



Underwater explosions and underwater noise as possible causes for harbour porpoise bycatch

Prof. Prof. h. c. Dr. Ursula Siebert, Dr. Maria Morell, Dr. Tobias Schaffeld, Dr. Joseph Schnitzler, Dr. Jan Lakemeyer

Institute for Terrestrial and Aquatic Wildlife Research, Büsum, Germany

Dr. Julius Stürznickel, PD Dr. Ralf Oheim, Prof. Dr. Michael Ameling

Department of Osteology and Biomechanics, University Medical Center Hamburg-Eppendorf, Germany

Sven Koschinski, Meereszoologie, Germany

Sources of noise



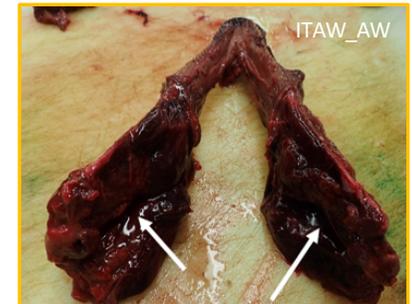
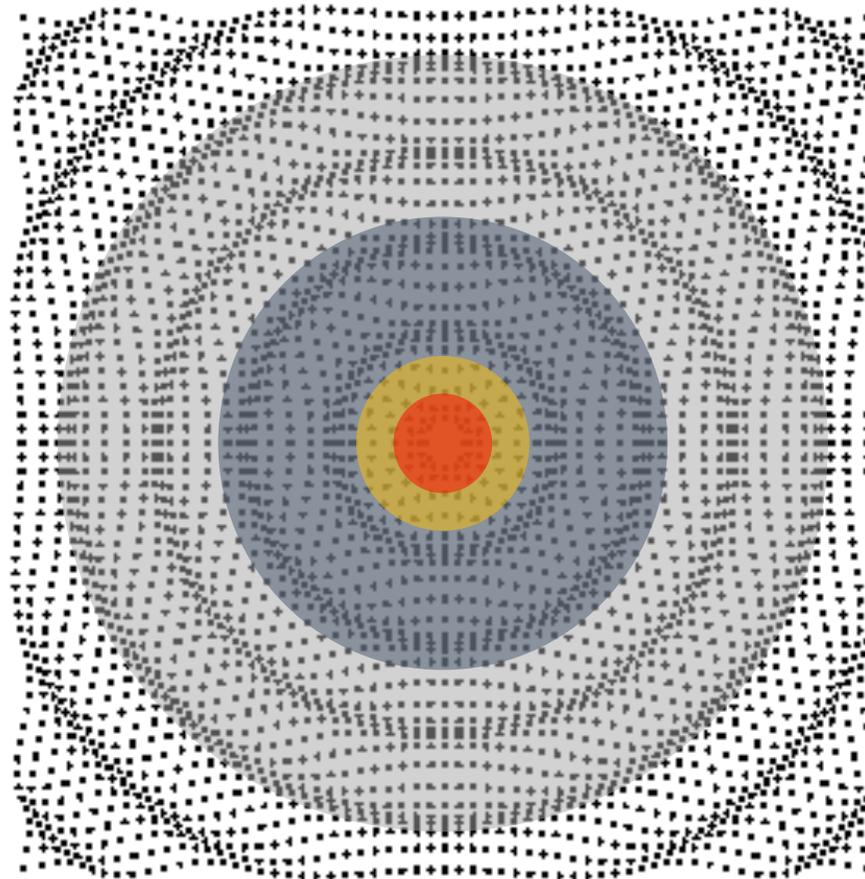
Impact zones of noise

