

Report of the Workshop on Advancing Efforts to Address Underwater Noise from Shipping

Virtual Meeting, 11 May 2020

Report of the Workshop on Advancing Efforts to Address Underwater Noise From Shipping¹

This workshop was held as a pre-meeting to SC68B on Monday 11 May 2020, 14:00-17:00 by remote video link. The list of participants is given in Annex A.

1. CONVENOR'S OPENING REMARKS AND TERMS OF REFERENCE

Cholewiak and Leaper convened the meeting. Cholewiak opened the remote meeting noting that it was only three hours because of the need to accommodate different times zones. This meant that the original agenda and scope for the planned full day face-to-face meeting had been considerably reduced. The Workshop therefore focussed on low-frequency noise from large ships, assessment frameworks for ambient sound, and collaboration with other organisations to address shipping noise.

2. APPOINTMENT OF RAPORTEURS

Calderan and Genov volunteered to act as rapporteurs.

3. ADOPTION OF AGENDA

The adopted agenda is Annex B.

4. AVAILABLE DOCUMENTS

The documents available to the Workshop were Merchant *et al.* (2018); Erbe *et al.* (2019); IMO (2014); IWC (2016a; 2016b); IWC (2018a; 2018b); TGNoise (2019); van Oostveen *et al.* (In prep., published 2020); and Weilgart (2018).

5. BACKGROUND INFORMATION

5.1 IWC work on underwater noise

The IWC Scientific Committee has been discussing the impacts of noise on cetaceans since at least 2004, including seismic surveys in 2005, noise from shipping in 2008, measurements of ambient noise and sound mapping in 2014 and a workshop on masking in 2016 (IWC, 2016b). Following the workshop in 2016, the Committee consolidated a number of its recommendations related to underwater noise and these were listed in the contribution of the IWC to the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea in 2018. The Commission also passed a Resolution, 2018-4 (IWC, 2018b) on anthropogenic underwater noise in 2018 which gave a number of instructions to the Scientific and Conservation Committees.

Many of the concerns about noise from shipping arose because of the impacts on baleen whales which are low-frequency specialists. More recently there have been a number of studies showing impacts of higher frequency noise from small vessels such as recreational craft (Erbe *et al.*, 2019). The IWC interest is on direct impacts on cetaceans but also on other ecosystem effects, particularly those that affect prey species (Weilgart, 2018) and by extension, cetaceans. The IWC Resolution 2018-4 noted that cetacean research and conservation management efforts should include the protection of the acoustic habitat and the impacts of anthropogenic underwater noise on lower trophic levels, including fish and invertebrates.

The IWC has observer status at the IMO and members of the Secretariat and Scientific Committee usually attend meetings of the Marine Environment Protection Committee. The IWC participated in the IMO correspondence group developing the 2014 guidelines (IMO, 2014) and provided a short summary update paper to the MEPC in 2018 (IWC, 2018a).

In 2008, the Committee endorsed a noise reduction target arising from the Okeanos Foundation workshop representing a broad set of interests that established a goal for 'initial global action that will reduce the contributions of shipping to ambient noise energy in the 10-300Hz band by 3dB in 10 years and by 10dB in 30 years relative to current levels' (Wright, 2008). The 2008 workshop had also noted that this goal would be accomplished by reducing noise contributions from individual ships. There has been considerable work done on the issue since 2008, including the setting of objectives for underwater noise for all EU member states under the Marine Strategy Framework Directive. One objective of the current workshop is to evaluate and review this target in the context of the considerable body of more recent work.

¹Presented to the Scientific Committee as SC/68B/REP/06.

5.2 Work of the IWC Conservation Committee on underwater noise

Iñíguez summarised the work of the Conservation Committee on anthropogenic noise. This is one of the primary threats considered in the Conservation Committee Strategic Plan for 2016-26 (Chair of the Conservation Committee, 2016a) with actions identified in the work plan (Chair of the Conservation Committee, 2016b). The aims include: (i) to consider and act upon, as appropriate, the advice and recommendations from the Scientific Committee on the impacts of anthropogenic noise on cetaceans; and (ii) establish linkages between the IWC and other relevant bodies to ensure the dissemination of the IWC advice on anthropogenic noise. Actions include to further identify and engage with appropriate regional and international bodies addressing anthropogenic noise and progress any opportunities for capacity building, in particular with regards to the IMO.

Iñíguez noted that a workshop to develop the Conservation Committee costed programme to address underwater noise, which had been planned for early 2020, was postponed due to the Covid-19 pandemic.

