



MARINE ENVIRONMENT PROTECTION
COMMITTEE
58th session
Agenda item 19

MEPC 58/19
25 June 2008
Original: ENGLISH

WORK PROGRAMME OF THE COMMITTEE AND SUBSIDIARY BODIES

Minimizing the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life

Submitted by the United States

SUMMARY

Executive summary: This document proposes the inclusion of a new high priority work programme item on the agenda of the Committee to take action to minimize the incidental introduction of noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life. A significant and growing portion of human noise input to the ocean is attributable to the increasing number and size of commercial ships operating over wide-ranging geographic areas. Noise from such ships has the potential to disturb behaviour and interfere with critical life functions of marine animals. Given the global nature of shipping, the long lifespan of a ship, and that the Organization is the recognized entity for the consideration of issues pertaining to international shipping, it is essential that the Organization provide the forum for the comprehensive consideration of global strategies to address this issue.

Strategic direction: 1, 7 and 13

High-level action: 1.1.2

Planned output: 1.1.2.3

Action to be taken: Paragraph 8

Related documents: Resolutions A.989(25), A.982(24), A.900(21), A.720(17) and A.468(XII); MSC/Circ.1014; MSC 84/INF.4; MSC 83/28; MEPC 57/INF.4 and MEPC 57/INF.22

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Introduction

1 The United States proposes the addition of a new high priority work item to the agenda of the Marine Environment Protection Committee (MEPC). This work item is to identify and address ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life, in particular through the development of non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices. This proposal, attached as annex 1 to this document, is in accordance with MSC-MEPC.1/Circ.1 (15 December 2006), which sets forth the criteria for submitting a new work item proposal.

Background

2 The introduction of human-produced noise¹ into the marine environment and its potential adverse impacts on marine life is a matter of increasing concern. While repeated measurements in an area over time to determine trends are limited, levels of background sound in the ocean (or “ambient noise”) are known to be increasing in certain areas and within specific sound frequency (“pitch”) bands. A significant human contribution to overall ambient noise at low frequencies is thought to be generated by the growing use of the ocean for international shipping. Commercial ships, which are increasing in both number and size, are producing ever-greater amounts of underwater noise as an incidental by-product of operation² (Southall 2005). In fact, multiple studies estimate, based on recent studies off the California coast, that there has been approximately a 3 decibel (dB) increase in – or a doubling³ of – background noise from commercial shipping per decade in some ocean areas. (Andrew *et al.* 2002, Cato and McCauley 2002, McDonald *et al.* 2006, Andrew *et al.* in press). Additionally, many other studies have characterized the relative contributions of shipping to the total low frequency noise in highly-trafficked and less-trafficked coastal and open-ocean areas. These studies indicate that ships are the dominant source of low frequency noise in many, if not most, highly-trafficked coastal zones in the northern hemisphere. These areas are also heavily used by marine animals that depend on sound, many of which use the same low frequency bands that are being affected by incidental noise from commercial shipping (Cato 1976, Ross 1976, Worley and Walker 1982, Zakarauskas 1986, Bachman *et al.* 1996, Zakarauskas *et al.* 1990, Curtis *et al.* 1999, Andrew *et al.* 2002, Cato and McCauley 2002, Heitmeyer *et al.* 2004, McDonald *et al.* 2006, Andrew *et al.* 2008, Hatch *et al.* in press).

3 Most marine animals produce and receive sounds for critical life functions such as communicating, foraging, evading predators, and navigating. Much as human rely heavily on their vision for most activities, most marine animals rely on sound for survival and reproduction. Scientific investigations of many marine animals (including mammals, fish, and even some invertebrates) have shown that the production and reception of sounds are critical to various aspects of their life histories. Human-produced sound has the potential to interfere with various

¹ “Noise” is the term to describe unwanted sound, whereas “signals” are sound with some biological importance. The generic term “sound” is used where the intent is not to distinguish between noise and signals or where the utility or effect is ambiguous or unknown; “noise” is used to refer specifically to exposures with adverse effects or in specific technical terms such as “ambient noise” (the general background din) or “masking noise” where interfering sound is by definition “noise.”

² Incidental in this context means the unintended production of sound energy from the propulsion systems and internal machinery of vessels. It does not include active depth finders and other communication sources used in orientation and safety of navigation.

³ In sound level terms, a doubling in the power of sound is measured as 3 dB.

important biological functions of marine animals. The range of resulting adverse impacts is highly dependent on characteristics of the sound source, the environment where the sound occurs, and the animals receiving the sounds. Marine animals such as large whales, many fish, and some seals and sea lions are particularly vulnerable to adverse impacts from incidental shipping noise because they primarily use the same low frequency sounds as that generated by commercial ships for such things as communication and/or to perceive their environments.

4 Among multiple human-induced sources of low frequency sound in the marine environment, commercial ships represent significant and relatively loud individual sources of sound, the exact characteristics of which depend on ship type, size, mode of propulsion, operational characteristics, speed, and other factors. Much – and in some conditions most – of the incidental noise generated by large ships results from propeller cavitation. Onboard machinery and turbulence around the ship’s hull also generate incidental noise that can be transmitted underwater via direct or secondary paths. Various parts of ships produce different frequency sounds which propagate differently in the water, with low frequency sound generally travelling farther due to the physical properties of sound in water. Low frequency sounds from ships can travel hundreds to thousands of miles and thus can increase ambient noise levels in large areas of the ocean. This has the very real probability of interfering with the abilities of marine animals to hear and communicate in the same frequency ranges (see paragraph 3), in some cases over relatively large areas. In general, however, the loudest areas are expected to be where the highest ship traffic occurs. While individual ships represent point sources for noise, and efforts directed at quieting will likely be approached on a ship-by-ship basis, the primary concern in terms of adverse impacts on marine life is likely to be the overall contribution of many vessels to increasing ambient noise levels, particularly in coastal areas where marine life is relatively abundant. It is important to recognize that radiated sound, unlike persistent forms of pollution such as heavy metals or greenhouse gases, once reduced or eliminated does not linger in the environment. Thus, the application of strategies to quiet vessels, including in particular quieting technologies, has the potential to reap immediate benefits for marine life.

