Seriousness of Ocean Noise and Proposals of Developmental Strategies

team SEA CROW

Contents

Military sonar affects whales even at long distance, study finds

By: **Jack O'Donovan**
Date posted: **22 March 2019**

Sonar technology used in British military activities is shown to have a sudden impact on beaked whales over 25 miles away from its source.

The effects of underwater noise on marine mammals, particularly beaked whales, is becoming clearer. A new study has found that some beaked whales, and particularly those in remote populations that aren't normally exposed to explosive sounds such as sonar, make sudden and dramatic behaviour changes in response to the noise.

The study, published in the journal Proceedings of the Royal Society B, reports that the animals are affected by intense forms of sonic waves that travel long distances through seawater, affecting animals both close by and tens of kilometres away.

New research teases apart complex effects of naval sonar on whales

by **Mongabay.com** on 28 March 2019

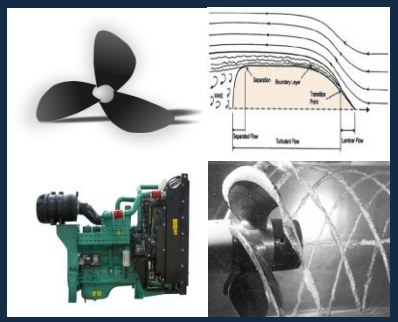
What is Ocean Noise?

Sounds made by human activities that can interfere with or obscure the ability of marine animals to hear natural sounds in the ocean

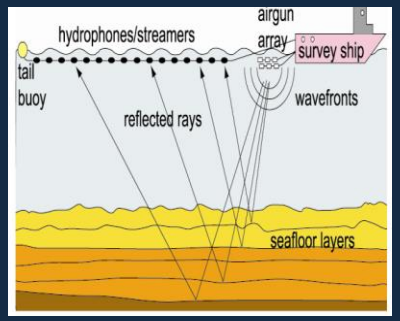
NOAA(National Oceanic and Atmospheric Administration)

Causes of Ocean Noises

Ship Noise

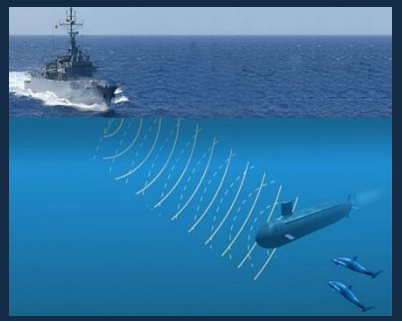


Seismic Exploration



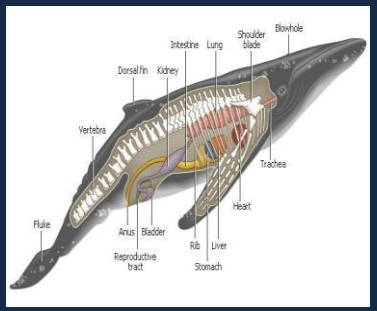
Pile Driving

Military Sonar



Problems of Ocean Noises

Anatomical Transformations



Massive internal injuries and cellular damages to statocysts and neurons, causing disorientation or hearing loss

Hearing damage or damage to sensory systems may represent a combination of impacts to an animal's anatomy and physiology. Noise can damage single cells or whole organs. Invertebrates use organs called statocysts for balance, orientation, and body positional information. These can be harmed by noise (André *et al.* 2011) as well as the ears or swim bladders in fish, causing loss of buoyancy control, disorientation, and stranding. André *et al.* (2011) found that experimental exposure to low sound frequencies of two species of squid, one species of cuttlefish, and one species of octopus resulted in "…massive acoustic trauma, not compatible with life,…". The noise produced substantial, permanent, cellular damage to the statocysts and neurons. A total of 87 individuals in tanks were exposed for only

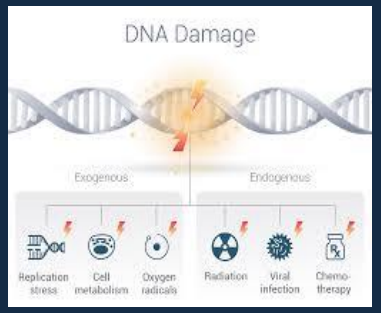
Stress Impacts

Higher levels of stress hormones, greater metabolic rate, oxygen uptake, cardiac output, and cannibalism