5. AMBIENT SOUND, NOISE BUDGETS AND INDICATORS

Širović described recent studies on deep-water ocean ambient sound across the northern hemisphere. Based on the recordings of ocean ambient sound collected during the mid-2010s across the North Pacific, the western Atlantic, and the Gulf of Mexico, it is clear that there is a substantial level of variation in deep ocean ambient sound. The Gulf of Mexico generally had the highest levels of ambient sound at frequencies below 100Hz, resulting from heavy industrialization of this ocean basin. In other regions, the levels were related to the exposure of monitoring locations to shipping lanes, resulting in a variation of up to 15dB at 40Hz. Sound levels at low frequencies were also locally and seasonally affected by baleen whale songs. While sound levels were generally lower in the 2010s than during the late 2000s in the North Pacific, there is no readily available explanation for these observed lower sound levels.

Discussion following Širović's presentation examined why ambient sound levels had continued to decrease even as economic activity and trade recovered post-2008. This was considered likely to be a combination of slower speeds and improvements in vessel design. Investigating historical AIS data for both vessel speeds and routes in relation to the acoustic moorings was recommended as a means of looking into this further. It was suggested that for long term changes in ambient sound, it might be helpful to examine different frequency bands beyond the 50Hz band plotted by Širović, as ship engine noise characteristics have changed since the 1960s. Looking at a greater bandwidth would also take account of the effects of changes in ambient noise on a wider range of cetacean species. However, Širović noted that there was limited scope for looking at different frequency bands in historical data sets. It was also noted that noise measurements in the Bering Strait Region of the Arctic showed similar trends over time to those in the North Pacific even though the levels of anthropogenic noise were relatively low (Southall *et al.*, 2020).

Merchant described the OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) indicator framework for the exposure of marine fauna to impulsive and continuous noise. The impulsive noise indicator is further advanced than that for continuous noise and is based on a noise registry that has been developed with a consistent specification for the OSPAR, HELCOM and Mediterranean regions (TGNoise, 2019). Noise monitoring in the OSPAR region is being conducted through two joint monitoring programmes, JOMOPANS in the North Sea and JONAS in the large scale, open ocean habitat of the North Atlantic. The generic framework includes a spatial analysis of the noise pressure coupled with data on sensitive species or habitats to generate an exposure assessment. For a particular population, the Exposure Index (EI) expresses the overall exposure of the population based on integrating the area under the exposure curve. The exposure curve represents the percentage of the population exposed for a percentage of the time. Results were presented for impulsive noise and harbour porpoise in the North Sea. The OSPAR Intersessional Correspondence Group on Underwater Noise intends to adapt the impulsive noise risk indicator for continuous noise pollution (largely generated by shipping). An example was given for the modelled proportion of time that broadband ship noise excess level exceeded 20dB during July 2017 for an area around the British Isles.

It was discussed whether variation in sound speed profiles both temporally and spatially was significant enough over the large scales of the project area to warrant further investigation and inclusion in the modelling. Using more than one indicator species was also discussed, to enable investigation of ambient sound effects on different hearing groups, and this was compared to work being carried out by Transport Canada and others on the west coast of Canada. The difference between the impacts of static and moving sound sources was discussed with reference to noise modelling and management measures.

Kinneging noted that the Proposal assessment framework for the OSPAR candidate indicator ambient underwater sound (see van Oostveen *et al.*, 2020) was still in draft form and comments were welcomed. It is expected to be finalised during the next few months for potential approval by OSPAR in late 2020.

Folegot presented a study quantifying the potential for masking of mating calls of harbour seals in Kattegat, the Baltic Sea, by acoustic modelling. The aim was to evaluate and quantify masking from shipping. In this case, the study species was the harbour seal, but the methodology can be applied to other species and also uses a framework derived from the OSPAR

approach for impulsive noise which had been described by Merchant. Although shipping traffic follows predictable routes, the noise propagation varied in space and time due to the effects of the local environmental conditions on propagation loss. The study modelled the excess level induced by ship noise and assessed the masking effect on communication range associated with reduced signal-to-noise ratio. This allowed an estimate of the proportion of time for which there was a certain percentage reduction in communication range. The study provided a framework for quantification of masking potential, giving an objective method to compare habitats that could provide an index for assessing whether Good Environmental Status with respect to noise, as defined in the European Union Marine Strategy Framework Directive, had been achieved.