5 In addition to the probable tangible benefits to marine life from quieting commercial ships, there are other considerations that support the addition of this work item to the Committee’s agenda. First, while the Organization is currently considering the revision of its Code on Noise Levels On Board Ships (A.468(XII) (November 1981)) which addresses the adverse impact of noise on the crew and passengers⁴ and it has adopted MSC/Circ.1014 (12 June 2001) which recognizes that mariner stress and fatigue may be caused by noise on board ships, any additional strategies taken to address sources of underwater noise from commercial ships could also benefit the crew and any passengers on board such vessels. Second, sound produced as an incidental by-product of a vessel’s operation serves no particular function in the transportation of goods and may, to some extent, represent wasted energy. Although the underlying technical issues involved are highly complex and need further consideration and validation, the potential for increased shipboard efficiency as a result of the reduction of incidentally-generated shipboard noises should be explored. These potential benefits may offset costs associated with the implementation of ship-quieting technologies. Third, over the next several years, various requirements set forth in International Maritime Organization (IMO) instruments will enter into force. These requirements may result in ships being replaced by new ones (*e.g.*, single hull tankers by double hull tankers) or new equipment being developed to address specific issues (*e.g.*, MARPOL Annex VI requirements). If the reduction of noise is taken into account in the building of new ships or the development of new equipment, significant noise reductions could take place. Consideration of this issue at the design phase of a ship and its

⁴ MSC 83/28, paragraph 25.41.

equipment is more cost-effective, efficient, and practical than retrofitting a vessel or affecting where a ship operates or its operational practices.

Proposal

6 Based on the above considerations, the United States invites the Committee to add to its agenda, as a high-priority work item, the development of non-mandatory technical guidelines for commercial ship-quieting technologies as well as potential navigational and operational practices, to minimize the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life.

7 To accomplish this task, the United States proposes that a correspondence group be formed to work on this issue. If the Committee agrees with this proposal, potential terms of reference for the establishment of the Correspondence Group could include:

- .1 identify and address ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life, in particular develop non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices; and
- .2 provide reports to the Committee.

The references and other literature considered in the development of this submission are set forth in annex 2.

Action requested of the Committee

8 The Committee is invited to add to its agenda, as a high-priority work item, minimizing the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life and form a correspondence group to work on this issue.

ANNEX 1

CRITERIA FOR NEW WORK PROGRAMME ITEMS

Scope of the proposal

1 As a new work item, the Committee would be able to consider minimizing the introduction of incidental noise from commercial shipping operations to reduce potential adverse impacts on marine life, with an emphasis on practical, effective solutions that can be implemented by the shipping industry. The Committee is invited in particular to develop non-mandatory technical guidelines on potential design and construction technologies and on potential navigation and operational practices that may minimize incidental noise from commercial shipping.

Need for work programme item

2 The criteria for a new work programme item require that a need be documented and, for proposals requesting the development of a new convention or amendment of an existing convention, a compelling need must be shown. The proposed action here is not a request for the development of a new convention or an amendment to an existing convention and therefore this proposal does not have to meet the burden of showing a compelling need. Notwithstanding, the United States believes that there exists a compelling and urgent need for the Committee to add this item to its agenda because of potential adverse impacts on the marine environment and marine life as well as on the crew and any passengers on board ships. There are also potential economic benefits that may be obtained by addressing this issue.

Environmental Impacts

3 Noise exposure may pose a host of potential adverse impacts to marine animals, including in particular marine mammals (*e.g.*, whales, dolphins, porpoises, seals, sea lions) and fish. Natural or human-generated noise can have various adverse effects on animals, including: alteration of behaviour; reduction of communication ranges for social interactions, foraging, and predator avoidance; temporary or permanent compromise of the auditory or other systems; and/or, in extreme cases, habitat avoidance or even death (Richardson *et al.*, 1995; Southall *et al.*, 2007). Potentially widespread impacts, particularly related to communication interference or “masking,” may result from increasing background ambient noise levels due to human activities. With regard to the incidental noise generated by shipping, the general low frequency band of large vessel noise overlaps the frequencies generally produced by some marine animals, primarily large whales, seals and sea lions, and fish (see Figure 1 below). Additionally, concerns with regard to such noise and its potential adverse impacts on acoustically-oriented marine animals is of increasing concern because: (1) commercial shipping operations cover a wide geographic area, (2) low frequency sounds from ships travel great distances, and (3) since international shipping is continuous, incidental noise from ships is ever-prevalent.

