

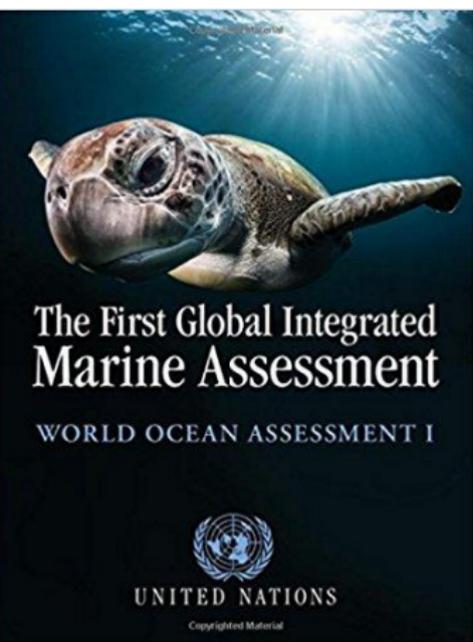
Ocean noise: a new global stressor ?



Sérgio M. Jesus & Ocean noise panel group
LARSyS, University of Algarve, Faro, Portugal

CIMA Conference - *Stress in the Ocean. From
multidisciplinary approaches to transdisciplinary research*

Faro November 11, 2019



Dec 2015 WOA I published

Feb 2018 draft of outline of WOA II, with
“Chapter 21: trends and inputs of anthropogenic noise to the marine environment”

Jun 2018 the group for chapter 21 is formed:
Ana Širovič (lead)
John A. Hildebrand
Sérgio M. Jesus
Jim H. Miller

Aug 2019 draft of the chapter submitted

Why is ocean noise so important ?

