ACOUSTIC TAG DEVELOPMENTS AND UPDATES ON BEHAVIORAL RESPONSE STUDIES

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Marine mammals have been reported to respond to naval exercises with unusual behavior or even mass strandings. However, it has not been possible to establish a cause and effect relationship nor to relate the putative responses to specific sound exposures. There are two complementary approaches to understanding the risk. Observations of marine mammal populations exposed to human activities and ideally compared to unexposed populations can help uncover population effects at ecological scales. Behavioral observations of individuals exposed to sound help to measure behavioral disruption, which is regulated in some jurisdictions, and to define the mechanisms of any larger scale effects. The classic method to establish cause and effect between acoustic exposure and behavioral response involves experiments that measure baseline behavior in a subject, then expose the animal to a controlled dose of sound, and observe the response. Studying the effects of sound on marine mammals has been hampered by difficulties in obtaining continuous unbiased measurements of behavior throughout the dive cycle, and in measuring or estimating the animal’s sound exposure. During the past decade, acoustic and behavior recording tags have been developed that can both measure acoustic dosage and behavioral response. These tags have enabled studies of behavioral responses in deep diving odontocetes such as beaked whales reported to mass strand during sonar exercises. Recent experiments have demonstrated the capability to tag beaked whales, expose them to sonar and control sounds, and to measure distinct and safe responses at specific received levels of sound. A Blainville’s beaked whale (Mesoplodon densirostris) was exposed to mid-frequency sonar during one deep foraging dive and killer whale sounds during the next foraging dive in the AUTEC naval underwater range near Andros Island Bahamas. When exposed to each sound, the whale prematurely stopped producing echolocation clicks used in foraging and ascended unusually slowly. The response to sonar was similar to that of the killer whale playback, but was less intense and was elicited by a higher received level of sound. By contrast, pilot whales exposed to the same experimental protocol showed elevated calling rates, formed tighter groups, and did not show such a clear avoidance response as beaked whales. These results, coupled with observational study of broader-scale responses of whales to actual sonar exercises, will help establish the contexts and exposures that pose a risk to which species, and will help establish measures to reduce the risk.