Much research has focused on noise effects on hearing, however current scientific knowledge shows that the non-hearing effects of noise on marine animals, such as stress, may be as, or more, severe than hearing effects (Aguilar de Soto 2016). Even temporary exposures to stressors in early life stages can have health and reproductive consequences later on (Kight & Swaddle 2011). Aguilar de Soto & Kight (2016) argue that 'bottom-up' (genetic, cellular, and physiological) processes allow us to make broad predictions about the mechanisms of noise effects. There are many similarities between species in the basic biochemical and physiological pathways of noise effects. For example, the stress response is largely conserved and shared across many species, enabling us to predict immunosuppression as one effect of stress for a wide variety of species. In contrast, 'top-down' (driven by environment, behavior, and ecology) mechanisms illuminate the complexity of responses to noise between species (Aguilar de Soto & Kight 2016).

Problems of Ocean Noises

DNA Integrities



Comprised as overall physiology, showing alarm responses, increased aggression, and decreased anti-predator defense

The octopus, cuttlefish, and two species of squid which exhibited such massive damage to their statocysts, did not show a dramatic reaction during the sound exposure (Solé *et al.* 2013b). Some individuals startled mildly, with some firing their ink sacs at the onset of the sound, but then stayed at the bottom of the tank, motionless, during the remaining 2 hours of playback. After the sound stopped, the animals remained motionless in the middle of the water column or near the surface, breathing regularly, but did not eat, mate or lay eggs until they were sacrificed 96 hours later (Solé *et al.* 2013b). Samson *et al.* (2014) played back pure-tone pips (85–188 dB re 1µPa_{rms} ; 0-17.1 ms^{-2}) to cuttlefish and found that the highest sound levels produced the greatest intensity responses, such as inking and jetting. Behavioral responses, such as body pattern changes and fin movements, occurred down to the lowest sound levels used (85 dB; 10^{-4} ms^{-2}), however (Samson *et al.* 2014). Off Western Australia, one small airgun (20 cu. in.) was towed toward and away (at 5-800 m distance) from caged southern reef squid, trevally, and pink

Commercial Catches

Dropped by up to 80 % due to noise

Engås *et al.* (1996) used sonar mapping and fishing trials with trawls and longlines 7 days before, 5 days during, and 5 days after seismic shooting to investigate whether seismic surveys (total volume: 5,000 cu. in.) affected cod and haddock abundance or catch rates. They found seismic shooting severely affected fish distribution, abundance, and catch rates over the entire 5,500 sq. km. study area. Trawl catches of both fish species and longline catches of haddock dropped by 50% after shooting. Longline catches of cod were reduced by 21% (Engås *et al.* 1996). Reductions in catch rates occurred 33 km from the seismic shooting area but the most dramatic reductions happened within the small shooting area (103 sq. km.), where trawl catches of both species and longline catches of haddock dropped by 70% and longline cod catches by 45%. Abundance and catch rates didn't return to pre-survey levels during the 5-day period following the survey (Engås *et al.* 1996).

Awareness of Ocean Noises

IMO
INTERNATIONAL MARITIME ORGANIZATION

Started to address the effects of noise on ships, approved non-mandatory guidelines for commercial ships on ways to reduce underwater noise.

MEPC

Found the primary problem for ocean noise was generated by shipping, urging the management of such noise require a coordinated international response.

World Health Organization

Dredging activities are also a source of anthropogenic noise.

LC&P
LONDON CONVENTION AND PROTOCOL

Notes that anthropogenic noise is recognized as a global pollutant ; one of the most harmful forms.

Current Rules Towards Ocean Noises

Marine Strategy Framework Directive (MSDF)

The Helsinki Commission (HELCOM)

OSPAR Convention

International Agreements

The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas

ACCOBAMS

International Convention on Migratory Species

Current Rules Towards Ocean Noises

IMO's effort on the issue

IMO

" Concern has been raised that a significant portion of the underwater noise generated by human activity may be related to commercial shipping. The international community recognizes that underwater-radiated noise from commercial ships may have both short and long-term negative consequences on marine life, especially marine mammals."

