

MARINE ENVIRONMENT PROTECTION
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WORK PROGRAMME OF THE COMMITTEE AND SUBSIDIARY BODIES

Assessment of acoustic habitat degradation due to shipping – A new perspective

Submitted by India

SUMMARY

Executive summary: The hazards of noise due to shipping, manifesting as acoustic habitat degradation for the marine ecosystem, is well known. There is substantial global attention to the issue and ongoing research efforts are aimed at facilitating sustainable growth for all. This document attempts to put in perspective the issue of acoustic habitat degradation in the Indian Ocean Region (IOR) with identification of hotspots in terms of extent of degradation, and proposes new means for site-specific assessment of the degradation. It also brings into focus Underwater Domain Awareness (UDA), based on the data gathered from IOR.

*Strategic direction,
if applicable:* 4

Output: Not applicable

Action to be taken: Paragraph 12

Related document: MEPC 74/17/2

Introduction

1 Previously, the Committee considered document MEPC 74/17/2 (Canada and France), which sought to advance international collaboration for quiet ship design and technologies to protect the marine environment. This document is built upon a foundation set by the previous work of the Committee and Member States.

Acoustic habitat degradation in the Indian Ocean Region (IOR)

2 The Indian Ocean Region (IOR) has strategically become the most critical sea area in the 21st century. The strategic relevance comes from the following economic, political and military aspects:

- .1 **Economic:** The East-West flow of energy and raw material from the Middle-East and the African coast to the growing economies in East Asia and also the return flow of finished goods to the markets in Africa and Europe ensure higher shipping traffic.

- .2 **Political:** The volatile geopolitical situation in the IOR has given rise to security concerns related to maritime terrorism and piracy, resulting in shifting of the shipping lanes to the near coastal waters. The nations that are farther on the development index, often find it difficult to prioritise sustainable growth models and therefore, lag in the application of Science & Technology (S&T) for enhanced understanding of the underwater domain.
- .3 **Military:** Security concerns have led to large scale deployment of maritime forces in the IOR, not just from the nations within, but also from the extra-regional powers. This has led to high volume of shipping traffic.

3 It is often stated that the shipping traffic has an adverse impact on the marine ecosystem due to the resulting acoustic habitat degradation. However, a precise assessment of the extent of damage is required, so that the necessary awareness is spread, and an informed decision-making process is expedited. The urgency of the issue needs to be quantified. Preliminary work done to assess the level of low frequency ambient noise due to shipping traffic reveals substantial increase with a spatio-temporal pattern, as shown in figure 1. The limitations in terms of the accuracy of the results are due to the restricted availability of Automatic Identification System (AIS) data and also lack of high-end computational infrastructure to undertake real-time simulation. However, this is a pilot project that can be replicated across the globe for such assessment and quantification of acoustic habitat degradation. The scale of noise is in dB and provides the indicative instantaneous value for average shipping traffic data over four years from 2011 to 2014. Such an assessment can provide significant inputs for future policy formulation that will aid management of the shipping traffic in ecologically sensitive areas. The noise reduction methods and their effectiveness can also be assessed using such algorithms. It is important to note that underwater noise is highly dependent on the local propagation conditions and other local sources of noise. The proposed work accounts for such site-specific characteristics to provide a realistic assessment of the situation that will facilitate well informed decision making.

