

The Whale, the Squid and the Sonarman: Using Broadband Acoustics to Find Food and Classify Sonar Clutter

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Abstract

Toothed whales have evolved impressive echolocation capabilities that include the ability to acoustically detect and localize prey at great depths where visual detection is limited. Spectral analysis of biosonar echoes measured, in situ, from the prey field of a Blainsville's Beaked whale suggests these animals may use broadband sonar to not only locate, but also discriminate prey from non-prey in high reverberation environments. Modeling of acoustic backscattering by squid, a chief prey of beaked whales, provides clues to the benefits of these broadband signals. Navy sonar operators are similarly challenged in clutter-rich environments. Echoes from biologics, such as large schools of acoustically resonant fish, can mask targets or present false alarms to the operators. Employment of long-range, broadband (1.5–5 kHz) sonar in the Gulf of Maine shows the potential to spectrally discriminate between echoes from this class of water-column scatterers and other echoes in the water column. Furthermore, physics-based predictions of false-alarm rates, based on sonar parameters, waveguide characteristics, and the spatial distribution of the fish schools, are presented.

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