

APPENDICE A

**LINEE GUIDA PER LA MITIGAZIONE DEGLI IMPATTI DEL RUMORE ANTROPOGENICO
SUGLI ORGANISMI MARINI**

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.

ALLEGATO III

Linee guida per la gestione dell'impatto di rumore antropogenico sui Cetacei nell'area ACCOBAMS

Estratto da:

Guidelines to address the issue of the impact of anthropogenic noise on marine mammals in the ACCOBAMS area. Document prepared by Gianni Pavan for the ACCOBAMS Secretariat, SC4/2006

Sezione generale- valida per tutte le attività che generano rumore subacqueo.

a) Consultare banche dati e bibliografia sulla distribuzione spaziale e stagionale di Cetacei in modo da pianificare e condurre le attività quando e dove è meno probabile incontrare animali e in maniera tale da evitare stagioni o habitat critici. Consultare dati e pubblicazioni relative a precedenti esperienze di mitigazione per uniformare protocolli e formato dati.

b) In mancanza o insufficienza di dati, organizzare survey dedicati e preventivi (da imbarcazioni e/o aeromobili, secondo il caso) e/o attività di monitoraggio attraverso l'uso di strumentazione di rilevazione acustica fissa (boe, bottom recorders, ecc.) per valutare la densità delle popolazioni nell'area prescelta per le operazioni. Survey pre e post esperimento sono comunque sempre da incoraggiare data la loro estrema valenza scientifica in questa fase di sviluppo e ricerca sull'impatto del rumore. La durata e modalità dei survey va stabilita da personale scientifico competente in materia.

c) Evitare aree chiave per i cetacei, aree marine protette e aree chiuse (es. baie, golfi), definire appropriate zone cuscinetto intorno ad esse; considerare possibili impatti di propagazioni a lungo raggio o lungo termine.

d) Durante la fase di pianificazione dell'evento, tenere conto dell'eventuale concomitanza di altre attività umane potenzialmente rumorose, sia connesse all'evento stesso (es. traffico navale di servizio), sia indipendenti (es. altri eventi, incremento della navigazione da diporto durante la stagione turistica).

e) Sviluppare banche dati/GIS fra di loro compatibili per costruire in prospettiva un documento di pianificazione completo e condivisibile.

f) Modellare il campo acustico generato in relazione alle condizioni oceanografiche (profilo di profondità/temperatura, canali acustici, profondità e caratteristiche del fondale, propagazione sferica o cilindrica) e alle caratteristiche della sorgente (frequenza dominante, intensità e direzionalità), per stabilire le distanze di propagazione, e quindi le EZ (Exclusion Zone), per le seguenti intensità: 160db re 1 μ Pa, 180db re 1 μ Pa, 190db re 1 μ Pa. In caso di Power Down (vedi sezione pratica lettera e), stabilire anche i raggi di propagazione di 180db re 1 μ Pa e 190db re 1 μ Pa relativi alla potenza ridotta. Ad esempio, un array di X airgun può essere ridotto a 1 solo airgun attivo a seguito di un Power Down, in modo da ridurre la potenza emessa (e il relativo raggio di pericolosità) senza spegnere la sorgente.

g) Utilizzare sempre la minima potenza della sorgente (es. airgun, sonar) utile al conseguimento degli obiettivi.

