REPORT OF THE JOINT ACCOBAMS/ASCOBANS/ECS/SPA-RAC WORKSHOP ON MARINE DEBRIS AND CETACEAN STRANDING

Friday 6th April 2018, La Spezia, Italy

MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE

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ANNEXES

I. INTRODUCTION

Cetaceans are known to be affected by marine litter through ingestion and entanglement in fishing nets; the phenomenon is well-known in the ACCOBAMS area, and information exists mainly from the monitoring of strandings in the Mediterranean and the Black Seas.

Overall, in comparison to the level of understanding that exists for some other marine species such as sea turtles and albatrosses, the current level of understanding of the threat posed by marine debris to cetaceans is poor (Simmonds, 2012).

In 2016, Parties to ACCOBAMS identified marine debris as a potentially key conservation issue to be addressed in priority by assessing impacts of ghost nets and plastic materials on cetaceans, in their 2017-2019 Work Programme. One way to improve the assessment would be to propose a standardized protocol to collect relevant data, including those to be collected through stranded cetaceans.

In this context, a collaborative approach of ACCOBAMS with other relevant Organizations is essential to address the issue of marine litter impacts. Therefore, a joint ACCOBAMS/ASCOBANS/SPA-RAC workshop on marine debris and cetacean stranding was held on Friday 8th April 2018 in La Spezia, Italy. It was organized jointly by the Agreement on Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS). Strengthening collaboration between global and regional intergovernmental organizations and NGOs interested in this issue was an objective of this workshop, in order to ensure better synergy and to optimize efforts.

It was supported by ACCOBAMS, through Voluntary Contributions from Italy and the Principality of Monaco, and by the Regional Activity Centre for Specially Protected Areas (SPA/RAC -MAP-UNEP).

The agenda of the workshop appears in Annex 1 of the report.

More than eighty attendees from 21 different Countries participated in the workshop. The list of participants can be found in Annex 2 of the report.

The workshop provided the opportunity (i) to further develop effective cooperation with the ongoing regional initiatives on marine debris, including ghost nets, (ii) to assess the impact of plastic materials on cetaceans and (iii) to discuss requirements for the development of a common approach and joint guidelines.

II. MARINE LITTERS – (Chair: Mr. Mark SIMMONDS)

- **Morgana Vighi** – MEDSEALITTER*: setting common methodologies for monitoring floating litter and its impact on biodiversity in the Mediterranean Sea

Marine litter is a global threat for marine organisms, including large vertebrates as marine mammals. Unfortunately the semi enclosed Mediterranean basin is heavily affected by this issue. To prioritize marine conservation measures, consistent data are needed to analyse litter impact on marine fauna. Regional, national and international programs highlight the necessity of effective and widely agreed standardized monitoring protocols of floating litter and its impact. The (Interreg MED) MEDSEALITTER project rises in this framework and focuses on the development of effective methodologies to monitor the potential impact of macro litter on megafauna. The partnership of the project brings together Italy, France, Spain and Greece with scientific organizations, MPAs and NGOs to develop, test, and implement efficient monitoring protocols for marine litter both at basin and local MPA scale. The project focuses on monitoring both micro- and macro-litter, floating and ingested, using different methods and platforms of observation. During the first 'studying' phase synoptic monitoring of macro-litter and macro-fauna were conducted from different platforms (visually from ferries, smaller boats, and aircrafts, and through aerial photographs taken from aircrafts and drones). The effects of potential covariates were analysed to set the protocol parameters: type of platform (height / speed), strip width, weather and visibility conditions, experience of observers, lower size limit of items, prevalent item sizes and colors of items, type and resolution of sensors. Preliminary results highlight a series of recommendations for monitoring including: spatial and temporal stratification; adaptation of the collection data sheet, strip width and size classes of litter to the type of platform and techniques used; review of the JRC/UNEP-MAP masterlists according to surveys results; synoptically collection of macro-fauna data to identify areas and seasons of higher risk. The draft protocol is going to be tested during 2018 in pilot areas representative of the various Mediterranean ecological conditions and results will be used both for the direct management of the MPAs involved in the project and to support the establishment of standardized conservation procedures at large basin scale.

- **Léa David** – Floating marine litter distribution and overlap with cetacean distribution in the western Mediterranean sea

Léa David presented on behlaf of her co-authors Di-méglio N. and Campana I., their study investigating the composition, density and distribution of floating macro-litter along the Liguro- Provençal basin with respect to cetaceans presence. Survey transects were performed in summer between 2006 and 2015 from sailing vessels with simultaneous cetaceans observations. During 5171 km travelled, 1993 floating items were recorded. Plastics was the predominant category (86.7%) and overall mean density reached 15 items/km^2. Kernel density estimation for plastics revealed ubiquitous distribution rather than high accumulation areas, mainly due to the circulation dynamics of this area. The presence range

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of cetaceans (259 sightings, 6 species) corresponded by ~50% with plastic distribution, indicating high potential of interaction, especially in the eastern part of the area, but effective risks for marine species might be underrepresented. Amongst the perspectives, data collecting from ferries (FLT Network med), on marine litter and fauna in parallel, might expand the coverage in the Mediterranean Sea and allow such analysis at a larger scale.

- **Marian Paiu –** Project on the Black Sea Cross border cooperation program: Assessing the vulnerability of the Black Sea marine ecosystem to human pressures - ANEMONE

The scope of the project ANEMONE is an harmonized monitoring and assessment, based on scientific knowledge, of the sea and coast is the indispensable basis for the management of human activities, in view of promoting sustainable use of the seas and coasts and conserving marine ecosystems and their sustainable development.
The overall objective is to deliver, through collaborative efforts among partners, a common strategy, themes and products related to regional harmonized monitoring and assessment of the Black Sea, as an indispensable basis for the management of human activities in view of promoting sustainable use of the Black Sea and its coasts and conserving its marine ecosystems.

- **University of La Rochelle** & **Benjamin Guichard**[**] - Sea mammals and marine litter: existing protocols, data and analyses from French waters

Interaction of sea mammals with marine litter is ancient but poorly documented. So far the issue has not been a primary objective for monitoring in France, therefore available data are by-products of pre-existing protocols, mostly anecdotal information and little summary statistics. This presentation gives an overview of the French stranding network, provides available information on marine mammal interaction with marine litter, as documented from stranded animals, and shows an attempt to map risk areas from aerial surveys. The French strading network has been established in 1972 and its general goal is to monitor changes marine mammal species composition, cause of death, health status, biological parameters. It is composed of 400 field correspondents, including 25 veterinarians, and is run the national marine mammal stranding data base and associated organ and tissue bank. An online reporting system is now available. Routine analyses include carcass drift back calculation to identify areas of mortality at sea, age and reproductive status, necropsies – including entanglement in marine litter - and associated analyses. Other analyses (diet including ingestion of marine litter, contaminants, genetics, stable isotopes) are conducted on a project by project basis. Among seals, 0.5% individuals were found to be entangled in marine litter, over the period 2000-present, whereas for cetaceans no more than 0.1% were found entangled, mostly deep-divers as sperm or beaked whales. As a complement to stranding data, aerial visual survey can provide valuable data on the distribution of marine litter floating at sea and allow risk areas to be highlighted by examining how marine megafauna and marine litter distributions overlap. An example of this approach involving sea turtles is given.

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3 - CEBC, Université de La Rochelle/CNRS, La Rochelle

- **Nino Pierantonio** - Relevant debris to be targeted for cetaceans

The 2017-2019 Work Programme of The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) requested an assessment of the impact of plastic bags, microplastics and other plastic materials ingested by cetaceans. This review considers the available information, which has increased in recent years, although a clear and quantifiable assessment of effects specifically on cetaceans remains elusive. Here we identify the cetacean species in which impacts of plastic debris and, more generally, marine litter have been documented. The types of debris affecting cetaceans are also presented.

The study concludes that cetaceans are affected by a wide range of types of debris and that effects range from negligible, through chronic to debris-related mortalities, although clear cases of ingested marine debris causing deaths remain few and scattered. The study is unable at this time to point at particular debris types as presenting a particular threat to cetaceans but we do make a series of recommendations which will help this situation to be better understood and addressed. These includes development and dissemination of standard post mortem protocols and further research to identify hot-spots.

The full study is available in Annex 3 of the report.

- **Mark Simmonds** - Draft protocol for relevant data gathering and sharing related to the targeted debris

It is essential to identify standardised procedures to collect information on debris, and to be included in the many well established necropsy protocol already existing worldwide.

The study proposes that the following types of information related to marine debris, should be collected during cetacean strandings :

1. Post-mortem examinations should be conducted using a classical differential diagnostic approach, when possible, to enable:
    a. The detection of trauma, chemical exposure and other sequelae related to exposure; and
    b. The analysis of their roles in contributing to morbidity and mortality in the context of other potential causes, such as infectious or non - infectious disease, nutrition, and other possible aetiologies.
2. In situations when a full differential diagnostic approach is not possible, efforts to document the presence of marine debris, both ingested and entangled, should still be put into place. These efforts should focus on both macrodebris and microdebris and should include the following components:
    a. Standard cetacean necropsy protocols should be followed (e.g. McLellan et al. 2004, Pugliares et al. 2007, Moore & Barco 2013);
    b. Gross necropsy examination and report: description, sketches, images, measurements, collection and preservation of entanglement/debris, and affected body part(s);
    c. The entire gastrointestinal tract should be opened and examined, and debris should be characterised by:
        i. Material (if plastic, polymer type e.g. polyethylene, polypropylene, polystyrene, polyamide (nylon), polyester, acrylic, polyoximethylene,

polyvinyl, polyvinylchloride, poly methylacrylate, polyethylene terephthalate, alkyd, polyurethane).

ii. Size (please refer to the definition of micro-, meso- and macrodebris): the size of each item should be recorded.

iii. Colour (e.g. transparent, crystalline, white, clear-white, cream, red, orange, blue, opaque, black, grey, brown, green, pink, tan, yellow)

iv. Shape (e.g. for pellets: cylindrical, disks, flat, ovoid, spheroids; for fragments: rounded, sub-rounded, sub-angular, angular; for general- irregular, elongated, degraded, rough, and broken edges)

v. Mass

vi. Volume

d. All evidence should be identified as to source using established techniques (Browne et al. 2010, 2015b, a) as practical and in collaboration with the relevant industries, to maximize the integration of data into these industries, such as plastics and fishing.

e. Further analyses such as histopathology, imaging, analytical chemistry, blood test and organ function tests, should be undertaken to document the presence of and type of debris as well as possible impacts.

f. Criteria for the assignation of degree of confidence of findings (e.g. quality of data) of entanglement or ingestion contributing to or causing morbidity and mortality should be used (Moore et al. 2013).

The full study is available in Annex 4 of the report.

III. CETACEAN STRANDINGS – (Chair: Mr. Patrick VAN KLAVEREN)

- **Patrick Van Klaveren** – Overview of National Stranding Networks in the ACCOBAMS Area

During the Sixth Meeting of the Parties to ACCOBAMS (Monaco, 22-25 November 2016), Parties requested the ACCOBAMS Scientific Committee to approach the ECS, IWC and ASCOBANS in order to develop a **common operational stranding[1] protocol** taking into account the proposed common definitions, the common data collection and the common necropsy protocol annexed to the Resolution 6.22.

Therefore, in order to draft recommendations, the ACCOBAMS Secretariat launched through the national focal points a questionnaire and a template "Stranding Network Organisation".

18 Countries (including 13 regional entities in Italy and Spain) answered to the questionnaire listing 102 entities involved in the national stranding networks (tab1). Unfortunately, none of the countries answered to the question "if you don't have a stranding network, why? "

Some of the information were collected from previous reports as the countries didn't answered or were in a process of restructuring their network.

The description of the involvement of each entities shows 25 which have a role in national coordination and give some precise information on the main others topics they are tackling, like biological analysis, reporting, necropsies.

[1] *The term "stranded cetacean" is expanded to include animals, dead or alive found floating or swimming, respectively, in shallow waters, in the latter case, showing clear signs of physiological dysfunction.*

Most of the Countries have either a well-documented on the field data collecting tool or a simple list of items to be observed.
From the questionnaire, some information could be collected on specific topics like necropsies, tissues banks, release and rehabilitation centre and the attention on marine debris during necropsies.
In some countries, the national coordinators implement a lot of missions but in others functions were dispatches in several specialised entities in a more "mature" networking system.
In the description of the "strong and weak topics", as quoted by the countries, it is clears that several countries are willing to go further in the analyse of data collected in particular related to the cause of the death and better use of the sampling for further studies. This was also reflected in the assistance or support expected from the ACCOBAMS permanent Secretariat.
The relation to MEDACES was actually the less documented aspect from the answers received. No one commented on the use of MEDACES data.
Follow up from the survey:

- On the field, it is clear that the well documented resolution ACCOBAMS 6.22 should be completed by a proposition of field datasheet for some countries able also to facilitate communications through the existing national data banks.
- This datasheet could be completed by some items related to marine debris.
- A web access dynamic register of the involved entities could be drafted including the availability for exchange and cooperation.
- Capacity building is needed in some several for samplings, necropsies and exchange with tissues banks

The full study is available in Annex 5 of the report.

- **Aline Kuehl-Stenzel -** Overview National Stranding Networks in the ASCOBANS area

The aim of the Agreement is to promote close cooperation between countries, with a view to achieving and maintaining a favourable conservation status for small cetaceans throughout the Agreement Area. The principal measures by which this objective is to be achieved are outlined in the Conservation and Management Plan, which appears as an Annex to the Agreement, and which requires Parties, inter alia:

- to establish an efficient system for reporting and retrieving by-catches and stranded specimens and to carry out, in the framework of the studies mentioned above, full autopsies in order to collect tissues for further studies and to reveal possible causes of death and to document food composition. The information collected shall be made available in an international database.
- to establish the obligation to release immediately any animals caught alive and in good health. (applies to live stranded animals also)

Resolution 8.10: Small Cetacean Stranding Response (2016) Calls for best practise guidelines for response to strandings events and establishment of an updated strandings protocol within the frameworks of IWC, ACCOBAMS and ECS.
Morever, in line with Resolution 8.1 ASCOBANS' national reporting in 2018 (covering 2017) focusses on bycatch, resource depletion, marine debris, surveys & research, use of bycatches & **strandings.**

- **Lonneke l. Ijsseldijk -** Strandings and marine debris: an overview for the Dutch situation***

Stranding records in the Netherlands are maintained by the Natural History museum of Leiden Naturalis, since 1970's and currently hold thousands of records, dating back as early as the 1255. The database is updated at least once a week and all records can be viewed online at www.walvisstrandingen.nl. Stranding numbers of harbour porpoises have always been below 100 per year, but increase since the 2000's till on average around 600 strandings annually nowadays, with peak years in 2011 and 2013 both counting almost 900 stranded porpoises. The beaches of the Netherlands, bordering the southern North Sea, are all sandy and well populated, therefore it is believed that all stranded animals are found and eventually reported. Since 2006, post mortem examination on a subsample of all stranded cases are conducted at the Faculty of Veterinary Medicine, Utrecht University (UU), by experienced veterinarians and biologist. The main aim of the research is to determine causes of death, especially the discrimination between natural and anthropogenic causes. The research is funded by the Dutch Government, due to the involvement of this species in several regional, international convention (e.g. ASCOBANS, MSFD and Habitat Directives). In addition, samples for tissue banking and other researches are collected.

One of the additional project that the UU is involved in focusses on the presence of marine debris in stranded cetaceans. This is a collaboration with Wageningen Marine Research and Bureau Waardenburg. Collectively, we published the results of the examination of 654 harbour porpoise stomachs for the presence of marine debris in AMBIO in January 2018[2]. We showed that the frequency of occurrence of plastic litter was 7% using overflow method, but this percentage increased to 15% using a 1mm sieve in addition to the overflow method. We concluded that standardization of methods is necessary, as proven by our study, but that in general harbour porpoises in our sample size presented a low frequency of ingestion of minor numbers and masses of litter items. Therefore, porpoises do not seem to be the strongest candidate for annual monitoring of marine debris, as only catastrophic changes may become visible during monitoring of this species. In addition, post mortem investigations did not reveal any cases of fatal plastic ingestion, but at least one case of fatal entanglement in fishing gear (non-bycatch).

From ten other species comprising of 34 individuals (both baleen- as well as toothed whales), gastrointestinal tracts were analysed. Plastic items were found in sperm whales[3] and beaked whales[4], but not in any other species and no cases of fatal ingestion were determined. Standardized protocol are however required in order to compare results between animals, species and international, with considerations among sample procedure started at the stranding event. This include a best practise per species (e.g. which parts to sample from which species, depending on their size), logistics, environmental pollution from items flying in during beach necropsies, as well as in the lab.

*** By: Lonneke L. IJsseldijk, Faculty of Veterinary Medicine, Utrecht University

[2] van Franeker, J. A., Rebolledo, E. L. B., Hesse, E., IJsseldijk, L. L., Kühn, S., Leopold, M., & Mielke, L. (2018). Plastic ingestion by harbour porpoises Phocoena phocoena in the Netherlands: Establishing a standardised method. Ambio, 47(4), 387-397.

[3] Unger, B., Rebolledo, E. L. B., Deaville, R., Gröne, A., IJsseldijk, L. L., Leopold, M. F., ... & Herr, H. (2016). Large amounts of marine debris found in sperm whales stranded along the North Sea coast in early 2016. Marine pollution bulletin, 112(1-2), 134-141.

[4] Rebolledo, E. L. B., IJsseldijk, L. L., Geelhoed, S.C.V. (2018). Investigating the occurrence of marine debris in stranded whales and dolphins in the Netherlands. Poster at European Cetacean Society conference, La Spezia, Italia, no. BS06.

- **Rob Deaville** - Evidence (positive and negative) of marine debris ingestion from the UK stranding programme side

- **Sandro Mazzariol** –The Data collection form proposed in the ACCOBAMS Resolution 6.22

An autopsy, also known as a postmortem examination or necropsy, is a specialized procedure that consists of a thorough examination of a carcass by dissection to determine the cause and manner of death and to evaluate any disease or injury that may be evident. It is usually performed by a specialized veterinarian with a specific training in animal pathology. If trained personnel is not available, veterinarians and/or biologist with an adequate training in cetaceans' anatomy could perform part of the gross and sampling procedures, as well as some of the main ancillary analyses (for instance life history, genetics, gastric content analyses, toxicological studies).

Information has scientific value only when carefully documented data are collected systematically using appropriate terminology. Depending on conditions listed in paragraph 1, data collection, as well as the postmortem procedure, may be basic (Level A), intermediate (Level B), or detailed (Level C). The use of standardized data sheets and forms is recommended working on the field. Please refer to the ACCOBAMS Resolution 6.22.

IV. DISCUSSION AND CONCLUSIONS: DATA MANAGEMENT AND NEEDS – (Chair: Mr. Aviad SCHEININ)

- **Benjamin Guichard** – INDICIT: Is entanglement a relevant indicator of the impact of marine litter on marine mammals with marine debris?

INDICIT *(Implementation Of Indicators Of Marine Litter On Sea Turtles And Biota In Regional Sea Conventions And Marine Strategy Framework Directive Areas),* is a two year project (february 2017 – february 2019 funded by the European Union. The consortium, composed of researchers from 7 different countries, is committed to support the implementation of EU's Marine Strategy Framework Directive (MSFD) and other international environmental policies aiming at protecting the marine environment (especially the Barcelona convention, the OSPAR convention, the HELCOM etc).

INDICIT focuses on the Descriptor 10 of the MSFD ("Marine Litter"), which aims to maintain or achieve the Good Environmental Status (GES) of the marine environment by 2020 with respect to marine litter. The overarching aim is to develop a set of standardized tools for monitoring the impacts of litter on marine fauna as bio-indicators: Indicator 1 "macro-litter ingested by sea turtle (debris items >5 mm)", Indicator 2 "Marine wildlife entanglement in debris (all taxa)" and Indicator 3 "micro-litter ingested by fish/ sea turtle (debris items <1mm)".

Targeted species were evaluated and the feasibility of implementing an entanglement indicator was assessed through a survey involving stranding/rescue networks, biologists and field naturalists. Cetaceans, sea birds, marine turtles, sharks but also benthic invertebrates were tested as indicator species. The main constraint for using vertebrates was linked to the difficulty to distinguish entanglement caused by active gears or by ghost fishing gears. The use of benthic invertebrates as a potential indicator of interactions between marine organisms and litter, monitored through Remotely Operated Vehicles, was also discussed.

- **Céline Arnal** - OBSENMER

OBSenMER is a collaborative platform that facilitates the capture and analysis of observations at sea. It concerns all types of observations: marine mammals, sea turtles, fish, birds, but also human activities, such as boating, fishing. , pollution, etc.

OBSenMER is aimed at collecting and sharing data on the Mediterranean macro-fauna and envitonmental factors.

A possible development of OBSenMER would be a dynamic interface for general public application (cetacean stranding monitoring, turtle nesting monitoring, marine waste monitoring), a creation of a new user type (species or group referees), exportation tools…

More information on http://www.obsenmer.org/ .

- **Rob Deaville** – A web-accessed database for marine mammal stranding and necropsy data

Across the ASCOBANS region, several long-term strandings monitoring and investigation programmes have been in place for several decades. Data that are collected during the course of such investigations are routinely recorded on national/local databases and in many instances, made available through reports and/or public release of information.

However, no centralised point of access across the ASCOBANS region currently exists to facilitate the display of centralized data on both strandings and any necropsies that may have been carried outSeveral international initiatives are currently being pursued that have lead or will lead to such data portals on strandings e.g. the Mediterranean Database for Cetacean Strandings (MEDACES) in the ACCOBAMS region and the 'Marine Mammal Health Monitoring and Analysis Platform in the USA (Simeone et al. 2015). The creation of a web-accessed database of data on strandings in the ASCOBANS region would help facilitate the delivery of a long-standing objective of the Conservation and Management Plan of the Agreement.

