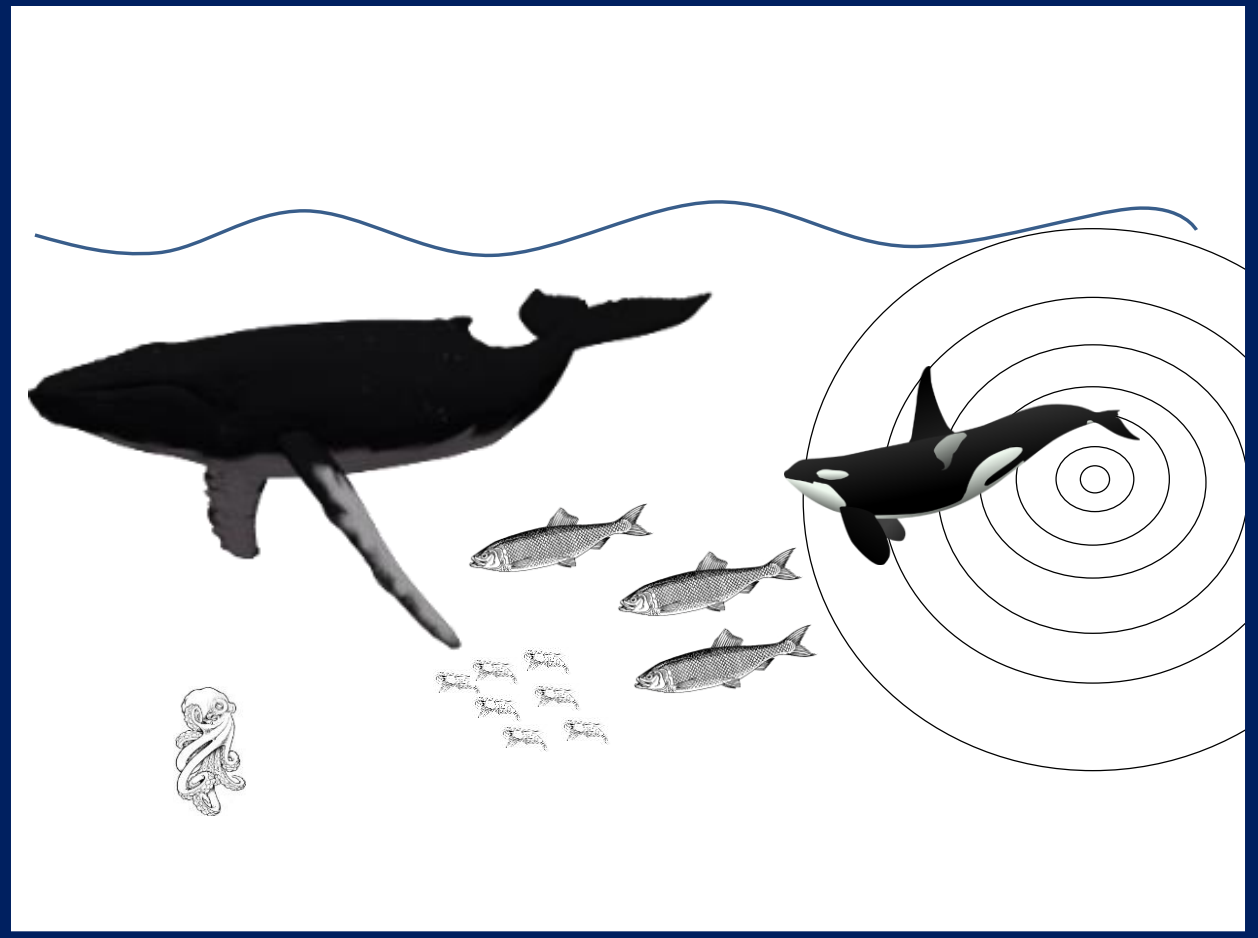
Frank Thomsen
Sónia Mendes
(Chairs)

European
MARINE BOARD
Advancing Seas & Ocean Science

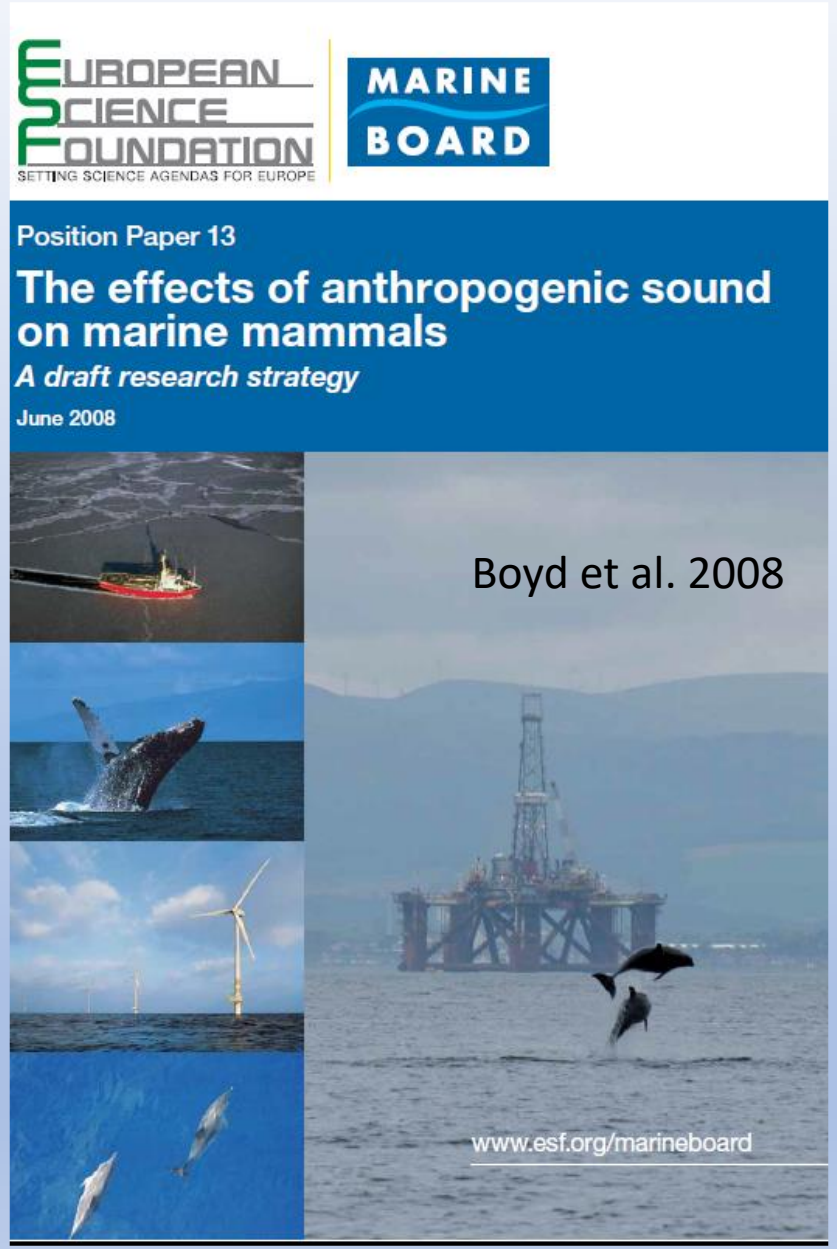
European Marine Board Expert Working Group