- h) *Verificare in campo, quando possibile, i reali livelli e distanze di propagazione, modificando eventualmente il raggio della Exclusion Zone. Per fare ciò, eseguire una serie di rilevazioni con strumentazione calibrata. Le misure andrebbero ripetute al cambiamento delle condizioni di propagazione. In caso di impossibilità, fare sempre riferimento al modello più conservativo.*
- i) *Considerare la possibilità di espandere la zona EZ anche oltre il limite dei 180db re 1 μ Pa adottando quella relativa ai 160db re 1 μ Pa nel caso si osservino variazioni comportamentali degli animali presenti al di fuori di essa.*
- j) *Prevedere un sistema automatico di logging dell'attività della sorgente per documentare l'ammontare di energia acustica prodotta e rendere disponibili queste informazioni agli organi deputati a regolamentare le emissioni acustiche, alla comunità scientifica e al pubblico.*
- k) *Prevedere l'utilizzo di un software di raccolta e registrazione dei dati di navigazione, condizioni meteo, avvistamenti e contatti acustici. Tale software deve essere il più automatizzato possibile per non distogliere gli MMO dai loro compiti di monitoraggio. Il software dovrebbe inoltre essere in grado di visualizzare geograficamente in tempo reale gli avvistamenti e i contatti acustici inseriti.*
- l) *Prevedere quale parte integrante delle misure di mitigazione la produzione di report per fornire informazioni sulle procedure applicate, sulla loro efficacia, e per fornire dati di presenza animali da utilizzarsi per alimentare i database già esistenti. Incoraggiare la pubblicazione dei report sulle riviste specializzate.*
- m) *Allertare, durante le operazioni, le reti per gli spiaggiamenti dell'area di interesse; pianificare, se necessario, attività di monitoraggio addizionale delle coste più vicine.*
- n) *In caso di spiaggiamenti o avvistamenti di carcasse potenzialmente legati alle operazioni (secondo il giudizio del Responsabile MMO a bordo), interrompere ogni emissione acustica, avvertire le autorità competenti e dedicare ogni possibile sforzo alla comprensione delle cause di morte.*
- o) *In caso di comportamenti anomali degli animali osservati nelle vicinanze delle operazioni, è facoltà degli MMO di richiedere la cessazione di ogni emissione acustica per determinare la causa del comportamento osservato ed evitare il suo protrarsi.*
- p) *Oltre che al monitoraggio visivo e acustico, gli MMO sono tenuti a sorvegliare l'applicazione delle regole di mitigazione e la conformità dell'esperimento (es. potenza della sorgente, zona di operazioni) alla Richiesta e relativa Autorizzazione vigente.*
- q) *Gli MMO fanno riferimento al Referente Nazionale che informa il segretariato ACCOBAMS attraverso report compilati su protocolli standardizzati. Discutere tempestivamente di ogni inaspettato cambiamento e condizione nei protocolli applicati con il Segretariato in collaborazione con il comitato scientifico.*
- r) *Le linee guida di mitigazione e le relative operazioni di implementazione adottate dovrebbero essere di volta in volta rese pubbliche da tutti i soggetti che si apprestino a svolgere attività rumorose in mare: Pubblici, Privati, Militari.*
- s) *Gli MMO devono essere personale competente e provvisto di adeguato background in materia. In caso di impossibilità di reperire tutto il personale con comprovata esperienza, assicurarsi che almeno la maggior parte di esso lo sia. Per operazioni che coprano le 24h per più giorni consecutivi, il numero minimo di MMO non deve essere inferiore a 5.*

Sezione pratica- illustra in dettaglio le procedure da mettere in atto nel corso delle attività.

a) Assicurare monitoraggio visivo e acustico passivo (PAM Passive Acoustic Monitoring) con team specializzati di osservatori e bioacustici al fine di assicurare che non siano presenti cetacei nella EZ almeno per 30 minuti prima di avviare le sorgenti acustiche (Ramp Up, lettera b di questa sezione). L'intera EZ deve essere chiaramente visibile agli osservatori per tutti i 30 minuti. Le osservazioni, acustiche e visive, devono proseguire durante tutta l'attività di emissione (avvistamento durante le ore diurne e acustica 24h)

b) Nel caso di prima accensione della sorgente (Ramp up), essa deve essere attivata alla potenza minima e successivamente incrementata di non più di 6db ogni 5 minuti fino al raggiungimento della potenza desiderata (NMFS, 2000; NURC, 2009). La EZ (calcolata sul valore massimo operativo della sorgente) deve essere libera da mammiferi marini per almeno 30 minuti precedenti.

c) Nel caso in cui un animale o un gruppo di essi sia presente o entri nella EZ durante i 30 min di osservazione precedenti all'attivazione della sorgente, attendere nuovamente 30 minuti ricalcolandoli come segue: 30 minuti da quando l'animale è stato visto lasciare la EZ; dopo 15 minuti nel caso in cui gli animali (piccoli cetacei) spariscano dalla vista e l'ultimo avvistamento sia avvenuto all'interno della EZ (totale 45 minuti dall'ultimo contatto visivo); dopo 30 minuti nel caso in cui gli animali (grandi cetacei) spariscano dalla vista e l'ultimo avvistamento sia avvenuto all'interno della EZ (totale 60 minuti dall'ultimo contatto visivo).

