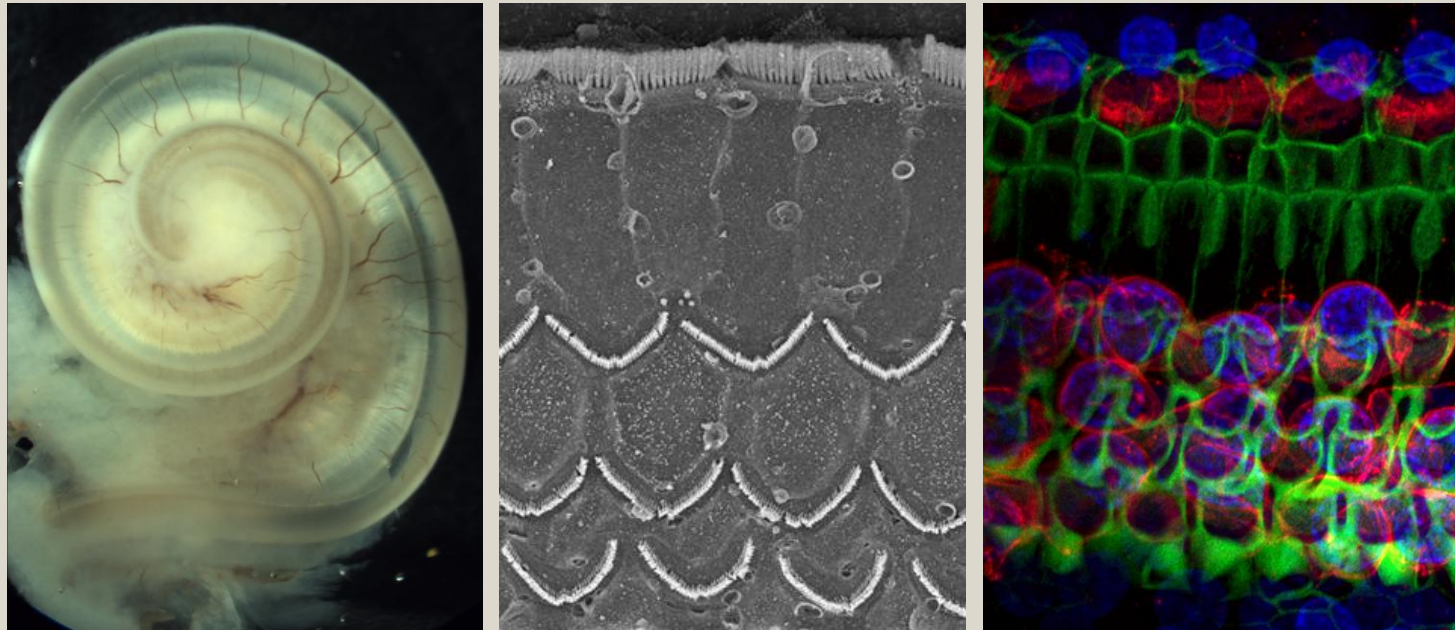


Advances in the inner ear analysis of cetaceans



Maria Morell, PhD PD

Institute for Terrestrial and Aquatic Wildlife Research, Germany

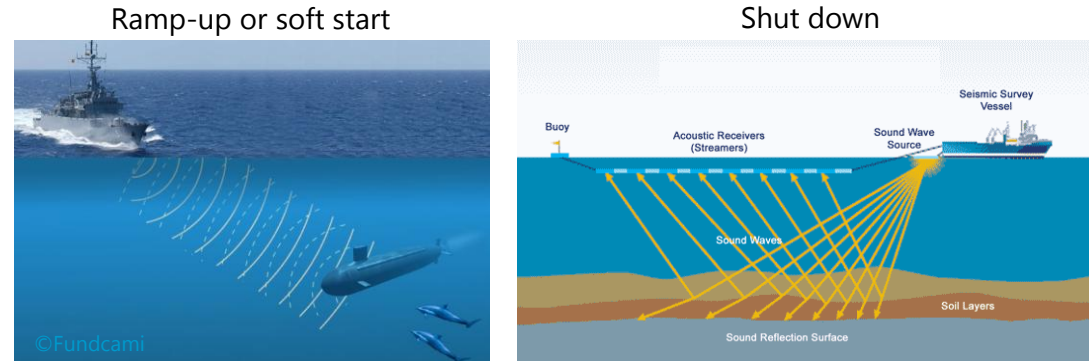
Noise-induced hearing loss? → Analysis of the inner ear