Underwater Noise

Underwater Noise impacts have become an important issue worldwide



A brief history



Boyd et al. 2008

TORs

High-level objectives

- Update on progress related to this topic since the 2008 EMB publication,
- Raise awareness of the current knowledge and research gaps
- Broaden the scope from marine mammals to all marine organisms, and
- Highlight the conflicts and solutions that exist relative to underwater noise.

Specific objectives

- Highlight areas of increased understanding of underwater noise causes and effects, and emergent research and methods
- Explore research and policy gaps
- Highlight the challenges and potential solutions when establishing underwater noise mitigation measures and assessing their effectiveness
- Consider current barriers to progress, including collaboration needs
- Considering all of the above, highlight key actions related to research, monitoring, policy and management needs

- Outcome 1 - *A clean Ocean where sources of pollution are identified and reduced or removed*
- Outcome 2 - *A healthy and resilient ocean where marine ecosystems are understood, protected, restored and managed*

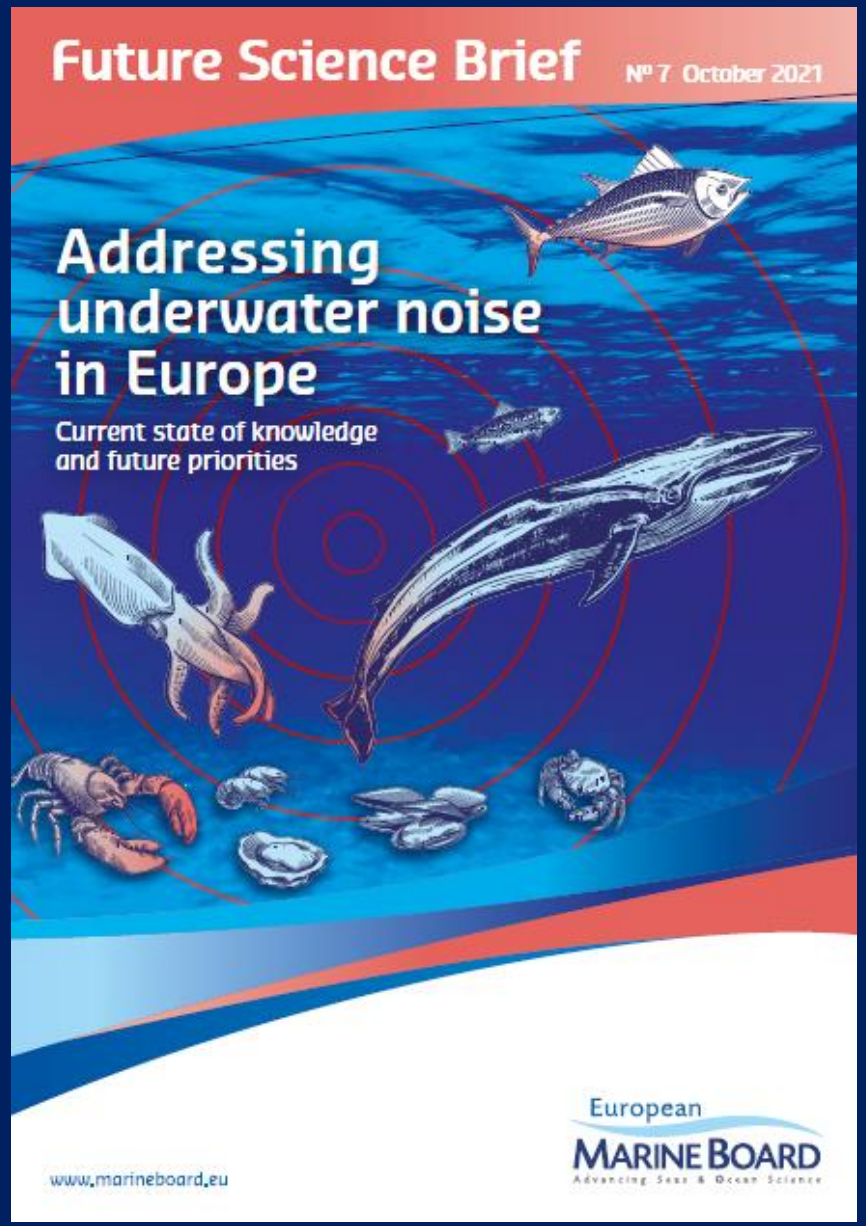
- Challenge 1 - *Understand and map land and sea-based sources of pollutants and contaminants and their potential impacts on human health and Ocean ecosystems, and develop solutions to remove or mitigate them*
- Challenge 2 - *Understand the effects of multiple stressors on Ocean ecosystems, and develop solutions to monitor, protect, manage and restore ecosystems and their biodiversity under changing environmental, social and climate conditions*
- Challenge 7 - *Ensure a sustainable ocean observing system across all ocean basins that delivers accessible, timely, and actionable data and information to all users*

