5:00

2pAB9. Modeling the role of nonhuman vocal membranes in phonation. Hanspeter Herzel (Inst. Theor. Biol., Humboldt Univ., Invalidenstr. 43, D-10115 Berlin, Germany, h.herzel@biologie.hu-berlin.de), Patrick Mergell (Univ. Erlangen--Nuremberg, Bohlenplatz 21, D-91054 Erlangen, Germany), and Tecumseh Fitch (Harvard/MIT Speech and Hearing Sci., Cambridge, MA 02138)

Although the mammalian larynx exhibits little structural variation compared to sound-producing organs in other taxa (birds or insects), there are some morphological features which could lead to significant differences in acoustic functioning, such as air sacs and vocal membranes. The vocal membrane (or ''vocal lip'') is a thin upward extension of the vocal fold that is present in many bat and primate species. The vocal membrane was modeled as an additional geometrical element in a two-mass model of the larynx. It was found that vocal membranes of an optimal angle and length can substantially lower the subglottal pressure at which phonation is supported, thus increasing vocal efficiency, and that this effect is most pronounced at high frequencies. The implications of this finding are discussed for animals such as bats and primates which are able to produce loud, high-pitched calls. Modeling efforts such as this provide guidance for future empirical investigations of vocal membrane structure and function, can provide insight into the mechanisms of animal communication, and could potentially lead to better understanding of human clinical disorders such as sulcus vocalis.

5:20

2pAB10. Middle ear frequency characteristics of Norwegian cattle. Magne Kringlebotn (Dept. of Phys., Norwegian Univ. of Science and Technol., N-7034 Trondheim, Norway)

Preliminary results indicate that for a constant sound pressure to the tympanic membrane, the mean low-frequency asymptote value for the volume displacement in the inner ear windows of Norwegian cattle as compared to human ears is less by about 8 dB, while above about 2 kHz the volume displacement becomes increasingly larger than in the human ear. If mean amplitude responses are roughly approximated by straight lines above 1 kHz, the slope for cattle ears is about -4 dB/oct as compared to an earlier measured value of -16 dB/oct for the human ear. Mean resonance frequencies are nearly equal, both about 0.8 kHz. The phase of the windows volume displacement relative to the sound pressure at the tympanic membrane is close to zero below 0.2 kHz, and falls to about -4π at 20 kHz. Earlier phase measurements in human ears indicating a phase change of less than 2π are believed to be in error.

TUESDAY AFTERNOON, 16 MARCH 1999 ROOM H1058, 2:00 TO 6:00 P.M.

Session 2pAO

Acoustical Oceanography: Innovations in Fish and Plankton Acoustics II

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Contributed Papers

2:00

2pAO1. High-resolution target strength measurements in deep water. Egil Ona and Ingvald Svellingen (Inst. of Marine Res., P.O. Box 1870, 5024 Bergen, Norway, egil.ona@imr.no)

High-resolution target strength data can only be claimed valid in situations where it can be safely shown to be much less than one target per pulse volume. Many fish species occur in densities and at depths where this demand hardly can be met with standard, hull-mounted, survey transducers. This paper describes a new and simple method for obtaining such data with some examples of target strength and target tracking data obtained in deep water at three different cruises. The system used is the Simrad EK-500 split beam echo sounder, connected to an oil-filled ES38D, pressure-resistant transducer, on cable lengths from 400-800 m. The transducer was lowered as a probe the desired depth, often inside or close to the fish layer, with the vessel stationary, or slowly drifting. For maximizing the number of detections per fish, the echo sounder was operated at maximum pulse repetition frequency. Recordings shown are from three different species, small myctophid fishes at 200–400 m, hake at 200–400 m, and herring at 50–400 m. High-quality target strength distributions were frequently obtained in less than 1 h at a typical target strength station.

2:20

2pAO2. A summary of target strength observations on fishes from the shelf off West Africa. Ingvald Svellingen and Egil Ona (Inst. of Marine Res., P.O. Box 1870, 5024 Bergen, Norway, egil.ona@imr.no)

In many areas, and in tropical waters in particular, it may be difficult to fulfill the resolution criteria for high-quality target strength measurements both with respect to density and species mixing. Since 1985 target strength data have been collected periodically during cruises with R/V DR. FRIDTJOF NANSEN in West African waters. As a first attempt to establish a reasonably correct target strength for important species in the area, swimbladder morphology was studied and compared with species from the North Atlantic. After 1986, *in situ* target strength data was collected off Morocco and in Namibian waters using split-beam echo sounders. Data from the following species have been analyzed and discussed: Pilchard (*Sardina Pilchardus*), horse mackerel (*Trachurus Capensis*), hake (*Merluccius Capensis*), and myctophids. Only data which were considered to be of high quality have been analyzed. The calculated average target strength for pilchard are several decibels higher than the currently applied target strength of North Sea herring, but not very different from other reported target strength of sardine in other areas. Also, the target strength of horse mackerel is high compared to the presently applied target strength. For hake, the measured target strength are comparable to reported data for gadoids.