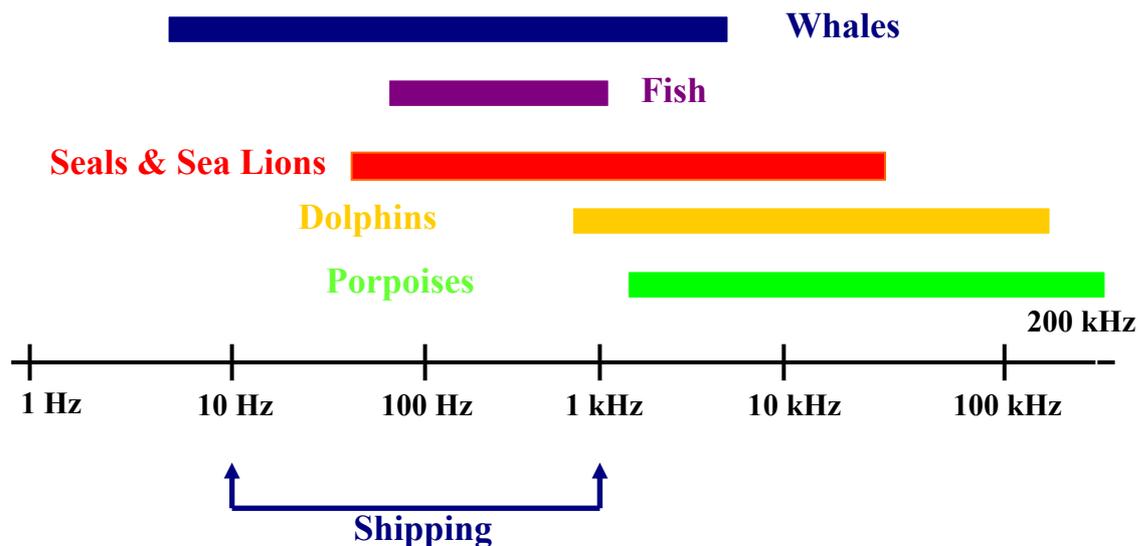


Figure 1: Frequency relationships between marine animal sounds and incidental noise from commercial shipping

4 The primary concern regarding potential adverse impacts of incidental shipping noise is not related to acute exposures, but rather to the general increase in continuous background ambient noise that may result from concentrations of vessel operations and the potential masking of marine animals' communication systems. While there is insufficient longitudinal data to conclude that ambient noise levels are increasing in large areas of the ocean as a function of vessel sounds, several recent studies off California analysing measurements over several decades do indicate changes that suggest, for particular areas, there has been approximately a 3 decibel (dB) increase in – or a doubling⁵ of – background noise from commercial shipping noise per decade (Andrew *et al.*, 2002; McDonald *et al.*, 2006; Andrew *et al.* in press; see Figure 2 below). Because of the logarithmic nature of sound and what is known about hearing systems in mammals, seemingly small changes in background noise levels can result in large reductions of marine animals' communication ranges (see Figure 3 below).

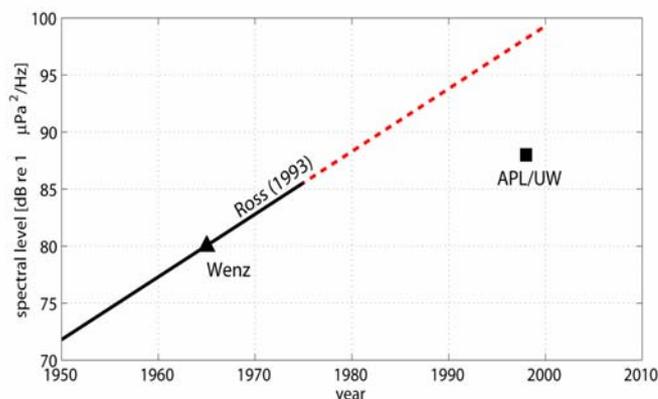


Figure 2: Ambient noise measurements in the 100-200 hertz (Hz) band measured off California in the 1950s (Wenz, 1962; Ross, 1993) and Applied Physics Laboratory/University of Washington (APL/UW) noise measurements in the late 1990s (Andrew *et al.*, 2002)

⁵ In sound level terms, a doubling in the power of sound is measured as 3 dB.

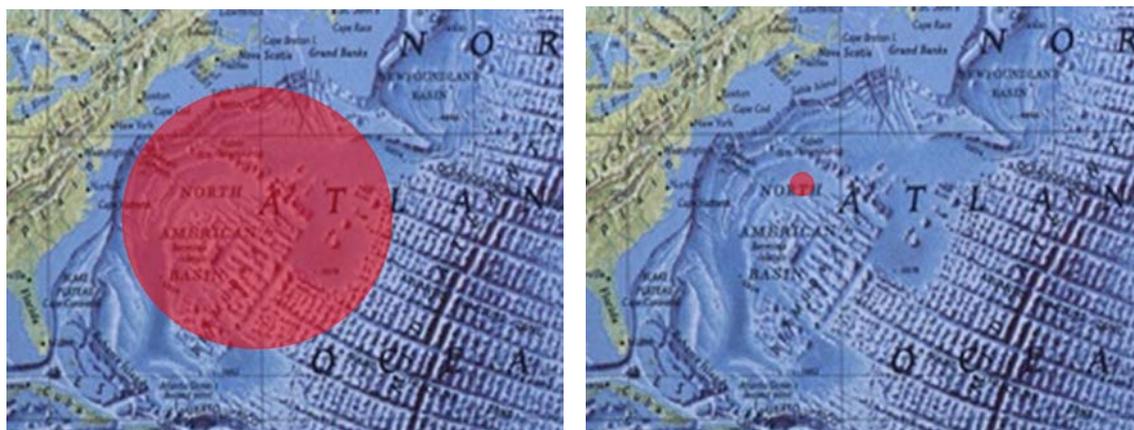


Figure 3: Expected reductions in blue whale communication ranges from the many hundreds of square miles possible prior to the advent of commercial shipping and other industrialized sounds (left) compared to the greatly reduced possible ranges for those same voices today (right). Figure courtesy of Christopher Clark, Cornell University based on historical and recent low frequency ambient noise and whale call measurements

5 There has been extensive documentation of how sound can mask marine animals' communication systems, including several specific examples relating to commercial shipping noise and its potential adverse impacts on marine life.

- .1 The fact that noise masks hearing is well established for human beings (e.g., Fletcher, 1940) and other animals, and it appears to be quite similar as a general phenomenon across many mammalian species (see Fay, 1986; Ward, 1997). Numerous studies have examined the impacts that masking has on a variety of species, and have considered and/or quantified the extent to which low frequency noise from shipping can dramatically reduce communication ranges for marine animals (e.g., Payne and Webb, 1971; Erbe and Farmer, 1998, 2000; Southall *et al.*, 2000, 2007; Erbe 2002; Morisaka *et al.*, 2005, Nowacek *et al.*, 2007).
- .2 Recent data on blue whales (*Balaenoptera musculus*) and North Atlantic right whales (*Eubalaena glacialis*) indicate that these species may be adjusting their vocalization (frequency and loudness) on both short and long timescales to compensate for masking associated with vessel noise (McDonald *et al.*, 2006; Parks 2003).
- .3 Measurements using a sophisticated underwater listening array demonstrated that a Cuvier's beaked whale (*Ziphius cavirostris*) reduced the production of sounds associated with foraging in response to a passing cargo ship (Soto *et al.*, 2006).

