



Issue Title: Threats posed to Marine Life in the Western Indian Ocean from Anthropogenic Ocean Noise and Shipping, including Ship strikes.

Submitted by: Wildlife Conservation Society, Madagascar & Western Indian Ocean Program

Introduction

Many marine animals are biologically dependent on their ability to hear and communicate using sound (Weilgart, 2007a; Boyd *et al.* 2008; Tyack, 2008; Richardson *et al.* 2013; Williams *et al.* 2015). The vastness of the sea and the reduced utility of visual, chemical, and tactile senses puts a premium on the use of acoustic channels to convey information; sound is of vital importance for a wide range of marine taxa (Williams *et al.* 2015). Many species listen to sounds in the environment to locate predators or prey, to orient themselves and to communicate with one another in social and reproductive contexts. It is of such significance in some marine species that it dominates aspects of their physical and neural anatomy (Harder & Sokoloff 1976; Ketten, 1992; Ladich & Fine, 2006). In particular dolphins and porpoises use high-resolution, high-frequency, underwater bio sonar to target prey and navigate. Breeding baleen whales communicate using complex and stereotypical songs that are transmitted at low-frequency over large (and occasionally huge) distances (Edds-Walton, 1997; Ketten, 2004; Tyack, 2008; Clark *et al.* 2009).

Anthropogenic underwater noise is recognised as a significant pollutant that is increasingly pervasive worldwide (Gordon *et al.*, 2004; McCarthy 2007; Weilgart, 2007b; Boyd *et al.*, 2008; Erbe, 2013; Bittencourt *et al.* 2014; Simmonds *et al.* 2014; IMO 2014; UNEP/WIOMSA, 2015; CBD 2016). Low-frequency ambient noises have increased in the world's oceans since the beginning of mechanized vessel transportation, but we are now beginning to quantify and understand the extent to which the deliberate use of sound (e.g., sonar, military activities, seismic airgun surveys) and incidental noise (e.g., shipping, pile-driving, construction) contribute to ocean soundscapes over broader scales of time and space (e.g., Weilgart, 2007a; Hildebrand *et al.*, 2009; Richardson *et al.* 2013; Hatch *et al.*, 2016; Nowacek & Southall, 2016). Underwater noise has a wide range of known and suspected consequences for marine ecosystems and species, and its management and mitigation is a major conservation concern (Cerchio *et al.* 2014; Cholewiak *et al.* 2018; Clark *et al.* 2009; Estabrook *et al.* 2016; Hatch *et al.* 2016; Hildebrand 2009; Jensen *et al.* 2009; McDonald *et al.* 2009; MEPC, 2013, 2014; Nowacek *et al.* 2007; Nowacek *et al.* 2015; Radford *et al.* 2014; Simmonds *et al.* 2014; Slabbekoorn *et al.* 2010; Tyack, 2008; Weilgart, 2007b).

Questions and concerns about the effects of human introduction of noise into the marine environment on increasingly large scales are well-founded. Major progress has been made in understanding how animals hear and may be impacted by noise. While overall amplitude is clearly relevant in terms of how sounds in the ocean may affect animals, other aspects of sound, such as frequency, directionality, duration, novelty, and other factors can be as or even more important (e.g., Ellison *et al.*, 2012). The more similar in frequency a sound is to the kinds of sounds an animal is tuned to, the more likely it is to have potential physical effects or to interfere with communication (e.g., Clark *et al.*, 2009; Southall *et al.*, 2013; Estabrook *et al.*, 2016; Hatch *et al.*, 2016). Specifically, issues related to disturbance of



animals from important feeding or breeding areas and interference (masking) of communication (e.g., Estabrook *et al.*, 2016; Hatch *et al.*, 2016) and navigational signals have received increasing consideration (Southall *et al.* 2013).

Shipping and ship strikes

Commercial shipping is among the most widespread of industrial activities in the oceans, transporting approximately 80% of the world's goods and energy ([UNCTAD 2017](#)). Noise associated with shipping is increasingly recognized as the major contributor of anthropogenic noise in marine ecosystems on a global scale (e.g. Aguilar Soto *et al.* 2006; McDonald *et al.* 2006; Wright *et al.* 2007; Hildebrand, 2009, Clark *et al.* 2009; Bittencourt *et al.* 2014; Williams *et al.* 2015; Hatch *et al.* 2016; Southall *et al.* 2017). Ship traffic tends to be highly concentrated within shipping lanes and near ports, and their operations, both individually and in aggregate, have a range of proven and potential impacts on marine species and ecosystems. Cetaceans (whales and dolphins) are most prominently affected by shipping and impacts include 1) **direct injury or mortality** from “ship strikes”¹ and 2) **sub-lethal behavioural effects** (noise can interfere with navigation, communication and foraging, as well as displace animals from preferred habitats). While these two broad issues differ in a number of ways, the relative risk of each increases where higher spatial and temporal overlap occurs between shipping density and the presence of susceptible species engaged in biologically important activities (e.g. Laist *et al.*, 2001; Redfern *et al.*, 2017; Metcalfe *et al.*, 2018). In short, the potential impacts of both are far greater when a high concentration of shipping activity intersects with the migratory routes, or habitats important for feeding and reproduction of vulnerable species.