d) Nel caso in cui un animale o un gruppo di essi entri o stia per entrare nella EZ di 180db re 1 μ Pa, l'MMO deve tempestivamente richiedere la diminuzione (Power Down; di seguito PD, alla lettera e) dell'intensità della sorgente o la cessazione (Shut Down; di seguito SD) della stessa, secondo quanto descritto al punto e).

e) Il Power Down comporta la riduzione della potenza della sorgente al livello minimo iniziale. In caso di airgun, per esempio, si mantiene attivo 1 solo airgun. Diminuendo la potenza emessa a livello minimo, la EZ di 180db re 1 μ Pa si riduce di conseguenza. Se gli animali continuano ad avvicinarsi fino a entrare nella nuova EZ, gli MMO richiedono uno Shut Down.

f) Lo Shut Down comporta lo spegnimento completo della sorgente acustica.

g) Dopo un avvistamento con relativo PD o SD, la sorgente può essere riattivata secondo le seguenti procedure:

- quando l'animale è stato visto lasciare la EZ;
- nel caso in cui l'animale non sia stato visto lasciare la EZ, dopo 15 minuti dall'ultimo contatto visivo nel caso di piccoli cetacei e pinnipedi;
- dopo 30 minuti nel caso di cetacei di grandi dimensioni.

h) Dopo un PD, uno SD o una qualsiasi interruzione dovuta a ragioni tecniche, la sorgente può essere riattivata direttamente a piena potenza se la sospensione/riduzione sia durata meno di 8 minuti. In tutti gli altri casi, deve essere ripetuto il Ramp Up. Non sono richiesti i 30 minuti di osservazione preventiva nel caso in cui il monitoraggio degli MMO sia proseguito senza interruzione o nel caso in cui la sorgente sia stata mantenuta attiva al livello di intensità iniziale minima dopo un PD.

i) I Ramp Up durante le ore notturne sono fortemente sconsigliati, date le oggettive difficoltà di rivelazione visiva degli animali. Possono comunque avvenire solo in caso in cui la sorgente non sia mai stata spenta per più di 8 minuti consecutivi.

- j) Prevedere che l'equipaggiamento per il monitoraggio visivo includa idonei binocoli (7x50, almeno uno per operatore in servizio), compresi big eyes (25x150, uno in caso di visione a 360 gradi, due, uno per lato, in caso di visione laterale limitata), da utilizzare secondo il protocollo di monitoraggio, che deve tenere in considerazione la rotazione degli operatori (secondo gli schemi solitamente adottati e accettati).
- k) Registrare ogni avvistamento e contatto acustico con le informazioni geografiche e temporali sia in un file con funzione di archivio che nel programma di log e visualizzazione geografica. Si suggerisce di utilizzare un solo programma che svolga entrambe le funzioni per evitare un doppio carico di lavoro per gli MMO.
- l) Registrare una linea di log ogni mezz'ora riportando i dati geografici, temporali e meteorologici e ogni qual volta si verifichi una variazione delle stesse o un evento degno di nota.
- m) Effettuare il monitoraggio acustico per tutta la durata delle emissioni acustiche attive e, in generale, per il maggior tempo possibile anche quando la sorgente è spenta.
- n) Le registrazioni acustiche andrebbero effettuate per tutto il periodo in cui la sorgente è attiva e comunque per tutto il periodo in cui l'array è in mare e operativo. Le stesse andrebbero conservate per almeno un anno dopo il termine dell'esperimento.
- o) Anche per il monitoraggio acustico, prevedere un software che assista l'operatore nella descrizione del contenuto delle stesse e compilare una linea di log ogni 30 minuti e ogni qual volta si verifichi un evento degno di nota.
- p) Effettuare il monitoraggio acustico con l'ausilio congiunto di cuffie (per la banda audio) e rappresentazione spettrografica full band per le bande infra e ultra soniche.
- q) L'operatore acustico deve essere in contatto sia con il team visual che con i tecnici della sorgente per assicurare la piena sincronia delle operazioni.
- r) Adattare la sequenza di linee di survey tenendo conto di ogni prevedibile movimento degli animali all'interno dell'area delle operazioni ed evitando di bloccare rotte di fuga. Nel caso di operazioni in prossimità di golfi e insenature, procedere sempre dall'interno verso l'esterno e mai viceversa.
- s) Le sorgenti ad alta potenza dovrebbero possibilmente essere interrotte durante la notte, durante altri periodi con scarsa visibilità e durante condizioni di trasmissione in superficie favorevole, in quanto il monitoraggio delle EZ risulta compromesso.
- t) Il monitoraggio acustico passivo (PAM) deve essere effettuato con cortine di idrofoni trainati (hydrophone arrays) o con altra idonea tecnologia con larghezza di banda e sensibilità sufficienti a captare le vocalizzazioni nell'intera gamma di frequenze utilizzate dai Cetacei attesi nell'area.
- u) Assicurare almeno due osservatori visual durante le ore diurne e un acustico 24h durante la fase di trasmissione su ogni nave sorgente, nel rispetto dei normali turni di attività/riposo.
- v) Cessare le emissioni ogni volta che all'interno dell'area monitorata siano osservate aggregazioni di specie vulnerabili (quali capodogli o zifidi).

