JOINT CMS/ASCOBANS/ACCOBAMS NOISE WORKING GROUP CONTRIBUTION TO CBD NOTIFICATION NO. 2014-001

Request for relevant information concerning the objectives of the Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, London, United Kingdom of Great Britain and Northern Ireland, 25 – 27 February 2014

The intention of this document is to draw on the recent publication of two papers that specifically relate to Environmental Impact Assessment (EIA) design for **marine seismic surveys** in an attempt to provide a practically orientated contribution to the CBD Expert Workshop Objective (ii): *Practical guidance and toolkits to minimize and mitigate the significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity, including marine mammals* and relates specifically to **marine seismic surveys.**

We urge the *CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversit*y to ensure that it reviews the considerable number of peer-reviewed scientific publications of the past 5-10 years on this subject.

The Joint CMS/ASCOBANS/ACCOBAMS Noise Working Group (Joint NWG) has been established with members and observers of the scientific and advisory bodies of the Convention on Migratory Species (CMS), the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS). External experts have been invited to participate in the Joint NWG in order to ensure the best possible advice can be generated for the Parties.

The Joint NWG addresses the mandates of relevant Resolutions of all three organizations, such as CMS Res.9.19, CMS Res.10.24, ACCOBAMS Res.3.10, ACCOBAMS Res.4.17, ASCOBANS Res.6.2 and ASCOBANS Res.7.2 and any relevant Resolutions still to be passed. It will present reports on progress and new information to each meeting of the CMS Scientific Council, ACCOBAMS Scientific Committee and ASCOBANS Advisory Committee.

We are conscious that the **ACCOBAMS Noise Guidelines** specifically articulate that the following should be taken into account for any activity generating underwater noise:

> e) Consider cumulative impacts not just of noise but of all anthropogenic threats over time; consider effects modelling; include consideration of seasonal and historical impacts from other activities (shipping, military, industrial, other seismic) in the specific survey area and nearby region. For these purposes, databases/GIS that track the history of sonar/seismic and other industrial activities and anthropogenic threats should be developed
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> f) Model the generated sound field in relation to oceanographic features (depth/temperature profile, sound channels, water depth, seafloor characteristics) to assess the area possibly affected by relevant impacts
>
> g) Determine safe / harmful exposure levels for various species, age classes, contexts, etc. This must be precautionary enough to handle large levels of uncertainty. When making extrapolations from other species, measures of uncertainty should quantify the chances of coming up with a wrong, and dangerous conclusion

The ACCOBAMS Noise Guidelines, in full, are annexed to this document, and we urge that these are also considered by your process.

The experiences of the Joint NWG are combined with the recommendations of two recent documents that specifically address EIA design, scope and processes for marine seismic surveys - Nowacek *et al*

2013 and Prideaux & Prideaux 2013 - to provide indicative practical detail about appropriate processes for planning, assessing impact and conducting marine seismic surveys that should be considered. We stress that this is not a comprehensive description of procedures and protocols recommended by the Joint NWG. We also stress that multiple national guidelines and peer-reviewed scientific publications should also be considered for advice for planning, assessing impact and conducting marine seismic surveys. The Joint NWG would be pleased to provide a more compressive document to the CBD process if invited to do so.
Current mitigation practices for marine seismic surveys generally call for noise producers to:

- minimise noise generation and source levels to the extent possible;
- avoid areas and seasons with high density of marine mammals or migrations;
- monitor the operational area months before and after seismic survey activities to document potential displacements;
- monitor the operational area to reduce the chances that animals are present hours before starting acoustic emissions;
- observe an exclusion zone around the seismic source while active reduce the chances that animals are within or are approaching the critical exposure area;
- use passive acoustic monitoring methods to listen for the presence of marine mammals;
- apply ramp-up procedures, consisting of gradually increasing the source output at the beginning of airgun operations;
- conduct an environmental audit process post survey; and
- report marine mammal observations to a regional/national database.

However, avoiding areas or seasons with high densities of marine mammals is often not possible and the effectiveness of relying on detecting animals within safety zones to reduce risks of injury has rarely been quantified.

While on-board, real-time mitigation measures to reduce immediate potential impacts (primarily direct injury) have been the historical focus of operational protocols these are limited in their effectiveness and do nothing to address disturbance and displacement. There is also a need to address the effects of noise at levels which cause changes in behaviour or displacement from preferred habitat but are not so intense as to cause direct injury. The potential for long-range effects (e.g. strandings, masking, stress) as well as the general industrialization of biologically important areas, which can result in more subtle, but sustained impacts on marine life, should also be considered. Consideration should extend to periods before, during, and following the seismic work itself and consider other potentially disturbing or confounding elements of the operation (e.g., vessel traffic, cable laying) as well as potential cumulative impacts.

To provide these details to inform regulator and assessors comprehensive Environmental Impact Assessments should be a requirement.

PLANNING STAGE: ASSESS ENVIRONMENT and PROPOSED ACTIONS

(1) Baseline environmental and biological data collection.
In situ measurements of the biological environment with sufficient characterization of sources of natural variability should be collected. The gathering of such data should be initiated as soon as possible at the planning stage of the project.
A key parameter to be included is the characterization of the seasonal presence and habitat use of noise sensitive species (e.g. cetaceans).