It would initially allow periodic upload and display of data on strandings, followed at a later date by the upload and display of data on causes of death in animals where necropsies have been carried out. It would allow display to a variety of end users, with allocation of appropriate access levels. End users could include, but not be limited to the general public, media/press, policy officials, the scientific community and of course, stranding networks that contribute data.

The collective integration of stranding datasets across the region, leading to the production of a significant combined dataset on strandings over a 20+ year period, would create significant synergies between stranding networks and will hopefully help facilitate additional collaborations. The inception of such a system would also potentially enable more efficient investigation of issues that may be transnational in nature (e.g. Dolman et al. 2008, Unger et al. 2016, Peltier et al. 2017).

The putative web-accessed database would also help promote the roles of all stakeholders involved in the project, from ASCOBANS and Parties and Range States to national funders and of course, collaborating stranding networks. Finally, it would help educate and inform the public about the drivers behind cetacean stranding events and enable us to further our understanding of a wide range of issues, so that we can try to improve the long-term conservation status of these charismatic marine species.

- **Sandro Mazzariol** –The necropsy protocol proposed in the ACCOBAMS Resolution 6.22

In order to quantify and explain the real impact of diseases, human activities and other causes of stranding, it is necessary to perform systematically postmortem examination of cetaceans found

stranded on the coast. These procedures should be carried out through a shared approach in order to compare and exchange data collected during necropsies.
These approaches should be maintained not only within the ACCOBAMS Area but worldwide since the need of comparison and sharing is a common feeling. For these reasons, the document has been prepared after consulting several colleagues (i.e. pathologists, stranding responders) working in the ACCOBAMS and ASCOBAMS Areas and also within the International Whaling Commission (IWC).
The present document should be considered as a postmortem examination guideline supporting the development of national postmortem best practices in the Mediterranean Sea, Black Sea and riparian waters in order to standardize data collection and support those stranding networks without specialists working in these fields.
For those countries without a structured network including veterinarians and laboratories, these procedures could offer a simple tool to collect data in the proper way also by untrained personnel; furthermore, the document give also indication and suggestion to develop a more detail postmortem examination. On the other hand, for countries where a more developed procedure has been established, the present guidelines could give the minimum standard to be achieved.
These guidelines should be considered as the first step of a multi-level approach considering:

<u>BASIC: basic gross examination and data collection</u>
- collection of data on stranding event (date and location coordinates)
- data on animal involved (species, sex, age class, physiological status)
- measuring the animal
- gross examination with general description of main findings
- possible external signs of human interaction
- stomach content examination

<u>INTERMEDIATE: sampling for general ancillary analyses</u>
- sampling and performing microscopic examination and tissue bank
- sampling and performing microbiology
- sampling and performing toxicology
- sampling and performing and life history

<u>ADVANCED: specific postmortem examinations and analyses with specific data and samples collection</u>
- Dolphin morbillivirus
- Human interaction (bycatch and ship strikes)
- Sound related mortality
- Mass strandings

In order to diagnose specific causes of death, more detailed analyses and diagnostic procedures should be implemented: for these reasons, the creation of a list of internationally recognized experts and diagnostic laboratories is proposed and it is recommended to give whoever needs a proper support for more detailed examinations and/or in case of specific causes of strandings and diseases. In particular, this “expert panel” could develop dedicated diagnostic protocols in case of specific problems, as dolphin morbillivirus mortalities, ship strikes and interaction with fisheries, sound related unusual mortalities or be considered as advisory consultant. They could also support ACCOBAMS

directly in the case of specific problems related to cetaceans' mortality or intervene in case of unusual mortality events.

Finally, the expert panel could be appointed to revise and implement the present document with those indications and recommendations coming from the dialogue with ACCOBAMS and IWC in order to compare and share data as well as implement the guidelines with new information and diagnostic approaches. These could be foreseen periodically during international meeting as European Cetacean Society which could also support a common protocol for postmortem investigation to be used around Europe.

V. RECOMMENDATIONS

Collaboratively identify, prioritise and mitigate impacts of marine debris on marine mammals, informing policy making decisions and helping to address the marine debris problem in particular through data collected during strandings.

Stranding Networking

1.1. Stranding events

- Evaluation of the needs for further development of national stranding networks;
- Promotion of establishment of National Stranding Networks under the national coordination/support;
- Promotion of harmonization of stranding protocols (collection, analysis, etc.) in order to exchange common data, as appropriate* ;
- Assessment of existing stranding protocols. Tiered guidelines- simpler as required: What is the *de minimis* approach? *;
- Addition of tiered marine debris collection protocols to updated ACCOBAMS/ASCOBANS strandings protocols;
- Implementation of relevant Capacity building ;
- Promotion/exchange of best practices in addressing cetacean stranding events*;
- Particular focus in areas of known high density of marine debris (e.g. Adriatic);
- *Special focus on stranding data from low densities and/or data deficient species (e.g. Grampus).*

1.2. Data banks

- Collation of existing data- which species, which regions, etc.;
- Inventory of all stranding information available from stranding data banks;
- Promotion of the establishment of regional tissue databank where there are none (e.g. Black Sea area);
- Improvement of communication between tissue data banks and between possible providers. Improvement also of access in both ways, providing and collection;
- Establishment of the minimum set of samples and the proper way of collection for tissue banks.

** See ASCOBANS Resolution 8.10 (2016) and ACCOBAMS Resolution 6.22 (2016)*

Necropsies - Improve general results from necropsies

- Investigation of pathogens presence;
- Investigation of contaminant levels released by debris ingestion and by prey ingestion (trophic transfer);
- Establishment of a list of the most important pollutants, pathogens, etc. which should be investigated in order to have a starting base line in common studies;
- Investigation of potential impacts of underwater anthropogenic noise;
- Identification of research groups/labs that may be able to analyse material collected by stranding networks;
- Identification of best practices worldwide;*
- Harmonization of pathology sampling methodologies;*
- Consideration should be given in using categorization of debris resulting from the MedSealitter project;
- Establishment of a common approach in interpreting results from postmortem analyses identifying a common language and code for mechanisms, as well as causes of death.

Data Gaps

- Collection and collation of existing and prospective "negative" data (absence of marine debris) recorded during necropsies;
- Identification and assessment of data banks and new tools/techniques globally;
- Improvement of stranding context by relating to species population distribution and abundance.

Research needs with future proofing

- Aerial surveys / boat surveys (see MedSealitter project): cost/benefits analyses;
- Investigation of relevance of using other animals (marine turtles[**] and seabirds) protocols for including marine debris data in cetacean stranding monitoring;
- Look into human impacts and initiatives; WHO initiatives, etc.;
- Encourage national/international collaborations.

Policy

- Promotion of relations stranding-marine debris data for advocating conservation policies.

[**] *See e.g. classification from INDICIT, MedSealitter projects*

ANNEX I – AGENDA

I. MARINE LITTERS – (Chair: Mr. Mark SIMMONDS)

- **a.** Regional initiatives / projects,
- **b.** Assessment of impacts on cetaceans *(turtles and birds might also be addressed)*
- **c.** Identification of debris to be targeted (plastic, ghost nets,…)
- **d.** Protocol for relevant data gathering / sharing related to the targeted marine debris

II. CETACEAN STRANDINGS – (Chair: Mr. Patrick VAN KLAVEREN)

- **a.** Overview of National Stranding Networks in the ACCOBAMS and ASCOBANS areas
- **b.** Overview of national stranding data sheets and inclusion of marine debris information

III. DISCUSSION AND CONCLUSIONS: DATA MANAGEMENT AND NEEDS – (Chair: Mr. Aviad SCHEININ)

- **a.** Data sources / Databases: what is needed?
- **b.** Recommendation on the use of stranding / necropsy to gather data on marine debris
- **c.** Proposition for a common operational stranding protocol
- **d.** Research priorities

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ANNEX III –RELEVANT DEBRIS TO BE TARGETED FOR CETACEANS: A REVIEW OF AVAILABLE INFORMATION

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I. Abstract

The 2017-2019 Work Programme of The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) requested an assessment of the impact of plastic bags, microplastics and other plastic materials ingested by cetaceans. This review considers the available information, which has increased in recent years, although a clear and quantifiable assessment of effects specifically on cetaceans remains elusive. Here we identify the cetacean species in which impacts of plastic debris and, more generally, marine litter have been documented. The types of debris affecting cetaceans are also presented.

We conclude that cetaceans are affected by a wide range of types of debris and that effects range from negligible, through chronic to debris-related mortalities, although clear cases of ingested marine debris causing deaths remain few and scattered. We are unable at this time to point at particular debris types as presenting a particular threat to cetaceans but we do make a series of recommendations which will help this situation to be better understood and addressed. These includes development and dissemination of standard post mortem protocols and further research to identify hot-spots.

II. Introduction

Marine debris (or marine litter) pollution in the ocean is a global environmental concern (e.g. Sebille et al. 2015, Worm 2015, Haward 2018). Recent studies (e.g. Law et al. 2010, Sebille et al. 2012, Cózar et al. 2015, Suaria et al. 2016, Walker 2018) have demonstrated that plastics, which account for most of marine debris (Galgani et al. 2000, Barnes et al. 2009, Law et al. 2010, Thiel et al. 2013, Law 2017), are ubiquitous and occur across all oceans, including in remote areas (e.g. Waller et al. 2017). Evidence suggests that plastics pose a serious threat to marine wildlife, with an ever-increasing list of species linked to negative effects from debris (e.g. Laist 1987, Gall & Thompson 2015), and also indirectly to human health (Thompson et al. 2009a, Rochman et al. 2015, Vethaak & Leslie 2016). A recent review by the United Nations Convention on Biological Diversity along with more recent investigations

demonstrate that about 700 species, 17% of which are listed on the IUCN Red List as near threatened or above, are affected by marine plastic litter (Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel—GEF 2012, Gall & Thompson 2015).

Virtually any man-made product can become marine debris when it reaches the marine environment. Marine debris is normally classified, based on size, into four main categories (here described in terms of plastics): macroplastics – size greater than 200 mm, mesoplastics – size between 5 and 200 mm, microplastics – size between 0.001 mm and 5 mm and and nanoplastics – size smaller than 0.001 mm (e.g. Germanov et al. 2018 and references therein).

Macroplastics are predominantly made up of any sort of item derived from human daily usage, ranging from plastic sheets to lost fishing gear (e.g. Eriksen et al. 2014). Once released in the ocean, their fate primarily depends on the density of the item which in turns influences its buoyancy, its position in the water column and its consequent availability to interact with marine species (e.g. Wright et al. 2013). Processes such as biofouling and the colonization of organisms on the surfaces of the plastic items, and also the leaching of additives from the plastics, can change the weight of particles, also affecting whether they float and their position in the water column (e.g. Ye & Andrady 1991, Kooi et al. 2016, Andrady 2017, Avio et al. 2017). Through photodegradation and other weathering processes (Gregory & Andrady 2003, Barnes et al. 2009), large plastic pieces can fragment and generate the so called secondary microplastics (and smaller particles). Microplastic pieces are also produced by industry directly and used in personal-care products and in other industrial applications; these are termed ‘primary microplastics’. For a short but exhaustive synthesis of the classification, origins and trophic transfer of microplastics please refer to the Box 1 and Figure 1 in Germanov et al. (2018).

Large pieces of litter, in particular plastics, affect wildlife primarily via entanglement and ingestion (e.g. Derraik 2002, Gregory 2009), although recent experimental studies describe toxicological effects of smaller pieces of debris at environmentally relevant concentrations in higher vertebrates (e.g. Talsness et al. 2009, Teuten et al. 2009, Whitacre 2012, Rochman et al. 2013, Rochman 2015, Avio et al. 2017).

Entanglement in macroplastics can restrict the movement of marine mammals and other megavertebrates and, in the worst instances, lead to their deaths, sometimes via a protracted process of increasing debilitation (Baulch & Perry 2014; Moore & van der Hoop 2012; van der Hoop et al. 2017). Similarly, ingestion can cause blockages and serious damage to the gastro-intestinal tract which can also lead to death (e.g. Denuncio et al. 2011, Brandao et al. 2011, Di Beneditto & Ramos 2014, Deudero et al. 2017).

Smaller particles of plastic and litter in general, and in particular microplastics, can be ingested (or aspired) by organisms of all sizes, from plankton to humans. These particles have been detected in all marine environments (Barnes et al. 2009) and also enter the human food chain (Mathalon & Hill 2014).

Floating marine macrolitter, only constitutes a small portion of the plastic in the world's oceans (e.g. Cózar et al. 2015) and it is not yet possible to fully estimate the magnitude of oceanic marine litter pollution (Worm 2015). Nonetheless, it is now recognised as a critical threat to marine fauna (Thompson et al. 2014) and, accordingly, marine litter is included in several national and international regulations (e.g. Thompson et al. 2009b, Löhr et al. 2017). These include the EU Marine Strategy Framework Directive (MSFD 2008/56/EC), with Descriptor 10 specifically focussing on marine litter (Galgani et al. 2013), amongst other legal measures[6,7,8].

Scientific research on interactions between marine debris and cetaceans has been growing, with increasing information and data available, and a more than sevenfold rise in the number of reported ingestion events in the last 50 years (Baulch & Perry 2014). There is also a concomitant increase in the number of cetacean species recorded to have ingested or been entangled in debris (Denuncio et al. 2011, Poeta et al. 2017).

In this work we present a review of available information on the number of species in which impacts of plastic debris and, more generally, marine litter have been documented in terms of both ingestion and entanglement. The most relevant types of debris affecting cetaceans are discussed in an effort to provide a comprehensive overview on the issue and inform appropriate mitigation and conservation decisions.

III. Methods

Information on the type of interaction (ingestion and/or entanglement) and type of litter (micro-, meso- and macrolitter and further details were available) were obtained through a content review of available sources such as peer-reviewed scientific papers and reports as well as other scientific grey literature and built upon previous reviews on the topic (e.g. Laist 1987, 1997, Walker & Coe 1990, Simmonds 2012, Baulch & Perry 2014, Poeta et al. 2017). Furthermore, given that many of the species impacted by marine litter are charismatic species *par excellence*, such as whales, sea turtles and birds, we have also investigated public and media attention to the issue by monitoring the evolution of web

[6] Marine Litter Legislation: A Toolkit for Policymakers (https://goo.gl/Zc588N)
[7] Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change (https://goo.gl/nSMzxw)
[8] International Law and Marine Plastic Pollution - Holding Offenders Accountable (https://goo.gl/484U2w)

searches of two simple terms, "*plastic*" and "*ocean*", during the time period between January 2004 and the present.

IV. Results and discussion

We reviewed 182 sources, the great majority being scientific peer reviewed articles. Published papers from the last 5 decades that provide specific details on the occurrence of interactions between marine litter and cetaceans, reveal a strong positive trend (Figure1). A similar pattern can be observed in the evolution of web searches of two terms "*plastic*" and "*ocean*" during the last 14 years (Figure 2). Both media coverage and public perception and concerns over marine plastics pollution and its detrimental effects on the oceans has greatly increased.

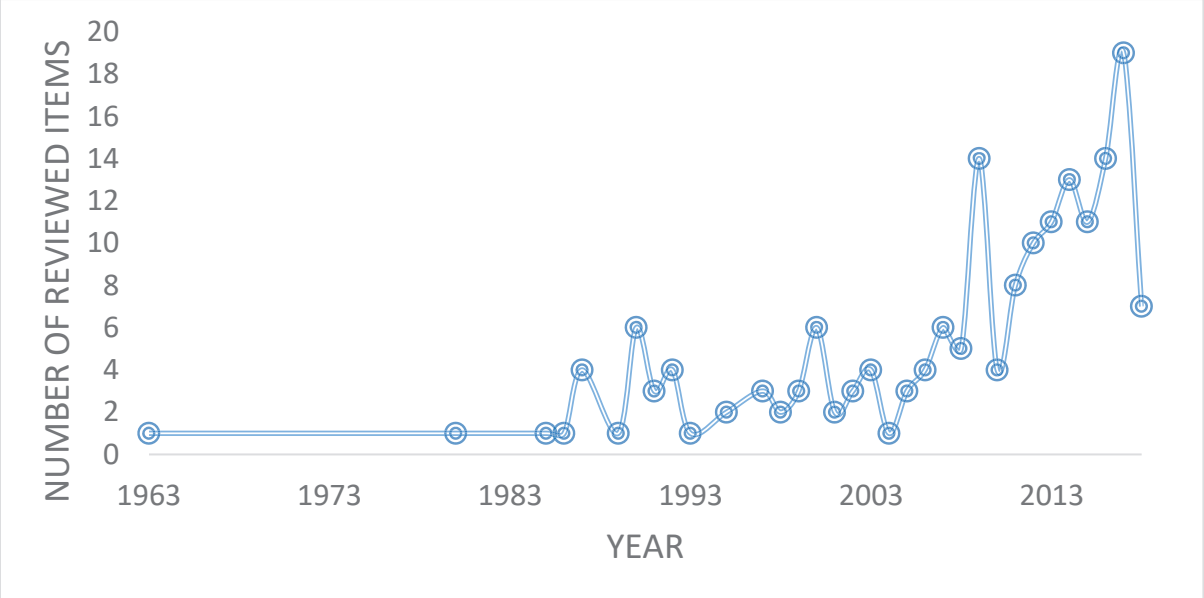

Fig. 1 - Evolution of number of published accounts reviewed in this paper and reporting interactions between marine debris and cetaceans during the time period 1963- March 2018.

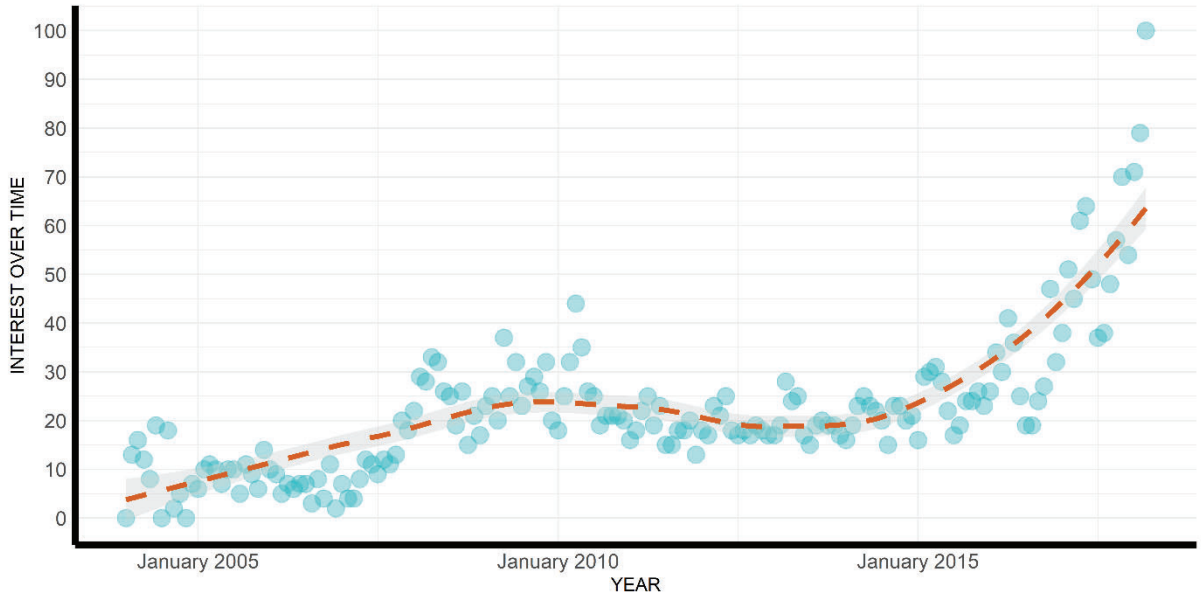

Fig. 1 - Evolution of web searches for the terms "*plastic*" and "*ocean*" during the time period between January 2004 and the present. Numbers represent search interest relative to the highest point on the chart. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means that there was not enough data for this term. Data source: Google Trends (www.google.com/trends).

Overall, 69 (77.5%) of the 89 cetacean species officially recognised by the International Union for the Conservation of Nature (IUCN)[9] and the Society for Marine Mammalogy (SMM)[10] have been reported to be in some way affected by marine debris pollution (either by ingestion or entanglement). A higher number of species seem to be impacted by entanglement (n=60; 67.4%) rather than ingestion (n=48; 53.9%), with macrolitter representing the main issue for all Families. Microlitter shows the highest reported incidence in the Balaenopteridae Family, while the Delphinidae seems to be particularly affected by meso and macrolitter. This variation can most likely be explained by the species' different feeding behaviours. To date, the Families (together only accounting for four species), that are not reported to be affected in any way by marine litter are *Lipotidae*, *Monodontidae* and *Platanistidae*. A summary of the collated information presented per Family is shown in Table 1 while the complete list of species along with the source of information used in the review process is presented in Annex I (Table S1).

[9] http://www.iucn-csg.org/index.php/2017/12/15/2017-cetacean-red-list-update/
[10] https://www.marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/

Tab. 1 – Summary of the number of Families of Cetaceans and the number of Species per Family impacted by marine debris. MD= Marine Debris; Ing.= Ingestion; Ent.= Entanglement; Micro.= Microlitter; Meso.= Mesolitter; Macro.= Macrolitter.