The (Dream) Team

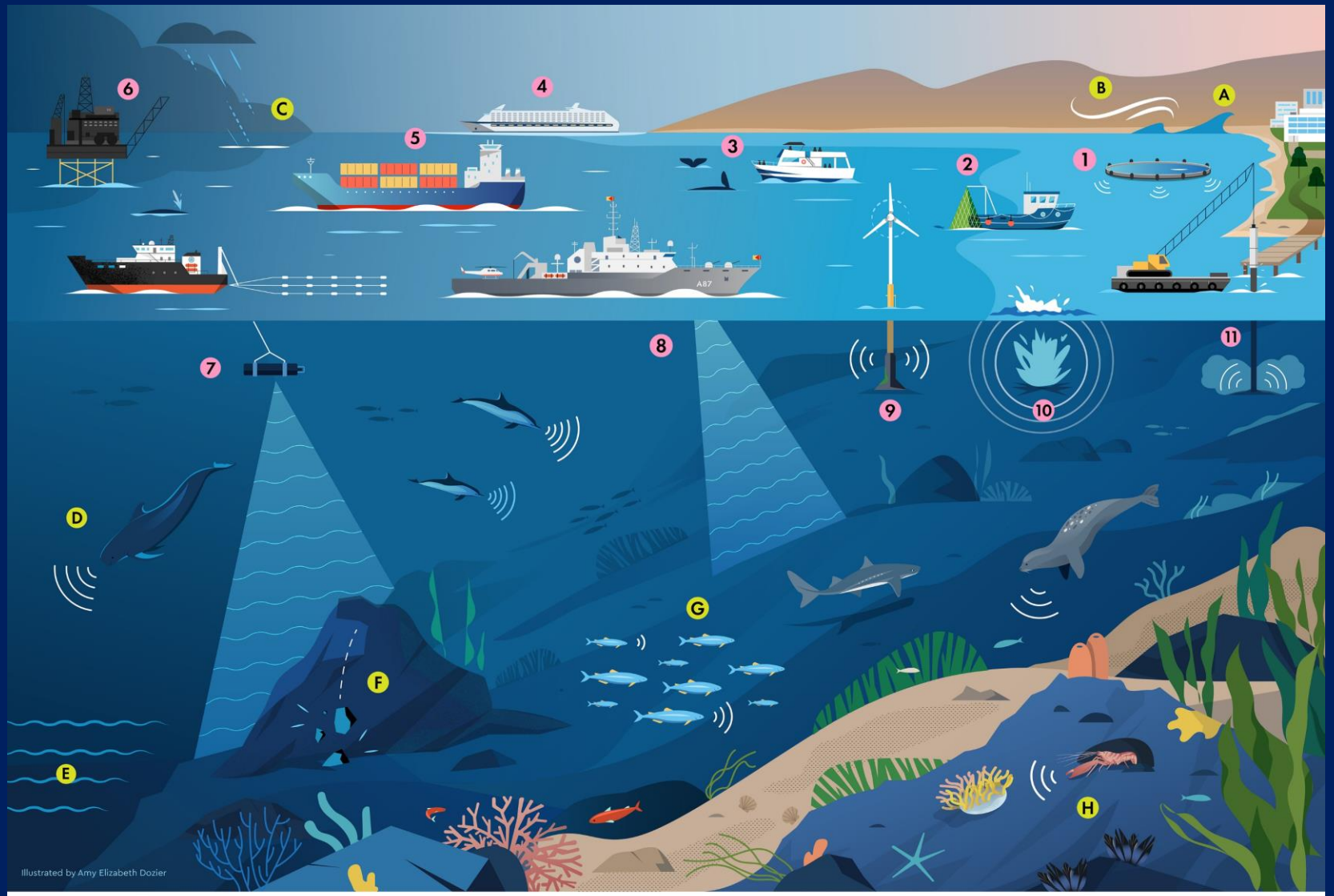
- **Chair** - Frank Thomsen, DHI, Denmark
- **Co-Chair** - Sonia Mendes, JNCC, UK
- Carina Juretzek, BSH, Germany
- Cecile Ducatel, Ifremer, France
- Elena Ciappi, CNR, Italy
- Elisabeth Debusschere, VLIZ, Belgium
- Frans-Peter Lam, TNO, Netherlands
- Frederic Bertucci, Laboratoire BOREA, France
- Joanne O'Brien, GMIT, Ireland
- Manuel dos Santos, ISPA, Portugal
- Monika Breitzke, Germany
- Thomas Folegot, Quiet-Ocean, France
- Alessandro Cresci, IMR, Norway

And:
Sheila Heymans
and
Paula Kellett (EMB)

Publication in October 2021



https://www.marineboard.eu/publications/addressing-underwater-noise-europe-current-state-knowledge-and-future-priorities



TODAY'S **OCEAN SOUNDSCAPE**

European MARINE BOARD Advancing Seas & Ocean Science

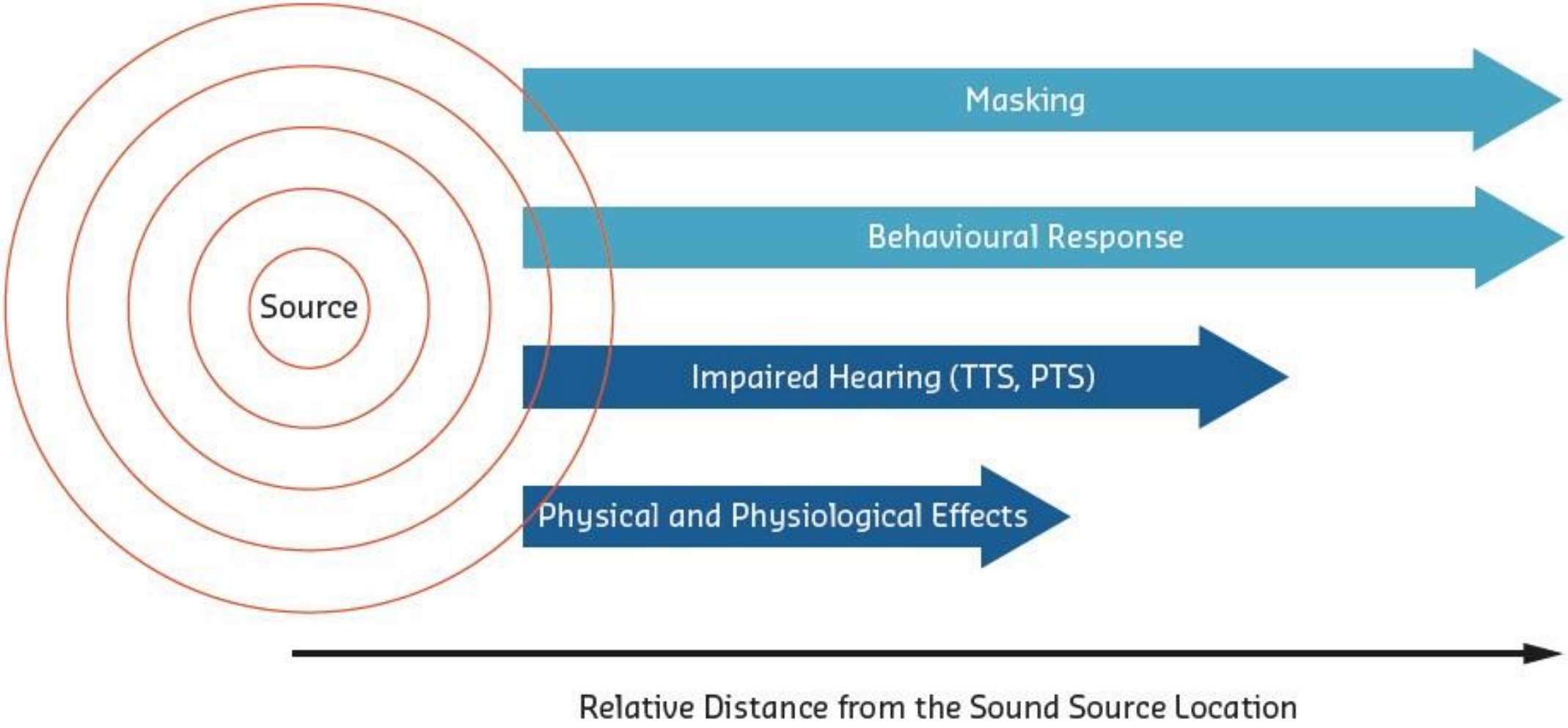
jonas Joint Framework for Ocean Noise in the Atlantic Seas

