ODONTOCETE EAR ANALYSIS BY IMAGING TECHNIQUES

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The increasing level of knowledge on the effect of underwater noise on the marine environment has lead to the necessity of studying the odontocete ear. However, the complicated access of the ears in those species together with their structure make difficult the use of conventional invasive methods, implying complex processing and interpretation of the results. Non-invasive imaging techniques as computed tomography (CT) and magnetic resonance imaging (MRI) appear to be an alternative to analyze the odontocete middle and inner ear structures, and the viability of these techniques could be explored both in vivo and post-mortem studies. With the purpose of describing the odontocete ear morphology, general CT and MRI were performed in 4 dead stranded dolphins in extremely fresh conditions. The extracted ears were analyzed with two spectrometers Bruker of 200Mhz/ 4.7 Teslas and 400Mhz/ 9.4 Teslas respectively. As already described for these imaging techniques, bony structures and their boundaries, including middle ear and auditory ossicles, are better visualized with CT scans. High magnetic field MRI units allow an increase of the image resolution but imply consequent long acquisition times and small sample sizes. Inner ear major structures were identified with the latter techniques - i.e. the cochlear scalae, the spiral ganglion and ligament, the organ of Corti - although the scans did not provide a good microscopic structure image, meaning a necessary posterior histological analysis. Those limiting factors restrain to macroscopic lesions the possibility of using these techniques for the diagnostic of ear pathologies. The planned development of MRI and CT units – e.g. power increase, accurate process parameters definition and acquisition times reduction - will provide images at cellular level, reducing the artifacts associated with complex histological processing and confirming the possibility of using these non-invasive techniques as an objective diagnostic tool both in dead and live animals.

EXPLORING THE SOUND GENERATION APPARATUS IN THE HARBOUR PORPOISE, *PHOCOENA PHOCOENA,* USING DISSECTION, CRYOSECTION AND COMPUTER RECONSTRUCTION

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Sonar signal generation in dolphins has been shown to take place in the upper nasal passages, driven by air pressure in the bony nares. This paper provides a photographic view of the blowhole region in Phocoena phocoena, supplemented with 3-D computer graphics reconstructions of serial cryosections. Laterally on either sides of the blowhole, there are two large vestibular sacs. The roof of these sacs is thin-walled, and distensible. The floor has deep, connective tissue supported folds in a semi-concentric pattern around a central, straight, transverse fold, opening down to the spiracular cavity, where there are two pairs of lip-like structures. These lips are demarcated on both sides by a color change in the epithelium, from black above to pinkish grey below. The lips on the right-hand side are slightly wider than those on the left side. The surface of the right nasal plug follows the caudal wall ventrally, forming a smooth air passage for the whole width of the lips. The position of the lips is identical to the site where small bubbles have been reported being formed and tissue vibrations recorded in connection with sound production in dolphins and porpoises. We also find the dorsal bursae embedded within the "phonic lips", which have also been identified by means of CT-scanning. The dorsal bursae of Phocoena are approximately equal in size on both sides (left and right), in contrast to the dolphins (e.g. Tursiops), which have asymmetric dorsal bursae. Similarly, the phonic lips in porpoises are equal in size. The core of the porpoise melon does not branch as it does in dolphins, but ends abruptly near the midline. These and other differences in structure are apparently related to differences in the biosonar signals, although the correlation is not easily understood.