Ship-strike probability and oceanic noise pollution can be monitored and their impacts reduced by integrating widely available remote-sensing and tracking technologies with scientific knowledge of animal presence and behaviour (Ward-Geiger *et al.* 2005; Silber *et al.* 2012; Van Parijs *et al.* 2013; Redfern *et al.* 2013; Tounadre, 2014; Simmonds *et al.* 2014; Redfern *et al.* 2017; Cholewiak *et al.* 2018). Noise quieting technologies may effectively mitigate shipping noise pollution at the source (Leaper *et al.* 2014) and ship speed management schemes can greatly reduce the lethality of ship strikes (Silber *et al.* 2012). In some jurisdictions, specific management measures have been adopted to reduce the impacts of noise and ship strikes on marine mammals (e.g. Laist *et al.* 2001; Erbe, 2013; Cholewiak *et al.* 2018). These include ship-routing and speed-control schemes as well as implementation of passive acoustic and ship-monitoring networks. Vessel-quieting guidelines have also been developed by the International Maritime Organization and others (Van Parijs *et al.* 2009; Silber *et al.* 2012; Erbe, 2013; IMO 2014). Guidelines for the reduction of ship strikes have been developed by the International Whaling Commission (Cates *et al.* 2016). However, additional and sustained efforts are needed to limit and reduce the impacts of vessel operations on marine life.

Underwater noise and ship strikes were highlighted by the Wildlife Conservation Society (WCS), The International Union for Conservation of Nature (IUCN) and the Government of

¹ “Ship strike” is a phrase commonly used to describe collisions between marine animals and vessels. Most reports involve large whales, but all cetacean species can be affected. Collisions often go unnoticed and unreported. Animals can be injured or killed and vessels can sustain damage.



France at the United Nations Oceans Conference (UNOC) held in New York in June 2017. A complete recording of the meeting and all documents related to outcomes and recommendations related to anthropogenic underwater noise can be found [here](#). Specific mention was subsequently made by member states of ocean noise in the final UNOC Call for Action. This event also initiated a collaborative effort that led to the formulation and registration of United Nations voluntary commitment [#OceanAction18553](#), entitled “A Commitment to reduce Ocean Noise Pollution.” Underwater noise and ship strikes were also a focal topic of the United Nations Open-ended Informal [Consultative Process](#) on Oceans and the Law of the Sea (June 2018).

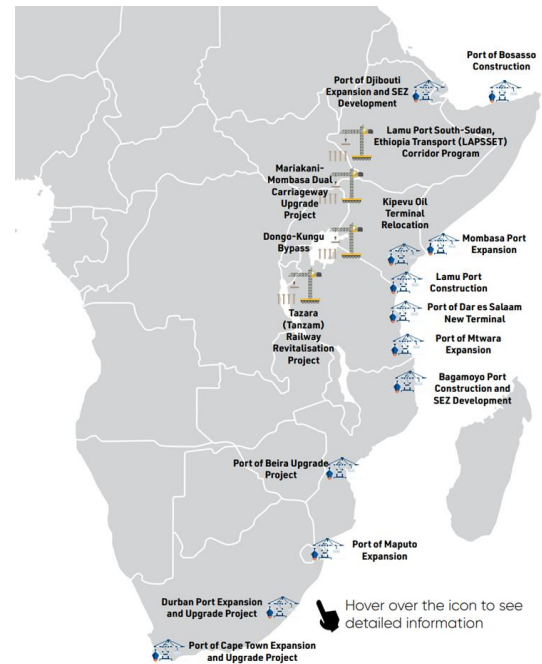
The need for increased action on oceanic noise and the mitigation of its effects on cetaceans and other migratory species was agreed by Parties to the Convention on Migratory Species at the 12th Conference of the Parties held in Manila in October 2017. Resolution 12.14 ([UNEP/CMS/Resolution 12.14](#)) followed on from previous resolutions (CMS/9.19 and CMS/10.241) and focuses on adverse impacts from anthropogenic marine/ocean noise on cetaceans and other biota. The resolution has particular resonance for the WIO and specifically: “*Urges Parties ...to take special care... to control the impact of anthropogenic marine noise pollution in habitats of vulnerable species and in areas where marine species that are vulnerable to the impact of anthropogenic marine noise may be concentrated, to undertake relevant environmental assessments on the introduction of activities that may lead to noise associated risks for CMS-listed marine species and their prey*”. The resolution also “*Strongly urges Parties to develop an appropriate regulatory framework or implement relevant measures to ensure a reduction or mitigation of anthropogenic marine noise...*” and to “ensure that Environmental Impact Assessments take full account of the effects of activities on CMS-listed marine species and their prey and consider a more holistic ecological approach at a strategic planning stage.”