ANTHROPOGENIC SOURCES

1 Acoustic deterrent devices
2 Fishing vessels
3 Recreational vessels
4 Cruise ships
5 Commercial shipping
6 Offshore oil & gas
7 Seismic airgun surveys
8 Military & civilian sonar
9 Offshore renewable energy
10 Underwater explosions
11 Construction and pile-driving

NATURAL SOURCES

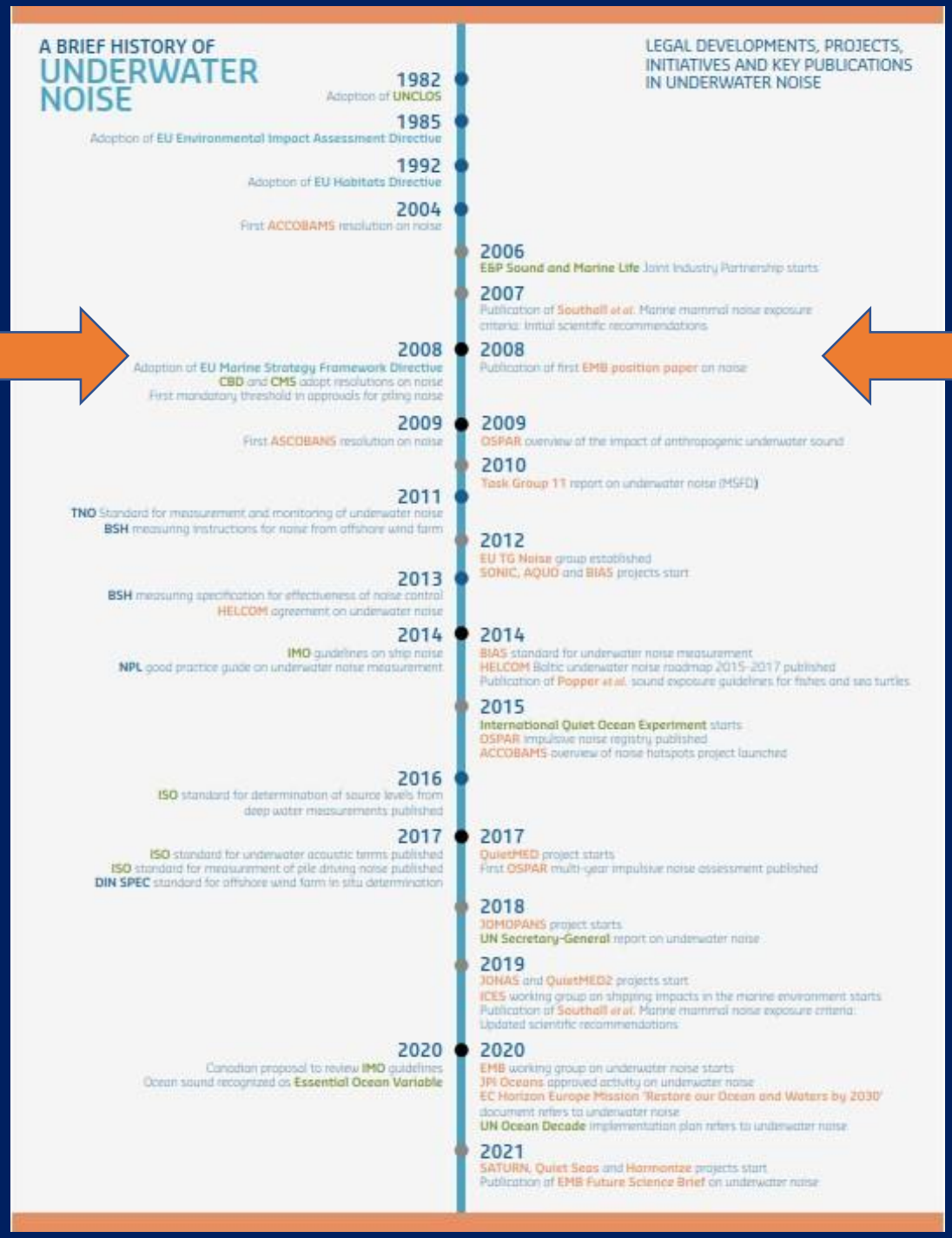
A Waves
B Wind
C Rain
D Marine mammals
E Currents
F Underwater landslides, volcanos and earthquakes
G Fishes
H Invertebrates


Masking
Behavioural Response
Source
Impaired Hearing (TTS, PTS)
Physical and Physiological Effects
Relative Distance from the Sound Source Location

