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UNIVERSITY OF VETERINARY MEDICINE HANNOVER, FOUNDATION

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How does underwater noise affect harbour porpoises?

Researchers investigate the effects of noise pollution on harbour porpoises in the North and Baltic Seas.

Researchers from the Institute for Terrestrial and Aquatic Wildlife Research (ITAW) of the University of Veterinary Medicine Hannover Foundation (TiHo) are investigating the effects of noise pollution on harbour porpoises in the North and Baltic Seas in close cooperation with researchers from the University of Aarhus, Denmark, and DWShipConsult GmbH in Schwentinental. Noise pollution in our waters is increasing. Knowledge on the effects of this burden is urgently needed for effective management to protect the whales, says Prof. Dr. Ursula Siebert, director of the ITAW. Part of the multi-year research programme Effects of Underwater Sound on Marine Vertebrates, the extensive investigations are financed by the German Federal Agency for Nature Conservation (BfN) to learn more about the effects of underwater noise on marine mammals.

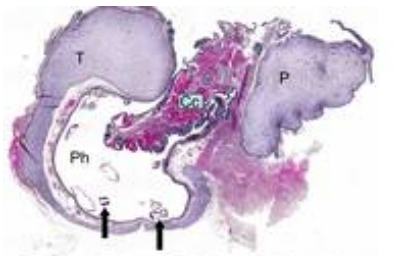
In addition to shipping and military exercises, the construction of offshore wind farms contributes to background noise in the North Sea: Particularly during installation of foundations for the wind turbines, very high sound levels are generated that are still audible at very large distances. During measurements at the Sylt Outer Reef in autumn of 2013, noise from two or more wind farms was recorded at least at 6 of 10 positions.

To assess the effects of underwater noise on harbour porpoises, the German and Danish researchers are measuring, worldwide for the first time, hearing ability and sensitivity of the free-living marine mammals. Danish fishermen notify the researchers when they accidentally capture harbour porpoises in their fishing nets. The researchers then examine the hearing ability of these animals under veterinary supervision before they are released. The researchers use a method called Auditory Evoked Potential (AEP) developed for research on the hearing of children, among others. We simulate an impulse sound comparable to the noise when foundations for offshore wind turbines are rammed into the seabed. This enables us to determine the onset of a so-called temporary hearing loss (TTS) in harbour porpoises, explains Dr. Andreas Ruser, the responsible researcher. The results of these measurements will show the sound levels at which initial but still reversible damage to the hearing of harbour porpoises occurs. This damage is comparable to the effects in a person who has visited a dance hall. The hearing can still recover completely, explains Ruser. Nonetheless, TTS is the first indication of physical damage after extremely loud sounds.

To learn more about the hearing of porpoises, the researchers also conduct auditory measurements on porpoises in human care at the Fjord and Belt Centre in Kerteminde, Denmark, and on stranded harbour porpoises during their rehabilitation at SOS-Dolfijn in

Photo: FBC/ITAW

Photo: Univ. Aarhus/J.Teilmann



Querschnitt durch das Ohr eines Schweinswals;
T = Tympanon; P = Periotikum; Cc = Corpus callosum;
Ph = Paukenhöhle mit Parasitenanschnitten (Pfeile);
Hämatoxylin-Eosin-Färbung

Photo: P. Wohlsein

Photo: SOSDolfijn

Photo: SOSDolfijn

Harderwijk, the Netherlands. These AEP studies help determine how well these animals can hear, which is indispensible for their survival in the wild.


Photo: J. Teilmann


Photo: J. Teilmann

Unfortunately, the extent of noise pollution in our oceans is not yet well understood, says Prof. Siebert. Therefore, a team at DW-ShipConsult, led by Dr. Dietrich Wittekind, is investigating the acoustic state of the areas protected under Natura2000 in the North and Baltic Seas with financing from the German Federal Agency for Nature Conservation. The results show that background noise in the Baltic is caused not only by the environment, such as waves or surf, but depends particularly on the density of ship traffic. For example, sound levels throughout the Fehmarnbelt, a heavily traveled shipping route, vary only little, and noise in many areas is very loud. Similar to a highway, several ships are usually nearby and can be heard by harbour porpoises at all times. In more remote protected areas, in contrast, such as the Pommerian Bight east of Rügen, sound levels show considerably more variation, and it is often more quiet than in the Fehmarnbelt. Over long time periods only natural sounds can be heard, to which the hearing of harbour porpoises can adapt. Only few loud events caused by humans were recorded during the 10-week long campaign to take measurements.

For a sound scientific statement, it is also very important to examine the ear of stranded and by-caught harbour porpoises found dead in the North and Baltic Seas. Only by doing this can we understand how different marine activities are altering the hearing ability of harbour porpoises, explains Prof. Dr. Ursula Siebert. In cooperation with Dr. Peter Wohlsein from the department of Pathology at the TiHo, numerous ears were studied. We found many more lesions in the ear than we had expected, including infections, parasitic infestation, haemorrhage and lesions caused by trauma. We urgently need to continue these investigations, says Prof. Siebert.

To understand the impacts of underwater noise on the behaviour of harbour porpoises, researchers from the University of Aarhus use a special acoustic tag developed under this project. The acoustic tag (D-tag) was constructed by Dr. Mark Johnson, University of St. Andrews, Scotland. From the first tagging results we can now see that harbour porpoises show clear reactions and abnormal behaviour to underwater noise caused by some ships, explains Dr. Jonas Teilmann, the researcher responsible at the University Aarhus. As a next step the researchers will quantify how much harbour porpoises alter their feeding behaviour. This will allow a calculation of the energetic cost resulting from noise disturbance for the marine mammals.

Because underwater noise also causes stress and influences their health status negatively, researchers are also monitoring parameters for the assessment of the endocrine and immune systems such as stress hormones. Initial results showed that harbour porpoises from the North and Baltic Seas are noticeably more sick compared to animals from less impacted areas like the Arctic.

We are convinced that the state-of-the-art methods applied to harbour porpoises in this project will help researchers and managers worldwide to understand how these fascinating animals interpret their habitat. We have to recognize that echolocation is the main sense of orientation in an often completely dark three-dimensional environment, and that the rapid changes from increasing human activity at sea will have a strong effect on marine life, says Prof. Dr. Ursula Siebert, the project leader.

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