

TP 15503E

FILTERING THROUGH THE NOISE:

Benchmarking Study on the Implementation of the
International Maritime Organization's Underwater Vessel
Noise Guidelines

9 August 2019



1. Transport Canada Publication No. TP 15503E		2. Project No. B1B8		3. Recipient's Catalogue No.	
4. Title and Subtitle FILTERING THROUGH THE NOISE: Benchmarking Study on the Implementation of the International Maritime Organization's Underwater Vessel Noise Guidelines				5. Publication Date 9 August 2019	
				6. Performing Organization Document No.	
7. Author(s) The research was led by a steering committee from the organizations described below				8. Transport Canada File No. RDIMS 17812965	
9. Performing Organization Name and Address Chamber of Shipping of America (CSA) World Wildlife Fund – Canada (WWF) The World Maritime University (WMU)				10. PWGSC File No.	
				11. PWGSC or Transport Canada Contract No.	
12. Sponsoring Agency Name and Address Transport Canada Place de Ville, Tower C 330 Sparks Street, 18th Floor Ottawa, Ontario K1A 0N5				13. Type of Publication and Period Covered	
				14. Project Officer Amelie Laprade	
15. Supplementary Notes (Funding programs, titles of related publications, etc.)					
16. Abstract In 2014, the International Maritime Organization (IMO) published the Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life (the Guidelines) to provide guidance to industries on the issue of underwater vessel noise. Since then, there has been growing international attention on the issue of anthropogenic underwater noise within the scientific, political and public fora. In order to further inform discussions underway at the IMO's Marine Environmental Protection Committee (MEPC), a benchmarking study was conducted in 2019 which involved one-on-one interviews with international stakeholders, including shipping industry representatives. The report highlights various issues and recommendations regarding awareness and uptake of the Guidelines.					
17. Key Words Marine – Underwater Noise			18. Distribution Statement Digital Copy		
19. Security Classification (of this publication) Unclassified		20. Security Classification (of this page) Unclassified		21. Declassification (date) —	22. No. of Pages 10
					23. Price Shipping/ Handling



1. N° de la publication de Transports Canada TP 15503E	2. N° de l'étude B1B8	3. N° de catalogue du destinataire		
4. Titre et sous-titre Filtrage à travers le bruit : Étude comparative sur la mise en œuvre des directives de l'Organisation Maritime Internationale sur le bruit sous-marin des navires		5. Date de la publication 9 août 2019		
		6. N° de document de l'organisme exécutant		
7. Auteur(s) La recherche a été dirigée par un comité directeur des organisations décrites ci-dessous.		8. N° de dossier - Transports Canada -SGDDI 17812965		
9. Nom et adresse de l'organisme exécutant Chamber of Shipping of America (CSA) World Wildlife Fund – Canada (WWF) The World Maritime University (WMU)		10. N° de dossier - TPSGC -		
		11. N° de contrat - TPSGC ou Transports Canada		
12. Nom et adresse de l'organisme parrain Transport Canada, Place de Ville, tour C 330, rue Sparks, 18e étage Ottawa (Ontario) K1A 0N5		13. Genre de publication et période visée		
		14. Agent de projet Amelie Laprade		
15. Remarques additionnelles (programmes de financement, titres de publications connexes, etc.)				
16. Résumé <p>En 2014, l'Organisation Maritime Internationale (OMI) a publié les Directives visant à réduire le bruit sous-marin produit par les navires de commerces pour atténuer leurs incidences néfastes sur la faune marine (les Directives) afin de fournir des orientations aux industries sur la question du bruit des navires sous-marins. Depuis, la question du bruit sous-marin anthropique suscite une attention internationale croissante au sein des forums scientifiques, politiques et publics. Afin d'éclairer davantage les discussions en cours au sein du Comité de protection de l'environnement marin (MEPC) de l'OMI, une étude comparative a été menée en 2019, impliquant des entretiens individuels avec des partenaires internationaux, y compris des représentants de l'industrie du transport maritime. Le rapport met en lumière divers défis et recommandations concernant la sensibilisation et l'adoption des Lignes directrices.</p>				
17. Mots clés Maritime – Bruits sous-marins		18. Diffusion Copie numérique		
19. Classification de sécurité (de cette publication) Non classifiée	20. Classification de sécurité (de cette page) Non classifiée	21. Déclassification (date) —	22. Nombre de pages 10	23. Prix Port et manutention

