

Status Quo on UXO in the ASCOBANS area

ASCOBANS AC 26, 8 November 2021

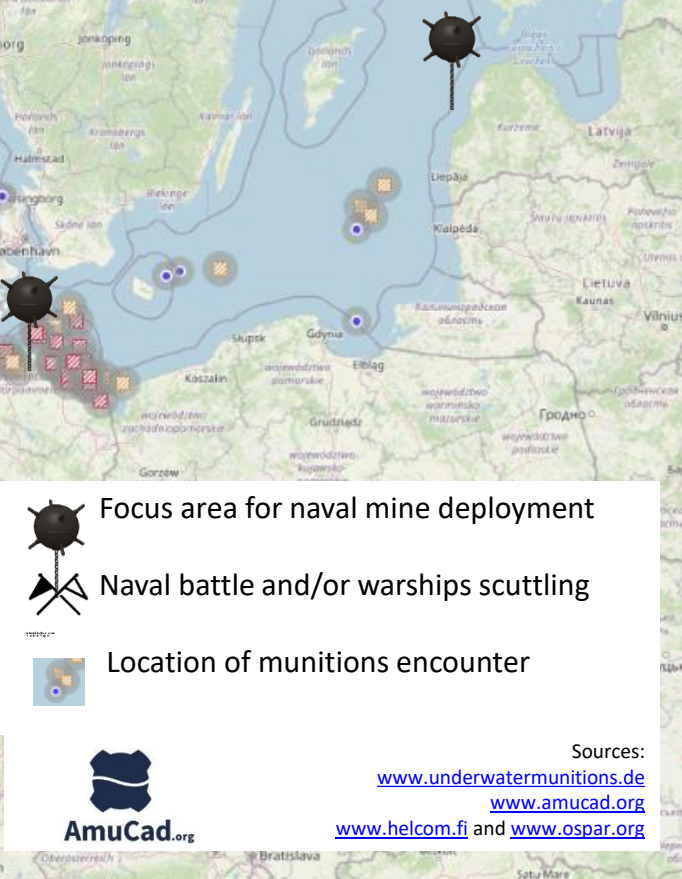
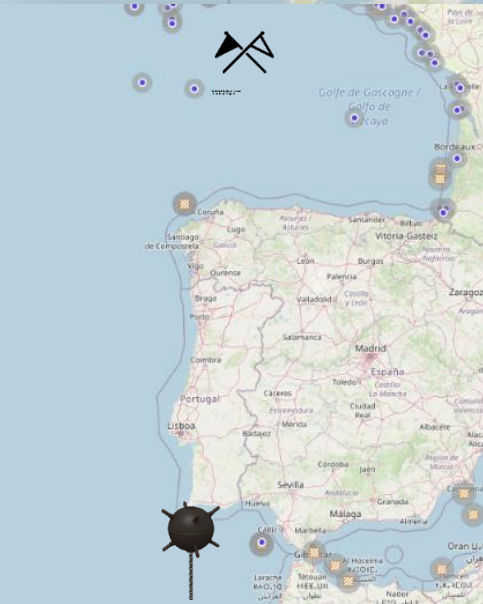
Sven Koschinski, Nehmten, Germany



Photo © GEOMAR Kiel

Status Quo on UXO in the ASCOBANS area

Where in the ASCOBANS area do we encounter UXO?



Focus area for naval mine deployment



Naval battle and/or warships scuttling



Location of munitions encounter



Sources:

www.underwatermunitions.de

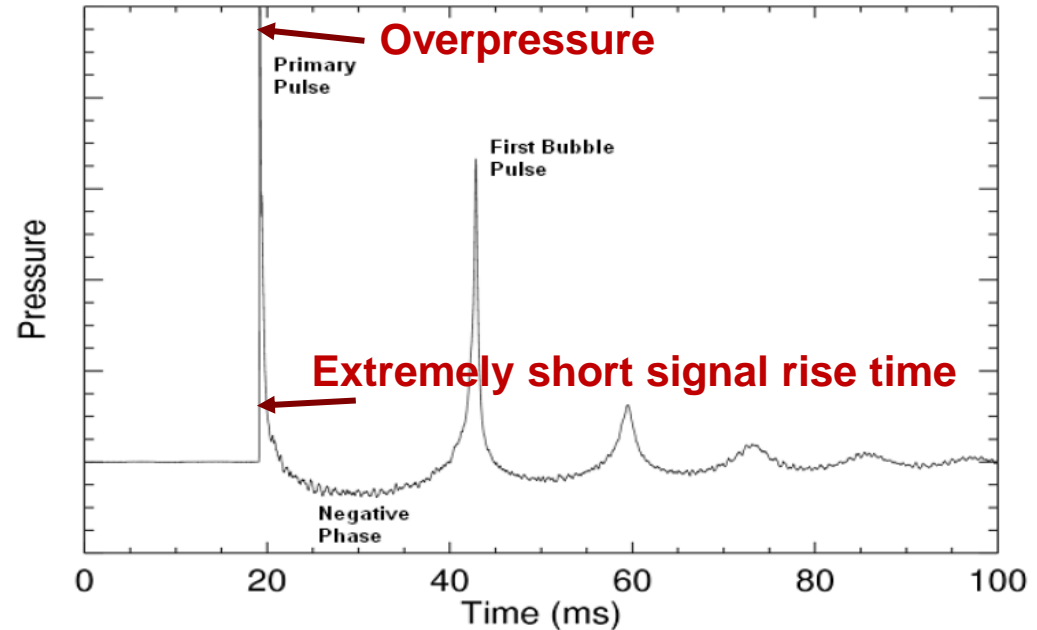
www.amucad.org

www.helcom.fi and www.ospar.org

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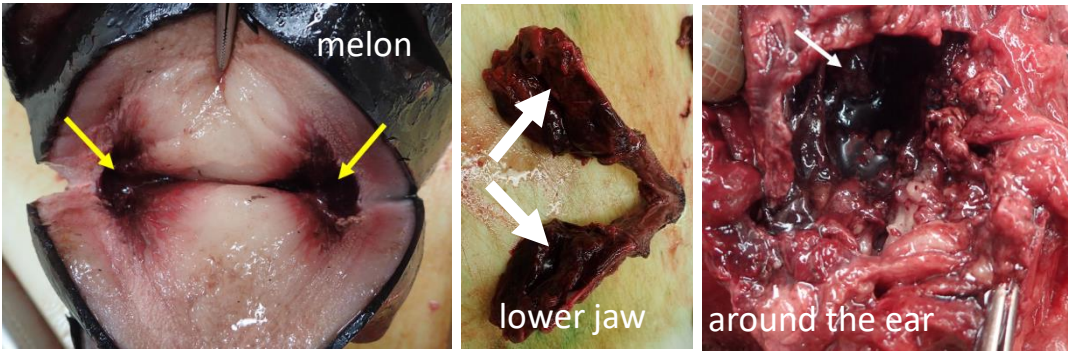
Why is UXO important to ASCOBANS?

- Explosions are the loudest point source of underwater impulsive noise
- Blast injuries affect small cetaceans at ranges of many kilometres
- Potential for population impact
- Release of toxic substances



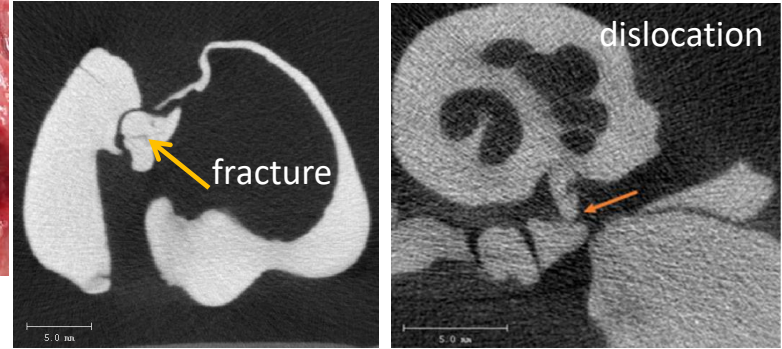
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What are the consequences for small cetaceans?



