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CONTENTS

from electronics experts on the choice and calibration of transducers for monitoring natural, biological, and anthropogenic sound sources, from physical acousticians to process signal/information provided by the ESONET NoE, from marine biologists to identify species sound-related behaviour and seasonality and large-scale data, from psychoacousticians to assess species-related hearing sensitivities, and from statisticians for the initial design, data analysis, and presentation.

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RISK ASSESSMENT OF SCIENTIFIC SONARS

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INTRODUCTION

Scientific sonars are an important asset for conducting oceanographic, geophysical, and biological research and are hence installed on many research vessels. Multibeam deep-sea echosounders map the sea-floor topography at high resolution, whereas sediment echosounders serve to explore the upper sediment layer stratification. Scientific fish finders map the fish and krill distribution over large areas. To achieve a high spatial resolution and full ocean depth coverage, scientific sonars emit high-intensity, mid- to high-frequency pings of high downward directivity and short duration. This study analyses the respective sound fields and discusses the potential risks of these echosounders' usage with special emphasis on true Antarctic cetaceans.

METHODS

The study uses the scientific sonars' source levels, pulse lengths, and beam patterns to determine the respective acoustic fields. Based on this information, injury criteria (http://www.mmc.gov/sound/plenary2/pdf/gentryetal.pdf), the latest information on beaked whale strandings

(Cox et al. 2006), and a proposed definition of biologically significant effects (http://www.mmc.gov/sound/plenary4/pdf/wartzok.pdf), this study discusses three possible impact scenarios: risk of injury due to immediate acoustic effects, risk of injury due to behavioural response, and risk of biologically significant effects due to impacts on the habitat.

RESULTS

The study quantifies that for a steaming ship, the risk of injury due to (multiple) ensonifications with pings from scientific sonars is estimated to be less then 2% of the risk of a collision between ship and whale. For both, steaming ships and ships on station, the risk of injury caused by behavioural responses appears unlikely due to the scientific sonars' characteristics and the physiological and behavioural characteristics of true Antarctic species. Risk of biologically significant effects due to impacts on the habitat appear unlikely due to the relatively short exposure periods.

DISCUSSION

Because of the significant lack of knowledge on marine mammal audition and behaviour, assumptions unavoidably had to be made. Following the precautionary principle, these were chosen conservatively

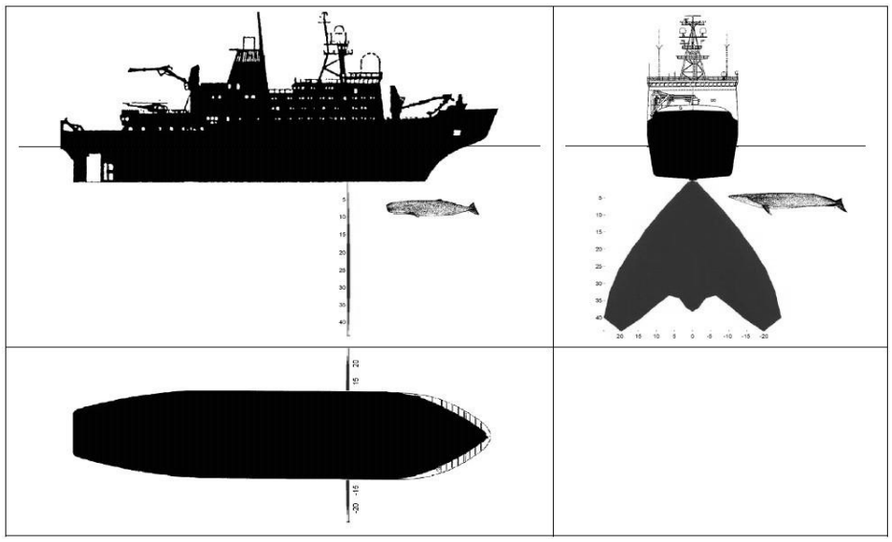

Figure 1. Silhouette of R/V Polarstern and water volume ensonified by multibeam echosounder within which injury criteria are exceeded if the whale is exposed to 5 or more pings. Axis labels in metres.

throughout. Even under these stringent requirements, the risks resulting from the usage of scientific sonars appear significantly smaller than the risk of collision. Only for ships on station does the risk of acoustic injury become a matter of concern. To mitigate possible negative effects, the Alfred Wegener Institute minimizes acoustic emissions by reducing the source levels of sonars onboard the R/V Polarstern to the extent scientifically feasible and shuts off its sonars when whales are observed within a critical radius during times when the ship is on station.

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CANADA'S APPROACH TO MITIGATION OF SEISMIC SOUND IN THE MARINE ENVIRONMENT

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Seismic surveys in Canada are conducted in the Atlantic, Pacific, and Arctic Oceans in waters with very diverse biological, oceanographic, and geomorphic characteristics. They are subject to review and