> This is needed for: Risk assessment (3); Mitigation design (4a); Monitoring program design (4b); Assessment of mitigation efficacy (7)

(2) Describe proposed development actions and alternatives

Provide detailed characterization of key operational parameters (e.g., sound output parameters from seismic and other acquisition sources, vessels, and other relevant sources such as air transport, coastal activities, etc.) and quantitative modelling of their propagation in the environment. Including:

- Full description of how impacts will be minimized to the greatest extent possible by a combination of seasonal timing, spatial mitigation (where possible), and use of alternative (quieting) seismic technologies, such as marine vibroseis;
- Ensure there is no unnecessary duplication of surveys, and that data are shared to the greatest extent possible;
- Specifics of the activity including anticipated nautical miles to be covered, track-lines, speed of vessels, duration of track-lines, start up and shut down procedures, swinging distance and procedures including any planned air gun power setting and array configuration changes;
- Computer modelling results in the form of plots and tables of sound propagation in the same season/weather conditions for sea surface parameters and water column temperature, salinity and stratification as the proposed survey. Local propagation features (spherical and cylindrical spreading, local propagation paths related to depth, sea bottom geoacoustic properties, surface parameters and sound velocity profiles, any SOFAR or natural channels characteristics), and out to a radius of a dB RL value of the average background noise level of the area or a default 100 dB re 1µPa. Models should then be verified in the field;
- Identification of proposed species exclusion zones and periods and description of how noise propagation into these zones will be minimised, taking into consideration the local propagation features and the survey design;
- Single signal source level (SL, dB re 1µPa at 1 m) and spectra (Hz) from a point source considering the array size, geometric configuration and pulse duration and cumulative sound exposure levels (SELcum) considering the interval between pulses (seconds) and the expected duration of the airgun activity (12/24 hour days) for the proposed survey;
- Identification of any other sound source, frequency of use and acoustic characteristics (SL, SELcum) such as single beam, multi beam, sub-bottom profilers or sparkers commonly used during seismic surveys; and
- Identification of other potentially impacting, even non-acoustic, activities in the region during the planned survey, and what the cumulative impact might be.

This is needed for: Risk assessment (3); Mitigation design (4a)

PLANNING STAGE: EVALUATE RISK and DEVELOP PLANS

(3) Evaluate risks of proposed development actions and alternatives

Conduct a quantitative risk assessment based on information from (1) and (2), including extrapolation and/or models derived from other species/areas if required. Generate exposure criteria for species involved, including:

- Identification of safe / harmful exposure levels for various species, age classes, functional hearing groups and contexts that is precautionary enough to handle large levels of uncertainty;
- Type of impact predicted to sensitive species (close-range, long-range, direct, indirect , its duration and spatial coverage) as well as impacts to their prey species;
- Plans for establishing spatial and seasonal restrictions;
- Definition of the exclusion zone (EZ) and buffer zones. This should be established on a scientific and precautionary basis rather than as arbitrary and/or static designation. The EZ isopleth limit should be verified in the field during the first day of operation and further verifications should be required if changes in the source or the environment are significant (e.g. changes in array configuration, changes in depth, sound velocity profile, etc.); and
- Description of all fisheries likely to be within the ensonified area during the seismic survey, or that might rely on prey that will be ensonified to levels or periods that could trigger negative impacts and proposed mitigation measures to minimise impact.

This should be precautionary but practical in the potential impacts formally assessed.

This is needed for: Mitigation design (4a)

(4a) Design effective mitigation actions

Agree on key objectives with all stakeholders. Measures must be shown to be likely to succeed in light of information on (1)–(3). Seasonal and spatial restrictions should be prioritized. Develop full protocols including command chain and real-time actions required if mitigation measures are impractical or ineffective. Integrate with (4b) and (5). Available methods and measures to be considered in survey planning include the following:

General information:

- Airgun specifications, array size, and configuration, frequency-maximum and working level of dB produced by the specific configuration; length of survey; and
- Spatial and temporal acoustic footprint based on prior empirical data and modelling.

Monitoring:

- Aerial surveys;
- Ship based surveys;
- Thermal and satellite imaging;
- Real time passive acoustic monitoring;
- Pre and post surveying;
- Onboard marine mammal observers (MMOs) trained up to a set standard, with an MMO protocol used, for the area of survey; and
- Sound source verification in field.

Mitigation:

- Spatial and seasonal restrictions;
- Use of quieter, alternative technology, such as marine vibroseis;
- Avoidance of sensitive areas;
- Use of lowest possible source power;
- Visual and acoustic monitoring (passive and active) of exclusion zone and buffer zone;
- Minimization of the survey area;
- Minimization of SLs;
- Minimization of horizontal propagation by optimal array geometry and synchronization
- Seismic survey line design and sequencing (segments of the area in which seismic data are obtained in sequence);
- Planned shutdowns;
- Operational shutdowns based on EZ monitoring, field observations of behaviour in buffer zone and sound-level criteria for behavioural disturbance and injury;
- Buffer zones and exclusion zones;
- Provisions for night-time operations and periods of poor visibility; and
- Application of Acoustic Harassment Devices prior to the airgun survey tailored to timing and area of interest.

This is needed for: Mitigation implementation (5)

(4b) Design effective monitoring methods for before, during, and following operations

Integrated (with 4a) monitoring techniques and protocols using real-time and archival technologies are required. These methods should be adaptable and with sufficient power to detect changes in sensitive species distribution and habitat use (1), determine if monitoring and mitigation measures (see 4a) are effective, address sensitive species data and information gaps, and contribute to long-term monitoring and regional database. Make survey plans publicly available months ahead of the seismic testing.

This is needed for: Mitigation implementation (5); Mitigation evaluation (7); Future mitigation design (8)

(4b) Design effective monitoring methods for before, during, and following operations
Integrated (with 4a) monitoring techniques and protocols using real-time and archival technologies are required. These methods should be adaptable and with sufficient power to detect changes in sensitive species distribution and habitat use (1), determine if monitoring and mitigation measures (see 4a) are effective, address sensitive species data and information gaps, and contribute to long-term monitoring and regional database. Make survey plans publicly available months ahead of the seismic testing.