	SPECIES PER FAMILY AFFECTED BY:					
Family (Species per Family)	**MD %)**	**Ing. (%)**	**Ent. (%)**	**Micro. (%)**	**Meso. (%)**	**Macro. (%)**
Balaenidae (4)	3 (75)	3 (75)	3 (75)	0 (0)	0 (0)	3 (75)
Balaenopteridae (8)	6 (75)	5 (62.5)	6 (75)	2 (25)	2 (25)	6 (75)
Delphinidae (38)	33 (86.8)	18 (47.4)	32 (84.2)	1 (2.6)	10 (26.3)	33 (86.8)
Eschrichtiidae (1)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	1 (100)
Iniidae (1)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)
Kogiidae (2)	2 (100)	2 (100)	2 (100)	0 (0)	1 (50)	2 (100)
Lipotidae (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Monodontidae (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Neobalaenidae (1)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)
Phocoenidae (7)	6 (85.7)	4 (57.1)	6 (85.7)	0 (0)	3 (42.9)	6 (85.7)
Physeteridae (1)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)
Platanistidae (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Pontoporiidae (1)	1 (100)	1 (100)	0 (0)	1 (100)	1 (100)	1 (100)
Ziphiidae (21)	14 (66.7)	13 (61.9)	7 (33.3)	1 (4.8)	6 (28.6)	12 (57.1)
Grand Total (89)	**69 (77.5)**	**48 (53.9)**	**60 (67.4)**	**6 (6.7)**	**24 (27)**	**67 (75.3)**

Evidence suggests an increase in the number of cases reported per species, with a concomitant increase in the number of cetacean species recorded to have ingested debris. As an example, Baird & Hooker (2000) describe 26 species of whales and dolphins as having been affected by marine litter as do Denuncio et al. (2011). A few years later, however, Baulch & Perry (2014) describe 48 (56% of) species as known to be affected. Then, 61.5% are reported by Kühn et al. (2015) and 70 (79.5%) species by Poeta et al. (2017). These last figures (from the most recent review) match closely with our results. As a matter of caution, it is important to highlight that this drastic increase is due in part also to a rise in the number of reports and papers available which includes specific descriptions of the presence and occurrence of plastics and debris in general. We can expect that observer effort will have changed over time with more attention being paid to the issue.

When available, temporal analyses of interactions between cetaceans and marine debris show clear patterns and differences amongst regions and species. Ceccarelli (2009), for example, shows that most of the cetaceans occurring in Australian waters are impacted by debris primarily between June and September, with between 50 and 60% of interactions recorded between June and August involving humpback whales.

Ingestion

The ingestion of debris can have a variety of detrimental health effects including but not limited to:

- laceration or ulceration of the gastro-intestinal tract, leading to infection and internal bleeding;
- direct blockage of the digestive tract, reducing or preventing nutrient uptake;
- satiation (i.e. reducing the urge to feed);
- failure of digestive tract compartmentalization, allowing highly acidic gastric secretions into areas not adequately shielded; and
- retention, leading to an increasing amount of debris in the digestive system of the organism.

Once ingested, sharp debris can puncture the lining of the digestive system and cause ulceration, persistent lesions, secondary infections and parasitism and inflammation of the surrounding tissues (Gregory 1991), leading to reduced fitness and disease. Gastrointestinal blockages due to ingesting non-food items have often been reported (e.g. Laist 1997, Derraik 2002), with such blockages causing malnutrition, starvation, and gastric rupture (e.g. Stamper et al. 2006, Jacobsen et al. 2010, de Stephanis et al. 2013). In general, regardless of the species, debris in the digestive tract, particularly the stomach, may lead to a false sense of satiation, reducing the animal's urge to feed properly (e.g. Secchi & Zarzur 1999).

As previously suggested (e.g. Simmonds 2012, Baulch & Perry 2014, Poeta et al. 2017), plastics, especially plastic bags, wrappers, plastic sheets, fragments of large plastic containers and to a lesser extent plastic bottles, represent the type of plastic item most frequently ingested by cetaceans.

The available information suggests that some types of marine debris may be especially problematic. For example, items linked to fishing activities, such as portions of ropes, nets, lines and hooks constitute a substantial portion of ingested debris (Simmonds 2012, 2017, Baulch & Perry 2014, Poeta et al. 2017, Lusher et al. 2018). Similarly, lethal cases, where plastic bags fully occluded gastrointestinal passages or filled up stomach cavities, are reported worldwide (e.g. Secchi & Zarzur 1999).

While examples exist where large cetaceans, mainly sperm whales and some large mysticetes, have been found with large hard pieces of plastic in their stomach (e.g. Unger et al. 2016), such as car parts, these events remain uncommon.

Recent investigations (Lusher et al. 2015, 2018) reviewing the current and historical incidence of marine debris in cetaceans stranded and bycaught in Irish waters, show that deep-diving offshore species such as True's and Cuvier's beaked whales ingest significantly more plastics than those species inhabiting coastal or shallower areas. Simmonds (2012) and Baulch & Perry (2014) in their earlier reviews also came to similar conclusions, suggesting that deep-diving cetaceans such as sperm and beaked whales could be more vulnerable than other species to the ingestion of marine debris.

Differences in the ingestion of marine debris by coastal species of sympatric dolphins of the same taxonomic group and trophic level have also been reported (Di Beneditto & Ramos 2014, Di Beneditto & Awabdi 2014). Similarly, variations in the amount, type and rate of ingestion of debris between estuarine and oceanic dolphins have been recently reported (Denuncio et al. 2011). Clearly habitat preferences, diving and feeding behaviour - as well as the "behaviour" and position of debris in the water column - affect the amount, type and rate of ingestion with clear differences amongst species.

Filter feeding species are reported to be mostly affected by the unintentional ingestion of microplastics, and microdebris, most likely through ingestion associated with lunge feeding or possibly as a result of trophic transfer through their prey. Fin whales in the Mediterranean Sea seem to be particularly vulnerable to microplastics because of direct ingestion and consumption of contaminated prey, with the potential impact of microplastics in this region being far greater that other areas, for example in the Sea of Cortez (e.g. Fossi et al. 2012, 2014, 2016, 2017b). Other species of mysticete that seems to be affected by microplastics include, but are not limited to, minke and sei whales (Baulch & Perry 2014) and humpback whales (Besseling et al. 2015). The latter seems to be the most impacted species in Australian waters (Ceccarelli 2009). There, deaths and injuries of 14 species of cetaceans could be attributed directly to interactions with plastic debris between 1998 and 2008, with humpback whales dominating the available records. In terms of ingestion, Ceccarelli (2009) despite reporting only 9 known cases between 1998 and 2008, suggests that this value does not necessarily reflect the rarity of the phenomenon.

In many areas, even including where there are strandings networks, data are scant or missing mostly due to the fact that marine debris has only relatively recently started to be considered an issue of conservation concern. Many studies, while investigating in depth the potential causes of strandings, do not give any specific detail on ingested plastic unless this was considered the primary cause of

death. The lack of information may also reflect the decreasing frequency with which necropsies have been carried out over recent years in some areas (Ceccarelli 2009).

Although the effects of microplastic on baleen whales yet have to be fully understood, and despite not being reported yet for most whale species, it may still be of particular concern and we recommend it should be studied alongside ingestion of macroplastics. Filter-feeders also seem potentially susceptible to large sheets of plastic debris that can become entangled in their baleen (Lambertsen et al. 2005), which may partially limit food intake.

Entanglement

Entanglement in marine debris is a global concern that is known to affect a large number of marine species (e.g. Macfadyen et al. 2009, NOAA Marine Debris Program. 2015). In the United States alone there have been at least 104 accounts of cetaceans impacted by plastic debris through entanglement or ingestion since 1998; of these, the vast majority (92.2%) relate to entanglement.

Fishing gear, including at least some abandoned, lost or otherwise discarded fishing gears (ALDFG), constitutes the vast majority of baleen whale entanglements. The majority of entanglement records are related to direct, incidental or by-catch events during active fishing activity, rather than entanglement in marine debris (e.g. Laist 1997, Butterworth et al. 2012, Baulch & Perry 2014). Nonetheless, diverse ALDFGs appear to pose a serious entanglement risks.

The rate and number of entanglements in marine debris are generally difficult to decipher. Very high numbers of reports do not differentiate between ALDFGs, active fishing gear, or any other marine debris, and usually describe the cause of the entanglement as “Unknown” when clearly not attributable to active fishing gears (e.g. Johnson 1989, Johnson et al. 2005, Neilson et al. 2009). Evidence suggests that entanglement of cetaceans in marine debris has increased dramatically in recent decades (e.g. Laist 1997, Simmonds 2012, Baulch & Perry 2014). However, data are insufficient to quantify trends.

Baleen whales with entanglement records that have clearly been attributed to marine debris include, but are not limited to, humpback, North Atlantic right, minke, gray, fin and bowhead whales (e.g. Laist 1997, Simmonds 2012, Baulch & Perry 2014), with the sources of entanglement being mostly line and net fragments attached through the mouth or around the tail and flippers. Southern right whales are also considered at high risk of entanglement due to their tendency to aggregate inshore, but available records are very few (Ceccarelli 2009). Odontocete species where marine debris entanglement has been shown are the sperm whale, the bottlenose dolphin, the harbour porpoise, and the Dall’s

porpoise, with most entanglements involving monofilament line, net fragments, or ropes attached to the animals' appendages.

Relevant debris that might be targeted for cetacean conservation

Whale and dolphin strandings provide a unique opportunity to assess the rates, extents and volumes of interaction with marine debris, even though the presence of litter might not be the primary cause of mortality. However, there are problems in the frequency and geographical extent of detailed reports specifying whether or not debris was identified and the type of debris involved in interactions with wildlife. This is particularly true for older accounts where, usually, the presence of plastic, and debris in general, when reported, was just mentioned rather than properly accounted for. Only relatively recently have detailed descriptions of items ingested by cetaceans started to be made available.

Lusher et al. (2018) provide a detailed list of items found in cetaceans stranded or by-caught in Ireland between 1990 and 2015, most of them being fibres rather than fragments. Plastic bags and portions of large plastic sheets were by far the most commonly identified items (Table S1 in Annex II).

Unger et al. (2016, 2017) report on gastrointestinal contents of sperm whales and harbour porpoises respectively, stranded along the coast of the North Sea and from German waters. In both cases, fishery related items, such as filaments, portions of ropes and nets, including monofilament netting, were the most abundant items along with plastic pieces and in general plastic bags and plastic sheeting (Table S2 and S3 in Annex II).

de Stephanis et al. (2013) in their review of debris found in stranded sperm whale describe 15 cases of ingestion of marine debris between 1895 and 2013 with most of the items being of plastic/rubber origin including plastic bottles, bags, large amounts of plastic sheets, portions of nets and lines. In the one Mediterranean sperm whale necropsied by de Stephanis et al. (2013) the largest amount of litter originated from greenhouse cover material with pieces ranging between 0.04 and 5.55 grams and amounting to a total area of 29.94 m^2. For two sperm whales stranded along the northern California coast Jacobsen et al. (2010) report large amounts of fishing related items and plastic bags. In particular, one animal had a ruptured stomach and the other was emaciated, and gastric impaction was suspected as the cause of both deaths. Overall, 134 different types of fragments and pieces of nets were found in these two animals, all made of floating material, varying in size from 10 cm^2 to about 16 m^2. Other findings included a variety of plastic garbage bag scraps and one large bag woven of narrow plastic strips.

Despite the scarcity of available information and the lack of detailed reports, evidence clearly suggests plastic bags, sheeting, food wrappers, portions of plastic bottles, disposable plates, cups, and miscellaneous broken pieces of polystyrene are the most frequently observed marine debris found in stranded cetaceans. Portions of nettings, fishing gear, floats, monofilament lines and hooks are the most commonly found fishery related items.

Identifying the origin of marine debris is a challenging process that increases the complexity of better understanding the nature of the interactions between cetaceans and marine debris. While for some items it is easier to identify their source and reconstruct the transportation processes (e.g. de Stephanis et al. 2013, Lusher et al. 2015, 2018), in the case of microplastics, we cannot infer the sources in the same way as with at least some macrodebris.

Patterns, including geographical and temporal differences in the occurrence and types of debris also emerge from the available literature. Marine litter occurs in different areas at different concentrations and quantities; moreover, the behaviour, transportability and position of each single item in the water column varies considerably. The number of species affected by each type of debris varies accordingly. In the Mediterranean Sea, recent studies suggest that the highest plastic concentrations are found in regions distant from land as well as in the first kilometre adjacent to the coastline. As expected, plastic concentrations are significantly higher in the vicinity of large human settlements (e.g. Pedrotti et al. 2016, 2018). The great accumulation of floating plastic in the Mediterranean Sea (Cózar et al. 2015) is clearly related to the high human pressure and the complex hydrodynamic characteristics of the basin (Suaria et al. 2016, Avio et al. 2017).

An increasing number of studies investigate the type of interactions between marine fauna and debris in the Mediterranean covering an ever-growing list of species that in some way are affected by this issue (e.g. Campani et al. 2013, Codina-García et al. 2013, Deudero & Alomar 2015, Romeo et al. 2015, Alomar et al. 2016, Deudero et al. 2017). Nonetheless, a full understanding of the impacts of litter, in particular plastic, remains poor (Fossi et al. 2017b). Given the general biological richness of the region (Coll et al. 2010), along with the occurrence of cetacean species of conservation concern (Notarbartolo di Sciara 2016), the effects of marine debris, in particular plastics, are expected to be of particular concern (Avio et al. 2017). Overall, in the Mediterranean Region, the sperm, fin and Cuvier's beaked whales, the common bottlenose, Risso's and striped dolphins have been reported to have ingested marine litter to some extent (Viale et al. 1992, Roberts 2003, Katsanevakis 2008, Levy et al. 2009, Mazzariol et al. 2011, Cañadas 2012, de Stephanis et al. 2013, Baulch & Perry 2014, Fossi et al. 2014, 2017a, Baini et al. 2017).

The large number of factors determining the magnitude of interactions between wildlife and marine debris (e.g. population size and distributions of species, behavioural traits, distributions and conduct of nearby fisheries and sizes of nearby urban centres, ocean currents, weather patterns etc.) contribute to the difficulty in obtaining accurate estimates of trends in debris-based mortality rates.

It is therefore essential, in the first place, to conduct as many necropsies as possible on stranded animals using standardised necropsy protocols shared at all spatial scales as previously suggested within the IWC (e.g. Section 3.4 in IWC 2013 and IWC 2014), ACCOBAMS, ASCOBANS (Marine Debris Working Group 2013), amongst others.

If data are not collected in a standardised or consistent manner, with a lack of homogeneity in sampling protocols between regional organisations, then information cannot be adequately compared or reviewed to accurately quantify impacts at both local and regional scales. The development of and sharing of national stranding information is of critical importance if a more detailed examination of all available evidence is to be made, including better understanding the magnitude of impacts. Despite the availability of many national and regional examples[11,12,13,14], a single unified protocol has only very recently been proposed for harbour porpoises (Franeker et al. 2018).

Furthermore, the application of a systematic classification of marine debris found ingested by or entangling cetaceans is essential to allow improved understanding of its sources, distribution, and impacts, and to allow the development of potential monitoring, mitigation and conservation actions. As previously suggested, especially for those species able to produce and use echolocation clicks, mechanisms other than involuntary ingestion during feeding activity might be responsible for the swallowing of marine debris (e.g. Walker & Coe 1990). As an instance, it has been suggested that the bottom feeding habits of sperm whales could explain the tendency of this species to ingest a variety of debris, including sand, rocks, coconuts and other debris (e.g. Nemoto and Nasu 1963), elevating its risk of involuntary fatal ingestion of litter than other cetacean species. Conversely, findings from Jacobsen et al. (2010) highlight how the very same species would ingest debris, in particular discarded or abandoned nettings, found near or at the surface. This evidence, therefore suggests that both unintentional ingestion and other behaviour leading to ingestion may be important in the same species.

[11] https://bit.ly/2HUfiAL
[12] https://bit.ly/2G3lmX2
[13] https://bit.ly/2pyNRpx
[14] https://bit.ly/2GiiNDW

Including information such as debris' physical nature – for example, colour (which may affect its visibility), flexibility, rigidity and presence of sharp edges, size, strength, density, shape/aspect ratio, will help in understanding the process of debris ingestion. Similar work, such as the effect of visual cues – is in progress for marine turtles (Schuyler et al. 2012, 2014). In addition, the physical nature of the debris may give clues as to where it might have originated in the water column.

V. Conclusions

We note that better understanding and mitigating the impacts of marine debris pollution specifically on cetaceans and, in general, on wildlife will require a multi-disciplinary approach delivered across different spatial and temporal scales. So here we present a series of priority research questions (building on those developed by Vegter and colleagues, 2014):

1. What are the impacts of plastic pollution on the physical condition of key marine habitats?
2. What are the impacts of plastic pollution on trophic linkages?
3. How does plastic pollution contribute to the transfer of non-native species?
4. What are the species-level impacts of plastic pollution, and can they be quantified?
5. What are the population-level impacts of plastic pollution, and can they be quantified?
6. What are the impacts of wildlife entanglement?
7. How will climate change influence the impacts of plastic pollution?
8. What, and where, are the main sources of plastic pollution entering the marine environment?
9. What factors drive the transport and deposition of plastic pollution in the marine environment, and where have these factors created high concentrations of accumulated plastic?
10. What are the chemical and physical properties of plastics that enable their persistence in the marine environment?
11. What are some standard approaches for the quantification of plastic pollution in marine and coastal habitats?
12. What are the barriers to, and opportunities for, delivering effective education and awareness strategies regarding plastic pollution?
13. What are the economic and social effects of plastic pollution in marine and coastal habitats?
14. What are the costs and benefits of mitigating plastic pollution, and how do we determine viable mitigation options?
15. How can we improve data integration to evaluate and refine management of plastic pollution?
16. What are the alternatives to plastic?

Finally, in conclusion, and based mainly on the recommendations of the recent series of workshops on marine debris (IWC 2013, 2014; Marine Debris Working Group 2013), and in line with the suggestions made in Lusher et al. (2015) and Fossi et al. (2017a), we recommend:

- The dissemination of standard post mortem protocols to support collection of data on marine debris ingestion/entanglement (see for example those developed by the first IWC debris workshop);
- Collation of rates of debris ingestion and entanglements in stranded/bycaught cetaceans via national progress reports, for example as provided to the IWC (and/or other reporting mechanisms) and addition to a suitable database (this might be combined with the IWC 'large whale entanglement' database);
- Further development and application of methods to determine whether fishing gear was active or discarded when entanglement occurred (for a discussion see Bernaldo de Quirós et al. 2018);
- Analysis to identify potential hotspot areas for cetacean entanglement and ingestion of marine debris, for example through ecological risk assessment methods or other mapping and modelling approaches (e.g. Schuyler et al. 2016, Currie et al. 2017; Darmon et al. 2017, Koelmans et al. 2017); and
- Further investigation of the impacts of debris ingestion and entanglement at an individual and population level, including that of microplastics.

In terms of whether particular types of marine debris should be targeted to help mitigate the threat to cetaceans, there seems to be no clear signal in the current literature pointing towards a focused action beyond urgently trying to stop all forms of plastics entering the seas and oceans. However, the high level of ingestion of 'greenhouse-related' waste reported from one sperm whale (de Stephanis et al. 2013) certainly makes a case that localised escapes or discharges of such materials into important habitat areas should be halted.

