8:12

HH4. Remote sensing of high-frequency internal waves with a narrow-beam echosounder. G. T. Kaye (Naval Ocean Systems Center, San Diego, CA 92152)

A method is presented to extract internal wave information from acoustic reverberation data. Previous work with a narrow-beam 87.5-kHz echosounder from R/P FLIP off southern California indicated that the reverberations from below the mixed layer was dominated by discrete returns from fish and other similarly sized organisms. Excellent qualitative agreement was found between scatterer depth fluctuations and high-frequency internal waves inferred from isotherm motions. For a quantitative comparison, a tracking scheme was developed which estimates the local mean vertical motion of a number of scatterers and thus approximates the internal waves. Good coherence is found between isotherm depth histories and the tracking output for frequencies of 0.5–10 cph, especially in the octave of 3–6 cph. [Work supported by DARPA, Code 222 of ONR, and NORDA.]

8:16

HH5. Broadband measurements of volume scattering strength in the Mediterranean Sea. James A. Doutt (Woods Hole Oceanographic Institution, Woods Hole, MA 02543)

Broadband measurements of volume scattering strength between the surface and 1200-m depth within a frequency range of 1.6–16 kHz have been made in the major basins of the Mediterranean. If contours of scattering strength are plotted versus depth and frequency, four zones of high scattering strength can be identified which are generally present in all the basins. Changes in the location of these zones during the diurnal migration will be discussed and seasonal changes will be related to the biology of the scatterers. [Work performed at NATO SACLANT ASW Research Centre.]

8:20

HH6. Volume-backscattering spectra in the North Atlantic Ocean. R. J. Vent and I. E. Davies (Naval Ocean Systems Center, Code 6352, San Diego, CA 92152)

Measures of acoutic volume-backscattering spectra using explosive sources were made in the eastern North Atlantic and southern Norwegian Sea (southwest and northeast of the Faeroe Islands) during August 1978. The experimental data were analyzed from 300 to 20 000 Hz with a resolution of 40 Hz. Spectra from both areas are noticeably different, particularly below 10 kHz where most volume scattering is caused by fishes possessing gas-filled swimbladders. Daytime spectra in the Norwegian Sea were dominated by a strong low-frequency peak between 1500–2000 Hz; concomitant high-resolution depth recordings indicated large concentrations of discrete targets layered between 100–350 m. The blue whiting, *Micromesistius poutassou*, is known to inhabit the entire area in commercial quantities during this time of year at these depths and is of the proper length (i.e., bladder size) to cause this strong peak. Daytime spectra of the southerly area exhibit features comparable with those commonly observed at midlatitudes which is attributed to swim-bladder resonance of smaller, mesopelagic fishes commonly associated with deep scattering layers.

8:24

HH7. Simulation of distributions of observed effective scattering strengths of individual fish. K. G. Foote (Department of Applied Mathematics, University of Bergen, 5014 Bergen, Norway)

A knowledge of the probability distribution of effective scattering strengths of observed fish is important in determining the reliability of acoustic estimates of fish abundance. The effective scattering strength is defined here as the product of backscattering cross section of observed fish and transmit and receive beam patterns of observing sonar. The distribution depends on the geometry of ensonification and fish behavior, or joint distribution of spatial and orientation states of fish, in addition to the sonar beam patterns and fish target strength as a function of orientation. Simulation of the distribution is discussed and illustrated for the case of observation of gadoids, for which measurements of the dorsal aspect target strength functions at two ultrasonic frequencies are available, by a directional downward-looking sonar.

8:28

HH8. A simple way to find resonances in sound scattering from water droplets in air. Jacob George (Physics Department, Catholic University of America, Washington, DC 20064)

An especially simple equation presented here reduces the task of locating the resonances in sound scattering from water droplets in air to only a matter of looking up the zeroes of spherical Bessel functions from mathematical tables. We demonstrate this technique by predicting and plotting twelve of the resonances, including the lowest in frequency. The use of these resonances for remote sonar determination of the sizes of the droplets is discussed. A complete derivation of the formulas for scattering cross section and for the resonance condition is given. [Supported in part by ONR.]

8:32

HH9. Acoustic response of bubbly wakes. J. M. Holzmann and M. M. Reischman (Naval Ocean Systems Center, Code 6352, San Diego, CA 92152)

The acoustic response of a bubble-laden wake can be predicted theoretically from knowledge of the bubble content. The inverse—surmising the bubble content from the acoustic response—can be accomplished also, albeit crudely. Studies indicate that the size of the bubbles formed by gas ejection from an orifice into a flow, depends on the ratio of the gas flow velocity to the water flow velocity [E. Silberman, 5th Midwestern Conference on Fluid Mechanics, (1957), and N. Hughes *et al.*, unpublished data, NOSC (1978)]. The variation of the acoustic response of a bubbly wake exhausted from a moving vehicle was studied as a function of the rate of flow of gas and as a function of time (an indication of the rate of rise and dissolution of the bubbles). Full scale sea tests were conducted by echo-ranging on the gaseous wake at frequencies between 20–80 kHz. Results indicate that the acoustic response of the wake is a function of the amount of gas contained therein and the wake age. [Work sponsored by NAVSEA 033.]

8:36

HH10. Formulae for estimation of undersea noise spectra. H. M. Merklinger (Defense Research Establishment Atlantic, P. O. Box 1012, Dartmouth, Nova Scotia, Canada B2Y 3Z7)

This paper describes simple formulae which may be used to describe underwater ambient noise spectra. Two noise sources are considered: shipping and wind-generated sea surface agitation. Shipping noise is defined at input by the estimated noise level at 60 Hz. Wind-generated noise is defined by wind speed. Spectral shapes are based largely on the 1962 paper of Wenz though several other references are considered. The formulae may be evaluated on a programmable hand calculator.

8:40

HH11. Infrasonic ambient ocean noise measurements: Eleuthera. Rudolph H. Nichols (Bell Laboratories, Whippany, NJ 07981)

Measurements of ambient ocean noise in the frequency range 0.02–