Agenda Item 3.2.3 Review of New Information on Threats to Small Cetaceans

Underwater Noise

Report and Recommendations of the Joint ACCOBAMS/ASCOBANS Workshop on Noise EIAs

Information Document 3.2.3

Report of the ECS/ASCOBANS/ACCOBAMS Workshop on *Introducing Noise into the Marine Environment – What are the requirements for an impact assessment for marine mammals?*

Action Requested

- Take note

Submitted by European Cetacean Society

NOTE:
DELEGATES ARE KINDLY REMINDED
TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

Report of the ECS/ASCOBANS/ACCOBAMS Workshop on
Introducing Noise into the Marine Environment –
What are the requirements for an impact assessment for marine mammals?
6th April 2014, Liège, Belgium

Around 120 persons from 25 countries participated in a workshop to examine requirements for assessing the impacts upon marine mammals of introducing noise into the marine environment. The all-day workshop was held on 6th April 2014 at the Aquarium-Museum in Liège, Belgium, immediately preceding the 28th Annual Conference of the European Cetacean Society. It was jointly organised by the European Cetacean Society and the two regional cetacean Agreements, ASCOBANS and ACCOBAMS through the Joint Noise Working Group, with an organising committee comprising Peter Evans, Sigrid Lüber, Yanis Souami, Heidrun Frisch, Maylis Salivas, and Florence Descroix-Comanducci.

The workshop was divided into three main themes:

- Common Issues for Environmental Impact Assessments: baseline surveys, impact evaluation, general mitigation methods
- Impact Assessments for Specific Anthropogenic Activities
- Noise Studies contributing to EIA Assessment

Each themed session comprised a number of presentations followed by questions and then a general discussion addressing that theme. These were then drawn together into a final discussion session in which a number of recommendations were made.

Introductory remarks by Peter Evans highlighted the overlap in acoustic production spaces between different cetacean taxa and anthropogenic activities producing noise such as shipping, seismic surveys, and mid-frequency active (MFA) sonar, and introduced the context of theoretical zones of noise influence at increasing distances from the sound source (hearing loss, discomfort & injury, behavioural response, acoustic masking, and detection). He briefly described the information flow and decision pathways typically used in the risk assessment process, and then outlined the knowledge gaps in assessing population consequences of acoustic disturbance (PCAD model). Finally, he outlined the steps to be taken for a robust EIA under the headings baseline environmental and biological information, characterisation of proposed operations, impact monitoring, post-operation evaluation, and appropriate mitigation measures.

In the first themed session, Roger Gentry introduced the Noise Exposure Criteria that were developed by a United States NOAA expert panel and published in the journal, Aquatic Mammals, in 2007. He then outlined work being conducted since then to refine and update those noise exposure criteria, with subgroups established to address TTS/PTS onset and frequency weighting functions (for mid- and high-frequency species), behavioural reactions, and improved sound source characterisation and propagation, and several publications arising on each of these topics.

Tom Stringell then described the EIA process adopted in the UK from an advisory & regulatory perspective. This can be divided into the application stage (project initiation, screening, scoping, and submission of an environmental statement), consideration of the application (consultation, further information gathering, and review by the competent authority), and the consenting process involving implementation and monitoring of mitigation measures. A number of challenges for the process were considered, applied to the entire life of the project: 1) the problem of not having standardisation of metrics across projects; 2) how to assess impacts (e.g. displacement, injury, barrier effects) at the appropriate scale; 3) deciding thresholds of significance to populations and how to assess population level effects; 4) determining cumulative effects; and 5) developing appropriate mitigation measures.

Michael Jasny, representing advocacy, illustrated some of the deficiencies in the EIA process with examples from the United States experience. He emphasised the need to include all potential impacts (including sub-lethal ones like masking), and to be conservative when accounting for uncertainty and sensitivity in impact models. Programmatic EIAs were to be encouraged, as was the use of proxies in cumulative impact analyses, whilst the necessity for monitoring and mitigation beyond the safety zone (time/area management, noise quieting technologies) was emphasised.

Frank Thomsen concluded the session with a review of the EIA process from an industry perspective. He summarised the operational, social/political, environmental and regulatory risks, emphasising the lack of comprehensive planning tools, the uncertainty about sound effects, and determining what is effective mitigation. In order to reduce conflicts between industries and marine life, he recommended better use of already existing EIA processes, an urgent need for a better earlier planning process facilitated by authorities (SEA or Strategic Environmental Assessment), better use of science as a tool for marine spatial planning, acknowledgement of the role that industry can play to fund research on sound effects, and better use of agreed guidelines for EIAs to further reduce risks.

