THIRTEENTH MEETING OF THE ACCOBAMS SCIENTIFIC COMMITTEE

Monaco
26-28 February 2020

Document : ACCOBAMS-SC13/2020/Doc11
Distribution : 26/02/2020

DRAFT: ACCOBAMS/IWC CMP FOR MEDITERRANEAN FIN WHALES (*BALAENOPTERA PHYSALUS*)

DRAFT: ACCOBAMS/IWC CMP for Mediterranean fin whales (*Balaenoptera physalus*)

CONTENTS

• EXECUTIVE SUMMARY (JUST AN EXAMPLE TO BE FINALISED WHEN THE PLAN IS READY)

The overall goal of the Mediterranean Fin Whale CMP is to manage human activities that affect fin whales in the Mediterranean Sea in order to maintain a favourable conservation status throughout their historical range, based on the best available scientific knowledge.

The CMP includes eight sections, of which the first three provide background information including biology and status of the Mediterranean fin whale population. Section 4 reviews ***actual and potential anthropogenic threats*** *and ranks these as low, moderate or high priority. Section 5 describes* ***mitigation measures*** *for those threats that have been accorded moderate or high priority. These include:*

- ***vessel strikes***
- ***noise (acute and chronic)***
- ***habitat degradation including chemical pollution and micro- and nano-plastics***

Section 6, dealing with ***public awareness and education****, will address …..*

Section 7 outlines the actions called for and includes sub-sections on monitoring, on implementation and coordination of the CMP, and on involvement of stakeholders. In order to be effective, the CMP must have a recognised, ***full-time Co-ordinator*** *who is responsible for* inter alia *actively involving stakeholders, especially those whose livelihoods may be affected. The Co-ordinator should report to* ***a Steering Committee*** *closely linked to appropriate authorities. The CMP will be useless without sufficient implementation funding. At the very least, sufficient funds must be made available to support the appointment and functioning of a Co-ordinator and Steering Group.*

Section 8 describes in detail the high priority actions identified at this stage (see table below). They fall under the following five headings: ***Co-ordination****,* ***Capacity building and public awareness****,* ***Research essential for providing adequate management advice****,* ***Monitoring****, and* ***Mitigation measures****. Descriptions of the high priority actions follow a common format, which consists of* ***description of action*** *(specific objective, rationale, target, timeline),* ***actors*** *(responsible for co-ordination of the action, stakeholders),* ***action evaluation*** *and* ***priority*** *(importance, feasibility).*

The most critical and urgent action is the implementation of the Mediterranean Fin Whale CMP (CORD-01). Funding must be found for this action at the earliest opportunity to appoint a Co-ordinator and set up the Steering Group to ensure that the CMP moves ahead in a timely fashion.

1 INTRODUCTION

CMP are developed under the umbrella of ACCOBAMS and the IWC. All relevant bodies of ACCOBAMS and the IWC need to be involved: strong links with the Scientific Committee, the Secretariat and regular information to National Focal Point (ACCOBAMS Res. 6.21) and other relevant stakeholders.

NB: A MAP OR MAPS WILL BE ADDED WITH ALL PLACE NAMES, RELEVANT GEOGRAPHICAL FEATURES, EEZS ETC

1.1 WHY A CONSERVATION MANAGEMENT PLAN IS NEEDED

The most recent genetic, stable isotope, passive acoustic, and telemetry evidence points to the ACCOBAMS region containing a single 'Mediterranean' population of fin whales (*Balaenoptera physalus*). Fin whales cross the Strait of Gibraltar in both directions but the population identity of these individuals is still not clear. Mediterranean fin whales have been proposed to move into the adjacent North Atlantic in summer returning back in the winter (Gauffier et al., 2018; and see Fig.1). Passive acoustic information (Castellote *et al.,* 2012) suggests that animals crossing the Strait of Gibraltar have song characteristics attributed to northeastern North Atlantic fin whales but the implications from a population/conservation standpoint requires further investigation (see Section 3.1). For the purposes of this iteration of the CMP it is assumed that all animals that spend at least some of their life in the Mediterranean Sea comprise a single population although this may need revision in the future (see Castellote et al. 2011, 2012, and Giménez et al. 2013 for evidence of NENA (Northeast North Atlantic) fin whales into the western Mediterranean Sea).

No whaling operations took place in the Mediterranean Sea although intense whaling occurred near the Strait of Gibraltar, primarily in the early 1920s, after which catches declined then ceased (Sanpera and Aguilar, 1992).

The only historic large scale-abundance estimate comes from a survey in 1991 that provided an estimate of around 3,500 animals (Forcada *et al.*, 1996).

In summer 2018, a synoptic survey was carried out across the Mediterranean Sea and contiguous Atlantic area, combining visual methods (including aerial surveys)and passive acoustic monitoring (PAM) from vessels (focused primarily on deep diving species and areas where aerial surveys were not possible). Line-transect sampling methodology was applied to estimate density and abundance through design-based and model-based approaches. A design-based estimate of 1,835 fin whales (CV=0.26; 95% CI=1,099-3,065) was produced (uncorrected as yet for availability and/or perception biases that may be substantial) for the areas covered by aerial surveys (Fig. 1). A model-based estimate is yet to be developed.

There are two recent pieces of evidence that suggest that Mediterranean fin whales may be declining (the most recent IUCN Red List classifies these fin whales as Vulnerable - Panigada and Notarbartolo di Sciara, 2012). The first is that a comparison of summer abundance in the 'Pelagos' Sanctuary (an area previously identified as important to fin whales in the summer - see Fig. 1) from 1992 and 2009, showed an appreciable decline; that may represent a true decline in abundance although potentially could reflect a change in distribution (Panigada *et al.*, 2011).

The second comes from a comparison of the abundance estimate from the only historic large-scale survey (a 1991 vessel survey) with the results for the same area from the even larger-scale summer 2018 aerial survey (the ACCOBAMS Survey Initiative; ASI). The only historic large scale-abundance estimate comes from a survey in 1991 that provided an estimate of around 3,500 animals (Forcada *et al.*, 1996).

In summer 2018, a synoptic survey was carried out across the Mediterranean Sea and contiguous Atlantic area, combining visual methods (including aerial surveys)and passive acoustic monitoring (PAM) from vessels (focused primarily on deep diving species and areas where aerial surveys were not possible). Line-transect sampling methodology was applied to estimate density and abundance through design-based and model-based approaches. A design-based estimate of 1,835 fin whales (CV=0.26; 95% CI=1,099-3,065) was produced (it is an underestimate as it is as yet uncorrected as for availability and/or perception biases) for the areas covered by aerial surveys (Fig. 1). A model-based estimate is yet to be developed.

The above information is sufficient to warrant conservation concern over this population. The potential threats (primarily ship strikes, pollution and noise) to the conservation status of fin whales in the Mediterranean Sea and mitigation approaches are detailed in this document.

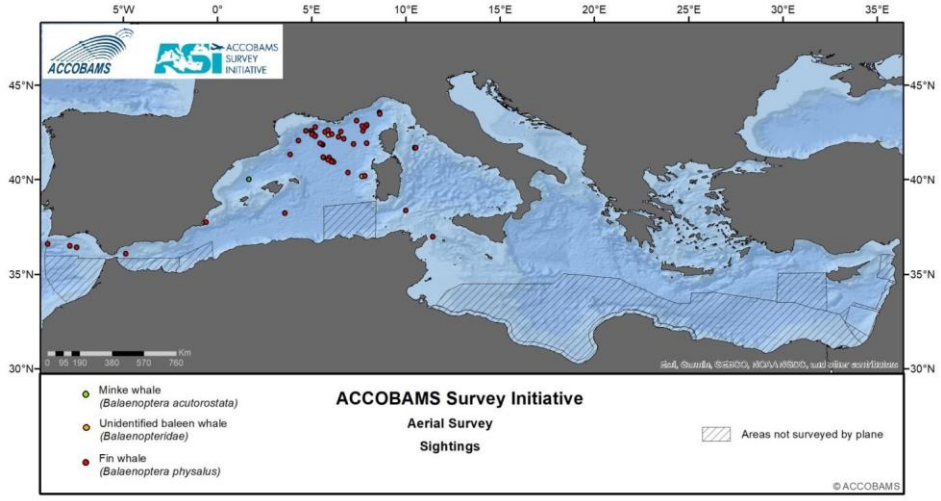


Fig. 1. Baleen whales' sightings during the aerial component of the ACCOBAMS Survey Initiative.

The distribution of fin whales in both national and international waters means that international collaboration is required on the conservation and management actions developed in this plan. This has been recognised and supported by both ACCOBAMS and the IWC and will require co-operation by many stakeholders, ranging from local and national governments, through intergovernmental bodies to industry and NGOs.

This CMP (following the general structure and philosophy given in Donovan *et al.* (2008)) and the accepted IWC template also adopted by ACCOBAMS (Res 6.21) is a framework to stimulate and guide the conservation of fin whales found in the Mediterranean Sea and as such it should be re-evaluated and updated regularly (see Item 8.3).

NEED TO INSERT A TABLE OF RANGE STATES AND INCLUDE WHETHER MEMBERS OF ACCOBAMS AND/OR IWC

1.1.1 WHAT IS A MEDITERRANEAN FIN WHALE?

For the purposes of this iteration of the plan, 'Mediterranean fin whales' are considered to be fin whales that spend all or most of their lives in the waters of the Mediterranean Sea (see below).

The plan highlights the need to better understand the population/conservation implications of the differences in song identified between animals that spend some of their lives in the western areas of the Mediterranean Sea and move through the Strait of Gibraltar to and from adjacent North Atlantic waters, along with need to understand any movements of Atlantic whales into the western Mediterranean. This is a priority for the next iteration of the CMP in around six year's time.

1.2 OVERALL GOAL OF THE CMP

It is not possible to 'manage' fin whales in the Mediterranean Sea themselves, but it is possible to manage human activities that adversely affect the whales and/or their habitat. Thus, by their nature, the management actions associated with this CMP require a degree of control and limitation on human activities.

> *The overall goal of this CMP is to manage human activities that affect fin whales in the Mediterranean Sea in order to maintain a favourable conservation status throughout their historical range, based on the best available scientific knowledge.*
>
> *In pursuing this goal, the needs and interests of stakeholders will be taken into account to the extent possible, whilst recognising that favourable conservation status is the highest priority. Moreover, scientific uncertainty must be taken into account while setting priorities and determining appropriate actions.*

Ideally, all management actions are based on adequate scientific data. However, there are occasions when the potential conservation consequences of waiting for confirmatory scientific evidence are sufficiently serious that it is justified to take action immediately whilst continuing to study the problem. This means following the 'precautionary principle'.

2 LEGAL FRAMEWORK

A summary of information on relevant conventions, agreements and national regulations is given in Annex 1. ADD A SECTION ON PROTECTION REGIME WITHIN THE MEDITERRANEAN, WITH REFERENCE TO PELAGOS SANCTUARY, MPAS, IMMAS, NATIONAL LEVEL CONSERVATION STATUS ETC.

3 BIOLOGY AND STATUS OF MEDITERRANEAN FIN WHALES

3.1 POPULATION STRUCTURE

Understanding population structure and movements is essential to interpreting abundance and trend information (see Item 3.3 below). The working hypothesis for this iteration of the CMP is that there is a single 'Mediterranean' population of fin whales, some of which move seasonally in and out of the Mediterranean through the Strait of Gibraltar based upon inferences from genetic, photo-ID, stable isotope and telemetry data. However, it is essential that additional work is undertaken before the next iteration of the CMP to better understand the population and conservation implications of the relationship between Mediterranean and North Atlantic fin whale populations inside or outside the Mediterranean basin.

Based upon the available information, it seems that the summer ASI abundance surveys comprise most of the Mediterranean population although any animals that might have moved through the Strait of Gibraltar to adjacent waters in the North Atlantic, would have not been covered. Of course if and whales from the Atlantic population moved into the Mediterranean Sea during the time of the survey effort would have been included in the ASI survey abundance estimate. Movements of a small number of fin whales have been observed through the Strait of Gibraltar, exiting the Mediterranean Sea in April-October and entering in November-March (Gauffier et al. 2018).

Sightings of fin whales have been reported in waters from Spain to the Ionian Sea, much less frequently elsewhere. In summer, they appear to congregate in feeding grounds in the northwestern portion of the basin, namely the Corso-Ligurian-Provençal Basin and the Gulf of Lions (e.g. Forcada *et al*., 1995; 1996; Notarbartolo di Sciara, 2003; Panigada *et al.*, 2011, 2017).

Stable isotopes

Stable isotope analyses in baleen plates and skin samples have shown differences between sampled animals in the northeast Atlantic and those from the north-western Mediterranean (Bentaleb et al., 2011; Das et al., 2017; Giménez et al., 2013; Ryan et al., 2013). As fin whales are believed to feed predominantly on *Meganyctiphanes norvegica* (see feeding paragraph), it seems to indicate that these animals feed in different areas. Individuals sampled in the Strait of Gibraltar exhibited seasonal differences in stable isotope signatures between summer and winter, suggesting that these whales may feed in the North Atlantic during the summer and in the Mediterranean Sea in winter (Gauffier et al., in review).

Acoustics

Male fin whales produce low frequency sounds, including typical 20-Hz note and backbeats (Clark et al., 2002; Watkins et al., 1987). These notes are usually repetitive and organized in songs, which are believed to be used as reproductive display (Croll et al., 2002; Moore et al., 1998; Watkins et al., 1987). Passive acoustic analyses have identified two types of songs within the Mediterranean Sea (Castellote et al., 2012; Clark et al., 2002). Recordings from the Ligurian Sea, Balearic Basin and Lampedusa Island had a different bandwidth (5 Hz vs 6.5 Hz) and inter-note intervals (>14s vs <13s of more than 14 s to those from south of the Balearic islands, the Alboran Sea and the Strait of Gibraltar in autumn and winter (Castellote et al., 2012; Clark et al., 2002; Sciacca et al., 2015). The latter were more similar to northeast Atlantic songs (Hatch and Clark, 2004). Few "Atlantic" songs were recorded in March in the Balearic basin, concurrently with Mediterranean songs (Castellote et al., 2011).

Fin whale acoustic presence was detected offshore Eastern Sicily (Ionian Sea), throughout the processing of about 10 months of continuous acoustic monitoring. The study confirms the

hypothesis that fin whales are present in the Ionian Sea throughout all seasons, with peaks in call detection rate during spring and autumn months (Sciacca et al., 2015).

- Important to add here new acoustic study from the South of Portugal when published.

Information gaps: Further PAM efforts are required in the Strait of Gibraltar and adjacent waters to provide information on the song types of passing whales and the spatio-temporal dispersal of Mediterranean (based upon song) whales within the North Atlantic). Also PAM in areas of high productivity based on modeling for the South and eastern Mediterranean, and transit channels to integrate with other Mediterranean basin-wide efforts.

3.1.1 SATELLITE TAGGING

Between 2012 and 2015, thirteen fin whales were equipped with satellite transmitters; 8 tags were deployed in September 2012 in the Pelagos Sanctuary, while 5 tags were deployed in the Strait of Sicily, in March 2013 and March 2015, respectively (Panigada et al., 2017). Tagging occurred late in the summer in the Pelagos Sanctuary to gather information from outside the known summer feeding areas and to observe movements towards 'winter destinations'. In the Strait of Sicily, transmitters were deployed in March, when small numbers of whales concentrate for feeding purposes (Canese *et al*., 2006). The tagged animals from the Pelagos Sanctuary revealed consistent movements within the Corso-Liguro-Provençal Basin and the Gulf of Lions and the Balearic Islands. Animals tagged in the Strait of Sicily in March remained mostly around Lampedusa with observed movements towards the southern coast of Sicily and northern Tunisia. Most of the whales sighted off Lampedusa in 2013–2015 were observed actively feeding at the surface on large swarms of krill (probably *Nyctiphanes couchii*). Two fin whales moved north towards the Southern Tyrrhenian Sea and the east coast of Sardinia Island with an individual reaching the area of the Pelagos Sanctuary.

The longitudinal movements of fin whales tagged in the Ligurian Sea in the late summer and the latitudinal migration recorded in early spring, support the hypothesis that the whales summering in the northwestern Mediterranean Sea travel southwards towards winter feeding grounds in the Strait of Sicily, and possibly towards non-identified breeding areas in the Southern Mediterranean Sea (Notarbartolo di Sciara *et al*., 2003; Castellote *et al*., 2012). One additional hypothesis is that whales would later move northbound towards the Pelagos Sanctuary and adjacent waters during the early- mid-spring, following the marked feeding habitat concentration in the area (Notarbartolo di Sciara *et al*., 2016).