6. DISCUSSION OF THE IWC ENDORSED TARGETS IN THE CONTEXT OF MORE RECENT WORK

It was noted that there had been a considerable amount of work on underwater noise since noise reduction targets had been endorsed by the Scientific Committee in 2008. This included a better understanding of the impacts on many species as well as hearing thresholds, considerable development of sound propagation models, and improved understanding of the radiated noise from ships. In addition, the presentations had outlined some of the work to develop pressure indicators to quantify the extent to which anthropogenic sound was contributing to ambient sound levels. The IWC endorsed targets were expressed in terms of a pressure indicator, i.e. a reduction in the input of sound energy at source rather than an impact indicator. This is in line with the proposals that will be considered by OSPAR for ambient noise (van Oostveen *et al.*, 2020). The proposed OSPAR assessment framework involves modelling of both anthropogenic and natural sounds in order to create a sound map of the 'excess' level resulting from shipping. The approach underlying the IWC endorsed targets is consistent with the concept of an excess level in that in areas where shipping consistently contributes to elevated sound levels, a reduction in shipping noise at source will result in a reduction in the excess level.

There was broad agreement that there is a need for a clear target on lowering ship noise to facilitate regulation, and that the target should not be too complex. It was also recognised that there is a need to make progress on developing practical indicators and targets. It was also noted that targets based on pressure indicators are more achievable than biological-based targets based on impacts given that a reduction of source levels is the main variable that can be controlled and measured. There were concerns that the 3dB and 10dB targets endorsed by the IWC were rather too simplistic, partly because the 10-300Hz bandwidth might not be sufficient to cover impacts on many cetacean taxa, and partly because they may not be ambitious enough to avoid harmful effects. However, it was noted this bandwidth includes the primary frequencies used in communication by most baleen whales, and therefore is relevant to addressing the impact reduction on communication space. However, it is also acknowledged that this bandwidth does not encompass the full hearing range of baleen whales and therefore the full range over which signal detection may be important.

The approaches used within the OSPAR area under the JOMOPANS and JONAS projects could help to better understand the implications of simple targets. For example, the models could include simulating different ship quieting scenarios across the fleet and evaluate the resulting changes to the assessment indicators. Although this detailed work would be done at a regional scale it could be informative for targets set for global shipping. It was recognised that there is a need for global standards and targets, even though these would not be perfect for all regions. Standards for measurements and assessment should also be global in order to ensure comparability. The focus of the workshop was on low-frequency noise propagating over large distances from large ships. In many areas, higher frequency noise from vessel traffic is also a problem for many species. Areas where higher frequency bands are dominated by vessel noise are often coastal, and management measures may be implemented through domestic legislation. By contrast management of environmental impacts of shipping needs to be coordinated at a global level and this is done through the IMO.

7. FUTURE COLLABORATION

7.1 Collaboration with the IMO Marine Environmental Protection Committee (MEPC)

The IWC has been contributing to work on underwater noise at IMO MEPC since the item was put on their agenda in 2009 and during the development of the guidelines, which were finalised in 2014.

Sanders presented information on Canadian efforts to address underwater vessel noise, through both domestic policies and interaction with the IMO. She described two domestic policy tools that are in development, including Underwater Vessel Noise Management Plans (UVNMPs), and the establishment of a new Underwater Vessel Noise Reduction Target Working Group. Transport Canada is in the process of developing a framework for the UVNMPs, which are intended to be customized plans that are developed by fleet owners and operators, to reduce fleets' underwater noise using both operational and technological measures. The objective of the Working Group is to develop recommendations on noise reduction targets for Canadian vessels, and is anticipated to begin working in summer 2020. At the same time, Canada is continuing to engage in international collaboration and with the IMO. A technical workshop held at the IMO Headquarters in January 2019 acknowledged that quieting ships is necessary to protect the marine environment and developed a number of recommendations. Canada also organised a follow up policy workshop in November 2019 on 'Quieting Ships to Protect

the Marine Environment'. That workshop was intended to assist in the development of a proposal to the IMO Marine Environment Protection Committee (MEPC 75) to include underwater noise as a new work item. Members of the IWC Secretariat and Scientific Committee attended these workshops.

Several papers on underwater noise were tabled for MEPC 75. Australia, Canada and the US submitted a proposal for a new output concerning a review of the 2014 Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (MEPC.1/Circ.833) and identification of next steps (MEPC/75/14), with comment papers from European Union countries (MEPC/75/14/1) and other organisations (MEPC/75/14/2 and MEPC/75/14/3). MEPC 75 was postponed due to the Covid-19 pandemic so it is not clear when these issues will be discussed.

Sanders noted that the IWC's work has been well-received at IMO as it offers a scientific perspective independent of any specific member state. It was noted that since 2008, there has been considerable progress in knowledge and awareness of underwater noise from shipping, including both its impacts on marine species and the marine environment, as well as technological and operational solutions to reduce noise from vessels. This also includes increased data collection and in-water testing to support action. A Transport Canada initiative which funds an underwater listening station in the shipping lanes en route to the Port of Vancouver shipping lane was discussed. The listening station measures sound levels in real time to assess source levels based on ISO standards. Ships can be measured entering and leaving port with different draughts. The data from the listening station will provide a database of ship source levels, which has been identified as a need by both modellers and shipping companies.