Human beings

6 IMO has recognized that noise levels on board ships affect human beings and has adopted a Code to address this issue (Code on Noise Levels On Board Ships, A.486(XII)) (November 1981). In recognizing the importance of this issue, the Maritime Safety Committee

recently assigned consideration of the revision of this Code to the Design and Equipment Sub-Committee. This Code gives guidance on, and recognizes that there should be, maximum noise levels and exposure limits. It focuses on prevention of potentially hazardous noise levels on board ships and reduction in the exposure of the crew and passengers to noise so as to, *inter alia*, prevent hearing loss and provide safe working conditions, taking into account the need for speech communication, hearing audible alarms, and working in an environment where clear-headed decisions are necessary to ensure safety of navigation and other essential operations of the ship. Circular 1014 adopted by the Maritime Safety Committee on 12 June 2001 also recognizes that noise may have an adverse impact on mariners by causing stress and fatigue. Adoption of strategies that quiet commercial ships for the benefit of marine life may also yield benefits for mariners and any passenger on board commercial ships.

Economic Benefits

7 As noted above in the background section, sound produced as an incidental by-product of vessel operations serves no particular function and may, to some extent, represent wasted energy. Although the underlying technical issues involved are highly complex and need further consideration and validation, quieter vessels may be more efficient to operate and maintain. Thus a reduction in noise may represent a reduction in both propeller cavitation and ship-board vibration and, consequently, result in reduced operational, maintenance, and fuel costs. There may be economic benefits to be gained by the shipping industry by minimizing the introduction of incidental noise into the marine environment. Additionally, it is also important, cost-effective, and practical to consider noise reduction technologies and strategies as part of the design phase of a ship and its equipment or in the shipbuilding contract instead of attempting to address it on existing ships or by affecting where a ship operates or its operational practices.

Is the issue within the scope of IMO's objectives and Strategic Plan of the Organization?

8 The addition of this issue to the Committee's work programme falls squarely within the scope of IMO's objectives and Strategic Plan. Resolution A.900(21) sets forth the objectives for the Organization in the 2000s. By addressing and minimizing the introduction of incidental noise into the marine environment from commercial shipping operations to reduce potential adverse impacts on marine life, the Committee would fulfil several of the objectives identified in the resolution. First, the resolution directs the Committees to take measures to implement a proactive policy so that trends which might adversely affect the safety of ships and those on board and/or the marine environment are identified at the earliest feasible stage and action taken to avoid or mitigate such effects. Second, it directs the Committees to shift emphasis on to people and address safety and environmental protection issues by ship types. The relevant objectives and Strategic Plan elements are addressed individually below.

Objective: Implementation of a proactive policy to address trends which might adversely affect the marine environment and identification of such trends at the earliest feasible stage so avoidance or mitigation action may be taken

9 There is increasing recognition of the introduction of noise into the marine environment and its potential adverse impacts on marine life. Various international organizations are taking action to address it. The United Nations General Assembly in A/Res/62/215, paragraph 120, recognizes the potential adverse impact of ocean noise on marine living resources and encourages further studies and consideration of this issue. Three regional organizations have also taken action. The parties to the Convention on Migratory Species (*e.g.*, the Agreement on the

Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Area (ACCOBAMS) and to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS)) have adopted resolutions and commissioned research on the effects of noise on marine mammals. *See* ASCOBANS MOP 4, Resolution 5, Effects of Noise and of Vessels (2003). In 2006, a report on Marine Acoustics and the Southern Ocean by the Scientific Committee on Antarctic Research was submitted to the Antarctic Treaty Consultative Meeting. ACTM XXIX, WP 41. Noise from shipping was explicitly considered in this report.

10 As there is sufficient data that the introduction of incidental noise from commercial shipping is an important and increasing source of sound in the marine environment and there are documented concerns regarding its potential adverse impacts on marine life, it is clearly part of a trend that may adversely affect the marine environment. Therefore, consistent with the Organization's objectives in resolution A.900(21), the Committee should – by adding this issue to its work agenda – take proactive action now to address it by taking action to minimize and reduce the adverse effects of the introduction of incidental noise from commercial shipping operations into the marine environment.

Objective: There should be a shift in emphasis to people and addressing environmental protection issues by ship types

11 By adding this issue to its work agenda, the Committee is fulfilling the objective of emphasizing people and addressing this environmental protection issue by ship type. First, as noted above in paragraph 10, the adoption of strategies to minimize the introduction of incidental noise by commercial shipping into the marine environment may also yield benefits to mariners and any passenger on board commercial ships. Second, with regard to considering environmental protection issues by ship type, each ship produces different incidental noise. The exact characteristics of this noise depend on ship type, size, mode of propulsion, operational characteristics, speed, and other factors. While the primary concern in terms of potential adverse impacts on marine life is likely to be the overall contribution of many vessels to increasing background noise, efforts directed at quieting will likely be pragmatically and strategically applied on a ship-by-ship basis. Thus, in considering the range of possible measures to effectively address this issue, it is necessary and appropriate that emphasis be given to the diversity of ship types and their activities. Different approaches will almost certainly be necessary for different types of vessels. Flexibility and optimization are consequently important in developing practical and effective strategies for minimizing the introduction of incidental noise into the marine environment by commercial shipping.