VI. References

Please refer to ANNEX III

ANNEX I

Index	Family	Scientific Name	Common Name	Ingestion	Entanglement	Microlitter	Mesolitter	Macrolitter
1	Balaenidae	Balaena mysticetus	bowhead whale	X	X	-	-	X
2	Balaenidae	Eubalaena australis	southern right whale	X	X	-	-	X
3	Balaenidae	Eubalaena glacialis	North Atlantic right whale	X	X	-	-	X
4	Balaenidae	Eubalaena japonica	North Pacific right whale	-	-	-	-	-
5	Balaenopteridae	Balaenoptera acutorostrata	Common minke whale	X	X	-	X	X
6	Balaenopteridae	Balaenoptera bonaerensis	Antarctic minke whale	-	-	-	-	-
7	Balaenopteridae	Balaenoptera borealis	sei whale	-	X	-	-	X
8	Balaenopteridae	Balaenoptera edeni	Bryde's whale	X	X	-	-	X
9	Balaenopteridae	Balaenoptera musculus	blue whale	X	X	-	-	X
10	Balaenopteridae	Balaenoptera omurai	Omura’s whale	-	-	-	-	-
11	Balaenopteridae	Balaenoptera physalus	fin whale	X	X	X	-	X
12	Balaenopteridae	Megaptera novaeangliae	humpback whale	X	X	X	X	X
13	Delphinidae	Cephalorhynchus commersonii	Commerson's dolphin	-	X	-	-	X

14	Delphinidae	Cephalorhynchus eutropia	Chilean dolphin	-	X	-	-	X
15	Delphinidae	Cephalorhynchus heavisidii	Heaviside's dolphin	-	X	-	-	X
16	Delphinidae	Cephalorhynchus hectori	Hector's dolphin	-	-	-	-	-
17	Delphinidae	Delphinus capensis	long-beaked common dolphin	-	-	-	-	-
18	Delphinidae	Delphinus delphis	common dolphin	X	X	-	X	X
19	Delphinidae	Feresa attenuata	pygmy killer whale	-	X	-	-	X
20	Delphinidae	Globicephala macrorhynchus	short-finned pilot whale	X	X	-	-	X
21	Delphinidae	Globicephala melas	long-finned pilot whale	X	X	-	X	X
22	Delphinidae	Grampus griseus	Risso's dolphin	X	X	-	-	X
23	Delphinidae	Lagenodelphis hosei	Fraser's dolphin	X	X	-	X	X
24	Delphinidae	Lagenorhynchus acutus	Atlantic white-sided dolphin	-	X	-	-	X
25	Delphinidae	Lagenorhynchus albirostris	white-beaked dolphin	X	X	-	-	X
26	Delphinidae	Lagenorhynchus australis	Peale's dolphin	-	X	-	-	X
27	Delphinidae	Lagenorhynchus cruciger	hourglass dolphin	-	-	-	-	-

28	Delphinidae	Lagenorhynchus obliquidens	Pacific white-sided dolphin	X	X	-	X	X
29	Delphinidae	Lagenorhynchus obscurus	dusky dolphin	-	X	-	-	X
30	Delphinidae	Lissodelphis borealis	northern right whale dolphin	X	X	-	X	X
31	Delphinidae	Lissodelphis peronii	southern right whale dolphin	-	X	-	-	X
32	Delphinidae	Orcaella brevirostris	Irrawaddy dolphin	X	X	-	-	X
33	Delphinidae	Orcaella heinsohni	Australian snubfin dolphin	-	X	-	-	X
34	Delphinidae	Orcinus orca	killer whale	X	X	-	-	X
35	Delphinidae	Peponocephala electra	melon-headed whale	-	X	-	-	X
36	Delphinidae	Pseudorca crassidens	false killer whale	X	X	-	X	X
37	Delphinidae	Sotalia fluviatilis	Tucuxi	X	-	-	X	X
38	Delphinidae	Sotalia guianensis	Guiana dolphin	X	X	X	X	X
39	Delphinidae	Sousa chinensis	Indo-Pacific humpbacked dolphin	-	X	-	-	X
40	Delphinidae	Sousa plumbea	Indian Ocean humpback dolphin	-	-	-	-	-
41	Delphinidae	Sousa sahulensis	Australian humpback dolphin	-	-	-	-	-
42	Delphinidae	Sousa teuszii	Atlantic humpback dolphin	-	X	-	-	X
43	Delphinidae	Stenella attenuata	pantropical spotted dolphin	X	X	-	-	X
44	Delphinidae	Stenella clymene	clymene dolphin	-	X	-	-	X

45	Delphinidae	Stenella coeruleoalba	striped dolphin	X	X	-	-	X
46	Delphinidae	Stenella frontalis	Atlantic spotted dolphin	X	X	-	-	X
47	Delphinidae	Stenella longirostris	spinner dolphin	-	X	-	-	X
48	Delphinidae	Steno bredanensis	rough-toothed dolphin	X	X	-	X	X
49	Delphinidae	Tursiops aduncus	Indo-Pacific bottlenose dolphin	-	X	-	-	X
50	Delphinidae	Tursiops truncatus	Common bottlenose dolphin	X	X	-	X	X
51	Eschrichtiidae	Eschrichtius robustus	gray whale	X	X	-	-	X
52	Iniidae	Inia geoffrensis	Boto	-	X	-	-	X
53	Kogiidae	Kogia breviceps	pygmy sperm whale	X	X	-	X	X
54	Kogiidae	Kogia sima	dwarf sperm whale	X	X	-	-	X
55	Lipotidae	Lipotes vexillifer	Baiji	-	-	-	-	-
56	Monodontidae	Delphinapterus leucas	white whale	-	-	-	-	-
57	Monodontidae	Monodon monoceros	Narwhal	-	-	-	-	-
58	Neobalaenidae	Caperea marginata	pygmy right whale	-	X	-	-	X
59	Phocoenidae	Neophocaena asiaeorientalis	Narrow-ridged finless porpoise	-	-	-	-	-
60	Phocoenidae	Neophocaena phocaenoides	finless porpoise	X	X	-	X	X
61	Phocoenidae	Phocoena dioptrica	spectacled porpoise	-	X	-	-	X
62	Phocoenidae	Phocoena phocoena	harbour porpoise	X	X	-	X	X
63	Phocoenidae	Phocoena sinus	Vaquita	-	X	-	-	X

64	Phocoenidae	Phocoena spinipinnis	Burmeister's porpoise	X	X	-	-	X
65	Phocoenidae	Phocoenoides dalli	Dall's porpoise	X	X	-	X	X
66	Physeteridae	Physeter macrocephalus	sperm whale	X	X	X	X	X
67	Platanistidae	Platanista gangetica gangetica	South Asian river dolphin	-	-	-	-	-
68	Pontoporiidae	Pontoporia blainvillei	Franciscana	X	-	X	X	X
69	Ziphiidae	Berardius arnuxii	Arnoux's beaked whale	-	-	-	-	-
70	Ziphiidae	Berardius bairdii	Baird's beaked whale	X	-	-	X	X
71	Ziphiidae	Hyperoodon ampullatus	northern bottlenose whale	X	X	-	X	X
72	Ziphiidae	Hyperoodon planifrons	southern bottlenose whale	-	-	-	-	-
73	Ziphiidae	Indopacetus pacificus	Longman's beaked whale	X	X	-	-	X
74	Ziphiidae	Mesoplodon bidens	Sowerby's beaked whale	X	-	-	X	X
75	Ziphiidae	Mesoplodon bowdoini	Andrews' beaked whale	-	-	-	-	-
76	Ziphiidae	Mesoplodon carlhubbsi	Hubbs' beaked whale	X	X	-	-	X
77	Ziphiidae	Mesoplodon densirostris	Blainville's beaked whale	X	-	-	X	X
78	Ziphiidae	Mesoplodon europaeus	Gervais' beaked whale	X	-	-	-	X

79	Ziphiidae	Mesoplodon ginkgodens	ginkgo-toothed beaked whale	X	-	-	-	-
80	Ziphiidae	Mesoplodon grayi	Gray's beaked whale	X	X	-	-	X
81	Ziphiidae	Mesoplodon hectori	Hector's beaked whale	-	-	-	-	-
82	Ziphiidae	Mesoplodon layardii	strap-toothed whale	-	-	-	-	-
83	Ziphiidae	Mesoplodon mirus	True's beaked whale	X	-	X	-	X
84	Ziphiidae	Mesoplodon perrini	Perrin's beaked whale	-	-	-	-	-
85	Ziphiidae	Mesoplodon peruvianus	pygmy beaked whale	-	X	-	-	X
86	Ziphiidae	Mesoplodon stejnegeri	Stejneger's beaked whale	X	X	-	X	X
87	Ziphiidae	Mesoplodon traversii	spade-toothed whale	-	-	-	-	-
88	Ziphiidae	Tasmacetus shepherdi	Shepherd's beaked whale	X	-	-	X	-
89	Ziphiidae	Ziphius cavirostris	Cuvier's beaked whale	X	X	-	-	X

ANNEX II

Table S1 - Incidence of marine debris ingestion by cetaceans recorded in Irish waters (1990-2015). Sex: M: male, F: female; Length in cm; Lat: latitude; Lon: longitude; Loc: location of macrodebris in the digestive tract (O: oesophagus, S: stomachs, I: intestines); PET: Polyethylene terephthalate; MP: microplastics. Diet: E: empty, E1: 1 otolith or beak from small specimen found, Sw: seaweed, M: milk, ++: full, +:1-3 fish, NA: data not available. * Animals with signs of entanglement/by-catch, $ rope around tail stock, and ? fluke mutilation. § animal was not analysed following Lusher et al. (2015) but microplastic fragments were found.

Species	Sex	Length	Date	Lat	Lon	Loc	Type of debris	Diet	Reference
Balaenoptera physalus$ (FW 2/00)	M	1,905	06/12/2000	51,95	-7,77	O	Rope in baleen plates and swallowed. Nylon blue rope	E	Smiddy et al. 2002
Megaptera Novaeangliae	M	600	21/07/2006	53,23	-9,49	S	Piece of clear plastic (300x150mm)	M	Berrow et al. 2007
Mesoplodon bidens	M	452	24/11/2009	53,84	-9,43	S	Small piece of hard plastic (70x40mm)	NA	Berrow et al. 2010
Mesoplodon mirus (TBW 1/97)	F	385	01/06/1997	51,57	-9,00	S	Plastic bags & ice cream wrapper	E	Gassner et al. 2005
Mesoplodon mirus (TBW_2013_077)	F	476	12/05/2013	55,32	-7,34	S	PET (71x22mm) shotgun cartridge	++	Lusher et al. 2015
Mesoplodon mirus (TBW_2013_088)	F	500	27/05/2013	53,42	-10,07	S+I	PET fragment (42x31mm) & MP	++	Lusher et al. 2015

Ziphius cavirostris (CBW_2014_087)	M	575	23/06/2014	52,39	-9,84	S+I	MP	E	This study
Ziphius cavirostris (CBW_2016_001)	F	370	31/12/2015	52,93	-9,35	S+I	2 plastic food bags & many pieces of plastic bags	E	This study
Delphinus delphis (CD 16/03)	M	145	28/11/2003	52,26	-6,34	S	Small piece of nylon rope (50mm)	++	This study
Delphinus delphis* § (CD 3/11)	M	188	12/07/2011	51,9	-8,39	I	3.92x1.54mm & 3.62x1 fragments. Other small fragments.	++	Curran et al. 2014
Delphinus delphis* § (CD 3/13)	M	217	30/01/2013	53,97	-10,19	S	Black piece of debris: (3.6x1.9x1.4mm)	++	This study
Delphinus delphis* (CD 4/13)	M	199	30/01/2013	53,97	-10,08	S	Black plastic (9.01x3.76x2.26mm)	+	This study
Delphinus delphis (CD_2013_074)	F	155	24/04/2013	54,1	-10,07	S+I	MP	++	This study
Delphinus delphis* (CD_2013_131)	M	220	16/08/2013	52,74	-9,53	O+S	Piece of gillnet in mouth. MP	++	This study

Delphinus (CD_2013_154)	delphis	M	210	01/10/2013	52,64	-9,55	S	Plastic bag and lots of seaweed	Sw	This study
Delphinus (CD_2013_156)	delphis	F	202	05/10/2013	52,57	-9,86	S	MP	NA	This study
Delphinus (CD_2013_175a)	delphis	F	181	25/11/2013	54,11	-10,12	S	MP	NA	This study
Delphinus (CD_2013_175b)	delphis	F	207	25/11/2013	54,19	-10,09	S	MP	NA	This study
Delphinus (CD_2014_011)*	delphis	M	160	20/01/2014	53,25	-9,21	S	Plastic nurdle. MP	+	This study
Delphinus (CD_2014_074)	delphis	M	178	11/05/2014	52,74	-9,53	S	MP	NA	This study
Delphinus (CD_2015_038)	delphis*	M	220	30/01/2015	52,77	-9,5	S+I	MP	++	This study
Delphinus (CD_2015_152)	delphis	M	147	17/03/2015	53,17	-9,00	S	MP	NA	This study

Stenella coeruleoalba? (SD_2002_069)	M	168	15/09/2002	51,64	-8,57	O+S	Plastic bags: (40x500-600mm, 130x100mm)	E1	Hernandez-Milian 2014
Stenella coeruleoalba (SD 6/06)	F	134,5	11/10/2006	51,93	-7,86	I	Piece of twine nylon-like with a yellow fragment 1mm	++	This study
Stenella coeruleoalba (SD_2011_096)	M	188	07/09/2011	52,18	-10,41	I	Piece of plastic sheet	E	This study
Stenella coeruleoalba (SD_2014_095)	F	183	14/07/2014	52,78	-9,48	S	MP	NA	This study
Stenella coeruleoalba (SD_2014_128)	F	150	19/10/2014	51.64	-8.57	S	MP	+	This study
Phocoena phocoena (HP 3/96)	F	137	28/02/1996	51,95	-7,72	S	23~15cm white rope	++	This study
Phocoena phocoena (HP 10/97)	M	113,5	14/08/1997	53,33	-6,21	S	Pieces of plastic bags	++	This study
Phocoena phocoena (HP 8/99)	F	169	27/04/1999	53,04	-6,07	S	Plastic shavings & unknown item	++	This study

Phocoena phocoena (HP_2000_033)	F	172	16/08/2000	53,58	-6,1	S+I	White plastic (145x45x5mm), black thread (165mm) & piece of plastic (81.6x70.7mm)	E1	This study
Phocoena phocoena (HP 1/03)	F	122,5	12/01/2003	53,99	-6,12	O	Piece of white plastic bag (150x35mm), black plastic (~35x2mm) & orange twine (140mm)	++	This study
Phocoena phocoena* (HP 2/11)	M	149	22/10/2011	51,86	-8,27	I	Piece of black plastic bag. A piece of rubber.	+	This study
Phocoena phocoena (HP 5/11)	F	158	01/11/2011	51,64	-8,57	S+I	MP	E	This study
Phocoena phocoena (HP_2013_001)	M	126	01/01/2013	52,68	-93,65	S	MP	++	This study
Phocoena phocoena (HP_2013_004)	F	122	10/01/2013	52.75	-9.50	S	MP	E	This study
Phocoena phocoena (HP_2014_051)	UNK	153	30/03/2014	53,42	-6,12	S	MP	E1	This study
Phocoena phocoena (HP_2015_004)	M	160	03/01/2015	52,56	-9,89	S+I	MP	NA	This study

Grampus griseus* (RD 5/97)	F	255	23/07/1997	52,19	-6,53	S	Metal hook	+	This study
Grampus griseus* (RD 1/03)	M	154	23/07/2003	52,16	-6,99	S	Piece of plastic wrap (45x25mm)	M	This study
Orcinus orca (KW 1/01)	F	545	08/07/2001	51,8	-8,3	I	Piece of paint sheet	E	This study
Orcinus orca (KW_2015_031)	F	512	31/01/2015	52,16	-7,14	S+I	MP	E	Hernandez-Milian et al. 2017
Tursiops truncatus (BND_2005_043)	M	340	26/04/2005	53,12	-9,67	S	Plastic bag (200x150mm), canvas (100x200mm)	++Sw	O'Brien & Berrow 2006
Tursiops truncatus (BND_2013_150)	F	177	20/09/2013	52,61	-9,71	S	MP	NA	This study
Tursiops truncatus (BND_2014_141)	M	252	28/11/2014	51.91	-7.9	S	MP	+	This study

Table S2 - List of all marine debris findings in sperm whales stranded in Germany (GER), The Netherlands (NET), the United Kingdom (UK) and France (FRA). In some cases the material could be identified: Polyethylene (PE), Polypropylene (PP), Polyvinyl chloride (PVC) and Polyamide (PA).

Animal no.	Locality in body	Debris items	Size (cm)/diametre (cm)	Material	Comment	Total weight (kg)
GER-02	Stomach (1. Compartement)	Net	250 × 150/0.4: mesh size: 8	PE		2
		Foil	0.9 × 0.2			
		Wood (3)	Between 0.8 × 0.25–0.13 × 0.6			
GER-04	Stomach (1. Compartement)	Rope	98 × 1.5	PP, PE		0.22
		Foil	9 × 9			
		Duct tape	2.9 × 1.6			
		Thread	3.3			
GER-06	Stomach (1. Compartement)	Net	1355 × 1.2/0.3; mesh size: 5	PE	Most likely protection net (shrimp fishery)	
		Net	156 × 0.51/0.1; mesh size: 3		Most likely protection net (shrimp fishery)	10.53
		Net	42/0.2; mesh size: 8	PE	Most likely protection net (shrimp fishery)	
		Netting yarns (30)	Between 3.4 × 0.4 and 169 × 0.6			
		Rope	441 × 0.4		Longline rope	
		Strapping tapes (3)	between 5 and 15 × 0.5 and 20 × 0.5			
		Coffee capsule	Diametre: 3			
		Monofilaments (66)	Between 1.1 and 16.6			
		Foil	8.6			
	Stomach (2. Compartement)	Net	46.5 × 24.5/0.6; mesh size: 10	PE	Most likely protection net (shrimp fishery)	0.078
		Foils (9)	Between 3.3 × 2.3 and 26 × 14.7			
		Screw-cap	Diametre: 7	PP		
		Plastic tube	18.1 × 1			
		"Snickers" wrap	13.4 × 9.3			
		Netting yarn	43.3 × 0.3			
		Strapping tape	30.7			
		Monofilaments (64)	Between 0.9 and 15.9			
		Plastic piece	1 × 0.6			
	Stomach (n.d.)	Plastic cap	1.7/0.7			0.016
		Netting yarn	5.7 × 0.1			
		Woods (3)	0.7–1.5 × 0.3			
		Plastic bag	3.3 × 1.2	PE	Part of a plastic bag (suture)	
		Plastic pieces (8)	Between 2 × 2.1 and 8.3 × 0.1			
		Netting yarns (4)	Between 13 × 0.3 and 21.5 × 0.4/0.5			
		Rope	9.3/1.4			
GER-07	Jaw/Mouth	Thread	161		Synthetic material (flame test)	0.002
GER-15	Stomach (1. Compartement)	Car part	68 × 23.5	PP	Engine protection (against wind, ©Ford), one strapping tape and one rope attached	0.66
		Plastic bucket	Diametre: 32			
		Foils (3)	Between 31 × 32.5 and 101.5 × 96	PVC	Agricultural foil	
		Plastic bag	32 × 19	PE	Part of a plastic bag (suture)	
	Pharynx	Plastic part of a bucket	10.8 × 14.5			
NET-01	Stomach (n.d.)	Fish hook	5.6 × 2.1 × 0.18		Used in longline fishery	0.001
NET-02	Stomach (n.d.)	Fragment plastic	13.5 × 7 × 2			0.453
		Ropes (3)	381–1314 × 0.5		Longline ropes	
		Ribbon	7.3 × 0.46		Used for ballons or present wrapping	
		Ropes (7)	Between 22.3 × 0.25 and 168.2 × 0.05		Most likely fishery related	
		Threadball	3.4 × 3.2			
		Foil	17 × 13		Accumulation of foils and bags (suture)	
		Strapping tape	53.4 × 0.51			
		Packaging material	n.a.		Sutures	
		Foil	n.a.		Agricultural foil	
		Sheetlike plastic (4)	Between 28 × 28 × 0.05 and 188 × 83 × 0.02			
UK-01	Stomach	Plastic pieces (2)	2–3			<0.001
FRA-01	Stomach	Plastic bags (2)	55 × 55 and 75 × 30			24.84
		(Cereal bar) wraps	10 × 3			
		Plastic cable	10 × 0.1			
		Strapping tape (4)	Between 4 × 2 and 140 × 1			
		Jute canvas	75 × 60			
		Plastic sheeting	130 × 115			
		Textile lifting strap (3)	Between 170 × 7 and 600 × 7			
		Ropes (13)	Between 45 × 0.8–2000 × 0.8		Rope with plastic sleeve	
		Netting yarns (39)	Between 8 × 0.4 and 280 × 0.5			
		Net (2)	45 × 10 mesh size: 1 - 35 × 8 mesh size: 0.5			
		Bundle of monofilament (3)		PA		

Table S2 – Continued

Animal no.	Locality in body	Debris items	Size (cm)/diametre (cm)	Material	Comment	Total weight (kg)
		Net	105 × 22/1; mesh size: 5			
		Net	200 × 10/0.4; mesh size: 7			
		Net	140 × 50/0.4; mesh size: 14			
		Nets (4)	(total) 466 × 170/0.3 mesh size: 15			
		Net	300 × 140/0.3; mesh size: 15			

Table S3 – Details on findings of marine debris in marine mammals of German waters between 1990 and 2014. SH: Schleswig-Holstein; MWP: Mecklenburg-Western Pomerania; NS: North Sea; BS: Baltic Sea; Ppho: *Phocoena phocoena* (harbour porpoise); Pvit: *Phoca vitulina* (harbour seal); Hgry: *Halichoerus grypus* (grey seal); m: male; f: female; N.A.: Not available. Internal findings are marked in grey, external findings left white. a) marine debris without evidence of tissue alterations or b) intralesional marine debris indicating that the debris represents the most likely cause of the tissue damage

ID	species ID	origin	federal state	sea	year of recovery	age (est.)	state of decay	nutritional state	pathological findings on location of finding	location of debris finding	debris items
1	Pvit_01	Eiderstedt	SH	NS	1997	juvenile	4	N.A.	no pathological investigation	stomach	plastic sheeting
2	Pvit_02	Isle of Helgoland	SH	NS	1998	juvenile	2	moderate	b) severe wound around the neck, corner in the mouth and tongue, severe granulomatous inflammation in skin, blubber and tongue (no histology conducted)	jaw	netting remains
3	Ppho_01	Isle of Sylt	SH	NS	1998	adult	3	emaciated	a) no lesions associated with debris	stomach	plastic piece and fish line
4	Ppho_02	Eiderstedt	SH	NS	2000	juvenile	2	good	a) no lesions associated with debris	stomach	three plastic pieces
5	Ppho_03	Isle of Helgoland	SH	NS	2002	juvenile	4	N.A.	no pathological investigation	jaw	monofilament netting
6	Pvit_03	Isle of Amrum	SH	NS	2002	juvenile	3	moderate	a) no lesions associated with debris	stomach	several wooden pieces

Table S3 - Continued

7	Pvit_04	Eiderstedt	SH	NS	2002	adult	2	moderate	b) perforation of the oesophagus, oedema of surrounding tissue	oesophagus	fish hook (mackerel)
8	Pvit_05	Eiderstedt	SH	NS	2006	juvenile	2	moderate	b) large wounds and severe ulceration with suppurative dermatitis	neck	netting loop
9	Ppho_04	Kiel Bight	SH	BS	2007	juvenile	4	moderate	a) no lesions associated with debris	stomach	fish hook
10	Ppho_05	Isle of Fehmarn	SH	BS	2007	juvenile	5	N.A.	no pathological investigation	fluke	fish line
11	Ppho_06	Kiel Bight	SH	BS	2009	adult	5	good	no pathological investigation	fluke	netting remains
12	Ppho_07	Isle of Sylt	SH	NS	2009	adult	4	moderate	a) no lesions associated with debris	mouth	bracelet
13	Pvit_06	Eckernförde Bight	SH	BS	2010	adult	2	good	a) no lesions associated with debris	stomach	rubber bait, sweets wrapper, lead sinker for rubber bait
14	Pvit_07	Großenbrode	SH	BS	2010	juvenile	3	emaciated	b) intestinal rupture, severe suppurative serositis and peritonitis	stomach, intestine	nylon string, fish hook
15	Pvit_08	Eiderstedt	SH	NS	2010	juvenile	4	N.A.	N.A.	neck	rubber band

