, due to its apparent simplicity, the power to detect a statistically significant change in abundance is an arduous task and it is highly dependent on the species, frequency of surveys, amount of the data used and their type and quality (White *et al.* 2022, Authier *et al.* 2020). For example, large-scale dedicated surveys, such as SCANS, have been conducted with a long-time gap between them, resulting in low precision and accuracy of some abundance estimates that do not grant the confidence necessary to perform a trend analysis (White *et al.* 2022, Authier *et al.* 2020, Katsanevakis *et al.* 2012, Taylor *et al.* 2007). The use of regional and opportunistic types of data, such as DCF surveys, has been suggested to complement the assessment of the large-scale abundance trends since they can offer higher statistical power due to their higher frequency, but they can also suffer from low precision (OSPAR Commission 2022, Authier *et al.* 2020).

To address the issue of statistical significance and imprecise and noisy data, Authier *et al.* (2020) estimated three types of errors with simulation modelling of abundance based in case studies from European waters: 1) type-I error, which is associated with the power to detect a trend; 2) type-S error, the probability of the trend being in the wrong direction if the trend is significant; 3) type-M error, the magnitude of the trend if it is significant. They showed that the power to detect small declines (less than 5%) in abundance was very low regardless of the time of the study (Figure 15), and only dramatic declines could be easily detected, as Taylor *et al.* (2007) also acknowledged in a prior study with different methodology. These results can cause irremediable damage or loss because measures might be delayed in the light of statistically insignificant declines, as observed with the vaquita *Phocoena sinus* (e.g. Taylor *et al.* 2007). The results from Authier *et al.* (2020) also indicate that large sample sizes do not always correspond to greater power to detect a trend, showing that noise in large datasets can easily dominate the signal in trend analysis. The largest error rates in sign (Type-S) were observed with small declines (since the signal was harder to detect) and decreased precision (higher CV). In the case of magnitude error rates (Type-M), a decrease in precision resulted in statistically significant estimates being underestimates of the true magnitude of the decline (Authier *et al.* 2020). This study clearly demonstrates the challenges that scientists face when analysing trends in abundance and providing meaningful information for policy makers to decide on management planning. For data-poor cases, such as most cetacean species, Authier *et al.* (2020) recommend using linear regression models with statistical regularization to incorporate prior information and decrease uncertainty.

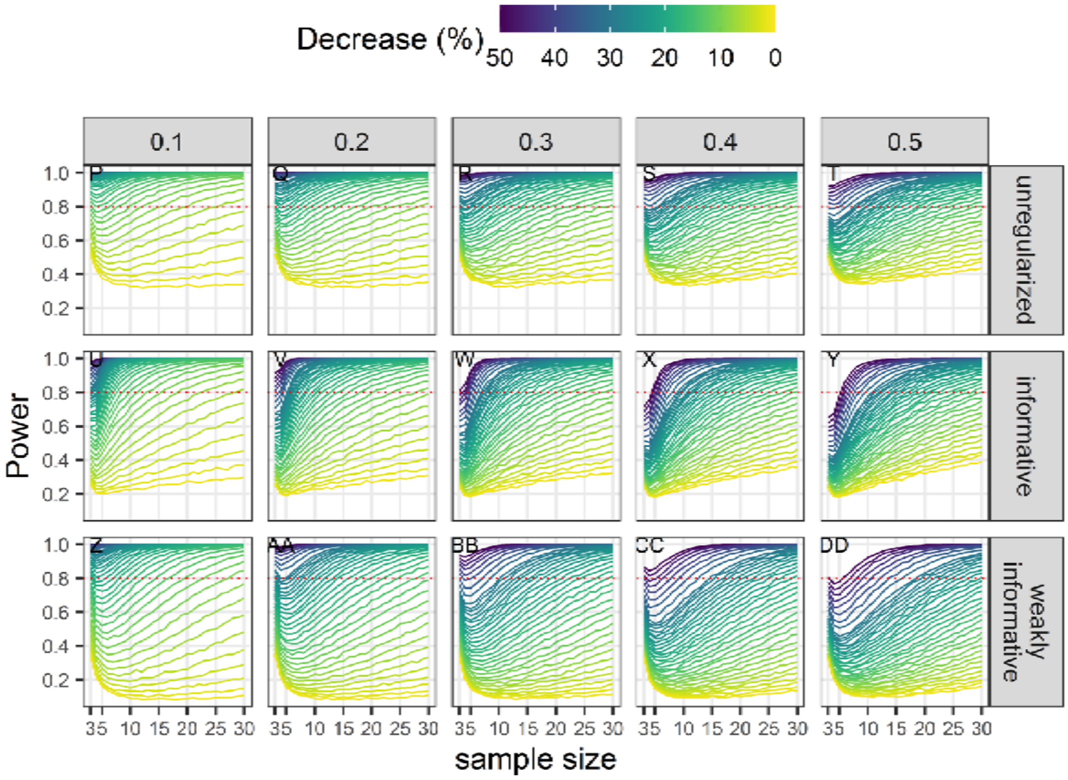


Figure 15. Power of a two-tailed test with a significance level set to 20% (P–DD) to detect a population decline over a study period T (sample size). Each column corresponds to a different assumption concerning the precision (different CV) of abundance estimates on which the trend is inferred. Each line corresponds to different modelling approaches used to estimate trend in abundance. From Authier *et al.* (2020).

Not only the statistical power to detect trends is challenging to achieve, but the meaning of a level of 80% statistical power (associated with a statistical significance level of 5% or 20%) might be arbitrary and shift the focus of real conservation issues (Authier *et al.* 2020). Authier *et al.* (2020) use the example of the changes in the vaquita abundance to illustrate how statistical ambiguities can also be associated with practical declines in abundance and have dramatic consequences for the species. At the beginning of the 90s, abundance estimates of the vaquita, with the best available data, were at a maximum of 1000 animals (Taylor & Gerrodette, 1993, Barlow *et al.* 1993, Silber 1990). Taylor & Gerrodette (1993) simulated line-transect survey data for the vaquita and showed that with such a small abundance, trends even based on frequent surveying would be nonsignificant even if the population was actually declining. With an abundance of 1000 individuals, simulations showed that even with annual surveys over a period of 10 years, the minimum detectable rate of decline was about 8%/year, which would mean detecting a 57% decline over that study period, which is a very high decline rate of the population (Taylor *et al.* 2007). In subsequent years, between 1997 and 2008, the decline of the vaquita abundance was estimated to be 7.6%/year, followed by a catastrophic decline between 2011 and 2015 of

34%/year (95% CRI, −48% to −21%; Jaramillo-Legorreta *et al.* 2016). The latest abundance of the vaquita, estimated in 2015, was only 59 (95% Bayesian Credible Interval [CRI] 22–145) individuals, which corresponded to a decrease of 92% (95% CRI 80–97%) over 18 years (Taylor *et al.* 2016). Most of the recent decline was caused by mortality in illegal gillnets of totoaba (*Totoaba macdonaldi*) (Valenzuela-Quiñonez *et al.* 2015, Anonymous 2016a, 2016b) and although protective measures are currently in place, the extinction of the vaquita seems imminent (Taylor *et al.* 2017). The simulation studies made by Authier *et al.* (2020) and Taylor & Gerrodette (1993) are dire warnings of the consequences of waiting for large and dramatic declines in abundance,, which are associated with a higher risk of irreversible damage, to take actions and urge for a more precautionary approach.