Information gaps: long-term information (ideally over a year, which would require implantable rather than LIMPET tags) on the movements of animals from the Strait of Gibraltar/Sea of Cadiz area, and between the western Mediterranean and the eastern Mediterranean, will be extremely important. More detailed shorter-term data (e.g. from limpet tags) can assist in verifying spatial modelling approaches such as that of Druon *et al*. (2012) (updated in Panigada *et al.* 2017, Fossi *et al.* 2017, maps and data: https://fishreg.jrc.ec.europa.eu/web/fish-habitat).

3.1.2 PHOTOGRAPHIC EFFORT

Long-term photo-identification was used to estimate survival rate, population size, rate of change, sex ratio (assessed molecularly through biopsy samples) of fin whales in the Pelagos Sanctuary. Abundance estimates for fin whales summering in the Pelagos Sanctuary feeding grounds were obtained through mark-recapture methods, which have never previously been applied for this

species in the Mediterranean Sea. Merging existing photo-identification catalogues from different Institutes operating in adjacent study areas in the northwestern Mediterranean Sea provided a large dataset (505 fin whales identified between 1990 and 2007). The number of resightings was highest for the years 1991-1995, and this time interval provided the most robust abundance estimates obtained through the mark-recapture analysis. Population values ranged between 930 individuals in 1991-92 and 1,133 in 1994-95, with CVs of around 34% (Zanardelli *et al*., in preparation). Other estimates have been done from a dataset of 239 photo IDs taken in the northwestern Mediterranean from 2006 to 2014: 189 individuals have been identified and the Jolly-Seber open population model gave a population size of 1,129 (CI 95%: 705-1548 ; Tardy et al, 2016).

In the Spanish Mediterranean, two areas have maintained a photo-ID catalogue over the last decades. In the Strait of Gibraltar about 50 animals have been identified between 1999 and 2014, including 5 individuals sighted in different years (Gauffier et al. 2018). In the "Garraf coast", in Catalonia (NE Spain), more than 150 individuals have been identified between 2011 and 2018, with 13% recaptures in different years (EDMAKTUB 2018).

Information gaps: a general catalogue and comparison of all photo-ID data from the various parts of the region is lacking that may provide valuable information on population structure and movements. Use of shared protocols is highly recommended.

3.1.3 GENETIC ANALYSES

The first large-scale population genetic assessment of North Atlantic fin whales, based on ~400 mitochondrial (mt) control region DNA sequences of 288 nucleotide length and genotypes at six nuclear microsatellite loci, found an elevated degree of genetic divergence between North Atlantic and Mediterranean Sea fin whales (Bérubé et al. 1998). The elevated degree of genetic divergence was indicative of limited gene flow, suggesting that Mediterranean Sea fin whales are distinct from con-specifics in the North Atlantic. A later study (Palsbøll *et al.* 2004) applied the Isolation-with-Migration framework, originally developed by Nielsen and Wakeley (2001), to determine if the elevated degree of genetic divergence between the North Atlantic and Mediterranean Sea was due to either low recurrent gene flow or a recent divergence of previously connected populations. The study was based on mtDNA control region sequences and estimated that a model of recurrent gene flow, at two females per generation, was more plausible than a model of recent divergence and subsequent zero gene flow. The inferred migration rate, low from an ecological/conservation perspective, suggests that the influx of North Atlantic fin whales is not sufficient to buffer a demographic decline in the Mediterranean Sea.

The spatial and temporal definition of the boundary between the North Atlantic and Mediterranean Sea fin whales is still being debated (Castellote et al. 2012, 2014; Giménez et al. 2013, 2014; Notarbartolo di Sciara et al. 2016). A recent study was undertaken with a larger sample size (N=1,600) and genetic markers (20 microsatellite loci and 450bp mitochondrial control region sequences). This increase in genetic markers made it possible to start studying the distribution of related individuals. The detection of four parent-offspring pairs between the Ligurian Sea and the Strait of Gibraltar (Schleimer *et al*. in prep) shows that the amount of connectivity between these areas should not be underestimated. In addition, one other pair was detected between a living animal from the northwestern Mediterranean and a stranded animal from the North Sea (Tardy et al, in prep).

New, as yet unpublished (Schleimer et al in prep.) population analyses found that fin whales sampled in the Strait of Gibraltar (N=50) were more closely related to fin whales from the Mediterranean Sea (N=150) than the northeastern Atlantic (N=300). In summary, the genetic analyses thus far suggests a Mediterranean population with occasional migration to and from the eastern North Atlantic basin. A well-defined estimate of the rate of contemporary gene flow between the eastern North Atlantic and Mediterranean Sea will require a much higher, coordinated sampling intensity and effort during a short period of time in both areas.

Based on 495 genetic samples collected from 2006 to 2019 in an area encompassing the Gulf of Lion and the Corso-Liguro-Provencal basin and using the likelihood method to estimate the effective population size (i.e. the number of individuals needed to maintain its genetic diversity; Wang 2009) was estimated at 396 individuals (95% CI: 343-467; Tardy et al, in prep,) although there are a number of uncertainties that must be recognised in this type of analysis.

Information gaps/needs: Intense coordinated sampling intensity and effort (biopsy, photo-Id, acoustics etc..) during a short period of time and in the eastern North Atlantic as well as the Mediterranean Sea using appropriate analytical approaches that integrate all relevant information (see 3.1.4)

3.1.4 INTEGRATION

Integrating the data from *inter alia* telemetry, genetics, photo-identification and sightings/distribution, acoustic surveys is essential to obtain a better understanding of population structure and determine plausible hypotheses. As discussed above, at present, the most recent genetic (and stable isotope and telemetry) evidence points to the ACCOBAMS region primarily containing a single 'Mediterranean' population of fin whales (*Balaenoptera physalus*). Some of these animals move out through the Strait of Gibraltar into the adjacent North Atlantic in summer and move back in the winter (Gauffier et al., 2018; and see Fig.1). However, acoustic analysis of the song characteristics recorded in the Strait of Gibraltar in 2008-2009 more closely match those of animals from the Northeast Atlantic (Castellote et al. 2012). This suggests that (a) Mediterranean fin whales rarely exit the Mediterranean basin but also (b) that a priority is for additional focussed work to further identify the whales passing through the Straits of Gibraltar and in the adjacent Atlantic waters.

For the purposes of this iteration of the CMP it has been assumed that all animals that spend at least some of their life in the Mediterranean Sea comprise a single population although this will need revisiting in the light of the results of the focussed research actions recommended in this iteration. This may be best achieved through a well-prepared expert workshop once all available data have been identified and collated.

3.1.5 INFORMATION GAPS/NEEDS

(a) Understanding of the population structure of fin whales in the region, in particular to allow understanding of:

- the relationship between the acoustic, genetic, and stable isotope information for animals from the Straits of Gibraltar, Alboran basin, and the Gulf of Cadiz.
- Basin-wide winter distribution, particularly off norther African coast and eastern basin

(b) To achieve this, needs include (NB these studies may provide important information on topics other than population structure):

- collation of available data/samples from a variety of techniques (genetics, photo-ID, telemetry, sightings and distribution, e-DNA, etc.) within and between seasons relevant to population structure;
- increased biopsy sampling/photoID/acoustic tagging work on 'singing' animals;
- identification of areas which may need more effort (spatial and other ecological modelling, PAM, biopsy samples, photo-id, etc.)
- creation and maintenance of a single photo-identification catalogue – ideally in conjunction with a genetic-ID catalogue;
- increased targeted satellite tagging and PAM effort to address:
    - long-term seasonal movements and origins of Strait of Gibraltar/Sea of Cadiz whales;
    - where and when fin whales mate and conceive;
    - winter distribution, with a special emphasis on the eastern and southern basin.

3.2 BASIC BIOLOGY

3.2.1 FEEDING

Fin whales favour upwelling and frontal zones with high concentrations of zooplankton (e.g. Bauer *et al.*, 2015). The euphausiid *Meganyctiphanes norvegica* or northern krill is considered to be the main prey. Fin whales concentrate for feeding during the summer in the high productivity region in the Corso-Ligurian-Provençal Basin and the Gulf of Lions (Astraldi *et al.*, 1994; 1995; Notarbartolo di Sciara *et al.*, 2003).

However, as summarised in Notarbartolo di Sciara *et al*. (2003), fin whales have been observed engaging in inferred or directly observed feeding in other areas and times of the year e.g. in summer off eastern Sicily and off the island of Ischia, in spring off eastern Sicily and in winter off northeastern Sardinia and off the island of Lampedusa. Using remote sensing data and fin whale observations, Druon *et al*. (2012) developed a modelling framework to predict in near real-time the presence of potential feeding habitats for fin whales in the northwestern Mediterranean Sea based on the satellite-derived identification of chlorophyll-a fronts (model updated in Panigada *et al.* 2017, Fossi *et al.* 2017, maps and data: https://fishreg.jrc.ec.europa.eu/web/fish-habitat). Meso-scale productivity fronts were shown to be sufficiently resilient to ensure an efficient energy transfer from phytoplankton to mesozooplankton (Druon *et al.* 2019).

In the last decade, a feeding aggregation was confirmed off the "Garraf coast", in Catalonia (NE Spain) in March-May, where whales have been observed actively surface feeding on *Meganyctiphanes norvegica* (EDMAKTUB 2018).

Stable isotope analyses indicate that fin whales sampled in the Strait of Gibraltar may feed in the North Atlantic in the summer and in the Mediterranean in winter (Gauffier et al. in review).

Information gaps: better knowledge of feeding areas outside the summer, including in the southern and eastern basin, e.g. by testing the Druon *et al*., spatial model with observations in other areas. Combine modeling results with PAM sampling.

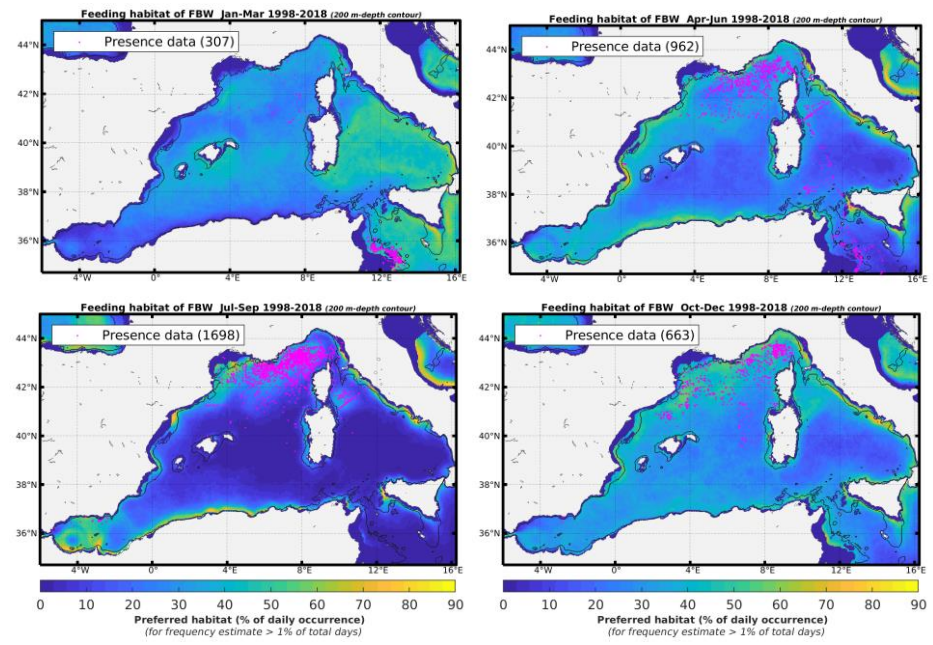


Fig.2. Seasonal potential habitat of fin whale (*Balaenoptera physalus*) in the western Mediterranean Sea derived from the frequency of chlorophyll-a fronts (model of Druon *et al.* (2012), updated in Panigada *et al.* 2017, Fossi *et al.* 2017) with overlay of presence data (pink dots, n = 3,630) over the period 1998-2018 (Upper left panel – winter, upper right panel – spring, lower left panel – summer, lower right panel autumn). Although effort in highly uneven in space and time, the spreading and contraction of favourable feeding habitat in winter and summer respectively is coherent with the observations. Note that 75% of fin whale observations were closer to 11 km of the highly favourable habitat (>50%) and 2 km of any favourable habitat level (>0%, n = 2,852) showing that whales are not always in their optimum feeding habitat, but they are frequently nearby likely searching for it.

3.2.2 LIFE HISTORY

Population parameters specific to fin whales in the region are poorly understood.

There is some evidence (seasonal distribution of whales estimated or measured to be ≤8m i.e. assumed recently born) that breeding in Mediterranean fin whales is not strictly seasonal unlike other areas of the world where they generally undertake regular migrations associated with feeding and reproduction, as discussed in Notarbartolo di Sciara *et al*. (2003; 2016). Most were seen (as would normally be expected) between September and January (6-10/month), but there were still a number (1-3/month) from February to August. This protracted period may reflect the milder environmental conditions in the Mediterranean providing more protracted feeding and placing less pressure on a narrow birth season.

As expected, records of newborn whales originated mostly from the western portion of the region where whale density is higher. However, newborns also occurred in the Eastern Mediterranean, supporting the hypothesis that fin whales, rather than gathering in specific breeding grounds, engage in breeding activities wherever favourable physiological conditions occur (Notarbartolo di Sciara *et al.* 2016).

There are no formal baseline data on reproductive or survival rates (e.g. from longitudinal studies) of Mediterranean fin whales. Such information would be valuable to conduct population status and viability assessments.

A collaboration amongst four photo-identification research groups resulted in a dataset of 505 individuals spanning 18 years (give them). Zanardelli et al. (In Prep) used a Jolly-Seber open population model to estimate: apparent survival rate (0.88, 95% CI = 0.76 - 0.94); population size in 1990 (980, 95% CI 670-1,437) and annual rate of population change (0.99, 95% CI = 0.92 – 1.07). A similar approach for a smaller area in the northwestern Mediterranean Sea (239 individuals over 9 years (give them) yielded an apparent survival rate was 0.92, 95% CI = 0.85-0.99 (Tardy et al., 2016).

The 'best' apparent survival rates above are lower compared to estimates from other large whale populations. If true, possible reasons include: (a) underestimation because of "transient" animals (animals that are seen once and then never again and are assumed to be just passing through; (b) permanent emigration (animals moving out of the study area), and (c) mortality additional to natural mortality (ship strikes?).

Apparent pregnancy and sexual maturation rates were estimated from biopsies collected in the Northwestern Mediterranean from 2010 to 2016 (over 174 females and 194 males). Some 42.5% of the females had progesterone levels consistent with early pregnancy while almost 65% of males were sexually mature (Siliart et al, 2012 ; WWF report, 2016).

Information gaps: better understanding of population parameters, breeding behaviour and distribution to aid (a) population modelling efforts to integrate several threats, and (b) development of targeted mitigation measures e.g. to improve survival of mature females.

3.3 DISTRIBUTION AND MOVEMENTS

A variety of sources of information on distribution are available including sightings from a variety of platforms, strandings, acoustics, individual identification (photographic and genetic). Most information is available from the western Mediterranean.

In describing a general pattern of fin whale distribution in the Mediterranean Sea (Notarbartolo di Sciara et al. 2003) identifies a major feeding summer aggregation in the Northwestern Mediterranean, in an area between the Gulf of Lion, the Corsican Sea and the western Ligurian Sea (a.k.a. the Corso-Liguro-Provençal Basin). Whales are found there throughout winter although in much smaller numbers.

In the western Mediterranean Sea, a southwest movement of fin whales is observed in autumn along the Spanish shelf edge, as well as the Balearic basin towards the Alboran Sea. A broadly 'opposite' direction of movement (northeasterly) is observed in these same areas in spring. Whales have been observed feeding along the coast of Garraf in Catalonia in March-May (Edmaktub 2018), near the Columbretes Islands and from spring to summer along the coast of southern Spain (Gozalbes et al. 2009), and in the Strait of Gibraltar and into the Atlantic (Gauffier et al. 2018).

During winter, whales appear to move eastward through the Strait of Gibraltar and are persistently acoustically detected in the Alboran Sea (Castellote et al., 2012).

