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An Update on Recent Noise Pollution Issues

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Information Paper Submitted by ASOC to the XXIX ATCM¹

(CEP Agenda Items 6, 7 and 8, ATCM Agenda Items 7, 10 and 14)

I. Introduction

The categorisation of undersea noise as a source of pollution and as a potential threat to marine biodiversity began in the early 1990s in response to a coincidence of three focusing events.² Namely: the shock testing of vessels by the US Navy; the transmission of up to 205 decibels of sound off Heard Island as part of the Acoustic Thermometry of Ocean Climate (ATOC) experiment; and the testing of low- and mid- frequency active sonar by US, Australian and NATO naval vessels. Somewhat less controversial, but arguably no less serious, is undersea noise resulting from seismic surveys, dredging and construction activities, shipping, offshore wind farms, sonar use associated with fishing and ocean science experiments.

Recent scientific research indicates that sources of undersea noise such as military sonar can cause cetaceans and other marine mammals' physiological damage.³ Moreover, recent instances of atypical mass strandings have been linked to the testing of tactical mid-frequency active sonar.⁴ The presence of undersea noise may also result in the exclusion of cetaceans from important habitats or impede reproductive and feeding patterns.⁵ Finally, it should be noted that comparatively little research has been undertaken in connection with the impact of undersea noise on species other than cetaceans, such as fish and deep sea squid.⁶ In this regard no such research has been carried out in respect of diving birds such as penguins and cormorants.

The issue of noise pollution and in particular, its impact on cetaceans, has reached the attention and the agenda of a number of international organisations concerned with the protection of the marine environment and the protection of biodiversity. These organisations include the International Whaling Commission (IWC)⁷ and the 1979 Convention on Migratory Species.⁸ Both ASCOBANS 1992⁹ and ACCOBAMS 1996¹⁰ have adopted resolutions on undersea noise and cetaceans and in particular, have addressed noise resulting from seismic surveys and whale watching activities.¹¹ More generally, the impact of undersea noise on

¹ ASOC thanks Sarah Dolman and Karen Scott for their role in developing this Information paper.

² The term focusing events has been adopted by McCarthy, *International Regulation of Underwater Sound: Establishing Rules and Standards to Address Ocean Noise Pollution* (2004) at 83.

³ Jepson *et al*, *Gas-Bubble Lesions in Stranded Cetaceans* (2003) 425 *Nature* 575. See also Fernández *et al*, *Whales, Sonar and Decompression Sickness* (2004) 428 *Nature* an online Brief Communication published 15/04/2004 available at: <http://www.nature.com>.

⁴ *Id.*; Balcomb and Claridge, "A Mass Stranding of Cetaceans Caused by Navel Sonar in the Bahamas" (2001) 2 *Bahamas Journal of Science* 1 – 12; Simmonds and Lopez-Jurado, "Whales and the Military" (1991) 351 *Nature* 448.

⁵ Richardson, Greene, Malme and Thomson, *Marine Mammals and Noise* (1995) chapter 9.

⁶ But see McCauley *et al*, "High Intensity Anthropogenic Sound Damages Fish Ears" (2003) 113 *J. Acoust. Soc. Am* 638 – 642; Popper, "The Impacts of Anthropogenic Sounds on Fishes" (2001) 110(5) pt. 2 *J. Acoust. Soc. Am.* 2750; Stocker, "Ocean Noise Could Injure More than Mammals" (2004) 430 *Nature* 291.

⁷ See the 1998 Report of the Scientific Committee, *J. Cetacean Res. Manage. 1 (Suppl.)* (1999) Annexes H and U and Appendix 6; 1999 Report of the Scientific Committee, *J. Cetacean Res. Manage. 2 (Suppl.)* (2000), 64 – 65; 2001 Report of the Scientific Committee, *J. Cetacean Res. Manage. 4 (Suppl.)* (2002), 41; 2003 Report of the Scientific Committee, *J. Cetacean Res. Manage. 6 (Suppl.)* (2004) 12.3.5 and Annex K; 2004 Report of the Scientific Committee; *J. Cetacean Res. Manage. 7 (Suppl.)* (2005) 12.2.5. and Annex K; 2005 Report of the Scientific Committee, to be published in the *J. Cetacean Res. Manage. 8 (Suppl.)* (2006) 12.3.5 and Annex K.

⁸ See CMS Resolution 8.22 (2005) on Adverse Human Induced Impacts on Cetaceans which lists marine noise as one of six impacts which must be addressed through threat abatement activities.

⁹ Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea.

¹⁰ Agreement on the Conservation of Cetaceans for the Black Sea and Mediterranean Sea.