Contents

Introduction.....	2
Purpose.....	2
Methodology	2
Profile of Respondents.....	3
What we heard From Participants	4
Awareness	4
Barriers	4
Driving Change	5
What We Heard From Industry.....	6
Conclusion.....	6

Figures

Figure 1. Distribution of participants in the survey interview	3
Figure 2. Geographic distribution of the participants in the survey interview	3
Figure 3. The extent to which reducing underwater radiated noise from vessels is an organizational priority	4
Figure 4. Participant’s awareness of the IMO Guidelines and their subsequent familiarity of them.....	4

Acknowledgements

- **Study Steering Committee: Chamber of Shipping of America (CSA), World Wildlife Fund – Canada (WWF), World Maritime University (WMU) and Transport Canada**
- **Research and survey analysis: Environics Research**
- **Qualitative analysis of the impacts of the findings: WMU**

INTRODUCTION

Purpose

Measurements taken over the last fifty years indicate an increase in anthropogenic noise emissions into the marine environment. The main sources include vessel traffic, seismic exploration, industrial activities (e.g. pile driving, drilling, tunnel boring and dredging), military and commercial sonar, acoustic deterrent devices, oceanographic experiments and explosions for underwater construction. An increasing number of studies have demonstrated that underwater noise (UWN) emitted specifically from commercial ships is a stressor for many marine species and ecosystems, including various marine mammals, fish and invertebrates.

In 2014, the International Maritime Organization (IMO) published the *Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life* (the Guidelines) to provide guidance to industries on the issue of underwater vessel noise. The Guidelines recognize two opportunities for mitigating the adverse effects of this topic: routing and operations, and ship design and maintenance. Since 2014, there has been growing international attention on the issue of anthropogenic underwater noise within the scientific, political and public fora. As such, the topic has been raised at the IMO Marine Environmental Protection Committee (MEPC) through various submissions from MEPC 71 through MEPC 74; which have highlighted recent quiet ship technology trials, complementary international action and scientific support of the impact of noise on marine ecosystems.

In order to further inform these discussions underway at MEPC, information was needed on the overall awareness and uptake of the Guidelines. For this reason, a benchmarking study was developed, which involved one-on-one interviews with key individuals in desired organizations and industry fields.

Methodology

The research was led by a steering committee comprised of the Chamber of Shipping of America (CSA), World Wildlife Fund – Canada (WWF), the World Maritime University (WMU), and Transport Canada. This steering committee provided input and guidance on the survey questions to be used during the interview, which were conducted by Environics Research by teleconference. The interview comprised a combination of qualitative and quantitative questions, allowing respondents the opportunity to provide both in-depth responses, as well as numerical evaluations of the various aspects of their awareness and use of the guidelines.

Over 150 potential participants were contacted (which consisted of representatives from ship owners, shipyards, equipment manufacturers and supplies), and a total of 19 international stakeholders agreed to be interviewed between January and June 2019k. Representatives from CSA, Transport Canada and Bureau Veritas reached out to their respective networks, and interviews were conducted with those that agreed to participate. Extensive efforts were required to recruit participants, which still resulted in a low participation rate. The lack of participation may reflect reluctance on the part of industry and stakeholders to discuss limited implementation of noise reduction measures to date. Therefore, the research was limited, due to time and willingness of participants, to a small number of industry representatives operating primarily in Europe and North America. It is unclear to which extent the findings are generalizable to the broader shipping industry, however certain themes were consistently raised by participants, thus providing good initial guidance on next steps and insights into the barriers of uptake.

Profile of Respondents

As illustrated in Figure 1, interviews with key individuals were targeted to shipyards and ship owners. The figure shows the distribution of the participants, in relation to their stakeholder profile, as most of the participants were ship owners (68.4%), followed by Naval Groups and ship yards (10.5% each), then providers and workshops (5.3% each). Ship owners provided a substantive amount of insight into their industry's stance and knowledge of UWN. The variability in the geographic distribution of the participants provided an international perspective (Figure 2). France (31.6%) and Canada (15.8%) had the highest participants, followed by Denmark, (10.5%), and then the Bahamas, Germany, Italy, Norway, Spain, Sweden, UK and USA (5.3% each).