Other locations where fin whales have been observed outside of the Corso-Liguro-Provençal Basin at various times of the year include: the east coast of Sicily in spring and late summer-autumn (Sciacca et al. 2015), the Strait of Sicily in winter, the east coast of Sardinia in spring, the eastern Ionian Sea off Greece in summer (Notarbartolo di Sciara et al. 2016), and the Adriatic sea in spring – late summer (Lipej et al., 2004; Holcer, unpublished) where feeding on krill in the Jabuka pit area during spring has also been confirmed (Holcer, unpublished).

A few individuals were photographically recaptured between the Alboran Sea in spring-summer and the Strait of Gibraltar (CIRCE/Alnilam, unpublished data). Other photo-ID catalogues

comparisons are underway but have not detected recaptures so far. Two females were genetically recaptured between the Corso-Liguro-Provençal Basin and subsequently the Strait of Gibraltar and one male was first sampled in the Strait of Gibraltar and then off the coast of Garraf (Gauffier et al. in prep, Schleimer et al. in prep). Satellite tagging and stable isotopes also provided a link between the Corso-Liguro-Provençal Basin and the Strait of Gibraltar (Bentaleb et al. 2011, Giménez et al. 2013, , Gauffier et al. in review, CIRCE, unpublished data).

Photographic recaptures and satellite tagging revealed movements of individual whales from the Strait of Sicily in late winter to the Pelagos Sanctuary in summer (Panigada et al., 2017; Aissi et al., 2008).

Fin whales are known to occur to the east of Greece (Notarbartolo di Sciara et al. 2003). Although the species' occurrence there during summer appears to be significantly lower than in the western Mediterranean Sea.

Information gaps: Understanding distribution and movements outside the summer (including in the eastern Mediterranean) is a priority for research in order to *inter alia* determine temporal and geographical overlaps between whales and threats.

3.4 ABUNDANCE AND TRENDS

Comprehensive basin-wide estimates of density and abundance are largely lacking for fin whales across the whole Mediterranean Region. The most comprehensive single survey prior to 2018 was undertaken in 1995 during summer; it covered the region from the Strait of Gibraltar to as far as the coast of north-western Italy. Almost all fin whales were seen in the Liguro-Provençal basin. Total estimated (uncorrected) abundance was around 3,500 animals – the sightings distribution suggests these were all or almost all from the Mediterranean populations. Panigada *et al*. (2011, 2017) and Bauer *et al*. (2015) provided a synthesis of the available information on the species' abundance, density and encounter rates in the western portion of the Basin and present the most recent seasonal abundance and density estimates for the Pelagos Sanctuary and adjacent waters. Bauer *et al*. (2015) and Laran *et al.* (2017) also provided estimates of density - corrected for the availability bias - for the same species in the Gulf of Lions in winter and summer.

Most recently, in summer 2018 a basin wide synoptic survey was undertaken across the Mediterranean Sea and contiguous Atlantic area, combining visual methods (aerial surveys) and visual and passive acoustic monitoring (PAM) from vessels (focused primarily on deep diving species and areas where aerial surveys were not possible). Line-transect sampling methodology was applied and density and abundance estimated through design-based and model-based approaches. Uncorrected for availability and/or perception biases, design-based results for fin whales for the areas covered by aerial surveys (Fig. 1) estimated a total of 1,835 fin whales (CV=0.26; 95% CI=1,099-3,065).

As discussed in Panigada *et al.* (2011), the appreciable decline in abundance estimates for an area broadly encompassing the Pelagos Sanctuary between surveys carried out in 1992, 2009 and 2018 is a cause for concern.

Information gaps/needs: there is a need to re-examine the available survey data, including use of spatial modelling approaches. Data on population trends are lacking and a thorough examination of the available data to determine an effective future monitoring approach (incorporating a realistic power analysis of the ability to detect trends should they occur) to ensure that adequate mitigation measures are working is needed. Data on winter distribution and abundance, including in the eastern basin, will enhance the ability to develop targeted mitigation approaches throughout the year. As referred to in the section on population structure, focussed research on

assessing levels of temporal and spatial overlap between Mediterranean and Atlantic fin whales is important in interpreting abundance and trend information.

3.5 'ATTRIBUTES' OF THE POPULATION(S) TO BE MONITORED

Potential attributes (power analyses needed to examine ability to detect trends if they occur):

(1) abundance and trends by population (high);

(2) distribution throughout the Mediterranean region and changes over time (medium);

(3) body and health condition, reproductive rates (e.g. from photographic studies including drones and photogrammetry, stress hormones etc.,) – feasibility to be assessed

4 SUMMARY OF ACTUAL AND POTENTIAL ANTHROPOGENIC THREATS

4.1 ACTUAL AND POTENTIAL ANTHROPOGENIC THREATS

Mediterranean fin whales face a number of both direct and indirect threats throughout their range (Table 1). Direct threats (i.e. those that may cause instantaneous or near instantaneous death of the animal) include vessel strikes, and, rarely but potentially, severe blasts of extremely loud noise. Fin whales seem to be less vulnerable than most Mediterranean cetaceans to fishery entanglements, even by pelagic drift nets (Notarbartolo di Sciara, 1990), and their effect on the population is therefore considered negligible. Indirect threats that may affect survival or reproduction but at a longer timescale, include:

- anthropogenic noise from different sources (e.g. industrial (extractive and prospective), military activities (sonar, detonations), commercial shipping traffic (long-distance additive noise, or even from approaching vessels, such as during whale watching or research, in particular geophysical); and
- chemical pollution including micro- and nano- plastic ingestion (both fin whales and/or their prey); physical disturbance (e.g. intrusive whale watching and research).

Climate change may influence/exacerbate several of these, especially abundance and distribution of prey (and hence whales).

Table 1

Initial draft summary of information on actual and potential threats

Actual/potential threat	Human activity	Strength of evidence	Possible impact	Priority for action	Relevant actions
Major threats (lethal or sub-lethal)					**Add later**
Vessel strikes	Ship traffic, particularly at speeds higher than 10 knots, Presence or development of ports in areas of high use by whales	Strong	Mortality, serious injury	High	
Anthropogenic noise	Production of loud noise by industrial activities including those related to oil and gas extraction, military activities, general ship traffic incl. whale watching and research activities	Strong or moderate	Temporary or even permanent threshold shift, sound masking, temporary or permanent displacement from breeding or feeding areas, risk of ship strikes	High	
Micro- and nano-plastic ingestion	Release of plastic debris into the marine environment (tends towards breaking down into smaller and smaller particles)	Strong	Bioaccumulation of contaminants, with negative physiological effects	High	
Other threats					
Chemical contamination of cetaceans and their prey	Chemical pollution from industrial and development activities on land spreading into the sea or release of chemicals directly into the sea, including oil spills	Strong or moderate	Leading to compromised health that may affect reproduction (e.g. affecting hormonal balance or production) and survival (e.g. through reduced immune response)	Moderate to High	
Physical disturbance	Intrusive marine activities including oil and gas developments, coastal developments, fishing, whale watching and research	Moderate	Avoidance, displacement, interruption of life cycle activities, detrimental effects at the population level	Moderate to High	
Climate change	Production of green house gases	Low or Moderate	May influence distribution and abundance of prey	Low	

4.1.1 VESSEL STRIKES

The Mediterranean Sea is subject to some of the heaviest vessel traffic in the world, with about 30% of the world's total merchant shipping concentrated within only 0.8% of the global ocean surface. Unusually high rates of ship collisions have been reported for fin whales in the region, where the minimum mean annual fatal collision rate increased from 1 to 1.7 whales/year from the 1970s to the 1990s. It should be noted that reported strikes greatly underestimate the true number of strikes.

By far, the majority of reported fatal strikes (over 82.2%) were reported in or adjacent to the Pelagos Sanctuary which contains high numbers of fin whales, especially in summer, but is also subject to high levels of traffic and seasonal whale concentrations (Panigada et al., 2006). A recent analysis of fin whale strandings in the French Mediterranean coast attributed 22,5% (± 7,3%) to vessel strikes; they occurred throughout the year but mostly between July and November (Peltier et al. 2019).

It has been estimated that about 3,500 'near miss events' occur in the Pelagos Sanctuary over one year (WWF France, Quiet Oceans, Ecooceans Institut, 2016) whilst the Strait of Gibraltar is also a high risk area for fin whales due to the intensity of maritime traffic concentrated in a migration corridor (Gauffier et al. 2018). Although the IMO has recommended that ships slow down to below 13 knots in the area between April and August, compliance is low, especially for ferries and fast-ferries (Gauffier et al. 2010, Silber et al 2012) and does not cover the winter presence of fin whales (Gauffier et al. 2018). Ship strikes have also been identified as an issue in the Balearic basin (Borrell et al. 2000, EDMAKTUB 2018).

A recent study in the California current system reveals that annual nighttime strike risk was twice as high as the daytime risk (Keen et al. 2019). The difference between the day- versus night time risk of vessel strikes must be accounted for when designing mitigation measures.

Efforts are being undertaken to assess whether Important Marine Mammal Areas (IMMAs) can be used as management tools to better delineate high density whale areas for the evaluation of the potential high risk areas for ship strikes.

Statistical models can be used to highlight recurring high collision risk areas and the results showed that the chlorophyll a spring bloom was a useful predictor allowing a yearly forecast of summer fin whale distribution and demonstrated the possibility to dynamically manage whale-vessel collisions in the Pelagos Sanctuary (Gin Swen Ham, abstract WMMC 2019).

The high likelihood of unreported fatal strikes, combined with other anthropogenic threats, suggests an urgent need for a comprehensive, basin-wide conservation strategy, including ship strike mitigation requirements, like real-time monitoring of whale presence, reduction of speed and re-location of shipping routes in the risk-hotspots, while considering the whales' yearly spatial distribution, as well as seasonal persistence.

Information gaps: understanding the relationship between true numbers of animals killed or severely wounded by ship strikes and reported numbers, improve understanding on the mechanism of ship strikes (vessel type, speed, noise signatures, whale behaviour etc.) to determine the most effective mitigation measures.

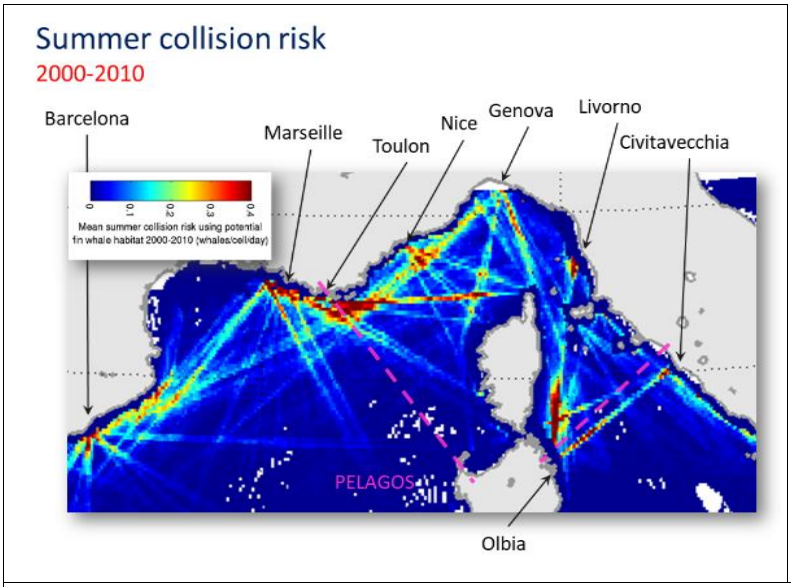


Fig.3. Spatial distribution of the potential risk of collision for fin whale merging data on favourable habitat (Druon et al. 2012) and on maritime traffic (Automatic Identification System) for the summer months of 2000-2010 (see Vaes and Druon 2013 for details). Note that 73% of fin whale observations were closer to 10 km of the highly favourable habitat (>50%) and 69% of observations are inside any favourable habitat level (>0%, n = 2,852). This result does not take into account the total annual nighttime strike risk which was found to be twice than daytime risk (Keen et al. 2019).

4.1.2 ANTHROPOGENIC NOISE

Noise can adversely affect whales in a number of different ways. In the most severe cases (e.g. extremely high levels of acute noise e.g. from seismic vessels) this can result in permanent threshold shift or even tissue damage conducive to death. Both acute and chronic noise at various time scales can affect whales e.g. by inducing temporary threshold shift and spatial displacement changing at least short-term and possibly long-term behaviour, excluding them from preferred habitat for shorter to longer time periods with the potential to impede successful feeding and/or reproduction. Chronic noise can also generate communication masking and reduction of acoustic space (Clark et al. 2009). In addition to vessel traffic of all types (cargo, transport, fishing, tourism) noisy activities can arise from geophysical exploration, military activities (sonar and explosions), dredging and coastal and offshore development (e.g. offshore windfarms), whale watching and research. Potentially, the noise emitted by vessels may affect the ability of whales to avoid collisions.

Information gaps: understanding of the hearing abilities (audiogram) of fin whales and the physical, vocal, and behavioural effects of both acute and chronic noise of different frequencies and intensities, sound mapping at the appropriate temporal and physical scales, better understanding of the cumulative noise effects from vessels and other noisy activities. QuietOceans (https://www.quiet-oceans.com/) is mapping all components of marine noise (natural and anthropogenic).

- Add Quietmed and Quietmed 2, MSFD D11.

4.1.3 MICRO AND NANO PLASTIC INGESTION

The interaction between free-ranging fin whales and microplastics in the Mediterranean Sea and elsewhere has only recently started to be investigated. Fossi *et al.* (2012) found considerable quantities of microplastics and plastic additives in surface water samples of and adjacent to the Pelagos Sanctuary. More recent studies suggest that debris, including micro-plastics and chemical additives (e.g., phthalates), tend to accumulate in pelagic areas in the Mediterranean (Fossi et al 2016, 2017), indicating a potential overlap between debris accumulation areas and fin whale feeding grounds. There was considerable overlap between high-density microplastic areas and whale feeding areas; exposure by whales was confirmed by a temporal increase in toxicological stress in whales. The authors concluded that exposure to microplastics (direct ingestion and consumption of contaminated prey) poses a major threat to the health of fin whales in the Mediterranean Sea This fact highlights the potential risks posed to endangered, threatened and endemic species of Mediterranean biodiversity.

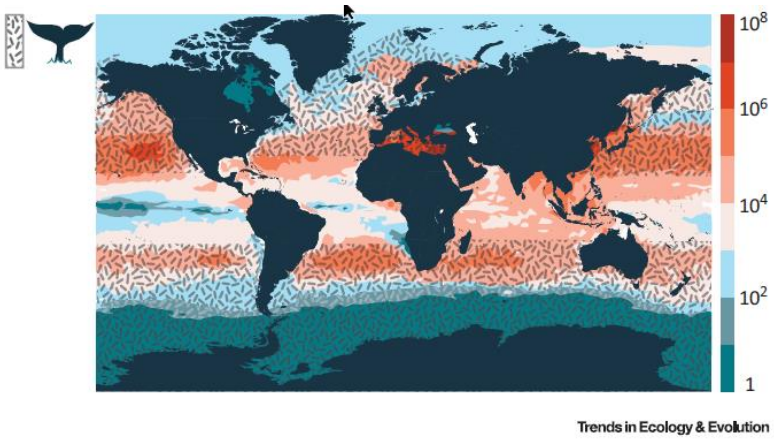


Figure X. Key Buoyant Microplastic Hot spots Overlap with Habitat Ranges of Filter-Feeding Marine Megafauna. Balaenoptera physalus, overlap with regions containing high levels of buoyant microplastic pollution. (Germanov et al. 2018)

Understanding the effects of microplastic contamination through metabolomics studies and monitoring of biomarkers responses (Fossi et al. 2016, Fossi et al 2018) can help to shed light on the health of populations in response to plastic-associated toxins. Long-lived species that are resident in specific regions can be monitored throughout their lives, providing an indication of toxin exposure overtime. The levels of toxins, especially those that are unique to plastics, in resident large filter feeders might provide indirect indicators, for microplastic pollution in local marine environments (Fossi et al 2018, Baini et al 2017).

Phthalates, as indicators of plastic contamination, have been analysed in 232 fin whale samples from 2016 to 2019 (WWF & AKINAO report, 2019). All individuals showed contamination from this

family of chemical compounds, but the concentrations were highly variable among individuals and years. The results suggested rapid metabolisation and therefore, there was no evidence of bioaccumulation along the food chain (Gobas et al, 2003). Four of them (DEHP, DiBP, DBP, DNHP-BBP) are recognised as toxic by the European regulation REACH. Analysed samples showed significant concentrations of these four compounds in particular DiBP and DBP with concentrations ranging from 1229±1016 ng/g to 9681±2398 ng/g (DiBP) and from 777±567 ng/g to 1.82±0.62 mg/g (DBP) are detected in higher concentration than the others for three years (more than twice).