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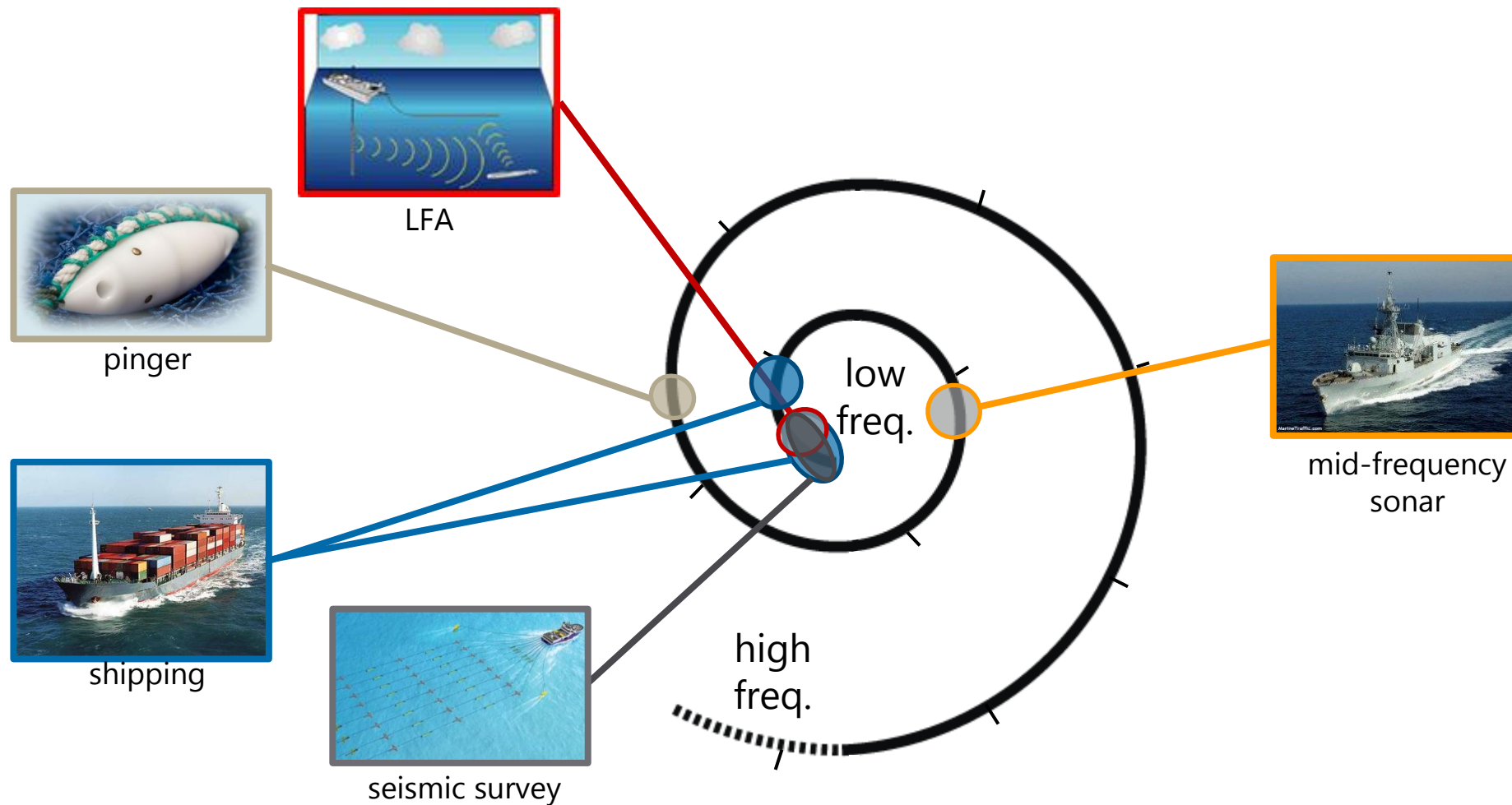
Implications of the study of hearing loss in cetaceans