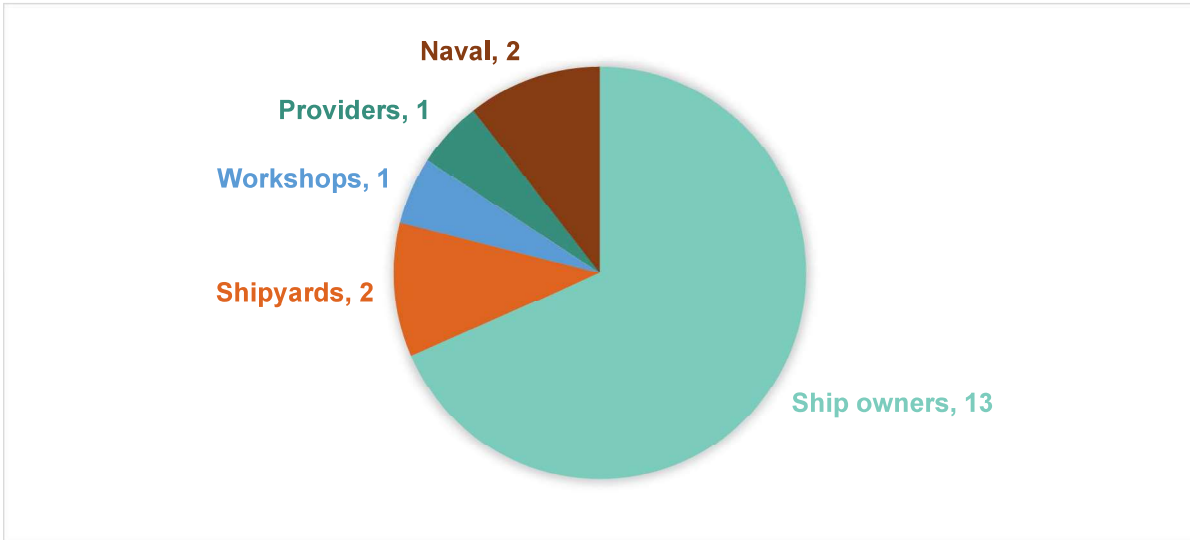


Figure 1. Distribution of participants in the survey interview

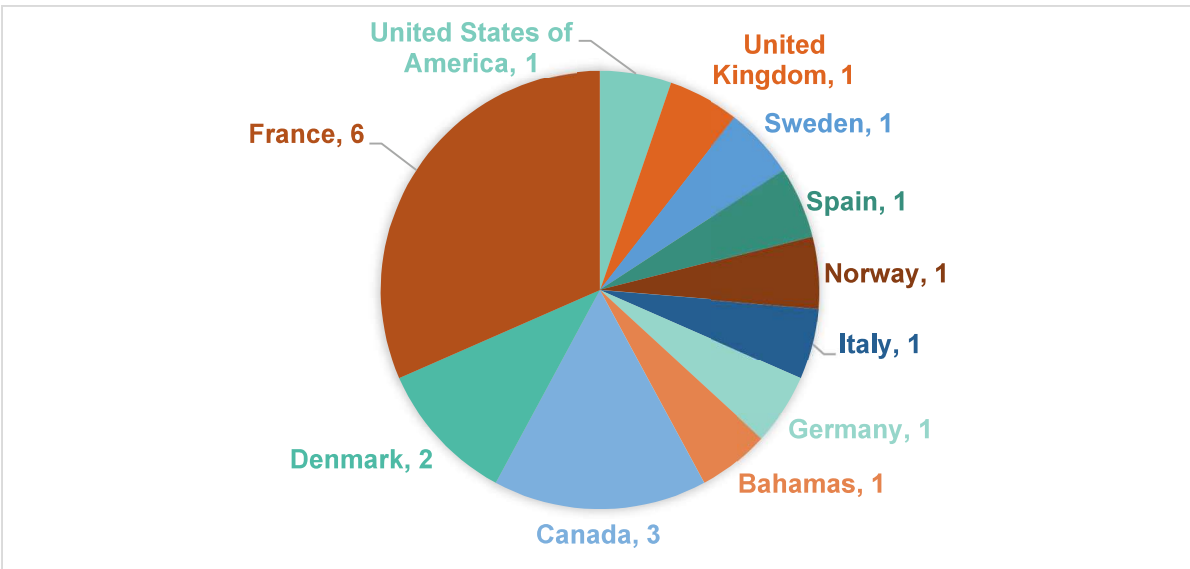


Figure 2. Geographic distribution of the participants in the survey interview.