The second session examined specific anthropogenic activities and summarised our current knowledge of their impacts on marine mammals. Roger Gentry started by presenting some of the results of the Joint Industry Program on Sound & Marine Life funded largely by companies that are members of the Oil & Gas Producers Association. These included measurements of airgun output at different frequencies, experimental determination of TTS in dolphins and arctic seals, and a five-year behavioural response study of humpbacks to a moving airgun array, ramp-up and hard-start.

Monika Dyndo reviewed the effects of shipping noise, highlighting the fact that it was the dominant source of low frequency underwater noise globally, and that there had been an estimated 15 dB increase between 1964 and 2004. Recently, however, it has also been demonstrated that there is a high frequency (up to 160 kHz) component to ship noise. Results were presented of an experimental study of harbour porpoises demonstrating a reaction to low levels (123 dB re 1 μPa, M-weighted) of high frequency vessel continuous noise.

Jonas Teilmann & Jakob Tougaard outlined the development in global offshore wind energy, and listed the requirements to assess impacts on individuals and populations from pile driving as: 1) information on construction activities (size of piles, source levels, number of strikes and their duration, other sources of noise); 2) complete knowledge of the impacted area (nature of the seabed and acoustic properties of the water); 3) spatial and temporal density of animals (including consideration of population structure); and 4) PTS/TTS thresholds and behavioural responses of all of the marine mammal species present. They then presented an individual based population model for porpoises in Inner Danish waters to evaluate the influence of various disturbance scenarios and thus better assess cumulative effects. A recommendation was made for universal criteria for assessing impacts, and in the decision process for what can be regarded as unacceptable.

Peter Tyack introduced current knowledge of the potential impacts of mid-frequency (2-10 kHz) active sonar as used during naval exercises nine of which in the last 15 years have been associated with mass strandings involving mainly beaked whale species. Experimental behavioural studies have demonstrated unusually long surfacing intervals, unusually straight courses, increased speed, reduced clicking and direct avoidance by Cuvier's beaked whales in response to both simulated and real sonar exposure. Premature cessation of foraging clicks were recorded in both Cuvier's and Blainville's beaked whales at received levels varying as low as 97-102 dB re 1μPa (rms broadband). Studies of this nature on a range of odontocete species were used to develop multi-species exposure-response functions.

The third session included presentations from a number of research projects contributing to noise monitoring and mitigation methods. Elke Burkhardt gave a brief demonstration of a ship-based infrared method used to more effectively detect whale blows so that appropriate mitigation measures could be implemented. The method performed well at ranges up to c. 5 km in cold environments (up to 20 degrees C), in low visibility (particularly night-time), and high sea states (at least up to Beaufort 7).

Jakob Tougaard introduced the BIAS programme – Baltic Sea Information about the Acoustic Soundscape. The aim of this project was to establish a baseline for underwater noise in the Baltic for a uniform implementation of descriptor 11 (i.e. average noise levels at 63 and 125 Hz centre frequencies) of MSFD in the region, developing a data platform for the Baltic and appropriate analysis tools. Two acoustic loggers fulfilled the criteria: DSG-OCEAN by Loggerhead Instruments and SM2M by Wildlife Acoustics. Around forty stations were deployed, some close to shipping lanes to obtain source information, and others far from shipping lanes so as to estimate propagation loss.

Gianni Pavan reviewed noise studies in the Mediterranean, highlighting the significance of shipping as the dominant source of continuous ambient noise in the region. Measurements have been taken using cabled seafloor observatories (NEMO-KMS/SMO/EMSO). He demonstrated the impact of ship noise by showing how the noise of a passing ship completely masked any fin whale communicative sound, reducing its ability to communicate to just a few miles Using a modelling approach, a real-time map of ship noise was presented based on AIS tracking of vessels (see www.oceannoisemap.com). The model, developed by SINAY (France) and MarSensing (Portugal) also allows one to simulate the benefits of quieting technologies and other noise reduction strategies.

Thomas Folegot showed how statistical noise mapping can be used as a relevant tool to assess risks by providing an acoustic footprint, illustrating this with seasonal maps to determine to what extent shipping noise exceeds other background noise. The benefits of noise mapping are that it describes actual received levels, taking account of the sound propagation properties of the local environment. It can be used to evaluate the probability to exceed noise exposure thresholds for PTS, TTS and behavioural responses by different species at a particular instant as well as cumulatively. From these, risks, mitigation & monitoring strategies can be developed.