At the EU level, trends in cetaceans abundance have been evaluated following several assessment methodologies and, when available, associated thresholds. The **trend-based approach** adopted by OSPAR has a (see Deliverable 1.1 for a detailed description) assess changes in the abundance of cetaceans, using the **quantitative threshold from IUCN Red List criterion A** (declining population) to determine whether populations/species belongs in a category of threat (IUCN 2019). Having the earliest abundance estimate from large-scale surveys as the **baseline value** of abundance, and assuming that populations were in GES at that time, the decline between the baseline and abundance estimates should **not be greater than 30% over 10 years or three generations** (OSPAR Commission 2022). In the IUCN guidelines, 10 years is considered to be the shortest period of time for which conservation plans and actions start to show any effects (IUCN 2019). The IUCN, as well as OSPAR, use the generation length of the species and/or taxon to scale the decline rate threshold for the species' life history so that changes in abundance are species-specific and can be assessed at shorter time scales (IUCN 2019, see Deliverable 1.1 Table 20 and Table 22). In the case of cetaceans, maximum annual declines are estimated to be between 0.5% (for 6 species) and 1.6% (for the harbour porpoise). OSPAR's approach to assess the abundance of cetaceans is based on detecting trends solely from estimates of abundance, assuming that all individuals contribute similarly to the population dynamics. Given the limitations on data and demographic information for most cetacean species, it is not possible to use population models and a broader quantitative assessment has to be undertaken. Wilson *et al.* (2011) showed that using only abundance to detect a risk of extinction may either fail to detect initial declines in abundance or have a high error rate of misclassification. Furthermore, as summarized above, there is difficulty in detecting small changes in abundance each year, with the small amount of data available.

For example, the most recent estimate of the abundance of the harbour porpoise population in the Iberian Peninsula (blocks AA, AB and AC from SCANS-III) is estimated to be 2898 individuals (CV: 0.32) (Hammond *et al.* 2021b). Based on IUCN criteria, the population can be classified as 'Endangered' (population size less than 2500 individuals) (IUCN 2019). The species is already classified as 'Vulnerable' in European waters and the accepted maximum decline (1.6%/year) can result in potentially dangerous declines of the population in the Iberian Peninsula. In the worst-case scenario, if this decline would be observed annually over a period of 10 years, it would correspond to a 14.9% decline in the population, potentially classifying it as 'Endangered' with 2466 individuals (additional criterion about the rate of decline and population dynamics need to be met before this classification). If the same decline would be observed each year over three generations (assuming an average generation length of 10 years), it would result in a 38.4% decline, with 1786 individuals. These estimates are only a very crude assessment and are based on the possibility of surveying each year. The harbour porpoise is a species that strands frequently, and it shows unsustainably high levels of by-catch in the Iberian Peninsula (Torres-Pereira *et al.* 2022, Pierce *et al.* 2022). In 2020, the International Whaling Commission (IWC) Scientific Committee called for effective monitoring of fishery bycatch in the region by Portugal and Spain that should include small-scale fisheries "with a particular emphasis on gillnet and beach seines gears" (Carlén *et al.* 2021). In 2022 the IWC Scientific Committee recommended "immediate actions to effectively reduce, and where possible eliminate, bycatch of harbour porpoise throughout Iberian Peninsula waters". Combining this information with the trend analysis of abundance, the worst-case scenario example of the harbour porpoise in the Iberian Peninsula would start to show a familiar resemblance to the vaquita case.

In the case of an abundant species, such as the common dolphin, the estimated abundance in the entire AU (northeast Atlantic) is 473 461 individuals (CV: 0.26) (Hammond *et al.* 2021b). Again, projecting a broad worst-case scenario with the OSPAR accepted annual decline (0.9%/year), would cause a decline of 8.6% over 10 years (leaving 432 534 individuals), and a decline of 28.8% over three generations (assuming an average generation length of 12.5 years, leaving 337 326 individuals). For a species with such large numbers of abundance estimates, even with large declines, it could be possible to assume that these losses would be potentially harmful to the viability of the population. However, the estimated by-catch of the common dolphin in 2020 for the entire AU was 6406 individuals (95% CI = 3052 – 9414) (ICES 2021), representing a removal of 1.35%. Just one cause of loss, which is the primary driver of marine mammal mortality worldwide (Lewison *et al.* 2014), would represent 1.5 times the annual accepted decline in abundance. Therefore, the IUCN thresholds for assessing trends in abundance should be considered with caution depending on the species, and their abundance and should be integrated with the different causes of decline, such as mortality caused by anthropogenic pressure. As mentioned above, the frequency and precision of the data are also crucial aspects to accurately determine trends in abundance. Trend analysis is a very powerful tool to help the management and conservation planning of wildlife, but in the case of less abundant species/populations, it should not be viewed as the unique driver for applying conservation measures because these endangered species/populations leave little margin for recovery (Taylor & Gerrodette 1993). In the case of abundant species, full integration of causes of decline need to be performed. To achieve GES, environmental targets should be in line with conservation objectives (the program of measures must be associated with the assessment).

For the Habitats Directive, a species is in ‘Favourable Conservation Status (FCS)’ if the **population size is equal to or larger than the ‘Favourable Reference Population** (FRP)’. If the decline in abundance is **greater than 1% per year within a specific period of time** or **the population size is more than 25% below the FRP**, then it is in ‘Unfavourable Conservation Status’ (European Commission, 2011). The FRP is defined as ‘the minimum population size necessary to ensure the long-term viability of the species and it should be at least the size of the population when the Directive came into force’ (Bijlsma *et al.* 2019). The FRP can be estimated according to a **model-based** approach or a **reference-based** approach (see Deliverable 1 or 3.3. for detailed descriptions), but the choice is based on the extent and quality of the existing data to assess abundance. For species with large datasets, specified by demography, such as the common dolphin and harbour porpoise, FRP can be estimated using a model-based approach, that includes a Population Viability Analysis (PVA) and Minimum Viable Population (MVP) (Bijlsma *et al.* 2019). This approach produces robust estimates, but it requires large datasets and only estimates a minimum estimate of population size to avoid extinction (Bijlsma *et al.* 2019). It requires data about age structure, age of first breeding, fecundity, survival, and carrying capacity (Palialexis *et al.* 2021). For other less data-rich species, FRP is based on a reference value, and it is indicative of the past abundance considered to be healthy. Although it requires less data, there are some uncertainties in the estimate of the baseline. In light of the HD, declines of 1% or more per year are considered to be large (Bijlsma *et al.* 2019), which correspond to overall declines in abundance of ≈ 10 and 26% over 10 and 30 years, respectively (Authier *et al.* 2020).

Within the ABI sub-region, each MS adopt different methodologies and strategies for their assessment of D1C2. All three MS estimate a trend in abundance with SCANS data, which corresponds to the indicator **OSPAR M4**, and therefore assess D1C2 with a regional indicator (Spitz *et al.* 2018, MITECO 2019a, b). However, France uses the threshold established by OSPAR, while Spain and Portugal do not define a TV for this criterion. France, Portugal and Spain use additional complementary indicators and data. Frances uses two other indicators: a trend in relative abundance (**MM_Abond**), estimated with data from national DCF surveys, and complements M4; and, in the case of resident communities of bottlenose dolphins, a trend in abundance with photo-ID data (which is equivalent to the previous **OSPAR M4a**) (Spitz *et al.* 2018). Spain undertakes an extensive compilation of scientific studies that contain relevant information to assess all MSFD criteria for the selected species (MITECO 2019a,b). The data comes from several scientific articles, reports, conference presentations and doctoral theses based on research work carried out by different organizations. Since surveys and analyses are performed with different protocols and specific aims, the population size of each study is assessed separately, which is not directly a quantitative analysis of the trend in abundance per se.

- **D1C3 – Demographic parameters:**

Currently, there is no quantitative assessment of the demographic parameters of cetaceans at the EU level. The aim of the MSFD and the HD is to guarantee an adequate age structure, mortality level and reproductive parameters, which should not be adversely affected by anthropogenic pressures. However, asuch quantitative assessment is not feasible for all species, given the data requirements. The most stranded species, the common dolphin and the harbour porpoise are the only species that may potentially have sufficient data to define a threshold and develop a quantitative assessment for some demographic parameters. France uses a national indicator (**MM_EME**) to assess the **impact of extreme mortality events** that are likely to affect the populations of harbour porpoise, common dolphin and striped dolphin, such as accidental captures of the common dolphin, or epizootics for the striped dolphin, or cumulative factors. The assessment is made by comparing the number of strandings with the maximum number of expected strandings under the assumption of constant pressures (Bouchard *et al.* 2019). This analysis requires an **adaptive threshold** (maximum number of expected strandings), that will depend on the distribution of the recorded number of strandings and the period of time for which the maximum estimate is done.