A set of EIA guidelines is also provided in CMS Resolution 12.14 (pp 7-31), and addresses underwater noise from a variety of sources. The guidelines were developed to help regulatory agencies entrusted with granting environmental permits with their assessment of the impacts on marine life from noise making activities in the marine environment. The Guidelines are accompanied by a detailed technical support document ([CMS/COP12/Inf.11](#)), which was designed as a tool for improving the assessment and regulation of the impacts of underwater noise on marine life. The document is applicable for national and regional contexts, and includes guidance for transboundary impacts.

Guidelines for the reduction of impacts associated with offshore geophysical (seismic) surveys as well as other forms of environmental imaging have also been developed by IUCN (Nowacek & Southall, 2016). The guide, entitled *Effective planning strategies for managing environmental risk associated with geophysical and other imaging surveys*, is a practical guide to the responsible and effective planning of offshore geophysical surveys and other forms of environmental imaging and provides extensive detail on the impacts of such surveys as well as providing guidelines for planning future surveys. The guide focuses on marine mammals, but is also relevant and adaptable for other marine species (fishes, sea turtles, seabirds).

The Western Indian Ocean

The threats that noise and shipping pose to marine life in the waters of the Western Indian Ocean (WIO)² are poorly understood and are currently very rarely considered in national or regional management and development plans. This is of significant concern, particularly as the cumulative effects of multiple noise and ship related stressors remain largely unassessed for the region. WIO states are accelerating plans to diversify marine economies (particularly trade) in keeping with the development of the regional “[Blue Economy](#)” (World Bank/UN 2017). The blue economy is central to the African Union Commission 2063 *Strategic Framework for the Transformation of the African Continent*, as well as the Charter of the *Indian Ocean Rim Association (IORA)*.



There are currently 13 commercial ports in the WIO region (see Figure 1) and several others are either planned or under construction (UNEP/WIOMSA, 2015). The region hosts several maritime trade routes, and currently 30% of global tanker traffic passes through the Mozambique Channel (Obura et al. 2015) transporting crude oil from the Persian Gulf and Indonesia to Europe and the Americas (World Bank 2012 - Report No: [72343-ZA](#)). WIO states are actively expanding their own offshore oil and gas production, activities that will further increase shipping and noise. Ambient noise levels in the Indian Ocean are known to be increasing (Miksis-Olds et al. 2013), and shipping in an already busy region has been projected to increase (Kaplan, 2009; Halpern et al. 2015).

Figure 1: New and expanding ports in the WIO region. Map extracted from the East Africa Ports expansion [website](#)

Assessments of the threats posed by underwater noise and ship strikes in the WIO region currently fall far short of what is needed, in part because the required scientific work to assess these threats has not been completed, and because general awareness of their importance, scale and significance is poor. National guidance on environmental noise does exist in each WIO state, but is almost exclusively terrestrial, and almost exclusively focused on reducing the impacts of loud and persistent noises on people. Regional management measures that are of broad relevance for the management of underwater noise and shipping impacts are few. Article 5 of the *Convention for the Protection, Management and development of the Marine and Coastal Environment of the Eastern African region (UNEP/Nairobi Convention)* concerns pollution from ships, but as phrased is currently limited to discharges, although Article 2 correctly includes the release of energy into the marine environment as part of its definition of ‘Pollution’. The absence of specific guidance is also evident in statutory Environmental Impact Assessments (EIA’s) for major ports; we

² here defined as the region encompassing the EEZ’s of contracting parties to the Nairobi Convention



could find no evidence of either the appropriate measurement of underwater sound (a baseline or the predicted change) or the appropriate assessment of threats to marine species associated with increased noise or shipping in the documents we studied for this working paper. For example the most recent [ESIA](#) for the Lamu-LAPPSET Port Development does highlight several cetacean species of concern, but no specific management measures are suggested and the threats posed by increased shipping to marine species are not considered at all. The [EIA](#) for the improvement of Dar es Salaam Port mentions increased noise pollution from shipping but (in a one-line statement) also suggests the increase will be of low magnitude without providing any qualifying evidence (Section 6.7.2.5). The Maputo Port (*Sociedade para o Desenvolvimento do Porto de Maputo*) HSE Principle 1.7 requires that both environmental pollution be prevented as far as possible, and that proactive measures are in place to prevent events that cause significant impacts on the marine environment. However, no further information on the active management or monitoring measures related to noise, shipping and their potential effects on wildlife in Maputo could be sourced, despite ongoing work to increase the number of berths and radically expand cargo handling capacity.