- Monitor the effectiveness of mitigation measures of acoustic sources



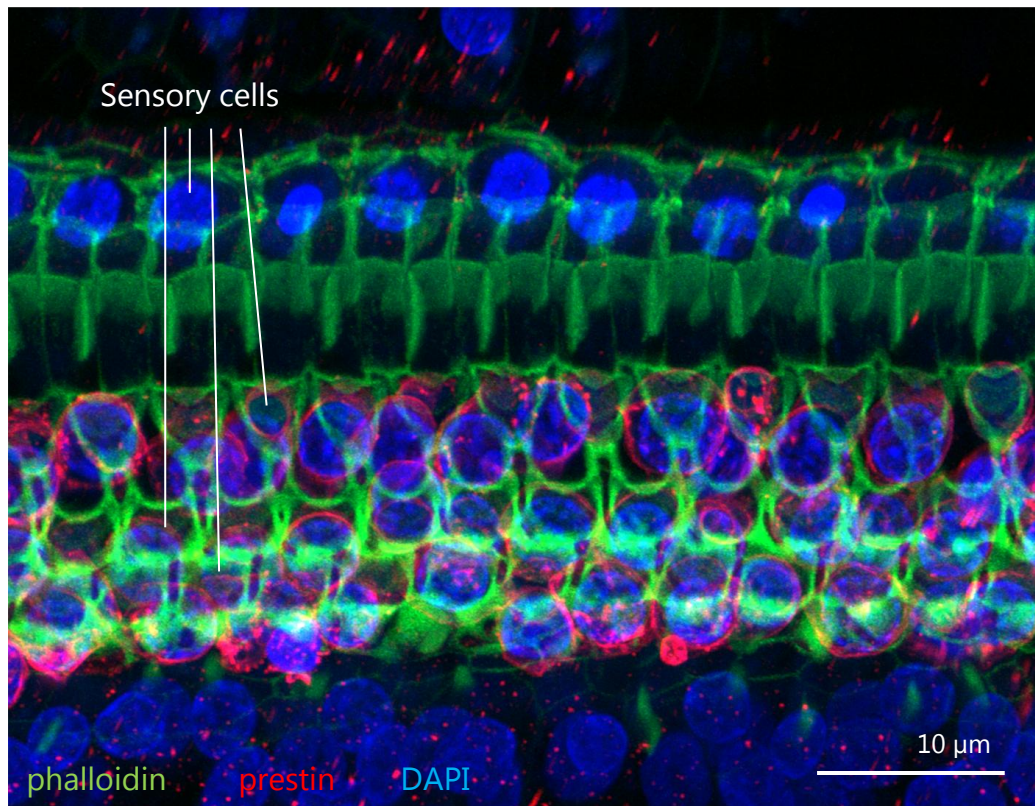
- Monitor the “acoustic health” of a population
- Bring information for the development of indicators within the descriptor 11 of the MSFD
- Provide data to population models to predict impacts at a population level