Bleeding and hemorrhages in acoustic fat

Damage e.g., in middle ear



-> hearing damage can inflict bycatch or ship strike

Siebert et al. in review, photos © ITAW Institute for Terrestrial and Aquatic Wildlife Research



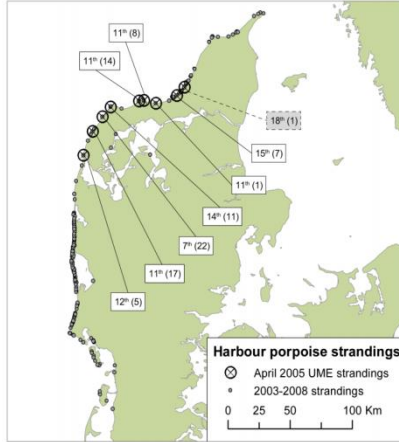
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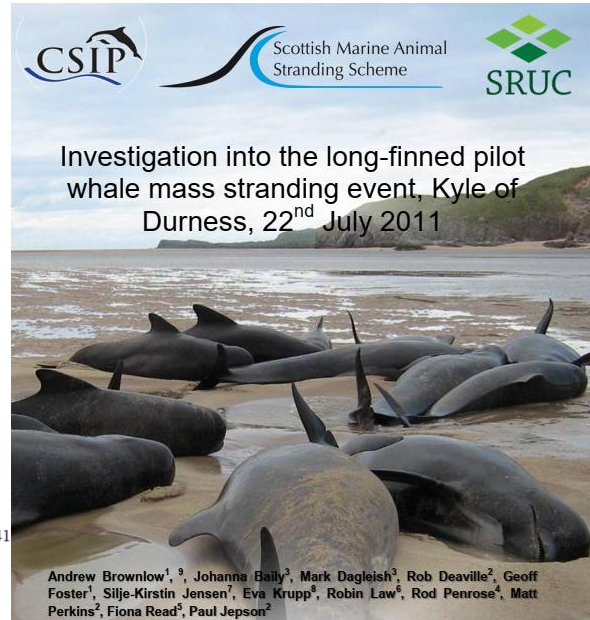


Possible Causes of a Harbour Porpoise Mass Stranding in Danish Waters in 2005

Andrew J. Wright^{1*}, Marie Maar¹, Christian Mohn¹, Jacob Nabe-Nielsen¹, Ursula Siebert², Lasse Fast Jensen³, Hans J. Baagøe⁴, Jonas Teilmann¹



0.1578/AM.41



Verendete Schweinswale

Tod durch Explosionstrauma

Stand: 21.10.2020 17:33 Uhr

Im August 2019 wurden bei Minensprengungen im Naturschutzgebiet Fehmarnbelt mehrere Schweinswale getötet. Jetzt hat das Bundesamt für Naturschutz seinen Bericht vorgelegt - Umweltschützer sprechen von einem Versagen der Bundeswehr.

Assessing the Impact of Underwater Clearance of Unexploded Ordnance on Harbour Porpoises (*Phocoena phocoena*) in the Southern North Sea

Alexander M. von Benda-Beckmann¹, Geert Aarts^{2, 3}, H. Özkan Sertlek^{4, 5}, Klaus Lucke^{2, 6}, Wim C. Verboom⁷, Ronald A. Kastelein⁸, Darlene R. Ketten⁹, Rob van Bemmelen², Frans-Peter A. Lam¹, Roger J. Kirkwood², and Michael A. Ainslie^{1, 10}