Information gaps: better understanding of effects of micro- and nano-plastics and plastic additives on whale reproduction and survival at the individual and population level. Investigation of new plastic tracers in tissues and the identification (through omics techniques) of the toxicological effects caused to plastic debris ingestion in these species (Panti et al 2019).

4.1.4 CONTAMINATION OF CETACEANS AND THEIR PREY

Systematic studies of the contamination by xenobiotic compounds of free-ranging Mediterranean fin whales first started in 1990 and revealed high levels of organochlorine compounds, heavy metals, polycyclic aromatic hydrocarbons, hexachlorobenzene (HCB) and trace elements. The poor detoxifying potential possessed by marine mammals must be taken into account when dealing with these pollutants. This needs updating and references. What comprises "high" needs clarifying e.g. wrt other baleen whales in particular but also with odontocetes.

The contamination for PCBS, PBDEs and DTT has been analysed in fin whale biopsies collected from 2006 to 2014 (N=125; WWF report, 2015; Tapie et al, 2012). The contamination for ∑6PCBs was 5425.3 ±2799.6 ng/g lp for males and 2352.4 ±3177.9 ng/g lp for females, ∑PBDEs is 190.2 ± 147.4 ng/g lp (males) and 102.3 ±184.8 ng/g lp (females), p,p'DDE is 6039.9 ±4840.3 ng/g lp (males) and 2955 ±48798.3 ng/g lp (females), p,p'DDD is 587.1 ±541.7 ng/g lp (males) and 145.9 ±135.4 ng/g lp (females). Males are about two times more contaminated than females (p<0.0001 Mann-Whitney).

Prey contamination: to be added

Emerging contaminants: to be added

Information gaps: to be inserted when section is updated. Will include how to incorporate information into modelling of effects of contaminants on reproduction and survival (e.g. see IWC POLLUTION 2020 initiative).

4.1.5 PHYSICAL DISTURBANCE

It is often difficult to separate physical disturbance (i.e. related directly to presence or physical damage to the habitat e.g. coastal developments) from factors associated with presence (e.g. high levels of noise during or because of coastal developments or other effects via the food chain).

Either way, directly or indirectly human development activities (both coastal and pelagic) in preferred habitat can have a serious adverse impact.

Invasive approaches of boats (e.g. from whale watching activities or even non-careful research activities) can also disturb whales through direct physical presence and/or via noise and interrupt

Commenté [1]: https://www.sciencedirect.com/science/article/pii/S0013935115001966

Commenté [2]: I have reviewed about 20 papers of PCB, DDT, PBDEs from North Atlantic and Med fin whales and they seem to be generally higher in the Med than NA and higher for males than females (as also found by WWF). but it is hard to compare as they included different measurements (fresh/dry/lipid weight), sometimes different compounds, and are from different years (so it could have changed after some compounds were forbidden, or not...). If I am not mistaken, none of them reach the "thresholds" of 17000 ng/g lw identified as problematic for seals and used widely as a limit, and that is routinely reached by odontocetes.

Commenté [3]: I believe this is very interesting information but that should be summarised to include the other studies, several by Fossi, Marsili and co-authors, Lauriano 2013, Pinzone 2015, etc.

Commenté [4]: this number is weird, can you check Celine or Denis?

important behaviour including feeding and reproduction (Jahoda et al., 2003). Long-term presence can exclude animals from preferred habitat.

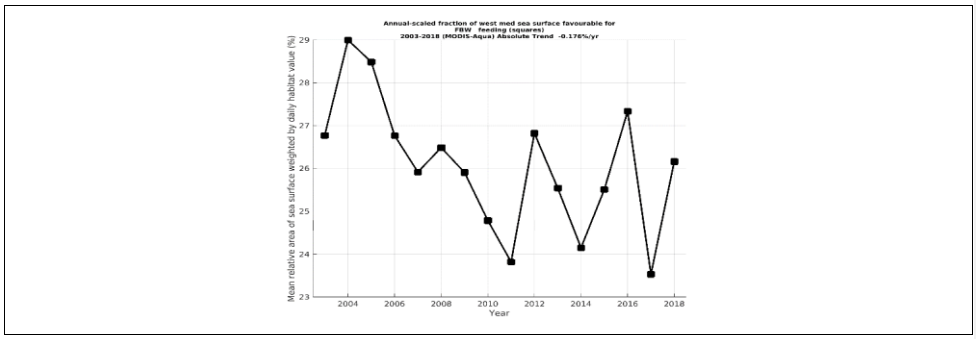
Unregulated whale watching activities, which may grow very fast is specific areas, may have detrimental effects at the population levels, which needs to be mitigated and prevented.

Currently, whale watching for fin whales is mainly concentrated in the Ligurian Sea and Pelagos Sanctuary-Gulf of Lions and specific attention should be dedicated to this area. Close and invasive approaches, such as those related to swim-with whales operations, should be prohibited in accordance with guidance from ACCOBAMS, the Pelagos Sanctuary Agreement and the IWC, as they may lead to severe disturbance to the animals.

Information gaps: better understanding of the direct and indirect of physical disturbance on fin whales and their prey. Data collection on whale watching activities (e.g. vessel positions using AIS (Automatic Identification System) and declarations for non-equipped AIS vessels).

4.1.6 CLIMATE CHANGE

The potential effects of global climate change or ocean acidification on fin whales in the Mediterranean, largely dependent for feeding on euphausiids (Notarbartolo di Sciara et al., 2003) that are possibly susceptible to adverse reactions to an increase in temperatures due to climate change, are unknown, but cannot be neglected and need further investigation.
Current effects of climate change on feeding opportunities can be assessed using satellite-derived chlorophyll-a concentration and horizontal gradient (frontal features). The frequency of surface productivity fronts, which was shown to be linked to zooplankton biomass (Druon et al. 2019), reveals regional positive or negative trends over the last 16 years (Fig. 3) likely driven by atmospheric processes (unusual wind, evaporation and precipitation events affecting vertical mixing of the surface ocean, Druon *et al.* 2019). In particular, the loss of feeding opportunities in the most productive areas is of 15-20% per decade in relative value as induced by climate change in the western Mediterranean Sea for the period 2003-2018 (see legend of Fig. 3 for details).



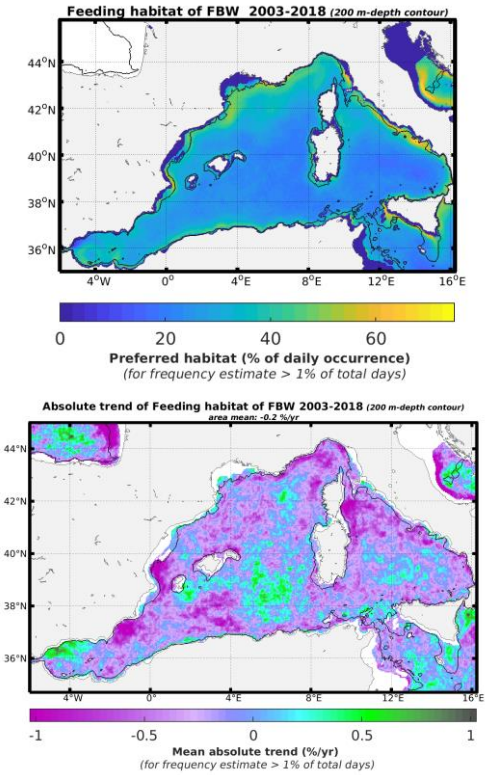


Fig.3. Annual variability (upper panel), inter-annual mean (lower left panel) and absolute trend distribution (lower right panel) of potential habitat of fin whale (*Balaenoptera physalus*) in the western Mediterranean Sea derived from the frequency of chlorophyll-a fronts (model of Druon *et al.* (2012), updated in Panigada *et al.* 2017, Fossi *et al.* 2017) over the period 2003-2018 (MODIS-Aqua sensor). The absolute trend map shows a general decrease of productivity fronts of about 1% per year in the most productive areas (40-50% of favourable habitat) resulting in a relative loss of feeding opportunities of 15-20% per decade induced by climate change. Although inter-annual variability is high at basin level (±12% in relative levels), a main loss of productivity fronts and related habitat occurred in the late 2000s (upper panel).

4.1.7 CUMULATIVE EFFECTS

The above sections discuss threats individually. However, it is clear that some or all of them may interact temporally and/or spatially. An initial approach to determine threat hot spots is to map threats against distribution (IWC-IUCN-ACCOBAMS report April 2019).

Cumulative effects can be considered as changes in reproduction and/or survivorship that negatively affect population dynamics and thus status as a result of repeated exposure to the same stressor(s) over time or the combined effects of multiple stressors. Developing robust ways to evaluating this is a complex problem. Perhaps the best-developed framework to date is the Population Consequences of Disturbance (PCoD) model (New et al. 2014) which has been extended to consider the Population Consequences of Multiple Stressors (PCoMS) (National Academies of Sciences, Engineering, and Medicine 2017). This approach moves through the effects of stressors on individuals' behaviour and physiology which is converted to effects on vital rates and then on to population trends and sustainability. However, the approach is extremely data demanding and requires quantitative temporal and spatial information on whales (distribution, demographics and

physiology), their prey and environment, human activities and models linking these - this complexity also contains inherent large levels of predictive uncertainty. In view of this, the present iteration of the CMP focuses initially on addressing individual threats whilst recognising the need ultimately to work towards evaluation of cumulative effects should mitigation measures on the individual threats proves insufficient.

4.2 MONITORING

Any active species conservation effort requires that human activities, as well as the animals, are monitored over time in order to determine whether threats are worsening or lessening and to interpret results on the effectiveness of mitigation. Examples for this CMP include monitoring the number and trends in ships/journeys in areas where ship strikes are known or expected to occur, how vessel traffic is changing (e.g. number and size of vessels, speeds, routing) and levels and characteristics of underwater noise in feeding (and other biologically important) areas. In all cases, the first step is to establish a baseline.

XXX specific actions are identified here to address threat monitoring. In addition to these actions, any baseline study of other threat factors should be encouraged.

- PAM to monitor both noise and fin wh presence & identity – link to MSFD

5 MITIGATION MEASURES

This section deals only with threats that are considered at this stage to be of high or moderate priority and where mitigation measures can be identified. This includes vessel strikes, noise and pollution. [refer to Pelagos Sanctuary actions where they exist]

5.1 VESSEL STRIKES

Mitigation measures for ship strikes with fin whales have been discussed during dedicated IWC-ACCOBAMS workshops (Beaulieau sur Mer, 2010; Panama, 2014), during which different recommendations were discussed and suggested. Measures that separate whales from vessels (or at least minimise co-occurrence) in space and time to the extent possible are the most effective, where this is possible (e.g. routing schemes). The most effective and only demonstrated measure to reduce fatal collisions with most large whales is to reduce speed to 10 knots (Vanderlan and Taggert, 2007; Conn and Silber, 2013; Laist et al., 2014).

Emphasis should also be placed on the collection and reporting of data to the IWC Global Ship Strikes Database which will both: (1) facilitate a proper evaluation, prioritisation and monitoring of ship strikes as a threat to various populations and regions; and (2) assist in the development of mitigation measures.

One of the key components of the IWC Ship Strikes Strategic Plan is to identify high risk areas for ship strikes (a high-risk area is defined as the convergence of either areas of high volume shipping and whales, or high numbers of whales and shipping); Important Marine Mammal Areas (IMMAs) represent a systematic and biocentric approach to identifying important habitats, and that as such they can be helpful in identifying potential high risk areas for ship strikes. In particular, if an IMMA contains a species or population that is vulnerable to ship strikes, and it is transited by significant shipping, the area can be "flagged" for further investigation and potential mitigation.

The latest IWC-IUCN-ACCOBAMS workshop (Messinia, 2019) recommends the following steps are undertaken as part of a process to identify High Risk Areas for Ship Strikes based on IMMAs:

(1) Traffic information (e.g. Types of vessel, size, speed, flag, etc.): plotting major ship routes and see if they cross IMMAs which host significant or high density populations of species that are threatened and/or vulnerable to ship strikes.
(2) Species information (e.g. Relative abundance, status, Animal Behaviour/seasonality/key lifecycle use in and within IMMAs)
(3) Management and Mitigation

The workshop had recommended to further develop the process for the designation of a PSSA by IMO at a scale that includes the North West Mediterranean Sea, Slope and Canyon IMMA, plus potentially the Spanish corridor, to take into account whale population movement and distribution. Zoning within the area with ship strike mitigation tools such as speed reduction and routing measures could be proposed as part of Associated Protective Measures within the PSSA. Co-operation with IMO, other IGOs, national authorities, the shipping industry, port authorities and the whale watching industry is essential if effective mitigation is to occur.

5.2 ANTHROPOGENIC NOISE

In recent years there has been a rapid growth in anthropogenic ocean noise, generated from a range of sources including shipping, seismic exploration, military exercises, drilling and construction. Anthropogenic noise in the marine environment can be generally classified as either acute or chronic. Acute noise is high in intensity and 'short' in duration (often pulsed) and key sources include seismic surveys and military sonar. Chronic noise refers to long-term, lower intensity noise, for example from shipping and industrial activity and this has been increasing considerably. Both have been shown to be likely to have some adverse effects on fin whale behaviour and physiology (as well as other cetaceans and marine fauna) although quantifying these effects at the population level is complex.

Problems associated with noise have been recognised by several international bodies including ACCOBAMS, CMS, IUCN,IWC and the UN and have been the subject of a number of resolutions (maybe a table?) that are applicable to range states within the Mediterranean, including guidelines for rigorous environmental impact assessments (e.g. UNEP/CMS/Resolution 12.14).

- Add here MSFD D11

5.2.1 ACUTE NOISE

Major sources of acute noise include geophysical (seismic) surveys by the oil and gas industry and some academic institutions, the use of active sonar (especially by the military) and the use of pile drivers in coastal and offshore construction work. Based upon work undertaken in a number of fora and agreed inter alia by the IWC, IUCN has published a practical approach to effective planning strategies for managing environmental risk associated with geophysical and other imaging surveys (with a focus on cetaceans (Nowacek and Southall, 2016). It offers a structured, systematic evaluation and decision-making framework for industry, regulators and scientists. The process (the principles of which are applicable to other types of threat) is summarised in the figure below and includes examples from a variety of situations. It should be noted that many countries may have national approaches (pull together and list?)

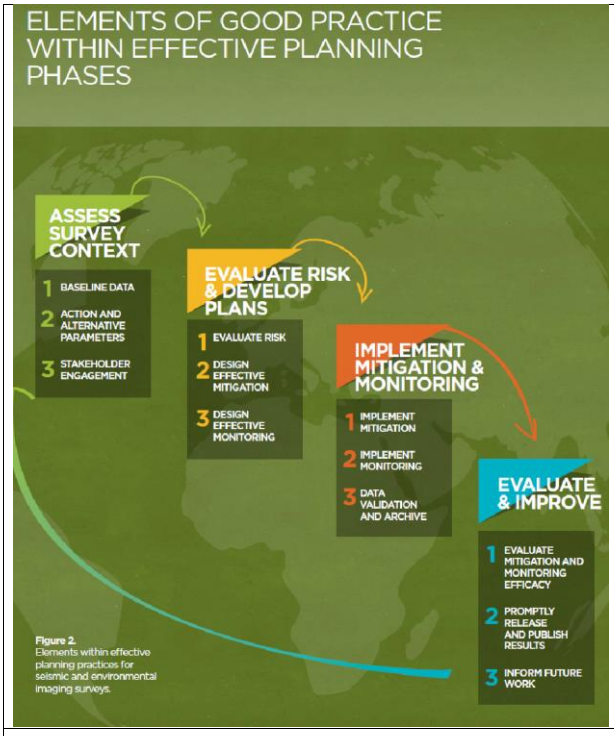


Figure 2.
Elements within effective planning practices for seismic and environmental imaging surveys.

5.2.2 CHRONIC NOISE

There are many sources of chronic noise in the environment and it is generally accepted (e.g. IWC, 2017) that there is compelling evidence that chronic anthropogenic noise is affecting the marine acoustic environment in many regions and that compromised acoustic habitat can affect some cetacean populations adversely.