These concerns are inextricably linked to the long-term conservation of the regions rich cetacean diversity (de Boer *et al.* 2002; Rosenbaum, 2003; Kiszka *et al.* 2009; REMMOA 2012). Recent sightings include seasonal blue whales (Barber *et al.* 2016; Branch *et al.* 2018), Longmans beaked whales (Martin & Nimak-Wood, 2016), coastal dolphins (Perez-Jorge *et al.* 2016) and seasonally migratory humpback whales (Best *et al.* 1998; Findlay *et al.* 2011; Braulik *et al.* 2018; Mwang'ombe *et al.* 2015). Recent acoustic work in Madagascar yielded detections of blue whales from three different sub-populations as well as newly discovered Omuras whales, fin whales, humpback whales and minke whales (Cerchio *et al.* 2018). Work by WCS and others has clarified the ecology of humpback whales (e.g. Best *et al.* 1998; Rosenbaum *et al.* 2009; Cerchio *et al.* 2009; Cerchio *et al.* 2016; Kershaw *et al.* 2017). Most recently satellite tagging studies revealed movement of humpback whales from Madagascar to Kenyan and Somalian waters, as well as those of Mozambique (Cerchio *et al.* 2016; Dulau *et al.* 2017). These findings reinforce the available evidence of connectivity between these areas and highlights their vulnerability to multiple stressors across the migratory range.

Next steps for the Western Indian Ocean

Forward-thinking measures to monitor potential impacts, including amending current EIA practices, can occur with moderate costs. The process is likely to be more efficient if completed in partnership with relevant research groups and NGOs, and will be more effective and efficient with explicit data sharing agreements. These sentiments are echoed in Articles 13 and 14 of *Convention for the Protection, Management and development of the Marine and Coastal Environment of the Eastern African region* (UNEP/Nairobi Convention), which deal with EIA's and Scientific and technical cooperation respectively. These issues are often not fully considered until there is a problem, and are typically costlier when the efforts are reactive. Proactive investment in efforts to establish baseline conditions for marine life and ocean noise levels in the short-term may be viewed by some as more costly, unneeded expenditures, or even unnecessary. However, it is our view that if the investment is made strategically, it will only promote best practices for marine life and important habitats in the



context of a blue economy and the UNSDG14 2030 targets.

Policy Recommendations

The development of best practice scenarios will require that governments, the shipping industry and civil society work together. Regional guidelines and research can benefit from extensive measures being implemented elsewhere around the globe and should be considered an urgent priority given sustainable development targets linked to 2030. Specific recommendations (which echo those of [UNEP/CMS/Resolution 12.14](#)) include:

- The urgent implementation of national and regional noise limiting and ship-strike prevention guidelines is considered essential. The development (or adoption) of guidelines should involve all relevant stakeholders. Solutions must be tractable and have real, achievable benchmarks within the framework of SDG 14 and towards 2030.
 - Regional guidelines should be in keeping with current global best practice. These include those of CMS, the [IMO](#), the [IWC](#), [CBD](#), [IUCN](#) and the World Bank (see [IFC 2017](#), pp 18-19).
 - Voluntary guidelines being adopted and implemented by the International Maritime Organization (IMO) need greater uptake with other industry sectors, which may be improved by effective education, communication and incentive-based systems.
- Regional research that actively investigates oceanic noise and its effects on marine life should be encouraged and supported. This should be considered an urgent concern, particularly as marine development proceeds at a rate that far exceeds our ability to reliably assess impacts. Research should include:
 - Targeted regional and collaborative research that seeks to improve our understanding of regional ocean noise levels, including establishment of acoustic baselines and the identification and protection of areas of critical biological importance. These areas should include implementing and/or reinforcing Marine Protected Areas (MPA) or Important Marine Mammal Areas (IMMAs).
 - Targeted research that highlights the potential impacts to marine mammals from shipping traffic (along with other noise sources) and the effects of expanded regional maritime trade. These targets will require developing a clear understanding of cetacean distribution and occurrence,

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