- **Integration:**

According to the most recent Assessment Guidance Document (European Commission 2022), the term integration refers to "**the combination of assessment information** across different assessment aspects (e.g., combination of information from two or more criteria or underlying indicators)". During the GES assessment, there are several steps of integration that can start at an indicator level and go up to the ecosystem component (even though the guidance mentions that this final step is not required, and integration can stop at the species group level). The methods that can be used in the integration process (ICES 2018) are shown in Table 7 and a detailed description of each one is included in Deliverable 1.01.

Table 7. Overview of integration rules to determine GES of marine mammals.

Integration rule	Advantages	Disadvantages
One-Out-All-Out (OOAO)	• Easy to understand and apply • No masking of poor indicators, which results in signs of early warning for adverse effects not to be 'missed' in the process	• Provides the strictest assessment • Data insufficiency is treated as an adverse effect
Proportional ruling	• A percentage or proportion of indicators/criteria/species to determine GES is set by expert judgment • Allows the chance of having indicators/criteria/species in bad status	• Requires numerous indicators
Non-weighted averaging	• Primary and secondary criteria are treated equally • A poor indicator/criteria/species/ data insufficiency can be compensated	• Requires numerous indicators • Masking of poor indicators could occur
Weighted averaging	• Indicators/criteria/species can have weights based on perceived importance, the area covered or their precision and accuracy • A poor indicator/criteria/species/	• Requires numerous indicators • Masking of poor indicators could occur

	data insufficiency can be compensated with different weights	
Conditional ruling	Weighing the specific statements of the individual criteria against	● Requires numerous indicators

The choice of integration rule(s) at each different level can depend on the number of assessment parameters or species assessed, the species conservation status and the amount of data used in the assessment, but ultimately it is a policy decision. In the case of marine mammals, the latest MSFD Guidance provides some flexibility in the integration rules at the lowest level, from indicators to criteria, suggesting a regional agreement about the method used (European Commission 2022). At the following level of integration, from criteria to species, the Guidance states that the assessment between **D1C1 and the other criteria** should be based on the **OOAO rule** (European Commission 2022). The conservation objective proposed by OSPAR to decrease or, when possible, to eliminate incidental catches of marine mammals such that they **do not represent a threat** to the conservation status of these species implies a strict rule of integration when considering D1C1. The integration among **D1C2, D1C3, D1C4** and **D1C5** can be based on a **conditional rule**, and **according to the HD**. Given that in the case of the ABI region, it was established that only D1C1, D1C2 and D1C3 would be quantitatively assessed, and only the harbour porpoise and common dolphin would have an assessment for the three criteria, that narrows the possibilities of ‘if…then’ scenarios of a conditional integration. For species with quantitative assessments of **D1C1 and D1C2 only**, the integration should be **OOAO**. For the harbour porpoise and the common dolphin, if D1C1 is in GES, the MSDF Guidance suggests that D1C3 could be treated with the equal weight of other criteria (European Commission 2022). The current assessment methodology for D1C3 in the ABI is based on the removal of individuals from the population caused by extreme events. The results of this indicator might give an **early warning of causes of mortality** that could be important in the future of the population. Therefore, if D1C1 is good status an **averaging rule** could be applied **between D1C2 and D1C3**. The alternative hypothesis, as a precautionary approach, could be the OOAO rule.

If a criterion cannot be assessed due to the lack of data, it results in an **‘unknown’** status, which is different from choosing not to assess a criterion (‘not assessed’) (European Commission 2022). Based on these rules, if a species has ‘unknown’ criteria, it should also have an ‘unknown’ statusThe MSFD Guidance states that the integration from **species to species groups** should be based on the **OOAO** rule because an assessment at this level should account for the ‘need to reach or maintain a favourable conservation status, according to the HD' (European Commission 2022). Furthermore, since the three groups of cetaceans have four or fewer species to consider in the integration process, the OOAO seems the most suitable rule. For example, in the case of groups of birds and fish, Dierschke *et al.* (2021) indicated that integration with few species should be based on the OOAO rule.

In the ABI region, the group of small toothed cetaceans include four species, two of them, the common dolphin and harbour porpoise, with a high level of threat from by-catch. The harbour porpoise has such a high level of threat that the Iberian subpopulation is classified into "Critically Endangered" in Spain and Portugal (BOE-A-2020-15296, Portuguese Mammal Red Data Book 2023) . Consequently, the group of small cetaceans presents a high probability of not achieving GES for a prolonged period, which is dependent on the effectiveness of conservation measures focused on the recovery of the harbour porpoise subpopulation. The habitat preferences of the harbour porpoise are very limited and are not representative of the full range of occurrence of small toothed cetaceans. Thus, one might think that an averaging or a proportional integration rule could be more appropriate to assess GES in this group of species since the OOAO rule penalizes the potential positive assessment of the other three species. However, the ecological role of the harbour porpoise in their preferred coastal habitats cannot be replaced by other small toothed cetaceans. Each species has a specific functional role in the ecosystem that needs to be preserved by a precautionary approach. Even if a red-listed species could not be assessed due to the lack of data, it would still be not in GES because the conservation status is based on scientific data on population trends and population dynamics, supporting the decision about GES (European Commission 2022, Dierschke *et al.* 2021). In this case, the GES assessment is used as a signal of extinction risk and trigger mitigation measures (Dierschke *et al.* 2021).

4. Reaching a common approach to the assessment of cetaceans in the Bay of Biscay and Iberian Coast: workshops results

4.1.Matosinhos technical workshop (WK2.1)

A technical workshop, organized by CIIMAR and DGRM, has been held in Matosinhos (Portugal), aiming at gathering the scientific experts of Portugal, Spain and France, as well as the competent authorities of each MS. The gathering facilitated the discussion on the selection of species to assess D1 marine mammals' groups of species in the ABI sub-region, as well as the available methods and data to assess each criterion. The agenda and participants are available in Annex 1.

4.1.1. Selection of species

Day 1 focused on the discussion of the available data to assess the species identified under WP1, for at least one criterion. The teams of each MS evaluated, for each species, whether data existed at the moment or was expected to be collected under the monitoring programmes foreseen, and also whether the assessments could be considered robust or not. The criteria that showed the most amount of data for an assessment of almost all species selected was D1C2. For D1C2, abundance estimates with CV lower than 0.3 are considered robust.

In **France,** the abundance of most species can be currently assessed by using the data collected in dedicated regional (SCANS[3] and CODA) and national (SAMM[4], CAPECET and SPEE) surveys, as well as surveys conducted under EU Data Collection Framework (DCF) (PELGAS, EVHOE). For the DCF surveys, there are very few sightings of harbour porpoise. The number of sightings of sperm whales, Cuvier's beaked whales and killer whales are, in all likelihood, too small to produce an assessment.