Sezione speciale- si indicano misure aggiuntive da mettere in atto a seconda del tipo di attività antropica. Per le prospezioni geofisiche si riportano le seguenti, da intendersi in aggiunta alle linee guida generali e alla sezione pratica.

a) Limitare la propagazione orizzontale adottando idonee configurazioni di arrays e sincronizzazione degli impulsi ed eliminando le componenti in alta frequenza non necessarie.

b) Applicare misure di mitigazione aggiuntive in aree di acque profonde nel caso di precedenti osservazioni di beaked whales in zona di operazioni o in caso di avvicinamento ad habitat elettivi per beaked whales (MacLeod et al, 2006): in questi casi prolungare le osservazioni preventive (alla lettera a della sezione pratica) a 120 minuti in maniera da aumentare la probabilità di rivelazione di specie deepdiver. La situazione ideale vorrebbe, tuttavia, che esercitazioni sonar non venissero condotte in aree di accertata frequentazione da parte di Zifidi.

c) Incoraggiare lo scambio di dati tra gli operatori in modo da minimizzare la duplicazione di campagne. Incoraggiare, ove possibile, il riutilizzo di vecchi dati da rianalizzare usando nuove tecnologie di signal processing o nuove tecniche di analisi.

ALLEGATO IV

Linee guida per ridurre l'impatto acustico generato dalle prospezioni geofisiche sui mammiferi marini

Estratto da:

*Guidelines for minimizing the risk of injury and disturbance to marine mammals from seismic surveys
by the Joint Nature Conservation Committee (August 2010)*

Sezione I- valutazione e riduzione del rischio di lesioni ai mammiferi marini.

Fase di pianificazione

- Consultare la bibliografia disponibile per determinare la probabilità di incontrare mammiferi marini nell'area interessata e valutare eventuali considerazioni di carattere stagionale da prendere in esame (periodo di migrazione, riproduttivo, etc.).
- Quando possibile, pianificare la prospezione in modo da evitare mammiferi marini durante la stagione riproduttiva o durante lo svezzamento.
- Munirsi di personale qualificato e con esperienza per ricoprire il ruolo di *Marine Mammal Observer* a bordo nave.
- L'attività sismica deve essere svolta durante le ore diurne; tuttavia è ammessa l'operatività durante le ore notturne qualora si disponga di un sistema di monitoraggio acustico passivo.
- Cercare di ridurre l'intensità delle emissioni sonore e le alte frequenze del rumore prodotto dagli airgun.

Sezione II- Gli Osservatori dei Mammiferi Marini – *Marine Mammal Observers* (MMOs).

Si sottolinea l'importanza del ruolo e dell'esperienza degli osservatori a bordo nave. In particolare, si richiede il massimo sforzo di avvistamento cetacei nei 30 minuti precedenti l'inizio dell'attività con il soft start.