HIFT (1991) - acoustic waves around the globe

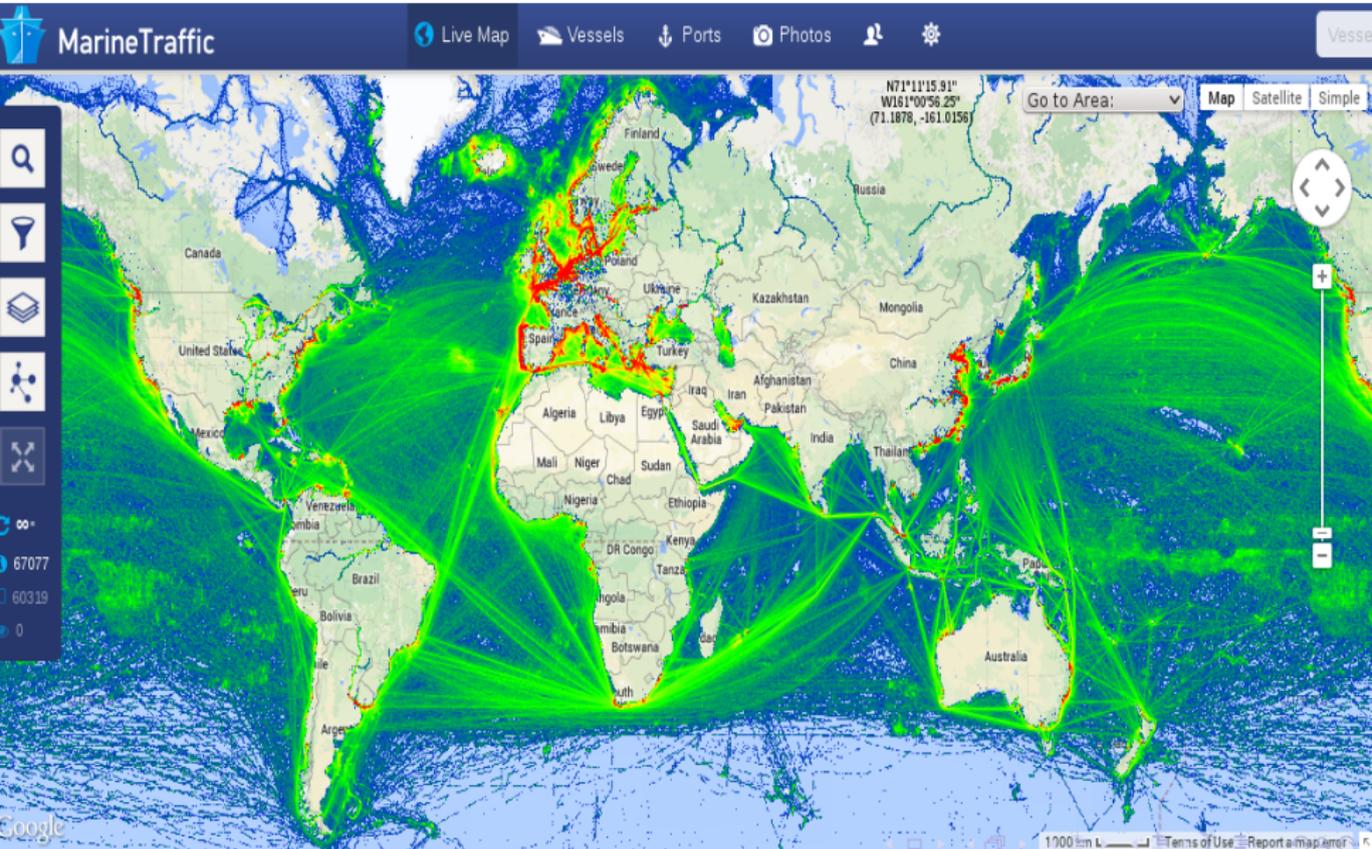


For two main reasons:

- ▶ sound is much less attenuated in water than in air, so it reaches greater distances (100s or 1000s km)
- ▶ animals in the ocean rely up to 85% on information gathered through sound, while for terrestrial animals it is 20-30%



Marine traffic: noise everywhere all time





MarineTraffic

Live Map

Vessels

Ports

Photos

Person icon

Settings icon

Vessel

what makes noise:

- ▶ propeller cavitation and turbulence;
- ▶ machinery noise radiated through ship's hull
- ▶ flow noise (dimension, tonnage, draft, load, speed²)

how much ?

- ▶ the main contributor > 200 Hz
- ▶ over 195 dB // $1\mu\text{Pa}$ @ for a modern container ship @ 12 knot (jet plane 120-140 dB / hearing damage > 85 dB)³

²Ross, D. (1976). Mechanics of Underwater Noise. Pergamon Press, New York, USA.

³McKenna et al (2013). Relationship between container ship underwater noise... *Scient. Rep.* 3: 1760.



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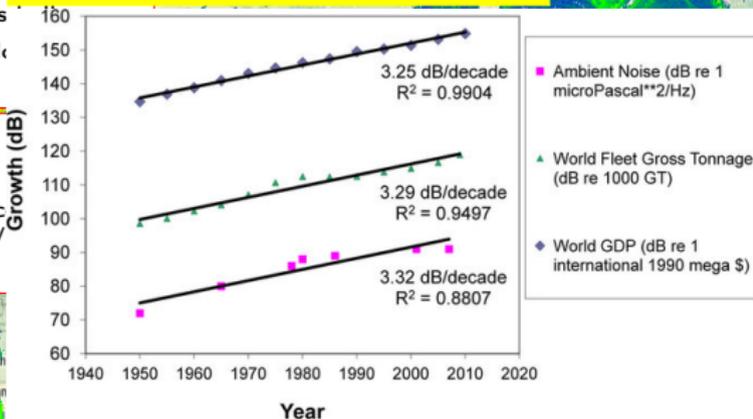
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Socio-economic impact in global trade