¹¹ See MOP4: Resolution No. 5 on Effects of Noise and of Vessels (ASCOBANS, Esbjerg 2003) and Resolution 2.16 on Assessment and Impact Assessment of Man-Made Noise (ACCOBAMS, Palma de Mallorca, 2004).

marine life has been identified as an issue that would benefit from future attention of the General Assembly by the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS) in its fifth report published in 2004.¹² As a consequence of this recommendation, the United Nations General Assembly in Resolution 60/30 (2005) declared that it “encourages further studies and consideration of the impacts of ocean noise of marine living resources.”¹³

The Committee on Environmental Protection has discussed undersea noise in the Southern Ocean at Antarctic Treaty Consultative Meetings since 2000¹⁴ and the topic has benefited from examination by SCAR through workshops held in 2002, 2004 and 2006.

II. Marine Noise Pollution and the Southern Ocean

SCAR is playing a key role in relation to noise pollution issues within the Antarctic Treaty, the Madrid Protocol and CCAMLR. ASOC welcomes SCAR’s recent workshop on the issue,¹⁵ which builds on previous workshops held in 2004¹⁶ and in 2002.¹⁷

Working Paper 023, presented by SCAR to XXV ATCM in 2002, made a number of important suggestions as to how this issue should be pursued in the field, including:

- (i) Research into the hearing and reaction to noise of Antarctic animals and into sound propagation conditions around Antarctica;
- (ii) Records of the locations, timing, duration, frequency, and nature of hydroacoustic and other activities should be maintained to permit retrospective assessment of the likely causes of any future observed changes in the distributions, abundance, or productivity of the potentially affected species and populations; and,
- (iii) Further research is needed to assess how well measures work and to monitor better the proximity of wildlife to a vessel. The Antarctic community and permitting agencies will need to monitor research progress to ensure practices are up-to-date.

ASOC encourages each of the Parties to pursue these important SCAR recommendations. ASOC looks forward to the presentation by SCAR to this ATCM of the results from its Cadiz workshop of experts, which met earlier this year.

Appendix 1 documents some recent scientific developments. **Significantly, the received level at the animal can be just as high at 12 km as at a range of 2 km from the seismic array. Indeed, higher received levels have been recorded at distance than closer to the source.**¹⁸ Given that it is not realistic to limit mitigation of potential impacts to within an observable radius of the sound source, wider protection remains an important consideration as a management option. The creation of MPAs that take noise pollution into account should ensure protection of areas of critical and productive habitats, and particularly of vulnerable and endangered populations. ASOC therefore

¹² See the *Fifth Report on the Work of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea* (2004) A/59/122 at para. 97(a).

¹³ A/Res/60/30 *Oceans and the Law of the Sea* (29 November 2005) at para. 84.

¹⁴ ASOC has submitted a series of Information Papers to the ATCM as well as to CCAMLR during the past few years. Those submitted to ATCMs are listed in the Appendix, while those submitted to CCAMLR can be found on the ASOC website (www.asoc.org) in the CCAMLR section.

¹⁵ SCAR, *Paper to CEP*, (2006).

¹⁶ Boebel *et al.*, *Risk Assessment of ATLAS HYDROSWEEP DS-2 Hydrographic Deep Sea Multi-beam Sweeping Survey Echo Sounder* (2005). Poster at the US-MMC/JNCC-UK International Policy Workshop on Sound and Marine Mammals, London, 28-30 September 2004.

¹⁷ O’Brien, *Impacts of Marine Acoustic Technology on the Antarctic Environment*, (2002) Report of the SCAR Ad Hoc Group on marine acoustic technology and the marine environment. 67 pages.

¹⁸ Madsen *et al.* *Quantitative measures of air gun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments*, (2006).

welcomes the efforts to pursue MPAs in the Southern Ocean (under both CCAMLR¹⁹ and through Annex V to the Environmental Protocol) and requests that noise pollution be considered as one basis for establishing MPAs.

Seismic surveying has been a focus of attention with regard to intense noise pollution in the Southern Ocean. Yet there are other noise sources that also require consideration. Levels of marine noise pollution in the Southern Ocean are undoubtedly lower than in most other parts of the world. However, particularly on a localised level, this does not lessen the significance of negative impacts to discrete populations.

There continues to be increasing interest in the Southern Ocean by a range of sectors. Research activities (both vessel and land based), shipping, military activities²⁰ and tourist vessels, including whale watching, have all been shown to impact marine mammals.²¹ Appendix 1 briefly documents some studies on the negative impacts of an increasing whale watching industry. We note that the Parties to the Madrid Protocol commit themselves to the comprehensive protection of the Antarctic environment and dependent and associated ecosystems. While noise concerns are only one element of concern with regard to whale watching activities, with the rapidly increasing tourism industry in the region,²² and the dependence upon whale watching as a key feature, independent review of the IAATO Marine Wildlife Watching Guidelines to ensure suitability and enforcement may be required.

III. Conclusions and Recommendations

Noise pollution is recognised in an increasing number of national and international fora. SCAR has been successful in maintaining an interest within the Antarctic community since 2002. There have been significant scientific and legal developments in the last year, and ongoing efforts in many parts of the world to manage and mitigate the negative impacts of noise pollution.