Strategic Plan: Mission Statement and categories of trends, developments, and challenges

12 The Organization's Strategic Plan is set forth in Assembly resolution A.989(25) (20 November 2007). The Mission Statement provides that the mission of the Organization is, *inter alia*, the promotion of environmentally sound, efficient, and sustainable shipping through cooperation. The resolution also sets forth categories of identified trends, developments, and challenges; the issue of the introduction of incidental noise from commercial shipping operations falls within two of these categories. The category of globalization identifies the challenges for IMO as being proactive in identifying trends and developments affecting shipping, providing an effective and efficient response to shipping issues so as to avoid regional and unilateral actions, and involving all of IMO in formulating and adopting policy. Paragraph 2.2. The category of heightened environmental consciousness includes the IMO's challenges of

identifying and addressing shipping activities and incidents that could have an adverse impact on the environment and developing effective responses to shipping incidents to mitigate impacts on the environment. Paragraphs 2.5.1, 2.5.3.

13 The acceptance by the Committee of the work agenda item of minimizing the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life fulfils the Organization's Mission Statement and two of the categories of trends, developments, and challenges. Since the Organization provides the forum for addressing international issues affecting commercial shipping, its consideration of this issue will allow for all Member Governments to cooperate on this issue and thus promote environmentally safe, efficient, and sustainable shipping. Furthermore, by developing an effective and efficient response to this environmental challenge, the Committee will be proactive in addressing an identified issue which affects shipping. It will ensure that this issue is considered in a coordinated, consistent manner by all of IMO, thus benefiting the shipping industry, and should also help to avoid regional and unilateral actions. Finally, a comprehensive consideration of this issue by IMO will ensure that all activities and issues involved are fully considered and effective mitigation strategies, as appropriate, are developed.

Strategic Plan: Strategic Directions

14 The issue also falls within at least three of the identified Strategic Directions (SD) set forth in the Organization's Strategic Plan. First, SD1 recognizes that IMO is the primary international forum for technical matters of all kinds affecting shipping and that an inclusive, comprehensive approach will be the "hallmark" of IMO. Second, SD7 states that IMO will focus on reducing and eliminating adverse impacts by shipping on the environment by identifying and addressing possible adverse impacts and developing effective measures for mitigating and responding to such impacts. Third, SD13 recognizes that IMO will seek to enhance environmental consciousness within the shipping industry. The minimization of incidental noise from commercial shipping into the marine environment to reduce potential adverse impacts on marine life involves technical issues and IMO is the primary and appropriate international forum to develop a global response to this issue. Those attending IMO have the technical expertise to identify issues involved and develop effective mitigation strategies. Finally, since many in the shipping industry are unaware of this issue, working on this issue through IMO will enhance their consciousness of this environmental issue and help to ensure that the appropriate players become involved.

Do adequate industry standards exist or are they being developed?

15 Two instruments have been adopted by the Organization that address sources of noise on board ships that may adversely affect those on board: A.468(XII) and MSC/Circ.1014. While the sources of incidental noise may be the same whether they are affecting those on board or marine life (e.g., machinery, propeller), these instruments only focus on the adverse impacts to those on board. Thus, even though there may be some limited benefits to marine life from the adoption of these instruments, they do not address the underwater potential adverse impacts to marine life.

Do the benefits *vis-à-vis* maritime safety, maritime security or protection of the marine environment expected to be derived from the inclusion of the new item proposed justify such action?

16 The benefits *vis-à-vis* maritime safety and protection of the marine environment justify the inclusion of this item on the work programme of the Committee. With regard to maritime safety, there are benefits that may accrue to the crew from the general reduction of noise from commercial shipping through the application of quieting technologies. Measures taken may further minimize the potential for hearing loss and enhance mariners' working conditions, including the ability to communicate verbally, hear audible alarms, and make clear-headed decisions that are necessary to ensure safety of navigation and other essential operations of the ship. They may also help address stress and fatigue caused by noise on board ships.

17 As noted in paragraphs 8-10 above, the introduction of incidental noise from commercial shipping may pose a host of potential problems for many marine animals and adversely impact their critical life functions. Since the number and size of commercial ships are growing, there will be an attendant and ever increasing amount of ambient noise entering the ocean from such ships. Additionally, much of the incidental noise associated with commercial vessels is – and may increasingly be – concentrated in relatively near-shore environments where marine life is also concentrated (Heitmeyer 2004, National Research Council of the U.S. National Academies 2003). Furthermore, the potential for increased vessel traffic in high latitude areas concomitant with retreating polar ice coverage is expected to result in the introduction of shipping noise in large areas that have not historically experienced it. Therefore, there is a pressing and timely need for proactive action to minimize incidental noise from commercial shipping operations to reduce potential adverse impacts on marine life.

Has the analysis of the issue sufficiently addressed the cost to the maritime industry as well as the relevant legislative and administrative burden?

18 The United States is not proposing that legally binding measures be adopted by the Organization and thus there are no mandatory costs to the maritime industry or legislative or administrative burdens. Notwithstanding, it must be recognized that if, for instance, guidelines are developed that recommend the installation of noise reducing technologies on board ships, then such technologies are likely to result in additional cost. There are, however, countervailing considerations. First, including such technologies at the design and construction phase is much more efficient, cost-effective, and practical than retrofitting them at a later stage or affecting where a ship operates or its operational practices. Second, as noted above, sound produced as an incidental by-product of vessel operation serves no particular function in the transportation of goods and may, to some extent, represent wasted energy. Although the underlying technical issues involved are highly complex and need further consideration and validation, quieter vessels could be more cost-effective and efficient to operate and maintain. Thus a minimization of noise may represent a reduction in both propeller cavitation and ship-board vibration and, consequently, result in reduced operational and maintenance costs.

Specific indication of the action required

19 The Committee is invited to identify and address ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life and, in particular, to develop non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices.

An emphasis should be on practical, effective solutions that can be implemented by the shipping industry.