Several IGOs (including ACCOBAMS, CMS, IWC) have agreed that absence of scientific certainty should not prevent their member nations from undertaking management efforts now to keep quiet areas quiet and make noisy areas quieter.
The general approach to addressing the issue of noise is applicable to all marine life not just fin whales and will benefit the ecosystem. Key measures include:

(1) ensuring that anthropogenic noise is properly quantified and effects on cetaceans considered for major activities in the Mediterranean, under a rigorous EIA system (see the CMS Guidelines), especially in areas/times where fin whales are present (the IMMA process will be helpful in this);

(2) continued improvements to sound mapping at appropriate spatial and temporal scales and the implementation of guidelines to reduce noise levels from shipping (e.g. IMO's 2014 Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life - MEPC.1/Circ.833);

(3) working with industry and IMO to encourage the development of effective mitigation to minimise acoustic energy released into the environment - commercial shipping noise is by far the most relevant source of chronic noise for fin whales

5.3 MICRO AND NANO PLASTIC INGESTION

Micro- and nano-plastics enter the marine environment either directly from improperly treated water waste management or result from the degradation of larger items breaking down into smaller particles.

Mitigation measures in relation to marine plastic pollution should focus on 1) preventing the leakage of new micro- and macro-plastic material into the environment and 2) instigating the removal of macro-plastics from the marine environment.

The Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 was established to reduce the impact of plastic on the environment (including marine ecosystems) by promoting the establishment of a circular economy. Considering that single-use plastics and fishing-related items represent the vast majority of marine litter, these products should be the main target of mitigation measures.

The transboundary spread of plastic litter in the marine environment will require the participation of all states bordering the Mediterranean Sea. The transition to a circular economy framework will involve the phasing out of single-use plastics, extended producer responsibilities, and recycling schemes.

Educational programmes and awareness campaigns should encourage the general public to reduce their plastic footprint (cross-reference to public awareness paragraph).

5.4 CONTAMINATION OF CETACEANS AND THEIR PREY

In practical terms, mitigation is clear if dependent on outside political will and public pressure: stop chucking this stuff into the ocean

Physical disturbance

To be added in light of IWC and ACCOBAMS guidelines, national EI assessments and coastal planning rules, and specific cases where these are known.

6 PUBLIC AWARENESS, EDUCATION AND CAPACITY BUILDING

The great difficulty of locating Mediterranean fin whales in the ACCOBAMS waters outside of their known summer feeding grounds in the Western Ligurian Sea both complicates the challenge of improving public awareness and understanding at the basin level but also provides an opportunity to engage 'citizen science' in improving our understanding. Thus, these difficulties reinforce the importance of trying to engage the public's interest and involvement in Mediterranean fin whale science and conservation.

Providing range state parties and the public with easy access to up-to-date, accurate information on Mediterranean fin whales is essential. Outreach should include the use of mass media such as internet, newspaper, radio and television; public lectures and symposiums; education programmes for teachers and students of all ages; and dissemination of information in written and spoken form to whale-watch boats and other tourism operations.

Coastal communities where fishing or tourism is significant to the economy should be targeted as a priority. In addition, awareness and education programmes should emphasise the need to reach audiences in the eastern range states where, in spite of considerable awareness of whales and marine life generally, there is relatively little knowledge of fin whales.

Capacity building differs from outreach in that the objective is to assure that individuals and organisations in responsible positions within each of the range states have the motivation, skills and resources needed to function effectively in implementing this plan. The transfer of necessary skills is but the initial step in this process, however. Ultimately, it is hoped that training efforts will translate into both legislative and regulatory actions and the commitment of necessary resources to support the conservation of Mediterranean fin whales throughout their range.

7 EXECUTIVE SUMMARY OF ACTIONS

Before moving to the specific actions, here we present some general considerations that require elucidation regarding the nature and usefulness of CMPs (and see Donovan, Cañadas and Hammond 2008).

7.1 DEALING WITH INADEQUATE DATA

While ideally, all CMPs and associated management actions are based on adequate scientific data, there are occasions when the potential conservation consequences of waiting for confirmatory scientific evidence mean that it is better to take action immediately whilst collecting the necessary information. This has become known as following the "precautionary principle" or taking a "precautionary approach." However, application of this principle must be carefully considered and well justified.

7.2 MONITORING

Establishing baseline information as a scientific reference for conservation actions is an important step towards effective conservation. Once this is achieved, monitoring (of the species or population, human activities, implementation and effectiveness of mitigation measures) **must** be an integral and essential part of management, not an optional extra.

7.3 LIFE OF THE CMP

Any CMP needs to be reviewed periodically so that the actions called for can be adjusted as appropriate in response to new information or changed circumstances. Once a Coordinator has been appointed and a steering committee is functioning, it is expected that a regular review and revision process will be implemented. It is suggested that this CMP would be reviewed every three years and that an in-depth review would be conducted every six years (to match the work-programme time frame of ACCOBAMS).

7.4 IMPLEMENTATION OF THE CMP; CO-ORDINATION, INVOLVEMENT OF STAKEHOLDERS

Experience has shown that in order to be effective, CMPs must have a recognized Coordinator who is either hired at least half-time under contract for the role or is situated professionally such that his or her investment of time and other resources (e.g. travel costs) is paid for as part of a salaried

position. This is particularly true where effective conservation requires action (including legislative or regulatory action) by multiple stakeholders including, for example, intergovernmental and national authorities, scientists from several disciplines, representatives from industry, local communities, and NGOs. We do not believe that it is sufficient for such a Plan to be run part-time. Ideally, the Coordinator should have a scientific and management background and be capable of communicating effectively with the various stakeholders. The importance of actively involving stakeholders, especially those whose livelihoods are likely to be affected by management measures, cannot be overemphasized. The Coordinator should report to a small Steering Committee appointed after consultation with appropriate authorities.

Amongst other things, the Coordinator and Steering Committee would be expected to:

- promote and coordinate implementation of the CMP (including investigating and pursuing funding opportunities and options), giving particular attention to stakeholders;
- make efforts to ensure that implementation of all high- and medium-priority actions has been initiated;
- determine and track the state of implementation of actions the results obtained, the objectives reached, and the difficulties encountered;
- communicate this information through regular reporting in an open, accessible format;
- appoint a group of experts to evaluate effectiveness and update the CMP every four years. The conclusions of this group should be made public in some way.

Finally, we stress that a CMP will not be effective without sufficient funding. At the very least, funds must be available to allow the Coordinator and the Steering Group to function.

7.5 TABLE OF ACTIONS

Coordination actions

Nr.	Action	Impor-tance	Feasibi-lity	Crossref.
CORD-01	Implementation of the CMP: Coordinator and Steering Committee	ESSENTIAL	HIGH	
CORD-02	Development of a Web-based exchange of scientific information – assess whether this is feasible, by contacting each potential partner. Standardized protocols and procedures.	MEDIUM-HIGH	HIGH	PACB-01

Capacity building and public awareness actions

Nr.	Action	Impor-tance	Feasibi-lity	Crossref.

PACB-01	Development of a strategy to increase public awareness and build capacity in range states with a focus on: (1) Occurrence, especially outside known range (outside known summer habitat); (2) Threats and mitigation	HIGH	HIGH	CORD-02

Research actions essential for providing adequate management advice

Nr.	Action	Impor-tance	Feasibi-lity	Crossref.
RES-01	Collation of available in situ data/samples on fin whales from a variety of techniques (except Photo ID in RES-05)	HIGH	HIGH	RES-02 RES-03 RES-04 PACB-01 CORD-02
RES-02	Creation and maintenance of a single photo-identification catalogue - in conjunction with a genetic-ID catalogue - to improve information on: population structure and movements, abundance and trends, population parameters, scarring and threats	HIGH	MEDIUM	RES-01
RES-03	Relationship between animals from the Mediterranean with those from adjacent Atlantic waters • Extent & seasonality of Med whales exiting • Extent & seasonality of NENA entering			
RES-04	Consider presence, abundance and distribution of fin whales in the Eastern Mediterranean, and their relationship to fin whales in the western Mediterranean	HIGH	MEDIUM-HIGH	RES-01 CORD-02 PACB-01
	Relationship between acoustic behavior and population identity (concurrent biopsing, acoustic tagging, and sonobuoy survey)			
RES-05	Assessing the seasonal distribution of fin whale exposure to threat	HIGH	MEDIUM-HIGH	RES-01 CORD-02
RES-06	Investigate the feasibility of using demographic parameters and population dynamics to quantify the impacts of anthropogenic pressure on the fin whale population			

Commenté [Mr. P.5]: Please note new order of actions.

Commenté [M6]: This needs to address 2 different topics. Med dispersal into N Atlantic, and NENA dispersal into Med.

Commenté [M7]: Equally important is the south, all the African northern shelf edge.

Commenté [M8]: I suggest a dedicated action to clarify the link between acoustic behavior and population origin. This will feed RES-03.

Monitoring actions

Nr.	Action	Impor-tance	Feasibi-lity	Crossref.
MON-01	Develop effective long-term monitoring programmes at basin scale to characterize seasonal distribution, movement patterns, and estimate abundance and trends through dedicated surveys	HIGH	HIGH	RES-04
MON-02	Ensure effective systematic long-term monitoring of distribution, abundance and trends in the main summer distribution area (Liguro-Corso-Provencal Basin/Gulf of Lions)	HIGH	HIGH	
	Dedicated efforts to identify wintering grounds basin-wide			
	Spanish Migration corridor monitoring and mitigation program			
MON-03	Monitor threats at the basin level			
	Integration to MSFD D1 and D11			
MON-04	Monitor existing adopted measures and guidelines			

Commenté [M9]: I suggest a specific monitoring action to identify wintering grounds.

Commenté [M10]: This is in line with the current Spanish efforts to declare a new MPA based on fin whale migration. There is a need to develop a monitoring program and a mitigation program for threats within the corridor (linked to MIT-02)

Commenté [M11]: There is a need to integrate this CMP monitoring actions to Med wide efforts on monitoring noise and biodiversity within the framework of the EU directive. This will touch several actions already listed here.

Commenté [M12]: Measures and guidelines of what? Needs more detail

Mitigation measure actions

Nr.	Action	Impor-tance	Feasibi-lity	Crossref.
MIT-01	Inventory and assess any proposed, existing or new technical mitigation measures for ship strikes and their implementation	HIGH	MEDIUM-HIGH	
MIT-02	Implementation of appropriate mitigation measures for ship strikes in ACCOBAMS area and specifically in high risk areas	HIGH	MEDIUM-HIGH	PACB-01 RES-03
	Adoption of a 'whale safe' certificate by shipping companies	HIGH	HIGH	PACB-01
MIT-03	Wider adoption and implementation of standardized codes of conduct (IWC/ACCOBAMS/CMS) to mitigate adverse impact of whale watching activities (including swim-with operations) and intrusive research	HIGH	HIGH	
	Analysis and implementation of noise exposure reduction from commercial shipping and ferry			

	in areas and periods of high exposure or critical functions (i.e., feeding, breeding)			

Commenté [M13]: Think Strait of Gibraltar, Ligurian Sea in summer, Sicily channel, Spanish migratory corridor, etc. we need to understand the effect of that exposure and how to mitigate it through modified shipping schemes, seasonally reduced speeds, etc.
This action should be in synch with MIT-01 and MIT-02 as there are synergisms. Potentially linked to MSFD monitoring programs for D11.

8 ACTIONS

The Actions are described below, with each action beginning on a new page. One of the first tasks for the Coordinator and Steering Committee will be to develop detailed specifications for each action and where appropriate, assign costings and likely sources of funding.

ACTION CORD-01: IMPLEMENTATION OF THE CMP: COORDINATOR AND STEERING COMMITTEE

Coordination Action Priority*:* **HIGH**

DESCRIPTION OF ACTION

- **Specific objectives:** to ensure timely progress is made on implementation of the CMP and the specific actions prescribed in it, and to provide progress reports to appropriate bodies including: ACCOBAMS, CMS, IWC, range states and regional stakeholders, thereby maximising the chances of survival and maintaining a favourable conservation status throughout the historical range of Mediterranean fin whales.
- **Rationale:** this CMP is complex and considerable coordination is essential for it to be effective. Implementation will depend on stakeholders in several countries and a broad range of expertise. A dedicated, well-supported coordinator and a similarly committed Steering Committee are essential.
- **Target:** appointment of a suitably qualified Coordinator and Steering Committee, with the required logistical and financial support.

  Ideally, the Coordinator will be based in (but operationally independent of) an office capable of providing some level of support. While logistical and other support from a host institution should be paid for at an appropriate rate, it would not be appropriate for overheads to be charged on all actions funded.

  It will be necessary for a broader stakeholder steering committee to be established as soon as possible, with specific terms of reference and *modus operandi*. One of the first tasks of the Steering Committee will be to assess the need for national Sub-coordinators in each of the range states.
- **Timeline:**

	WHAT	WHO	WHEN
(0)	Selection AND Constitution of the Interim Steering Committee (ISC)	The experts from the CMP workshop	First quarter 2020
(1)	Identification of host institution and agreement on hosting conditions	Interim Steering Committee (ISC)	First quarter 2020
(2)	Development of detailed job description and conditions of work based on the tasks outlined below	ISC	First quarter 2020
(3)	Identification of initial funds	ISC	Last quarter 2019 – first quarter 2020
(4)	Recruitment of co-ordinator	ISC	First quarter 2020
(5)	Co-ordinator begins work (initial 3-year contract)	Co-ordinator	Second quarter 2020
(6)	Development of proposed terms of reference and *modus operandi* for stakeholder Steering Committee	ACCOBAMS, IWC, ISC, funders	Second quarter 2020
(7)	ppointment of Steering Committee	ACCOBAMS, IWC, ISC, funders	Second or third quarter 2020

Commenté [M14]: I respectfully disagree here. There might be experts that cannot attend the CMP workshop. WHO should be the experts on Mediterranean fin whales based on peer-reviewed literature, and non-Med fin whale experts in case of having gaps in Med expertise. This MUST be a transparent process where both ACCOBAMS and IWC focal points should provide their list of experts.

- **Tasks of Coordinator in conjunction with Steering Committee:**
  - To assess the need for national Sub-coordinators in each range state.
  - To promote and explain the CMP and progress with its implementation to relevant stakeholders, including:
    - International and regional bodies.
    - Range state officials.
    - Industry representatives including, shipping, hydrocarbon exploration and development, etc.
    - Local authorities and communities in selected areas.
    - NGOs.
  - To raise funds for and manage the Mediterranean fin whales CMP Fund including, where necessary, assigning contracts to ensure that the Actions of the CMP are undertaken and completed.
  - To liaise with relevant authorities to facilitate any permitting required to undertake Actions of the CMP.

- To facilitate (and if necessary adapt or modify existing) data-sharing agreements to ensure that data are made available in timely fashion to maximise their value for conservation.
- To support the development of a database or databases and coordinate the collation, in an appropriate electronic format, of relevant data and information on human activities, the environment and whales, as far as possible in a GIS context.
- To maintain and update the existing list of international and national regulations and guidelines relevant to the conservation of Mediterranean fin whales (see Annex 1).
- To produce concise annual progress reports on the implementation of the CMP.
- To arrange for periodic expert review of the CMP and the development of new or modified actions as appropriate
- To develop a Mediterranean fin whale CMP website linked to ACCOBAMS domain as a resource for researchers, stakeholders and the general public.

INITIAL BUDGET ITEMS TO BE CONSIDERED BY ISC

- Recruitment process (*e.g.* advertising, travel and subsistence for ISC and shortlisted candidates).
- Host institution annual costs (needs to be negotiated by ISC).
- Salary of Coordinator (level, tax and benefits issues).
- Initial working budget for Coordinator (travel and subsistence including visits to range states and meetings with stakeholders).

ACTORS

- **Responsible for coordination of the action:** the ISC to identify the host institution, obtain initial funding and appoint the Coordinator; ACCOBAMS and IWC to appoint the broader stakeholder Steering Committee for the CMP.
- **Stakeholders**: as listed above under 'Tasks'.

ACTION EVALUATION

- ACCOBAMS, IWC.
- Regular (*e.g.* biennial or triennial) meetings open to stakeholders.