WHAT WE HEARD FROM PARTICIPANTS

Awareness

The first question asked of participants was whether the issue of UWN was an organizational priority currently, or in the future. The openness of this question was intentional, allowing industry to indicate its awareness of general vessel UWN, and their willingness to initiate mitigation measures without mentioning the 2014 IMO Guidelines. The majority of respondents indicated that reducing UWN from vessels is a low priority, specifying that priority is instead given to mandatory regulatory requirements, such as those around energy efficiency and water/wastewater discharge (see Figure 3). Not surprisingly, the participants that stated UWN noise was a high or medium priority were involved with specific vessel types that have operational requirements for quieter ships (e.g. naval defense and research). Additionally, it was understood from the participants that industry prioritizes other types of noise reductions, particularly internal and aerial noise for passenger and crew safety and port regulations.

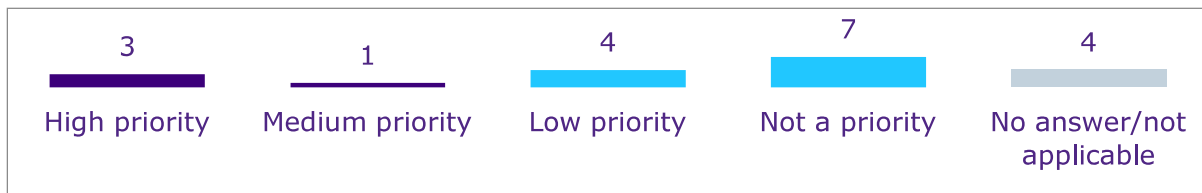


Figure 3. The extent to which reducing underwater radiated noise from vessels is an organizational priority.

Another question posed to participants specifically asked if they were aware of the Guidelines, and if so, their familiarity of them. Roughly three-quarters of participants stated that they had heard of the Guidelines, but amongst these industry members familiarity of the specifics of the Guidelines varies greatly (Figure 4). The low participation rate in this survey may be skewed to those that are more aware of UWN, and thus the Guidelines. Therefore, it is still relatively unclear as to the awareness among the broader industry of ship owners. Generally, participants stated that they were aware of the Guidelines as part of their job requirement or through their participation at various IMO workshops and stakeholder sessions related to UWN.

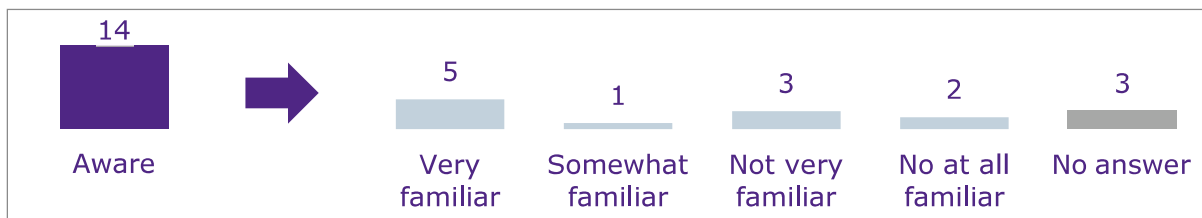


Figure 4. Participant's awareness of the IMO Guidelines and their subsequent familiarity of them.

Barriers

Those that indicated they were aware of the Guidelines were asked about their perception of them. One such question related to the perception of the guidelines within their industry and/or organization. The general view indicates that the Guidelines are only viewed as optional, meaning that since there is no legal requirement to follow them there is no incentive to do so. Furthermore, participants indicated that the Guidelines do not provide enough detail for ship owners to understand what is recommended for various vessel types, and thus clarity is needed for future application. Of note, none of the participants in the study reported using the Guidelines to directly reduce UWN. When pressed

further, participants indicated that they understood other design or retrofit modifications made to their vessels to benefit their business, such as improved energy efficiency or passenger comfort, have potentially reduced UWN outputs as well.

