

Contribution from the Secretariat of the International Whaling Commission to Part 1 of the report of the United Nations Secretary General on oceans and Law of the Sea

Anthropogenic Underwater Noise

The IWC was established in 1946 as an international agreement to regulate whaling and to provide for conservation of whale stocks. The Commission has a membership of 87 Contracting Governments. The International Convention for the Regulation of Whaling contains an integral Schedule which sets out specific measures that the IWC has collectively decided are necessary in order to regulate whaling and conserve whale stocks. In addition, the IWC co-ordinates and funds conservation work on many species of cetacean. Through its Scientific Committee it undertakes extensive study and research on cetacean populations, develops and maintains scientific databases, and publishes its own peer reviewed scientific journal, the *Journal of Cetacean Research and Management*.

The work of the Commission and its sub-groups has increasingly considered a wide range of issues that are also addressed by UNCLOS, including Anthropogenic Underwater noise. The IWC has been discussing the impacts of noise on cetaceans since 2004, particularly through its Scientific Committee, including seismic surveys in 2005 (IWC, 2006) and specifically considering noise from shipping in 2008 (IWC, 2009), measurements of ambient noise and sound mapping (IWC 2015) and masking in 2016 (IWC, In Press). Anthropogenic sound is one of the priority threats set out in the IWC Conservation Committee Strategic Plan (<https://iwc.int/conservation-committee>).

This report briefly summarises the work and recommendations of the IWC to date. More detailed information can be found at <https://iwc.int/anthropogenic-sound> and in the reports of the relevant IWC Scientific Committee meetings and Workshops which are referenced below.

1. Seismic Surveys

Subsequent to the consideration of seismic surveys in 2006, the IWC Scientific Committee endorsed the principles and guidelines paper for responsible seismic surveys developed by Nowacek *et al.* (2013). These incorporate all stages from design of surveys to implementation of monitoring and mitigation plans.

2. Noise from Shipping

In 2010, the IWC Scientific Committee endorsed a 'simple' but ambitious target for reducing shipping noise by half within ten years also strongly recommending co-operation with IMO on this and other aspects of underwater noise pollution. The IWC participated in IMO discussions where it was recognised that scientific uncertainty as to the effects of noise should not preclude efforts towards developing quieting technologies for commercial ships and non-mandatory technical guidelines for reducing ship noise were agreed. In 2016 (IWC, In Press), as key components of work to meet the target, the IWC Scientific Committee recommended an approach to identify the noisiest ships, quantify their contribution to overall ocean noise and assign priority to replacing/modifying those ships that contribute disproportionately to ocean noise.

3. Sound Mapping and Related Issues

The IWC, International Quiet Ocean Experiment (IQOE), NOAA, ONRG (Office of Naval Research Global), TNO (the Netherlands Organization for Applied Scientific Research) and Netherlands Ministry of Infrastructure and the Environment held a workshop on sound mapping in 2014 (IWC 2015). A summary of the main recommendations of that Workshop (with some recent additions by the IWC Scientific Committee last year) can be found in Table 1.

Table 1

Summary of Recommendationson noise generation and noise modelling.

Recommendation	Example	Level of effort required
1. Noise generation		
1.1. Compile a log/registry of what noise sources operate where and when	Ship Automatic Identification System data, licensed activities generating intense sounds such as seismic surveys, and offshore pile driving.	Bookkeeping, no research need but has proven challenging. Within Europe, states are developing registries of noise generating activities to meet requirements of the Marine Strategy Framework Directive.
1.2. Compile inventory of: (a) sound source signatures; and (b) parameters that affect signatures	(a) Source levels and spectra and spectrograms, beam patterns; (b) as a function of vessel speed, draught, etc.	Some data collection left to do, in particular on parameters affecting signatures. Some desktop work/data compilation, some research.
1.3. Identify noisiest sources/vessels	What are the noisiest ships that could most benefit from application of noise quieting?	Data collection, data mining.
1.4. Create an inventory of ambient noise	Statistical distribution of noise levels, on various time scales.	Some data collection necessary in specific areas, otherwise data mining.
2. Noise modelling and prediction		
2.1. Create inventory of parameters that affect sound propagation	Sound speed profile in the water and seafloor, absorption.	There are databases on bathymetry and ocean parameters with large-scale coverage and detailed info in specific areas; depending on area might need to do additional data mining or collection.
2.2. Model noise levels on a variety of time, space and spectral scales	Need high resolution model for short-term, localised monitoring; low-res for ocean-basin scale.	Data mining, slow processing exercise.
2.3. Quantify uncertainty and accuracy; validation	Validate existing models (some available as share-ware) with spot measurements, or model against model.	Data mining and processing exercise.

4. Masking and Modelling Population Level Effects on Cetaceans

In 2016 (IWC, In Press), the IWC Scientific Committee held a workshop on 'Acoustic Masking and Whale Population Dynamics'. It was agreed that the impacts of increased ocean noise are largely chronic rather than acute, on a large rather than small scale, and occur across multiple species, with some populations likely losing large portions (>50%) of their acoustic habitats for many months of the year over many years. Population consequences are very difficult to quantify but for some species and areas (e.g. North Atlantic right whales in the western North Atlantic) there is good evidence that masking probably has some population consequences. Lack of good (and in some cases any) data of parameters related to both noise and cetaceans are the key hindrance to modelling efforts to estimate population consequences.

The IWC Scientific Committee has made a number of recommendations for future research as summarised in Table 2.

Table 2

Recommendations for further research on noise masking parameters.

Recommendation	Example	Level of effort required
1. Compile inventory of parameters relevant to masking.	Audiograms, critical ratios, critical bandwidths, temporal integration, etc.	Experiments, data collection, research
2. Need better understanding of masking release mechanisms (Erbe <i>et al.</i> , 2016).	Spatial release from masking, co-modulation masking release, Lombard effect.	Research
3. Undertake research on signal-to-noise ratio required for signal detection, discrimination, recognition, comfortable communication.	A higher signal excess is required to 'make sense' of a signal (Erbe <i>et al.</i> , 2016).	Research

In order to integrate changes in acoustic habitat into population dynamics models, the Committee recommended work to (a) generate and provide the best estimates of all aspects of a model (e.g. functional links, parameters, sound field maps) along with associated measures of uncertainty; (b) develop models to address pertinent management questions about impacts and the effectiveness of mitigation to reduce ocean noise; and (c) use these models to construct hypotheses and explore uncertainty.

In addition to supporting relevant research, the Committee also recommended that IWC member nations took ocean noise into account in a variety of contexts including:

- (1) management efforts to keep quiet areas quiet and make noisy areas quieter;
- (2) keeping commitments to the Convention on Biological Diversity (Aichi Targets 7 and 11) and under the United Nations Sustainable Development Goals (Goal 14); and
- (3) supporting efforts of the IUCN Joint Species Survival Commission/World Commission on Protected Areas Task Force on Marine Mammal Protected Areas.

References

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