Should the item be assigned a high priority?

21 Paragraph 2.14 of the annex to MSC-MEPC.1/Circ.1 provides for the consideration of establishing the priorities of items on the Committees' work programmes. It is generally noted that a higher priority should be assigned to items that can be shown, or estimated, to have the greatest effect on such things as protection of the environment and the highest ratio of benefit to be gained from the implementation of the proposal compared with the cost of its implementation. The United States believes that this issue warrants high priority. As set forth above, the introduction of incidental noise from commercial shipping operations into the marine environment is growing because of the increasing number and size of ships and such noise may pose adverse impacts on critical life functions of many marine animals. Moreover, even though this issue involves commercial shipping and the Organization is the international entity charged with the responsibility for adopting measures related to shipping, there has been no previous consideration of this issue by the Organization and mariners in large part are unaware of it. Action taken to address it can therefore be expected to have significant benefits. Moreover, since the United States is proposing non-mandatory measures, the cost of any such action is likely to be small compared to the potential benefits.

22 The issue also satisfies several of the specific factors that are to be considered in assigning an issue high priority. The adoption by IMO of measures to minimize the introduction of incidental noise from commercial shipping into the marine environment would promote the widest possible implementation of such measures by the shipping community as a whole and thus avoid regional or unilateral action to address it. Second, there are some that consider noise as a form of pollution (Firestone and Jarvis 2007, Haren 2007, Scott 2007, McCarthy 2004) and it satisfies the factor of the adoption of measures which aim substantially at preventing pollution. Incidental noise from commercial shipping does not, unlike persistent forms of pollution such as heavy metals or greenhouse gases, remain in the marine environment after it is introduced. Thus, the application of strategies to quiet vessel, including in particular quieting technologies, has the potential to reap immediate environmental benefits for marine life. Third, as noted above, quieting commercial ships has a significant likelihood that it will improve the health and safety of ships' crews and any passengers on board the ship.

What is the target completion date?

23 The United States believes that three or four sessions of the Committee are necessary to complete its work on this issue. Therefore the target completion date is either MEPC 61 or MEPC 62; however, progress reports should be submitted to each intervening session of the Committee.

ANNEX 2

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MARINE ENVIRONMENT PROTECTION
COMMITTEE
58th session
Agenda item 19

MEPC 58/INF.19
1 August 2008
ENGLISH ONLY

WORK PROGRAMME OF THE COMMITTEE AND SUBSIDIARY BODIES

Information on Noise from Commercial Shipping Operations and Marine Life

Submitted by Australia

SUMMARY

Executive summary:	This document provides information on the levels of shipping noise in the marine environment, particularly in Australia and Antarctic oceans. It also gives a brief summary of some ship design elements that can assist in minimizing the introduction of noise into the marine environment.
Strategic direction:	1, 7 and 13
High-level action:	1.1.2
Planned output:	1.1.2.3
Action to be taken:	Paragraph 21
Related document:	MEPC 58/19

Introduction

1 In document MEPC 58/19, the United States proposes the addition of a new high priority work item on the MEPC agenda to identify and address ways to minimize the introduction of incidental noise into the marine environment by commercial shipping to reduce the potential adverse impact on marine life. The proposal is to develop non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices.

2 Australia considers that the potential adverse impact on marine life from noise produced by commercial shipping warrants action by IMO, and supports the work programme item proposal and the approach suggested by the United States.

3 This document presents information on recent research in Australia and the Southern Ocean which may be of assistance to the Committee in its deliberations. The purpose of presenting this information is to provide a perspective based on research in Australian and Antarctic oceans where shipping densities are generally lower than in the European and North American waters. In developing internationally relevant guidelines, MEPC will need to recognize the large spatial variations in shipping noise and understand the processes that cause these variations.

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

4 This paper also provides some information on aspects of ship design which can help to mitigate the generation of underwater noise from ships, and considers specific shipping activities that contribute to underwater noise.

The benefits of studying low traffic areas

5 According to Cato & McCauley (2002)¹, ocean noise dependence on position and time is so complex that there is little point trying to ‘map’ ambient noise from point observations. Instead, the processes that generate ocean noise must be understood. Ambient noise in Australian waters is substantially different to that in waters around North America and Europe. Lower levels of shipping traffic noise near Australia and a substantial focus on shallow, tropical waters have allowed the study of aspects of natural noise including rain, wind and biological noise (Cato & McCauley, 2002).

6 In Australian waters, traffic noise varies by as much as 20 decibels with different shipping densities and underwater sound propagation conditions. The wide variation in traffic noise levels in Australia may be more representative of much of the world’s oceans, than North American and European datasets (Cato, 2000)².

7 In northern waters, the wind component has not been discernible from traffic noise, because there are no characteristics of wind noise that can be used to distinguish it from traffic noise (Cato & McCauley, 2002). Biological noise (generated by marine mammals, fish and invertebrates) has also not featured strongly in northern hemisphere ambient noise prediction models, but Australian research has shown that, at least in Australian waters, that this component is of vital importance to a full understanding of ocean noise (Cato & McCauley, 2002).

8 At the request of the Antarctic Treaty Consultative Meeting XXIII in 2000, marine acoustics in the Southern Ocean have been under review by the Scientific Committee on Antarctic Research (SCAR) which most recently reported to ATCM XXIX in 2006 (SCAR, 2006)³. In the absence of high shipping densities, the Southern Ocean provides an opportunity to study natural ocean noise as well as the risk of introducing anthropogenic noise.

9 There are many low frequency natural sounds in the Southern Ocean which can travel long distances, including continuous wave noise, the breaking and movement of sea ice, calving of sea ice, and icebergs dragging on the sea floor (SCAR, 2006). Like the sounds from commercial ships, these noises can travel great distances and contribute to ambient noise in ocean basins. In addition, seismic noise in the Southern Ocean emanates from tectonic plate movements and underwater volcanic activity around the South Sandwich Trench (SCAR, 2006).