(IMO MEPC 1./Circ.833: Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life)

Designating Particularly Sensitive Sea Areas (PSSAs)

Strategic Directions 4

Engage in ocean governance

IMO

To ensure the sustainable development of activities in the marine space, such activities have to be balanced with the capacity of the oceans to remain healthy and diverse in the long term.

Limitations of Current Rules

Indirectness

HELCOM

The Helsinki Commission (HELCOM) aims to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental co-operation involving Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden and the European Community. Project CORESET (2010-2013) is developing a set of core indicators to assess the effectiveness of the implementation of the Baltic Sea Action Plan and the above-mentioned MSDF.

OSPAR Convention

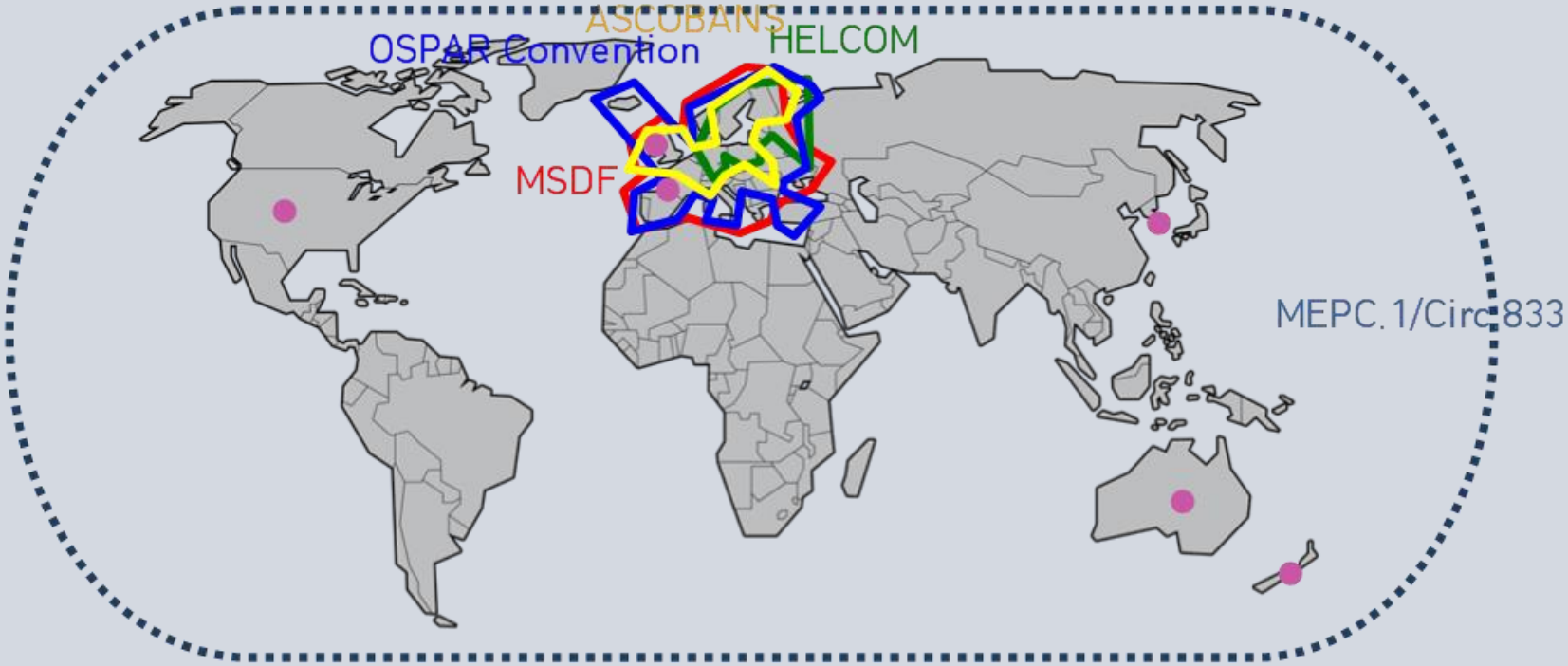
OSPAR guides international cooperation on the protection of the marine environment of the northeast Atlantic. The OSPAR Commission includes 15 European countries and the European Commission, representing the European Union.