In **Spain,** abundance cannot yet be assessed for some species. Currently, only common dolphin, bottlenose dolphin (coastal and resident AUs), killer whale and fin whale can be assessed. However, for the next MSFD cycle, it should also be possible to assess harbour porpoise and striped dolphin, the fourth species that

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[3] Small Cetaceans in European Atlantic waters and the North Sea (SCANS)

[4] *Suivi Aérien de la Mégafaune Marine* (SAMM)

strands the most in northern Spain. In addition to the dedicated international surveys (SCANS), several national campaigns are used to collect data for abundance estimates, such as PELACUS, BIOMAN, JUVENA, IBERAS. For harbour porpoise, under the PHOCOEVAL project, one aerial survey was conducted in 2015, but the estimate of abundance (186 individuals) is not considered robust (CV: 0.83) due to the small number of sightings. More recently (2020), a small airplane campaign (976 km) in the southwestern Galician coast registered only one porpoise sighting (two animals) out of 93 cetacean sightings (project VIRADA). For harbour porpoise specifically, an area of higher occurrence identified based on previous data will be surveyed more frequently to allow a more robust assessment of this species. An assessment of Cuvier's beaked whales and pilot whale may be possible but likely not be robust. In order to not exclude the assessment of deep-diving species within the national waters of the sub-region, an effort will be made to report on these two species. For Cuvier's beaked whales, alternative methods based on acoustics may be trialled for assessment. The assessment of Risso's dolphin, sperm whale and minke whale is not considered possible, despite the foreseen increased monitoring effort, due to low or no sightings in previous surveys.

In **Portugal,** some of the criteria for the small toothed cetacean species under consideration should be possible to assess by aerial surveys (e.g. SCANS and other national surveys) and surveys conducted under DCF (e.g. PELAGO and IBERAS). In fact, in addition to the dedicated international surveys (SCANS), several aerial surveys were conducted during the period 2011-2015, with robust estimates for harbour porpoise (CV: 0.22) and common dolphin abundance (CV: 0.25) (Vingada & Eira 2018). The only exception is the killer whale, which is only possible to monitor through photo-ID. Reports recorded between 2020 and 2022 that account interactions between vessels and some individuals of the subpopulation of the Strait of Gibraltar show that movements of at least part of the population are extensive and diffuse throughout the Iberian Peninsula (Esteban *et al.* 2022). Consequently, dedicated and systematic surveys for the monitoring of this species throughout the Iberian Peninsula, including Portuguese waters, are very cost-intensive and with potential small results. Therefore, the best approach for now, is to monitor this species during the time when it concentrates in a limited area, i.e., in the Strait of Gibraltar during spring. In Portuguese waters, records of the interactions between killer whales and vessels will be compiled, but not for MSFD requirements.

Regarding harbour porpoise, although sightings are few, this is an HD Annex II species and the status of the Iberian population is considered "Critically Endangered" (Portuguese Mammal Red Data Book, 2023), with increasing strandings of the species (Torres-Pereira *et al.* 2022). Further surveys, apart from

SCANS-IV are needed to provide a robust assessment of the species and therefore, an increased effort for this species should be foreseen in the entire coastal area. Acoustic devices to monitor the occurrence of this species in punctual areas of Portugal have been trialled and towed acoustic devices could potentially complement harbour porpoise occurrence data. However, fixed acoustic devices are recommended along with measures to account for the high use of coastal waters by vessels, the fishing sector and other emerging activities. Recently, within the ATLANTIDA Project, CIIMAR is using passive acoustic monitoring devices to record vocal cetaceans (and soundscape). Nevertheless, data collection only started recently and is only expected until the end of the project (2023), which prevent robust results in the short-term.

Regarding bottlenose dolphins, there are no discrete coastal units identified so far except for the Sado resident population, which is not under MSFD evaluation. Although the occurrence of the coastal and offshore ecotypes is acknowledged, it is yet not certain how to assess these units separately. Further discussion at a national level is needed.

Sightings of all deep-diving species are few, making nearly impossible to produce robust assessments based on distance sampling visual data. During SCANS-III, there were only a few sightings in the offshore waters of the ABI sub-region, in the Bay of Biscay and northern Spain (Hammond *et al.* 2021). Sperm whales were also sighted in offshore Portuguese waters (50-200nm) during dedicated surveys performed during the LIFE MarPro project (Vingada & Eira 2018). It was decided to keep Cuvier's beaked whale as a key representative species of deep-diving toothed cetaceans, due to its importance for the assessment of noise effects, and the potential use of acoustic methods to increase confidence. However, currently, there is no monitoring programme established for that purpose and funding must be discussed.

Based on the discussions **Table 8** was produced and shared with the group for agreement.

Table 8. Number of management units selected to assess D1 for marine mammals in the ABI sub-region (1: one assessment unit; 2: two assessment units; 3: three assessment units)

Groups of species	Species	Portugal	Spain	France
Small toothed cetaceans	Short-beaked common dolphin	1	1	1
	Harbour porpoise	1	1	1
	Bottlenose dolphin	1 or 2	3	1

	Striped dolphin	1	1	1
	Killer whale	0	1	0
Deep-diving toothed cetaceans	Cuvier's beaked whale	1	1	0
	Long-finned pilot whale	0	1	1
	Risso’s dolphin	0	0	1
Baleen whales	Minke whale	1	0	1
	Fin whale	1	1	1

4.1.2. Criteria and indicators

On Day 2 discussions focused on the methods to assess each criterion:

- **D1C1 (bycatch)**: according to the experts, the mortality rate from fishing based on data from observer programmes may be possible to estimate for a more frequent species, namely, common dolphin, harbour porpoise, and possibly bottlenose dolphin, since even though all cetacean species are included in monitoring programmes, events of species that are less frequent in bycatch render limitations to estimation of bycatch rates. It provides however unreplaceable information on fishing gear that caused the bycatch events, even if with difficulties in quantification of bycatch rates. Similarly to data from observer programmes, data from strandings also includes all cetaceans species, whether more or less frequently stranded, and data can be presented as the percentage of stranded animals with evidence of bycatch for all species (considering animals for which cause of death could be determined), as well as the total number of animals stranded, including those with low risk from bycatch. For example, stranding data highlight the need to properly address the common dolphin and harbour porpoise bycatch issues. In France, estimates for the mortality rate of the common dolphin and the harbour porpoise, are possible to be obtained by analysing strandings data. **Table 9** summarizes which parameters may be used for each species and MS.

  It was also discussed whether other sources of mortality (e.g. from ship collisions) should be reported under D1C1, but it was concluded that other sources of mortality should be assessed under D1C3.

Table 9. Parameters to assess criterion D1C1 per species and Member State in the ABI sub-region.

Parameter		Species
D1C1	**Mortality rate from fishing (observers)**	Common dolphin (PT, ES, FR) Harbour porpoise (PT, ES) Bottlenose dolphin (?)
	Mortality rate from fishing (strandings data)	Common dolphin (FR) Harbour porpoise (FR)
	Stranded animals with evidence of bycatch	Common dolphin (PT, ES, FR) Harbour porpoise (PT, ES, FR) Bottlenose dolphin (PT, ES, FR) Striped dolphin (PT, ES, FR) Bottlenose dolphin (resident-ES) Killer whale (ES) Cuvier's beaked whale (PT, ES) Long-finned pilot whale (ES, FR)

		Risso's dolphin (FR) Minke whale ((PT, ES) Fin whale (PT, ES, FR)

- **D1C2 (abundance)**: all the three MS foresee collecting visual data (from dedicated aerial and ship surveys and DCF surveys) and applying distance sampling. It was agreed that both model-based and design-based abundance estimates may be provided. Model-based abundance estimates allows more flexible restrictions than design-based analysis (equi-probability coverage), as well as to pool data from different surveys and to better understand the relationships between abundance and environmental variables. In cases for which absolute abundance estimates are uncertain, relative abundance may be used as an index to assess trends. In Spain, the abundance of the resident populations of bottlenose dolphin and killer whale will be monitored through photo-ID to produce estimates of relative abundance for these species. For Risso's dolphin, a species with a few sightings in the data provided by France, an assessment may not be robust. The Cuvier's beaked whale is also a species for which the lack of sightings will not allow a robust assessment. Regarding this point, the Spanish experts commented that performing acoustic surveys in areas with acknowledge presence of this species might be the most adequate solution to obtain abundance estimates, specifically mentioning the canyons, in the north of Spain (e.g. SAC ESZZ12003 Sistema de cañones submarinos de Avilés). This will be possibility explored by the Spanish competent authorities. Deep-diving toothed cetaceans might be easier to assess at a sub-regional level by pooling data for the entire area and providing a broad assessment (instead of having no national assessment). All three MS agreed that the adequate term to assess D1C2 is 'trend in abundance'. **Table 10** summarizes which parameters may be used for each species and MS.