This is needed for: Mitigation implementation (5); Mitigation evaluation (7); Future mitigation design (8)

Risk evaluation, proposed migration actions as well monitoring methods and design should be publically available.

IMPLEMENTATION STAGE: MITIGATION and MONITORING

(5) Implement mitigation and monitoring
Systems and qualified personnel must be in place in the field to ensure that agreed mitigation measures and agreed monitoring actions are correctly and effectively implemented in a timely manner. Written protocols, based on anticipated scenarios, must be understood and practiced ahead of time by all involved parties. Clear chains of command and communication are essential as is honest assessment of the value and limitation of all observing systems. The expected risk reduction for the mitigation measures should be quantified.

This is needed for: Mitigation and monitoring

(6) Implement data collection, validation, and archiving Must have systems in place to ensure that data are available, properly treated (QA/QC) and redundantly archived.
NEEDED FOR: Mitigation evaluation (7); Future mitigation design (8)

POST OPPERATION STAGE: EVALUATE and IMPROVE

(7) Evaluate effectiveness of mitigation measures
Evaluation of monitoring results to determine if mitigation measures as implemented were adequate to meet agreed objectives in (4a).

This is needed for: Future mitigation design (8)

(8) Evaluate effectiveness of monitoring program
Determine if monitoring results were sufficient to adequately address (7) and identify any residual risk to species of concern.

This is needed for: Future mitigation and monitoring design

(9) Prompt analysis and publication of results
Ensure that analyses are completed promptly and results published immediately in report form (and ideally in open, peer-reviewed literature over the longer term) to inform future risk assessments and mitigation and monitoring actions.

Provisions of these results to appropriate bodies, such as ASCOBANS, ACCOBAMS or CMS is also important

SPECIES SCOPE

Depending on the region, species to be included in this level of assessment may include cetaceans, pinnipeds, sirenians, fish, crustaceans, turtles, elasmobranchs and cephalopods.

JOINT NWG RECCOMENDATIONS

The Joint NWG would be pleased to provide a more compressive document to the CBD process if invited to do so.

We request that consideration is given to incorporating these practical measure, including the details of the ACCOBAMS Noise Guidelines, in the report of the workshop which we understand is to be made available for consideration by a meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) prior to the twelfth meeting of the CBD Conference of the Parties (paragraph 20, decision XI/18).

We urge the report is framed to facilitate SBSTTA endorsement of these practical measures as guidelines, to ensure that they are appropriately discussed during the CBD CoP, CMS CoP and the next meetings of ASCOBANS and ACCOBAMS.

The documents directly summarized in this contribution to CBD Notification No. 2014-001 are:

Nowacek DP, Bröker K, Donovan G, Gailey G, Racca R, Reeves RR, Vedenev AI, Weller DW and Southall BL (2013) Responsible Practices for Minimizing and Monitoring Environmental Impacts of Marine Seismic Surveys with an Emphasis on Marine Mammals, *Aquatic Mammals* 39, no. 4

Prideaux G & Prideaux M (2013) Seismic Seas: Understanding the impact of offshore seismic petroleum exploration surveys on marine species, Wild Migration Technical and Policy Review #3, *Wild Migration*, Australia

The Joint NWG highly recommends that multiple national guidelines and peer-reviewed scientific publications should also be considered for advice for planning, assessing impact and conducting marine seismic surveys.

This document has been reviewed and accepted by the majority of Members of the Joint CMS/ASCOBANS/ACCOBAMS Noise Working Group

One of the Joint NWG members voiced concern that CBD was seeking to develop practical guidance and toolkits to minimize and mitigate the significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity, including marine mammals. They felt it was inappropriate to call for extensive environmental baselines, monitoring and reporting as this seemed predicated on the assumption that marine seismic surveys represent a disproportionate threat to marine species and that as a threat it was not set in the context of other factors to which populations of marine mammals are routinely exposed. They also held concerns that the Joint NWG paper suggested a shift of the burden of environmental assessment from regulatory agencies to the oil and gas industry. Overall, they were not able to support the document's recommendations.

Another Joint NWG member raised concerns that the document does not represent a substantial improvement in seismic survey mitigation and that it contains important gaps. They believed there was a case to ask for additional baseline monitoring. They believed that the two papers used as the foundation point of the document were simply a repeat common knowledge

RESOLUTION 4.17

GUIDELINES TO ADDRESS THE IMPACT OF ANTHROPOGENIC NOISE ON CETACEANS IN THE ACCOBAMS AREA

The Meeting of the Parties to the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS):

Taking in consideration the recommendation of the ACCOBAMS Scientific Committee,

Recognizing that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death,

Recalling Article 236 of the United Nations Convention on the Law of the Sea, which states: "The provisions of this Convention regarding the protection and preservation of the marine environment do not apply to any warship, naval auxiliary, other vessels or aircraft owned or operated by a State and used, for the time being, only on government non-commercial service. However, each State shall ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such vessels or aircraft owned or operated by it, that such vessels or aircraft act in a manner consistent, so far as is reasonable and practicable, with the said Convention,"

Aware of the work on noise undertaken within, *inter alia*. the International Whaling Commission Scientific Committee, the European Union, the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, the NATO Undersea Research Center (NURC), the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas, the United States Marine Mammal Commission, the United States National Marine Fisheries Service, the National Oceanic and Atmospheric Administration (NOAA) and other governmental and nongovernmental Organizations,

