Update: Managing the Effects of an-thropogenic noise in the Antarctic – Steps towards the development of an underwater noise protection

concept for Antarctica

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Introduction

One of the key pollutants created by human activities in the Antarctic is underwater noise, which is primarily caused by ship traffic, but also by research activities (e.g. seismic surveys) or logistic activities. Concern about the potential impacts of anthropogenic noise in the Southern Ocean was first raised at the ATCM in 2000. However, the Committee for Environmental Protection (CEP) has not discussed impacts of underwater noise in Antarctic waters since 2007 (see ATCM XXIX WP 41, *SCAR Report on Marine Acoustics and the Southern Ocean* or ATCM XXX IP 80, *Taking Action on Marine Noise in the Southern Ocean*), though SCAR provided Updates on Anthropogenic Sound in the Southern Ocean in 2012 (ATCM XXXV IP 21) and 2019 (ATCM XLII WP 68 and BP 03, also published as SCAR Bulletin 204 (2021).

The Protocol on Environmental Protection to the Antarctic Treaty (the Protocol) provides for comprehensive protection for native birds and mammals (Article 3 Annex II to the Protocol) and specifies that the impacts of activities must undergo a prior assessment according to Annex I of the Protocol (Article 8 para. 1 of the Protocol). New tools such as the Animal Audiogram Database can aid this assessment process (see also ATCM XLIII BP 06). Nevertheless, gaps in knowledge of the effects of anthropogenic underwater noise on Antarctic marine mammals make the assessment of such activities difficult and it is still unresolved, which noise exposure limits and noise mitigation measures should be used to ensure the full level of protection for Antarctic marine mammals and birds pursuant to the Protocol. Further, there is no common understanding by all Treaty Parties on how to implement the Protocol when evaluating activities in the Antarctic organised in their respective country or proceed from their respective territory. This leads to different assessment methodologies for such activities.

The SCAR Antarctic and Southern Ocean Science Horizon Scan undertaken in 2014 identified "*How will organisms and ecosystems respond to a changing soundscape in the Southern Ocean?*" as one of the 80 most pressing questions regarding the future of Antarctica. In its recent update on Anthropogenic Sound in the Southern Ocean (ATCM XLII BP 03 and SCAR Bulletin 204 (2021): ‘*Anthropogenic Noise in the Southern Ocean: an Update’*), SCAR polled a committee of experts on the current status of underwater noise as the first step of a qualitative assessment of the state of knowledge. According to the SCAR experts, the state of knowledge of potential impacts on cetaceans (and marine mammals in general) and the understanding of the sources and types of anthropogenic noise present in Antarctic marine waters is fair to good.

Germany reported in ATCM XLIII IP 19 on a research project commissioned by the German Environment Agency (UBA) with funding from the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection that will run from January 2020 to July 2023. This project was based on a 2018 workshop that aimed to determine the current state of knowledge on the effects of noise on marine mammals in Antarctica (results presented in ATCM XLII IP 31 and Erbe et al. 2019). The participating international experts on marine mammals highlighted a variety of research and management needs. The management need with the highest score was a refinement of noise exposure criteria for the Antarctic: the participating experts recommended that a series of focused international expert workshops should be held in order to develop a criteria matrix specifically for Antarctic marine mammal species and the main anthropogenic sound sources as the basis for an underwater noise protection concept for Antarctica.

Short Project Overview

The objective of the current project “Managing the Effects of anthropogenic noise in the Antarctic – Steps towards the development of an underwater noise protection concept for Antarctica” is to develop a criteria matrix that specifically addresses the 25 native Antarctic marine mammal species and the three main sources of anthropogenic underwater noise: seismic airguns, hydroacoustic research equipment and vessels.

To achieve this, a series of short studies was developed to support two workshops at which the maximum sound exposure values were developed with the aim to prevent 1) “injury” and 2) “molesting” by anthropogenic sound. However, the large number of species and sound sources constituted a considerable challenge, as there are several uncertainties involved in deriving such thresholds. To address this, the project used an Expert Elicitation (EE) approach.

EE is a heuristic process typically used in situations with a scarcity of empirical data but a need for conservation or management decisions (Martin et al. 2012). It is best suited to situations in which the state of knowledge will remain too insufficient to support timely informed assessment and decision making (Morgan 2014). It is most robust when it builds on the best available research and knowledge. These EE approaches generate probabilistic distributions which quantify scientific uncertainty and minimize inadvertent bias in the elicited information.

The short studies developed covered the sound sources to be considered, the distribution of marine mammals in the Antarctic, as well as the current knowledge of auditory injury and behavioural response to noise. Once these were prepared, two EE workshops were designed and planned – with global subject knowledge experts invited to participate. The two 3-day EE workshops took place on the 20th to 22nd April (auditory injury) and 3rd to 5th May 2022 (behavioural response) in Berlin, Germany. In two preceding webinars, participants were introduced to the expert elicitation process and the topics, and the relevant definitions, scenarios and questions were outlined and discussed. This collaborative approach ensured experts guided this process with their expert knowledge and helped ensure the quality of the outcomes. It was decided that in order to develop a criteria matrix, marine mammal species will be divided into groups of similar hearing abilities and sensitivities and considered in hearing groups similar to those proposed by Southall et al. (2019), and evaluated against the following sound sources: vessel, seismic airguns and hydroacoustic research equipment. Noise thresholds were then elicited for:

1. “injury” being defined as significant (=non-negligible) damage to the physical integrity or health of an animal, which can be a temporary/reversable impairment, and
2. “molesting” being defined as all actions and activities that either have an impact on individual fitness, a physiological impact or result in disruption to or interference with an organism’s behavioural pattern or life processes, or that have a negative impact on the psychological well-being of the animal.

Finally, new thresholds could be determined which can be used to support the evaluation of activities in the German permitting procedure according to the German Act Implementing the Protocol of Environmental Protection to the Antarctic Treaty.

The results of the project were presented to a panel of experts and stakeholders in a closing conference on the 14th and 15th March 2023 in Berlin. This process allowed discussion with stakeholders to help ensure a common understanding and acceptance of the developed thresholds and the elaboration of the future steps required to advance this subject area and form the basis for a noise protection concept in the Antarctic. The project is now being finalised and the results will then be published in the series “TEXTE” of the German Environment Agency.

References

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*ATCM XLII WP 68, Anthropogenic Noise in the Southern Ocean: an Update*

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*ATCM XLII IP 31, Results from the international workshop “The Effects of Noise on Marine Mammals in Antarctica” held in November 2018 in Germany*

*ATCM XLIII BP 06, The Animal Audiogram Database*

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