¹ Cato, D.H. & McCauley, R.D. (2002) Australian research in ambient sea noise. *Acoustics Australia*, April 2002, pp1-13.

² Cato, D.H. (2000) Ocean noise and the use of sound by marine mammals. *Proceedings of the Acoustics 2000 Conference, Joondalup Resort, Western Australia, 15-17 November 2000*.

³ SCAR (2006) SCAR Report on marine acoustics and the Southern Ocean. ATCM XXIX WP41.

Implications of natural ocean noise for understanding the impact of ambient noise from shipping

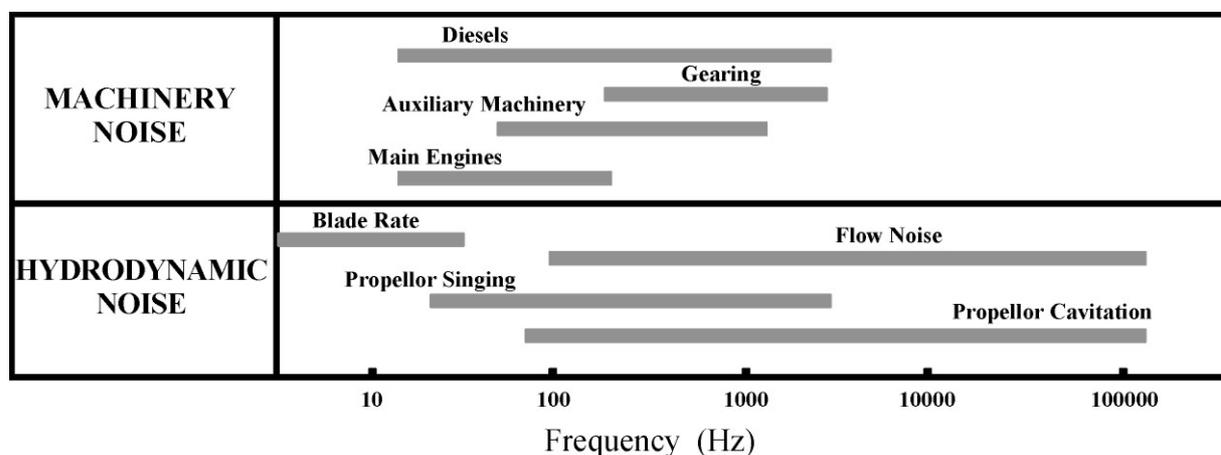
10 Low frequency wind-dependent noise is the dominant prevailing component of ambient noise at frequencies below 200Hz in the Australian region. Winds of 15-20m/s generate sea conditions leading to underwater noise that is comparable to the high levels of traffic noise in North American waters. For a significant proportion of time, wind-dependent noise is at similar levels to shipping traffic noise (Cato, 2000)⁴.

11 Wind and biological noise add significantly to ambient noise at low frequencies, and this suggests that marine animals have always been subject to noise levels that are often comparable to moderate or high levels of traffic noise (Cato, 2000). Since there is no acoustical distinction between the traffic and wind-dependent noise, both sources are limiting to the use of sound by marine life (Cato, 2000). Natural variations in ambient noise over the range between 10Hz and 20kHz is about 20dB, with extremes of 30dB. This variation is typical and common, so marine animals must cope with regular variation in the distance over which their use of sound is effective.

12 It has been supposed on the basis of data from high shipping densities that there was once a ‘noise notch’ of low frequencies that were exploited by whales, but is no longer available due to traffic noise. However, a consideration of the wind and other natural noise sources indicates that the contribution of shipping to ambient noise in high traffic areas has actually been to remove the ‘quiet times’ when wind and biological noise is low (Cato, 2000; Cato, in press⁵).

Types and control of ship-sourced noise

13 Ships generate underwater noise over a broad range of frequencies, from <10Hz to >100kHz as represented in the diagram below (Source: Norwood)⁶.



14 If a vessel is to meet specified noise requirements, then these requirements need to be clearly defined and incorporated during the design phase, as retro-fitting noise control treatments can cost two to three times what it would have cost during construction, as well as taking additional installation time and adding weight to the vessel (Norwood).

⁴ Cato, D.H. (2000) Ocean noise and the use of sound by marine mammals. *Proceedings of the Acoustics 2000 Conference, Joondalup Resort, Western Australia, 15-17 November 2000.*

⁵ Cato, D.H. (in press) The effects of noise on aquatic life.

⁶ Norwood, C. (not dated) *Noise from vessels and its control.* Teaching materials, Defence Science and Technology Organization, Australia.

15 There are a number of design elements that are known to reduce the generation and transmission of noise by a vessel. For example, measures that may be incorporated into machinery design include resilient mounting of equipment with flexible pipe couplings, optimization of machinery frequencies in comparison with the natural frequencies of mountings and connections, effective balancing of machinery, design and quality of bearings, optimization of tooth pitch and helix angle in gearing, and precision in gear fabrication. Pumps can be chosen and designed to closely match flow requirements as they are generally quietest when working at or near design point. Electrical equipment can be dynamically balanced, designed with quieter cooling fans and optimized in terms of flux densities and machine speed (Norwood).

16 The hull design is also important in controlling noise, particularly through the reduction of turbulence – elliptical bow shape, no abrupt changes of shape in the waterline, minimization and alignment with flow of appendages and fittings, flush welds, undistorted plates and smooth paintwork (Norwood).

17 Propeller cavitation is the formation then collapse of water vapour bubbles as water moves across a propeller blade. If propeller cavitation occurs, it will be the dominant noise source and increases noise levels by about 20dB in the 80Hz to 100kHz band. While all propellers will cavitate if sufficiently loaded, cavitation can be avoided under normal operating conditions through good design – optimizing load, ensuring uniform water flow into propellers which can be influenced by hull design), and careful selection of propeller size and blade section, pitch and camber (Norwood).