Welcoming the activities of the International Maritime Organization (IMO) to address the impact of ship-generated noise on cetaceans and the establishment by its Marine Environmental Protection Committee (MEPC58, October 2008 and MEPC 61, October 2010, that plan to prepare draft Guidelines on noise from vessels and its adverse impacts on marine life that should be presented for MEPC 62 in 2011) of a high priority programme of work on minimizing the introduction of incidental noise from commercial shipping operations into the marine environment,

Recalling that:

- Article II of ACCOBAMS requires the Parties to apply conservation, research and management measures to the assessment and management of human–cetacean interactions, on the basis of the precautionary principle;
- the Conservation Plan, which is a full part of the Agreement, requires the Parties to:
    - carry out impact assessments to provide a basis for allowing or prohibiting the continuation or the development of activities that might affect cetaceans or their habitats in the Agreement area and to establish the conditions under which such activities may be conducted; and
    - regulate the discharge at sea of pollutants believed to have adverse effects on cetaceans, and to adopt within the framework of other appropriate legal instruments stricter standards for such pollutants,

Recalling also:

- Resolution 8.22 of 2005 on Adverse Human Induced Impacts on Cetaceans and the 9.19 of 2008 on adverse anthropogenic marine/ocean noise impacts on cetaceans and other biota adopted within the framework of the Bonn Convention on the Conservation of Migratory Species of Wild Animals;

- Resolution 5.4 on Adverse effects of sound vessels and other forms of disturbance on small cetaceans and Resolution 6.2 on adverse effects of underwater noise on marine mammals during offshore constructions activities for renewable energy production of ASCOBANS;
- Articles 65 and 120 of the United Nations Convention on the Law of the Sea (UNCLOS) on State cooperation through the appropriate international organizations for the conservation and management of marine mammals (Articles 65 and 120); and
- Directive 92/43/EEC (Habitats Directive) and Directive 2008/56/EC of the European Parliament and of the Council (Marine Strategy Framework Directive);

1. *Welcomes strongly* the Scientific Committee report on the impact of anthropogenic noise on cetaceans in the ACCOBAMS area and its associated guidelines presented in the Annex to this resolution;

2. *Mandates* the Secretariat to publish these guidelines to the Parties and to operators of noise sources (e.g., seismic exploration industry, offshore windfarms);

3. *Encourages* the Parties and operators to take these guidelines as a reference in conducting noise-producing activities;

4. *Encourages* Parties:
   - to address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities;
   - to integrate the issue of anthropogenic noise in management plans for marine protected areas;
   - to avoid or minimize producing noise in marine protected areas, as well as in particular in areas containing critical habitat of cetaceans likely to be affected by man-made sound;

5. *Strongly requests* Parties to emphasize the need for a precautionary approach and to envisage the appropriate mitigation measures, including a provision for expert review by specialists and a provision for the action to be taken if unusual events, such as atypical mass strandings, occur;

6. *Mandates* the Agreement Secretariat to develop, on the basis of the reports submitted by States Parties, a typology of activities within the region that have been approved and include a noise component, so that in the occurrence of an unusual event, such as a mass stranding, it will be possible to examine the possible causes;

7. *Directs* the Secretariat to work with Parties to collect information on noise levels and noise sources in the ACCOBAMS area, and directs the Scientific Committee to evaluate such information, in order to detect the most affected sites within the region and determine if cetacean critical habitats are involved, and to report its findings to the next Meeting of Parties;

8. *Encourages* Parties and Secretariat to strengthen stranding networks throughout the ACCOBAMS area and to improve the capacity to promptly investigate and intervene in case of atypical mass strandings, including the capacity to collect tissues and perform necropsies, in a manner that is appropriate to detect the occurrence of gas and fat embolic syndrome and to analyze auditory system damage in stranded cetaceans;

9. *Urges* Parties and Secretariat to support ongoing international efforts, including in the International Maritime Organization, in the development and adoption of vessel-quieting technologies;

10. *Mandates* the Secretariat in collaboration with the Scientific Committee to establish as far as possible a common working group with CMS, ASCOBANS and Pelagos in order to develop appropriate tools to assess the impact of anthropogenic noise on cetaceans and to further elaborate measures to mitigate such impacts and to coordinate efforts on this issue with other international bodies, in particular, the Coordination Unit for the Mediterranean Action Plan, the Commission on the Protection of the Black Sea Against Pollution and the Secretariat of the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic and the International Maritime Organization (IMO);

11. *Entrusts* the Scientific Committee:
    - with the task to continue the study on the extent and temporal variability of the habitat of species that are known to be particularly vulnerable to man-made noise (e.g., *Ziphius cavirostris*), asking the Parties to further support through the Secretariat's action the modelling exercise currently undertaken, in order to ensure that more data are made available, to increase the model's robustness and to compare different algorithms for best results;
    - with the task to provide scientific review of potential effects of anthropogenic noise and appropriate mitigation measures to the Parties that request it;
    - to keep the subject of this Resolution on its agenda and in particular provide a regular review of new information;

12. *Directs* the Secretariat to distribute to the Parties the findings of the Scientific Committee on the habitat of species particularly vulnerable to noise and appropriate mitigation measures, as these findings become available, and encourages the Parties to utilize said findings in minimizing harm to vulnerable species and to report to the next Meeting of Parties on steps they have taken to utilize these findings;

13. *Directs* the Working Group established in Resolution 3.10, in cooperation with the Secretariat, the Scientific Committee, and Parties, to further develop the guidelines presented in the Annex, with the aim of testing the application of the guidelines in particular areas to make them implementable by the Parties and operators, and to report about progress made in implementing this resolution to the next Meeting of Parties.

ANNEX

Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area

General guidelines

Mitigation procedures should be practical in that they should use data that can be readily collected by cetacean observers, account for operating conditions and constraints, and, as far as possible, minimize disruption of operations while maximizing environmental protection.

