EFFECTS OF A 3.3 KHZ SONAR SYSTEM ON HUMPBACK WHALES, MEGAPTERA NOVAEANGLIAE, IN HAWAIIAN WATERS

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By

Hilary Lynn Maybaum

Thesis Committee:

Edward D. Stroup, Chairman
Jed Hirota
Louis M. Herman

ABSTRACT

Field studies of nektonic organisms are often limited by methodology, particularly when the subject is a member of the Cetacea. Sonar is one technology which could potentially provide substantial advancements in cetacean studies, by detecting and tracking submerged whales. The extent to which sonar will contribute to such studies is partially determined by its influence on the subject. The objective of this study was to assess effects of a 3.3 kHz sonar system on humpback whales in Hawaiian waters. In controlled sound playback experiments, whales were presented with sounds of either a 3.3 kHz sonar pulse, a sonar frequency sweep ranging from 3.1 to 3.6 kHz, or a blank cassette tape. Behavior was observed from an elevated shore platform; movement was simultaneously tracked using a surveyor's theodolite. Acoustic vocalizations were monitored from a proximal vessel. Two-way analysis of variance was used on main effects, least squares regression was applied to all predictor variables, and paired sample comparisons were performed in an exploratory context. Humpbacks responded to the sonar pulse by increasing their distance from the sound source; the strength of this effect varied directly with elapsed time. Response to the frequency sweep was more acute, and consisted of slightly increased swimming speeds combined

with increased track linearity. The latter reaction was a direct function of increasing sound intensities. Underwater vocalizations remained relatively constant during all acoustically monitored periods. Decreased behavioral rates in the control condition may have been indicative of system noise, vessel placement effects, or random effects due to natural variability in behavior. Evidence suggests that observed avoidance reactions arose because of possible resemblances between the sonar signals and natural sounds in the humpback's environment associated with biological threats or warnings. However, exponential attenuation of sound intensity with distance could prove to be auspicious in the application of sonar to cetacean research.