ASCOBANS

The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) was signed by eight countries bordering the Baltic and North Seas and focused on bycatch rates, habitat deterioration and anthropogenic disturbances to small cetaceans [17].

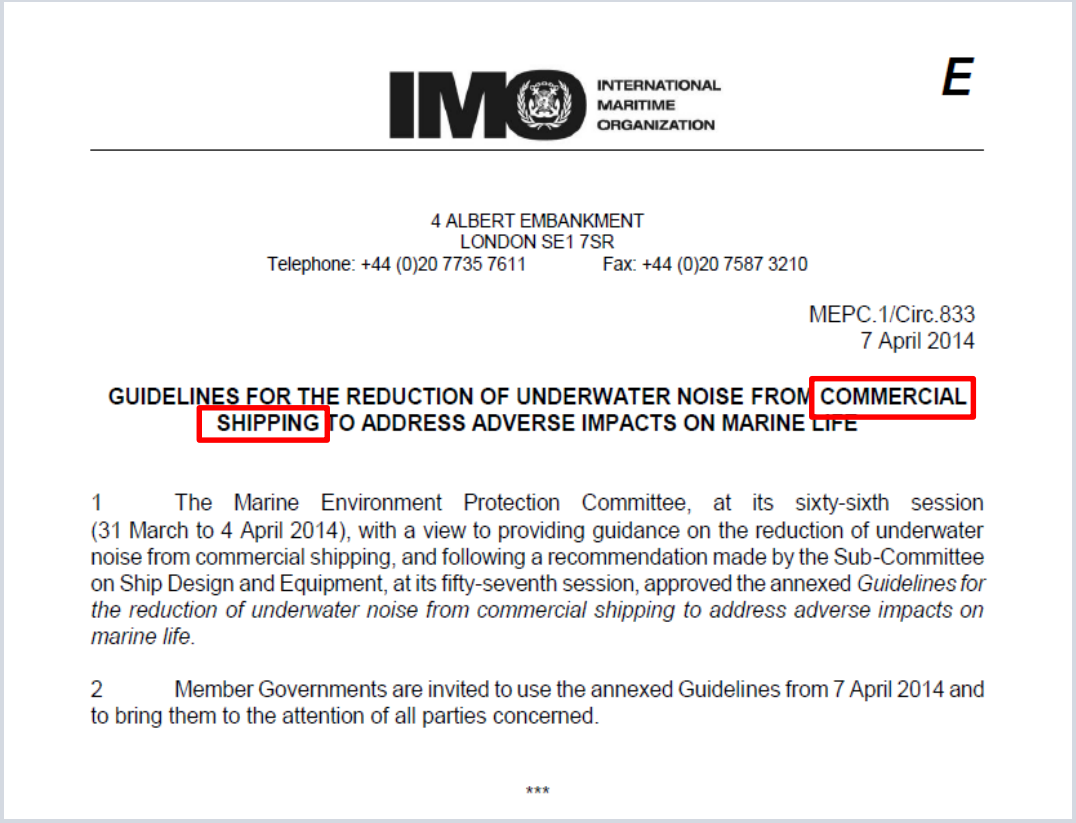
Limitations of Current Rules

Regionality



Limitations of Current Rules

Unbalanced Interests Between the Reason



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MEPC.1/Circ.833
7 April 2014

GUIDELINES FOR THE REDUCTION OF UNDERWATER NOISE FROM COMMERCIAL SHIPPING TO ADDRESS ADVERSE IMPACTS ON MARINE LIFE

1 The Marine Environment Protection Committee, at its sixty-sixth session (31 March to 4 April 2014), with a view to providing guidance on the reduction of underwater noise from commercial shipping, and following a recommendation made by the Sub-Committee on Ship Design and Equipment, at its fifty-seventh session, approved the annexed *Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life*.

2 Member Governments are invited to use the annexed Guidelines from 7 April 2014 and to bring them to the attention of all parties concerned.

