

Ministerie van Infrastructuur en Milieu

Onderwatergeluid van schepen

'krachtenveld'

(inter)nationale ontwikkelingen

Projectleider Geluid in Zee
René Dekeling
DG Water

Verskil: decibel schalen lucht en water

Quantity: RMS pressure
Weighting: adjusted for human hearing ("A weighting")
Reference pressure: $p_{ref} = 20 \mu Pa$

Quantity: peak pressure
Weighting: none
Reference pressure: $p_{ref} = 1 \mu Pa$

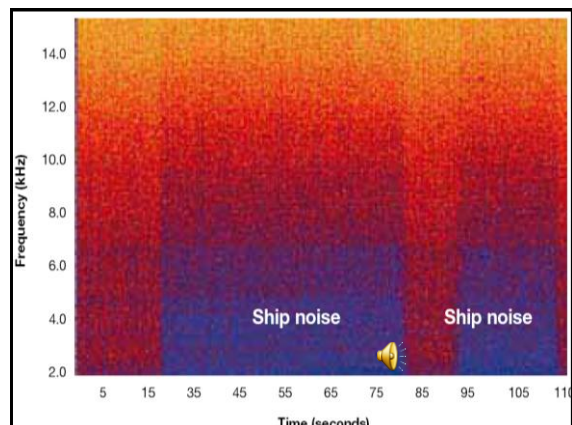
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Une prodigieuse révélation...

LE MONDE DU SILENCE

- Jacques Cousteau (1955) was wrong!
- The ocean is full of sounds:
 - Natural (biological and non-biological)
 - Man-made (intentional and non-intentional)

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ARTICLE IN PRESS

Review

A noisy spring: the impact of globally rising underwater sound levels on fish

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The underwater environment is filled with biotic and abiotic sounds, many of which can be important for the survival and reproduction of fish. Over the last century, human activities in and near the water have increasingly added artificial sounds to this environment. Very loud sounds of relatively short exposure, such as those produced during pile driving, can harm nearby fish. However, more moderate underwater noises of longer duration, such as those produced by vessels, could potentially impact much larger areas, and involve much larger numbers of fish. Here we call attention to the urgent need to study the role of sound in the lives of fish and to develop a better understanding of the ecological impact of anthropogenic noise.

The myth of a silent underwater world

the harshest insight as to the nature and extent of the behavioural impact of such sounds on fishes (Figure 1). While data on fish behavioural responses to the increase in ambient sound are generally not available, we can use data derived from other vertebrates to suggest that anthropogenic noise may deter fish from important feeding and reproduction areas, interrupt critical activities, or cause stress-induced reduction in growth and reproductive output. The concern about wide-ranging effects is further heightened because sound is of critical importance in the lives of many fish species. Impeding the ability of fish to hear biologically relevant sounds might interfere with critical functions such as acoustic communication, predator avoidance and prey detection, and use of the 'acoustic scene' or 'soundscape' [15,16] to learn about the overall environment. Taken together, these potential effects could


Why is underwater noise an issue for us

- Underwater sound is essential for most marine life
 - Communication, locating food, detecting threats, navigation, etc.
- Many anthropogenic sounds of concern:
 - Piling, seismic, sonar
 - Shipping noise
- Shipping: Increase of ambient noise level observed
- Societal concern
- Legal: the Marine Strategy Framework Directive

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Windturbineparken

- Bouwfase
- Productiefase



Changing Oceans

A Push for Quieter Ships

Although sonar and air guns have grabbed headlines, researchers say the cacophony from ships creates far more ocean noise

FROM A DRIFTING BOAT, THE OCEAN OFF Massachusetts can seem like one of the quietest places on Earth. But Laila Hatch isn't fooled. Over the past 4 years, the marine ecologist has helped lead studies at the Gerry E. Studds Stellwagen Bank National Marine Sanctuary that are documenting how human activities are ramping up the region's undersea noise—and highlighting just how difficult it may be to turn down the volume. “We’re getting a much better understanding of how much sound is in the sanctuary and where the sounds come from,” Hatch

tures use to communicate, find mates, and navigate their watery world. Researchers worry that the cacophony is making it even harder for these creatures to overcome the numerous human threats—from toxic pollution to overexploitation—that have already pushed some to the edge of extinction. Stellwagen’s monitoring program, one of the world’s most intensive, has implications well beyond the marine sanctuary. It has helped focus attention on the growing acoustic clutter created by the world’s nearly 100,000 large commercial ships. Tollbooth