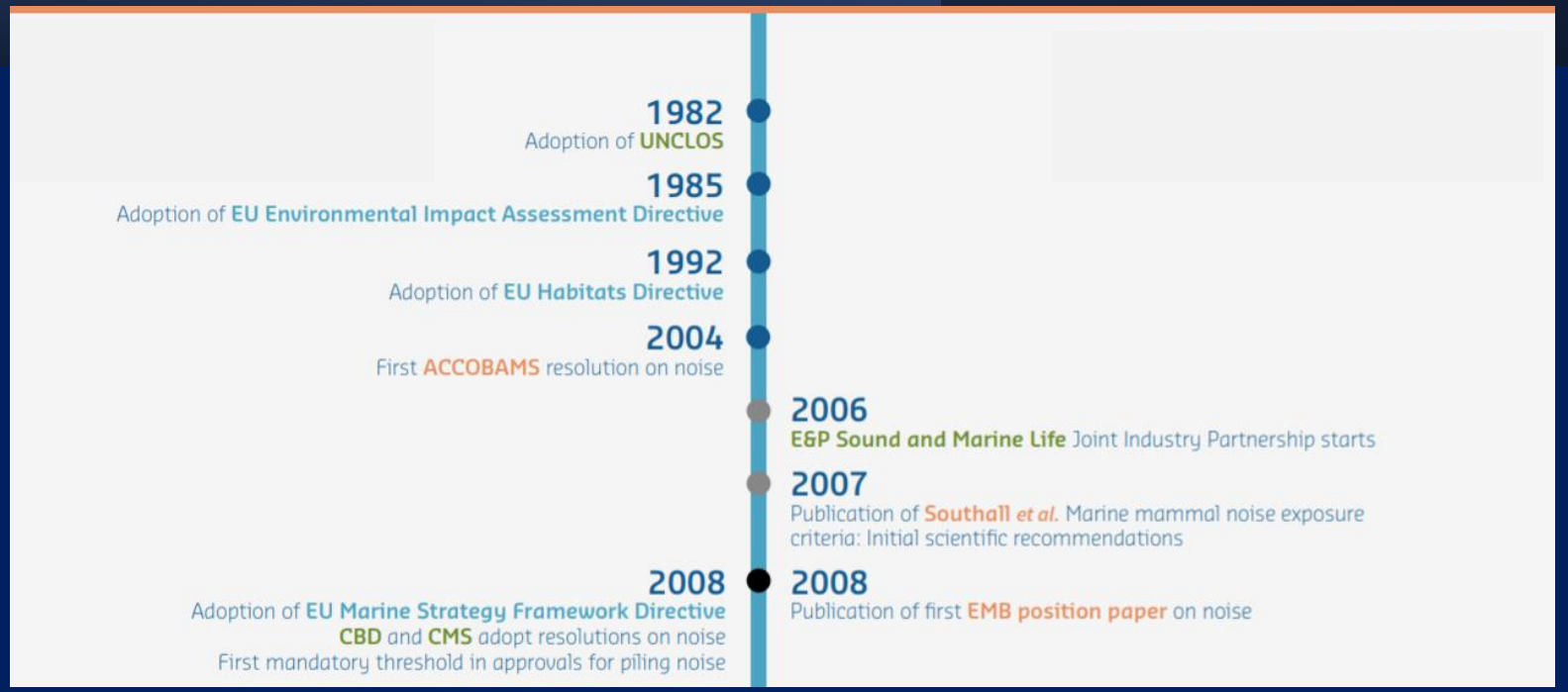
Chapters 4 and 6

- International, regional and national regulations and other drivers
- Environmental impact assessments of underwater noise
- Mitigating the effects of underwater noise
- Emerging technologies and methods
- EMB WG recommended priority actions on underwater noise