Table 10. Parameters to assess criterion D1C2 per species in the ABI sub-region *: if sufficient data becomes available. Species with parenthesis indicate an assessment might not be possible.

Parameter		Species
D1C2	**Trend in abundance**	
	• Line-Transect, distance sampling (visual) (model-based estimates) (design-based estimates)	Common dolphin Harbour porpoise (*) Bottlenose dolphin Striped dolphin Long-finned pilot whale Minke whale Fin whale (Risso's dolphin)

	• Photo-ID	Bottlenose dolphin (resident) Killer whale
	• Distance sampling (acoustic)	Cuvier's beaked whale
	• Opportunistic (visual)	Harbour porpoise

- **D1C3 (demography):** as long-lived species, it is hard to detect changes in life parameters of cetaceans. Since this criterion relies mostly on data from strandings, it may be only possible to collect enough data to develop baselines for some parameters such as age-at-maturity and pregnancy rate for the species which strand the most. Age of maturity can indicate if animals are maturing earlier or later when comparing to previous data. Changes in this parameter may be due to an environmental stressor (although other causes cannot be excluded a priori) and it is therefore considered a good parameter. Also, age determination based on teeth GLGs is preferable to determine age rather than total body length but. Only for common dolphin it is foreseeable that these parameters may be estimated. The aim is, in the long-term, to develop a demographic model to estimate the growth rate of the population. However, such models require a lot of data to inform several parameters. Still based on data from strandings, it was also agreed to assess the trend of the maximum number of stranded individuals for common dolphin and harbour porpoise, the species with more stranding records in all the three MS. In Spain, the photo-ID data collected to assess the resident populations (killer whale and bottlenose dolphins) may allow the estimation of birth rates. **Table 11** summarizes which parameters may be used for each species.

Table 11. Parameters to assess criterion D1C3 per species in the ABI sub-region. Cells in yellow indicate that an assessment is not possible now, but it is planned as soon as sufficient data becomes available. Cells in red indicate that an assessment is highly unlikely in the foreseeable future because of insufficient amount of data of demography of these species.

Indicators		Species
D1C3	**Trend in (max) number of stranded individuals**	Common dolphin Harbour porpoise
	Reproductive rate	
	• Strandings (pregnancy rate, age at maturity)	Common dolphin
	• Photo-ID (birth rate)	Bottlenose dolphin (resident) Killer whale
	Population growth rate • Demographic model	Common dolphin

Indicators		Species
	Not assessed	Bottlenose dolphin Striped dolphin Cuvier’s beaked whale Long-finned pilot whale Risso’s dolphin Minke whale Fin whale

- **D1C4 (distribution):** while experts agree on the importance of considering distribution, it is not possible to quantitatively assess changes in the distribution as required by the GES Decision for highly mobile species such as cetaceans. Large-scale surveys, like SCANS, are designed to estimate density and abundance and are not suitable to assess changes in distribution. In any case, there is no available methodology to assess potential changes. To make sure that limits of the distributional range of a species are well-defined and changes accurately assessed, surveys must cover the historical and current limits of a species range, which can be challenging. For most species, changes in distribution patterns are likely related with changes in the environmental conditions, namely prey availability, which vary between years and months. The difference in the distribution maps of harbour porpoise based on SCANS II and III were mentioned as an example of a considerable change in the distribution of the species between years. It was noted that a similar conclusion had been reached under the MISTIC SEAS project, which focused on Macaronesia. It was agreed however that density surface maps should be produced and changes in distribution can be potentially assessed, for small coastal units like resident bottlenose dolphins and killer whales and harbour porpoises, and considering data from a wider number of sources. However, it is important here to use modelling approaches that can allow to investigate both changes within- (i.e., seasonal) and between-years. **Table 12** summarizes the agreement reached about D1C4.

Table 12. Indicator to assess criterion D1C4 per species in the ABI sub-region.

D1C4	Not assessed (assessment not appropriate but density surface maps produced at regional and national scales)	Common dolphin Harbour porpoise Bottlenose dolphin Striped dolphin Killer whale Cuvier beaked whale Long-finned pilot whale Risso’s dolphin Minke whale Fin whale

- **D1C5 (habitat): given the difficulties in the definitions of the indicators to assess this criterion and how to perform a quantitative assessment,** there is no indicator adopted to assess this criterion, at the moment. OSPAR is developing an indicator on contamination from PCBs that could inform it, but there are still discussions about whether PCBs are appropriate indicators for D1C5 or not, since they will be included in D8, and how its assessment could provide a quantitative status of habitat. All three MS have some data on PCBs levels for common dolphin, bottlenose dolphin and harbour porpoise. Moreover, Portugal has data on striped dolphins too. Spain may also collect these data for striped dolphins and killer whales. It was noted that there is already a candidate indicator at OSPAR to assess habitat quality for seabirds (*B7 Marine bird habitat quality*) which explores the influences of both environmental variables as well as anthropogenic pressures, including visual disturbance by offshore wind farms and shipping, and physical disturbance to the seabed by bottom-trawling, on the spatio-temporal abundance of marine bird species. In the UK noise risk maps have been produced for harbour porpoises, considering noise propagation from shipping and other maritime activities. Thresholds, such as 60% of a species habitat with high levels of noise, are under discussion by TG Noise and could also be used to assess this criterion although the GES Decision does not require it. Ship collision risk maps have also been developed. If it is not possible to model the habitat of a species, exposure maps could also be developed within marine protected areas. Finally, it was agreed that although for most species this criterion cannot currently be assessed, an effort should be made to develop exposure maps to better understand pressure-state relationships and inform decision making. **Table 13** summarizes the decisions adopted about D1C5.

Table 13. Indicator to assess criterion D1C4 per species in the ABI sub-region.

D1C5	Candidate OSPAR ∑PCB and other persistent chemicals indicator	Common dolphin Bottlenose dolphin Harbour porpoise Killer whale
	Not assessed (no guidance available but exposure to pressures maps, such as noise risk maps could be shown)	Striped dolphin Cuvier beaked whale; Long-finned pilot whale; Risso's dolphin Fin whale Minke whale

4.1.3. Assessment scales

On Day 3, the subject of assessment scales was briefly discussed. Experts agreed that both national and regional level assessment results should be reported. It was also noted, however, that the exact boundaries of the assessment areas are a complex subject. It was decided to create a shared folder containing all the assessment areas which will facilitate providing results for any chosen assessment area.

4.2.Vigo technical workshop

A technical workshop, organized by IEO-CSIC, has been held in Vigo (Spain), to discuss a coordinated sub-regional definition of GES and the monitoring strategy for cetacean bycatch (Tasks 3.2, 3.3 & 3.4 + Tasks 2.3 & 2.4). In what concerns to the present deliverable, the discussion was focused on the definition of parameters, indicators, and threshold values for the selected criteria and integration rules.

4.2.1. Criteria, parameters and indicators

D1C1 (bycatch): the experts defined that the **number of stranded animals with by-catch evidence relative to the number of stranded fresh carcasses** (and not decomposed carcasses where cause of death cannot be accurately determined) is the estimate to report regarding D1C1. The data for this indicator is only based on strandings. However, strandings data does not reveal the métiers that cause the mortality detected in strandings. Evidence of fleet/gear and area of the bycatch events can be shown by scientific observers onboard or electronic monitoring, even if with limitations to quantification of mortality rates. Although monitoring data of this type is currently limited in terms of coverage (space, time and fleets/gears), the data collected by on-board observers is extremely Important to assess specific métiers-mortality rate. D1C1 should not include entanglement records, because it is a result of marine litter and not a product of active fishery, and it is being proposed for D10C4. Experts discussed that in the future, D1C1 could include different types of anthropogenic-caused mortality because, although by-catch is the major cause of human-induced mortality of cetaceans, it does not affect all groups of species equally. In the case of baleen whales, records of ship collisions suggest that this is a major issue that is not yet assessed.