PRIORITY

- **Importance**: Essential
- **Feasibility**: high if political will is there

● ACTION CORD-02: DEVELOPMENT OF A WEB-BASED EXCHANGE OF SCIENTIFIC INFORMATION

Co-ordination Action Priority: **HIGH**

○ DESCRIPTION OF ACTION

- **Specific objective**: develop a web-based platform by which scientific information (*e.g.* photo-ID catalogues, tissue sample database, sighting record registry) can be maintained in a centralized location and freely exchanged among interested parties (also see CORD-01).
- **Specific threats to be mitigated**: while not a mitigation action *per se*, this action will provide a valuable framework for the exchange of information necessary to develop and/or monitor the effectiveness of mitigation measures.
- **Rationale**: integration of information on Mediterranean fin whales from all areas where they are observed is of substantial value in understanding patterns of habitat use and the links between geographic areas as well as in determining migration routes and wintering area location(s). Having a centralized data repository where all interested parties (including the public) would be able to share and exchange information on Mediterranean fin whales in accordance with an agreed data availability protocol (see CORD-01) would benefit conservation measures at a broader (*i.e.* rangewide) geo-spatial scale.
- **Target:** creation of a centralized data exchange forum allowing for information sharing and integration amongst interested parties should be developed as soon as possible, realistically beginning January 2020 upon engagement of the CMP coordinator.
- **Method**: The first step is the CMP coordinator will organize a workshop to define the IT aspects of the platform. The second step is the identify the IT in charge of the action. Then, the CMP coordinator will support the design and implementation of a web-based forum (see CORD-01). The platform will host, link and exchange of information relevant to Mediterranean fin whale conservation that would incorporate: 1) photo-identification data/catalogue, 2) information on genetic samples and analyses, 3) sighting records, 4) stranding and necropsy data, 5) current and future human activities, and 6) environmental information. Where appropriate, data will be available in standard GIS format. Data safeguards and sharing agreements will be developed and taken into account.
- **Implementation-timeline**: begin design of web-based site immediately with establishment of a live URL launched as soon as possible.

○ ACTORS

- **Responsible for coordination of action:** CMP coordinator.
- **Stakeholders**: Range State Governments, EC, ACCOBAMS, Pelagos Agreement, IWC, industry, local authorities, NGOs, research organisations.

○ ACTION EVALUATION

- IWC
- ACCOBAMS

○ PRIORITY

- **Importance:** high
- **Feasibility:** high

ACTION PACB-01: DEVELOP A STRATEGY TO INCREASE PUBLIC AWARENESS AND BUILD CAPACITY IN RANGE STATES

Public Awareness and Capacity Building Action Priority: **HIGH**

Commenté [15]: we might want to divide this action into (1) capacity building, (2) public awareness/citizen science

DESCRIPTION OF ACTION

- **Specific objective**: to develop a strategy specific to each range State for the timely production of a series of resources to inform citizens of range states of the status of Mediterranean fin whales and what they should do if they see animals either at sea or stranded.
- **Rationale:** it is extremely difficult to obtain information on Mediterranean fin whales away from the known concentrations on the feeding grounds, given the small total number of animals and the lack of information on migration routes and on the location of breeding grounds (see Action RES-01). The value of opportunistic observations should be maximised using the variety of communication techniques available, including the internet, newspapers, radio and television. The information obtained will be of direct value to conservation efforts in a number of ways.
- **Target:** to develop a strategy and Actions to produce a variety of targeted, accurate, public awareness resources that will inform people on the status of Mediterranean fin whales and on how citizens can assist in conservation efforts including what they should do if they encounter living or dead Mediterranean fin whales. 'Targeted' refers to a variety of categories of persons (there will be overlap), to be determined but certainly including, for each range state: mariners (and their trade associations where applicable), fishermen (and their trade associations where applicable), whale watching operators, NGOs, research institutes, schools. Such efforts will need oversight by the coordinator and Steering Committee such that local differences are accounted for but ensuring overall consistency and accuracy. The CMP website and Web-based forum/platform will play an important role (see Actions CORD-01 and CORD-02).
- **Timeline:**

	WHAT	WHO	WHEN
(1)	Preparation for a small expert workshop to develop a strategy for the public awareness effort (including expert in communication)	Interim Steering Committee (ISC) – see Action CORD-01	December 2020
(2)	Hold workshop	Identified participants (see methods below)	March 2021
(3)	Implement strategy and actions agreed by workshop following a timeline established by the workshop (probably a staged process)	Workshop, coordinator of CMP	To be determined
(4)	Establish indicators to assess the efficiency of the strategic plan and fix objectives		
(5)	Assess strategic plan according to indicators and review		

- **Methods:** the ISC begin preparations for a small expert workshop to determine the strategy for public awareness materials, including:
  - Identification of target groups, by range state where appropriate.
  - Identification of existing/development of new text, audio and visual material to provide general background to the situation of Mediterranean fin whales; consideration should be given to how this material may need to be varied for any of the target groups.
  - Identification of existing/development of new text, audio and visual material to provide information on what to do and how to report if one encounters a living or dead animal; consideration should be given to how this material may need to be varied for any of the target groups, taking into account Actions MIT-01 and MIT-02.
  - Identify/ensure that mechanisms are in place to receive, review and incorporate information (data, photos, tissues etc.) for maximum conservation benefit, taking into account Actions CORD-01 and CORD-02. The development and use of a smartphone application as a data collection tool for citizen science and whale watching operators could be an efficient way to proceed. (See example here for alien species: https://digitalearthlab.jrc.ec.europa.eu/app/invasive-alien-species-europe)

- Determine a mechanism to ensure that the general objective/target is met in as timely a fashion as possible, including specific actions, a budget and a timeline.
- Disseminate according to the strategic plan

- Attendees should include:
  - Coordinator of the CMP and representatives of the stakeholder Steering Committee.
  - Scientists familiar with the Mediterranean fin whale situation.
  - Scientists familiar with incorporating data from the general public – *e.g.* IWC ship strikes project (http://www.iwcoffice.org/sci_com/shipstrikes.htm).
  - Public awareness experts from each country.

INITIAL BUDGET ITEMS TO BE CONSIDERED BY ISC

Costs associated with preparatory materials and holding of a workshop in December 2020.

ACTORS

- **Responsible for co-ordination of the action:** the ISC to prepare for the holding of the workshop, subsequently the coordinator and broader stakeholder Steering Committee for the CMP.
- **Responsible for carrying out the action:** to be determined at workshop.
- **Stakeholders**: all

ACTION EVALUATION

- ACCOBAMS, IWC.
- Feedback system built in to materials.

PRIORITY

- **Importance**: high
- **Feasibility**: high

• ACTION RES-01: COLLATION OF AVAILABLE IN SITU DATA/SAMPLES ON FIN WHALES FROM A VARIETY OF TECHNIQUES

Research Action Priority: **HIGH**

○ DESCRIPTION OF ACTION

Specific objective: The collation of available data (as outlined in CORD-02) from various techniques (genetic, photographic, surveys etc..) to facilitate the implementation of RES-01, RES-02, RES04, RESXX, MIT-XX (to be completed) and conduct interdisciplinary studies.

- **Rationale**: Along with the data inventory generated by CORD-02, data types from different sources will require standardisation (in terms of language, format, methods, etc) before datasets can be merged and analysed. Such a collation of datasets will facilitate the implementation of other research and mitigation actions outlined in the fin whale CMP and allow for interdisciplinary studies to be conducted to improve the scientific basis for mitigation actions. Through the increased sampling effort in the eastern Mediterranean Sea (RES-02) and the Strait of Gibraltar (RES-01), the newly available data can be integrated to conduct population structuring analyses throughout the range of the Mediterranean Sea fin whales. The photo-identification component of this work is described in RES-05.

- **Target:** At the first stage the Coordinator of the fin whale CMP should coordinate the collation of available data (cf CORD-02). Standardised protocols for each data type should be agreed on (e.g. using pre-existing IWC/ACCOBAMS recommendations), where possible. The Coordinator will appoint curators in charge of collating the databases from different techniques.

- **Method**:

The Coordinator of the fin whale CMP will work with all known data holders (past and present) to develop an agreed MoU dealing in particular with ownership of the data, data access (and subsequent analyses), publication arrangements. Once this has been agreed for each data type then steering groups (including a curator) will be formed by data type.

(1) *genetic data*: the steering group to standardise methods/markers before merging datasets. A database curator will be assigned to collate the data.

(2) *acoustic data*: the steering group will propose a standardised protocol/definition for the detection of fin whale calls and the curator will collate the data.

4) *telemetry data:* the steering group will propose a standardised approach to classifying location data and the curator will compile available satellite telemetry information (movements and diving behaviour).

(5) *sighting surveys*: the assigned curator will aggregate data from visual shipboard and aerial line transect surveys that followed distance sampling methodology (e.g. ASI) and from land-based sighting records.

(6) *strandings*: integrate stranding data from MEDACES and review the results on a regular basis.

(7) *stable isotope:* the steering group will assess whether stable isotope data generated from different laboratories are comparable before they are collated by the curator.

(8) *phot0-idnetification data:* the steering group will develop this in line with RES-02

The steering groups will determine priority analyses (both by data type and integrated) to assist the determination of appropriate units to conserve and to assist with monitoring and mitigation actions.

Implementation-timeline:

○ ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

○ ACTION EVALUATION

- IWC
- ACCOBAMS

Commenté [M16]: Why is RES-03 left out here?

- PRIORITY

- **Importance:** high
- **Feasibility:** high

- **ACTION RES-02: CREATION AND MAINTENANCE OF A SINGLE PHOTO-IDENTIFICATION CATALOGUE – IDEALLY IN CONJUNCTION WITH A GENETIC-ID CATALOGUE TO IMPROVE INFORMATION ON: POPULATION STRUCTURE AND MOVEMENTS, ABUNDANCE AND TRENDS, POPULATION PARAMETERS, SCARRING AND THREATS**

Research Action Priority*:* **HIGH**

- DESCRIPTION OF ACTION

- **Specific objectives:** to merge all existing photo-identification (and possibly genetic-id as well) catalogues in the entire fin whale range owned by different research organizations; establish an agreed common standardization of data collection for future research effort. This is a fundamental data source to inform other conservation and management actions.
- **Rationale:** individual identification (and the following of known individuals over time) is a powerful tool to inform evaluation of *inter alia* status, monitoring, temporal and spatial movements, population structure, population parameters and health (including evidence of ship strikes). A single unified photo-identification catalogue (there are several smaller scale catalogues) provides the best way to enable robust analyses of questions directly relevant to developing and/or evaluating mitigation measures. The value of such a catalogue will be enhanced greatly if it is linked to or contains information on individual identification (and sex) using genetic techniques (again several such catalogues exist).
- **Target:** development of a single photo-identification catalogue to inform conservation related research within the Mediterranean.
- **Methods:** the Coordinator of the fin whale CMP should work with all known data holders (past and present) to develop an agreed MoU for the creation of a joint catalogue (the IWC data sharing and photo-catalogue guidelines will assist in this), dealing in particular with ownership of the data, data access (and subsequent analyses), publication arrangements. The initial focus will be on photo-identification data followed by genetic data

  Assuming an agreed MoU is developed and there is a commitment from the major contributors then they shall:

  - agree an appropriate software and cataloguing system including data fields;
  - identify a host institution, co-ordinator and steering group to develop a budget and oversee the unification process including developing matching protocols and a validation approach for incorporating existing and new data (and a timeframe for catalogue review every few years;
  - develop a cost proposal for analyses to assist objectives of the CMP, including dissemination and publication.

  Consideration as to the most efficient way to undertake this – initially by correspondence followed by an expert workshop?

- **Timeline:**

	WHAT	WHO	WHEN
(1)	Identification of initial funds		
(2)	Development of MoU between organizations		
(3)	Identification of host institution and agreement on hosting conditions		
(4)	Recruitment of group of work and its coordinator		
(5)	Collection of available data		
(6)	Consensus on cataloguing system		
(7)	Analysis of data		
(8)	Dissemination and publication		

- **Tasks of Coordinator in conjunction with Steering Committee:**
  - To raise funds for the Mediterranean fin whales joint catalogue.

Commenté [M17]: This needs a strong justification. Why is photo-ID a single individual Action instead of being part of RES-01??? It seems that more synergisms would be built if a standardized photo-id cataloguing would be part of RES-01.

- To facilitate (and if necessary adapt or modify existing) data-sharing agreements to ensure that data are made available in a timely fashion to maximise their value for conservation.
- To develop a database or databases and coordinate the collation, in an appropriate electronic format, of relevant data
- To produce concise annual progress reports on the implementation of the task
- To arrange for periodic expert review of the catalogue and the development of new or modified actions as appropriate

INITIAL BUDGET ITEMS TO BE CONSIDERED BY ISC

- Catalogue host institution annual costs (needs to be negotiated by ISC).
- Salary of Group coordinator and ? (level, tax and benefits issues).

ACTORS

- **Responsible for coordination of the action:** Co-ordinator of Conservation Plan
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs

ACTION EVALUATION

- ACCOBAMS, IWC
- Regular (*e.g.* biennial or triennial) meetings open to stakeholders.

PRIORITY

- **Importance**: high
- **Feasibility**: medium-high

- **ACTION RES-03: RELATIONSHIP BETWEEN ANIMALS FROM THE MEDITERRANEAN WITH THOSE FROM ADJACENT ATLANTIC WATERS**

Research Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**:

Clarify the extent of the connectivity of Mediterranean whales with the Atlantic Ocean through the Strait of Gibraltar and Atlantic whales with the Mediterranean Sea.

- **Rationale**:

The most recent genetic stable isotope and telemetry evidence points to the ACCOBAMS region containing a single 'Mediterranean' population of fin whales (*Balaenoptera physalus*) and this is the working hypothesisi for this iteration of the CMP. Some animals move out of the Mediterranean through the Straits of Gibraltar into the adjacent North Atlantic in summer and move back in the winter (Gauffier et al., 2018; and see Fig.1). However, acoustic song information (Castellote *et al.,* 2012) suggests that these animals have different song characteristics to those that spend all year within the Mediterranean and also that Atlantic animals may enter the western Mediterranean. The implications of the acoustic information from the perspective of appropriate units-to-conserve requires further investigation. Information from the eastern Mediterranean is sparse. Due to the possible conservation implications of more than one population in the Mediterranean, population structure must be clarified before the next iteration of the CMP in six year's time. This is also relevant to the 'Atlantic Adjacent Waters' to be included in the ACCOBAMS region.

- **Target:**

To provide new information (with a focus on the western Mediterranean Sea, Strait of Gibraltar and poorly studied adjacent Atlantic area, see map XX) from a variety of techniques to contribute towards the determination of appropriate unit(s) to conserve (and their temporal and spatial distribution) within the ACCOBAMS region (and see RES-02)

Method:

- Design and implement visual line transect surveys (aerial and/or boat surveys) of the poorly studied Atlantic areas adjacent to the western Mediterranean (initially covering the waters within Spanish-Portugal-Morocco EEZ) in summer and winter to provide information about seasonal presence and fin whale density;
- Use these data to extend potential feeding habitat models to these poorly studied areas;
- Collect photo-ID and biopsy samples from animals encountered (either as part of a line transect boat survey or a targeted individual ID cruise) in adjacent Atlantic waters and increase the number of samples from the Strait of Gibraltar, especially during the winter.
- Assess the feasibility (and if yes undertake) of collecting photo-ID and biopsy samples from vocalising individuals using directional sonobuoys and acoustic tags to match acoustic recordings with genetics and stable isotopes analysis.
- Deploy passive acoustic moorings in the Strait of Gibraltar, Gulf of Cádiz, Moroccan-Spanish-Portugal EEZ (up to Galicia) to assess distribution, year-long or seasonal presence, and possible inter-annual or seasonal variability in song patterns.
- Assess the need to deploy additional satellite tags in the western Mediterranean and adjacent Atlantic waters and if deemed necessary and feasible design and implement a targeted programme.

- **Implementation-timeline**: This will be an iterative process

ACTORS

- **Responsible for coordination of action:**
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

Commenté [18]: Add a sentence in each research action stating it should follow IWC/ACCOBAMS/EU etc guidelines to justify intrusive research

Commenté [M19]: VERY IMPORTANT: do not forget the other half of the story!!!!

Commenté [M20]: This needs revision, geographical scope needs to be re-defined.