Besides procedures for specific activities, the following guidelines and concepts should be taken into account for any activity:

a) Consult databases of cetacean spatial and seasonal distribution and habitat databases so that activities can be planned and conducted to avoid critical habitats and when and where animals are unlikely to be encountered

b) Collect information and, if required, organize surveys (shipboard and/or aerial) or monitoring with fixed detectors (buoys, bottom recorders, etc.) to assess the population density in the areas chosen for operation

c) Avoid cetaceans' key habitats and marine protected areas, define appropriate buffer zones around them; consider the possible impact of long-range propagation

d) Closed areas should be avoided and surrounded by appropriate buffer zones

e) Consider cumulative impacts not just of noise but of all anthropogenic threats over time; consider effects modelling; include consideration of seasonal and historical impacts from other activities (shipping, military, industrial, other seismic) in the specific survey area and nearby region. For these purposes, databases/GIS that track the history of sonar/seismic and other industrial activities and anthropogenic threats should be developed

f) Model the generated sound field in relation with oceanographic features (depth/temperature profile, sound channels, water depth, seafloor characteristics) to assess the area possibly affected by relevant impacts

g) Determine safe / harmful exposure levels for various species, age classes, contexts, etc. This must be precautionary enough to handle large levels of uncertainty. When making extrapolations from other species, measures of uncertainty should quantify the chances of coming up with a wrong, and dangerous conclusion

h) There should be a scientific and precautionary basis for the exclusion zone (EZ) rather than an arbitrary and/or static designation; exclusion zones should be dynamically modelled based on the characteristic of the source (power and directionality), on the expected species, and on the local propagation features (cylindrical vs spherical spreading, depth and type of sea bottom, local propagation paths related to thermal stratification). These EZ should be verified in the field

i) In the case of multiple EZ choices, the safest, most precautionary option should be adopted

j) Consider establishment of an expanded exclusion zone aimed at reducing behavioural disruption This should be based on received levels much lower than those supposed to produce physiological and physical damage. Whenever possible, consider an expanded exclusion zone where exposure could be limited by reducing the emitted power (power-down) whilst maintaining acceptable operative capabilities

k) Cetacean mitigation guidelines should be adopted and publicized by all operators, whether military, industrial or academic

l) A system of automated logging of acoustic source use should be developed to document the amount of acoustic energy produced, and this information should be available to noise regulators and to the public

m) Mitigation should include monitoring and reporting protocols to provide information on the implemented procedures, on their effectiveness, and to provide datasets to be used for improving existing cetacean databases
n) During operations, existing stranding networks in the area should be alerted; if required, additional monitoring of the closest coasts and for deaths at sea should be organized
o) If required, organize post cruise survey to verify if changes in the population density or anomalous deaths occurred as a possible consequence of operations (this requires a knowledge of the area before any operation has occurred – see points a & b)
p) In the case of strandings possibly related with the operations, any acoustic emission should be stopped and maximum effort devoted to understanding the causes of the deaths
q) In the case of abnormal behaviours observed in animals close to the operations, any acoustic emission should be stopped and maximum effort addressed at monitoring those animals
r) Trained and approved Cetaceans Observers (visual observers and/or acoustic monitors where appropriate) should be employed for the monitoring and reporting program including overseeing implemented mitigation rules
s) Cetacean observers and bio-acousticians in charge of the monitoring program must be qualified, dedicated and experienced, with suitable equipment
t) Marine mammal observers should report to the National Focal Point that will inform the ACCOBAMS Secretariat using a standardized reporting protocol. Any unexpected condition and/or change in applied protocols should be discussed with the Secretariat in collaboration with the Scientific Committee.
u) Accurate reporting is required to verify the EIA hypotheses and the effectiveness of mitigation
v) Procedures and protocols should be based on a conservative approach that reflects levels of uncertainty. They should include mechanisms that create an incentive for good practice.
w) Take a precautionary approach every time uncertainties emerge; in the case of unexpected events or uncertainties refer to the National Focal Point.

Guidelines for (military sonar and civil) high power sonar

For sonar operations the following guidelines and key concepts should apply in addition to the general guidelines:

a) Sonar surveys should be planned so as to avoid key cetacean habitat and areas of cetacean density, so that entire habitats or migration paths are not blocked, so that cumulative sonar sound is limited within any particular area, and so that multiple vessels operating in the same or nearby areas at the same time are prohibited
b) Use of the lowest practicable source power
c) Adapt the sequencing of sonar lines to account for any predictable movements of animals across the survey area and avoid blocking escape routes
d) Continuous visual and passive acoustic monitoring (PAM) with a specialized team of cetaceans observers and bio-acousticians to ensure that cetaceans are not in the "exclusion zone" before turning on the acoustic sources and while sources are active.
e) Equipment for visual monitoring should include suitable binoculars, including big eyes, to be used according to the monitoring protocol
f) High power sources should be restricted at night, during other periods of low visibility, and during significant surface-ducting conditions, since current mitigation techniques may be inadequate to detect and localize cetaceans. Because of the impact of adverse weather conditions on the visual detection of mammals, emission during unfavourable conditions should be restricted as well
g) Passive acoustic monitoring (PAM) (towed array technology or other suitable technologies with enough bandwidth to be sensitive to the whole frequency range of cetaceans expected in the area) should be used to improve detection capabilities. PAM should be mandatory for night operations or when visibility is poor. However, PAM may be inadequate mitigation for night operations if cetaceans in the area are not vocal or easily heard.
h) At least two dedicated Cetacean Observers should be on watch at every time on every operative ship; organize shifts to allow enough rotation and resting periods to MMOs. In case of acoustic

monitoring, at least one operator should be on watch and shifts should be organized to allow 24/24h operation, unless automatic detection/alerting systems with proven effectiveness are available

i) Before beginning any emission there should be a dedicated watch of at least 30 minutes to ensure no animals are within the EZ

j) Extra mitigation measures should be applied in deep water areas if beaked whales have been seen diving on the vessel trackline or if habitats suitable for beaked whales are approached: in such cases, the watch should be prolonged to 120 minutes to increase the probability that deep-diving species are detected (e.g. Cuvier's beaked whales). Ideally, however, sonar exercises should not be done in areas that beaked whales are known to inhabit.