- Lesions due to noise exposure are frequency dependent → source



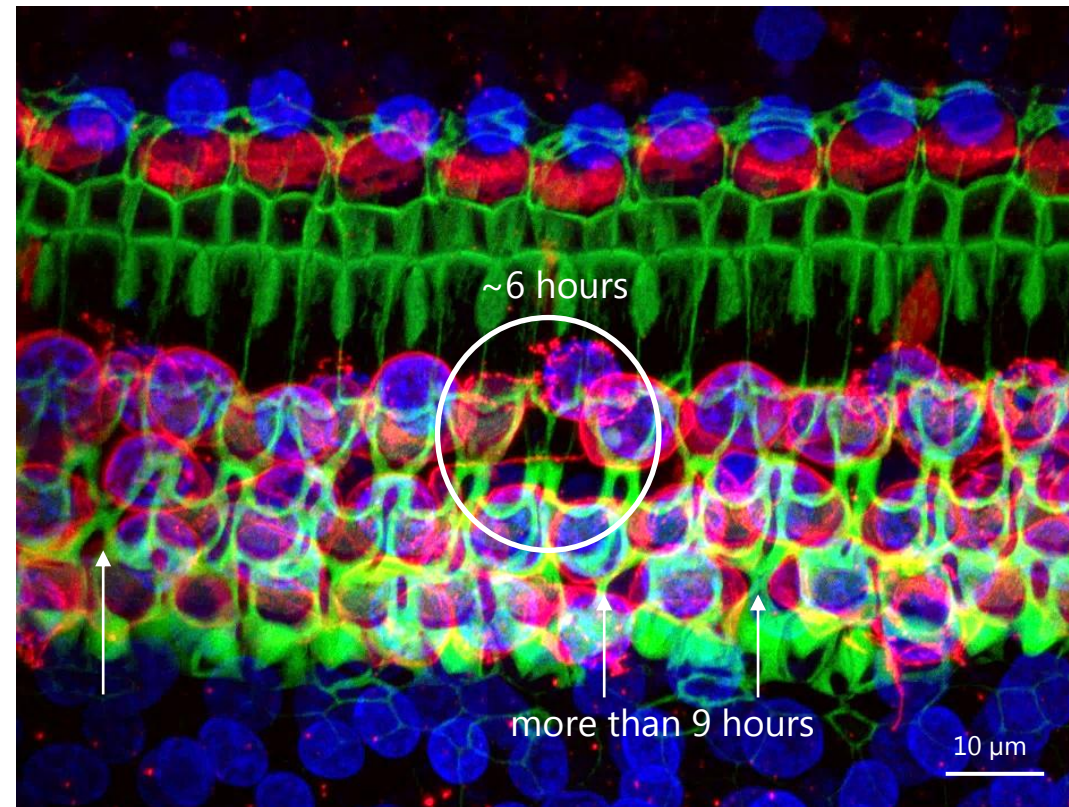
Immunofluorescence (codes 1 and 2)