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Proposals of Developmental Strategy

Directness

Internationality

Balanced Interests
Between the Reasons

Proposals of Developmental Strategy

Make international rules refering to presenting regional multinational rules and domestic rules

Country	Sound Sources Potentially Addressed	Relevant Laws or Means of Regulation
Brazil	Seismic survey activities	Resolution 305 of the National Environment Council (CONAMA), July 2004
Gabon	Seismic survey activities	Law 16/93 Related to Improvement and Protection of the Environment
South Africa	Seismic survey activities	2004 Minerals Act
United Kingdom	All activities with potential to kill or disturb cetaceans and other designated species	Wildlife and Countryside Act 1981; Conservation (Natural Habitats &c.) Regulations 1994
United States	All activities with potential to "take" marine mammals, with some exceptions	1972 Marine Mammal Protection Act; 1973 Endangered Species Act; 1969 National Environmental Protection Act; 1972 Coastal Zone Management Act; 1953 Outer Continental Shelf Lands Act

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7 April 2014

GUIDELINES FOR THE REDUCTION OF UNDERWATER NOISE ~~FROM COMMERCIAL SHIPPING~~ TO ADDRESS ADVERSE IMPACTS ON MARINE LIFE

The topic should be "Ocean Noise" or "Underwater Noise", directly

Delete this statement to make the rule more comprehensive

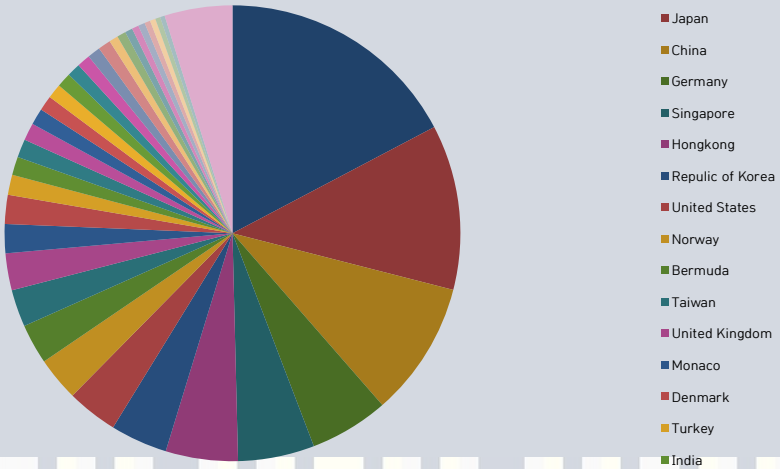
Proposals of Developmental Strategy

Fund Raising for Ocean Noise Research

	Country or territory	Number of vessels			Dead-weight tonnage (thousands of tons)			
		National flag	Foreign or international flag	Total	National flag	Foreign or international flag	Total	National flag as percentage of total (dead-weight tonnage)
1	Greece	774	3 597	4 371	64 977	265 199	330 176	19.7
2	Japan	988	2 853	3 841	38 053	185 562	223 615	17.0
3	China	3 556	1 956	5 512	83 639	99 455	183 094	45.7
4	Germany	319	2 550	2 869	11 730	95 389	107 119	11.0
5	Singapore	240	2 389	2 629	2 255	101 327	103 583	2.2
6	Hong Kong (China)	95	1 497	1 592	2 411	95 396	97 806	2.5
7	Republic of Korea	801	825	1 626	14 019	63 258	77 277	18.1
8	United States	943	1 128	2 071	13 319	55 611	68 930	19.3
9	Norway	549	1 433	1 982	4 944	54 437	59 380	8.3
10	Bermuda	21	473	494	1 215	53 036	54 252	2.2

GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

GREEN CLIMATE FUND



International
Fund for
Ocean
Noise
Research

Proposals of Developmental Strategy

Suggestion of Noise Eco Mode

10.5 ***Rerouteing and operational decisions to reduce adverse impacts on marine life***