k) Every time sources are turned on, there should be a slow increase of acoustic power (ramp-up or soft start) to allow cetaceans sufficient opportunity to leave the ensonified area in the event that visual and passive searches are unsuccessful. Ramp-up should be at least 30 minutes (the effectiveness of this procedure is still debatable)

l) The beginning of emissions should be delayed if cetacean species are observed within the exclusion zone (EZ) or approaching it. Ramp-up may not begin until 30 minutes after the animals are seen to leave the EZ or 30 minutes after they are last seen (120 minutes in case of beaked whales)

m) Avoid exposing animals to harmful acoustic levels by preventing them from entering into the EZ, by changing the ship course, if applicable, or by reducing (power-down) or ceasing (shut-down) the acoustic emissions

n) Shut-down of source(s) whenever a cetacean is seen to enter the EZ and whenever aggregations of vulnerable species (such as beaked whales and sperm whales) are detected anywhere within the monitoring area

Guidelines for seismic surveys and airgun uses

Guidelines for mitigating the effects of seismic surveys have been experimented with mostly in the context of academic seismic surveys conducted under NMFS permits. Most of the following guidelines are equivalent to those required for sonar operations and should apply in addition to general guidelines:

a) Seismic surveys should be planned so as to avoid key cetacean habitat and areas of cetacean density, so that entire habitats or migration paths are not blocked, so that cumulative seismic noise is limited within any particular area, and so that multiple vessels operating in the same or nearby areas at the same time are specifically regulated or prohibited.

b) Use of the lowest practicable source power

c) Limit horizontal propagation by adopting suitable array configurations and pulse synchronization and eliminating unnecessary high frequencies.

d) Adapt the sequencing of seismic lines to account for any predictable movements of animals across the survey area and avoid blocking escape routes

e) Modelling of the generated sound field in relation with oceanographic features (depth/temperature profile, water depth, seafloor characteristics) to dynamically set the Exclusion Zone. Confirm models by EZ tests in the field.

f) Mitigation procedures should be practical in that they should use data that can be readily collected by cetacean observers during offshore operations, account for operating conditions and constraints of seismic surveys and, as far as possible, minimize disruption of surveys while maximizing environmental protection

g) Continuous visual and passive acoustic monitoring (PAM) with a specialized team of cetacean observers and bioacousticians to ensure that cetaceans are not in the Exclusion Zone before turning on the acoustic sources and while sources are active.

h) Equipment for visual monitoring should include suitable binoculars and big eyes to be used according to the monitoring protocol

i) Ideally, high power airgun configurations should be prohibited at night, during other periods of low visibility, and during significant surface-ducting conditions, since current mitigation techniques may be inadequate to detect and localize cetaceans. Because of the impact of adverse weather conditions on the visual detection of mammals, emissions during unfavourable conditions should be restricted as well

j) Passive acoustic monitoring (PAM) (towed array technology or other suitable technologies with enough bandwidth to be sensitive to the whole frequency range of cetaceans expected in the area) should be used to improve detection capabilities. PAM should be mandatory for night operations or when visibility is scarce. However, PAM may be inadequate mitigation for night operations if cetaceans in the area are not vocal or easily heard.

k) At least two dedicated Cetacean Observers should be on watch at one time on every operative ship; shifts should be organized to allow enough rotation and resting periods to MMOs. In the case of acoustic monitoring, at least one operator should be on watch and shifts should be organized to allow 24/24h operation., unless automatic detection/alerting systems with proven effectiveness are available

l) Before beginning any emission there should be a dedicated watch of at least 30 minutes to ensure no animals are within the EZ

m) Extra mitigation measures should be applied in deep water areas if beaked whales have been seen diving on the vessel trackline or if habitats suitable for beaked whales are approached: in such a cases the watch should be at least 120 minutes to increase the probability that deep-diving species are detected (e.g. Cuvier's beaked whales).

n) Every time sources are turned on, there should be a slow increase of acoustic power (ramp-up or soft start) to allow cetaceans sufficient opportunity to leave the ensonified area in the event that visual and passive searches are unsuccessful (the effectiveness of this procedure is still debatable)

o) The beginning of emissions should be delayed if cetacean species are observed within the exclusion zone (EZ) or approaching it. Ramp-up may not begin until 30 minutes after the animals are seen to leave the EZ or 30 minutes after they are last seen (120 minutes in case of beaked whales)

p) Exposing animals to harmful acoustic levels should be avoided by preventing them from entering the EZ, by changing the ship course, if applicable, or by reducing (power-down) or ceasing (shut-down) the acoustic emissions

q) There should be a shut-down of source(s) whenever a cetacean is seen to enter the EZ and whenever aggregations of vulnerable species (such as beaked whales) are detected anywhere within the monitoring area

r) If more than one seismic survey vessel is operating in the same area, they should maintain a minimum separation distance to allow escape routes between sound fields.

s) Data sharing among surveyors should be encouraged to minimize duplicate surveying. Also, if old seismic data can be usefully re-analyzed using new signal processing or analysis techniques, this should be encouraged.