Participants also identified multiple barriers that need to be overcome in order to reduce impacts of UWN from vessels. One of the most widely mentioned challenges is the measurement of UWN, with participants pointing out that the industry lacks a baseline measurement, a noise reduction target, and a clear and consistent methodology to determine if that target is being met. Currently, the approach to measurement and targets is not harmonized among classification societies, which is a barrier to making retrofits on existing ships, but also a challenge for shipyards that may need to demonstrate that they have met noise reduction requirements for new ships. One participant stated these concerns very clearly, saying, *“there is no single standard on how you measure UWN. Shipyards don’t really know what to measure. There is not as much knowledge in the industry. So that is a kind of barrier: there is not much information and research provided on how the measurement of noise is done”*.

Additionally, a need for scientific data on the impact of UWN from shipping was strongly expressed throughout the interview process. Some participants suggested that there is confusion within the industry as to whether this is an important issue, and further data and education is required to cement this issue. Alternatively, some organizations indicated that they are aware that different parts of the world and different species are impacted by UWN in different ways. Organizations indicated that more information and UWN research in areas they travel, as well as on species they encounter, would inform the development of more feasible and effective mitigation measures, rather than blanket requirements.

A final barrier mentioned by participants is the perception that further noise reduction efforts are not possible, or even feasible. Some ship owners are not convinced additional noise reduction can be achieved beyond the changes already made for energy efficiency. While some participants cited existing changes made for energy efficiency purposes that subsequently reduced UWN, others described efficiency and noise reduction changes as counterproductive. For example, travelling farther around environmentally sensitive areas means a greater distance travelled, and increases in fuel use and greenhouse gas emissions. On a similar note, there are technical limitations to noise reduction technologies at the retrofit stage, with a few participants indicating that few things can be done to change the noise profile of the vessel once it’s been built.

Driving Change

The general belief indicated throughout the survey, was that change would need to be driven by increased demand by the ship owners, which will subsequently affect the supply from shipyards. However, to make financial investments in noise reduction technologies, such as retrofits and new designs, ship owners need to have a business case and an understanding of whether the benefits outweigh the costs. Similarly, participants indicated that shipyards are not motivated to produce quieter ships. Instead, due to economies of scale, ship yards are building and owners are buying an “off the shelf” product. There is little economic incentive for builders to supply, or owners to demand, costly noise reduction technologies that may only result in minor improvements to the environment.

Overall, there were mixed views about the introduction of IMO regulations requiring vessels to reduce UWN, and an understanding of the long timelines involved to gain stakeholders support. Some participants suggested that national and local governments and regulators also have a substantial role to play. Some participants point to initiatives put in place by local authorities, such as the Port of Vancouver, as particularly effective in encouraging organizations to make investments they might not otherwise have considered.

WHAT WE HEARD FROM INDUSTRY

Looking at industries specifically, it is interesting to note that few shipping companies claimed that they were aware of UWN propagation in relation to some of the vessels that are currently in operation. The reasons varied from the nature and the necessity of their work and service, as well as coinciding the operation field of their vessels within sensitive areas and following local requirements such as the Vancouver ECHO program. Meanwhile, the answers that were received from the shipyards were different. They mentioned that due to customers' requests the UWN issue is considered a priority for them, and they predict that this issue will become a higher priority in the future. Moreover, the shipyards pointed out that they utilise the simulations, model tests, cavitation and noise tunnel tests, as well as sea and noise trials for measuring a ship's noise propagation during vessel production.

It was also recognized that cost plays a crucial role for participants in complying with any regulation. Some ship owners made it clear that they would be willing to invest in UWN reduction costs, only if an economic advantage and pay back can be concretely ensured. In addition, some of these ship owners pointed out the challenges that exist between ship owners and shipyards. They believe that shipyards are not ready or prepared to design quieter ships, and moreover, they were uncertain whether shipyards could meet targets and customer specifics or requests for these quieter vessels. Some believe that shipyards need to have data from other stakeholders, such as propeller manufacturers and machinery producers, in order to build quieter ships.