- **D1C2 (abundance):** MS discussed the potential use of relative abundance to complement abundance estimates from large-scale surveys to assess trends. It was noted that relative abundance is mostly obtained from data with different protocols, observers, and methodology, which results in high uncertainty and therefore priority should be given to abundance estimates from dedicated surveys using similar methodologies. However, if MS consider using relative abundance as a sub-regional indicator for D1C2, a **standard protocol** for data collection and analysis should be developed.

- **D1C5 (habitat):** the use of **PCBs** to assess habitat was further considered. Since the impact of PCBs in the reduction of fecundity is documented (together with decreased immune function, leading to diseases and mortality), PCBs can be included in D1C3. However, ES pointed that D1C3 already includes several indicators, and D1C5 should have an indicator that could be PCBs, which are being considered by OSPAR and MSFD to assess habitat. PT and ES agreed to use PCBs, but FR was still uncertain about it. FR was concerned about not having a threshold yet.

4.2.2. Integration rules

Given the small number of species and indicators, the MS agreed that **OOAO** is at the moment the most appropriate integration rule to apply at each level of integration. However, there were concerns about the OOAO rule rewarding the lack of data, as it was exemplified by the case of baleen whales. Currently, in the ABI, baleen whales are assessed only with D1C2 because there is not enough data to assess D1C3 and D1C1. As D1C1 and D1C3 are currently defined, they do not include specific threats to this group of species, such as ship collisions and entanglement (pollution). Therefore, an assessment of baleen whales only based on abundance potentially results in GES because of the lack of data as well as inadequate indicators to assess the impact of anthropogenic pressures. In the case of small toothed cetaceans, since their assessment is based on D1C1, D1C2 and D1C3 (for some species), GES is probably not achieved because the criteria to assess anthropogenic pressures is appropriate for this group of species (e.g. by-catch). MS agreed that further discussions about integration rules are needed. **Table 14** summarizes the agreement and suggestions that can possibly be adopted.

Table 14. Summary of the integration rules selected for the GES assessment in the ABI region.

Level of integration	Integration rule
Indicators to criteria	• OOAO, when there is more than one indicator. Few indicators are established
Criteria to species	• OOAO between D1C1 and other criteria, reflecting OSPAR's conservation objective • Conditional, if D1C1 is in GES averaging between D1C2 and D1C3
Species to species groups	• OOAO, following the Habitats Directive

5. Conclusions

Cetaceans are long-lived animals, with complex social lives and occurrence, and are highly mobile, crossing jurisdictional boundaries. Because of these aspects, cetaceans require long-term datasets to monitor them and international cooperation for management and conservation efforts. The extensive literature review and discussions in two workshops resulted in the development of a common approach for the assessment of cetaceans in the Bay of Biscay and the Iberian Coast. A total of 10 species were considered and only one was excluded from the final list (sperm whale). The species selected to assess cetaceans in the ABI are harbour porpoise, bottlenose dolphin, common dolphin, and striped dolphin, to represent small toothed cetaceans; Risso's dolphin, pilot whale and Cuvier's beaked whale, to represent deep-diving toothed cetaceans; and fin whale and minke whale, to represent baleen whales. For each criterion, the most suitable and informative indicators, parameters and methodologies were identified and, when possible, the use of common indicators already established by regional cooperation was adopted. All MS agreed that the criteria to be evaluated are: D1C1 (by-catch), D1C2 (abundance) and D1C3 (demography). The assessment of these criteria will not be undertaken for all species, since it is highly dependent on the existing data and the possibility of acquiring more in the foreseeable future. D1C2 is the criterion with the most standardized methodology for data collection, analysis and assessment. Under OSPAR, abundance is assessed with a common indicator that represents a 'trend in abundance', which is estimated with sightings data from large-scale dedicated and opportunistic (e.g. DCF) surveys, as well as photo-ID data, in the case of bottlenose dolphins and killer whales. All MS agreed to adopt the common indicator already established by OSPAR and its thresholds and assessment methodology. Sufficient demographic data to assess D1C3 is only available for two species, the harbour porpoise and the common dolphin. A total of 5 parameters were suggested to be estimated, related to the age structure of the population, mortality and fecundity. In WK2.1, an additional parameter to quantify the impact of extreme events on the population was also suggested. However, there is still no quantitative threshold or methodologies to assess this criterion. Although D1C4 (distribution) is also assessed under OSPAR, all MS decided that current methodologies and definitions of this criterion, along with D1C5 (habitat) are not fully developed to provide a quantitative assessment. The model-based approach to acquire estimates for D1C2 also provides maps of the distribution of each species, which reflect the relationship between the species density and several environmental and anthropogenic variables. Nevertheless, these maps are based on data to obtain abundance and do not allow a quantitative assessment of changes in the distribution and the identification of potential causes of the changes. Given the small number of species, criteria, indicators and parameters, the most appropriate integration rule to combine the results in a quantitative assessment of GES is the OOAO rule. The success of the implementation of this common approach will be dependent on the close sharing of information and developments on methodologies among all MS.

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ANNEX I: Matosinhos Technical Workshop agenda and list of participants

- **Agenda**

Day 1

14:00 - 14:15	Registration
14:15 - 14:30	*Welcome*
14:30 - 14:35	Aims of the workshop
14:35 - 14:50	WP1/WP3 highlights: selected species/management units and criteria; monitoring programmes overview
14:50 – 15:00	Draft proposal species and criteria for: 1. small toothed cetaceans 2. deep-diving toothed cetaceans and 3. baleen whales
15:00 - 16:30	Group discussion: list of species/management units and criteria for 1. small toothed cetaceans 2. deep-diving toothed cetaceans and 3. baleen whales
16:30 - 16:45	*Break*
16:45 - 17:45	Continue discussion
17:45 - 18:00	Wrap up and adjourn

Day 2

09:30 - 09:45	WP1 highlights: selected indicators and assessment scales by species
09:45 - 10:00	Task 2.1 highlights: data gathering and joint analysis and identification of data gaps
10:00 - 11:15	Draft proposal on indicators and scale of assessments for small toothed cetaceans
10:15 - 11:30	Group discussion on indicators and scale of assessments
11:30 - 11:45	*Break*
11:45 - 13:00	Continue discussion
13:00 - 14:15	*Lunch*
14:15 - 14:30	Draft proposal on indicators and scale of assessments for deep-diving toothed cetaceans

14:30 - 16:00	Group discussion on indicators and scale of assessments
16:00 - 16:15	Wrap up and adjourn
16:15 - 16:30	*Break*
16:30-18:00	**Steering Committee/Partners meeting**

Day 3

09:30 - 09:45	Highlights of the previous day
09:45 - 11:00	Continue group discussion (deep-diving toothed cetaceans)
11:00 - 11:30	*Break*
11:30 - 11:45	Draft proposal on indicators and scale of assessments for baleen whales
11:45 - 13:30	Group discussion on indicators and scale of assessments
13:30 - 14:30	*Lunch*
14:30 - 15:00	Presentation on WK main achievements and proposal of way forward
15:30 - 16:00	Discussion
16:00	**End of workshop**

List of participants

In-person:

1. Graham Pierce (IIM-CSIC)
2. Rebeca Rodrígues (IIM-CSIC)
3. Marie Petitguyot (IIM-CSIC)
4. Andreia Pereira (DGRM)
5. Joana Otero (DGRM)
6. Vera Lopes (DGRM)
7. André Couto (DGRM)
8. Ana Mafalda Correia (CIIMAR)
9. Cláudia Rodrigues (CIIMAR)
10. Raul Valente (CIIMAR)
11. Marina Sequeira (ICNF)
12. Rita Vasconcelos (IPMA)
13. Teresa Moura (IPMA)
14. Marta Gonçalves (IPMA)
15. Catarina Eira (CESAM)
16. Camilo Saavedra (IEO-CSIC)
17. José Vazquez (IEO-CSIC)
18. Paula Gutiérrez (IEO-CSIC)
19. Nair Arrondo (IEO-CSIC)
20. Francisco Martínez (SEMA)

21. Amaia Astarloa (AZTI)
22. Floriane Plard (La Rochelle)
23. Authier Matthieu (La Rochelle)
24. Nolwenn Cozannet (OFB)

Online:

25. Andrea Fariñas
26. Diego Fernández
27. Eréndira García
28. Hélène Renault
29. Peter Evans
30. Sinéad Murphy
31. James Waggit

ANNEX II (a): ‘ART8_GES’ schema

Table A 1. ART8_GES schema for small toothed cetaceans in the Bay of Biscay and Iberian Coast

<table>
<tr><td rowspan="2">MarineReportingUnit</td><td colspan="2">**PT**</td><td>**ES**</td><td>**FR**</td></tr>
<tr><td colspan="2">ABI-PT-SD-CONT</td><td>ABI-ES-SD-NOR
ABI-ES-SD-SUD</td><td>ABI-FR-SD-GDG</td></tr>
<tr><td>~~MRUextent~~</td><td colspan="4"></td></tr>
<tr><td>RegionalAssessmentArea</td><td colspan="4">*Relevant OSPAR assessment units or joint assessment area*</td></tr>
<tr><td>GEScomponent</td><td colspan="4">D1</td></tr>
<tr><td>Feature</td><td colspan="4">Small toothed cetaceans</td></tr>
<tr><td>GESextentThreshold</td><td colspan="4">100%</td></tr>
<tr><td>GESextentAchieved</td><td colspan="4">e.g. 50%</td></tr>
<tr><td>GESextentUnit</td><td colspan="4">‘Proportion of species in good status within species group’</td></tr>
<tr><td>GESachieved</td><td colspan="4">GES expected to be achieved later than 2024, no Article 14 exception reported’</td></tr>
<tr><td>DescriptionOverallStatus</td><td colspan="4"></td></tr>
<tr><td>AssessmentPeriod</td><td colspan="4">(YYYY-YYYY)</td></tr>
<tr><td>RelatedPressures</td><td colspan="4">1. Disturbance of species (e.g. where they breed, rest and feed) due to human presence;
2. Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities);
3. Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) diffuse sources, point sources, atmospheric deposition, acute events;
4. Input of anthropogenic sound (impulsive, continuous);</td></tr>
<tr><td rowspan="3">RelatedTargets</td><td>**PT**</td><td colspan="3">ABIPT-T1-D1Cont; ABIPT-T1-D1Cont_ Phocoenaphocoena; ABIPT-T2-D1Cont</td></tr>
<tr><td>**ES**</td><td colspan="3">A.N.3; A.S.3; C.N.3; C.S.3</td></tr>
<tr><td>**FR**</td><td colspan="3">D01-MT-OE02; D01-MT-OE03</td></tr>
<tr><td>IntegrationRuleType Criteria</td><td colspan="4">Other (OTH) OR OOAO</td></tr>
<tr><td>IntegrationRuleDescription Criteria</td><td colspan="4">*Habitats Directive matrix*</td></tr>
<tr><td>IntegrationRuleTypeParameter</td><td colspan="4">'Not relevant'(for most cases)</td></tr>
<tr><td></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Element</td><td colspan="2">**PT**</td><td>**ES**</td><td>**FR**</td></tr>
<tr><td colspan="2">Common dolphin
Harbour porpoise
Bottlenose dolphin
Striped dolphin</td><td>Common dolphin
Harbour porpoise
Bottlenose dolphin
Striped dolphin
Killer whale</td><td>Common dolphin
Harbour porpoise
Bottlenose dolphin
Striped dolphin</td></tr>
</table>

~~ElementExtent~~			
Element2 (*relevant only for bottlenose dolphin*)	**PT**	**ES**	**FR**
	Coastal ecotype Offshore ecotype	Coastal ecotype South Galicia unit	(not relevant)
DescriptionElement			
ElementStatus	‘Good’, 'Good, based on low risk', ‘Not good’ OR ‘Unknown’		
Criteria	D1C1, D1C2, D1C3, D1C4 and D1C5		
CriteriaStatus	D1C 1	All species	‘Good’, 'Good, based on low risk', ‘Not good’ OR ‘Unknown
	D1C 2	All species	‘Good’, 'Good, based on low risk', ‘Not good’ OR ‘Unknown’
	D1C 3	Harbour porpoise Common dolphin Bottlenose dolphin Killer whale (ES)	Good’, 'Good, based on low risk', ‘Not good’ OR ‘Unknown’
		Striped dolphin	‘Not assessed’
	D1C 4	All species	‘Not assessed’
	D1C 5	Harbour porpoise Common dolphin Bottlenose dolphin Killer whale	Good’, 'Good, based on low risk', ‘Not good’, ‘Unknown’ OR ‘Not assessed’
		Striped dolphin	‘Not assessed’
DescriptionCriteria			
Parameter	D1C 1	MOR/F (mortality rate from fishing)	
		OTH (other)	
	D1C 2	ABU (abundance)	
	D1C 3	Harbour porpoise Common dolphin Bottlenose dolphin Killer whale	OTH (other)
	D1C 5	Habour porpoise Common dolphin Bottlenose dolphin Killer whale	CONC-B
ParameterOther	D1C 1	All species	Percentage of stranded animals with evidence of bycatch
	D1C 3	Common dolphin Harbour porpoise	Maximum number of stranded individuals
		Common dolphin	Pregnancy rate
		Common dolphin	Age at maturity
		Bottlenose dolphin (RES) Killer whale (RES)	Birth rate
ThresholdValueUpper			
ThresholdValueLower			

ThresholdQualitative	D1C1	cetAMBICIon	
ThresholdValueSource	D1C1	OSPAR	
	D1C2	OSPAR	
	D1C3	OTH	
	D1C5	OSPAR	
ThresholdValueSourceOther	D1C3	cetAMBICIon	
ValueAchievedUpper	*to be assessed*		
ValueAchievedLower	*to be assessed*		
ValueUnit	D1C1	Mortality rate from fishing	percentage
		Percentage of stranded animals with evidence of bycatch	percentage
	D1C2	Abundance	percentage
	D1C3	Trend in (maximum) number of stranded individuals	percentage
		Birth rate	percentage
		Pregnancy rate	
		Age at maturity	
	D1C5	OSPAR ∑PCB	mg/Kg lw
ValueUnitOther			
~~ProportionThresholdValue~~			
~~ProportionValueAchieved~~			
~~ProportionThresholdValueUnit~~			
Trend			
ParameterAchieved	'Yes', 'Yes, based on low risk', 'No', OR 'Unknown'		
DescriptionParameter	*detail the source of the estimates: model based, designed based, photo-ID, strandings etc.*		
RelatedIndicator	D1C1	Mortality rate from fishing (observers programmes)	ABI-CET-MOR/F-observers
		Percentage of stranded animals with evidence of bycatch	ABI-CET-MOR/F-strandings
	D1C2	Trend in Abundance	OSPAR-M4
			ABI-CET-abundance
	D1C3	Trend in (maximum) number of stranded individuals	ABI-CET-maxstrandings

		Pregnancy rate	ABI-CET-pregnancyrate
		Age at maturity	ABI-CET-agematurity
		Birth rate	ABI-CET-birthrate
	D1C5	OSPAR ∑PCB and other persistent chemicals	OSPAR-PCB