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** medium

- **ACTION RES-04: CONSIDER PRESENCE, ABUNDANCE AND DISTRIBUTION OF FIN WHALES IN THE EASTERN MEDITERRANEAN, AND THEIR RELATIONSHIP TO FIN WHALES IN THE WESTERN MEDITERRANEAN.**

Research Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: To better understand the use of the Eastern Mediterranean by fin whales (i.e., east of the Italian Peninsula): movements across the eastern basin, presence and whereabouts of feeding and breeding grounds, seasonality of occurrence to enable focussed mitigation efforts to be developed on identified threats.
- **Rationale**: Ecological knowledge of fin whales in the Eastern Mediterranean is fragmented and mostly limited to summer occurrence. Thus the available information is insufficient to understand the spatial and temporal extent to which fin whales use the Eastern Mediterranean. This is of conservation importance since it is possible that locations in the Eastern Mediterranean hold significant numbers of fin whales during the colder months, and could be a destination of at least part of the whales that assemble in the NW Mediterranean in summer during the remainder of the year.
- **Targets:** Improving knowledge of fin whales in the eastern Mediterranean using a variety of techniques (telemetry, eDNA, acoustic recorders, satellite imagery) to enable a better assessment of threats in the region and the need for targeted mitigation.
- **Methods**:
- Satellite tag whales found off the east coast of Sicily in Spring or Autumn to ascertain where those whales travel to in subsequent months and see whether there is a difference in destination between the two seasons.
- Initially based upon the modelled presence of fin whale feeding habitat based upon summer data:
    - Sample eDNA to detect whale presence during two replicate cruises (summer and winter) in specific locations of the Eastern Mediterranean
    - Deploy acoustic recorders (year-round) in specific locations of the Eastern Mediterranean to provide information on distribution, identity, and seasonality of fin whales. And examine data collection from already existing listening stations (i.e. neutrino telescopes).
    - Examine appropriate high-resolution satellite imagery to detect presence of fin whales in specific locations of the Eastern Mediterranean.
- **Implementation-timeline**:

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

ACTION RES-05: ASSESSING THE SEASONAL DISTRIBUTION OF FIN WHALE EXPOSURE TO THREATS

Research Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: to map the seasonal exposure to a suite of threats, including ship strike, anthropogenic noise, micro- and nano-plastics ingestion, chemical contaminant exposure, physical disturbance and climate change with a final goal of assessing the potential risk caused by cumulative effects in the entire Mediterranean Sea.
- **Specific threats to be mitigated**: all potential threats are considered, including direct and indirect. Several basic data to assess these threats are relatively well defined in space and time (AIS data for ship strike, noise and physical disturbance, environmental data for climate change) while others are relatively data-poor (plastics and contaminants).
- **Rationale**: Knowledge on the impact and distribution of threats to fin whale is key information for efficient mitigation. The development of spatial and temporal layers of threats on one hand and on fin whale distribution for feeding and reproduction on the other hand will allow identifying the exposure to single and multiple threats. When new data become available, this framework shall allow improvement of the exposure assessment.
- **Target:** creation of a Geographic Information System (GIS) platform hosting the habitat and threat layers to facilitate the exposure analysis and cumulative impacts.
- **Method**: Use of data collated by RES-01-02 and of model outputs to develop spatial and temporal layers of fin whale habitats (feeding and reproduction) and of threats - PAM related actions can provide noise metrics.

  Effective (observation per unit effort, IMMAs) and potential habitats are to be developed and confronted in order to assess accuracy and ensure coherent estimates at large scale. The habitats of feeding, mating and nursing should ideally be analysed. Various modelling methods for identifying potential habitats should be foreseen if possible (deterministic, statistical, artificial intelligence). Trends in potential habitat will inform on the current impact of climate change.

  Both acute and chronic noises likely have variable levels of adverse effects on fin whale behaviour, distribution and physiology ranging from disturbance to lethal effect. Major sources of acute noise include geophysical (seismic) surveys by the oil and gas industry and some academic institutions, active sonar (especially by the navy) and pile drivers in coastal construction work. Chronic noise is mostly originating from maritime traffic. Identifying the various sources of anthropogenic noise and its components from short to long time scales are required.

  Precise information on maritime traffic, such as data from vessel positioning systems, is essential to identify the distribution of the risk of ship strike. Similarly, the quantification of the risk of physical disturbance requires detailed information on whale watching activity.

  Point sources and diffusion/concentration processes of pollutants (plastics, contaminants) shall provide information on the exposure. Modelling of processes (e.g. plastic fragmentation) shall be used where necessary.
- **Implementation-timeline**:

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high

- **Feasibility:** high

• ACTION RES-06: INVESTIGATE THE FEASIBILITY OF USING DEMOGRAPHIC PARAMETERS AND POPULATION DYNAMICS MODELS TO PROVIDE ROBUST PREDICTIVE CONCLUSIONS AND CONSERVATION FOR MEDITERRANEAN FIN WHALES

Research Action Priority*:* **TBD**

○ DESCRIPTION OF ACTION

- **Specific objectives:** Investigate the feasibility of estimating key population parameters (e.g. pregnancy rate, calving rate, age at sexual maturity, survival rate) with sufficient precision and accuracy to be able to (a) detect changes in these should they occur and (b) use in population dynamics modelling in a robust predictive manner to inform conservation actions.

- **Rationale:** Use of population dynamics models to provide robust predictive modelling of the effects of direct removals has been undertaken by the IWC Scientific Committee for a number of years. For fin whales this has been undertaken for the aboriginal subsistence hunt off West Greenland (ref) and the commercial hunt off Iceland using a general age-and sex-structured model. For populations such as western gray whales off Sakhalin Island for which there is a large body of photo-identification data, the modelling approach used is a modified IBM (individually based model) that directly integrates resightings data by sex and age-class. Such models provide an integrated way to examine the effects of human activities on populations (it is easier to model the effects of direct removals such as ship strikes than it is to model the effects of indirect effects -the latter can be approximated by making assumptions about changes in carrying capacity or reproductive/survival rates). The value of the modelling exercises depends on the robustness of the predictions/inferences to the inevitable uncertainties in the input parameters as well as the assumptions within the models themselves. Such modelling may be valuable in the case of the Mediterranean fin whale and this proposal is to examine, given the available information whether (a) one or more modelling approaches are suitably robust to provide management advice and (b) whether they can be used to focus research or monitoring efforts (e.g. by identifying which parameters are most important in influencing conclusions) and at what level of precision they need to be determined to allow models to provide robust conclusions. The Mediterranean datasets of interest include photo-identification data and genetic data from biopsy samples. The latter for example have produced estimates of pregnancy rate and numbers of calves produced over a lifetime within part of the western Mediterranean (Siliart et al. 2012).

- **Target:** to determine the feasibility of population dynamics modelling (given the levels of precision/accuracy in estimating reproductive and survival rates for Mediterranean fin whales) to provide robust predictive conclusions relevant to conservation and mitigation, including consideration of whether improved future research effort to refine key parameters may allow robust conclusion to be developed in the future if the present data are inadequate.

- **Methods:**
  - Estimate the precision and accuracy of key reproductive and survival parameters using existing datasets (primarily photo-identification and genetic data) from the Mediterranean and undertake power analyses to investigate the ability to detect changes in these should they occur.
  - Using these data, investigate the use of general age- and sex-structured population dynamics models (where parameters are direct inputs) and individually-based or modified individually-based models (where parameters are estimated within the model itself and provided as output) to determine the robustness of model predictions for the provision of conservation advice (e.g. on status and trends) or advice on research or mitigation focus, taking into account both direct and indirect impacts of human activities.
  - Compare results for the Mediterranean with those for fin whales in other areas.

- **Timeline:**

	WHAT	WHO	WHEN
(1)			
(2)			
(3)			
(4)			

(5)			
(6)			
(7)			
(8)			

- **Tasks of Coordinator in conjunction with Steering Committee:**

○ INITIAL BUDGET ITEMS TO BE CONSIDERED BY ISC

○ ACTORS

- **Responsible for coordination of the action:**
- **Stakeholders**:

○ ACTION EVALUATION

- ACCOBAMS, IWC
- Regular (*e.g.* biennial or triennial) meetings open to stakeholders.

○ PRIORITY

- **Importance**: TBD
- **Feasibility**: Medium

ACTION MON-01: DEVELOP EFFECTIVE LONG-TERM MONITORING PROGRAMMES AT BASIN SCALE TO ESTIMATE ABUNDANCE AND TRENDS THROUGH DEDICATED SURVEYS

Monitoring actions Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: obtain robust and unbiased population estimates and distributional information of Mediterranean fin whales at regular intervals (suggested 6 years).
- **Rationale**: promote suitable monitoring programme for the Mediterranean region to enable trends and potential distributional changes to be identified, in order to suggest timely mitigation actions. The systematic monitoring of the abundance and distribution of wild species constitutes a crucial element of any conservation strategy, but it is often neglected in many regions, including much of the Mediterranean. Importantly, it represents a priority for ACCOBAMS. Robust baseline information on parameters such as abundance and density is necessary to inform conservation actions and to implement and evaluate the efficacy of any measures currently in place.

  The European Habitat Directive, the Marine Strategy Framework Directive, and the Ecosystem Approach not only require the monitoring of the Good Environmental Status (GES) of species and habitats of community interest, but also require reporting on this status every 6 years. This is essential to guarantee regulations enforcement in the ACCOBAMS Member States, as well as to gain continuous information on species trends.
- **Target:** determine whether ACCOBAMS is meeting its conservation objectives with regards to Mediterranean fin whales; properly assess whether in place mitigation measures from actual threats are effective (ref. RES-04). Efforts should be made to survey those regions that did not previously receive either aerial or vessel survey effort (ref ASI, 2018).
- **Method**: A synoptic survey, applying line transect distance sampling methodologies, to be carried out in a short period of time across the whole Mediterranean Sea, combining visual survey methods (boat- and ship-based surveys) and passive acoustic monitoring (PAM). The main aim in both aerial and vessel-based surveys is to assess density and abundance and assess potential trends over time. Standardized and agreed protocols should be used for the monitoring actions, following the ACCOBAMS Survey Initiative (ASI, 2018) experience. Abundance estimates will be corrected for availability bias.
- Use existing ongoing programs, such as those on ferry routes, to integrate abundance estimates and trend estimates.
- Consider the possibility to perform photoID and biopsy and eDNA sampling during large scale surveys to: (1) sample poor-data areas, (2) monitor changes in hormones levels, stable isotopes, contaminants in areas of interest as identified by previous surveys
- Power analysis will be used to design the specific monitoring framework to detect a trend of a given magnitude and to detect specific rates of population change.

- **Implementation-timeline**:

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

Commenté [M21]: MSFD D1 and D11 must be integrated here.

• ACTION MON-02: ENSURE EFFECTIVE SYSTEMATIC LONG-TERM MONITORING OF DISTRIBUTION, ABUNDANCE AND TRENDS IN THE MAIN DISTRIBUTION AREA (LIGURO-CORSO-PROVENCAL BASIN/GULF OF LIONS)

Monitoring actions Priority: **HIGH**

Description of action

- **Specific objective**: Ensure that annual and seasonal monitoring of distribution, abundance and trends is regularly conducted in the Corso-Ligurian-Provencal Basin, Gulf of Lions and North Tyrrhenian through mark recapture methods (photo-identification and genetic biopsy sampling and analysis).
- **Rationale**: Continued monitoring of the Mediterranean fin whale population and regular updates of a population assessment are essential for meeting conservation objectives. Photo-identification is a widely used technique in cetacean research that can provide estimates of abundance and population parameters e.g. survival and calving rate. This method can be used for population level monitoring of species with appropriate markings, if data can be collected across the distribution of the population. A long time series of photo-identified fin whales will be available (ref. RES-05), creating the possibility of detecting changes in abundance over time (ref MIT-02). Similarly, biopsy sampling can be used to describe population parameters and to estimate abundance through mark-recapture analysis. This action would also further improve our understanding of interannual distributional fluctuations, particularly if observed distribution changes can be compared with modelled feeding habitat changes.
- **Target:** Collection of photographic and genetic data on an annual/seasonal basis.
- **Method**: Monitoring at the regional level may require data collection throughout the year, to better understand seasonal patterns in distribution, whereas monitoring at the population level would mainly address inter-annual changes. A power analysis will be needed to determine the scale of photo-identification effort, in terms of both days in the field and time interval between surveys, needed to detect any change in abundance or trends for this population. Mark-recapture models must be applied to photo-identification and genetic data to estimate abundance for specific areas that populations or part of populations occupy during one or more seasons of the year. Collate information coming from different research groups in these areas. Evaluate the feasibility of monitoring demography of Mediterranean fin whale by means of photo-identification studies, to detect potential changes. An additional aspect that should be assessed is the possibility of monitoring body condition of individual whales in the feeding areas.

  If new areas are identified by previous actions (RES-01 and RES-02), these should also be monitored within this action.
- **Implementation-timeline:**

Commenté [M22]: PAM should be considered here. Best tool for long-term continued monitoring. PAM data should be explored for estimation of abundance, some efforts already done in this direction.

Actors

- **Responsible for coordination of action:.**
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

Action evaluation

- IWC
- ACCOBAMS

Priority

- **Importance:** high
- **Feasibility:** high

ACTION MON-03: MONITOR THREATS AT THE BASIN LEVEL

Monitoring Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: to periodically assess the status and trends of threats, including ship strike, anthropogenic noise, micro- and nano-plastics ingestion, chemical contaminant exposure, physical disturbance and climate change and their cumulative effects in the entire Mediterranean Sea, and the emergence of new possible threats, following actions RES-04 and MIT-01.
- **Specific threats to be mitigated**: all potential threats are considered, including direct and indirect, and potential new emerging threats.
- **Rationale**: Status and trends of threats to fin whale is key information to assess the efficiency of existing mitigation measures (MIT-02 and MIT-03, and future mitigations actions) and the needs for adaptation of the mitigation strategy. Trend maps will inform on the evolution of known threats in previously identified risk areas compared to the last assessment, the identification of new risk areas and the emergence of new threats.
- **Target:** use of the Geographic Information System (GIS) platform from RES-04 hosting the habitat and threat layers to evaluate every 3 years the exposure levels and cumulative impacts.
- **Method**: Status and trend maps of single and multiple exposure (e.g. Micheli et al. 2013) are performed using the layers of RES-04 on threats and habitat. When new data are collated or new methods are used to create any layer, the re-evaluation of trend is performed over the entire time-series.

  Trend maps will be computed in absolute change of risk over three periods:

  - in the last 6 years to assess progress from the last assessment,
  - since a given mitigation measure was implemented, to assess progress,
  - since a fixed reference year to be determined based on historic information about threat, to facilitate the identification of target levels.

  Any presentation of a trend map will be associated to a mean status map to evaluate the rate of change over the given period.
- **Implementation-timeline**:

This action highly depends on the completion of RES04.

Commenté [M23]: Integrate with MSFD D1

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

ACTION MON-04: MONITOR EXISTING ADOPTED MEASURES AND GUIDELINES

Monitoring Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: to assess the implementation by Countries of all relevant Resolutions / Guidelines adopted in the framework of relevant bodies including ACCOBAMS, CMS, Barcelona Convention, IWC, Pelagos Agreement,
- **Specific threats to be mitigated**: all Resolutions / Guidelines directed to address: ship strike, noise, physical disturbance, micro and nano plastics and contaminants (climate change?)
- **Rationale**: existing adopted measures and Guidelines need to be monitored to ensure compliance and ultimately benefit fin whale conservation
- **Target:** improve compliance with all the provisions of the relevant bodies including ACCOBAMS, CMS, Barcelona Convention, IWC, Pelagos Agreement.
- **Method:**
  - consult National Reports of relevant bodies including ACCOBAMS, CMS, Barcelona Convention, IWC, Pelagos Agreement,
  - ?
- **Implementation-timeline**: ?

ACTORS

- **Responsible for coordination of action:** CMP coordinator, Secretariats and National Focal Points of relevant bodies.
- **Stakeholders**: Range State Governments, ACCOBAMS (including the Follow up Committee), IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

Commenté [M24]: This is not clear, is this to monitor the implementation of monitoring and/or mitigation actions by other resolutions? This needs clarification.

Commenté [25]: Shouldn't be open to any official body world wide?

• ACTION MIT-01: INVENTORY AND ASSESS SHIP STRIKE MITIGATION MEASURES AND THE EFFICIENCY OF THEIR IMPLEMENTATION

Mitigation Action Priority: **MEDIUM-HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: Identify efficient mitigation measures for ship strike to be implemented in MIT-02
- **Specific threats to be mitigated**: ship strike
- **Rationale**:

Ship strike is one of the most important threats for fin whales worldwide and specifically in the Mediterranean Sea. Therefore there is a high priority to reduce the impacts of this threat for Mediterranean fin whales. Measures that separate whales from vessels (or at least minimise co-occurrence) in space and time are the most effective (e.g. re-routing schemes), additionally reducing speed to 10 knots have been shown to significantly reduce fatal collisions with large whales. However, these measures are not always feasible. A panel of mitigation measures have been implemented worldwide and their effectiveness needs to be assessed to decide which should be implemented in the Mediterranean (MIT-02).