We believe it appropriate for the CEP to make a series of recommendations to the ATCM that will lead to actions to ensure the effective, holistic and long-term protection of marine mammals in the Southern Ocean. We therefore make the following recommendations:

1. Assessing Noise Implications of Activities as Part of the IEE and CEE Procedures

ASOC recommends that the noise impacts of all activities taking place within the Antarctic Treaty Area be subject to an initial environmental evaluation (IEE) or comprehensive environmental evaluation (CEE) (as appropriate), as required under Article 8 and Annex I of the Environmental Protocol.

In the past it has been apparent that the practice of assessing the noise impacts of an activity has not been consistent.²³ Where an activity is likely to have a minor or transitory undersea noise impact, that activity and its acoustic impact, must be subject to an initial environmental evaluation. The IEE must consider the cumulative impact of the acoustic implications of the activity. Where an activity is likely to have more than a minor or transitory impact, the CEE must consider possible indirect impacts of the activity and (where appropriate) include a discussion of monitoring programmes and mitigation measures.²⁴

ASOC notes the additional obligation to undertake reasonable preventative measures designed to reduce the risk of environmental emergencies and their potential adverse impact as provided for under Article 3 of Annex VI on Liability and Emergency Response Action to the Protocol adopted in Stockholm in 2005.

¹⁹ CCAMLR's Scientific Committee convened its first-ever intersessional workshop on Marine Protected Areas in August 2005, and the workshop report presented to CCAMLR was endorsed by the CCAMLR Commission later in 2005. A work plan was approved and is proceeding, chaired by Dr. Polly Penhale (US National Science Foundation).

²⁰ Although Treaty provisions create prohibitions, military activities or potential impacts that extend into the Antarctic Treaty and CCAMLR areas cannot be discounted.

²¹ Richardson, Greene, Malme and Thomson, *Marine Mammals and Noise* (1995)

²² See, for example, ASOC and UNEP, *Antarctic Tourism Graphics: An overview of tourism activities in the Antarctic Treaty Area* (2005) Information Paper to XXVIII ATCM.

²³ As noted by SCAR in WP-023 (2002).

²⁴ See further Resolution 4 (2005) which updates the EIA guidelines.

ASOC recommends that the ATCM adopt a Resolution requesting all Parties to consider the acoustic impacts of all their activities as part of the IEE or CEE procedure, as appropriate.

ASOC further recommends that Parties resume their examination of the term “minor and transitory” as it is used in Article 8 and Annex 1 of the Protocol, and that they expressly consider the acoustic impacts of activities, and the cumulative impacts of such activities, when they agree on a definition of this term.

2. Noise Mitigation

ASOC recommends that monitoring be conducted from all scientific vessels that operate intense noise sources in the Southern Ocean.

The limitations of on-board mitigation with regard to seismic sources were presented in ASOC’s 2005 Information Paper, and have been further reviewed in Appendix 1. However, as this is currently the most widely used practice to protect marine mammals from the harmful impacts of intense noise pollution, precautionary measures for marine mammal mitigation during seismic surveys would be a useful and timely development in the Antarctic.²⁵

3. Creation of Marine Protected Areas

ASOC recommends that waters within the Antarctic Treaty Area where biologically important activities occur should be entirely protected from the effects of high-intensity underwater sound.

As previously noted by ASOC, well designed and managed MPAs can play a key role in the conservation of cetaceans and marine ecosystems.²⁶ The Ad Hoc Open-Ended Working Group on Protected Areas established under the auspices of the 1992 Convention on Biological Diversity has noted that marine areas beyond national jurisdiction in the Southern Ocean should be categorised as priority areas for MPA protection and targeted conservation action.²⁷ The 1991 Environmental Protocol provides a mechanism for the creation of MPAs within the Antarctic Treaty Area. Under Annex V of the Protocol, Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMAs) may be designated and these may comprise (wholly or in part) marine ecosystems. Within these areas, activities may be prohibited, restricted or managed in accordance with management plans developed pursuant to the Annex.²⁸ ASOC recommends that waters where biologically important activities occur are designated ASPAs and that those activities resulting in high-intensity underwater sound should be prohibited or restricted as appropriate therein.

ASOC further recommends that the ATCM and CCAMLR explore mechanisms for establishing MPAs beyond the Antarctic Treaty Area within the Southern Ocean with a view to minimising noise pollution within the Southern Ocean. ASOC welcomes, and requests the ATCM to take notice of, the report prepared by the Ad Hoc Open-Ended Working Group on Protected Areas established under the auspices of the 1992 Convention on Biological Diversity entitled *Options for Cooperation for the Establishment of Marine Protected Areas Beyond the Limits of National Jurisdiction* (2005).²⁹

4. Liaison with other international bodies

ASOC recommends that a closer working relationship is developed between SCAR and other international bodies that have experience working on noise pollution issues. A prominent example is the Scientific Committee of the International Whaling Commission (IWC), where noise has been on the agenda since 1998. In 2006 the IWC is holding a Workshop on Seismic Surveys and their Potential Impacts to Cetaceans just before its regular meeting.