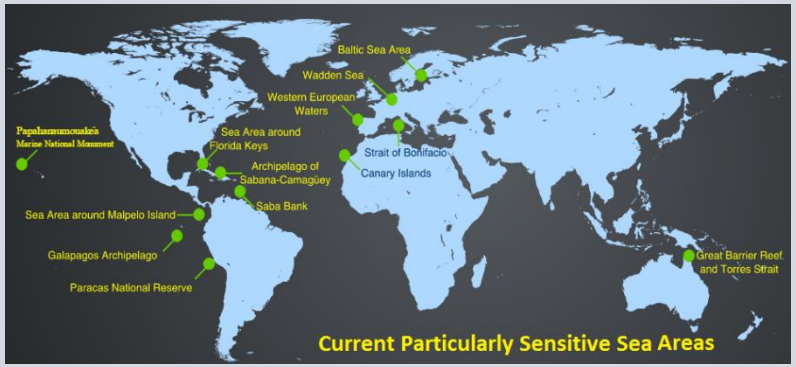
Speed reductions or routing decisions to avoid sensitive marine areas including well-known habitats or migratory pathways when in transit will help to reduce adverse impacts on marine life.

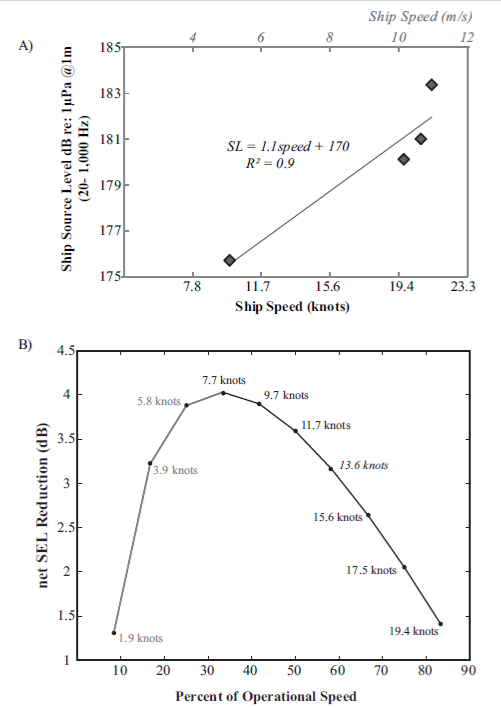
10.4 ***Selection of ship speed***

10.4.1 In general, for ships equipped with fixed pitch propellers, reducing ship speed can be a very effective operational measure for reducing underwater noise, especially when it becomes lower than the cavitation inception speed.

10.4.2 For ships equipped with controllable pitch propellers, there may be no reduction in noise with reduced speed. Therefore, consideration should be given to optimum combinations of shaft speed and propeller pitch.

10.4.3 However, there may be other, overriding reasons for a particular speed to be maintained, such as safety, operation and energy efficiency. Consideration should be given in general to any critical speeds of an individual ship with respect to cavitation and resulting increases in radiated noise.





Speed Control

Mount Equipment Control

Ocean is not only for human beings, but also for all maritime creatures. Making the ocean a safe place is our responsibility, obligation and courtesy towards our neighbors. For this, our efforts to regulate ocean noises are necessary.

References

https://www.mcsuk.org/news/beaked-whales-sonar

https://news.mongabay.com/2019/03/new-research-teases-apart-complex-effects-of-naval-sonar-on-whales/

https://oceanservice.noaa.gov/facts/ocean-noise.html

https://www.oceancare.org/en/our-work/ocean-conservation/underwater-noise/silent-oceans-causes-underwater-noise/

http://www.imo.org/en/ourwork/environment/PSSAs/pages/default.aspx

MEPC.1/Circ.833. Annex 1.1(4th.July,2014)

UNCTAD/RMT/2018

Weilgart, L. I. N. D. Y. "The impact of ocean noise pollution on fish and invertebrates." *Report for OceanCare, Switzerland. URL: https://www. oceancare. org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018. pdf (дата обращения: 11.09. 2018)* (2018).

Chiristine Erbe, "International regulation of underwater noise", Acoustics Australia 41.1 (2013): 12-19
Erbe, Christine. "INTERNATIONAL REGULATION OF UNDERWATER NOISE." *Acoustics Australia* 41.1 (2013).

McKenna, Megan F., Sean M. Wiggins, and John A. Hildebrand. "Relationship between container ship underwater noise levels and ship design, operational and oceanographic conditions." *Scientific reports* 3 (2013): 1760.