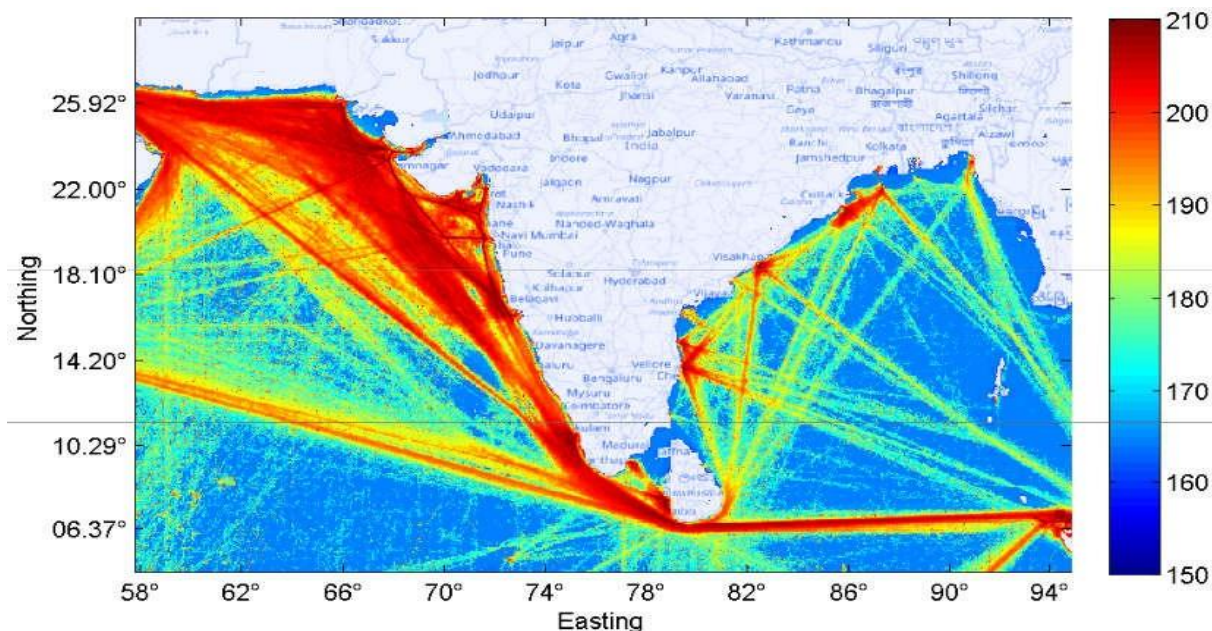


Figure 1: Spatio-temporal low frequency ambient noise due to shipping in the IOR

4 The IOR has seen a substantial increase in stranding incidents in recent times. The low frequency noise due to shipping traffic affects the big whale species; and multiple species need to be assessed for their vulnerability to the increasing noise levels. More focused research is called for to evaluate the precise cause and effect. Again, some preliminary work has revealed the trend of low frequency ambient noise over the last two decades and also its correlation with some recent events. Figure 2 presents real recordings and a comparison of ambient noise across different seas and Indian Ocean recordings over a decade with some other sea areas.

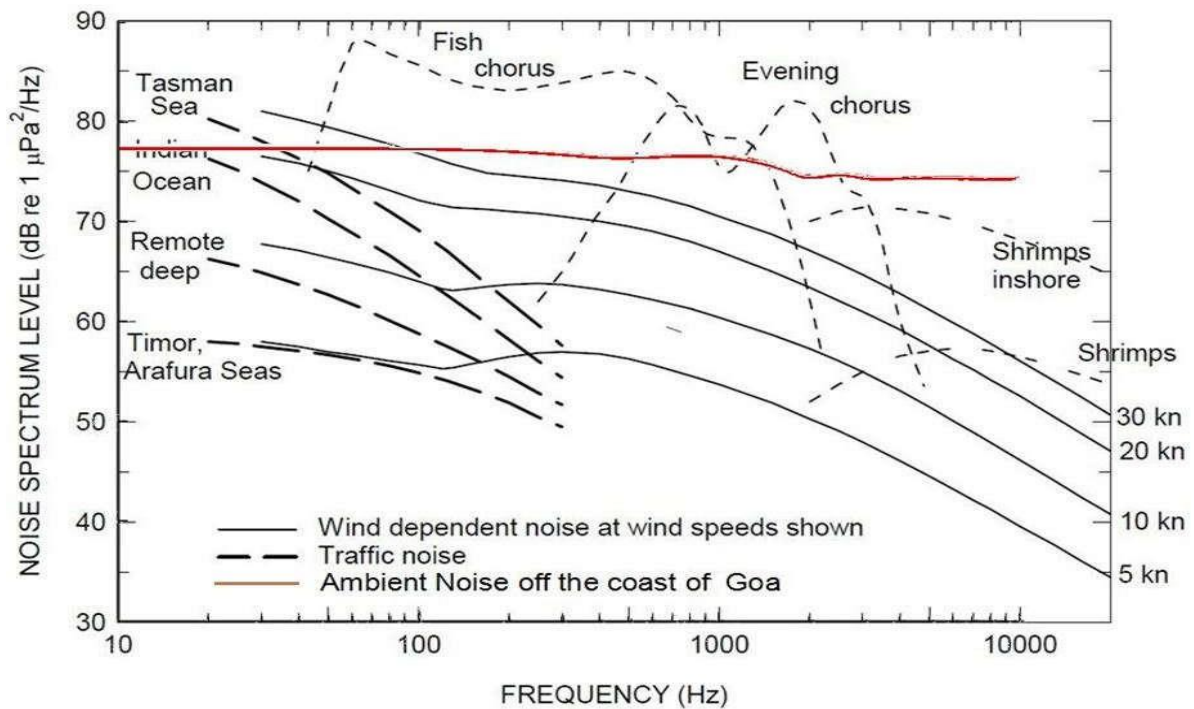


Figure 2: Ambient noise comparison across different seas and Indian Ocean recordings over a decade. Recent data (in red) recorded off the west coast of India closer to the stranding area in 2010, post the anti-piracy measures is compared with recordings made earlier