²⁵ See, for example, Weir et al., Marine mammal mitigation during seismic surveys and recommendations for worldwide standard mitigation guidance. (2006) Paper presented to IWC Scientific Committee.

²⁶ IP 59 (2005). See also Hoyt 2005.

²⁷ UNEP/CBD/WG-PA/1/2 (20 April 2005) *Options for Cooperation for the Establishment of Marine Protected Areas Beyond the Limits of National Jurisdiction* at para. 13(c).

²⁸ Annex V, Article II.

²⁹ UNEP/CBD/WG-PA/1/2 (20 April 2005)

Appendix 1

Only developments between May 2005 and April 2006 are briefly noted in this Appendix. For scientific and legal developments prior to this period please see the following information papers submitted by ASOC to previous ATCMs: IP 59 (2005), IP 56 (2004) and IP 73 (2003). Further background information can be found in the references section of this Appendix. In particular, the results of the SCAR Action Group on the Impacts of Acoustic Technology on the Antarctic Marine Environment (2004 Workshop) are reproduced in *Antarctic Science* 17(4) 533 – 540 (2005).

1. Recent Scientific Developments

Mounting evidence indicates that high-intensity anthropogenic sound from sonar and airguns leads to strandings, injury and mortality of beaked whales³⁰ and other cetacean species. There have been several focusing events since XXVIII ATCM in Stockholm, Sweden in June 2005.

a) Military sonar

The first was a multi-species stranding of 33 short-finned pilot whales, *Globicephala macrorhynchus*, a minke whale, *Balaenoptera acuturostrata*, and two dwarf sperm whales, *Kogia sima*, in North Carolina, United States, in January 2005. The unusual conditions surrounding this event prompted the Federal government to determine it an Unusual Mortality Event. Naval activity using tactical mid-frequency sonar transmissions were spatially and temporally associated with the stranding and had a number of other features in common with other sonar-related strandings (e.g. the 'atypical' distribution of strandings involving multiple offshore species, all stranding alive, and without evidence of common infectious or other disease process).³¹

Secondly, a mass stranding of Cuvier's beaked whales, *Ziphius cavirostris*, occurred on the Spanish coast of Almería in January 2006.³² As in previous mass stranding events, involving beaked whales on the Canary Islands in 2002 and 2004, in the presence of military activities,³³ the Almería event was an 'atypical' stranding – a term that is becoming increasingly familiar, and appears to be a reliable indicator of localised intense noise pollution. Further, pathological findings of the animals in Almería revealed that all four animals showed gas and fat embolic syndrome - as has also been identified in the 2002 and 2004 events.

A further mass stranding in which at least 145 long-finned pilot whales, *Globicephala melas*, perished, occurred in Tasmania, Australia, 25 – 27 October 2005. Mass strandings of this species in this area have occurred seven times over the previous 50 years. However, at the time of this latest stranding event, two Royal Australian Navy mine-hunting vessels were conducting a search in the region using high-frequency sonar. The Federal Government instigated an incident review which found that the first stranding event was unrelated to either the presence or activities of the Navy ships as it occurred at least six hours prior to the ships arriving in the area. However, behavioural responses of the whales to the sonar transmissions were not discounted because of the coincidence in time and space of the sonar transmissions, and the second, and possibly third, stranding events. Biological samples, including heads, were collected and will be analysed for signs of trauma and other pathology.³⁴

³⁰ Hildebrand, "Impacts of Anthropogenic Sound" (2005) in J.E. Reynolds et al. (eds), *Marine Mammal Research: Conservation beyond Crisis*. The Johns Hopkins University Press, Baltimore, Maryland. Pages 101-124.

³¹ Hohn et al., Report on Marine Mammal Unusual Mortality Event UMESE0501Sp: Multi species stranding of short-finned pilot whales (*Globicephala macrorhynchus*) minke whale (*Balaenoptera acuturostrata*) and dwarf sperm whales (*Kogia sima*) in North Carolina, 15 – 16 January 2005. (2006) NOAA Technical Memorandum NMFS – SEFSC 537.

³² Fernández, Beaked whale (*Ziphius cavirostris*) mass stranding on Almería's coasts in southern Spain, 26th – 27th January 2006. (2006) Report of the University of Las Palmas de Gran Canaria, Canary Islands.

³³ Fernández *et al.*, *New gas and fat embolic pathology in beaked whales stranded in the Canary Islands*. (2005) Poster presented to the European Cetacean Society Conference, La Rochelle, France. 4 – 6 April 2005.

³⁴ Department of Environment and Heritage, *Marion Bay Whale Stranding. Incident Review Findings*. (2005). See <http://www.deh.gov.au/coasts/publications/marion-bay-strandings-2005.html>.

