2:35

1pAO2. A synopsis of state-of-the-art high-frequency sonars for water column measurements. Mark V. Trevorrow (Defence Res. Establishment Atlantic, P.O. Box 1012, Dartmouth, NS B2Y 3Z7, Canada, Mark.Trevorrow@drea.dnd.ca)

In recent years there has been a dramatic surge in the use of high-frequency (10 kHz–2 MHz) backscatter sonar systems for oceanographic and bioacoustic measurements in oceans, lakes, and rivers. These applications have generally focused on measuring the distribution of scatterers, such as bubbles, particulates, microstructure, fish, and zooplankton. Additionally, oceanographic flows and wave motions can be illuminated using these scatterers as tracers, using both the intensity and Doppler signals. Advances in electronics, data storage, signal processing, and transducer materials technology have made, and will continue to make, HF sonars smaller yet more capable in terms of bandwidth, resolution, and endurance. Some novel applications of simple echo sounders and sidescan sonars will be reviewed, showing examples of near-surface bubble distributions, internal hydraulic flows, and fish and zooplankton detection. Newer developments in multifrequency, volumetric multibeam and parametric sonars will be discussed.

3:05–3:25 Break

Contributed Papers

3:25

1pAO3. Expanding capabilities of acoustic instruments: Benefits of calibrated output signals, bandwidth, midwater signals, and dynamic range. Kenneth G. Foote (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543)

Echo sounders, multibeam sonars, acoustic Dopper current profilers (ADCPs), and other acoustic instruments are widely used, if often for quite specific applications. Sometimes, these applications have been pursued at the design stage to the detriment of general system performance and versatility. Availability of a calibrated output signal in a fishery echo sounder, for example, may enable this to be used in quantitative applications. The availability of bandwidth may enable scientific echo sounders to classify and quantify multispecies assemblages of zooplankton. The provision of midwater signals may enable multibeam bathymetric sonars to be used for imaging scatterers in the water column. Extension of the dynamic range of ADCPs may enable a single unit to be used as four synchronous echo sounders with noncollinear beams. In general, the capacities of most underwater acoustic systems can be expanded significantly by attention to issues such as those mentioned here. Resulting opportunities for new applications are described, with justification in the physics of scattering. [Work supported by the Alfred P. Sloan Foundation.]

3:40

1pAO4. Multibeam SONAR from the bottom and up. Jeff Condiotty (SIMRAD, Inc., 19210 33rd Ave. W., Lynnwood, WA 98036) and Oywind (Irv) Bjorkheim (Kongsberg Simrad, Inc., Lynnwood, WA 98036)

Acoustic multibeam technology has traditionally been used for hydrographic surveying but is now being introduced as a useful tool in data collection within the water column. A new PC-based system operating at frequencies of 90 or 200 kHz allows visualizing targets within the water column for fisheries behavioral and enumeration studies as well as bottom characterization and profiling, at the same time. The system takes advantage of a wide sampling swath, up to 150 with up to 128 individual beams. The system can be operated in a wide beam mode or used in a Mill's Cross mode to control the beamwidth in two dimensions. Data are displayed as a SONAR image in real time while raw data (pre-beamformed or beamformed) can be stored for further processing utilizing commercial software. The transducer can be either hull mounted, installed on a submersed vehicle, or attached to a pole mount on a small boat. Applications and data collection methodology to visual and measure target reflectors will be discussed along with calibration of individual beams to produce quantitative results.

3:55

1pAO5. Target strength analysis in high fish densities using a probing split beam transducer. Egil Ona and Ingvald Svellingen (Inst. of Marine Res., P.O. Box 1870, 5024 Bergen, Norway)

Unbiased measurements of the mean target strength are needed if the absolute fish abundance is to be measured. For most pelagic fish, this also requires direct target strength techniques to work in high-density situations. A probing, pressure stabilized split beam transducer has been lowered from the research vessel directly into dense herring layers in order to resolve a single target at short range. Specialized hardware has been used for single fish target tracking, from which data on target strength, target directivity, swimming speed and tilt angle are derived. The paper will focus particularly on calibration procedures for transducer depth performance, target-tracking methodology and on the monitoring of essential transducer movement parameters.

4:10

1pAO6. Instantaneous target strength measurement of live squid with synchronized video image. Tohru Mukai and Kohji Iida (Grad. School of Fisheries Sci., Hokkaido Univ., 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan, mukai@fish.hokudai.ac.jp)

The TS is a complex function of the fish's size, shape, orientation, behavior, and internal structure, as well as of the acoustic wavelength employed. Therefore, for practical purposes, it is necessary to measure the TS experimentally. There is a considerable amount of knowledge about the TS of fish. Information about the TS of squid, however, is much less. Through previous studies over the past 6 years at our experimental field, acoustic equipment has been modified and gradually stabilized. It was also possible to use live squid in our specially designed experimental barge equipped with two underwater video cameras which look at the side view and upward. Preliminary TS and orientation measurements were done on single tethered live squid *Todarodes pacificus*. The live squid was suspended with monofilament nylon string near the acoustic beam axis and positioned 3.5 m below the transducers. The echo signals of the squid at six frequencies were converted to amplitude modulated signals in audible frequency, then they were recorded on audio channels of video tape with a video image simultaneously. Afterward, the echo envelopes were demodulated to analyze the relationship between TS and the swimming aspect of live squid by synchronized video image. Preliminary results from this measurement will be presented.

4:25–4:55

Panel Discussion