Underwater Domain Awareness (UDA)

5 The evolving maritime governance has often seen each stakeholder trying to individually deploy resources for scientific research and technological development at national and regional levels. The tropical littoral challenges of sub-optimal sonar performance are a major hurdle in ensuring effective UDA for ensuring safe, secure, sustainable growth for all in the region. Effective UDA will also allow us to navigate sustainable growth and ensure minimal acoustic habitat degradation.

6 The UDA framework proposed in this information document suggests pooling of resources and synergizing of efforts across stakeholders to optimize the resource deployment for effective UDA. Figure 3 depicts the broad UDA framework that can address multiple political as well as economic challenges in the IOR. The four stakeholders – the national security apparatus, blue economic entities, environmental regulators and disaster management authorities, and science and technology providers - need to come together under this proposed UDA framework. They need to focus on acoustic capacity and capability building to be able to enhance sonar performance to facilitate efficient resource deployment across multiple applications. The framework also provides a new way ahead to address the socio-economic challenges in terms of career opportunities for the young generation in the region High

research funding requirements for marine environmental issues in the region will be better served by the UDA framework proposed in the document.

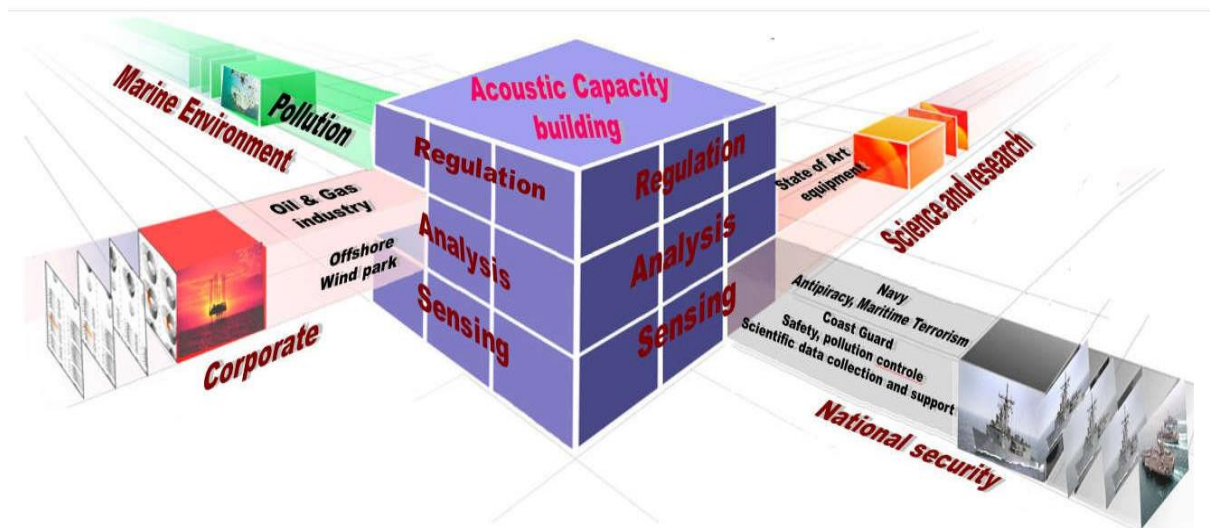


Figure 3: Comprehensive perspective of undersea domain awareness

Underwater Radiated Noise (URN) management

7 The UDA framework for URN management is a critical way ahead for stakeholder integration for developing effective acoustic capacity and capabilities. Figure 4 indicates a specific framework to comprehensively manage the entire URN issue across stakeholders. Acoustic stealth is a very critical requirement for warships; the same techniques are relevant for managing acoustic habitat degradation and also for ship designers and manufacturers in the business of making better ships in all aspects.