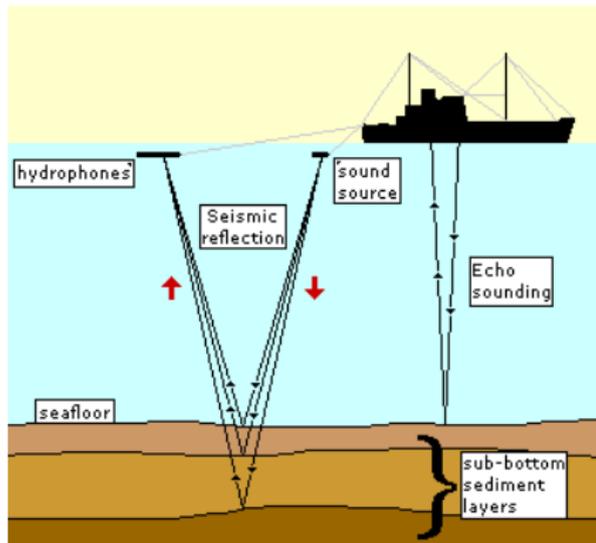


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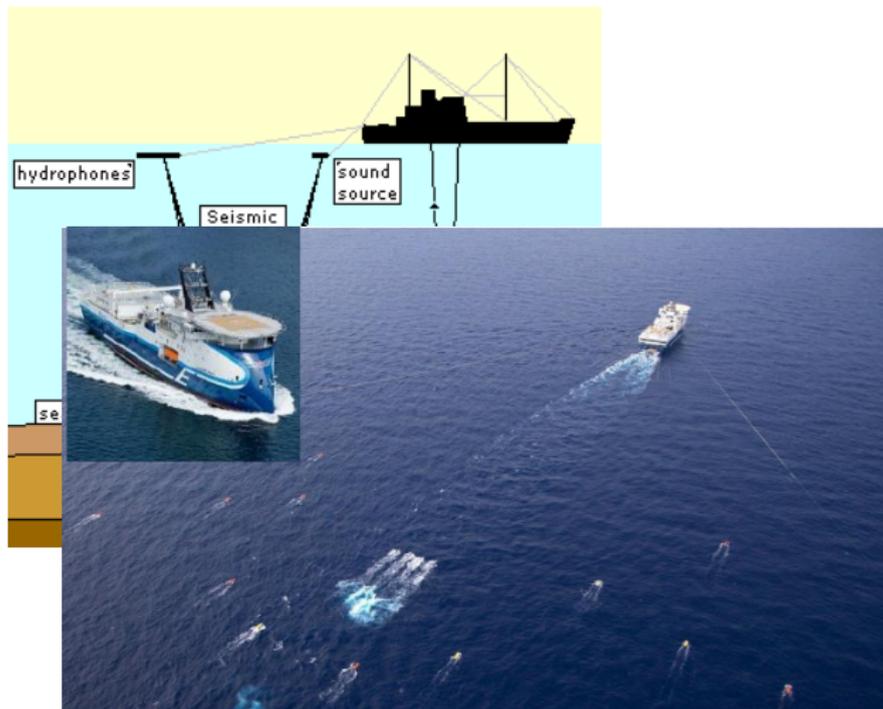
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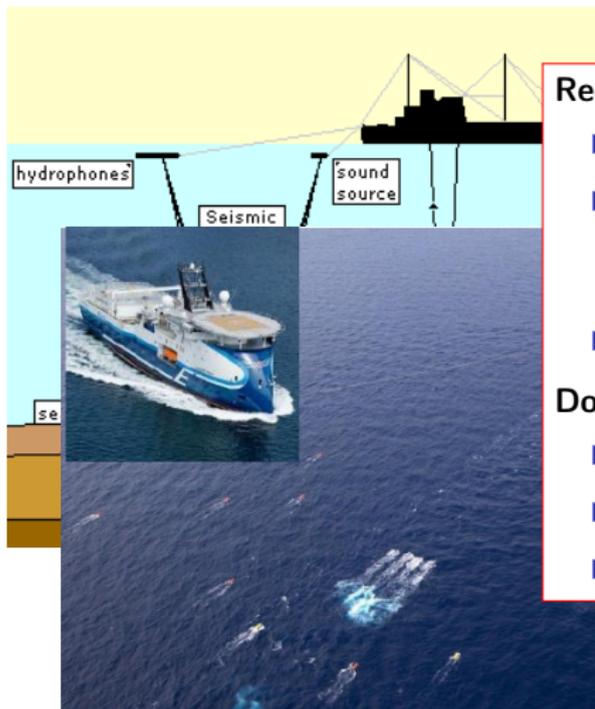
⁴Frisk G. (2012) Noiseconomics: The relationship between ambient noise levels ... Sci.Rep., 2(437).

Seismic exploration for oil & gas



Seismic exploration for oil & gas





Requirements:

- ▶ to penetrate solid Earth
- ▶ airgun arrays (typically 25-50) generating up to 260 dB // $1\mu\text{Pa}$ @ 1m sound level in 10-50 Hz band
- ▶ operations for weeks to months

Downfall:

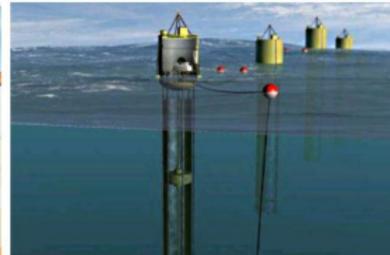
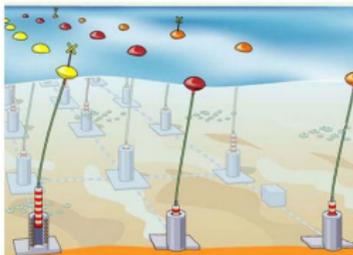
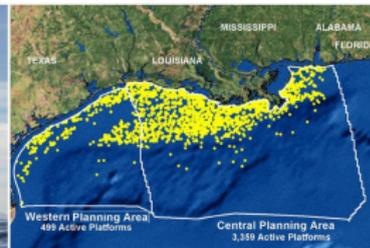
- ▶ within large whales frequency range
- ▶ heavy hearing damage
- ▶ can be heard 1000s km away⁵

⁵Nieukirk *et.al* (2004) Low-frequency whale and seismic airgun ...J. Acoust.Soc.Am. 115(4) p.1852.