7.2 The IWC Conservation Committee

The Arctic was highlighted as an area where the IWC has a close interest, including a workshop in 2014 on Impacts of Increased Marine Activities on Cetaceans in the Arctic (Reeves *et al.*, 2016), and also the IMO has specific regulations within the Polar Code. The potential for large changes in shipping associated with receding ice cover requires special attention. Merchant noted that OSPAR does not have a current monitoring programme in the Arctic but the OSPAR Secretariat is in joint initiative with Canada under the Arctic Council to assess ocean noise.

It was noted that the Conservation Committee and Scientific Committee need to work intersessionally in order to make progress, and that Convenors should attend the Conservation Committee, with efforts made to optimise liaising and communications between the committees. It was also noted that underwater noise from shipping and ship strikes should be considered together where appropriate as many issues are common to both threats and some of the same mitigation actions such as reduced speed and routing measures can be effective.

This meeting had been planned to follow on from a planning workshop on noise by the Conservation Committee and the IMO MEPC 75. Given that both these meetings have been postponed and the very limited time available at the meeting, it was not possible to identify specific recommendations for how the Scientific Committee could best contribute. There will be a need for further discussions once these other bodies have agreed on their work programmes.

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Annex A

List of Participants

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| Kai Abrahamsen | Danielle Grabiél | Naomi Rose |
| Artur Andriolo | Jan Haelters | Howard Rosenbaum |
| Eric Baudin | Tore Haug | Teri Rowles |
| Celeste Bollini | Patricia Holm | Katherine Ryeng |
| Robert Brownell | Miguel Iñíguez | Michelle Sanders |
| Elke Burkhardt | Niels Kinneging | Aviad Scheinin |
| Susannah Calderan | Sivakumar Kuppasamy | Mark Peter Simmonds |
| Manolo Castellote | Melanie Lancaster | Ana Širović |
| Maria Cély | Stephanie Langerock | Liz Slooten |
| Salvatore Cerchio | Russell Leaper | Sarah Smith* |
| Danielle Cholewiak | Rebecca Lent* | Hawsun Sohn |
| Tim, Collins | David Lundquist | Iain Staniland* |
| Julie Creek* | Sarah Mallette | Raphaëla Stimmelmayer |
| René Dekeling | Nathan Merchant | Carlos Hugo |
| Camila Domit | Gianna Minton | Suarez Sampaio |
| Greg Donovan* | Kimihiko Okano | Robert Suydam |
| Christine Erbe | Chris Parsons | Leigh Torres |
| Thomas Folegot | Melissa Perera | Michel Vély |
| Caterina Fortuna | Stephanie Plön | Jip Vrooman |
| Silvia Frey | Vanesa Reyes Reyes | Imogen Webster* |
| Heidrun Frisch-Nwakanma | Vincent Ridoux | Lindy Weilgart |
| Pierre Gallego | Fabian Ritter | Harald Yurk |
| Tilen Genov | Jooke Robbins | |

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Annex B

Agenda

1. Welcome and aims of the meeting
 - Meeting goals for discussion and documented outputs
 - Communication paper on IWC endorsed targets aimed at shipping industry
 - Input regarding IWC-IMO potential collaboration
 - Input into IWC Conservation Committee work plan
 2. Appointment of rapporteurs
 3. Adoption of Agenda
 4. Available documents and Sharepoint folder
 5. Background information and presentations
 - 5.1 Brief introduction from Russell Leaper on IWC work on underwater noise
 - 5.2. Brief introduction from Miguel Iñíguez on the work of the IWC Conservation Committee
 - 5.3 Presentations
 - 5.3.1 Ana Širović: Deep-water ocean ambient sound across the Northern Hemisphere
 - 5.3.2 Nathan Merchant: Marine noise budgets and OSPAR
 - 5.3.3 Thomas Folegot: JONAS project
 - 5.3.4 Michelle Sanders: Canadian proposal to IMO and Underwater Vessel Noise Reduction Target Working Group
 6. Discussion of IWC endorsed targets in the context of more recent work
 - 6.1 Questions for group discussion
 - 6.2. Plan for intended communication paper to IMO
 7. Future collaboration
 - 7.1 IWC Scientific and Conservation Committees and the IMO Marine Environmental Protection Committee (MEPC)
 - Discussion of what the IWC can most usefully do to collaborate with the IMO on reducing shipping noise
 - 7.2 IWC Conservation Committee – Work item on noise
 - Discussion of high priority items that the Conservation Committee may take up under their work plan, and how these may link to the IMO process
 8. Other business
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