Lethal injuries

Hearing impairment

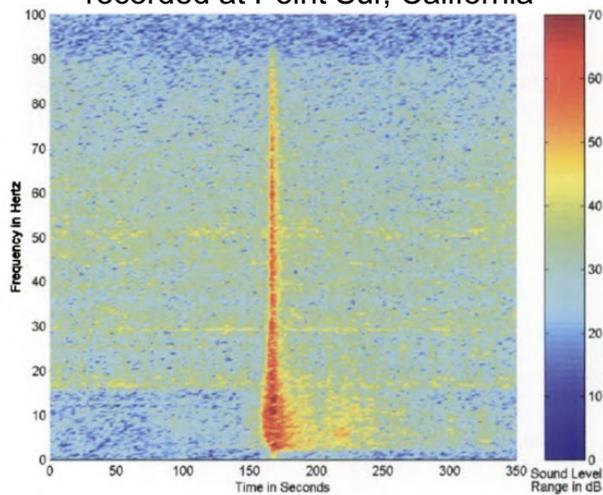
Behavioural reactions

Masking

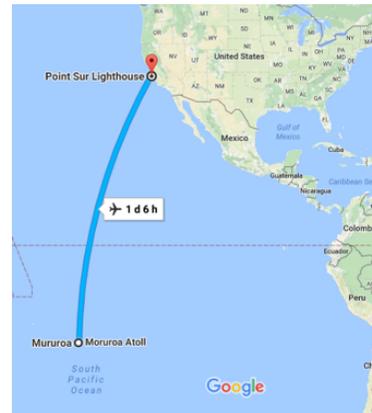


Explosions

Sonogram of a submarine nuclear test on the Mururoa Atoll on Oct. 21st 1992: recorded at Point Sur, California



© Sound Images of the Ocean: in Research and Monitoring, Peter Wille



→
280 dB

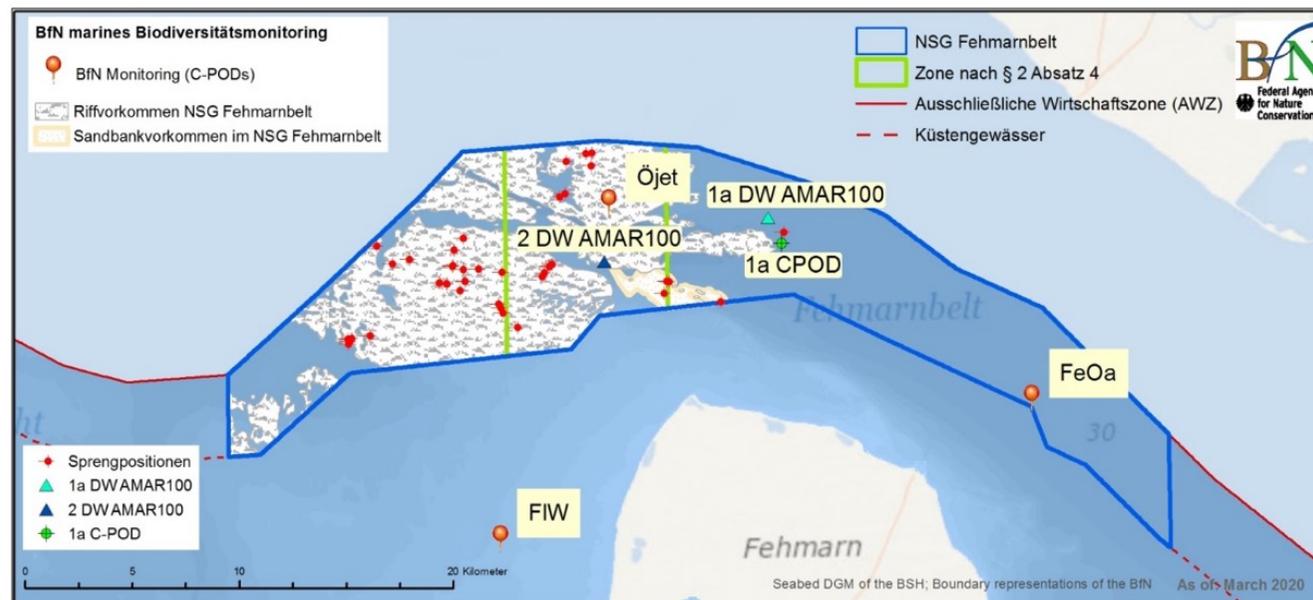
Underwater sound file of a nuclear explosion at the Mururoa Atoll on 27.10.1965
Recorded at a distance of 6600 km