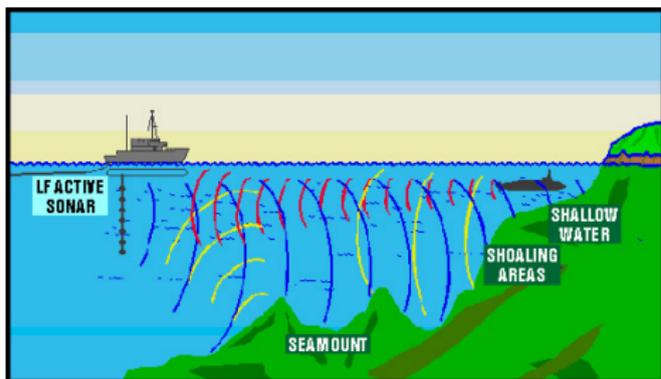
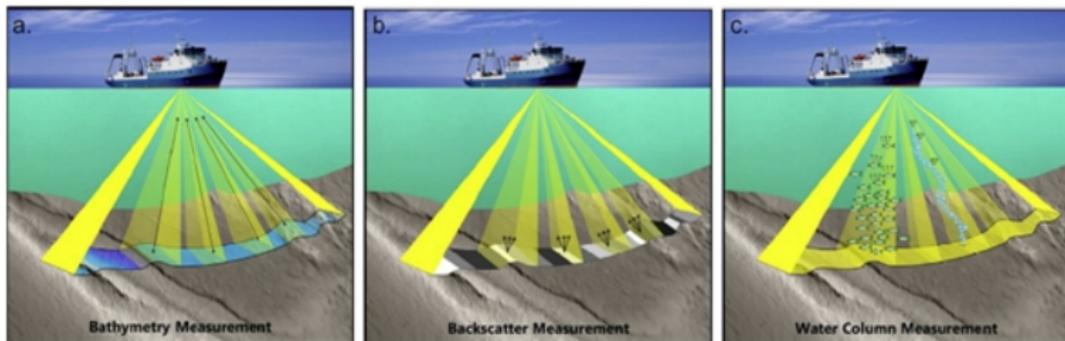


Coastal man made noise

- ▶ pile driving, construction
- ▶ humming, offshore windfarms
- ▶ offshore platforms
- ▶ renewable energy generators



Sidescan / multibeam sonar, echosounding



Low Frequency Sonar - LFA

- ▶ low frequency/long range sound waves
- ▶ high power, low frequency
- ▶ deep to shallow water

Why does it matters ?

well, it matters because..

- ▶ now aware of the importance and impact of anthropogenic sound on marine life : marine mammals, over 100 fish species, invertebrates
- ▶ increasing noise levels make species change their behavior
- ▶ reduce biodiversity, to noise adaptive or resistant species

... also economic and social

- ▶ deplete marine life from noise stressed areas (reduced catch)
- ▶ less tourism opportunities (empty seas)

but things are moving on the policy side

- ▶ **2008**: EU pioneered with the MSFD (descriptor 11), part of GES
- ▶ **2018**: anthropogenic noise was the topic of the Informal Consultative Process on Oceans and the Law of the Sea (UN)
- ▶ **sound** identified as an Essential Ocean Variable (EOV) by the Global Ocean Observing System's (GOOS) Biology and Ecology Panel.

Remaining key gaps:

- ▶ **knowledge gap:** fundamental lack of knowledge regarding baseline ocean ambient noise; impact on species but not on populations; lack of standardization
- ▶ **capacity-building gap:** monitoring concentrated in Europe and North America; need cooperation for southern hemisphere observations; to establish broad policies; ocean noise has no borders !

Outlook:

- ▶ **shipping:** IWC and IMO to reduce noise (13 dB / 30 years) through propeller blade optimization and engine isolation; reduce ship speed and divert from marine sensitive areas
- ▶ **seismic:** usage of vibrators instead of airguns; required consensus and agreed thresholds



JONAS

JOINT FRAMEWORK FOR OCEAN NOISE
IN THE ATLANTIC SEAS

Addressing threats to biodiversity from
underwater noise pollution on sensitive
species in the NE Atlantic by streamlining
ocean noise monitoring and risk
management on a transnational basis.



THANK YOU !!!



marinescotland

