provides full echo information. Raw data for post-processing is used for accurate biomass evaluation. The easy operation of this system offers a wider range of users more adequate and reliable data for fishery resource surveys.

**10:35**

**2aAOb8. Hydroacoustic performance of fishery survey instruments.** Hans P. Knudsen, Egil Ona, and Ingvald Svellingen (Inst. of Marine Res., P.O. Box 1870, Nordnes, N-5817 Bergen, Norway)

Accurate estimation of fish stock abundance by acoustic surveying methods is now essential for long-term assessment of many of the world's largest fish stocks and the status of their ecosystems. Significant improvements of the acoustic oceanic surveying methodology have been achieved over the last decade, in particular in calibration stability, receiver design, post-processing systems and transducer installations for oceanic, bad-weather operation. Experiences with introducing these new elements on four ocean-going research vessels, with examples, are presented and discussed. Since many of the potential survey errors related to the technical instrumentation seem to be overcome or minimized, the present focus for improvements must now be on biotic factors such as target strength variability, vessel avoidance and vertical distribution of the fish relative to the acoustic sampling volumes. The effect of significantly reducing vessel-emitted noise and improved observation methods in the echo sounder dead zones are discussed.

**10:50**

**2aAOb9. Detection range of acoustic instruments for fisheries.** Masahiko Furusawa, Jusam Park, Myounghee Kang, and Chumming Fan (Tokyo Univ. of Fisheries, Tokyo, Japan)

Detection ranges of acoustic instruments mainly used for fisheries and their research are derived as the range bordered by a certain signal-to-noise ratio (SNR) threshold. The SNR is depicted by several factors on transmitting and receiving, sound propagation, scattering by objects, and mainly self-ship noise. The detection ranges are shown for several fisheries instruments: fisheries echo sounder, quantitative echo sounder, and bio-telemetry system. The results can be used for designing the instruments, examining the capability of user's own instruments, and interpreting obtained data or echograms. Some examples of the results follow. Increasing transmitting power is not as effective for high frequencies as for low frequencies to increase the detection range. Comparison of volume backscattering strengths obtained by the quantitative echo sounder at several frequencies for the purpose of rough species' identification should be done within the same detection range. By applying the concept of the detection range for the bio-telemetry receiver beams, the number of the beams and the beamwidths can be determined.

**11:05**

**2aAOb10. Experimental tests of a new method to monitor sea medium by analyzing ambient noise and reradiating it from a distant point.** V. Furduev Alexander (Head of Lab. Andreyev Acoust. Inst., 4 Shvernik Str., 117036 Moscow, Russia) and D. Svet Victor (Head of Lab. Andreyev Acoust. Inst., 117036 Moscow, Russia)

In-sea experiments show a possibility to estimate parameters of the water column by analyzing space-time characteristics of the natural ambient noise. If the noise is reradiated by sound transponder located at a distance from the receiver, a regenerative monitoring scheme can be implemented. In such scheme a feedback is present that increases the contrast of the spectrum maximums to higher accuracy. By increasing the amplification gain of the whole circuit (including the feedback loop of the underwater channel), one comes to a self-sustained oscillator, its frequency deviations are indicating variations of the medium parameters. Experimental examples are presented to confirm feasibility of the proposed monitoring technique for measuring temperature variations, current velocity, periods of internal waves, and other features of the water column. The method is especially applicable to small sea areas like straits, harbors, and lakes to monitor their environmental equilibrium or manifestations of human activity. [Work supported by RFBR, Project No. 00-05-64226.]



**11:20–12:00**

**Panel Discussion**

TUESDAY MORNING, 5 JUNE 2001 SALONS III/IV, 8:00 TO 9:15 A.M.

## Session 2aBBa

## Biomedical Ultrasound/Bioresponse to Vibration: Ultrasound and Vibration in Musculoskeletal Structures

R. Glynn Holt, Chair

*Department of Aerospace and Mechanical Engineering, Boston University, 110 Cummington Street, Boston, Massachusetts 02215*

### *Contributed Papers*

**8:00**

**2aBBa1. Evaluation of vibratory coherence as an alternative to radiography in assessing bone healing after osteo-distraction.** Tarek H. El-Bialy, Thomas J. Royston, and Akira Sakata (Univ. of Illinois at Chicago, Chicago, IL 60607, troyston@uic.edu)

Distraction osteogenesis is used in orthopedics to lengthen bones, by cutting or breaking the bone and gradually separating the two pieces as new bone fills the intervening space. There is a need for early assessment of the degree of bone healing that allows for normal functioning without unwanted side effects. This study compared different techniques used to evaluate the degree of bone healing during mandibular osteodistraction in 21 rabbits. For each rabbit, the mandible was cut in a surgical procedure and then 72 h later distraction began at a rate of 3 mm per day. Bone formation at the distraction site was assessed by *in vivo* photodensitometry on head radiographs, an *in vivo* (nondestructive) vibratory coherence test across the distraction site, a post-mortem, *ex vivo* (destructive) three-point bending mechanical test, and by post-mortem, *ex vivo* (destructive) histological examination. Statistical analyses included analysis of variance (ANOVA) and correlation coefficient tests. The findings revealed that the results of bone photodensity and the vibration technique are positively correlated to the results of the mechanical three-point test and histological examination. The use of the vibration technique may provide a substitute for or augment the routine use of radiography for *in vivo* evaluation and monitoring of bone healing.