Table S3 - Continued

16	Hgry_01	Lübeck Bight	SH	BS	2011	adult	3	good	b) perforation of the oesophagus, with abscessation and final septicaemia due to hemolytic streptococci	oesophagus	fish hook
17	Hgry_02	Isle of Sylt	SH	NS	2011	juvenile	3	moderate	b) large wounds and severe ulcerative dermatitis and panniculitis with fibrosis, final septicaemia due to hemolytic streptococci	neck	netting remains
18	Pvit_09	Isle of Sylt	SH	NS	2011	juvenile	3	moderate	b) large wounds and severe ulcerative dermatitis and panniculatis with granulation tissue with final septicaemia due to hemolytic streptococci	neck	monofilament netting
19	Pvit_10	Isle of Föhr	SH	NS	2011	juvenile	3	emaciated	a) no lesions associated with debris	stomach	green plastic piece
20	Pvit_11	Eiderstedt	SH	NS	2012	juvenile	4	emaciated	a) no lesions associated with debris	stomach	several wooden pieces

Table S3 - Continued

21	Pvit_12	Isle of Sylt	SH	NS	2012	juvenile	3	emaciated	b) large wounds and focal necrosis with severe suppurative deep dermatitis and panniculitis	neck	monofilament netting
22	Pvit_13	Isle of Sylt	SH	NS	2013	juvenile	3	emaciated	b) moderate gastritis (type not identifiable due to state of decay)	stomach	thread
23	Hgry_03	Isle of Sylt	SH	NS	2014	juvenile	2	emaciated	b) large wounds and severe suppurative dermatitis with suspected final septicaemia due to hemolytic streptococci	neck	netting remains
24	Pvit_14	Kiel Bight	SH	BS	2014	juvenile	5	good	a) no pathological lesions macroscopically detectable	neck	netting remains
25	Pvit_15	Elbe River (Wedel)	SH	NS (Elbe River)	2014	adult	3	emaciated	b) moderate mononuclear gastritis	stomach	rubber bait
26	Pvit_16	Isle of Hiddensee	MWP	BS	2002	adult	N.A.	N.A.	b) perforation of fish hook into abdominal cavity	stomach	fish hook

Table S3 - Continued

27	Ppho_08	Groß Schwansee	MWP	BS	2008	n.a.	N.A.	N.A.	N.A.	body	netting remains
28	Ppho_09	Brook	MWP	BS	2009	n.a.	N.A.	N.A.	N.A.	body	netting remains
29	Hgry_04	Isle of Rügen	MWP	BS	2009	adult	N.A.	N.A.	N.A.	stomach	fish hook
30	Hgry_05	Peninsula of Usedom	MWP	BS	2010	juvenile	1	good	b) wounds around the neck, no histology	body	entangled in monofilament netting
31	Hgry_06	Thiessow, Peninsula of Mönchgut	MWP	BS	2010	juvenile	N.A.	good	b) suspected perforation of the stomach, no histology	stomach	wooden stick

ANNEX III – References

The following list includes all the references cited in the main text as well as a list of reports, conference proceedings, peer reviewed articles contribution to workshops and other grey literature reviewed to generate the list in ANNEX I. Please, for the description of specific case studies and original sources such as personal communications included in some of the above sources, refer to the single items listed below

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ANNEX IV – DRAFT PROTOCOL FOR RELEVANT DATA GATHERING AND SHARING RELATED TO THE ISSUE OF MARINE DEBRIS AND CETACEANS

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Rationale

A large and diverse number of factors determine the volume and severity of interactions between wildlife and marine debris. Population sizes and distributions, behavioural traits, proximity of urban centres, ocean currents and weather patterns, among many other factors, can all contribute to interactions and also to the difficulty in obtaining accurate estimates of trends in debris-based impacts, including mortality rates. Nevertheless, in this context, cetacean strandings provide a unique opportunity to assess the rates, extents and volumes of interaction with marine debris. There are, however, clear imbalances in the frequency and geographical extent of detailed reports. Older accounts, in particular, lack details. As a result, apparent differences in the frequency of occurrence of some types of debris can reflect regional variation in stranded cetacean recovery and detailed necropsy techniques rather than true geographic differences in abundance of marine debris (Walker & Coe 1990). Detailed descriptions of items ingested by cetaceans have only recently become available (e.g. de Stephanis et al. 2013, Unger et al. 2016, 2017, Lusher et al. 2018).

Appropriate examination of dead bodies can be useful for detecting ingestion and for assessing entanglement, including providing specific information on the type of gear or marine debris associated with an entanglement. However, despite an increase in the number of studies in recent years, information on the interaction between cetaceans and marine litter is still poor and this is in part caused by a lack of standardised methods and protocols for monitoring both the ingestion of and the entanglement in marine litter (e.g. Deudero & Alomar 2015, Fossi et al. 2017, Provencher et al. 2017).

It is therefore essential to identify standardised procedures to collect information on debris, and to be included in the many well established necropsy protocol already existing worldwide. These procedures should be shared at all spatial scales as previously suggested within the IWC, ACCOBAMS and ASCOBANS, amongst others. Examples of standardised procedures have already been proposed for some marine species such the northern fulmar (*Fulmarus glacialis*; Franeker et al. 2011, Provencher et

al. 2017, Terepocki et al. 2017)[15] and the loggerhead sea turtle (*Caretta caretta*; Campani et al. 2013, Matiddi et al. 2017). Despite the availability of many national and regional examples[16,17,18,19], a single unified protocol has only very recently been proposed for harbour porpoises (Franeker et al. 2018).

Taking into account

- the conclusions from the two IWC marine debris workshops (IWC 2013, 2014);
- recommendations from ASCOBANS (Marine Debris Working Group 2013);
- the OSPAR Beach Litter Programme[20]; and
- recalling the actions to be achieved under the 2017-2019 ACCOBAMS Work Programme[21], amongst others,

we propose that the following types of information related to marine debris, should be collected during cetacean strandings. The inclusion of information such as debris' colour, flexibility, presence of sharp edges, size, strength, density, shape/aspect ratio, will help in understanding the process of debris ingestion and associated risk. It will also help better understand the possible significance of visual cues, as reported for marine turtles (e.g. Schuyler et al. 2014, 2016), and will contribute to the identification of those processes leading to both the unintentional and intentional ingestion of debris. Furthermore, considering that some species like the Mediterranean sub-populations of fin and sperm whales have been recognised (Fossi et al. 2017) to be reliable indicators to assess trends in the amount and composition of ingested marine litter under the Marine Strategy Framework Directive (MSFD; DIRECTIVE 2008/56/EC)[22,23], we used some of the categories provided within the Directive itself[24,25] as integral parts of our proposals here

Recommendations:

3. Post-mortem examinations should be conducted using a classical differential diagnostic approach, when possible, to enable:

[15] https://bit.ly/2GeLu4G
[16] https://bit.ly/2HUfiAL
[17] https://bit.ly/2G3lmX2
[18] https://bit.ly/2pyNRpx
[19] https://bit.ly/2GiiNDW
[20] https://bit.ly/2pmw7yd
[21] https://bit.ly/2pxM57M
[22] DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. 17 June 2008. Establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive); http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN We
[23] We specifically refer to the MSFD Descriptor 10, Criteria 10.2 and Indicator (iv) "Trends in the amount and composition of litter ingested by marine animals"
[24] Marine Litter Technical Recommendations for the Implementation of MSFD Requirements; https://bit.ly/2INFVsb
[25] Guidance on Monitoring of Marine Litter in European Seas; https://bit.ly/2pE9GTU

a. The detection of trauma, chemical exposure and other sequelae related to exposure; and
b. The analysis of their roles in contributing to morbidity and mortality in the context of other potential causes, such as infectious or non - infectious disease, nutrition, and other possible aetiologies.

4. In situations when a full differential diagnostic approach is not possible, efforts to document the presence of marine debris, both ingested and entangled, should still be put into place. These efforts should focus on both macrodebris and microdebris and should include the following components:
    a. Standard cetacean necropsy protocols should be followed (e.g. McLellan et al. 2004, Pugliares et al. 2007, Moore & Barco 2013);
    b. Gross necropsy examination and report: description, sketches, images, measurements, collection and preservation of entanglement/debris, and affected body part(s);
    c. The entire gastrointestinal tract should be opened and examined, and debris should be characterised by:
        vii. Material (if plastic, polymer type e.g. polyethylene, polypropylene, polystyrene, polyamide (nylon), polyester, acrylic, polyoximethylene, polyvinyl, polyvinylchloride, poly methylacrylate, polyethylene terephthalate, alkyd, polyurethane).
        viii. Size (please refer to the definition of micro-, meso- and macrodebris): the size of each item should be recorded.
        ix. Colour (e.g. transparent, crystalline, white, clear-white, cream, red, orange, blue, opaque, black, grey, brown, green, pink, tan, yellow)
        x. Shape (e.g. for pellets: cylindrical, disks, flat, ovoid, spheroids; for fragments: rounded, sub-rounded, sub-angular, angular; for general- irregular, elongated, degraded, rough, and broken edges)
        xi. Mass
        xii. Volume
    d. All evidence should be identified as to source using established techniques (Browne et al. 2010, 2015b, a) as practical and in collaboration with the relevant industries, to maximize the integration of data into these industries, such as plastics and fishing.
    e. Further analyses such as histopathology, imaging, analytical chemistry, blood test and organ function tests, should be undertaken to document the presence of and type of debris as well as possible impacts.

f. Criteria for the assignation of degree of confidence of findings (e.g. quality of data) of entanglement or ingestion contributing to or causing morbidity and mortality should be used (Moore et al. 2013).

In relation specifically to item 2c of the above list, we propose a standard list of litter items to be used as a basis for preparing protocols and for collecting information during post-mortem examinations. The use of standard lists and definitions of items will enable the comparison of results between regions and environmental compartments. If the list is detailed enough it will be possible, to a certain degree, to infer about potential or/and most likely sources (e.g. fisheries, shipping) and type of item (e.g. packaging, user item). This is a crucial step to identify key priorities to tackle, design a programme of measures and support the monitoring of their effectiveness. We suggest the use of the list as proposed in the Guidance on Monitoring of Marine Litter in European Seas[26]; the choice is based on the fact that this list has been built on the categories of items used in a series of other established programmes such as:

- For beach litter: UNEP, OSPAR, MCS, Slovenia, ICC.
- For floating litter: HELMEPA, NOAA, ECOOCEAN and Hinojosa/Thiel (2009).
- For seabed litter: OSPAR/ICES list (IBTS) and HELMEPA.
- For micro - litter: CEFAS.
- For ingested litter: Monitoring programme of Fulmars (ingestion), used in the North Sea.

(Please refer to Table S1 in ANNEX I for a detailed list of items with a series of parameters.)

Accordingly, the list includes:

- “General Code” - a unique alphanumeric code
- “General Name” - a short description of the item
- “Materials” - (main) materials that the items are made of. Each material has more items, but each item is associated with only one material.

Further levels of information can be added, which could improve the value of the data especially with regard to the identification of sources or the assessment of harm for example:

- “Source” if identifiable.
- “Pathway - General use of the item” provides information on the activities in which items are most probably used and possible pathways of entry into the marine environment.
  “Source groupings” - sensible groupings of items, which will give the sum of items from a given source etc. (e.g. smoking related).

[26] https://bit.ly/2pE9GTU

The final list consists of a set of over 200 items. It includes a list of core items – which occur in all regions (e.g. cigarette ends, plastic bottles) and regionally specific items (e.g. octopus pots), which only occur in some sub-regions.

It will not always be practical to use such a long list of items, especially in conjunction with the further details on colour, size, etc. Many items do not occur regularly in a particular region; however, a considerable number of items will be common to all regions. It is suggested that each group collecting data on stranded animals, should create a basic list using those core items that occur more often in their analyses while keeping the general item codes unchanged. This will allow data to be easily comparable across different geographical scales once all the collated information is gathered in a unified single database.

We have focused here on marine debris. However, many cetacean entanglements occur in fishing gears and other fishery related items and tools. If the gear is not active at the point of entanglement then it might be deemed to be marine debris. Identification of fishing gear is a major topic in its own right and we do not cover it here. For further information we suggest to consider the information and the discussion provided in specific programmes such as the NOAA Marine Debris Programme[27] and similar initiatives[28,29].

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[27] www.marinedebris.noaa.gov
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ANNEX I – Table S1. List of categories of litter items

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G1	1	PL05	4/6-pack yokes, six-pack rings	Artificial polymer materials	x	x				
G2		PL07	Bags	Artificial polymer materials	x		x	x		
G3	2	PL07	Shopping Bags incl. pieces	Artificial polymer materials		x				
G4	3	PL07	Small plastic bags, *e.g.* freezer bags incl. pieces	Artificial polymer materials		x				
G5	112		Plastic bag collective role; what remains from rip-off plastic bags	Artificial polymer materials		x				
G6	4	PL02	Bottles	Artificial polymer materials	x		x	x		
G7	4	PL02	Drink bottles <=0.5l	Artificial polymer materials		x				
G8	4	PL02	Drink bottles >0.5l	Artificial polymer materials		x				
G9	5	PL02	Cleaner bottles & containers	Artificial polymer materials	x	x				
G10	6	PL06	Food containers incl. fast food containers	Artificial polymer materials	x	x	x			
G11	7	PL02	Beach use related cosmetic bottles and containers, *e.g.* Sunblocks	Artificial polymer materials		x				
G12	7	PL02	Other cosmetics bottles & containers	Artificial polymer materials	x	x				
G13	12	PL02	Other bottles & containers (drums)	Artificial polymer materials	x	x				
G14	8		Engine oil bottles & containers <50 cm	Artificial polymer materials		x				
G15	9	PL03	Engine oil bottles & containers >50 cm	Artificial polymer materials		x				
G16	10	PL03	Jerry cans (square plastic containers with handle)	Artificial polymer materials		x				
G17	11		Injection gun containers	Artificial polymer materials		x				
G18	13	PL13	Crates and containers / baskets	Artificial polymer materials		x	x	x		
G19	14		Car parts	Artificial polymer materials		x				
G20		PL01	Plastic caps and lids	Artificial polymer materials			x			
G21	15	PL01	Plastic caps/lids drinks	Artificial polymer materials		x				
G22	15	PL01	Plastic caps/lids chemicals, detergents (non-food)	Artificial polymer materials	x	x				
G23	15	PL01	Plastic caps/lids unidentified	Artificial polymer materials		x				
G24	15	PL01	Plastic rings from bottle caps/lids	Artificial polymer materials		x				
G25			Tobacco pouches / plastic cigarette box packaging	Artificial polymer materials		x				
G26	16	PL10	Cigarette lighters	Artificial polymer materials	x	x				
G27	64	PL11	Cigarette butts and filters	Artificial polymer materials		x	x			
G28	17		Pens and pen lids	Artificial polymer materials		x				
G29	18		Combs/hair brushes/sunglasses	Artificial polymer materials		x				
G30	19		Crisps packets/sweets wrappers	Artificial polymer materials		x				

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G31	19		Lolly sticks	Artificial polymer materials		x				
G32	20	PL08	Toys and party poppers	Artificial polymer materials	x	x				
G33	21	PL06	Cups and cup lids	Artificial polymer materials	x	x				
G34	22	PL04	Cutlery and trays	Artificial polymer materials		x				
G35	22	PL04	Straws and stirrers	Artificial polymer materials		x				
G36	23		Fertiliser/animal feed bags	Artificial polymer materials		x				
G37	24	PL15	Mesh vegetable bags	Artificial polymer materials		x				
G38			Cover / packaging	Artificial polymer materials				x		
G39		PL09	Gloves	Artificial polymer materials			x	x		
G40	25	PL09	Gloves (washing up)	Artificial polymer materials	x	x				
G41	113	RB03	Gloves (industrial/professional rubber gloves)	Artificial polymer materials	x	x				
G42	26	PL17	Crab/lobster pots and tops	Artificial polymer materials		x				
G43	114		Tags (fishing and industry)	Artificial polymer materials		x				
G44	27	PL17	Octopus pots	Artificial polymer materials		x				
G45	28	PL15	Mussels nets, Oyster nets	Artificial polymer materials		x				
G46	29		Oyster trays (round from oyster cultures)	Artificial polymer materials		x				
G47	30		Plastic sheeting from mussel culture (Tahitians)	Artificial polymer materials		x				
G48			Synthetic rope	Artificial polymer materials			x	x		
G49	31	PL19	Rope (diameter more than 1cm)	Artificial polymer materials	x	x				
G50	32	PL19	String and cord (diameter less than 1cm)	Artificial polymer materials	x	x				
G51		PL20	Fishing net	Artificial polymer materials			x	x		
G52		PL20	Nets and pieces of net	Artificial polymer materials	x	x				
G53	115	PL20	Nets and pieces of net < 50 cm	Artificial polymer materials		x				
G54	116	PL20	Nets and pieces of net > 50 cm	Artificial polymer materials		x				
G55		PL18	Fishing line (entangled)	Artificial polymer materials			x			
G56	33	PL20	Tangled nets/cord	Artificial polymer materials		x				
G57	34	PL17	Fish boxes - plastic	Artificial polymer materials		x		x		
G58	34	PL17	Fish boxes - expanded polystyrene	Artificial polymer materials		x		x		
G59	35	PL18	Fishing line/monofilament (angling)	Artificial polymer materials	x	x	x			
G60	36	PL17	Light sticks (tubes with fluid) incl. packaging	Artificial polymer materials		x				
G61			Other fishing related	Artificial polymer materials			x			
G62	37	PL14	Floats for fishing nets	Artificial polymer materials	x	x				
G63	37	PL14	Buoys	Artificial polymer materials		x		x		

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G64			Fenders	Artificial polymer materials		x				
G65	38	PL03	Buckets	Artificial polymer materials		x				
G66	39	PL21	Strapping bands	Artificial polymer materials	x	x	x			
G67	40	PL16	Sheets, industrial packaging, plastic sheeting	Artificial polymer materials		x	x	x		
G68	41	PL22	Fibre glass/fragments	Artificial polymer materials		x				
G69	42		Hard hats/Helmets	Artificial polymer materials		x				
G70	43		Shotgun cartridges	Artificial polymer materials		x				
G71	44	CL01	Shoes/sandals	Artificial polymer materials		x				
G72			Traffic cones	Artificial polymer materials		x				
G73	45	FP01	Foam sponge	Artificial polymer materials		x				
G74			Foam packaging/insulation/polyurethane	Artificial polymer materials				x		
G75	117		Plastic/polystyrene pieces 0 - 2.5 cm	Artificial polymer materials		x				
G76	46		Plastic/polystyrene pieces 2.5 cm > < 50cm	Artificial polymer materials		x				
G77	47		Plastic/polystyrene pieces > 50 cm	Artificial polymer materials		x				
G78			Plastic pieces 0 - 2.5 cm	Artificial polymer materials		x				
G79			Plastic pieces 2.5 cm > < 50cm	Artificial polymer materials		x		x		
G80			Plastic pieces > 50 cm	Artificial polymer materials		x		x		
G81			Polystyrene pieces 0 - 2.5 cm	Artificial polymer materials		x				
G82			Polystyrene pieces 2.5 cm > < 50cm	Artificial polymer materials		x		x		
G83			Polystyrene pieces > 50 cm	Artificial polymer materials		x		x		
G84			CD, CD-box	Artificial polymer materials		x				
G85			Salt packaging	Artificial polymer materials		x				
G86			Fin trees (from fins for scuba diving)	Artificial polymer materials		x				
G87			Masking tape	Artificial polymer materials		x				
G88			Telephone (incl. parts)	Artificial polymer materials		x				
G89			Plastic construction waste	Artificial polymer materials		x				
G90			Plastic flower pots	Artificial polymer materials		x				
G91			Biomass holder from sewage treatment plants	Artificial polymer materials		x				
G92			Bait containers/packaging	Artificial polymer materials		x				
G93			Cable ties	Artificial polymer materials		x	x			
G94			Table cloth	Artificial polymer materials				x		
G95	98	OT02	Cotton bud sticks	Artificial polymer materials	x	x	x			
G96	99	OT02	Sanitary towels/panty liners/backing strips	Artificial polymer materials		x	x			

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G97	101	OT02	Toilet fresheners	Artificial polymer materials		x				
G98		OT02	Diapers/nappies	Artificial polymer materials		x	x			
G99	104	PL12	Syringes/needles	Artificial polymer materials		x	x			
G100	103		Medical/Pharmaceuticals containers/tubes	Artificial polymer materials		x				
G101	121		Dog faeces bag	Artificial polymer materials	x	x				
G102		RB02	Flip-flops	Artificial polymer materials		x				
G103			Plastic fragments rounded <5mm	Artificial polymer materials						x
G104			Plastic fragments subrounded <5mm	Artificial polymer materials						x
G105			Plastic fragments subangular <5mm	Artificial polymer materials						x
G106			Plastic fragments angular <5mm	Artificial polymer materials						x
G107			cylindrical pellets <5mm	Artificial polymer materials						x
G108			disks pellets <5mm	Artificial polymer materials						x
G109			flat pellets <5mm	Artificial polymer materials						x
G110			ovoid pellets <5mm	Artificial polymer materials						x
G111			spheruloids pellets <5mm	Artificial polymer materials						x
G112		PL23	Industrial pellets	Artificial polymer materials	x				x	
G113			Filament <5mm	Artificial polymer materials						x
G114			Films <5mm	Artificial polymer materials						x
G115			Foamed plastic <5mm	Artificial polymer materials						x
G116			Granules <5mm	Artificial polymer materials						x
G117			Styrofoam <5mm	Artificial polymer materials						x
G118			Small industrial spheres (<5mm)	Artificial polymer materials					x	
G119			Sheet like user plastic (>1mm)	Artificial polymer materials					x	
G120			Threadlike user plastic (>1mm)	Artificial polymer materials					x	
G121			Foamed user plastic (>1mm)	Artificial polymer materials					x	
G122			Plastic fragments (>1mm)	Artificial polymer materials					x	
G123			Polyurethane granules <5mm	Artificial polymer materials				x		
G124	48	PL24	Other plastic/polystyrene items (identifiable)	Artificial polymer materials		x	x	x		
G125	49	RB01	Balloons and balloon sticks	Rubber	x	x	x	x		
G126		RB01	Balls	Rubber		x		x		
G127	50		Rubber boots	Rubber		x	x	x		
G128	52	RB04	Tyres and belts	Rubber	x	x	x	x		
G129		RB05	Inner-tubes and rubber sheet	Rubber		x				
G130			Wheels	Rubber	x	x				
G131		RB06	Rubber bands (small, for	Rubber		x				