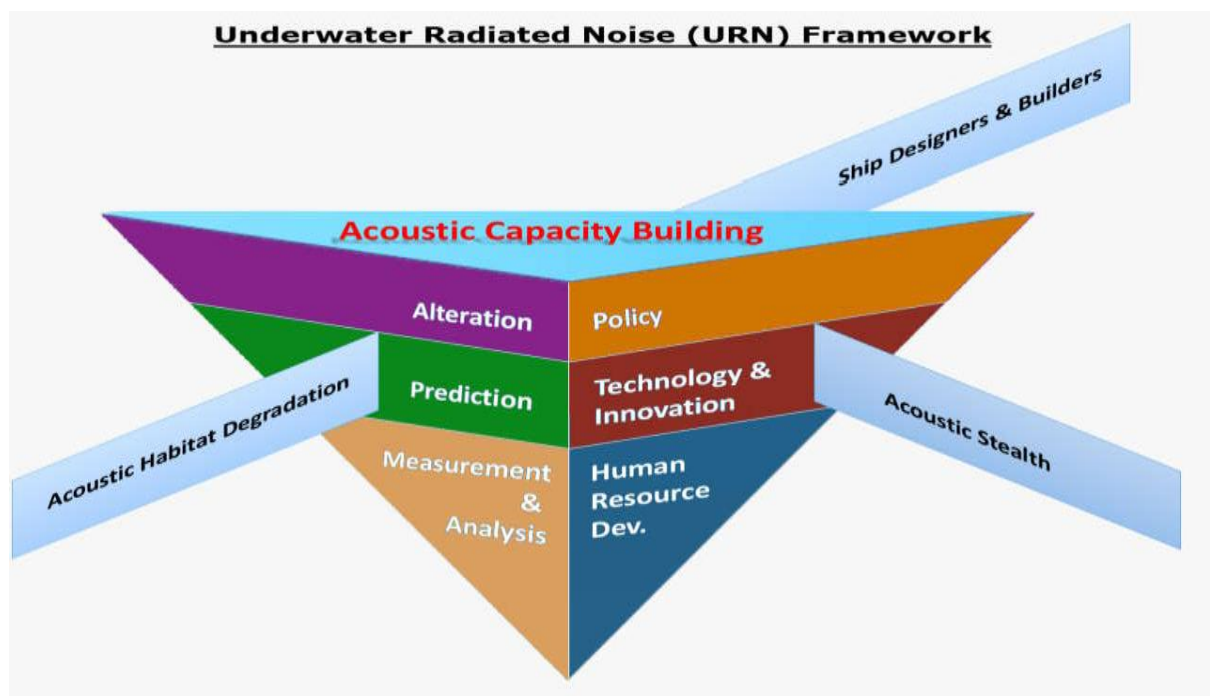


Figure 4: URN management framework

8 The URN management for acoustic stealth of warships has been a very well developed domain for quite some time. The same noise control techniques for design as well operational aspects are also relevant for acoustic habitat degradation management. There is requirement for a policy, technology and innovation, and human resource development to effectively address URN management. The other aspect relates to the stages of URN management, from measurement and analysis, to prediction and deception (in naval terminology) or alteration (in case of acoustic habitat degradation). Since the local medium will play a major role in the propagation of the sound from the source to the receiver, a source- path-receiver study is equally relevant. Acoustic capacity and capability building will remain key for effective URN management and the larger UDA framework.

Next step

9 Effective URN management in the IOR will require a nuanced approach. The following could be a way ahead in order to achieve optimum success:

- .1 Evolution of a UDA framework to address the competing resource requirements and also to ascertain the viability of the requirement.
- .2 Undertaking a detailed study project to identify gaps in the policy structure, technology and innovation, and human resource development.
- .3 Acoustic habitat degradation is a real issue and requires a focused approach from all levels. Precise assessment of the extent of degradation, and identification of the trends, global regulatory provisions and the possible way ahead needs to be undertaken.
- .4 Massive awareness initiatives through workshops/seminars across policy makers, practitioners, stakeholders, academia and others need to be undertaken on an aggressive scale.
- .5 Institutionalization of fellowships for acoustic capability and capacity building across multi-disciplinary, project based research and development initiatives with a significant field experimental component for real world problem solving.

10 India is well placed to play a leading role in comprehensively addressing the issue. The Government of India has declared the Security and Growth for All in the Region (SAGAR) vision to address multiple security concerns and to encourage maritime led growth for itself and others in the region. Sustainable growth in the oceans is better served by effective management of acoustic habitat degradation through the UDA framework proposed in the document. The spatio-temporal low frequency ambient noise mapping is a novel tool for precise and dynamic assessment that can become a model for the entire IOR and beyond.

11 The URN management strategy proposed in this work can be a model for the entire world, including socio-economically challenged nations, to optimize resource deployment and also achieve sustainable growth objectives.

Action requested of the Committee

12 The Committee is invited to note the information in this document.