In a further compelling case, a non-stranding event occurred in Hawaii, in July 2004 involving 150 – 200 melon-headed whales, and subsequently, a stranded calf. Melon-headed whales, like other blackfish,³⁵ are generally pelagic and deep diving species that live in well structured family groups. The whales gathered in the shallow waters of Hanalei Bay during the use of mid-frequency sonar, and remained in the Bay for over 28 hours, when they were returned to deeper waters by human assistance. The event was spatially and temporally correlated with the Rim of the Pacific exercises (RIMPAC) involving the US and other Rim-of-the-Pacific Navies. The government report concluded that the sonar use was a “plausible, if not likely” cause of the embayment, citing the “close spatiotemporal correlation” and “the absence of any other compelling causative explanation,” among other evidence.³⁶

Significantly, some governments are increasingly mitigating the impacts of noise in their domestic waters. As an exceptional example, Spain has implemented a moratorium in its waters around the Canary Islands in response to a series of beaked whale mortalities associated with military activities. A number of other countries have implemented guidelines for the protection of cetaceans, and in some cases pinnipeds, from the potential impacts of military activities, seismic activities or both (for example, Australia). New Zealand has recently finalised its national seismic guidelines³⁷ and Australia is currently reviewing its seismic guidelines.³⁸ Other countries with seismic guidelines include the United Kingdom, United States, Brazil, Canada and Russia (for operations around Sakhalin Island).

b) Seismic surveys

The IUCN (World Conservation Union) convened the Interim Independent Scientists Group (IISG) to review Sakhalin Energy’s plans for mitigation of the critically endangered population of western North Pacific gray whales in their feeding habitat on the Sakhalin Shelf during the industry’s 2006 construction season.³⁹ The IISG made a number of recommendations for the monitoring, mitigation and management of noise impacts. Significantly, it proposed thresholds for noise exposure and real-time acoustic monitoring. Based on previous research,⁴⁰ the IISG set 120 dB re 1 μ Pa as a criterion threshold for response. Such a low received level would be a significant distance from the source vessel and the practicalities of monitoring are complicated.

Airgun operations appear to affect the foraging behaviour of sperm whales, and possibly reduce their foraging rate, even at moderate received levels.⁴¹ When sperm whales were close to the surface, the first arrival of airgun pulses contained much energy between 0.3 and 3 kHz, a frequency range well beyond the normal frequencies of interest in seismic exploration. This increases concern of the potential impact on toothed whales with assumed poor low-frequency hearing, and particularly for those species that spend more time traveling and socialising near the surface.⁴² Further, the received level of first pulse arrivals can be just as high at 12 km as at a range of 2 km from the seismic array. Indeed, secondary arrivals have higher received levels at 5 – 12.6 km than they do at ranges closer to the source.

³⁵ Blackfish includes Orcas, *Orcinus orca*, Pilot whales, *Globicephalus sp.*, False killer whales, *Pseudorca crassidens*, Melon-headed whales, *Peponocephala electra* and Pygmy killer whales, *Feresa attenuata*.

³⁶ Southall, B. L., R. Braun, F. M. D. Gulland, A. D. Heard, R. W. Baird, S. M. Wilkin and T. K. Rowles. 2006. Hawaiian melon-headed whale (*Peponocephala electra*) mass stranding event of July 3-4, 2004. NOAA Technical Memorandum NMFS-OPR-31. 73 pp.

³⁷ Department of Conservation, *Guidelines for minimising acoustic disturbance to marine mammals during seismic survey operations*. (2006)

³⁸ Department of Environment and Heritage, *Guidelines on the application of the Environment Protection and Biodiversity Conservation Act to interactions between offshore seismic operations and larger cetaceans*. (2001) See <http://www.deh.gov.au/epbc/policy/seismic/index.html>.

³⁹ IUCN, Report of the Interim Independent Scientists Group (IISG) on Mitigation Measures to Protect Western Gray Whales During Sakhalin II Construction Operations in 2006. (2006). See http://www.iucn.org/themes/business/ISRP_Followup/Final%20Vancouver%20II%20report%20with%20SAKHALIN%20ENR%20RGY.pdf.

⁴⁰ Malme *et al.* *Observations of feeding gray whale responses to controlled industrial noise exposure*. (1988). pp. 55-73. In: W.M. Sackinger, M.O. Jefferies, J.L. Imm and S.D. Treacy (eds.) Vol. 2. Port and Ocean Engineering under Arctic Conditions. University of Alaska, Fairbanks, AK. 111pp.

⁴¹ Miller *et al.* *At-sea experiments indicate that airguns affect the foraging behaviour of sperm whales in the Gulf of Mexico*. (2006)

⁴² Madsen *et al.*, *Quantitative measures of air gun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments*. (2006).

c) *Whale watching*

Longer call duration of killer whales (*Orcinus orca*) was reported in the presence of increased whale watch boat traffic. The authors suggested that the response seems to be initiated to counteract anthropogenic noise once it reaches a critical level.⁴³ The responses of adult male killer whales to approach by a few (1-3) vessels versus many (>3) vessels were documented. Responses of killer whales to different numbers of vessels differed significantly. This data highlights the subtlety in response, that had the data been pooled these significant responses would have been masked, leading to a false suggestion that boat presence had no effect. The interpretation of biological significance of null findings from impact assessments is problematic, and highlights the need for consideration of statistical power, experimental design and appropriateness of response variables.⁴⁴