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
			kitchen/household/post use)							
G132			Bobbins (fishing)	Rubber		x	x			
G133	97	RB07	Condoms (incl. packaging)	Rubber		x	x			
G134	53	RB08	Other rubber pieces	Rubber		x	x	x		
G135		CL01	Clothing (clothes, shoes)	Cloth/textile				x		
G136		CL01	Shoes	Cloth/textile			x			
G137	54	CL01	Clothing / rags (clothing, hats, towels)	Cloth/textile	x	x	x			
G138	57	CL01	Shoes and sandals (*e.g.* Leather, cloth)	Cloth/textile		x				
G139		CL02	Backpacks & bags	Cloth/textile		x				
G140	56	CL03	Sacking (hessian)	Cloth/textile		x				
G141	55	CL05	Carpet & Furnishing	Cloth/textile		x	x	x		
G142		CL04	Rope, string and nets	Cloth/textile		x	x	x		
G143		CL03	Sails, canvas	Cloth/textile		x		x		
G144	100	OT02	Tampons and tampon applicators	Cloth/textile	x	x				
G145	59	CL06	Other textiles (incl. rags)	Cloth/textile		x	x	x		
G146			Paper/Cardboard	Paper/Cardboard			x			
G147	60		Paper bags	Paper/Cardboard		x				
G148	61	PC02	Cardboard (boxes & fragments)	Paper/Cardboard	x	x	x	x		
G149		PC03	Paper packaging	Paper/Cardboard				x		
G150	118	PC03	Cartons/Tetrapack Milk	Paper/Cardboard	x	x				
G151	62	PC03	Cartons/Tetrapack (others)	Paper/Cardboard	x	x				
G152	63	PC03	Cigarette packets	Paper/Cardboard		x				
G153	65	PC03	Cups, food trays, food wrappers, drink containers	Paper/Cardboard	x	x				
G154	66	PC01	Newspapers & magazines	Paper/Cardboard		x		x		
G155		PC04	Tubes for fireworks	Paper/Cardboard		x				
G156			Paper fragments	Paper/Cardboard		x				
G157			Paper	Paper/Cardboard					x	
G158	67	PC05	Other paper items	Paper/Cardboard		x	x	x		
G159	68	WD01	Corks	Processed/worked wood		x				
G160	69	WD04	Pallets	Processed/worked wood	x	x	x	x		
G161	69	WD04	Processed timber	Processed/worked wood		x				
G162	70	WD04	Crates	Processed/worked wood	x	x		x		
G163	71	WD02	Crab/lobster pots	Processed/worked wood		x				
G164	119		Fish boxes	Processed/worked wood	x	x				
G165	72	WD03	Ice-cream sticks, chip forks, chopsticks, toothpicks	Processed/worked wood	x	x				

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G166	73		Paint brushes	Processed/worked wood		x				
G167		WD05	Matches & fireworks	Processed/worked wood		x				
G168			Wood boards	Processed/worked wood				x		
G169			Beams / Dunnage	Processed/worked wood				x		
G170			Wood (processed)	Processed/worked wood			x			
G171	74	WD06	Other wood < 50 cm	Processed/worked wood		x				
G172	75	WD06	Other wood > 50 cm	Processed/worked wood		x				
G173		WD06	Other (specify)	Processed/worked wood	x		x	x		
G174	76		Aerosol/Spray cans industry	Metal	x	x				
G175	78	ME03	Cans (beverage)	Metal	x	x	x	x		
G176	82	ME04	Cans (food)	Metal	x	x	x			
G177	81	ME06	Foil wrappers, aluminium foil	Metal		x				
G178	77	ME02	Bottle caps, lids & pull tabs	Metal	x	x				
G179	120		Disposable BBQ's	Metal		x				
G180	79	ME10	Appliances (refrigerators, washers, etc.)	Metal		x	x			
G181		ME01	Tableware (plates, cups & cutlery)	Metal		x				
G182	80	ME07	Fishing related (weights, sinkers, lures, hooks)	Metal		x	x	x		
G183		ME07	Fish hook remains	Metal					x	
G184	87	ME07	Lobster/crab pots	Metal	x	x				
G185			Middle size containers	Metal			x			
G186	83	ME10	Industrial scrap	Metal		x				
G187	84	ME05	Drums, *e.g.* oil	Metal		x	x			
G188		ME04	Other cans (< 4 L)	Metal		x				
G189		ME05	Gas bottles, drums & buckets (> 4 L)	Metal		x				
G190	86	ME05	Paint tins	Metal		x				
G191	88	ME09	Wire, wire mesh, barbed wire	Metal		x		x		
G192		ME05	Barrels	Metal				x		
G193			Car parts / batteries	Metal		x	x			
G194			Cables	Metal		x	x			
G195		OT04	Household Batteries	Metal		x				
G196			Large metallic objects	Metal			x			
G197			Other (metal)	Metal			x	x		
G198	89	ME10	Other metal pieces < 50 cm	Metal		x				
G199	90	ME10	Other metal pieces > 50 cm	Metal		x				
G200	91	GC02	Bottles incl. pieces	Glass/ceramics	x	x	x			
G201		GC02	Jars incl. pieces	Glass/ceramics		x	x			

TSG_ML General- Code	OSPAR- Code	UNEP- Code	General Name	Level 1 - Materials	Core	Beach	Seafloor	Floating	Biota	Micro
G202	92	GC04	Light bulbs	Glass/ceramics	x	x				
G203		GC03	Tableware (plates & cups)	Glass/ceramics		x				
G204	94	GC01	Construction material (brick, cement, pipes)	Glass/ceramics		x				
G205	92	GC05	Fluorescent light tubes	Glass/ceramics	x	x				
G206		GC06	Glass buoys	Glass/ceramics		x				
G207	95		Octopus pots	Glass/ceramics		x				
G208		GC07	Glass or ceramic fragments >2.5cm	Glass/ceramics		x	x			
G209			Large glass objects (specify)	Glass/ceramics			x			
G210	96	GC08	Other glass items	Glass/ceramics	x	x	x			
G211	105	OT05	Other medical items (swabs, bandaging, adhesive plaster etc.)	unidentified		x				
G212			Slack / Coal						x	
G213	181, 109, 110	OT01	Paraffin/Wax	Chemicals		x			x	
G214			Oil/Tar	Chemicals					x	
G215			Food waste (galley waste)	Food waste					x	
G216			various rubbish (worked wood, metal parts)	undefined					x	
G217			Other (glass, metal, tar) <5mm	unidentified						x

ANNEX V – SURVEY OF THE NATIONAL STRANDING NETWORKS

A progress report on relevant information regarding stranding data in ACCOBAMS Parties

Introduction

During the Sixth Meeting of the Parties to ACCOBAMS (Monaco, 22-25 November 2016), Parties requested the ACCOBAMS Scientific Committee to approach the ECS, IWC and ASCOBANS in order to develop a **common operational stranding[30] protocol** taking into account the proposed common definitions, the common data collection and the common necropsy protocol annexed to the Resolution 6.22. In addition, cetaceans are known to be affected by marine litter through ingestion and entanglement in fishing nets.

In this context a scientific exchange on cetaceans stranding issues was organised, as a dedicated workshop, covering also marine litters, at the European Cetaceans Society Conference held on 6th April 2018 in La Spezia (Italy). In this context, and as you may understand, efficient discussions could only be based on updated information from the riparian States.

Therefore, in order to draft recommendations, the ACCOBAMS Secretariat launched through the national focal points a questionnaire and a template "Stranding Network Organisation".

The aim of these two documents was to update relevant information from those already collected from some Countries in 2014 (but which was focused on life strandings):

- Evaluation of the regional coverage and the obstacles to the creating of new networks;
- Analysis of data contained in each datasheet used in the field, to determine if they contain information regarding any evident sign of human interaction and more particularly regarding marine litters;
- Description of national stranding networks in the ACCOBAMS Area

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18 Countries (including 13 regional entities in Italy and Spain) answered to the questionnaire listing 102 entities involved in the national stranding networks (tab1). Unfortunately, none of the countries answered to the question "if you don't have a stranding network, why? "

Some of the information were collected from previous reports as the countries didn't answered or were in a process of restructuring their network.

The description of the involvement of each entities shows 25 which have a role in national coordination and give some precise information on the main others topics they are tackling, like biological analysis, reporting, necropsies, … (Fig 1).

Most of the Countries have a well-documented on the field data collecting tool or a simple list of items to be observed.

From the questionnaire, some information could be collected on specific topics like necropsies, tissues banks, release and rehabilitation centre and the attention on marine debris during necropsies.

In some countries, the national coordinators implement a lot of missions but in others functions were dispatches in several specialised entities in a more "mature" networking system (Fig 2).

In the description of the "strong and weak topics", as quoted by the countries, it is clears that several countries are willing to go further in the analyse of data collected in particular related to the cause of the death and better use

[30] *The term "stranded cetacean" is expanded to include animals, dead or alive found floating or swimming, respectively, in shallow waters, in the latter case, showing clear signs of physiological dysfunction.*

of the sampling for further studies. This was also reflected in the assistance or support expected from the ACCOBAMS permanent Secretariat.

The relation to MEDACES was quite the less documented point from the answers. No one comments with the use of MEDACES data.

Follow up from the survey:
This follow up should be completed with the conclusions of the common ACCOBAMS/ASCOBANS/ECS workshop held on the April the 6th in La Spezia.

- On the field, it is clear that the well documented resolution ACCOBAMS 6.22 should be completed by a proposition of field datasheet for some countries able also to facilitate communications through the existing national data banks.
- This datasheet could be completed by some items related to marine debris.

- A web access dynamic register of the involved entities could be drafted including the availability for exchange and cooperation.

- Capacity building is needed in some several for samplings, necropsies and exchange with tissues banks.

Figures and tables

Tab 1 some networks descriptors

				Number on entities involved in			
	Total entities involved	Field datasheet	Debris o-bservation in necropsies	Necropsies	Tissues Bank	Release and rehabilitation	Data transmission to Medaces
Albania							
Algeria	8	Y	N			1	Y
Bulgaria	6	N	N			2	Y
Croatia	11	Y	Y	1	1		N
Cyprus	3	N	N	2		2	
Egypt		Y					
France	2	Y	Y	1	1		Y
Georgia							
Greece							
Italy	5						
Lebanon	3	Y	N	2	2		N
Libya	3	Y	N	3			N
Malta							
Morocco	1	Y	Y		1	1	N
Monaco	3						
Montenegro							
Portugal	4				1	1	N
Romania	9	Y	Y	3		2	Y
Slovenia	4			1			Y
Spain	17	Y	Y	8	5	4	Y
Syria							
Tunisia	4	N	Y		3	1	N
Turkey	3	Y	Y	3	1	1	N
Ukraine	16	Y	Y	1	2	3	N

Fig 1 Typology of the 102 involved entities

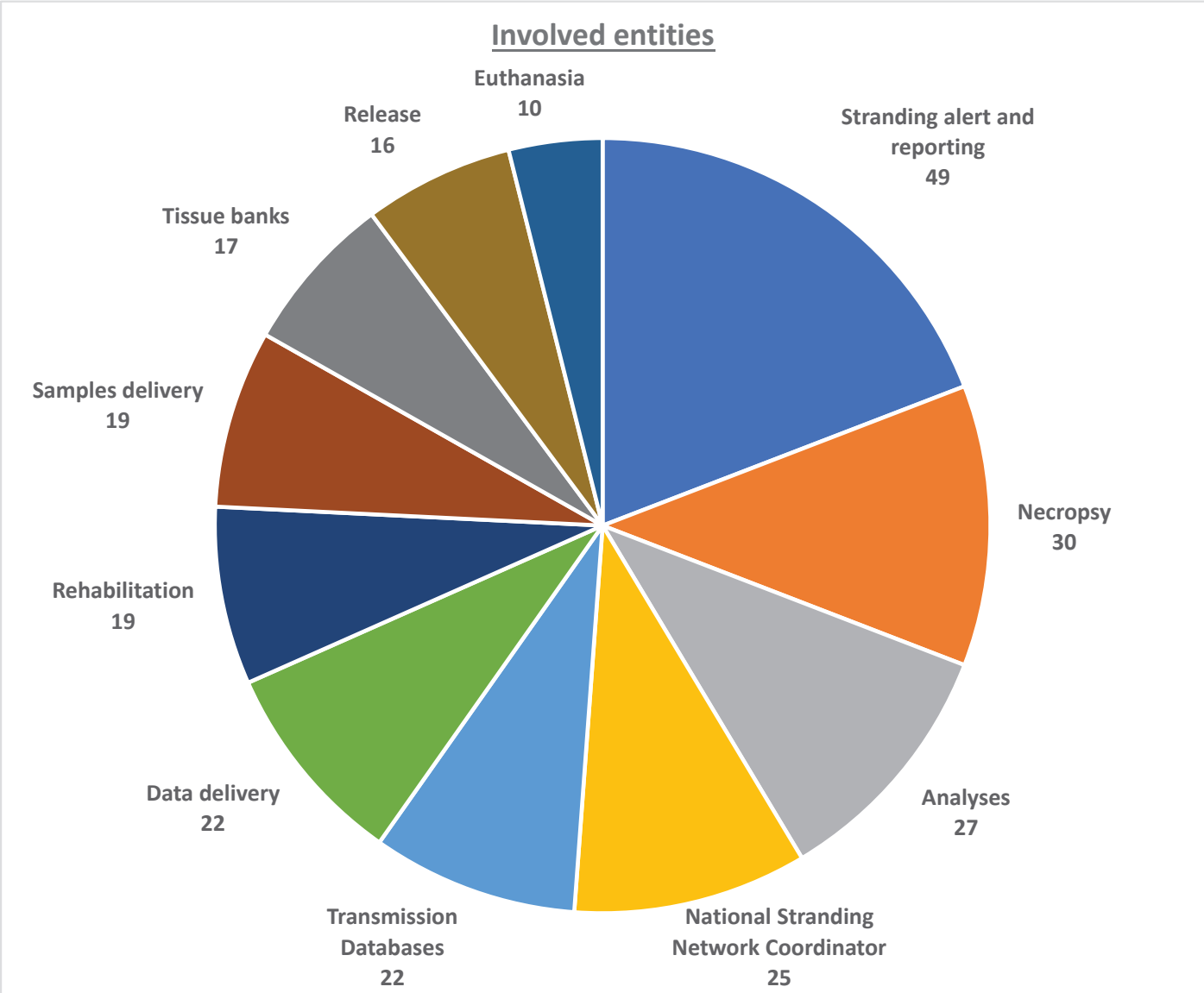
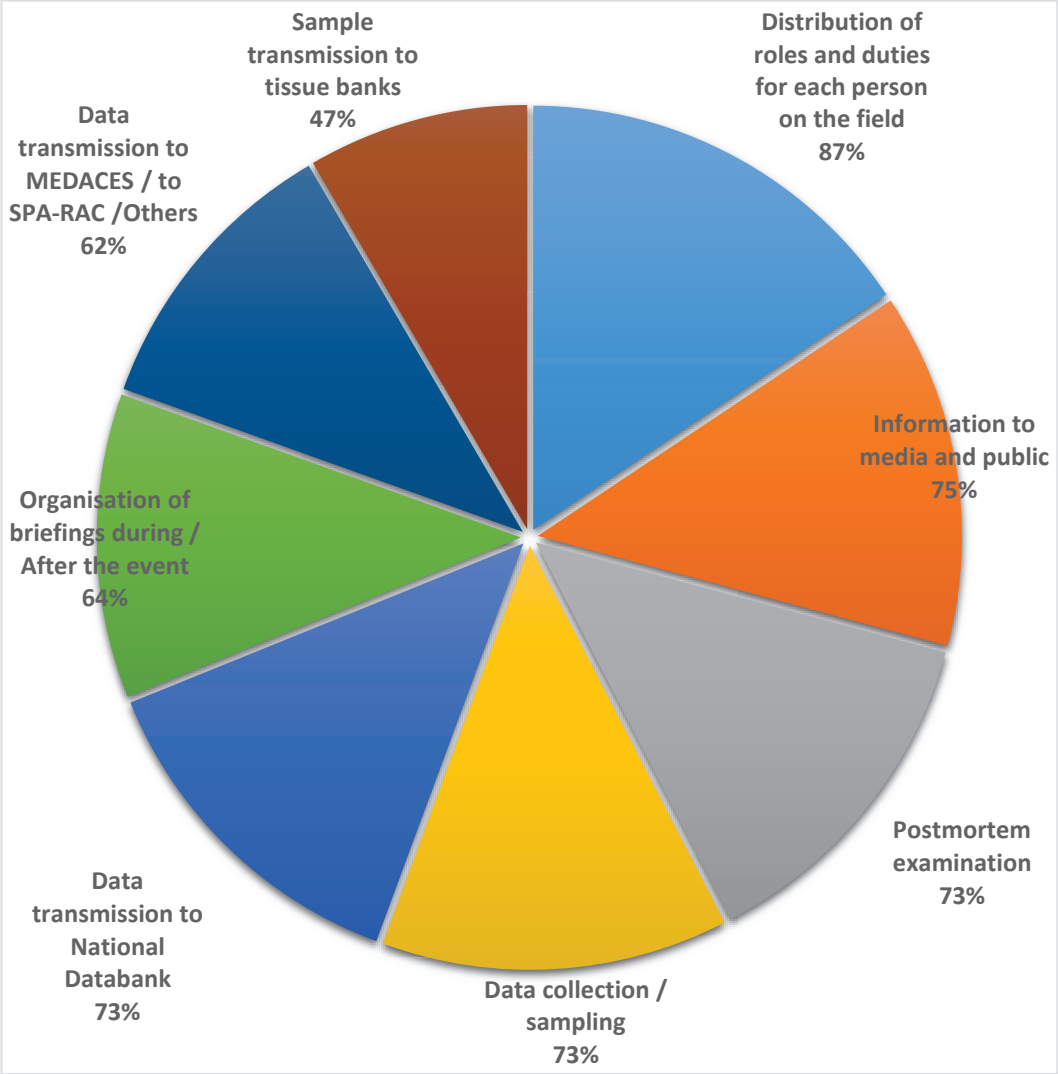


Fig 2. Coordinator functions



Tab 2 Weak points of the national networks organisations
(obviously some of these topics are interrelated)

Logistic on the spot	75%
Tissues samples and tissues bank	62%
National organization / operative protocol	58%
Establishment of roles and duties for each person in the network	53%
Data transmission to MEDACES	50%
Post-mortem examination	40%
Public awareness / information	50%
Alert system	45%
Data collection / sampling	21%
Data transmission to National Databank	28%

Power point presentation of the results of the ACCOBAMS stranding networks survey - March/April 2018

ACCOBAMS

develop the systems for collecting data on observations, incidental catches, **strandings**, epizootics and other phenomena related to cetaceans;

за да разработват системите за събиране на данни върху наблюдения, случайни улови, **засядания на сушата**, епизоотии и други явления, свързани с китоподобните;

développer les systèmes de collecte de données sur les observations, les prises accidentelles, les **échouages**, les épizooties et autres phénomènes relatifs aux Cétacés;

αναπτύξουν συστήματα για την συλλογή δεδομένων που αφορούν παρατηρήσεις, τυχαίες συλλήψεις, **εκβραζόμενα ζώα**, επιδημίες και άλλα φαινόμενα που σχετίζονται με τα κητώδη,

развитии систем сбора данных по наблюдениям, приловам, **выбросам на побережье**, эпизоотиям и другим явлениям, относящимся к китообразным;

sviluppare i sistemi di raccolta di dati sulle osservazioni, le catture accidentali, gli **arenamenti**, le epizoozie ed altri fenomeni relativi ai Cetacei;

razradi sustava prikupljanja podataka o promatranju, slučajnom ulovu, **nasukavanju**, epizootici i drugim pojavama vezanima uz kitove;

desarrollar los sistemas de recopilación de información sobre observaciones, capturas incidentales, **varamientos**, epizootias y otros fenómenos relacionados con los cetáceos;

ACCOBAMS' stranding networks

- An evaluation of the management of the stranding data base MEDACES was done in for the last Meeting of the Parties (MOP6 – November 2016).
- the Contracting Parties, recommends to assess **how we can improve the coverage and the efficiency** of the ACCOBAMS area's stranding networks.

At the time of this Meeting of the Parties, From the 27 ACCOBAMS Riparian States, 21 had once recorded data in MEDACES, but only 10 were regular data providers and 17 countries somehow had stranding networks or rescue centers :

- Algeria
- Bulgaria
- Croatia
- Cyprus
- France
- Georgia
- Greece
- *Israel*
- Italy
- Monaco
- Morocco
- Portugal
- Romania
- Slovenia
- Spain
- Tunisia
- Ukraine

ACCOBAMS MOP6 RECOMENDATIONS

From **the Parties**:

The budgetary contribution from ACCOBAMS to MEDACES is maintained for the next triennium in coordination with the RAC/SPA. Done

From the **ACCOBAMS focal points**:

- **An evaluation of the real efficiency of their stranding network**; This report
- The transfer of data from their national stranding database to MEDACES;
- To raise the awareness of their scientific communities toward MEDACES; Some progress
- An identification of a MEDACES national coordinator in capacity to transmit directly data to the databank.