© Kampfmittelräumdienst-SH

Investigation of the effects of anthropogenic sounds on harbour porpoises

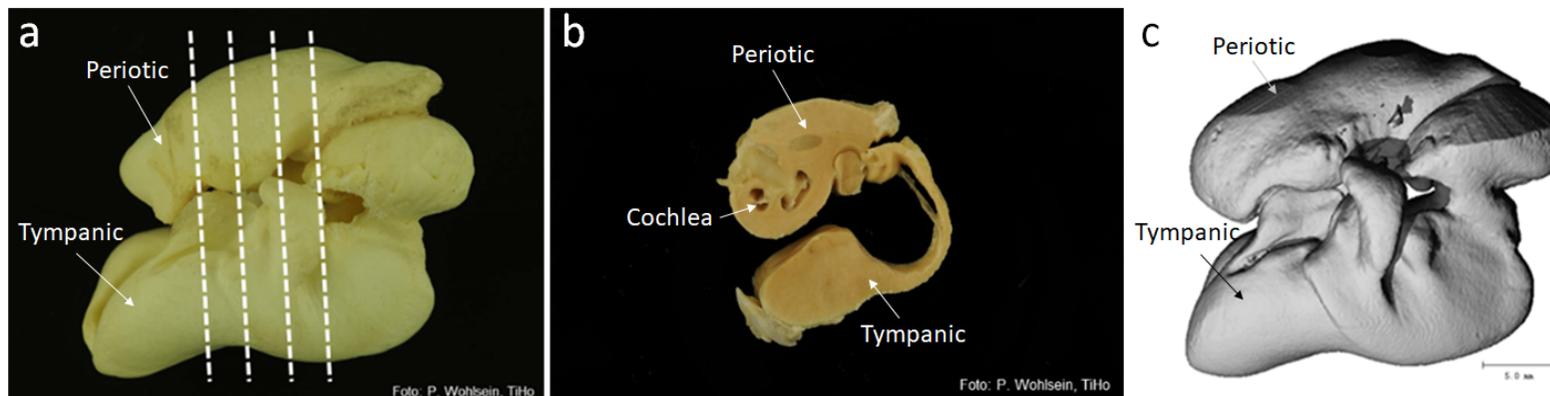
Blast trauma / acoustic trauma in harbour porpoises from the Baltic Sea



- Forty-two British ground mines of the type MK 1-7 from World War II were cleared by means of blasting
- In the period from 28 August to 31 August 2019 by a NATO unit (participation of the German Navy)
- in the Exclusive Economic Zone within the MPA Fehmarnbelt, Germany

Blast injury / acoustic trauma in harbour porpoises from the Baltic Sea

- Forensic pathological investigations including extended image processing were conducted on 24 harbour porpoises funded by the Federal Agency for Nature Conservation
- Conducted by the University of Veterinary Medicine Hannover and the University Medical Center Hamburg-Eppendorf, Germany
- 24 harbour porpoises collected through the stranding network in Schleswig-Holstein between Sept to Nov 2019



- Tympano-periotic complex of a harbour porpoise, indicating the transverse sectional planes used for histopathology.
- Decalcified tympano-periotic complex of a porpoise in cross-section.
- 3D reconstruction of a tympano-periotic complex of a harbour porpoise by HR-pQCT scan.

Photo: ITAW-TiHo

Blast trauma / acoustic trauma in harbour porpoises from the Baltic Sea



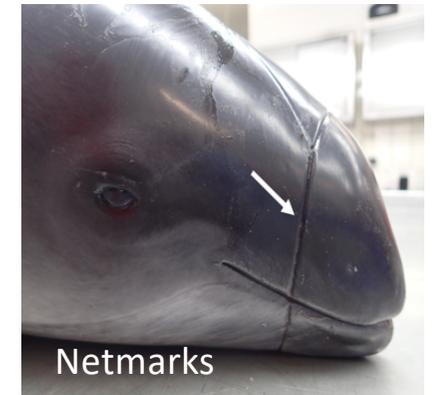
Summary:

1. Out of the 24 harbour porpoises

8 animals died of blast/acoustic trauma,

1 animal died of blast/acoustic trauma and blunt trauma

1 animal died of blast/acoustic trauma and bycatch



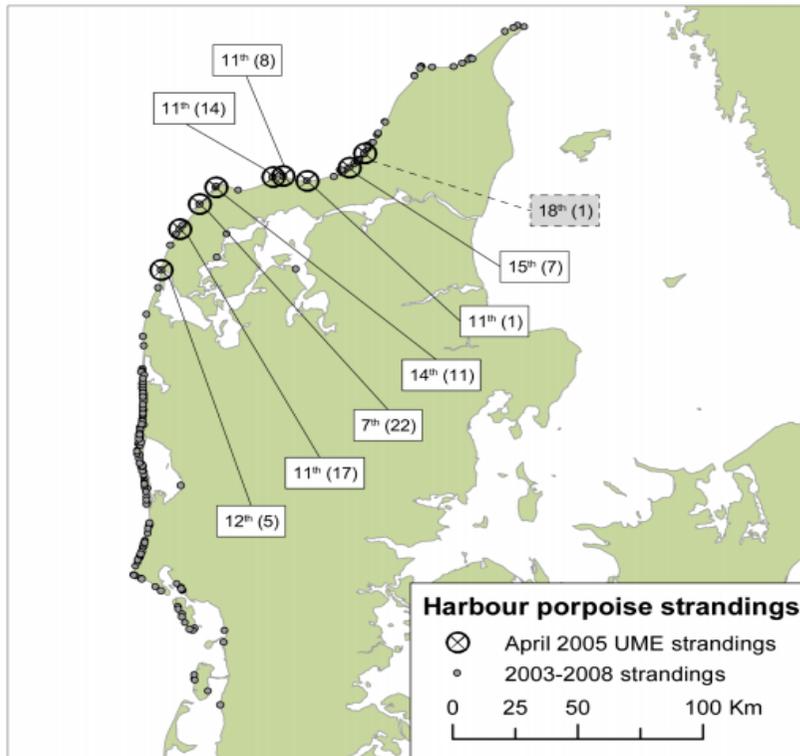
2. Explosions during military activities and removal of ammunition by blast is an enormous threat for harbour porpoises and other marine animals due to direct and indirect effects. Application of noise mitigation measures and deterrence of animals is critically needed without exceptions.

3. Bycatch may obscure noise impact as the cause of death.

4. Systematic investigations on the hearing system need to be allowed and conducted by specialists to understand effects of acoustic impacts.

Photo: ITAW-TiHo

Unusual harbour porpoise mass stranding and bycatch event 2005



Wright et al. 2013. Possible Causes of a Harbour Porpoise Mass Stranding in Danish Waters in 2005. PLOSone

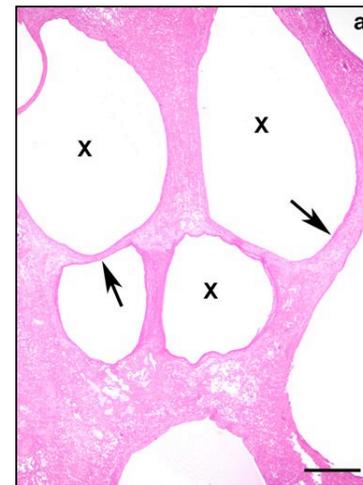
- 85 strandings within ~one week, 27 with signs of bycatch
- 19 post-mortem examinations, 6 reported & 3 suspicious for bycatch
- Possible contributing factors:
- Wind, currents, tides
- High season in lumpfish fisheries
- Occurrence of prey (whiting) might have attracted porpoises

Unusual harbour porpoise mass stranding and bycatch event 2005



- NATO exercise with 85 ships, **including sonar use for mine clearance activities**
- -> Sonar exercises could have affected the attention of harbour porpoises and may have therefore led indirectly to increased bycatches
- -> hearing impairment and blast trauma was not investigated!
- **It can only be speculated whether blast trauma as initial reason for death has been obscured by bycatch**

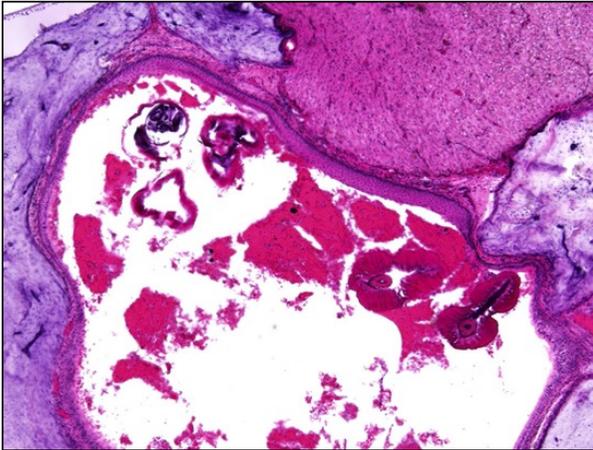
Wright et al. 2013. Possible Causes of a Harbour Porpoise Mass Stranding in Danish Waters in 2005. PLOSone