Guidelines for coastal and offshore construction works

Coastal and offshore construction works, which may include demolition of existent structures, may produce high noise levels, even for prolonged periods, depending on the technologies used and on local propagation features that include propagation through the substrate.
Construction works on the coast or on the shoreline, including harbours, may propagate noise (e.g. from pile drivers and jack hammers) over wide areas in particular where the substrate is rocky. Traditional percussive pile-driving produces vibrations that propagate well and can ensonify large marine areas at distances of more than 100km; in such conditions alternative technologies should be used. In some cases mitigation can be achieved through the use of bubble screens or material screens that attenuate sound emitted from the source or other technical modifications.

In the case of prolonged activities, such as construction works of large structures, a scheduling of the most noisy activities could be evaluated as a measure to avoid continuous exposures especially during critical periods for cetaceans living or transiting in the area; the concentration of noisy operations in

short periods of time and alternative construction technologies should be also evaluated to minimize noise impacts.

a) Modelling of the generated sound field in relation to geological and oceanographic features (depth/temperature profile, water depth, coastal and seafloor characteristics) should occur, in addition to verification in the field; the area where animals could receive harmful noise levels (Exclusion Zone) should be defined
b) Noise producing activities should be scheduled according to the presence of cetaceans, if seasonal
c) Alternative technologies should be used or countermeasures to reduce noise diffusion, i.e. bubble curtains should be adopted
d) Noise monitoring stations at given distances from the source area should be set up to monitor for both local and long range noise levels and verify if predicted levels are reached or not
e) Visual observation points/platforms to monitor for the presence and behaviour of cetaceans should be set up
f) Before beginning any noise producing action there should be a dedicated watch of at least 30 minutes to ensure no animals are within the EZ
g) In areas where water depths in the EZ exceed 200m the watch should be at least 120 minutes to increase the probability that deep-diving species are detected

It is also important to consider the noise that will be generated by the structures once they are operative. Bridges propagate vibrations related to the traffic; offshore wind-farms and oil extraction platforms produce their own noise and thus their environmental impact should be carefully evaluated and mitigated with dedicated rules.

Guidelines for offshore platforms

Offshore platforms may be used for a variety of different activities, such as seafloor drilling, oil/gas extraction, electricity production (wind-farms), each one with its own particular impacts on the marine environment. Their placement should be carefully regulated; if their impacts include noise, they should be required to undergo a specific implementation of monitoring and mitigation procedures to be defined on a case by case basis and separately for the construction phase and for the operative life. The growing number of windfarms in coastal areas may have an impact on cetaceans, in particular because of the noise they make. They should be designed and operated to produce the lowest possible noise in all activity phases.

Guidelines for Playback & Sound Exposure Experiments

Playback and Controlled Exposure Experiments (CEEs) are experiments in which animals in the wild are exposed to controlled doses of sound for the purposes of assessing their behavioural or physiological responses. CEEs are one of several methods that have historically been and are increasingly being applied to the study of cetacean behavioural responses to sound. These approaches can complement opportunistic observations or the tagging of animals around noise-producing activities. CEEs (which include some recent experiments under the generic heading of Behavioural Response Studies (BRS)), are designed to introduce small amounts of additional sound into the ocean in order to scientifically determine responses and assess the potential risk from human activities. However, playbacks may carry some risks themselves to target individuals and potentially expose not only the target species and/or individuals to be studied, but also additional ones. These considerations need to be carefully addressed through precautionary protocols in the execution of CEEs and the possible risks should be balanced against the potential for these studies to provide answers to management and/or scientific questions on a case by case basis.

Given that some CEEs can be controversial, and because of the known underlying concerns, it is particularly important that they are carefully designed and carefully conducted and their limitations and risks acknowledged. In order to achieve optimal scientific and conservation value, those involved in conducting, funding and managing large-scale CEE experiments should strive for international

cooperation, coordination and very transparent information exchange and where possible joint programmes of work. Avoidance of duplicative or overlapping research will also help to prevent any unnecessary introduction of noise into the marine environment.

Controlled Exposure Experiments typically strive to use, without exceeding harmful levels, sound exposures that are as realistic as possible (relative to known human sound sources), but with the capability of close control over the type and nature of exposures. Many CEEs are designed to minimize the exposure required to elicit a detectable response. Opportunistic studies, on the other hand, involve actual sound sources and, thus, more realistic exposures, though the lack of experimental control in some circumstances can limit the power of resulting observations.

Both kinds of studies must include (or be preceded) by baseline studies of behaviour and physiology so that the results of the experiments are meaningful and can be properly interpreted. . To increase the utility of the results to regulatory decision-making, researchers conducting CEEs should openly communicate the design, procedures, and results of such studies to policymakers.

As with all biological research, methods that can yield conclusive results with less risk of harm to the animals should be preferred. Systematic observations using ongoing sound-producing activities should be used in place of CEEs if they can provide similar information with similar power to detect effects. It is noted, however, that the lack of experimental control over sources in opportunistic contexts, as well as the safety and/or national security considerations inherent in some situations can significantly limit their value in many real-world applications. Systematic studies of ongoing sound-producing activities can validate and strengthen monitoring efforts required as mitigation, and have the benefit that such studies do not introduce additional sound directed at the mammals. The advantages of both observational and experimental studies are increased as more attention is given to optimizing measurement methods and study designs with the greatest power to detect real effects and provide convincing results. In practice, research investigating the impacts of large sound sources could be most successful when using a suite of approaches including observations of both controlled and uncontrolled sound exposures. Therefore, controlled experiments and opportunistic observations are usually best seen not as alternatives, but rather as complementary approaches that yield the most powerful results when both are conducted.

