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Do cetaceans alter their vocal behaviour in response to military sonar?

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Concerns about increasing potential disturbance of cetaceans due to human activities in the ocean has led to an increased effort to study the responses of cetaceans to such disturbances. One source of potential disturbance is mid-frequency active sonar (MFAS) used by military vessels, which involves the underwater emission of intense and repetitive sounds. Cetaceans produce a variety of vocalization types for social or environmental sensing which vary among species, populations and behavioural context. The range of frequencies ranges of these sounds often overlaps with the frequencies used for MFAS, which increases the potential for disturbance. The goal of this study was to identify possible changes in the vocal behaviour of cetaceans (specifically delphinids, minke whales and sperm whales) in relation to military sonar exercises. To identify such changes, we compared the detected vocalizations from periods before, during and after sonar exercises using acoustic data collected in the presence of vocalizing cetaceans and MFAS using Marine Acoustic Recording Units off the coast of Jacksonville, FL and in Onslow Bay, NC. We review some of the potential changes in vocalization behaviour in relation to military sonar and the corresponding analytical methods used to assess these changes. Specifically, we address the following questions: 1. Are vocalizations detected more or less frequently in the presence of sonar? 2. Given the detection of vocalizations, does the probability of detecting specific vocalization types change in the presence of sonar (delphinids only)? 3. Do parameters describing the individual detected vocalizations (e.g. vocalization length or maximum frequency) change in the presence of sonar? For each question, we define a response variable which is modelled using factor, linear and smooth terms. We report on the changes in some of these responses for delphinids and minke whales and discuss the inferential limitations of this study.

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