

Vocal behavior of short-finned pilot whales pre, during and post exposure to playbacks of mid frequency active sonar and killer whale calls

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There is a need for further data on behavioral responses of marine mammals to anthropogenic sound. Currently limited data are available to quantify effects and much focus has been on species that show stranding or avoidance responses. Social odontocetes may show subtle responses such as changes in call types and rates, in contrast to the silencing response of beaked whales, yet these are also important to fully understand the effects of anthropogenic noise. Short-finned pilot whales, *Globicephala macrorhynchus*, are a deep-diving, social species that produce a range of vocalizations. However, no system for categorizing calls or determining repertoire currently exists for pilot whales, and no behavioral response study has quantified changes in call types and rates with exposure. During the 2007 Behavioral Response Study in the Bahamas, four short-finned pilot whales were tagged with Digital Acoustic Tags (DTAGs) for a total of 30 hours. Two of the pilot whales were exposed to playback sequences of mid frequency active (MFA) sonar and killer whale calls. All audible sounds from exposed and non-exposed animals were digitized ($n = 3,202$), and spectrograms were independently categorized by three experienced observers. Call rates per minute were calculated for randomly selected pre, during and post exposure periods of equal length, for both exposure animals. Calls rates were significantly different between periods for each exposure animal (Kruskal-Wallis test, $p < 0.001$). Post-hoc tests show that both animals had significantly higher call rates during pre exposure and the first MFA exposure (Mann-Whitney test $p < 0.05$) compared to the second MFA exposure and the killer whale calls. Significantly higher rates of certain categorized, stereotyped calls were also evident during pre exposure and the first MFA exposure (Kruskal-Wallis $p < 0.05$). This is the first study to assess biologically significant changes in both call rates and types in short-finned pilot whales in relation to sonar exposure.