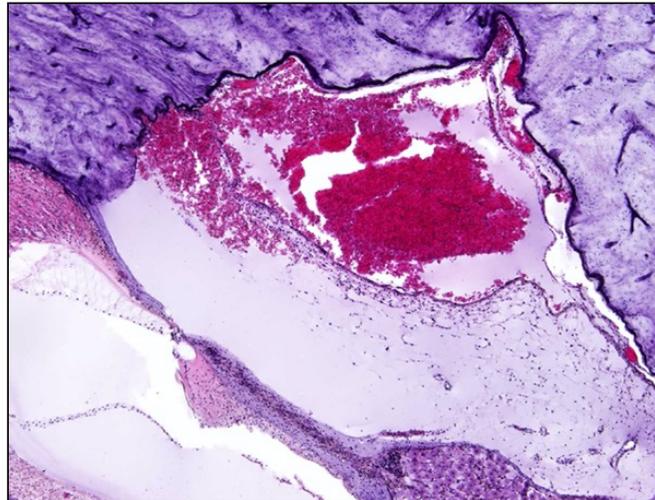
Siebert & P. D. Jepson & P. Wohlsein, Eur J Wildl Res (2013) 59: 441 – 444 First indication of gas embolism in a harbour porpoise (*Phocoena phocoena*) from German waters, U.



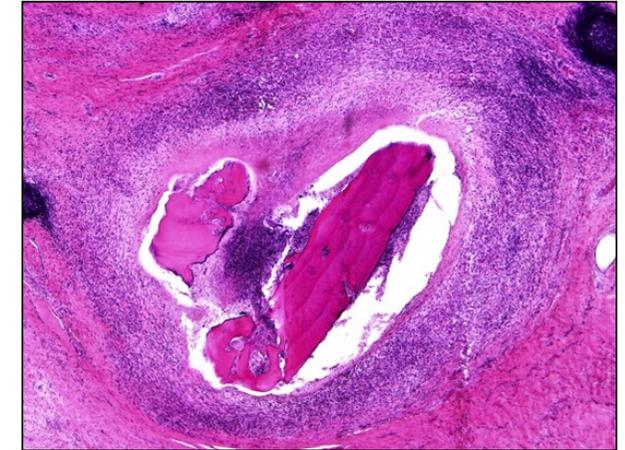
Pathological findings in the ear complex of bycaught animals



Haemorrhages in the tympanic cavity



Haemorrhages in the cochlea



Fracture of the TP complex with sequestration of bone fragments

Wohlsein et al., 2019. J. Comp. Pathol

Stiftung Tierärztliche Hochschule Hannover
University of Veterinary Medicine Hannover, Foundation

Photos: ITAW-TiHo

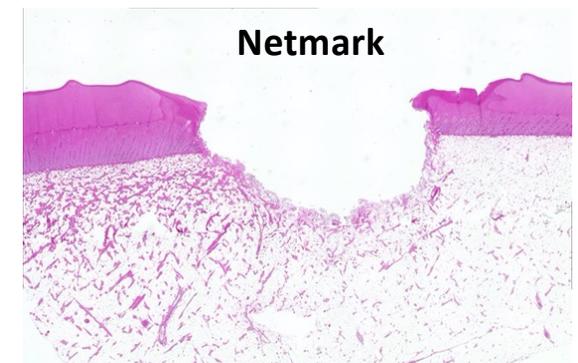
Underwater noise and bycatch

Conclusions:

The contribution of underwater noise effects as causes for bycatch need to be investigated in detail in order to find successful management solutions:

- A. Cetaceans may be permanently (PTS) or temporarily (TTS) injured by underwater noise
- B. Distracted from nets by underwater noise especially young animals
- C. Showing strong behaviour reactions and being stressed by underwater noise
- D. Being unable to detect nets by masking underwater noise

Cetaceans may just be “blind” and unable to detect and react to nets and their alerting systems.



Siebert et al. 2020, Environ. Int

Thank you for your attention