2. Recent Legal Developments

During the period May 2005 – April 2006 acoustic marine pollution was both identified, and (to an extent) addressed, by a number of global and regional organisations.

a) *United Nations General Assembly*

In its 2005 Resolution on Oceans and the Law of the Sea (A/RES/60/30) the UN General Assembly declared that it “encourages further studies and consideration of the impacts of ocean noise on marine living resources” (at paragraph 84). This is the first time the General Assembly has directly referred to undersea noise in a resolution and attests to its increasing profile as a source of marine pollution.

b) *International Whaling Commission*

The Scientific Committee established under the auspices of the IWC discussed issues related to anthropogenic noise and its potential effects on cetaceans as reported to the 57th Annual Meeting held in Ulsan, Republic of Korea (20 - 24 June 2005). The Committee recommended that producers of high-intensity noise (e.g. sonar and seismic operators) share information on noise source characteristics and work with cetacean scientists to investigate the impacts of these activities. Having held already a symposium on acoustic impacts at the 56th Annual Meeting held in Sorrento, Italy (29 June-10 July 2004), a two-day workshop assessing the potential for seismic surveys to impact on cetaceans is due to be held in advance of the 2006 IWC meeting.⁴⁵

c) *1979 Convention on Migratory Species*

At the Eighth Conference of the Parties held in Nairobi (20 – 25 November 2005) the Parties to CMS adopted Resolution 8.22 entitled *Adverse Human Impacts on Cetaceans*. Resolution 8.22 requests the CMS Secretariat and Scientific Council to review the extent to which CMS and CMS related agreements address six human induced impacts on cetaceans including marine noise (paragraph 3.b). Paragraph 1 of Resolution 8.22 “urges Parties and non-Parties which exercise jurisdiction over any part of the range of cetacean species listed on the appendices of CMS, or over flag vessels which are engaged outside national jurisdictional limits to cooperate as appropriate with relevant international organizations; and to promote the integration of cetacean conservation into all relevant sectors by coordinating their national positions among various conventions, agreements and other international fora.”

d) *1996 ACCOBAMS*

At the Third Meeting of the Scientific Committee (Cairo, Egypt, 15 – 17 May 2005) the Chair presented a document entitled “Recommendations and Guidelines to address the impact of anthropogenic noise on marine mammals in the Mediterranean Sea: toward a permit system for the ACCOBAMS area.”⁴⁶ Although establishing a permit system is not required by MOP Resolution 2.16 and a number of members expressed concern about the feasibility of the measures, the Scientific Committee decided to prepare a programme of work and to ask the Secretariat to contact an

⁴³ Foote et al. “Whale-call response to masking boat noise” (2004) *Nature*, 910.

⁴⁴ Ashe and Williams Killer whale responses to boats varies with boat number: Implications for experimental design of vessel impact assessments. (2006). Presentation to the 20th Annual Conference of the European Cetacean Society.

⁴⁵ *Chair’s Report of the 57th IWC Meeting* (Ulsan, Republic of Korea) (20 – 24 June 2005) at para. 11.1.1.

⁴⁶ SC3/Doc. 20 (2005)

expert to prepare draft guidelines for the ACCOBAMS area, including the relevant justification and rationale. The draft guidelines are due to be submitted to the next meeting of the Scientific Committee.⁴⁷

e) 1992 ASCOBANS

Noise pollution and other forms of disturbance were discussed at the Thirteenth Advisory Committee Meeting held between 25 and 27 April 2006. Draft Resolution No. 4 addresses the adverse effects of noise, vessels and other forms of disturbance on small cetaceans. It requests parties to introduce guidelines in connection with measures and procedures for seismic surveys and to conduct research into other sources of undersea noise. This resolution will be presented to the Fifth Meeting of the Parties due to take place between 19 – 22 September 2006. The UK has submitted reports on the use of offshore explosives by the UK (2003 – 2005) and the conduct of seismic activities (2004 – 2005) in connection with the Thirteenth Advisory Committee Meeting.⁴⁸ Previously Resolution No. 4 (2000) and Resolution No. 5 (2003) were adopted to address the issue of underwater noise.

⁴⁷ *Report of the Third Meeting of the Scientific Committee* (Cairo, 15 – 17 May 2005) agenda item 5.6.

⁴⁸ Document AC13/Doc.33(P) and Document AC13/Doc.36(P) respectively.