ACCOBAMS MOP6 RECOMENDATIONS

From the **ACCOBAMS Secretariat** in close relation with RAC/SPA:

- A portal to access to MEDACES from the ACCOBAMS web-site; Done
- An awareness action on MEDACES utility; In progress
- A revisit of the relations with RAC/SPA on MEDACES and the establishment of a trilateral MoU ACCOBAMS-RAC/SPA-MEDACES (or Spanish Ministry of Environment) formalizing the three years commitment; In progress
- An analysis of the potential or the complementarity of other regional or worldwide network/databanks/reporting system (like GROMS, OBIS/SEAMAP, IWC, GBIF, UNEP/WCMC …); A point to discuss here
- A study of a citizen participation to the stranding networking and the feasibility of a smartphone application to this purpose. In progress

ACCOBAMS MOP6 RECOMENDATIONS

From **MEDACES**:

- A revision of the deontological code related to the inclusion of a requirement to a feedback from the users of data when publishing, through the acknowledgment of the data providers and explicit quotation in the publication;
- The implementation of a follow-up mechanism of the interrogation of the databank by, *inter alia*, a counter or a registration of internet access to the databank, …
- The inclusion, in the MEDACES reports, of the relations between the MEDACES team and the scientific communities;
- An assessment of the possibility of increasing the interactivity of the database as GIS formats and linking with NETCOBAMS;
- An updating of the available in line documentation.

ACCOBAMS' stranding networks institutionnal survey

- **1- Existence of a national network for cetacean stranding monitoring?**
- **If yes**, please specify year of establishment:
-
- **If no**, please indicate the reasons:

Disapointing

No Country without monitoring network have answered ....

Building an who's who in the strandings networks

2- You are invited to fill the attached document on "Stranding Network Organisation" and to provide below additional information on relevant entities:

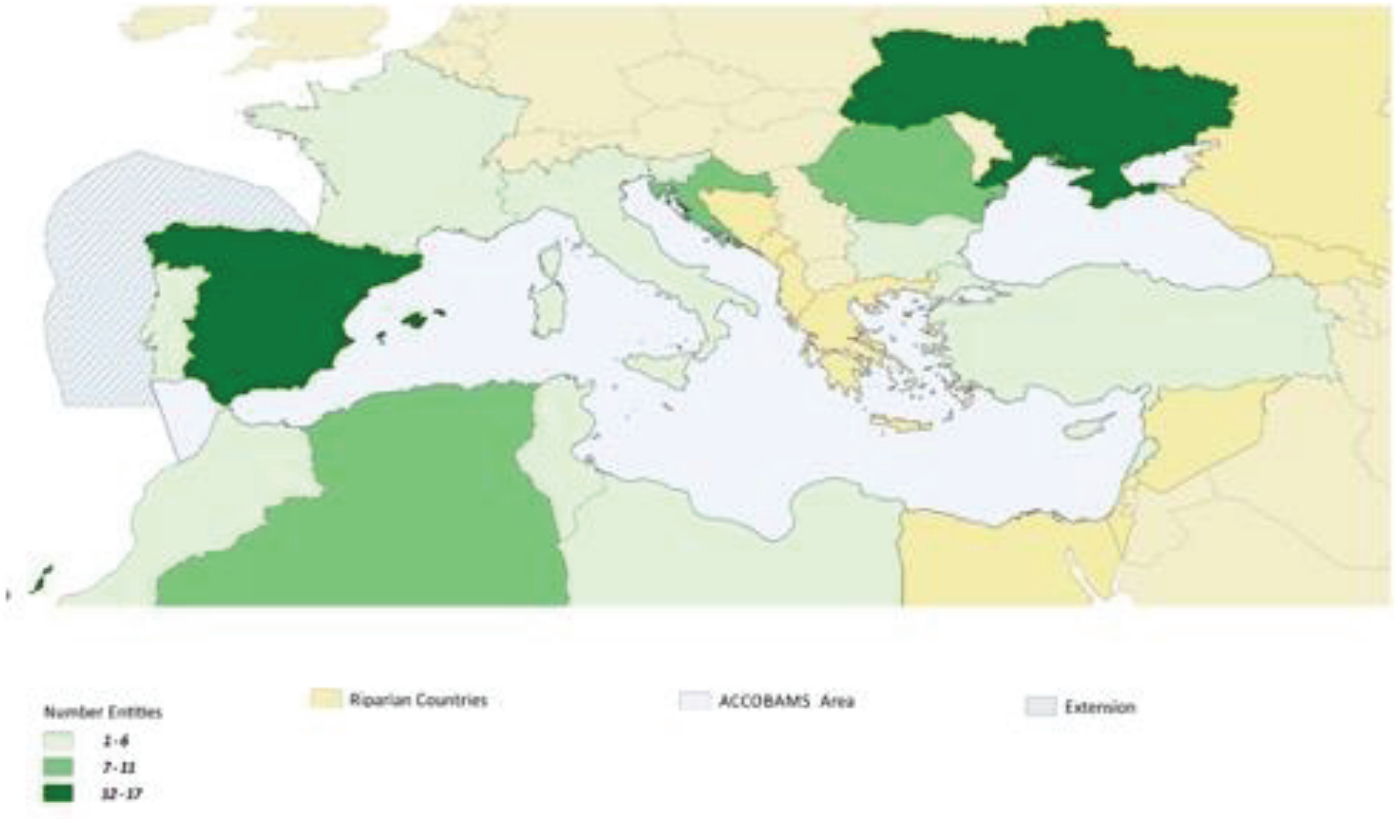
Entity Name	Referent Person	ROLE										Full address	Email	Phone	Fax
		National Stranding Network Coordinator	Stranding alert and reporting	Necropsy	Data delivery	Samples delivery	Analyses	Euthanasia	Release	Rehabilitation	Transmission Databases	Tissue banks				

17 Parties have answered, listing 102 entities *(plus the Egyptian document but received too late to take it into details)*

From the 26 ACCOBAMS' Parties 17 answers were received. Obviously this was quite disappointing, however the lack of answer from some of the northern Mediterranean countries does not impede the analyse of the weak points and the description of the needs for ACCOBAMS support.

	Nb. of entities involved
Spain	17
Ukraine	16
Croatia	11
Romania	9
Algeria	8
Bulgaria	6
Italy (Pelagos)	5
Portugal	4
Slovenia	4
Tunisia	4
Cyprus	3
Liban	3
Lybia	3
Monaco	3
Turkey	3
France	2
Maroc	1
Albania	?
Egypt	?
Georgia	?
Greece	?
Malta	?
Montenegro	?
Syria	?

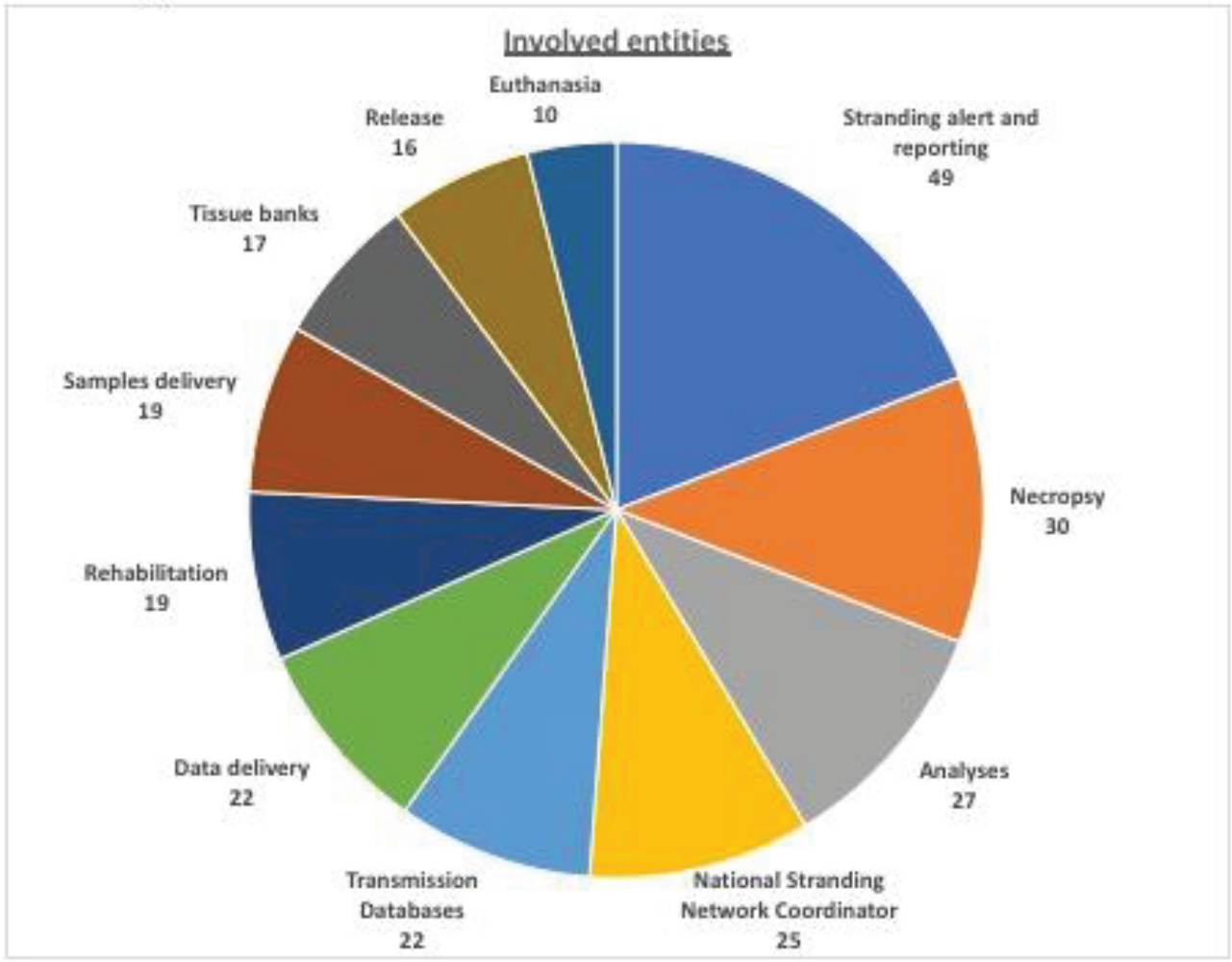
102 differents entities are involved in the strandings networks of 17 ACCOBAMS' Parties



Who do what in the strandings networks

In
17 Countries
13 Regions

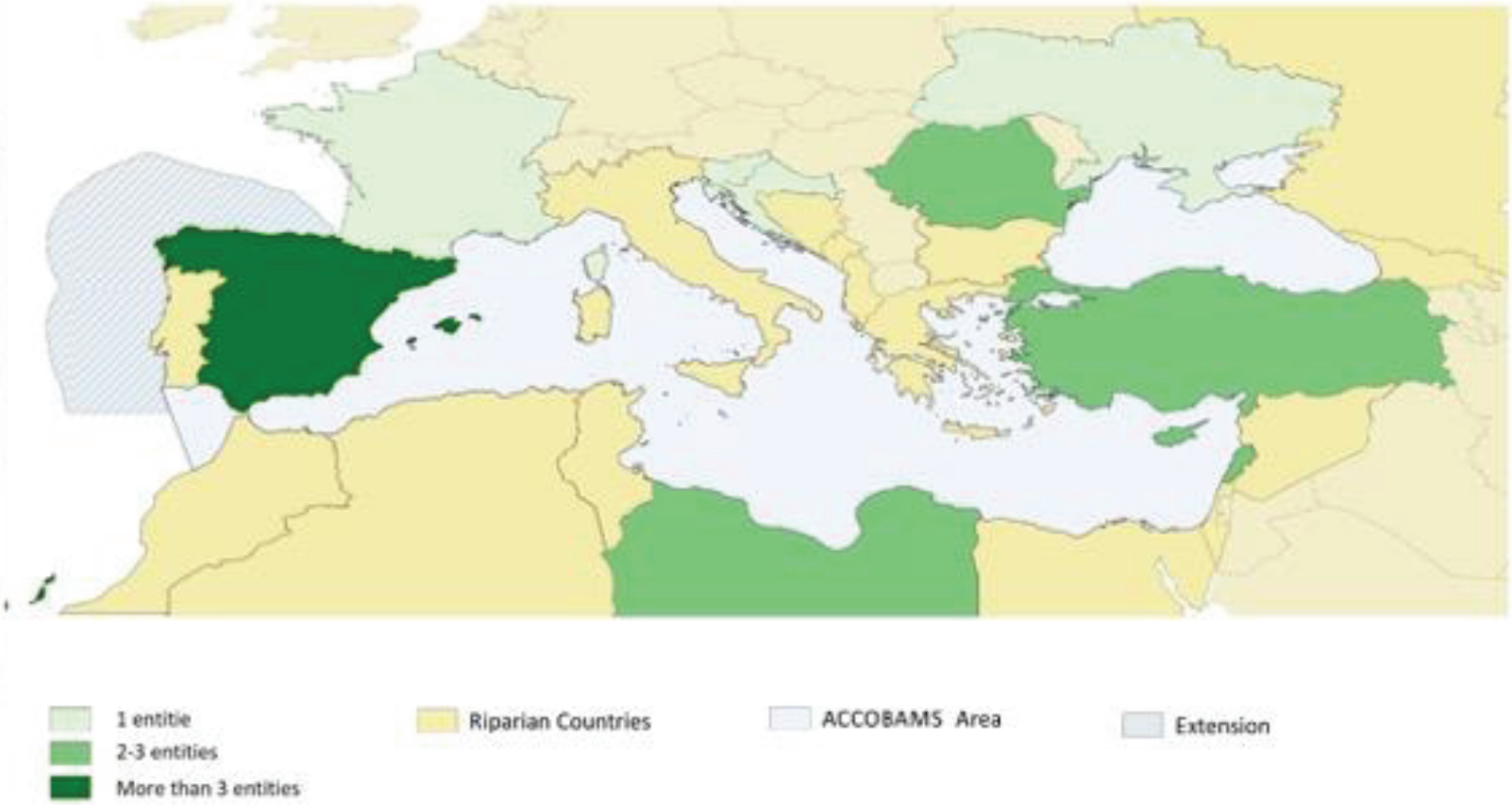
102 Entities



Focus on some special topics

COUNTRIES MAKING NECROPSIES

	Entities involved in necropsies
Spain	8
Lybia	3
Romania	3
Turkey	3
Cyprus	2
Liban	2
Croatia	1
France	1
Slovenia	1
Ukraine	1

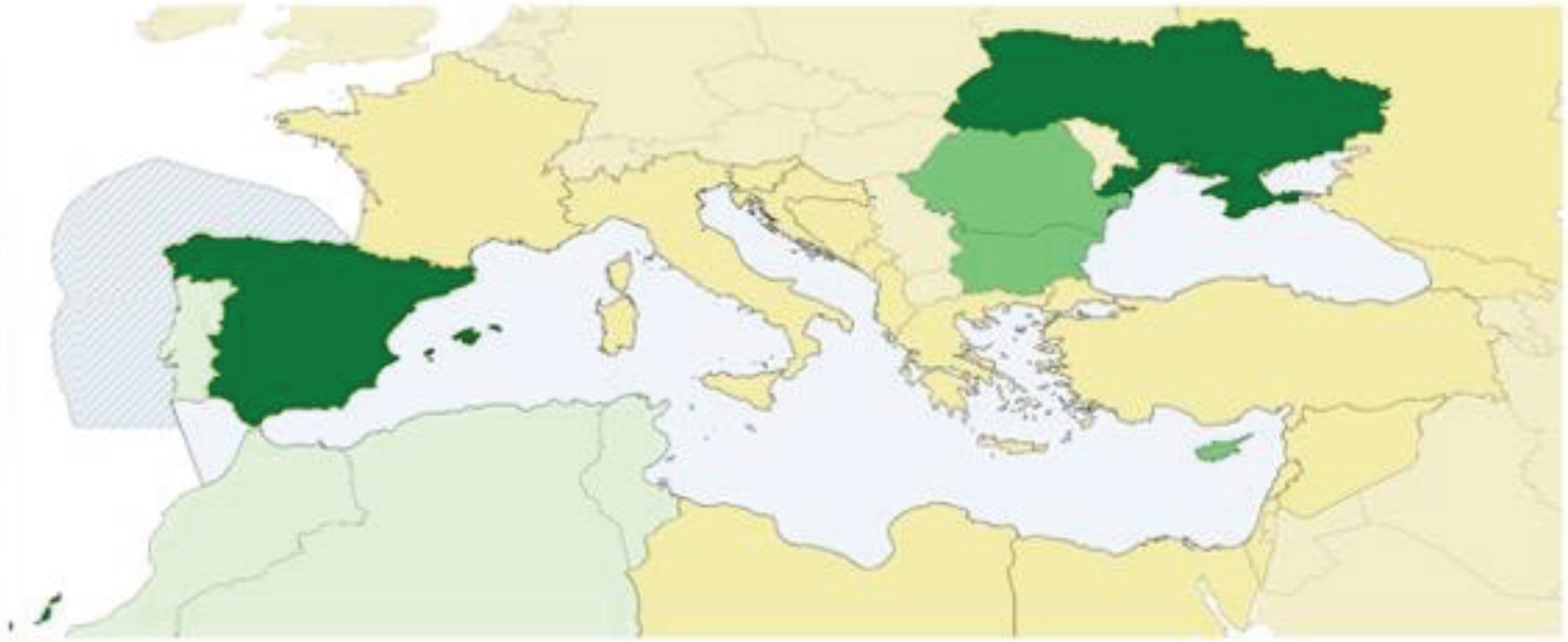


COUNTRIES HAVING TISSUES BANKS

	Entities involved in Tissues Bank
Spain	5
Tunisia	3
Liban	2
Ukraine	2
Croatia	1
France	1
Maroc	1
Portugal	1
Turkey	1

COUNTRIES WITH CENTER FOR RELEASE/REHABILITATION

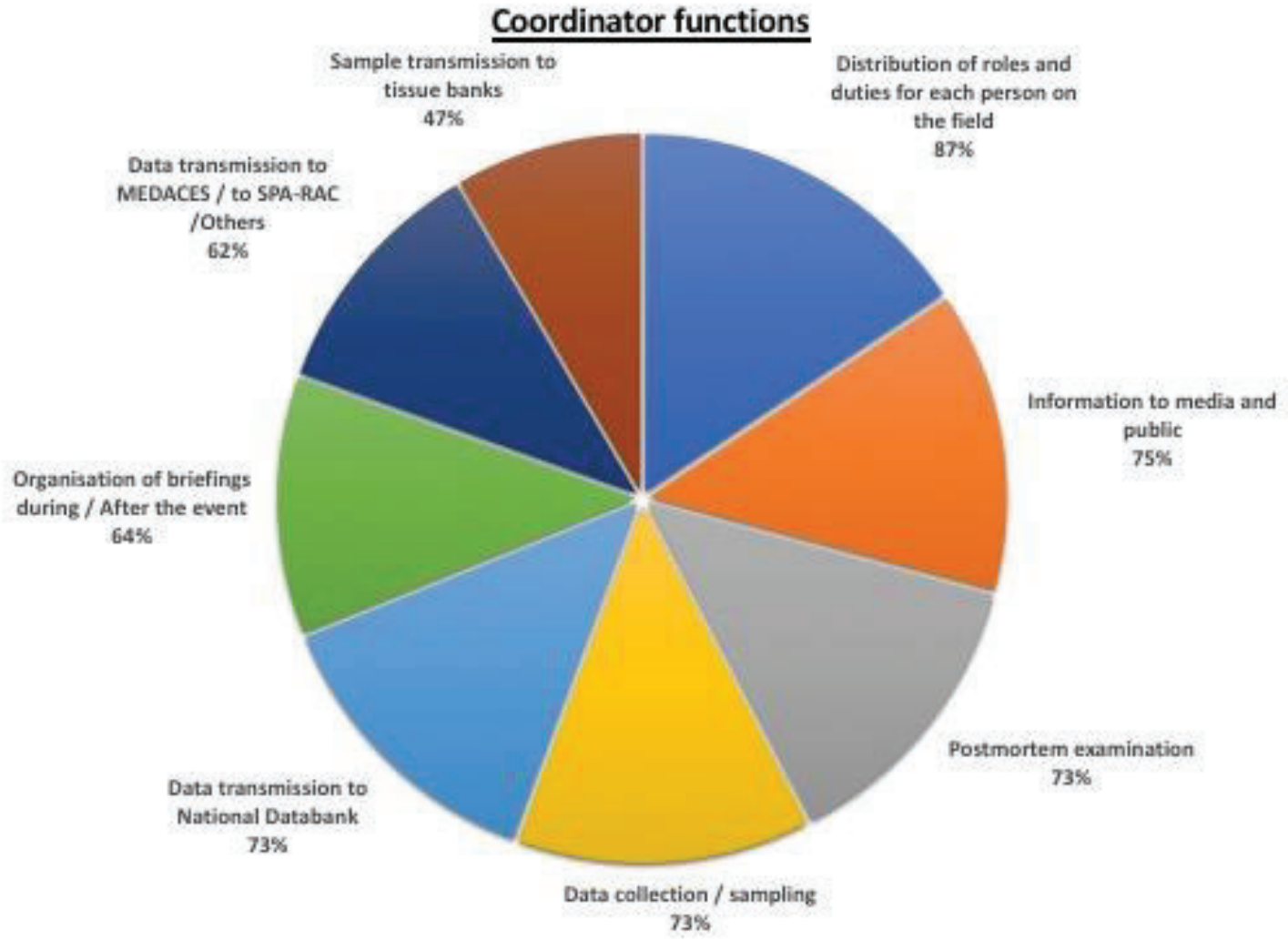
	Entities involved in release and rehabilitation
Spain	4
Ukraine	3
Bulgaria	2
Cyprus	2
Romania	2
Algeria	1
Maroc	1
Portugal	1
Tunisia	1
Turkey	1



8- Do you take care of marine debris during necropsy (stomach contents)?