18 Propellers can also ‘sing’ when the frequency the turbulence created by the propeller matches the natural frequency of the propeller itself. The resonance produced results in the emission of an intense tone, which can cause hull vibration and transmission of the sound within the vessel and through the water (Norwood).

19 Finally, specific shipping activities can generate underwater noise. For example, ice-breaking ships introduce continuous, loud noise, and this continuous noise can produce a temporary change in an animal’s auditory sensitivity (“Temporary Threshold Shift” or TTS) at lower levels than pulsed sound (SCAR, 2006). Shipping in the Southern Ocean includes supply ships, tourist, fishing, research and military vessels. These operations, although relatively infrequent, are more common during the summer months, and also tend to be concentrated on particular localities. Tourist vessels, in particular, focus on wildlife so activities are often conducted near wildlife breeding sites (SCAR, 2006). Coordination and management of the intensity of tourist activities in sensitive areas could take into account noise impacts from icebreaking and other incidental ship-sourced noise.

Recommendation

20 Australia welcomes the proposal for a new work programme item on minimizing the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life.

Action requested of the Committee

21 The Committee is invited to consider the information presented in this document in its further deliberations on this issue.

delegations on the inadequacy of information and statistics on incidents and ships strikes with cetaceans and its impacts, and provided a summary of the data collected by the IWC Vessel Strike Data Standardization Group. Document MEPC 58/INF.15 (Spain) provided information on the work being undertaken in Spain to improve safety of navigation and enhance the conservation of cetaceans.

18.6 Several delegations and non-governmental organizations expressed support for the development of a guidance document for minimizing the risk of ship strikes with cetaceans.

18.7 The Committee, recognizing that further work was needed to fully develop the draft guidance document, agreed to invite delegations to provide comments on the draft guidance document, as submitted by the United States in document MEPC 58/18, with a view to approval at its next session for circulation as an MEPC circular.

19 WORK PROGRAMME OF THE COMMITTEE AND SUBSIDIARY BODIES

Proposal for a new item on noise from commercial shipping and its adverse impacts on marine life

19.1 The Committee noted a proposal by the United States (MEPC 58/19) on the development of non-mandatory technical guidelines to minimize the introduction of incidental noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life and its inclusion as a new work programme of the Committee with target completion date of three or four sessions, starting from MEPC 59 (July 2009).

19.2 The Committee also noted a submission by Australia (MEPC 58/INF.19), which provided additional information on ship traffic noise in the southern hemisphere (Australia and the Southern Ocean) consisting of machinery noise (main engines, gearing) and hydrographic noise (flow, propeller singing/cavitation) that overlap with sounds (between 10 Hz and 1 KHz) produced by certain mammals such as seals, sea lions and whales as well as some fish with potential to disturb behaviour and interfere with critical life functions of marine life.

19.3 In accordance with paragraph 2.20 of the Committees' Guidelines (MSC-MEPC.1/Circ.2), the Chairman made a preliminary assessment on the proposed new work programme by the United States. The Chairman's assessment showed that the criteria for general acceptance provided in paragraph 2.10 of the Committees' Guidelines had been met.

19.4 During deliberation, some delegations suggested that this new work programme item should be considered as a low priority item in the work programme of the Committee. The Chairman informed the Committee that prioritization of work programme items would only be made when it is forwarded to the sub-committees for consideration.

19.5 The Committee, having considered the proposal by the United States, approved the inclusion of a new item in the agenda of MEPC 59 (July 2009) on "Noise from commercial shipping and its adverse impacts on marine life" with a target completion date of three or four sessions and invited Member Governments to submit appropriate documents to MEPC 59 for consideration.

19.6 The Committee also approved the establishment of an intersessional correspondence group, as proposed in paragraph 7 of document MEPC 58/19, co-ordinated by United States³ with the following terms of reference:

- “.1 identify and address ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life, in particular develop voluntary technical guidelines for ship-quieting technologies as well as potential navigation and operational practices; and
- .2 provide a written report to MEPC 59.”

Work programme and provisional agenda of the BLG Sub-Committee

19.7 The Committee recalled that MSC 84 (7 to 16 May 2008) noted that MEPC 57 had agreed to include, in the work programme of the BLG Sub-committee and the provisional agenda for BLG 13, high-priority items on “Review of relevant non-mandatory instruments as a consequence of the amended MARPOL Annex VI and the NO_x Technical Code” and on “Amendments to MARPOL Annex I on the use and carriage of heavy grade oil on ships in the Antarctic area”, both with a target completion date of 2010 (MSC 84/24, paragraph 22.5).

19.8 The Committee noted that MSC 84 had revised and approved the work programme of the BLG Sub-Committee and the provisional agenda for BLG 13 and requested the Secretariat to inform the MEPC accordingly (MSC 84/24, paragraphs 22.7 and 22.8).

19.9 The Committee considered document MEPC 58/19/1 (Secretariat) and approved the work programme of the BLG Sub-Committee and provisional agenda for BLG 13, requesting the Secretariat to inform the MSC accordingly. The work programme of the BLG Sub-Committee and provisional agenda for BLG 13 are set out in annex 29.

Work programme and provisional agenda of the FSI Sub-Committee

19.10 The Committee noted that MSC 84 had revised and approved the work programme of the FSI Sub-Committee and provisional agenda for FSI 16 (MSC 84/24, paragraphs 22.31 and 22.32).

19.11 The Committee also noted that MSC 84 had agreed:

- .1 to instruct the FSI Sub-Committee to develop appropriate amendments to the Survey Guidelines under the HSSC (resolution A.997(25)) to explain the possibility of alternative arrangement where on bottom inspection in dry dock may be substituted by a bottom inspection with the ship in water (MSC 84/24, paragraph 22.26); and

³ **Co-ordinator:**

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