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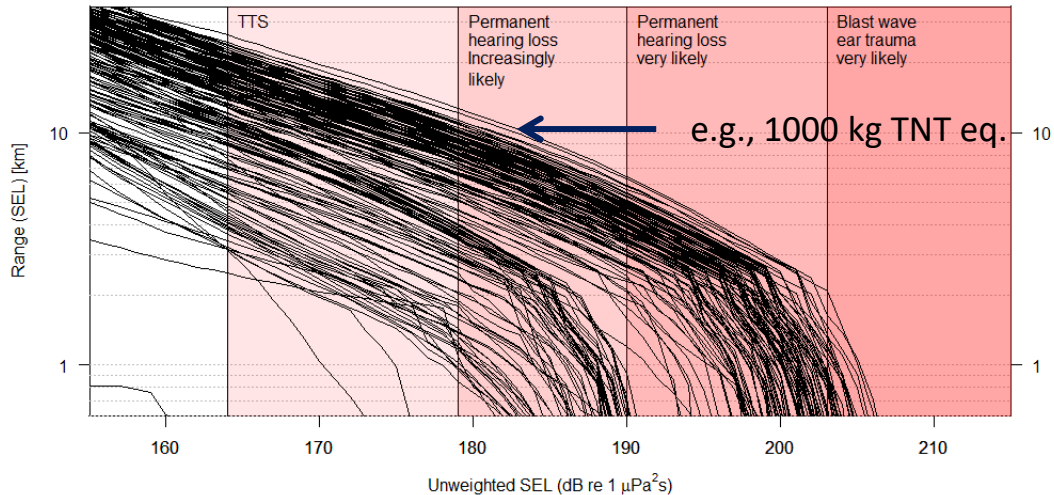
How big is the problem?

- We do not know, if all these events have been caused by detonations
- We know that small cetaceans frequently are killed by underwater detonations
- Sometimes directly by blast injuries
- Sometimes by bycatch or collision as a result of hearing damage
- Only a small fraction of strandings is investigated for their cause of death
- We do not know the amount of animals killed by explosions
- The number of explosions is increasing due to the continued industrialisation of our seas

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How large is the danger zone of a blast?

Estimated effect distances - near bottom



It depends on e.g.:

- Charge size
- Water depth
- Sediment
- Place in the water column
- Orientation of the animal
- Size of the animal
- Species

Source: von Benda-Beckmann et al. 2015

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How effective is mitigation by a bubble curtain compared to a seal scarer?

A few rough calculations:

Scaring distance of a seal scarer is ~ 1 km (if 100% of animals are to be deterred), danger radius is ~ 10 km

Deterrence area is 1 % of the danger area: 3.14 km^2 vs. 314 km^2

animals from inner circle are deterred to outer circle, but not outside the danger zone

How far can a protected species observer see? 1 km? Depending on light, waves, weather.

Bubble curtain:

Pressure reduction of 15 dB reduces danger radius by a factor of 10 (assumption: $15 \log R$ noise radiation) and danger area by 99 %