A shifting soundscape. Increased shipping has made the ocean noisier, potentially disrupting communication among whales and other marine life. seems like we spend most of our time talking about the other 5 or 10% of the problem,” says Brandon Southall, a former leader of U.S. government efforts to study and regulate ocean noise and now a consultant with SEA Inc. in Santa Cruz, California. In part, that’s because ships typically aren’t covered by the world’s few laws that deal with ocean noise. The conversation, however, is shifting. Recently, a group of shipping industry officials, scientists, and government regulators began to examine strategies for slaking low-frequency shipping noise. Engineers say such a reduction is technologically feasible, but the costs—and opposition from some shipping companies—could be formidable. Still, “shipping noise is an issue that is getting more attention,” says acoustician Arthur Popper of the University of Maryland, College Park, who studies the effects of sound on fish and is organizing a major international conference on ocean noise set for Ireland in August.

Sound pollution
The Stellwagen sanctuary’s innovative monitoring effort is a key to gaining attention at the meeting. Almost from the moment the U.S. government announced its commitment in 2007, the

Geluid nationaal

- Implementatie Europese Kaderrichtlijn Mariene Strategie
- Werkgroep Geluid in Zee
- Inventarisatie van geluidsbronnen
 - TNO-rapport, 2009 (Ainslie et al)

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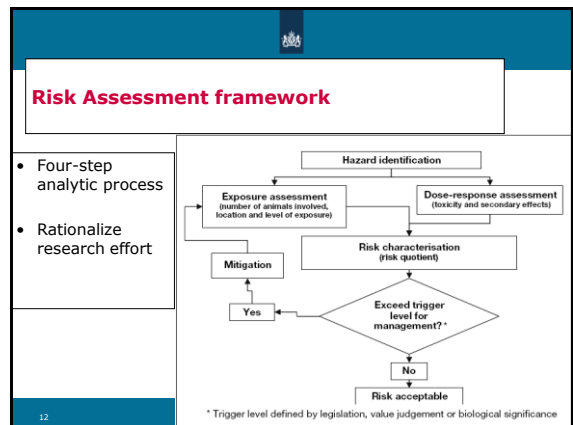
Type of source	Estimated annual average of acoustic power output in the North Sea (NCP) [GJ/y]	Order of magnitude estimation of frequency [kHz]	Order of magnitude estimation of time-averaged total (frequency) acoustic energy [J]
Airgun arrays (3D seismic survey)	30-300	0.01-1	1000-10,000
Shipping	85-850	0.03-3	1000-10,000
Pile driving (wind farm construction)	2-20	0.01-1	100-1000
Explosions (clearance of historic munitions)	< 14	0.01-1	100-1000
Navigation echo sounders	20-200	10-300	< 1
Fish-finding sonar	3-30	10-300	< 1
Military search sonar	< 0.2	1-100	< 1

Ministerie van Verkeer en Waterstaat Werkgroep Geluid in Zee 26 mei 2009

Geluid nationaal

- Inventarisatie van geluidsbronnen
 - Natuurlijk, antropogeen
- Belangrijkste antropogeen geluidsbronnen
 - Heien
 - Seismisch onderzoek
 - Explosieven
 - Scheepvaart
- IDON: IMO initiatieven volgen

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International

- EU-MSFD: technical (sub)-group noise
- OSPAR: Quality Status Report 2010
- IMO-correspondence group
- ESF-Marine Board EMAR2RES workshop
- Others: CEDA, ASCOBANS, International Quiet Ocean Experiment

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EU Marine Strategy



to protect Europe's oceans and seas

'pollution' - the introduction of substances or energy, including human-induced underwater noise, which results or is likely to result in deleterious effects ...

EUROPEAN COMMISSION
<http://europa.eu.int/comm/environment/water/marine.htm>

Europe: Marine Strategy Framework Directive

- Mechanism:
 - initial assessment
 - determination of GES
 - indicators and targets
- To be completed mid 2012
- Two types of noise identified:
 - loud, low and mid frequency impulsive sounds
 - continuous low frequency sound

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Europe: Marine Strategy Framework Directive

- Identified criteria and indicators in the Commission decision:
 - Distribution in time and place of loud, low and mid frequency impulsive sounds
 - Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1µPa².s) or as peak sound pressure level (in dB re 1µPa peak) at one meter, measured over the frequency band 10 Hz to 10 kHz
 - Continuous low frequency sound
 - Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate

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Technical Subgroup Noise

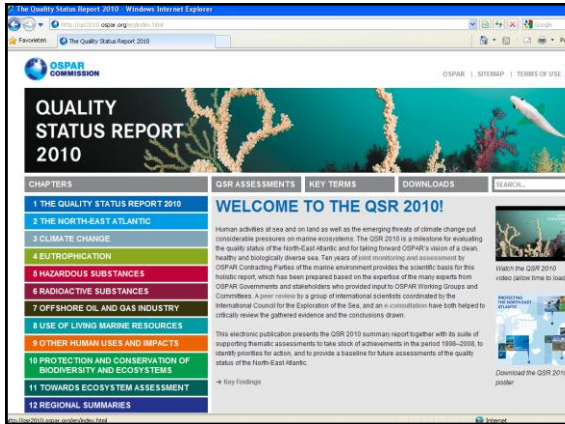
- Terms of reference
 1. Identify and review existing data and monitoring methods on underwater noise
 2. Develop proposals for methodological standards for registering loud impulsive sounds
 3. Develop proposals to monitor low frequency continuous sounds
 4. Assess the need to develop criteria and indicators for other forms of energy
 5. Good Environmental Status, targets and indicators (**'normen'!**)
 6. Research needs and recommendation for future work
- Planning
 - Co-lead UK and NL
 - Participants from governments, NGO's, science, industry
 - Majority of work to be done in 2011
 - First meeting February 2011 (Delft)

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OSPAR

- Noise assessments and background documents
- Quality Status Report 2010
- New: development of guidance on mitigation measures
 - GER, UK (+NL, SP, OGP)
 - EIHA 2011
 - priority: marine piling?

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IMO

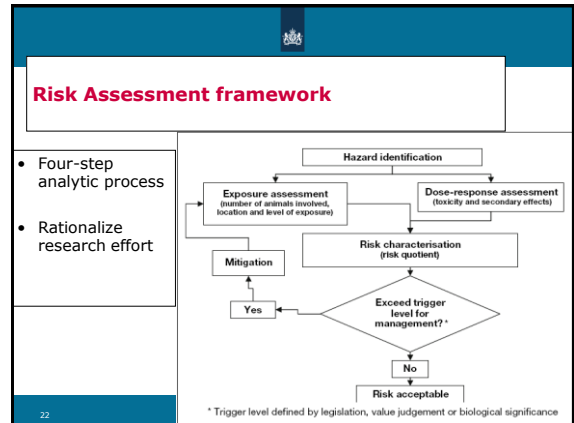
- MEPC 58 – october 2008
 - correspondence group (CG)
 - development of non binding measures
- MEPC 61
 - future research programmes should focus on the propeller and the relationship between cavitation and the cause of underwater sonic energy
 - non-binding, technical guidelines
 - identification of loudest ship types and noisiest individual ships
 - continuation of CG

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ESF Position Paper (2008)

The effects of anthropogenic sound on marine mammals

Main recommendation: use analytical risk framework process to assess and identify priority research topics




EMAR2RES Workshop, Ostend June 2010

- Workshops to identify Areas of Common interest between the marine and maritime RTD communities
- Impact of maritime transport on the marine environment
 - Workshop 1: "biological/chemical" relationships
 - Workshop 2: "Physical" relationships (noise, air emissions)

MARINE BOARD

EMAR2RES Workshop, Ostend June 2010


- Create synergies between maritime and marine RTD communities:**
 - To establish new scientific knowledge of the physical impacts on the marine environment of maritime technologies and practices;
 - To ensure the sustainability and competitiveness of EU maritime transport;
 - To develop the means to obtain Good Environmental Status of the Marine Environment using Best Available Technology;
 - To promote socio-economic benefit of maritime and marine RTD.
- Main recommendation**
 - Use a **Risk Assessment (RA) framework** to consider the impacts and mitigation of hazards such as noise on the marine ecosystem



International

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- OSPAR: Quality Status Report 2010
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- ESF-Marine Board
- Others: CEDA, ASCOBANS, International Quiet Ocean Experiment



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Conclusions

- Underwater noise will be addressed within international community
- Fundamental data gaps that need to be solved (effects!)
- Shipping noise is 'priority issue'
- Monitoring and target setting could start from 2012

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...AND REDUCE THE ADVERSE IMPACT OF SOUND ON THE MARINE ENVIRONMENT

Headache 013