A critical examination of the interview results highlights the lack of synergy, communication and consensus between stakeholders. Ship owners believe that there are technical limitations to the shipbuilders' ability to develop quieter vessels. Shipyards and suppliers indicated that they have the technologies and ability to apply measures to reduce UWN from commercial vessels. However, shipyards also indicated they have not received requests to reduce vessel noise from their clientele and suggested that ship owners may not be ready or are reluctant to assume additional costs in a competitive marketplace. Furthermore, most of the participants were ship owners, which had limited awareness of other sources of information about UWN pollution, aside from the IMO Guidelines. Shipyards cited more references available for use, such as the International Council for the Exploration of the Sea (ICES 209) guidelines.

CONCLUSION

The survey provided valuable information on the participants' familiarity with the IMO Guidelines as implemented internationally, helped identify what stakeholders believe is important for future next steps, and aided in the understanding of whether moving to mandatory quiet ship design standards is required. The qualitative interviews provided significant information on the Guidelines' meaning, compliance and potential barriers amongst different stakeholders. In terms of research strategy, the survey was designed with an opportunity to explore the qualitative analysis in determining the extent of which stakeholders have implemented changes to their operations and understand barriers to change.

As mentioned previously, extensive efforts were put forth to recruit survey participants, with limited success, which may reflect a reluctance on the part of industry to discuss the limited implementation of noise reduction measures to date. The study found a general awareness of the guidelines among participants, however this should not be taken to mean that they understand and/or follow the Guidelines. The study also clarified the absence of communication, synergy and consensus between crucial stakeholders, especially ship owners and shipyards. While the former believes that technical

adjustments are not possible or feasible, the latter believes that their clients are not interested in changes due to the implications for cost and competitiveness.

Overall, it does not appear the Guidelines are being used to make changes to reduce UWN, often because the recommended changes have been made as a by-product of mandatory regulations (e.g. energy efficiency). In addition to the lack of regulation requiring UWN reduction, the main barriers include:

1. Measurement: Lack of a noise reduction target/objective to be met; lack of a harmonized approach to measurement.
2. Lack of data on how UWN noise affects different species in different areas, to guide types of changes to be made globally.
3. Skepticism about the feasibility of changes above and beyond those already made, and that do not cancel out other objectives (such as energy efficiency regulations and greenhouse gas reductions).

Participants believe that change will be driven by ship owners/operators requiring shipyards to build quieter ships. For this to happen, ship owners must have a business case demonstrating that the benefits of UWN reduction outweigh the costs. Participants acknowledge such a business case exists if IMO introduces mandatory targets, and/or design standards.

However, participants also suggested that a more timely and effective solution may be for national governments to introduce regulations and/or offer financial incentives for quiet vessels that protect local marine conditions (e.g. the Port of Vancouver Quiet Vessel incentive program). The need to build awareness of the issue, invest in measurement, disseminate research on impacts and introduce regulatory/financial incentives were identified as solutions.

A review and analysis of the survey results indicated that potential next steps could include:

1. Design, develop and implement a regulatory framework to prevent, control, mitigate and monitor UWN from commercial vessels, either through national or international initiatives.
 - a. Example: a new Annex to MARPOL 73/78 to designate UWN as a pollutant
2. Encourage further research on UWN pollution on the following topics:
 - a. Adverse impacts of UWN pollution on marine life; and
 - b. Elaborate on the relationship of EEDI and SEEMP in tackling UWN pollution from commercial vessels.
3. Develop a standard methodology in data collection methods, measurement procedures, and techniques especially in shallow waters.
4. Create an updated “quiet ships design guidelines” for ship owners, operators and shipyards.
5. Develop a universal and publicly accessible classification database (based on the ship type, size and operational profile).
6. Establish ship-based noise limits by considering a “phase-in over time”, and taking into account where the vessel travels with respect to sensitive marine areas.

Thank you to the Steering Committee (Chamber of Shipping of America (CSA), World Wildlife Fund – Canada (WWF), the World Maritime University (WMU) and Transport Canada) for the guidance of this study, Envirionics for conducting the research and survey analysis, and WMU for their qualitative analysis regarding the impacts of the findings.