→ **best to use both in combination!**

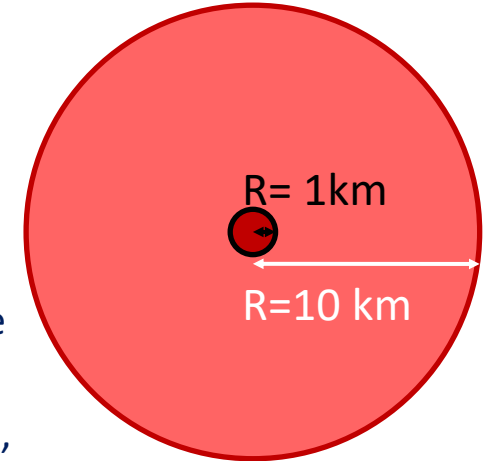
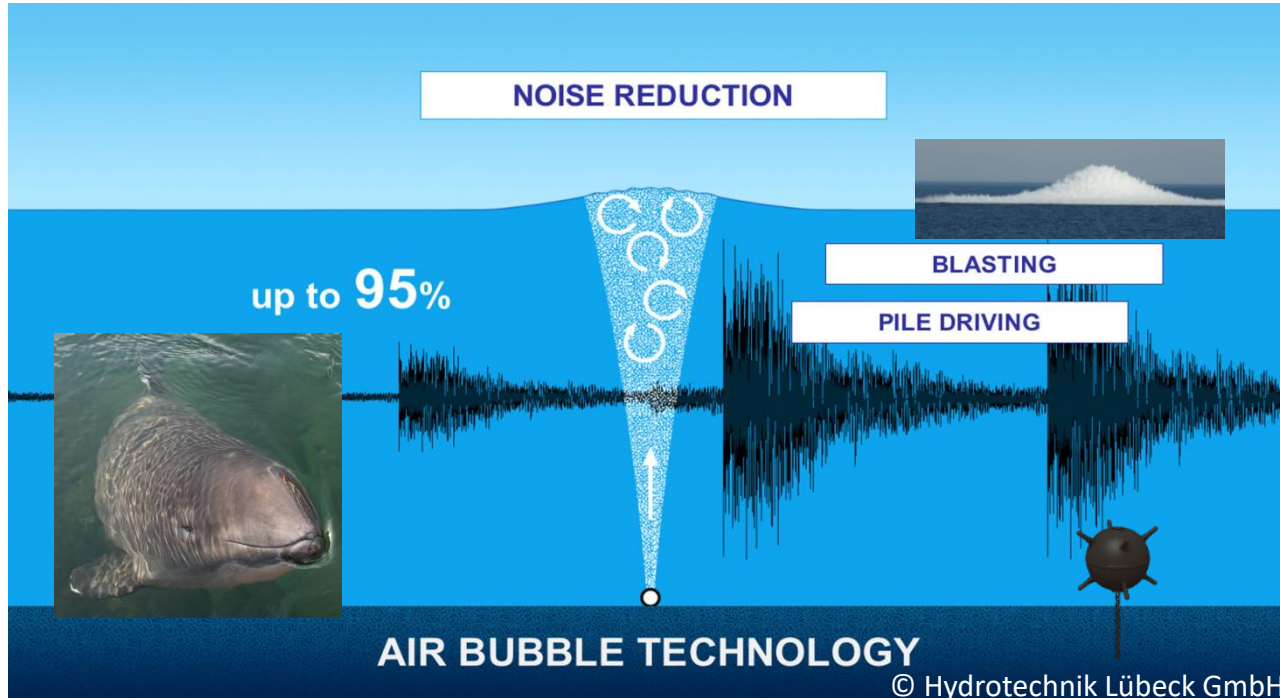


Photo: Hydrotechnik Lübeck GmbH

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What technology is BAT and BEP?



Factors affecting bubble curtain effectiveness:

- Bubble density in water
- Charge size -> radius
- Depth -> amount of air

Research needed to increase cost efficiency.

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What technology is BAT and BEP?

A bubble curtain is best practice to reduce impulsive noise. But not every bubble curtain is effective!

Compare 1997 and 2021 systems:



Soll die Druckwelle dämpfen: Die WTD 71 erprobt diesen mit Luftdüsen bestückten Rahmen, der unter Wasser einen Blasenschleier erzeugt.

Eckernförde Nachrichten 20.9.97

Ein Schleier für Wale

WTD 71 und Meereskundler suchen neue Lösungen für Sprengversuche

Eckernförde (erd) Gebanntes Warten auf den Countdown. Dann ein dumpfer Knall – im Sperrgebiet in der Eckernförder Bucht vor Schönhagen ist eine 500-Gramm-Ladung unter Wasser detoniert. Unter Deck der „Bums“, der Bundesmeßschute, sind alle Augen auf die Monitore gerichtet. Die aufgezeichneten Kurven sollen Aufschluß darüber geben, inwieweit ein ausgelegter Blasenschleier die Druckwelle mindert. Mit diesen und weiteren Untersuchungen, die auch vom Kieler Institut für Meereskunde begleitet werden, will die W echnische Dienststelle WTD 71 mögliche Auswirkungen auf Schweinswale vermeiden. Umweltschützer hatten im Sommer 1996 Sprengungen der WTD mit dem Hinweis auf die Meeressäuger kritisiert. Die Spreng-Tests in diesem Gebiet waren daraufhin eingestellt worden.