International, regional and national regulations and other drivers



Up to 2008

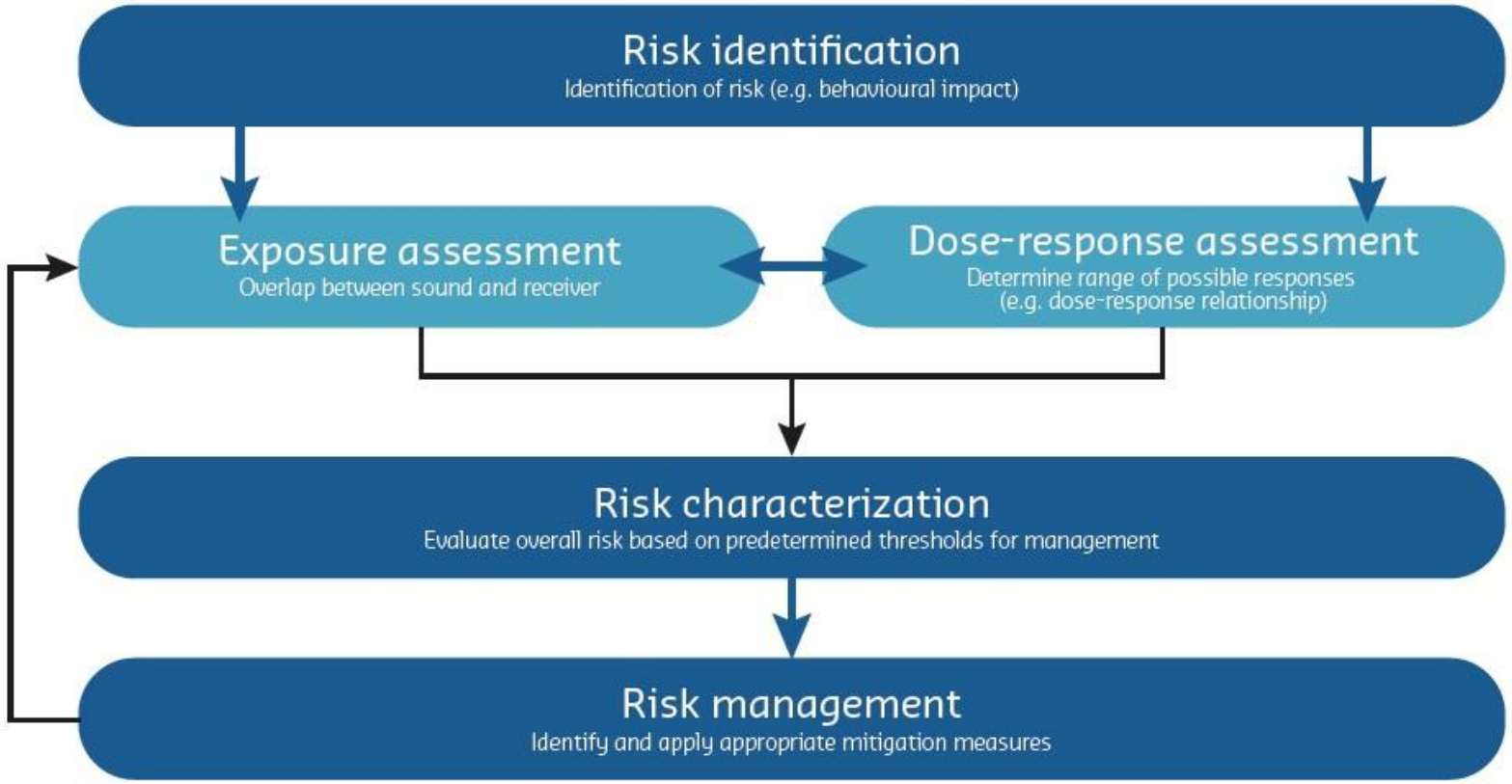

1982
Adoption of UNCLOS
1985
Adoption of EU Environmental Impact Assessment Directive
1992
Adoption of EU Habitats Directive
2004
First ACCOBAMS resolution on noise
2006
E&P Sound and Marine Life Joint Industry Partnership starts
2007
Publication of Southall et al. Marine mammal noise exposure criteria: Initial scientific recommendations
2008
Adoption of EU Marine Strategy Framework Directive
CBD and CMS adopt resolutions on noise
First mandatory threshold in approvals for piling noise
2008
Publication of first EMB position paper on noise

Since 2008


2009
First ASCOBANS resolution on noise
2009
OSPAR overview of the impact of anthropogenic underwater sound
2010
Task Group 11 report on underwater noise (MSFD)
2011
TNO Standard for measurement and monitoring of underwater noise
BSH measuring instructions for noise from offshore wind farm
2012
EU TG Noise group established
SONIC, AQUO and BIAS projects start
2013
BSH measuring specification for effectiveness of noise control
HELCOM agreement on underwater noise
2014
IMO guidelines on ship noise
NPL good practice guide on underwater noise measurement
2014
BIAS standard for underwater noise measurement
HELCOM Baltic underwater noise roadmap 2015-2017 published
Publication of Popper et al. sound exposure guidelines for fishes and sea turtles
2015
International Quiet Ocean Experiment starts
OSPAR impulsive noise registry published
ACCOBAMS overview of noise hotspots project launched
2016
ISO standard for determination of source levels from deep water measurements published
2017
ISO standard for underwater acoustic terms published
ISO standard for measurement of pile driving noise published
DIN SPEC standard for offshore wind farm in situ determination
2017
QuietMED project starts
First OSPAR multi-year impulsive noise assessment published
2018
JOMOPANS project starts
UN Secretary-General report on underwater noise
2019
JONAS and QuietMED2 projects start
ICES working group on shipping impacts in the marine environment starts
Publication of Southall et al. Marine mammal noise exposure criteria: Updated scientific recommendations
2020
Canadian proposal to review IMO guidelines
Ocean sound recognized as Essential Ocean Variable
2020
EMB working group on underwater noise starts
JPI Oceans approved activity on underwater noise
EC Horizon Europe Mission 'Restore our Ocean and Waters by 2030' document refers to underwater noise
UN Ocean Decade implementation plan refers to underwater noise
2021
SATURN, Quiet Seas and Harmonize projects start
Publication of EMB Future Science Brief on underwater noise

Environmental impact assessments of underwater noise

The risk-based approach



World Organization of Dredging Associations, WODA 2013 after Boyd et al., 2008

Noise risk assessments should be proportionate to risk and uncertainty

Noise EIA Guidance

PRACTITIONER'S PERSPECTIVE

Journal of Applied Ecology | BRITISH ECOLOGICAL SOCIETY

Guiding principles for assessing the impact of underwater noise

Rebecca C. Faulkner | Adrian Farcas | Nathan D. Merchant

CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities

CMS

ACCOBAMS

ASCOBANS

Geoff Prideaux (Editor) 2016

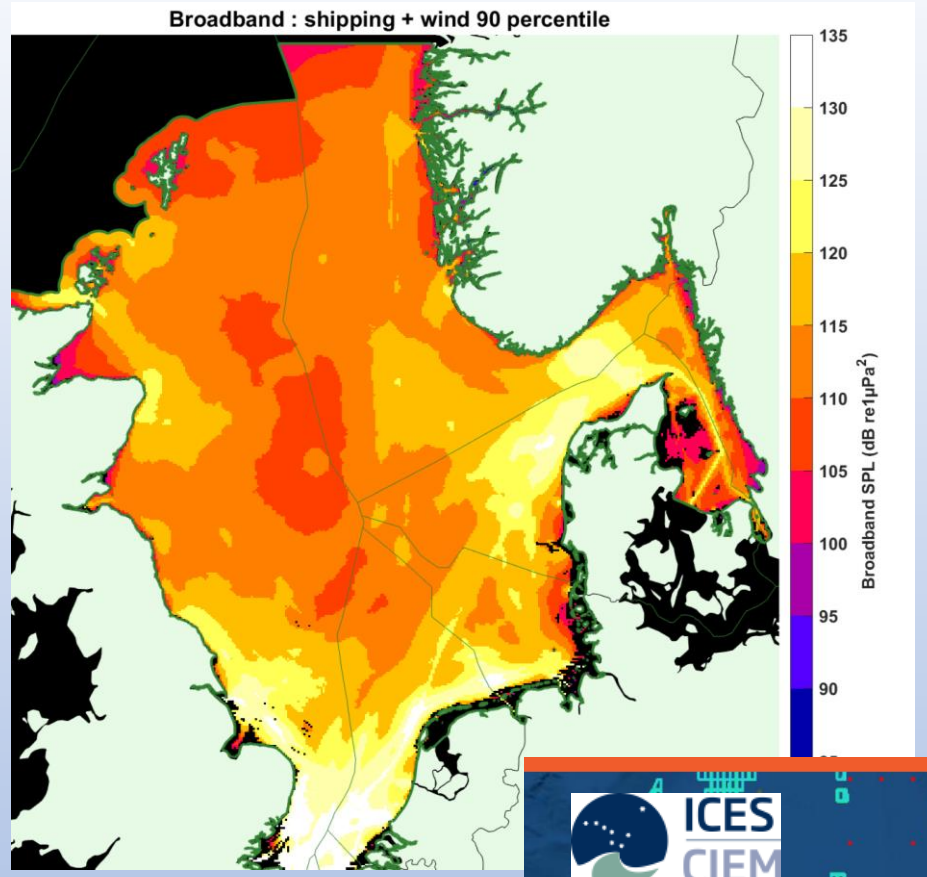
Integrated Environmental Assessment and Management — Volume 00, Number 00—pp. 1–13
Received: 1 October 2019 | Returned for Revision: 11 December 2019 | Accepted: 6 March 2020