Finally, Michel André demonstrated how soundscapes can be composed from real-time acoustic data streams and utilised as a risk management technique for implementing EIAs. He emphasised the uncertainties that exist within the noise issue: the species affected, behaviours concerned, sound characteristics, cumulative effects, and available tools for monitoring, mitigation, modelling, stranding response, and environmental impact assessment. Introducing the LIDO (Listening to the Deep-Ocean Environment) project, he showed the management benefits of real-time passive acoustic monitoring, measuring both local and global noise, mapping marine mammal distributions, and describing foraging behaviour (e.g. sperm whales in the Ligurian Sea). It was noted that the software package SONS-DCL behind LIDO is readily available to interested parties and can be operated by a non-expert.

After the session discussions and a more general discussion at the end, a number of recommendations were made under the following headings:

1) Baseline Environmental & Biological Information

- Need to make better use of Strategic Environmental Assessments, with regular updates on the basis of new information; SEAs can help attract information and funding from a variety of sources besides government
- There is much scope for using predictive modelling to fill in gaps in our knowledge of species distributions, habitat usage, and potential impacts of anthropogenic activities
- There is a role for more real-time and predictive measurements of soundscapes
- The quality of existing EIAs is very variable both within countries and between; there is a need for improved standardisation and for continued revisions of the EU EIA Directive (Note: a revision of this Directive came into force on 15 May 2014)

2) Characterisation of Proposed Operations

- Source characterisation – pressure levels, energy levels, rise times, kurtosis, presence of harmonics, pulse repetition rates, total duration: all these need to be measured and those metrics need to be standardised
- A library of calibrated wave forms should thus be established along with a library of ships and their noise characteristics
- Local sound propagation features need to be determined through noise measurement and modelling
- Potential cumulative effects (multiple stressors) need particular consideration; these should be examined by regulators and their advisors rather than by the developers themselves (partly to avoid different assessments being produced for different developments in the same area)

3) Impact Monitoring

- Direct noise measurements in real time – emphasis on received levels
- Visual detections of animals and their responses – how effective are MMOs, possible use of observers on independent platforms
- Acoustic detections – role of towed PAM, fixed PAM systems, D-tags; need for hydrophones to be placed into the airgun streamer
- Other detection methods – infra-red, active acoustics, drones, gliders, telemetry
- During seismic surveys, there is a need for additional monitoring of cetacean behaviour when airguns are off
- Tags should provide more response data than simply visual observations alone
- Careful interpretation is needed of the results of behavioural response experiments including consideration of low sample sizes, environmental & behavioural context, captive *vs* wild situation, actual *vs* simulated noise signals

4) Post-Operation Evaluation

- Continued monitoring of animals through the lifetime of the project – numbers, distribution and activities
- Environmental monitoring – soundscapes, other human activities, preferably with access to an online system to retrieve information in a timely fashion after the noise event

- Generally, a better feedback mechanism for impact evaluation should be established
- Post-operation evaluation needs to be taken into account by the regulators

5) Mitigation measures

- Quieting technologies – vibroseis, bubble curtains, insulation sleeves, and alternative foundations, e.g. gravity bases
- Spatial and temporal displacement to minimise overlap of the conflicting activity and animals
- Operational shutdowns
- Ramp up
- Alerting or harassment devices
- Possible role of active noise control (e.g. stapedial reflex) in some species
- Some progress has been made on the first of the above proposed mitigation measures: IMO guidelines were issued earlier this year, encouraging technologies to reduce shipping noise, but there will be a need to optimise power output following cavitation reduction (so far, only cruise ship lines and Navies are prepared to do this); online real-time feedback to the bridge/ship's captain on noise levels has shown potential, as may labelling of 'quiet' ships; three marine vibrator prototypes are being built and will be tested in about one year's time; costs for bubble curtains are currently very high but could be used in priority areas; potential use of gravity based devices for noise reduction
- Technological modifications to vessels need to take account of possible reductions in fuel efficiency, and whether reduction in vessel speed may actually generate greater rather than less noise (this could be tested remotely by using AIS to identify individual vessels alongside application of real-time received noise level measurements, but need to carefully consider local differences in the environment)
- If animals can be detected at a reasonable range from the noise source (for example, by infra-red, active acoustics, or PAM systems), one has the ability to temporarily shut down the operation; however, these methods can be expensive, for example an infra-red unit may cost 380,000 euros; nevertheless, it has proved very useful to alert human observers as a support detection mechanism, and its effectiveness can be increased with experience since the infra-red computer system is based upon learning
- It is important to use measures that mitigate noise and not solely injury.

Peter G.H. Evans
European Cetacean Society