Gli MMO sono responsabili anche del reporting a fine attività, che deve necessariamente includere le seguenti informazioni:

- Numero identificativo del survey sismico
- Data e luogo del survey

- Numero e volume di ciascun airgun
- Caratteristiche dell'array di airgun
- Numero e tipo di imbarcazione utilizzate
- Durata del soft start
- Problemi incontrati durante il survey e/o in caso di avvistamento cetacei
- Avvistamenti di mammiferi marini (schede standard)
- Procedure messe in atto in caso di avvistamenti durante le prospezioni.

Sezione III- Prima e durante l'attività sismica.

Almeno 30 minuti prima dell'attivazione della sorgente sismica, l'osservatore a bordo nave (MMO) deve verificare l'assenza di mammiferi marini in un raggio di 500 metri.

In acque profonde ($\geq 200\text{m}$), la ricerca deve essere estesa a 60 minuti in quanto potrebbero essere presenti specie, quali gli zifidi e il capodoglio, note per compiere immersioni profonde e prolungate. Per consentire una tempistica più adeguata delle operazioni in acque profonde, la ricerca di mammiferi marini può cominciare prima della fine di ciascuna linea sismica (a sorgente sismica ancora attiva). Se un mammifero marino viene avvistato a sorgente sismica attiva, l'osservatore non deve far altro che monitorare la situazione. Il soft start all'inizio di ciascuna linea sismica deve essere invece ritardato di 20 minuti qualora mammiferi marini vengano avvistati a sorgente sismica spenta.

Qualora mammiferi marini fossero avvistati all'interno dell'area di sicurezza (500 metri), l'attivazione della sorgente sismica deve essere ritardata fino a quando gli animali risultano allontanati. Agli animali deve essere lasciato il tempo necessario per allontanarsi in seguito all'ultimo avvistamento (almeno 20 minuti). In questo caso, il monitoraggio acustico passivo può essere determinante nel rilevare la presenza di mammiferi marini.

Qualora mammiferi marini vengano avvistati all'interno dell'area di sicurezza a sorgente sismica attiva **NON** è richiesto lo spegnimento della sorgente del rumore.

Il Soft start

Viene definito come il periodo di tempo in cui gli airgun cominciano a sparare in maniera blanda fino al raggiungimento della piena potenza operativa. Per eseguire correttamente un soft start:

- Le emissioni sonore devono essere graduali (viene attivato prima l'airgun di dimensioni inferiori e mano a mano sono aggiunti gli altri) con un start up a bassa energia che deve protrarsi per almeno 20 minuti in maniera da permettere l'allontanamento dei mammiferi marini presenti nelle

vicinanze. Il soft start deve essere effettuato ogni volta che vengono attivati gli airgun a prescindere dalla presenza di mammiferi marini nell'area.

- Per minimizzare l'introduzione di ulteriore rumore in ambiente marino, il soft start non deve essere protratto per più di 40 minuti. Evitare spari oltre quelli strettamente necessari per le normali operazioni.
- Qualora durante il survey si fossero interrotti gli spari per un periodo pari o superiore a 10 minuti, prima di riattivare gli airgun deve essere effettuata una ricerca di mammiferi marini e un soft start completo di 20 minuti. Dopo un'interruzione degli spari, di qualsiasi durata, deve essere effettuato un controllo visivo per assicurarsi dell'assenza di mammiferi marini nel raggio di 500 metri. Qualora fosse rilevata la presenza di un mammifero marino, le operazioni devono essere ritardate come descritto sopra.

Cambio di linea sismica

A seconda del volume degli airgun coinvolti e del tempo necessario alla nave per iniziare una nuova linea sismica, si è tenuti ad attuare o meno lo spegnimento della sorgente. Nel caso in cui gli airgun continuano a sparare viene aumentato l'intervallo di tempo tra due spari successivi (*Shot Point Interval*).

Sezione IV- Monitoraggio acustico

Il monitoraggio acustico deve essere utilizzato per rilevare la presenza di mammiferi marini prima di effettuare la tecnica del soft start, soprattutto in aree dove è nota la presenza di specie sensibili difficili da avvistare. Fortemente consigliato come strumento di mitigazione durante le ore notturne o in condizioni di scarsa visibilità o quando le condizioni meteo marine rendono difficili gli avvistamenti. Tuttavia, risulta essere meno preciso del monitoraggio visivo nel determinare la distanza a cui si trovano i mammiferi marini rispetto all'array di airgun.