References and Bibliography

- Aguilar de Soto, N., Johnson, M., Díaz, F., Domínguez, I., Aparicio, C., Guerra, M., Hernández, A., Padrón, A., Tyack, P., and Brito, A. 2005. Deep foraging of pilot and beaked whales: DTag results. 19th annual conference of the European Cetacean Society. La Rochelle 2nd-7th April 2005.
- Arbelo, M., Calabuig, P., Carillo, M., Méndez, M., Sierra, E., Castro, P., Jaber, J., Herraéz, P. and Fernández, A. 2005. Gas embolic syndrome in two single stranded beaked whales. Poster presented to the European Cetacean Society Conference, La Rochelle, France. 4 – 6 April 2005.
- Ashe, E. and Williams, R. 2006. Killer whale responses to boats varies with boat number: Implications for experimental design of vessel impact assessments. *Presentation to the 20th Annual Conference of the European Cetacean Society*.
- ASOC and UNEP. 2005. Antarctic Tourism Graphics: An overview of tourism activities in the Antarctic Treaty Area. Information Paper to XXVIII ATCM.
- Barlow, J. and Gisiner, R. (In press). Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales.
- Beale, C. M. and Monaghan, P. 2004. Behavioural responses to human disturbance: a matter of choice? *Animal behaviour*, 68, 1065 – 1069.
- Boebel, O., Bornemann, H., Breitzke, M., Burkhardt, E., Kindermann, L., Klinck, H., Plötz, J., Ruholl, C., and Schenke, H.-W. 2004. Risk Assessment of ATLAS HYDROSWEEP DS-2 Hydrographic Deep Sea Multi-beam Sweeping Survey Echo Sounder. Poster at the US-MMC/JNCC-UK International Policy Workshop on Sound and Marine Mammals, London, 28-30 September 2004: http://mmc.gov/sound/internationalwrkshp/pdf/poster_03boebel.pdf and http://mmc.gov/sound/internationalwrkshp/pdf/abstract_03boebel.pdf
- Brownell, R. L. Jr., Yamada, T., Mead, J. G. and van Helden, A. L. 2004. Mass strandings of Cuvier's Beaked Whales in Japan: U.S. Naval Acoustic Link? Paper presented to the IWC Scientific Committee. SC/56/E37.
- Brownell, R. L. Jr., Mead, J. G., van Helden, A. L., Yamada, T., and Frantzis, A. 2005. Worldwide mass strandings of beaked whales: Retrospective review and causes. 19th annual conference of the European Cetacean Society. La Rochelle 2nd-7th April 2005.
- Cihlar, 2004. The Navy and Low Frequency Active Sonar: Stripping the Endangered Species Act of its Authority, 38 *William and Mary Environmental Law and Policy Review* 913 – 949;
- Crum, L., Kargl, S. and Matula, T. 2004. A potential explanation for marine mammal strandings. Presentation to the Journal of the Acoustical Society of America, 116 (94), 2533.
- Department of Conservation. 2006. Guidelines for minimising acoustic disturbance to marine mammals during seismic survey operations.
- Department of Environment and Heritage, 2005. Marion Bay Whale Stranding. Incident Review Findings. See <http://www.deh.gov.au/coasts/publications/marion-bay-strandings-2005.html>.
- Department of Environment and Heritage, 2001. Guidelines on the application of the *Environment Protection and Biodiversity Conservation Act* to interactions between offshore seismic operations and larger cetaceans. See <http://www.deh.gov.au/epbc/policy/seismic/index.html>.
- Dotinga and Elferink, 2000. Acoustic Pollution in the Oceans: The search for Legal Standards. *Ocean Development and International Law* 151 – 182.
- Espinosa, A., Arbelo, M., Castro, P., Martín, V., Gallardo, T. and Fernández, A. 2005. New beaked whale mass stranding in Canary Islands associated with naval military exercises (Majestic Eagle 2004). Poster presented to the European Cetacean Society Conference, La Rochelle, France. 4 – 6 April 2005.
- Fernández, A. 2006. Beaked whale (*Ziphius cavirostris*) mass stranding on Almería's coasts in southern Spain, 26th – 27th January 2006. Report of the University of Las Palmas de Gran Canaria, Canary Islands.
- Fernández, A., Méndez, M., Sierra, E., Godinho, A., Herraéz, P., Espinosa de los Monteros, A., Rodríguez, F. and Arbelo, M. 2005. New gas and fat embolic pathology in beaked whales stranded in the Canary Islands. Poster presented to the European Cetacean Society Conference, La Rochelle, France. 4 – 6 April 2005.

