

ANIMAL SONAR PROCESSES AND PERFORMANCE. Edited by Paul E. Nachtigall and Patrick W. B. Moore. Proceedings of the NATO ASI Conference held at Helsingør, Denmark. NATO Advanced Studies Institute Series Series A: Life Sciences Vol. 156. Published by Plenum Press 1988, ISBN 0-306-43031-2 Contents: 89 papers, totalling 862 pages. Price: \$125.00.

This collated set of papers is the third in the series of NATO ASI conference proceedings on this subject and follows the tradition, initiated in the 1966 Frascati conference, of bringing together leading researchers in the field of animal sonar. The preceding volumes reporting the Frascati '66 and Jersey '79

conferences are generally accepted as essential references to all interested in the subject of Biological Sonar.

The book includes 89 papers of which 32 directly relate to Odontocetes, the remainder addressing the sonar abilities of Bats and certain birds. The papers are presented in 6 sections headed:

Echolocation signals and their production, Auditory systems of echolocating animals, Performance of animal sonar systems, Natural History of Echolocation, Echolocation and cognition, Echolocation theory and applications.

With such a large number of excellent papers to choose from it is impossible to give more than an impression in such a short review. Although for the purposes of this journal it is tempting to ignore contributions relating to non-aquatic mammals it must be noted that some very significant advances are reported, particularly in echosensory neural mechanisms. In respect to these, attention is drawn to two papers on 'Parallel auditory pathways' co-authored by John Casseday and George Pollak who examine the advances made since 1980 in studies of the microchiropteran bats.

Of the papers specifically addressing the Odontocetes, the paper by Randall Brill on 'The Jaw Hearing Dolphin: Preliminary Behavioral and Acoustical Evidence' seems particularly significant. This first report provides clear behavioural support for the long held hypothesis, originally put forward by Norris, that echolocation signals are perceived using the lower jaw. The experiments described demonstrate that the application of acoustic screening material to the lower jaw resulted in significant impairment of the animal's target echo discrimination ability. The paper however chooses to describe the sense tested as simply 'hearing' although it is echo-perception which is tested. The go/no-go target presentation was made at a fixed range and the distinction between spatial positioning ability and target echo quality (target classification) is not examined. This distinction might usefully be examined if the work is to be extended.

The hypothesis that Odontocetes use intense sound to debilitate their prey is examined in two papers. The first by Marten, Norris, Moore and Englund examines in depth the structure of loud sounds recorded in a predation context from several species of Odontocete. The paper considers the vocal emissions of trained animals and the effects of loud sound on sample fish in controlled conditions, however no debilitating physiological effects on the prey are detected. The second paper by Rachel Smolker and Andrew Richards reports their studies of Indian Ocean Bottlenose dolphins. The observations clarify some of the circumstances where loud underwater 'bangs' occur with dolphin fishing activity and which apparently correlate with a few examples of prey

'stunned' before capture. Three alternative mechanisms to explain 'bang' generation are discussed. It is clear from the examples that the action of a dolphin tail 'swatting' or 'swiping' the fish is the mechanism most closely connected with prey debilitation. The authors conclude that, prey 'stunning' as a direct result of hitting the fish with the tail, is the most plausible explanation consistent with some of the 'loud bangs' heard. However the close alternative to a 'hit', where a powerful 'tail swipe' generates a cavitation zone in the water around the fish, is considered. The fish presumably being debilitated by tissue damage from the instantaneous depressurization (near vacuum) followed by sudden recompression as the bubbles collapse. Neither of these hypotheses are strictly acoustic stunning as the loud sounds emanate as a byproduct of the tail action. The technique of 'tail swiping' the prey might well have evolved as a manoeuvre to counter an escaping fish that the dolphin missed with its beak.

There are, as one would expect, a number of contributions from researchers involved with the US Naval Ocean System Center programmes. New experimental techniques which use digital signal processing in real time to generate phantom echoes, from the dolphin's own transmissions are reported. The signal components actually exploited by the animal during target discrimination can be manipulated and the technique seems particularly powerful. Included among the results of these experiments is an accurate determination of the dolphin's echo integration time (264 microsecs) and a conclusion that 'Apparently, dolphins may process broadband transient signals differently than narrowband pure tone signals'. This seems an important observation as echo-perception of a target's spatial position must require very different neural processing to that required for conventional 'hearing'. In the conclusions of 'Dolphin Echolocation and Audition', Patrick Moore makes a similar point in support of duplex acoustic receptors, separately optimized for high and low frequency sound perception, and he warns that conventional continuous wave (CW) audiogram techniques may be misleading. This paper provides an interesting and readable summary of recent psycho-acoustic research studies of Tursiops, although it does have some tantalizing omissions. For example in the description of voluntary control of source level (where a dolphin was trained to transmit high or low amplitude pulse trains on command) the author omits to confirm the anticipated changes in the spectral energy peak with changing source levels. Surely this was one of the more important parameters investigated, especially as the equipment described included a bank of filters specifically for spectral analysis! The supporting reference quoted for this work is a brief conference abstract (1983).

In his paper on 'Detection and Recognition—Models of Dolphin Sonar Systems' Whitlow Au reports some interesting results from experiments where human subjects were asked to discriminate target echoes obtained from a monostatic sonar transmitting a dolphin-like broadband signal. The recorded signal and echoes were slowed by a factor of 50 in order to shift the frequencies down to perceivable frequencies. The surprising conclusion, that, for a wide variety of target types, the human discrimination was at least as good as the dolphins, is fascinating!

To conclude, the editors are to be congratulated on a book in which most of the contents match the very high standard set by its predecessors in the NATO ASI Series and it must be recommended reading for all interested in the echolocation abilities of animals. The book contains a very large quantity of excellent research material and the reader needs to take time to appreciate it all.

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A COLOUR ATLAS OF DANGEROUS MARINE ANIMALS. By Bruce W. Halstead, Paul S. Auerbach and Dorman R. Campbell, published 1990, London, by Wolfe Medical Publications. 192 pp. £29.50.

Dr. Halstead's 'Dangerous Marine Animals' originally published in 1959 has for years been the handy guide to the creatures of the sea that bite, sting, shock or intoxicate, and the medical aspects involved.

Now this atlas covers the same fascinating field, but with the addition of magnificent colour photographs and details of the latest advanced treatment. As well as concisely discussing the traumatic consequences of a brush with a Great White or Saltwater crocodile, less well-known threats in the shape of bristle worms and the highly poisonous Deadly seaweed of Hana (not a plant but a zoanthid) are dealt with.

Did you know that the flesh of the Australian sea-lion is very poisonous or that the green un-laid eggs of the Horseshoe crab, a popular delicacy in parts of Asia, are often likewise?

Everyone with an interest in the sea and its denizens should buy this most interesting book. For those who work in the waters, particularly of the Tropics, as well as the staff of aquaria and oceanaria housing