

SEEWIESEN

LECTURE SERIES

FALL/WINTER 2018/19

Max Planck Institute
for Ornithology



MAX-PLANCK-GESELLSCHAFT

THURSDAY | February 21th, 2019 | 13.00 | HOUSE 4 LECTURE ROOM

PETER TEGLBERG MADSEN

Aarhus University | Host: Goerlitz Research Group

Functional convergence in bat and toothed whale echolocation

Echolocation is a process where bats and toothed whales must emit sound to generate echoes returning to their auditory systems for processing, meaning that they control sensory information flow by the rate, type and direction of the sounds they produce as well as by adjusting the sensitivity of their hearing. These parameters directly influence the temporal resolution and spatial extent of their perception of their environment, enabling dynamic control of attention in response to environmental complexity and behavioral objectives. Thus, the way that echolocating animals manipulate their perception of the surrounding environment is revealed by the sonar pulses they emit, the echoes they receive and the evoked behavioral changes; all of which can now be sampled by small archival tags attached to both bats and toothed whales during dark hunts in the wild. It appears that this form of active sensing in two very different media of air and water show a remarkable level of functional convergence in terms of sampling rates, acoustic gaze adjustments and frequency ranges. Conversely, in other aspects of their sensory ecology, bats and toothed whales diverge by having extreme versions of reactive versus deliberate modes of sensory-motor operation due to very different relationships between sensory volume and forward speed. I will argue that echolocating bats and toothed whales are ideal experimental models for studying sensory and cognitive adaptations that confer advantages in handling a dynamic sensory Umwelt in time and space, providing a unique, non-invasive insight into perception in naturally behaving animals.

WHO IS PETER TEGLBERG MADSEN?

- 2018-2019: J.C. Skou Senior Fellow at Aarhus Institute for Advanced Studies
- 2015-2017: Deputy Head of Dept. of Bioscience, Aarhus University, Denmark
- 2010 -2014: Full Professor, Dept. of Bioscience, Aarhus University, Denmark
- 2007-2010: Associate Professor with tenure, Dept. of Bioscience, Aarhus University, Denmark
- 2005-2006: Assistant Research Professor, Dept. of Bioscience, Aarhus University, Denmark
- 2003-2005: Post doc. in Dr. Peter Tyack's lab, Woods Hole Oceanographic Institution, MA, USA
- 2002-2003: Post doc. in Dr. Roger Payne's lab, Ocean Alliance, MA, USA

SELECTED RELEVANT PUBLICATIONS

- Stidsholt L., Johnson M., Beedholm, K., Jakobsen L., Kugler K., Brinkløv S., Salles A., Moss C., and Madsen, P. T. (2018), "A 2.6 gram sound and movement recording tag for studying the auditory scene and kinematics of echolocating bats", *Methods in Ecology and Evolution*. doi: 10.1111/2041-210X.131
- Jensen F. H., Johnson M., Ladegaard M., Wisniewska, D.M., and Madsen, P.T. (2018), "Narrow acoustic field of view drives frequency scaling in toothed whale biosonar", *Curr. Bio.* doi.org/10.1016/j.cub.2018.10.037
- Wisniewska, D.M., Johnson, M., Teilmann, J., Rojano-Doñate, L., Shearer, J., Sveegaard, S., Miller, L.A., Siebert, U. and Madsen, P.T. (2016), "Ultra-high foraging rates of harbor porpoises make them vulnerable to anthropogenic disturbance", *Curr. Biol.*, 26:1-6

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