Normal



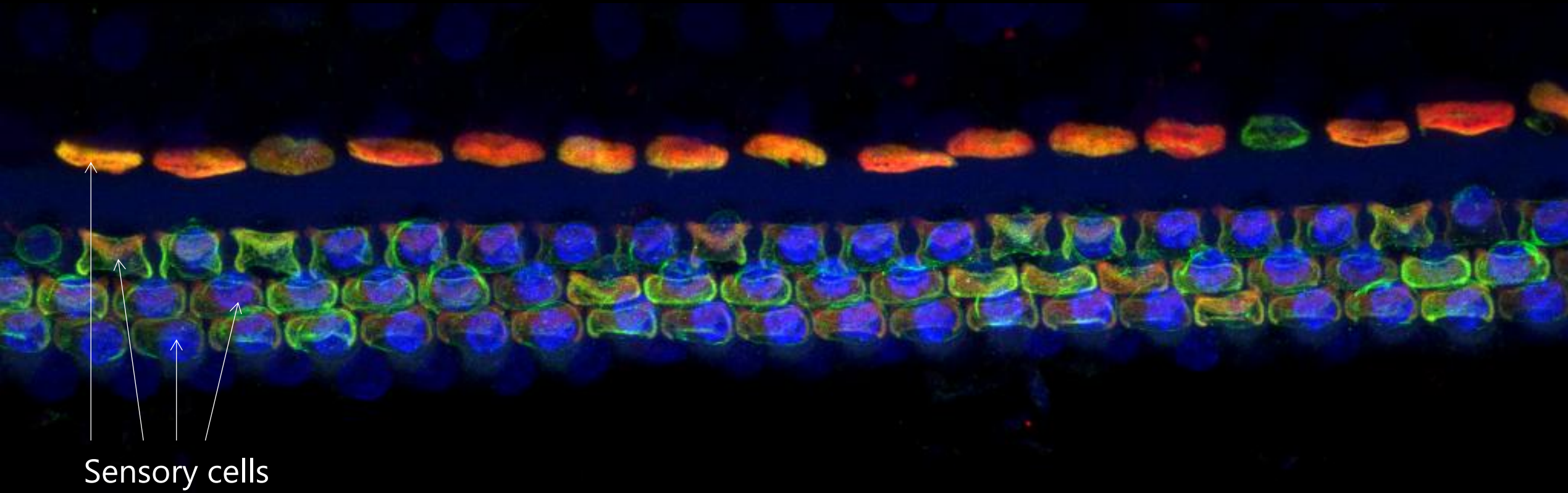
Morell *et al.*, 2022

Recent OHC loss



Morell *et al.*, 2020

Immunofluorescence

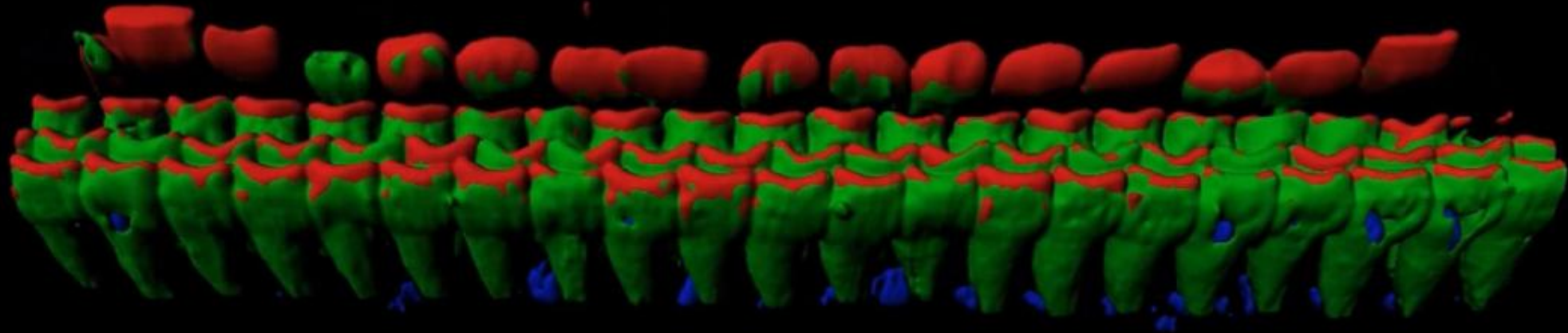


Myosin VI

Prestin

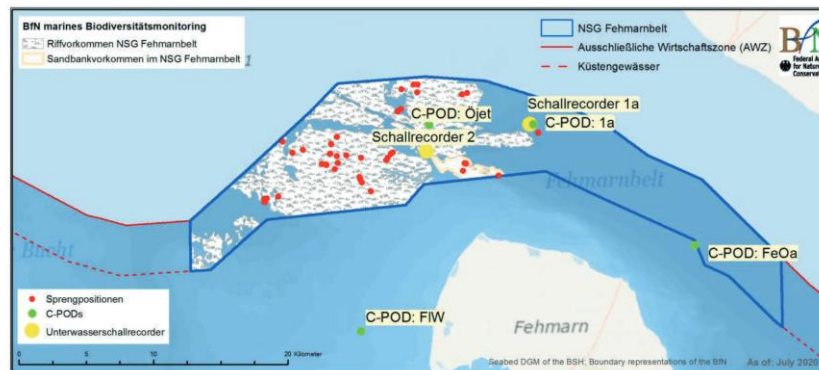
DAPI

Immunofluorescence

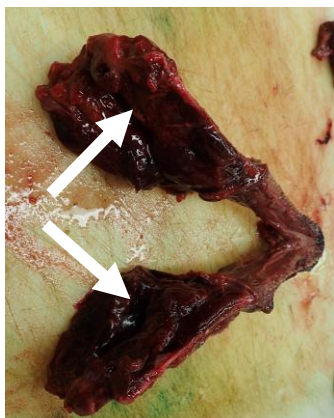


Blast injury (ear analysis with codes 1-5)