Table A 2. ART8_GES schema for deep-diving toothed cetaceans in the Bay of Biscay and Iberian Coast

MarineReportingUnit	**PT**	**ES**	**FR**
	ABI-PT-SD-CONT	ABI-ES-SD-NOR ABI-ES-SD-SUD	ABI-FR-SD-GDG
~~MRUextent~~			
RegionalAssessmentArea	*Relevant OSPAR assessment units or joint assessment area*		
GEScomponent	D1		
Feature	Deep-diving toothed cetaceans		
GESextentThreshold	100%		
GESextentAchieved	e.g. 50%		
GESextentUnit	‘Proportion of species in good status within species group’		
GESachieved	‘GES achieved by 2018’, ‘GES achieved by 2020’, ‘GES achieved by 2024’, ‘GES expected to be achieved later than 2024, no Article 14 exception reported’, OR ‘**Unknown**’		
DescriptionOverallStatus			
AssessmentPeriod	(YYYY-YYYY)		
RelatedPressures	**PT**	**ES**	**FR**
	1. Disturbance of species (e.g. where they breed, rest and feed) due to human presence **2.** Input of other substances diffuse sources, point sources, atmospheric deposition, acute events **3.** Input of anthropogenic sound (impulsive, continuous)		
		4. Extraction of, or mortality/injury to, wild species	
RelatedTargets	**PT**		
	ES	A.N.3; A.S.3; C.N.3; C.S.3	
	FR	D01-MT-OE03	
IntegrationRuleType Criteria	Other (OTH)		
IntegrationRuleDescription Criteria	*Habitats Directive matrix*		
IntegrationRuleType Parameter	'Not relevant'		
Element	**PT**	**ES**	**FR**

	Cuvier's beaked whale	Cuvier's beaked whale Long-finned pilot whale	Long-finned pilot whale Risso's dolphin
~~ElementExtent~~			
~~Element2~~			
DescriptionElement			
ElementStatus	Long-finned pilot whale Risso's dolphin	'Good', 'Good, based on low risk', 'Not good' OR 'Unknown'	
	Cuvier beaked whale	'Unknown'	
Criteria	D1C1, D1C2, D1C3, D1C4 and D1C5		
CriteriaStatus	D1C1	Long-finned pilot whale Risso's dolphin Cuvier beaked whale	'Good, based on low risk' OR 'Unknown'
	D1C2	Long-finned pilot whale Risso's dolphin	'Good', 'Not good' OR 'Unknown'
		Cuvier beaked whale	'Unknown'
	D1C3	Long-finned pilot whale Risso's dolphin Cuvier beaked whale	'Not assessed'
	D1C4	Long-finned pilot whale Risso's dolphin Cuvier beaked whale	'Not assessed'
	D1C5	Long-finned pilot whale Risso's dolphin Cuvier beaked whale	'Not assessed'
DescriptionCriteria			
Parameter	D1C1	OTH (other)	
	D1C2	ABU (abundance)	
ParameterOther	D1C1	Long-finned pilot whale Risso's dolphin	Percentage of stranded animals with evidence of bycatch
ThresholdValueUpper			
ThresholdValueLower			
ThresholdQualitative	D1C1		
ThresholdValueSource	D1C2	OSPAR	
ThresholdValueSourceOther			
ValueAchievedUpper			

ValueAchievedLower			
ValueUnit	D1C1	percentage	
	D1C2	percentage	
~~ValueUnitOther~~			
~~ProportionThreshold Value~~			
~~ProportionValue Achieved~~			
~~ProportionThresholdValue Unit~~			
Trend			
ParameterAchieved			
DescriptionParameter	*detail the source of the estimates: model based, designed based, photo-ID etc.*		
RelatedIndicator	D1C1	Percentage of stranded animals with evidence of bycatch	ABI-MOR/F-strandings
	D1C2	Trend in Abundance	OSPAR-M4
			ABI-CET-abundance

Table A 3. ART8_GES schema for baleen whales in the Bay of Biscay and Iberian Coast

MarineReportingUnit	**PT**	**ES**	**FR**
	ABI-PT-SD-CONT	ABI-ES-SD-NOR ABI-ES-SD-SUD	ABI-FR-SD-GDG
~~MRUextent~~			
RegionalAssessmentArea	*Relevant OSPAR assessment units or joint assessment area*		
GEScomponent	D1		
Feature	Baleen whales		
GESextentThreshold	100%		
GESextentAchieved	e.g. 50%		
GESextentUnit	'Proportion of species in good status within species group'		
GESachieved	'GES achieved by 2018', 'GES achieved by 2020', 'GES achieved by 2024', 'GES expected to be achieved later than 2024, no Article 14 exception reported', OR 'Unknown'		
DescriptionOverallStatus			
AssessmentPeriod	(YYYY-YYYY)		
RelatedPressures	1. Disturbance of species (e.g. where they breed, rest and feed) due to human presence; 2. Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities); 3. Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) diffuse sources, point sources, atmospheric deposition, acute events; 4. Input of anthropogenic sound (impulsive, continuous);		
RelatedTargets	**PT**	ABIPT-T1-D1Cont	
	ES	A.N.3; A.S.3; C.N.3; C.S.3	
	FR	D01-MT-OE03	
IntegrationRuleTypeCriteria	Other (OTH)		
IntegrationRuleDescriptionCriteria	*Habitats Directive matrix*		
IntegrationRuleTypeParameter	'Not relevant'(for most cases)		
Element	**PT**	**ES**	**FR**
	Minke whale Fin whale	Fin whale	Fin whale Minke whale
~~ElementExtent~~			
~~Element2~~			
DescriptionElement			
ElementStatus	'Good', 'Good, based on low risk', 'Not good' OR 'Unknown'		
Criteria	D1C1, D1C2, D1C3, D1C4 and D1C5		
CriteriaStatus	D1C1	Minke whale Fin whale	'Good', 'Good, based on low risk', 'Not good' OR 'Unknown

	D1C2	Minke whale Fin whale	'Good', 'Not good' OR 'Unknown'
	D1C3	Minke whale Fin whale	'Not assessed'
	D1C4	Minke whale Fin whale	'Not assessed'
	D1C5	Minke whale Fin whale	'Not assessed'
DescriptionCriteria			
Parameter	D1C1	OTH (other)	
	D1C2	ABU (abundance)	
ParameterOther	D1C1	Fin whale Minke whale	Percentage of stranded animals with evidence of bycatch
ThresholdValueUpper			
ThresholdValueLower			
ThresholdQualitative	D1C1		
ThresholdValueSource	D1C2	OSPAR	
ThresholdValueSourceOther	cetAMBICIon		
ValueAchievedUpper			
ValueAchievedLower			
ValueUnit	D1C1	percentage	
	D1C2	percentage	
~~ValueUnitOther~~			
~~ProportionThresholdValue~~			
~~ProportionValueAchieved~~			
~~ProportionThresholdValueUnit~~			
Trend			
ParameterAchieved			
DescriptionParameter			
RelatedIndicator	D1C1	Percentage of stranded animals with evidence of bycatch	ABI-MOR/F-strandings
	D1C2	Trend in Abundance	OSPAR-M4 ABI-CET-abundance

ANNEX II (b): 'Indicators' schema

IndicatorCode	ABI-CET-MOR/F-observers
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-MOR/F-strandings
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	OSPAR-M4
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	

Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-abundance
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-maxstrandings
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-pregnancyrate
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	

RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-agematurity
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	ABI-CET-birthrate
IndicatorTitle	
IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	

IndicatorCode	OSPAR-PCB
IndicatorTitle	

IndicatorSource	
IndicatorSourceOther	
UniqueReference	
RelatedTargets	
DatasetVoidReason	
GEScomponent	
Feature	
MarineReportingUnit	
URL	
MD_URL	