- **Target**:

Inventory and review any proposed, existing or new measures to mitigate ship strike for fin whales in the Mediterranean. This will be used to inform action MIT-02 and implement selected mitigation measures in high risk areas, which need to be identified and/or confirmed on a seasonal/yearly basis. Periodically assess the efficiency of measures that have been implemented in MIT-02 based on MON-03.

- **Method**:

(1) Inventory and assess ship strike mitigation measures, included the following measures proposed or implemented worldwide:

- separating whales and ships via re-routing schemes, Traffic Separation Scheme (TSS) and Areas to be avoided, implemented through the IMO;
- reducing speed in high density areas where re-routing is not possible, implemented through measures such as PSSAs within the framework of IMO;
- real time alerting (such as REPCET, infrared vision system, acoustic technologies like whale Auto-Detection Buoy System, Whale Alert platform and App);
- training of crew personnel and presence of independent observers

➔ create an inventory of mitigation measures used;
➔ assess the efficiency of each implemented measures:
  - ◆ quantity of shipping companies/stakeholders involved;
  - ◆ legal analysis of each mitigation measures
  - ◆ recommended actions put in force to reduce ship strikes by each measure;
  - ◆ existence of reporting from shipping company;
  - ◆ assessment of compliance by shipping company to specific recommendations of mitigation measures;
  - ◆ existence of feedback from stakeholders to shipping companies about compliance to mitigation measure recommendations.
  - ◆ existence of process to update the mitigation measure recommendations.
➔ update the inventory and assessment when new mitigation measures are developed

(2) Implement the most appropriate measures in the ACCOBAMS area and specifically in the high risk areas identified in RES-04 and through MIT-02

(3) Review the efficiency of the measures implemented in MIT-02

- **Implementation-timeline**:

	WHAT	WHO	WHEN
(1)	Identification of existing mitigation measures		

(2)	Collection of available data for the efficiency assessment		
(3)	Analysis of data		
(4)	Reporting		
5	Assess the efficiency of in place measures		

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

● ACTION MIT-02: IMPLEMENTATION OF APPROPRIATE MITIGATION MEASURES FOR SHIP STRIKES IN ACCOBAMS AREA AND SPECIFICALLY IN HIGH RISK AREAS

Mitigation Action Priority: **MEDIUM-HIGH**

○ DESCRIPTION OF ACTION

- **Specific objective**: Reduce mortality and injuries of fin whales in high risk areas using efficient mitigation measures
- **Specific threats to be mitigated**: ship strikes
- **Rationale**:

Ship strike is one of the most important threats for fin whales worldwide and specifically in the Mediterranean Sea. There is a high priority to reduce the impacts of this threat for Mediterranean fin whale. Ship strike mitigation measures have been reviewed in MIT-01, which provides indications to select the most efficient measures to implement in the ACCOBAMS area and specifically in high-risk areas. IWC define high-risk areas as the convergence of either areas of high volume shipping and whales, or high numbers of whales and shipping. IMMAs proved to be an efficient tool to flag areas where fin whales may be at risk of ship strike, but since they mainly encompass areas with high numbers of whales, mitigation should also apply for areas with high volume of shipping that may limit the presence of whales despite favourable habitats.

- **Target:**

Implement appropriate mitigation measures for ship strike based upon the information reviewed in MIT-01 and depending on the characteristics of each high risk area identified in RES-04, and in areas already defined as priority for fin whales by member states (e.g. Ligurian Sanctuary, Spanish migratory corridor) in the ACCOBAMS area.

- **Method**:

The tasks will be to :

- ➔ constitute a ship strike committee composed of all stakeholders including National authorities, scientific experts and shipping companies;
- ➔ assess the feasibility of the mitigation measures evaluated in MIT-01 according to the characteristics of each high risk area;
- ➔ assess the feasibility of the mitigation measures evaluated in MIT-01 in the ACCOBAMS area;
- ➔ contact the appropriate stakeholders based on legal analysis for each mitigation measures described in MIT-01, such as the IMO, and including shipping companies and National authorities;
- ➔ implement the selected mitigation measures;
- ➔ implement a reporting system from and to shipping companies;
- ➔ increase international collaborations about ship strike issues (e.g. International Maritime Organization, IWC, ACCOBAMS, ASCOBANS, NGOs, ...);
- ➔ increase public and industry awareness about the issue and measures used to reduce this threat (PACB01).
- ➔ Consider the use of dedicated certificates to be given to ships and companies which comply with mitigation measures.
- ➔ Assess the efficiency of in place measures

- **Implementation-timeline**:

	WHAT	WHO	WHEN
(1)	Assess the feasibility of the mitigation measures assessed in MIT-01 for each defined high risk area		
(2)	Contact the appropriate stakeholders including shipping companies, IMO, national authorities		
(3)	Design an implementation scheme		

(4)			

○ ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

○ ACTION EVALUATION

- IWC
- ACCOBAMS

○ PRIORITY

- **Importance:** high
- **Feasibility:** high

• ACTION MIT-03: WIDER ADOPTION AND IMPLEMENTATION OF STANDARDIZED MEASURES (IWC/ACCOBAMS/CMS) TO MITIGATE ADVERSE IMPACT OF WHALE WATCHING ACTIVITIES

Mitigation Action Priority: **HIGH**

DESCRIPTION OF ACTION

- **Specific objective**: reduce the negative impacts of commercial whale watching activities thanks to efficient management of the activity through a suitable management framework and thanks to the implementation of relevant standardized codes of conduct (IWC, ACCOBAMS, CMS).
- **Specific threats to be mitigated**: physical disturbance
- **Rationale**:

Harassment risk begins when a vessel is deliberately closer than the minimum distance identified in common rules for commercial cetaceans watching or when the vessel stays for a period longer than prescribed. This is especially true for swim-with cetacean activities. Moreover, direct interactions between swimmers and animals is demonstrated as presenting risks of animal violent behaviour and transmission of diseases.

Additionally, individuals that are regularly approached (even in respect of the code of conduct) can have significant stress and this may lead to impact at the population level on medium to long term (New Zealand study on bottlenose) (Chronic impact vs acute impact).

Commenté [26]: accute vs chronic stress?

- **Target:**

Minimize the risk of whale watching activities having negative impacts on cetaceans, by the implementation of effective management strategies including the adoption and implementation of standardized codes of conduct (IWC, ACCOBAMS, CMS).

Commenté [27]: mandatory? voluntary?

- **Method**:
    - collate and review of scientific literature, on potential adverse effects of whale-watching on cetaceans and means to mitigate them, with an emphasis on population-level impacts, swim-with activities, feeding and use of spotter aircraft, and recreational drones and also on the concept of "carrying capacity"
    - review and update guidelines / codes of conduct for sustainable cetacean-watching
    - review and update whale-watching certifications and other mitigation measures
    - analysis of the efficiency of whale-watching mitigation measures
    - increase international collaborations working for whale-watching mitigation (e.g. IWC, ACCOBAMS, ASCOBANS, NGOs, ...);
    - increase public and industry awareness about the issue and measures used to reduce this threat (PACB01).
    - Assess the efficiency of in place measures

- **Implementation-timeline**:

	WHAT	WHO	WHEN
(0)	Constitution of group of work and its coordinator		
(1)	Identification of existing mitigation measures		
(2)	Collection of available data for the efficiency assessment		
	Data collection about negative impacts of whale-watching activities on cetaceans		
	Analysis of data		
	Reporting		

	Collaboration		

ACTORS

- **Responsible for coordination of action:**.
- **Stakeholders**: Range State Governments, ACCOBAMS, IWC, industry, local authorities, NGOs.

ACTION EVALUATION

- IWC
- ACCOBAMS

PRIORITY

- **Importance:** high
- **Feasibility:** high

9 REFERENCES

Druon JN, Hélaouët P, Beaugrand G., Fromentin JM, Palialexis A and Hoepffner N (2019) Satellite-based indicator of zooplankton distribution for global monitoring, Nature Scientific Reports 9:4732, DOI: 10.1038/s41598-019-41212-2

Fossi MC, Romeo T, Baini M, Panti C, Marsili L, Campani T, Canese S, Galgani F, Druon JN, Airoldi S, Taddei S, Fattorini M, Brandini C and Lapucci C (2017) Plastic debris occurrence, convergence areas and fin whales feeding ground in the Mediterranean Marine Protected Area Pelagos Sanctuary: a modelling approach, Frontiers in Marine Science 4:167 | DOI: 10.3389/fmars.2017.00167

Gobas, F. A., Mackintosh, C. E., Webster, G., Ikonomou, M., Parkerton, T. F., & Robillard, K. (2003). Bioaccumulation of phthalate esters in aquatic food-webs. In Series Anthropogenic Compounds (pp. 201-225). Springer, Berlin, Heidelberg.

Keen Eric M., Scales Kylie L., Rone Brenda K., Hazen Elliott L., Falcone Erin A., Schorr Gregory S. (2019) Night and Day: Diel Differences in Ship Strike Risk for Fin Whales (Balaenoptera physalus) in the California Current System. Frontiers in Marine Science, 6, 730, 10.3389/fmars.2019.00730 https://www.frontiersin.org/article/10.3389/fmars.2019.00730

Micheli F., Halpern B.S., Walbridge S., Ciriaco S., Ferretti F., Fraschetti S., Lewison R., Nykjaer L., Rosenberg A.A. 2013. Cumulative human impacts on Mediterranean and Black Sea marine ecosystems: assessing current pressures and opportunities. PloS ONE 8(12): e79889. doi:10.1371/journal.pone.0079889

Siliart B., Berder C., Legavre T., Rivallan R., Risterucci A.M., Ody D., Tasciotti A. 2012. Étude préliminaire à l'évaluation de l'activité reproductrice du rorqual commun en Méditerranée. Scientific Reports of the Port-Cros National Park 26:207-215.

Tapie et al, 2012. Contamination en PCB, OCP et PBDE des rorquals communs de Méditerranée nord-occidentale. Scientific Reports of the Port-Cros National Park, 26: 217-230.

Tardy Céline, Di-Méglio Nathalie, Roul Marine, David Léa, Ody Denis, Jacob Théa, Gimenez Olivier et Labach Hélène, 2016. Caractérisation de la population de Rorquals communs fréquentant le bassin de Méditerranée nord-occidentale. Parc national de Port-Cros, Animateur de la Partie française de l'Accord Pelagos et GIS 3M. Fr. : 63 pp

Vaes and Druon 2013 Mapping of potential risk of ship strike with fin whales in the Western Mediterranean Sea. A scientific and technical review using the potential habitat of fin whales and the effective vessel density, European Commission Report (EUR 25847 EN), doi: 10.2788/8520

Wang, J. (2009). A new method for estimating effective population sizes from a single sample of multilocus genotypes. Molecular Ecology, 18(10), 2148-2164.

WWF France, 2016. Réseau de suivi de contamination de la chaîne trophique 2016 - Analyse des microplastiques. WWF Report. World Wildlife Fund for Nature, Paris, France.

WWF France, QUIET-OCEANS, ECOOCEANS INSTITUT, 2016. Characteristics of maritime traffic in the Pelagos sanctuary and analysis of collision risk with large cetaceans. En : 23 pp.

• ANNEX 1 THIS IS A PRELIMINARY ROUGH DRAFT AND WILL REQUIRE ASSISTANCE FROM THE LEGALLY MINDED

Annex 1 includes a summary of information on relevant international conventions and agreements, and on relevant national legislation. A more detailed treatment of this will be available from the Mediterranean Fin Whale CMP webpage, once this has been established.

1 INTERNATIONAL CONVENTIONS AND AGREEMENTS

1.1 INTERNATIONAL CONVENTION FOR THE REGULATION OF WHALING

The **International Convention for the Regulation of Whaling** (ICRW) was adopted on 2 December 1946. It established the International Whaling Commission (IWC) to ensure the proper and effective conservation and development of whale stocks by regulating whaling activities. List which range states are members as of 2018. Since the 1985/1986 season, commercial takes of all large whales have been suspended and catch limits set for only aboriginal subsistence whaling. Convention on the Conservation of Migratory Species of Wild Animals

1.2 CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES

The **Convention on the Conservation of Migratory Species of Wild Animals** (CMS), also known as the **Bonn Convention**, is an intergovernmental treaty under the auspices of the United Nations Environment Programme. It aims to "conserve terrestrial, marine and avian migratory species throughout their range". List which range states are members as of 2018. Appendix I of the Convention is a list of endangered migratory species that are threatened with extinction while Appendix II is a list of migratory species that need or would significantly benefit from international co-operation. The species is listed on both Appendix I or Appendix II.

1.3 AGREEMENT ON THE CONSERVATION OF CETACEANS IN BLACK SEA, MEDITERRANEAN SEA AND CONTIGUOUS ATLANTIC AREA

xxxx

1.4 CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

The **Convention on International Trade in Endangered Species of Wild Fauna and Flora** (CITES) was agreed at a meeting of representatives of 80 countries in Washington DC., United States of America, on 3 March 1973, and on 1 July 1975 CITES entered into force. The purpose of the convention is to protect endangered animals and plants from over-exploitation by regulating international trade. All range states of Mediterranean fin whales except the Democratic People's Republic of Korea are members of CITES. Endangered species threatened with extinction are listed in Appendix I of the Convention. International trade of these species is prohibited except for non-commercial uses where it can be shown that limited and well-documented trade represents no risk to the species (*e.g.* scientific research). The fin whale is listed in Appendix I.

1.5 INTERNATIONAL MARITIME ORGANISATION

The **International Maritime Organisation** (IMO) was established on 6 March 1948 with the mandate to "…develop and maintain a comprehensive regulatory framework for shipping…" as well as to prevent and control marine pollution from ships. All Mediterranean fin whale range states are members. The IMO has spawned a number of international conventions intended to

regulate or prevent impacts of shipping activities on the marine and coastal environment as well as insure people's safety:

The **Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter**, generally known as the **London Convention**, was adopted on 29 December 1972. It was replaced on 17 November 1996 by the **Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter**, also known as the **London Protocol**. This protocol aims to protect the marine environment from human activities and defines the global rules and regulations on dumping. With the exception of the Democratic People's Republic of Korea, all other range states are members. Among them, only the People's Republic of China (1998), Japan (2007) and the Republic of Korea (2009) have signed the London Protocol. The London Protocol promotes waste management by regulating and preventing dumping activities.

The **International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)** came into force on 2 October 1983. Among the range states, only the People's Republic of China, Japan, and the Republic of Korea have signed all MARPOL Annexes. The Democratic People's Republic of Korea and the Russian Federation agreed to all except MARPOL Annex VI on the prevention of air pollution from ships. This Convention acts to prevent accidental and operational pollution of the marine environment resulting from shipping activities. It incorporates most of the articles of the ***International Convention for the Prevention of Pollution of the Sea by Oil***, also known as OILPOL, adopted in 1954. MARPOL 73/78 explicitly provides regulations for oil, chemicals, harmful substances in packaged form, sewage and garbage pollution. Under this agreement, ships are required to have double hulls, ballast tanks and other appropriate equipment to prevent or limit pollution and discharges at sea. The Convention also designates special areas where dumping and pollution are strictly prohibited.

The **International Convention on Oil Pollution Preparedness, Response and Co-operation**, known as the **OPRC Convention**, was adopted on 30 November 1990. It promotes international co-operation and mutual assistance for preparation and response to oil pollution incidents. It also encourages members to develop and maintain an adequate capability to deal with oil pollution emergencies. Among the range states, only Japan, the Republic of Korea and the People's Republic of China have signed this convention.

+Convention on Biological Diversity ?

1.6 REGIONAL FISHERIES BODIES

To be added

1.7 OTHER BODIES THAT MANAGE HUMAN ACTIVITIES IN THE MARINE ENVIRONMENT

The **United Nations Convention on the Law of the Sea (UNCLOS)** is a legal instrument defining the legal status of the different seas and straits as well as countries' limits, rights and duties within territorial seas. The convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. List Range States

The **Convention on the Transboundary Movement of Hazardous Wastes**, known as the **Basel Convention**, controls the movement and disposal of hazardous wastes across nations.

Etc, Etc…….

2 NATIONAL LEGISLATION

The information on relevant national range state legislation needs to be developed ?by the Secretariat? – a useful resource is EcoLex (http://www.ecolex.org)