Bucht ermöglichen.

Eine neue Frogatte mußte deswe-

Die Bundesmeßschute „Bums“ ist die schwimmende Versuchsplattform, von der aus Sprengungs-Schutz für Schweinswale getestet wird.

Fotos Rohde



Photo: Hydrotechnik Lübeck GmbH

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How can UXO clearing be mitigated?

Examples for technical and operational mitigation measures

| Planning phase | Pre detonation | During detonation | Post detonation |
|--|--|--|---|
| <p>Involve nature conservation agencies</p> <p>impact assessment</p> <p>Analyse recovery options</p> <p>Analyse options for relocating or postponing detonations</p> <p>Develop mitigation strategy for unavoidable detonations</p> <p>Plan pre- and post detonation survey, use of deterrents, observers, PAM, safety procedures</p> | <p>Pre-detonation survey (visual, acoustic)</p> <p>Use of acoustic deterrents</p> <p>No explosive deterrents!</p> <p>Protected species observers (PSOs)</p> <p>Safety procedures allowing to stop operation when PS are sighted</p> | <p>Bubble curtain incl. performance monitoring</p> <p>Other abatement options:</p> <p>Detonate on sandbank (in air)</p> <p>Detonate in shallow water, in a bay, or near the surface</p> <p>„Shockwave shaper“</p> | <p>Perform air based marine mammal survey in wider area</p> <p>Conduct beach surveys in wider area of detonation site</p> <p>Necropsies of stranded animals with a focus on detecting blast trauma</p> |



For unavoidable detonations due to **imminent danger**, a safety procedure allowing at least some basic protection should be ready!

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Is deflagration a good idea?

- + no shock wave
 - contamination with toxic, carcinogenic and mutagenic unburnt residue
 - Ingestion of residue particles by filter-feeders, contaminants enter the food web
 - large surface of unburnt particles increases the amount dissolved explosives
 - deflagration often turns into high-order detonation which then is unmitigated
- **depending on the conservation objectives in few cases this might be an option**



Fig. 3. Left: a photograph of a 10 kg shell showing the 25 g shaped charge used to initiate deflagration. Right: a photograph of the shell and contents after deflagration (white and grey matter around inner edge of shell).

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Munition
Clearance
Week

Kiel

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A few impressions from the conference:

Navies and NATO are aware of the problem

Their given tasks focus on national security and human safety, not on the environment

They would like to be environmentally friendly

They showed some willingness of cooperation

Industry presented ideas for a robotic salvage platform

6 - 10 SEPTEMBER 2021 - KIEL

The international forum
for tackling the challenges of
offshore munition clearance

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Action points

1. Develop national and international strategies for Regional Seas to map, evaluate, prioritise and finally retrieve unexploded ordnance (with e.g., HELCOM, OSPAR)
2. Exchange of ideas, study results and other information on BAT and BEP between NATO, Navies, approval and nature conservation authorities taking into account technology developed under US programmes ESTCP and SERDP (KMCW would be a good forum)
3. Develop guidelines and international standards for mitigation of explosions and environmentally sound removal of UXO from the sea
4. Prioritize UXO removal from the sea over all other forms of management (such as detonation, deflagration, burying) to minimise environmental impact
5. Detonate UXO only if no other method can technically be applied, ensured that a bubble curtain or other abatement method resulting in a comparable noise/pressure reduction is used;
6. Investigate stranded small cetaceans for blast trauma related injuries

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Questions?

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