	Marine debris examination
Croatia	Yes
France	Yes
Maroc	Yes
Romania	Yes
Spain	Yes
Tunisia	Yes
Turkey	Yes
Ukraine	Yes

3- What are missions of the National Stranding Coordinator during stranding events?



4- Overview of cetacean stranding events in your Country over the last 3 years.

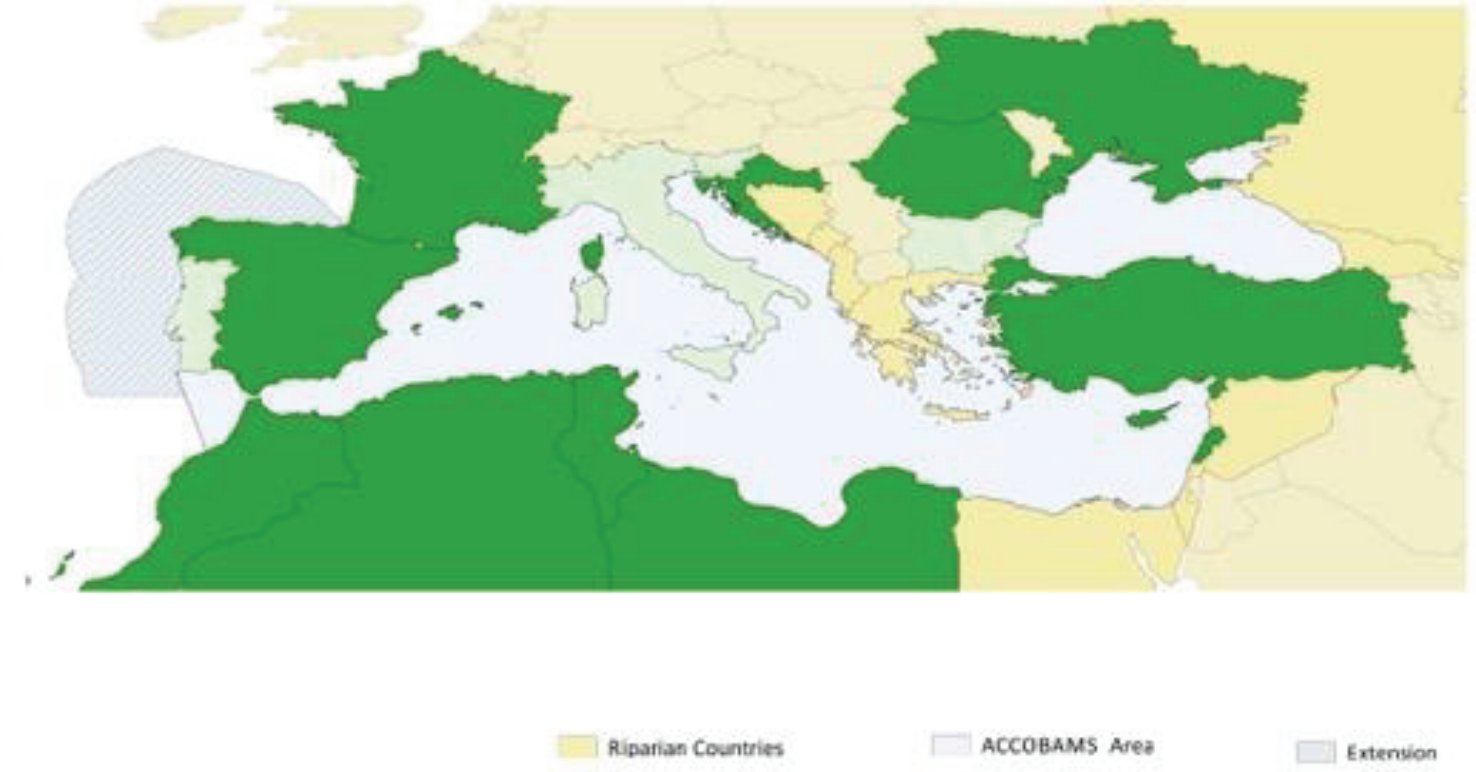
4	More than 100
3	50 to 100
2	10 to 50
1	Less than 10

Turkey	4
France	4
Spain Med	3
Spain Atlan	3
Romania	3
Maroc	3
Bulgaria	3
Algeria	3
Ukraine	2
Tunisia	2
Lybia	2
Croatia	2
Slovenia	1
Monaco	1
Liban	1
Cyprus	1
Egypt	1
Ukraine	?
Syria	?
Portugal	?
Montenegro	?
Malta	?
Italy	?
Greece	?
Georgia	?
Albania	?

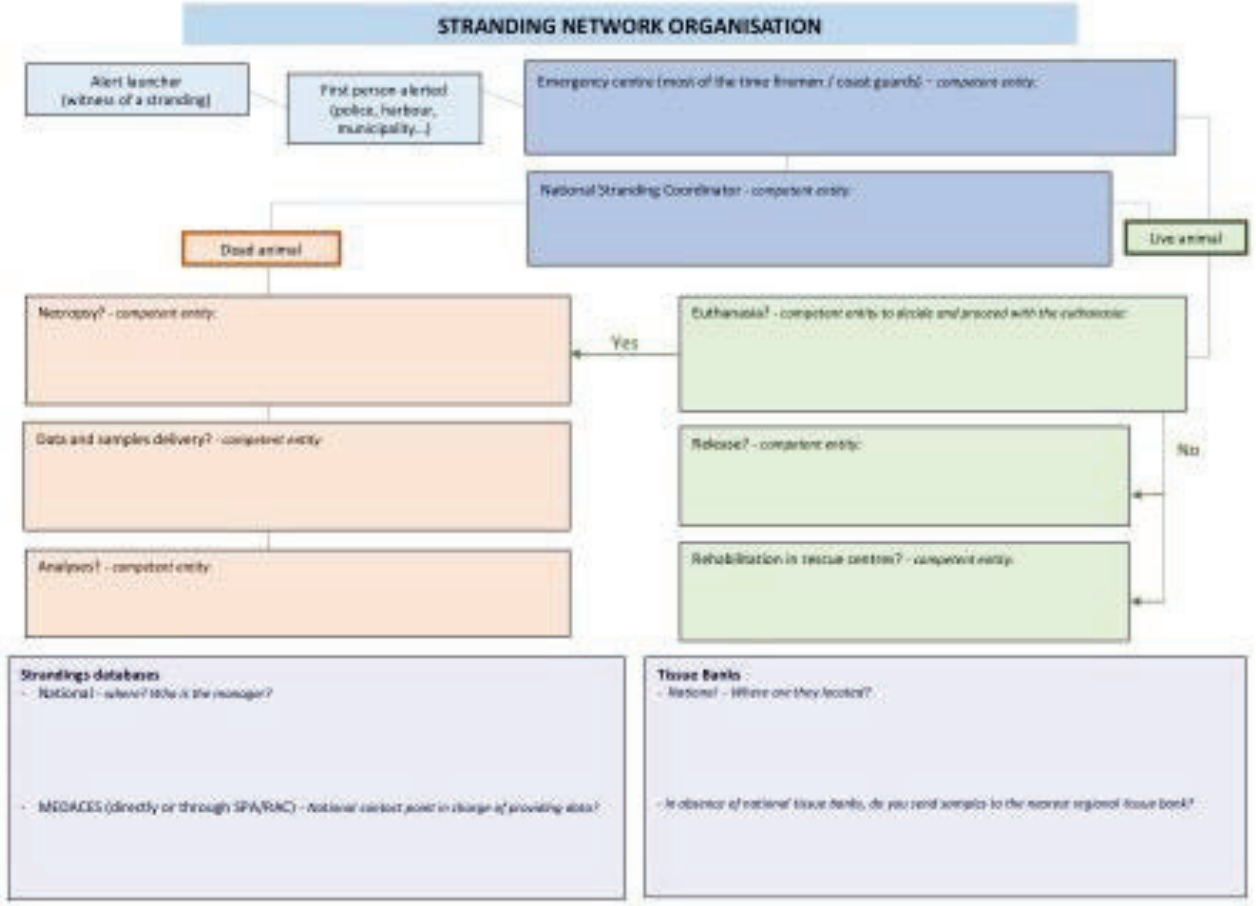
5- Data collection: Please provide the ACCOBAMS Permanent Secretariat with a copy of datasheet used or list the main information to be filled out in the field during the stranding event.

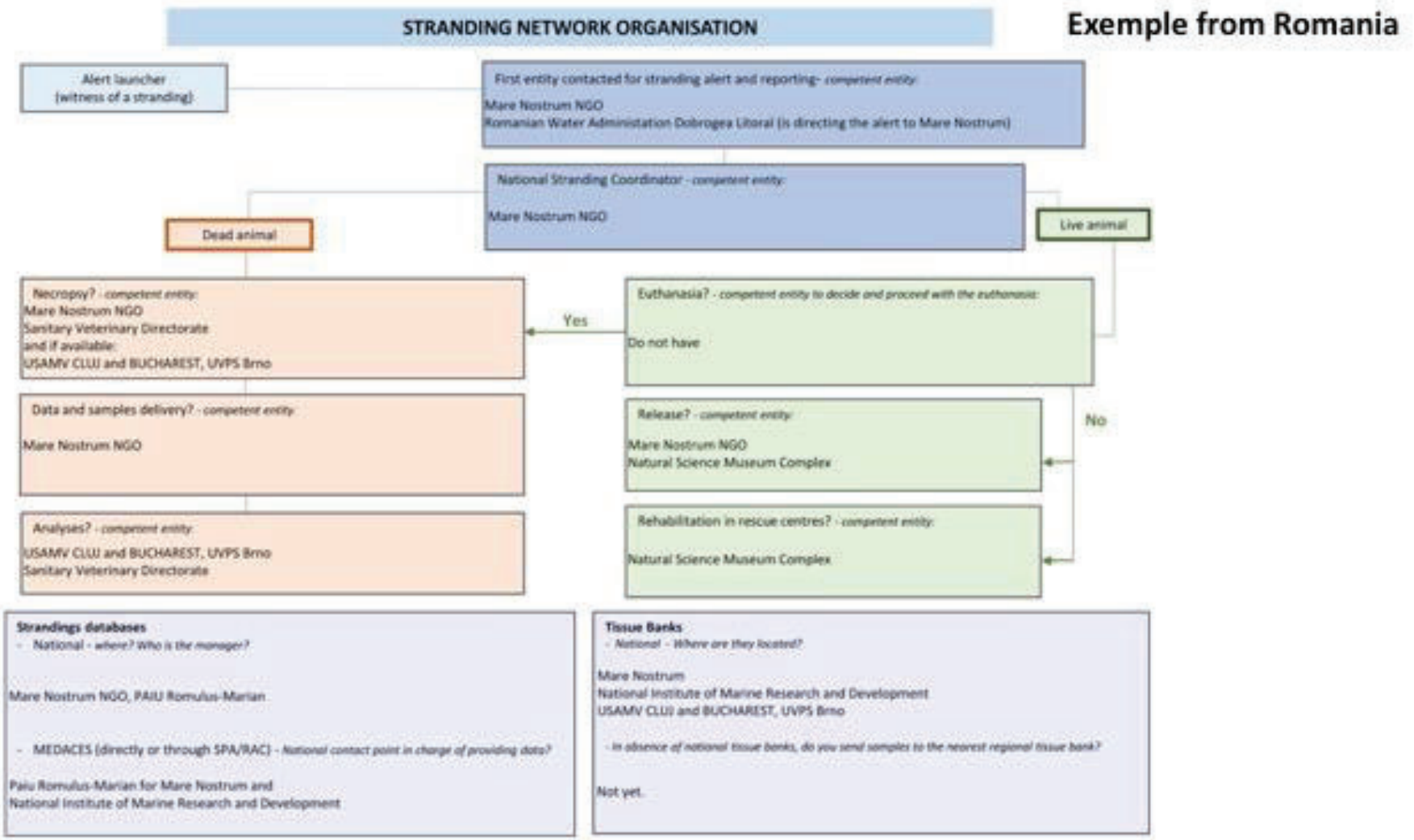
	Standardized datasheet
Algeria	1
Croatia	1
France	1
Liban	1
Lybia	1
Maroc	1
Romania	1
Spain	1
Turkey	1
Ukraine	1

COUNTRIES HAVING A STANDARDIZED FIELD DATASHEETS

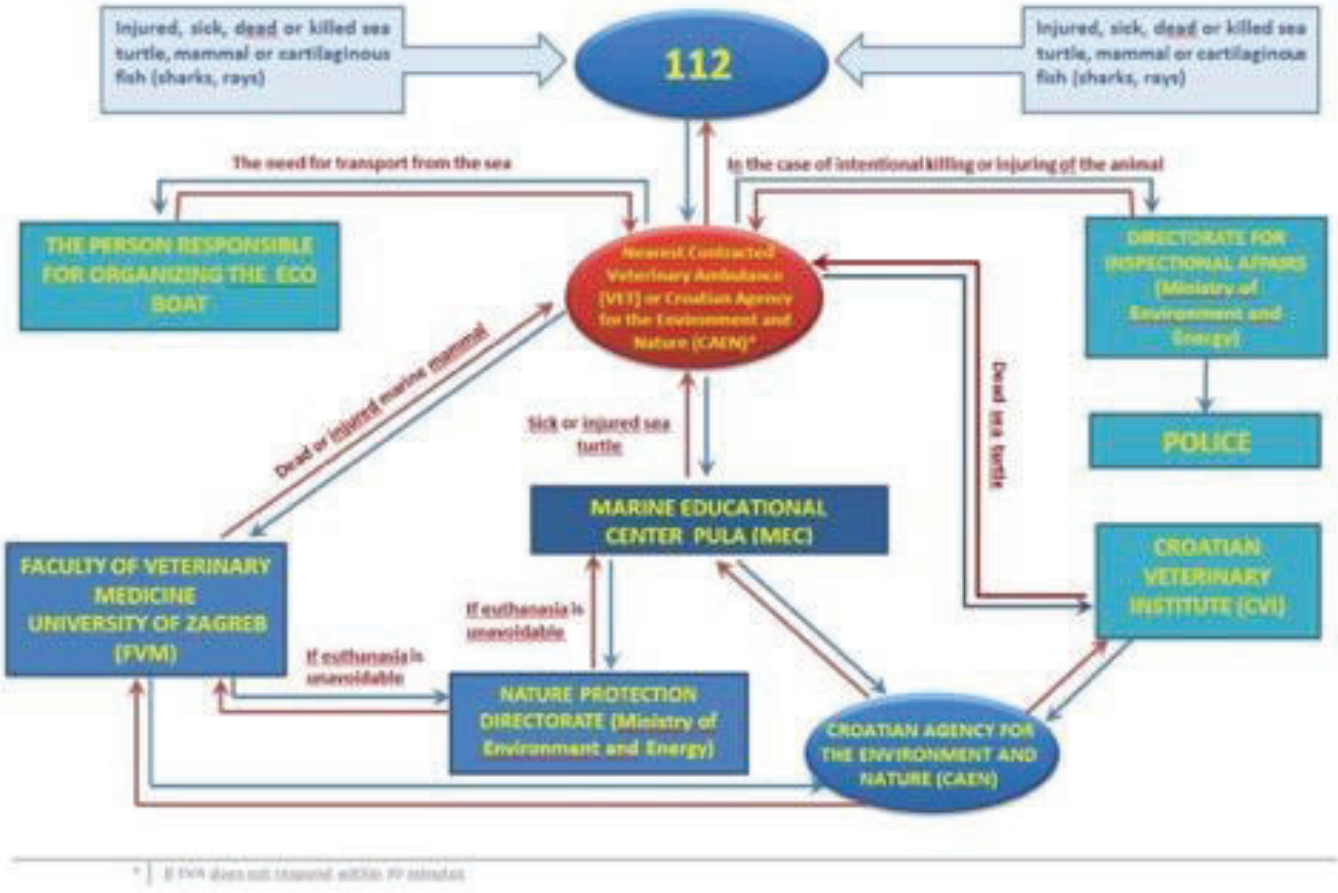


Please filled the "Stranding Network Organisation"/national alert scheme with all relevant information




STRANDING NETWORK ORGANISATION
Exemple from Romania
Alert launcher
(witness of a stranding)
First entity contacted for stranding alert and reporting- competent entity:
Mare Nostrum NGO
Romanian Water Administation Dobrogea Litoral (is directing the alert to Mare Nostrum)
National Stranding Coordinator - competent entity:
Mare Nostrum NGO
Dead animal
Live animal
Necropsy? - competent entity:
Mare Nostrum NGO
Sanitary Veterinary Directorate
and if available:
USAMV CLUJ and BUCHAREST, UVPS Brno
Yes
Euthanasia? - competent entity to decide and proceed with the euthanasia:
Do not have
No
Data and samples delivery? - competent entity:
Mare Nostrum NGO
Release? - competent entity:
Mare Nostrum NGO
Natural Science Museum Complex
Analyses? - competent entity:
USAMV CLUJ and BUCHAREST, UVPS Brno
Sanitary Veterinary Directorate
Rehabilitation in rescue centres? - competent entity:
Natural Science Museum Complex
Strandings databases
- National - where? Who is the manager?
Mare Nostrum NGO, PAIU Romulus-Marian
- MEDACES (directly or through SPA/RAC) - National contact point in charge of providing data?
Paiu Romulus-Marian for Mare Nostrum and
National Institute of Marine Research and Development
Tissue Banks
- National - Where are they located?
Mare Nostrum
National Institute of Marine Research and Development
USAMV CLUJ and BUCHAREST, UVPS Brno
- In absence of national tissue banks, do you send samples to the nearest regional tissue bank?
Not yet

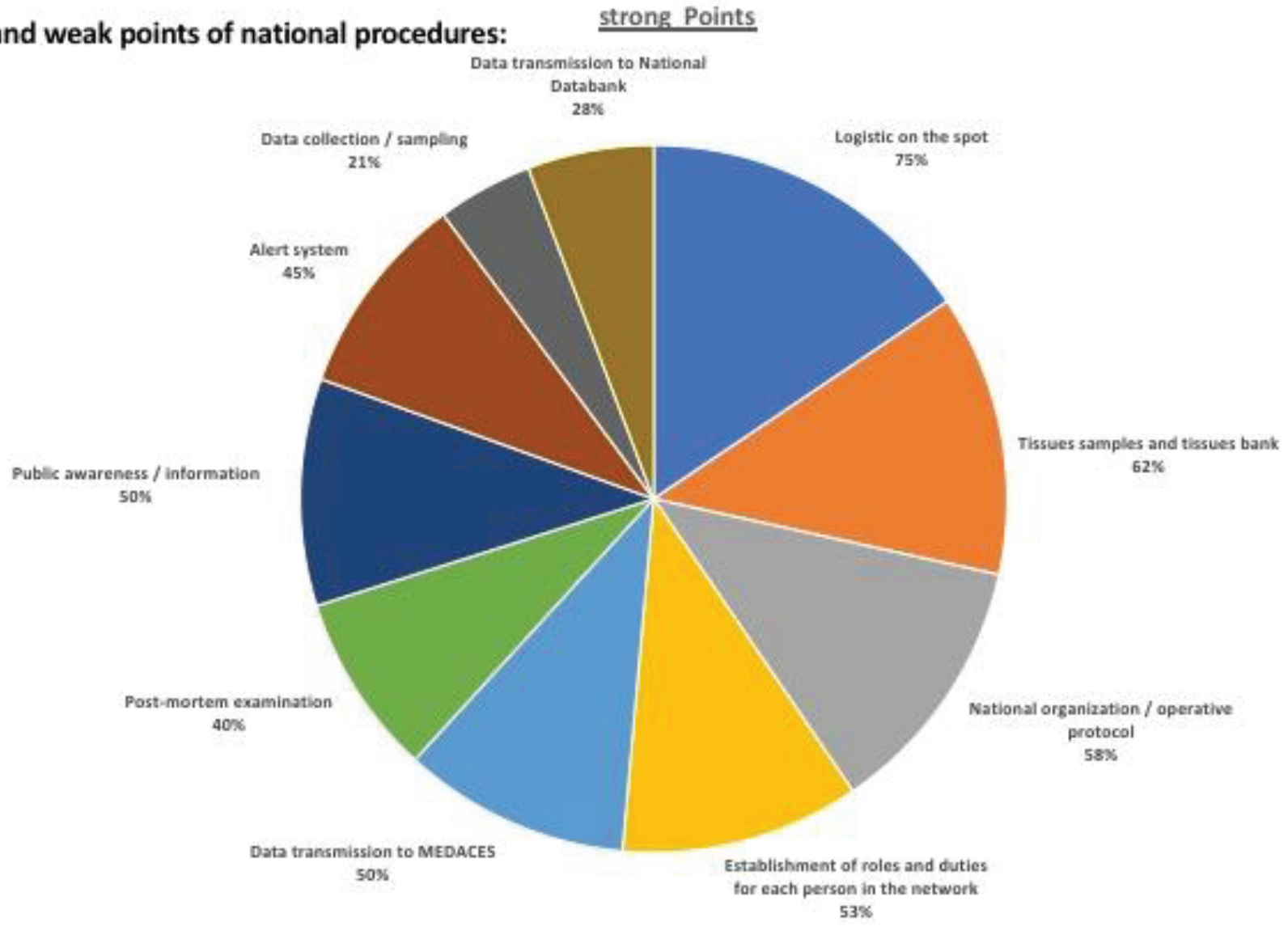
Exemple from Croatia



COUNTRIES SENDING DATA TO MEDACES

	Countries providing MEDACES with data
Spain	1
Ukraine	1
Romania	1
Algeria	1
Tunisia	1
Cyprus	1
France	1

9- Strong and weak points of national procedures:



10- Assistance or support needed/expected from the ACCOBAMS Permanent Secretariat