Session 2AO

Acoustical Oceanography: Open Workshop on Acoustical Determination of Biological Ocean Structure I

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Chair's Introduction—8:30

Invited Papers

8:35

2AO1. Biological oceanography and bioacoustics: Promises, pitfalls, and idiosyncratic perspectives. Peter B. Ortner (NOAA/AOML, 4301 Rickenbacker Cswy., Miami, FL 33149)

Populations of marine animals vary significantly in abundance over a broad range of time and space scales. It is almost certainly the case that the time and space scales of biological and physical processes are related but are so in a highly complex and nonlinear manner. Documenting and understanding the dynamics of this linkage has become a major intellectual focus for biological oceanography. The technical challenge implicit is the development of appropriate sampling and measurement systems. Although fisheries acoustics has received considerable attention, acoustic sampling of microzooplankton, macrozooplankton, and micronekton (organisms ranging from ca. 0.05 mm to a few centimeters) is in its comparative infancy. Nonetheless, results obtained to date have both stimulated the biological oceanographic community and occasioned major new funding initiatives within the federal agencies. Perhaps the potential that has most greatly contributed to the general excitement is the possibility of sampling biological structure on scales heretofore beyond reach, of sampling biological variability concomitantly with physical variability. Not surprisingly, once these possibilities were explored, a set of inherent difficulties became obvious. Perhaps the least tractable of all is the problem of target identification. For some ecological inquiries this is a critical lacuna of acoustical methodology. For others it may turn out to be less critical than first thought. To some degree, our community has converged upon the notion that if acoustical methods can be efficiently combined with alternative technologies (and the principal candidates have to date been optical) the target identification problem can be contained if not overcome.

9:00

2AO2. Acoustic scattering models of zooplankton. Timothy K. Stanton, Dezhang Chu (Woods Hole Oceanographic Inst., Woods Hole, MA 02543), and Kenneth G. Foote (Inst. of Marine Research, 5024 Bergen, Norway)

Quantitative analysis of echoes from marine organisms such as zooplankton can only be possible with the use of accurate acoustic scattering models. In order to describe the scattering of sound by organisms, their size with respect to acoustic wavelength, shape, orientation, and material properties must be taken into account. In this talk, zooplankton backscatter data collected from a variety of investigators in both the laboratory and field are presented. The data are compared with single realizations and averages of the scattering predicted by the deformed cylinder model [T. K. Stanton, J. Acoust. Soc. Am. **86**, 691–705 (1989)] and indicate that the animals behave acoustically as weakly scattering fluid elongated objects. The accuracy of current predictions is discussed. [Work supported by ONR.]

9:25

2AO3. Two-frequency plankton biomass estimation. D. V. Holliday (Tracor Appl. Sci., 9150 Chesapeake Dr., San Diego, CA 92123)

In a recent meeting of scientists associated with the Global Ocean Ecosystems (GLOBEC) program, a recommendation was made for the development of improved quantitative methods for combining acoustic backscattering information from more than one frequency. An algorithm for combining volume scattering strength data from two frequencies [C. F. Greenlaw, Limnol. Oceanogr. **24**, 226–242 (1979)] has been applied to several data sets collected with the Multifrequency Acoustic Profiling System (MAPS) [Pieper *et al.*, J. Plankton Res. **12**, 433–441 (1990)]. In MAPS data, the scattering is usually dominated by zooplankton. The result of estimating biovolume versus depth using data from only two of the MAPS