Sound exposure experiments require an explicit protocol to manage possible interactions among the sound source(s) and the target(s); in general, while designing and conducting such experiments, these guidelines should be taken into consideration:

- use sound exposures that are as realistic as possible (while minimizing exposure required to detect responses) and with the same or similar characteristics of sound that the mammals are likely to be exposed to
- model sound propagation from the source to the targets based on local oceanographic features and background noise information
- use available technologies to monitor both target and non-target animals; monitor other individuals and species – which may require different methods but may provide additional information
- design experiments so that monitored animals are those exposed to highest levels
- halt sound emission if adverse response or behavioural changes are observed on either target or non target animals
- limit repeated exposures on the same target(s) unless required by the research protocol
- avoid enclosed areas, avoid blocking escape routes
- avoid “chasing” animals during playbacks; if they move away -- don’t modify the course to follow them with the playback source
- exposures that are expected to elicit particular behavioural responses (e.g., responses elicited by predator sounds, conspecific signals) may be particularly useful control stimuli in CEEs; however, such exposures should be used only as necessary as part of a careful experimental paradigm that includes specific mitigation and monitoring protocols. In such cases, it is

important to consider that the response may not be related to the loudness of the exposure but to the behavioural significance of the signal used.

Guidelines for shipping

noise from ships should be evaluated both at close range for its direct possible effects on local marine life and at long-range for the contribute to background noise at low frequencies. It is still difficult to say how much the radiated noise should be reduced to get visible effects. However, noise reduction should be evaluated in order to reduce both local and long range effects (see quieting technologies).

Guidelines for other mitigation cases

Any activity that produces noise levels that may pose risks to cetaceans requires attention and the implementation of monitoring and mitigation procedures. Some of the cases reported in this chapter (touristic boats and whale watching) may not produce physical injuries; however they contribute to the underwater noise and may have a significant impact on the behaviour and welfare of the animals, and, in the long term, a negative effect on the local population. At least in sensitive areas these should be taken under control and eventually limited.

Touristic boats
Tourist traffic in some areas is becoming a serious problem; noise irradiated by engines and propellers is an important component of the disturbance to animals.

Tourist boats should avoid approaching dolphins and dolphins schools, as well as larger cetaceans, and especially if calves are present. Specific guidelines are already available and their distribution should be supported as much as possible.

In case of sensitive habitats and marine protected areas, the relevant authorities should severely restrict the use of tourist motorboats and eventually encourage the use quieter electric engine boats.

Boats should be as quiet as possible and noise controls should be made at the beginning of every field season. Noise limits should be set to reduce the behavioural disturbance to animals as much as possible.

Whale watching
Whale watching is an activity that is increasing every year and that may have an impact on cetacean populations, stocks, and individuals. Rules and permits are already in force in many countries, but the noise issue is seldom taken into consideration. Noise irradiated by engines and propellers is an important component of the disturbance to animals. Beyond complying with national rules and restrictions, whale watching operators should also comply with noise emission restrictions.

Boats should be as quiet as possible and noise controls should be made at the beginning of every field season. Noise limits should be set to reduce the behavioural disturbance to animals as much as possible.

Explosive disposal of residual war weapons, use of explosives for testing or for decommissioning structures
In many areas of the Mediterranean Sea the detonation of residual war weapons is a recurrent activity that needs special care; also explosives are used widely for offshore decommissioning of structures and for military trials, e.g. for testing ships and submarines.

In all such cases, the definition of an Exclusion Zone is required, based on the power of the expected explosion(s) and on the oceanographic features; consequently the EZ area should be monitored to be sure no animals are inside. The watch before starting operations should be at least 30 min, it should be prolonged to 120 minutes in areas where deep divers could be present. Additional measures could

include the use of absorbing materials, e.g. bubble curtains that are proven to attenuate the shock wave or at least to dampen the shock wave onset. The use of aversive sound devices to remove animals from the danger area for the relatively short period of blasting holds great promise for mitigation. However, further studies to develop and test such devices with the range of species of interest would be required before these could be relied on for mitigation.

Underwater acoustically active devices

Underwater acoustics is an expanding field and new acoustic technologies are continuously developed, tested and applied for a variety of uses, e.g. for searching/monitoring/exploiting environmental resources, for conducting scientific research, and for military purposes.

Examples of activities that may require a permit include: oceanographic experiments based on the use of high power acoustic sources, including the use of acoustic positioning devices, the use of deterrent devices (Pingers, Acoustic Deterrent Devices, and Acoustic Harassment Devices, in particular if used in array configurations), e.g. to protect commercial fisheries or to protect industrial water intakes (cooling systems).

In all cases where high noise levels are expected in areas with the potential presence of cetaceans, at least the following guidelines should apply:

a) There should be modelling of the generated sound field in relation to oceanographic features (depth/temperature profile, water depth, coastal and seafloor characteristics) and verification in the field; the area where animals could receive harmful noise levels (Exclusion Zone) should be defined
b) Activities should be planned for areas with low cetacean densities, avoiding wherever possible sensitive species, such as beaked whales, and sensitive habitats (e.g. breeding areas, nursing areas, etc.)
c) Noise producing activities should be scheduled according to the presence/absence of cetaceans, if seasonal
d) Noise monitoring stations should be set up to monitor for both local and long range noise levels and verify if predicted levels are reached or not
e) Visual observation points or mobile platforms should be set up to monitor for the presence and behaviour of cetaceans
f) PAM stations or mobile platforms should be setup to monitor for the presence and behaviour of cetaceans
g) Before beginning any noise producing action there should be a dedicated watch of at least 30 minutes to ensure no animals are within the EZ

In areas where water depths in the EZ exceed 200m the watch should be at least 120 minutes to increase the probability that deep-diving species are detected.