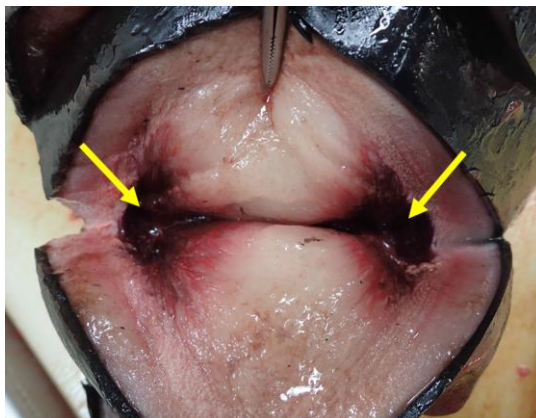
42 explosions to clear underwater munition in the Baltic Sea (28-31 August 2019)



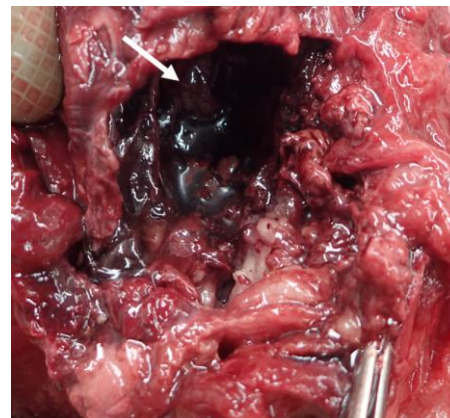
Cause of death of 8 individuals (from 24 harbour porpoises, 30%): **Blast injury**



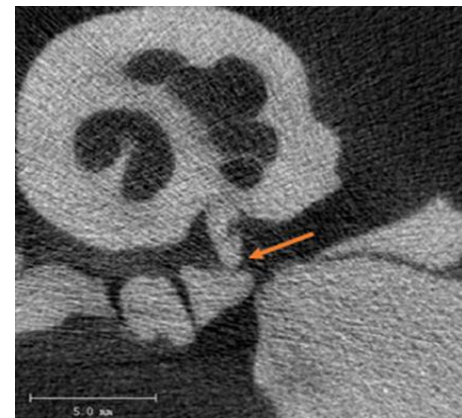
Hemorrhages in the acoustic fat



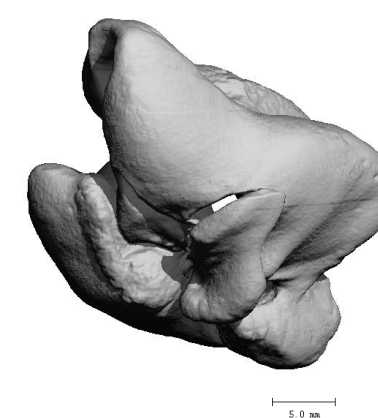
Bleeding in the melon



Bleeding in the peribullar cavity



Dislocation of the middle ear ossicles



Fracture of the tympanic

Need to quantify the prevalence of lesions in the bony structures of the ears of porpoises that may be consistent with blast injury, as well as to estimate possible trends over the last 10 years

BMASK Project

Objective: to develop recognized indicators based on reliable data to reliably assess the status of marine mammals in the North and Baltic Seas



generating evaluation methods, basic and urgently needed knowledge



Federal Agency for
Nature Conservation

Ear analysis (BMASK Project)

Results so far from the high-resolution CT scans:

28 out of 181 ears (15.5%) have fractures in the tympanic bone and/or dislocations of the middle ear ossicles (2 ship strikes)

Next steps



1) Increase the sample size (perform more high-resolution CT scans):

- Add the contralateral ear of those individuals with fractures in the ears
- Add more samples from the North Sea
- Add more samples to have a more balanced effort among the years

2) Evaluate using histopathology those cases with abnormalities in the ear bones (codes 1-3, in progress)

3) Integrate the results of the ear analysis with the post-mortem examination of the whole animal

Conclusions

- We can obtain valuable information of the ear analysis in ALL decomposition conditions
- With ear analysis: possible to detect cases of hearing loss compatible with noise exposure (and other causes), not detectable by analyzing other tissues
- Importance to always collect the ears
- Implications:
 - Prevalence of stranded individuals with hearing loss
 - Monitor the effectiveness of mitigation measures of acoustic sources
 - Bring information for the development of indicators within the descriptor 11 of the MSFD

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