Health & Ecological Risk Assessment

Ecological Risk Assessment of Underwater Sounds from Dredging Operations

Andrew D McQueen,† Burton C Suedel,† Christ de Jong,‡ and Frank Thomsen§*

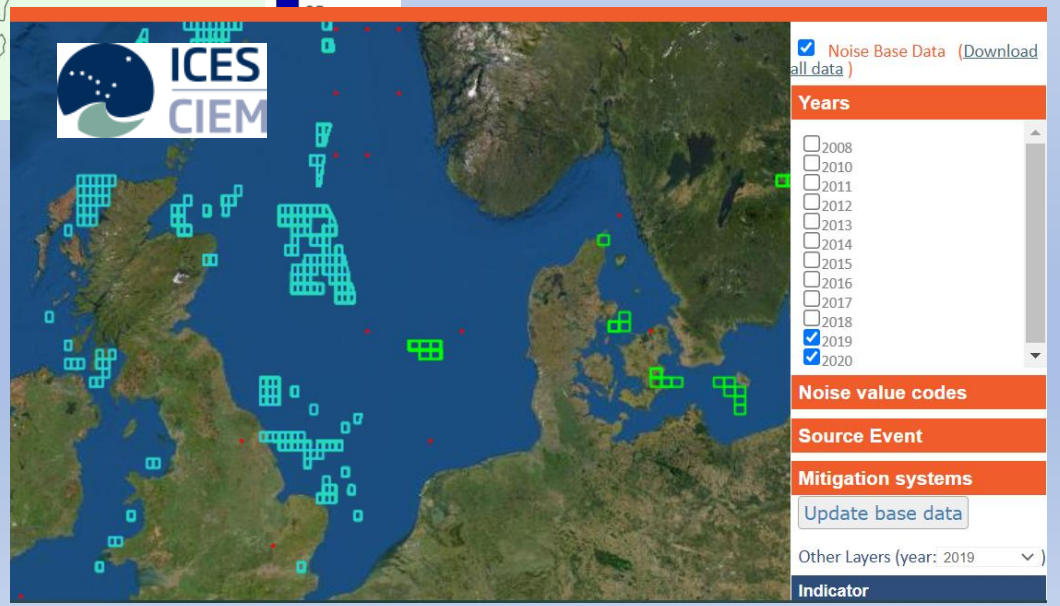
Regional noise monitoring in Europe



© JOMOPANS/TNO

Ambient **continuous sound**

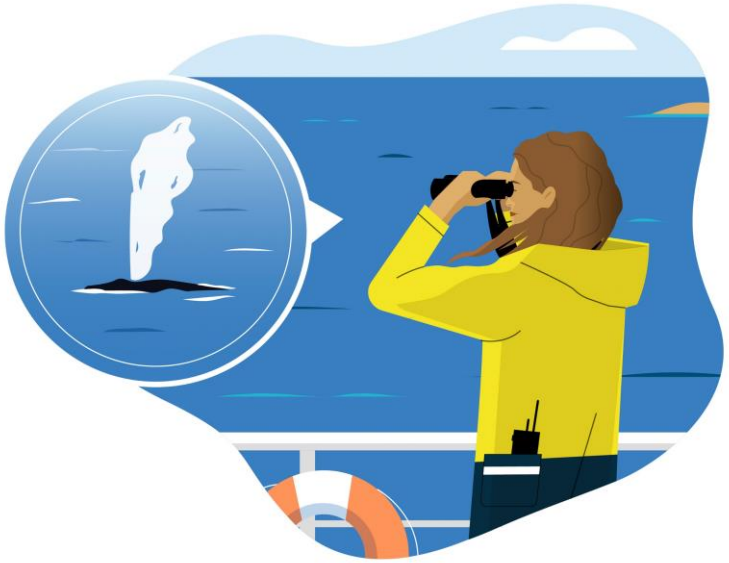
Impulsive sound from industry sources



Mitigating the effects of underwater noise:

Operational measures

Visual or acoustic **monitoring** – Marine Mammal Observers



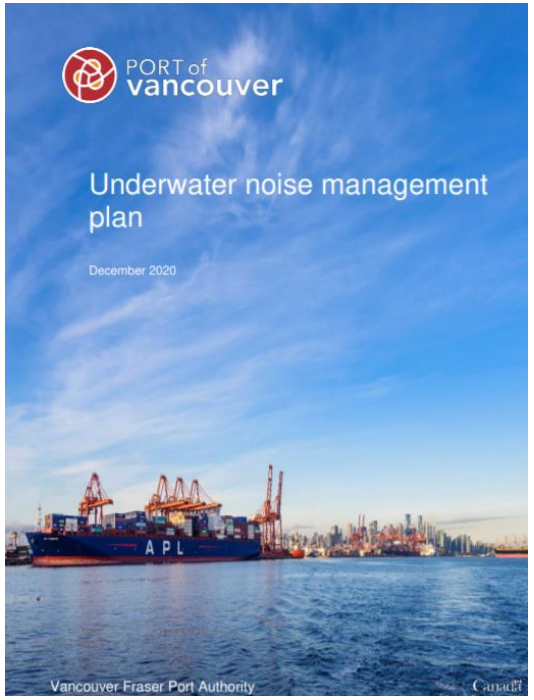
Spatio-temporal restrictions/noise limits

Mitigating the effects of underwater noise:

Shipping noise

Technological solutions
– quiet ships

Speed restrictions

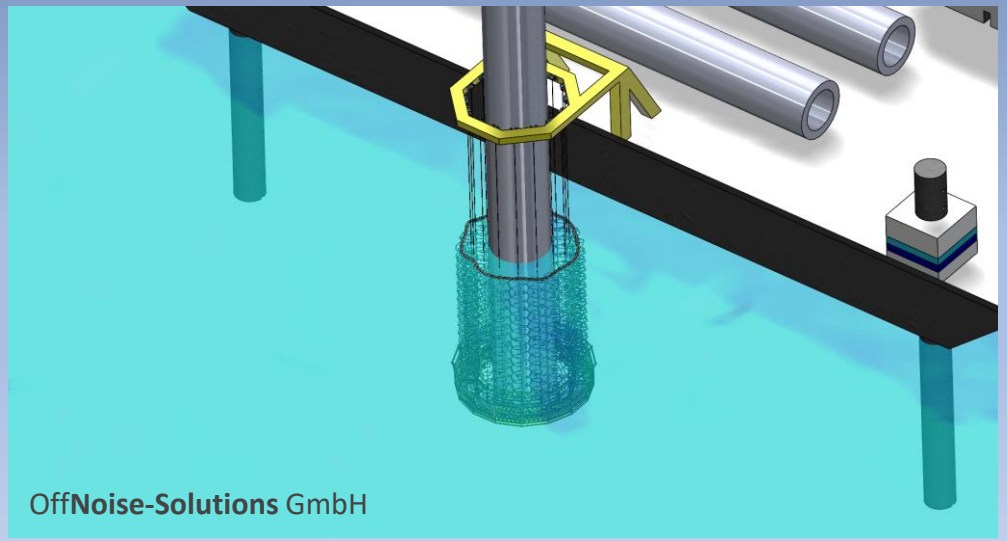


Mitigating the effects of underwater noise:

Noise abatement

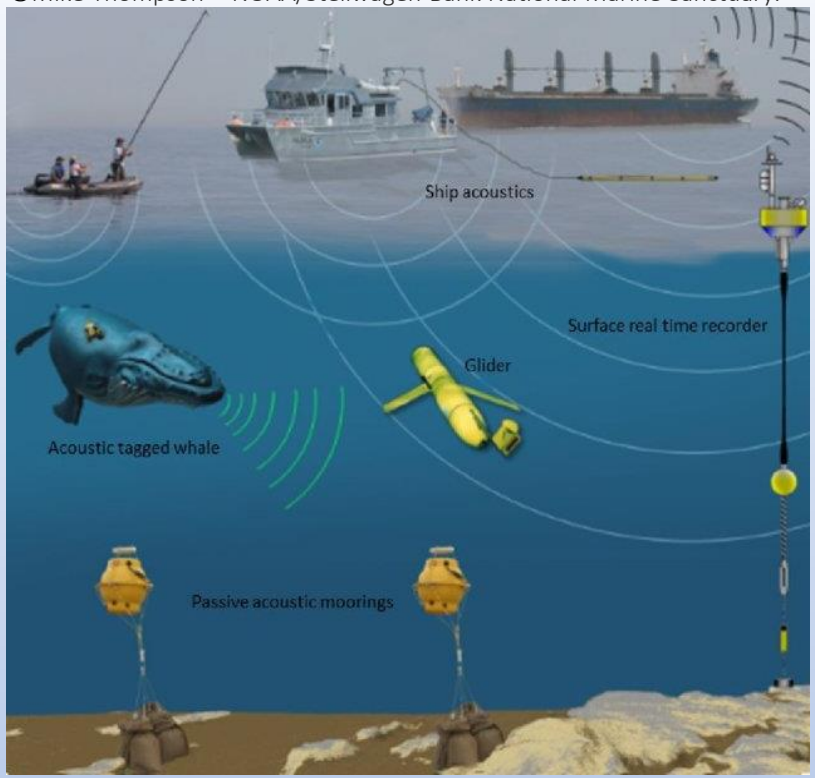
e.g. Bubble curtains

e.g. Hydro-Sound-Damper-System



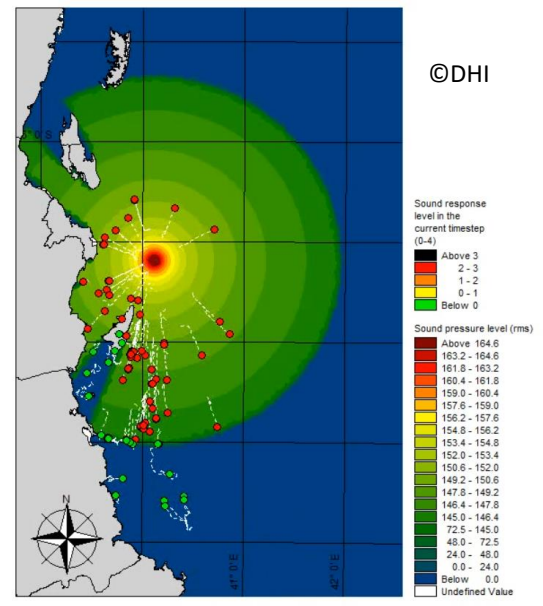
Emerging technologies and methods

©Mike Thompson - NOAA/Stellwagen Bank National Marine Sanctuary.



Passive **acoustic monitoring** and wildlife **tags**

Animal **movement models**



Remotely operated aerial **monitoring** (e.g. drones)

EMB WG recommended actions (chapter 6)

1. Develop collaborative **international standards** applicable to all steps of the risk framework.

2. Conduct **comprehensive monitoring** combined with spatial ecological modelling of **marine species**' dynamic habitat use, movements, behaviour and distribution to establish baselines.

3. Foster comprehensive monitoring and data collection of current **soundscapes/ambient noise**, including via **joint monitoring programmes** in existing and new areas.

4. Shortlist high priority (and biologically relevant) sound sources and perform **standardized source characterisation** studies.

EMB WG recommended actions

(5-10: actions related to other chapters of EMB paper)

11. Conduct dedicated modelling and field studies to improve **understanding on effectiveness, safety and cost-effectiveness of noise mitigation devices, mitigation measures and management options.**

12. Develop **regional action plans** and **guidelines** for Environmental Impact Assessment and policies.

13. Initiate **international collaborative projects** to develop stakeholder and societal capacity in understanding and addressing underwater noise.

Acknowledgements

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Thank you for listening!