- Foote, A. D., Osbourne, R. W. And Hoelzel, A. R. 2004. Whale-call response to masking boat noise. *Nature*, 910.
- Frantzis, A. 1998. Does acoustic testing strand whales? *Nature* 392: 29.
- Gardner, 1998. The Precautionary Principle as Applied to Marine Acoustic Activities. (October 31 – November 1) *Emerging Issues in National Ocean and Coastal Policy* 9 – 14.
- Hildebrand, J. A. 2005. "Impacts of Anthropogenic Sound" in J.E. Reynolds et al. (eds), *Marine Mammal Research: Conservation beyond Crisis*. The Johns Hopkins University Press, Baltimore, Maryland. Pages 101-124.
- Hohn, A. A., Rotstein, D. S., Harms, C. A. and Southall, B. L. 2006. Report on Marine Mammal Unusual Mortality Event UMESE0501Sp: Multi species stranding of short-finned pilot whales (*Globicephala macrorhynchus*) minke whale (*Balaenoptera acuturostrata*) and dwarf sperm whales (*Kogia sima*) in North Carolina, 15 – 16 January 2005. NOAA Technical Memorandum NMFS – SEFSC 537.
- Houser, D.S., Howard, R., and Ridgway, S. Can diving-induced tissue nitrogen supersaturation increase the chance of acoustically driven bubble growth in marine mammals? *Journal of Theoretical Biology*, 213: 183-195.
- Hoyt, E. 2005. Marine Protected Areas For Whales, Dolphins and Porpoises. A World Handbook for Cetacean Habitat Conservation. Earthscan.
- Inkelas, 2005. Security, Sound and Cetaceans: Legal Challenges to low Frequency Active Sonar Under US and International Environmental Law 37 *George Washington International Law Review* 207 – 249.
- IUCN. 2006. Report of the Interim Independent Scientists Group (IISG) on Mitigation Measures to Protect Western Gray Whales During Sakhalin II Construction Operations in 2006. See http://www.iucn.org/themes/business/ISRP_Followup/Final%20Vancouver%20II%20report%20with%20SAKHALIN%20ENERGY.pdf.
- Kappen, L. 2004. Proceedings of the Conference on Impact of Acoustics on Marine Organisms, 17 – 19 June 2002, Berlin – A Preface. *Polarforschung*, 72 (2/3), 59 – 61.
- Kremser, U., Klemm, P. and Kötz, W-D. 2005. Estimating the risk of temporary acoustic threshold shift, caused by hydroacoustic devices, in whales in the Southern Ocean. *Antarctic Science*, 17 (1): 3 – 10.
- Leaper, R., Gillespie, D. and Papastavrou, V. 2000. Results of passive acoustic surveys for odontocetes in the Southern Ocean. *J. Cetacean Res. Manage.* 2 (3): 187 – 196.
- Madsen, P.T., Johnson, M., Miller, P. J. O., Aguilar Soto, N., Lynch, J. And Tyack, P. 2006. Quantative measures of air gun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments. Paper presented to IWC Scientific Committee 2006.
- Madsen, P. T. 2005. Marine mammals and noise : Problems with root mean square sound pressure levels for transients. *Journal of the Acoustical Society of America*, 117 (6), 3952 – 3957.
- Malme, C.I., Würsig, B., Bird, J.E. and Tyack, P. 1988. Observations of feeding gray whale responses to controlled industrial noise exposure. pp. 55-73. In: W.M. Sackinger, M.O. Jefferies, J.L. Imm and S.D. Treacy (eds.) Vol. 2. Port and Ocean Engineering under Arctic Conditions. University of Alaska, Fairbanks, AK. 111pp.
- McCarthy, 2001. International Regulation of Transboundary Pollutants : the Emerging Challenge of Ocean Noise, *Ocean and Coastal Law Journal* 257 – 292.
- McCarthy (2004) *International Regulation of Underwater Sound : Establishing Rule and Standards to Address Ocean Noise Pollution* (Kluwer).
- Méndez, M., Arbelo, M., Sierra, E., Godinho, A., Jaber, J., Herráez, P. and Fernández, A. 2005. Lung fat embolism in cetaceans stranded in the Canary Islands coasts. Poster presented to the European Cetacean Society Conference, La Rochelle, France. 4 – 6 April 2005.

- Miller, P. J. O., Johnson, M., Madsen, P. T., Quero, M. E., Biassoni, N., King, R. and Tyack, P. L. 2006. At-sea experiments indicate that airguns affect the foraging behaviour of sperm whales in the Gulf of Mexico. Paper presented to IWC Scientific Committee, 2006.
- Nieukirk, S. L., Stafford, K. M., Mellinger, D. K., Dziak, R. P. and Fox, C. G. 2004. Low frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. *Journal of the Acoustical Society of America*, 115 (4), 1832 – 1843.
- Nowacek, D. P., Johnson, M. P. and Tyack, P. L. 2004. North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli. *Proc. R. Soc. Lond. B.* 271, 227 – 231.
- O'Brien. 2002. *Impacts of Marine Acoustic Technology on the Antarctic Environment*. Report of the SCAR Ad Hoc Group on marine acoustic technology and the marine environment. 67 pages.
- Potter, J.R. A possible mechanism for acoustic triggering of decompression sickness symptoms in deep-diving marine mammals. Paper presented to the 2004 IEEE International Symposium on Underwater Technology, Taipei, Taiwan, 19-23 April 2004.
- Širović, A., Hildebrand, J. A., Wiggins, S. M., McDonald, M. A., Moore, S. E. and Thiele, D. 2004. Seasonality of blue and fin whale calls and the influence of sea ice in the Western Antarctic Peninsula. *Deep-Sea Research II*, 51, 2327 – 2344.
- Scott, K. N. 2004. International Regulation of Undersea Noise. *ICLQ*, 53, 287 – 324.
- Scott, K. N. 2006. Sound and Cetaceans: A Regional Response to Regulating Acoustic Marine Pollution. *Forthcoming in the Journal of International Wildlife Law and Policy*.
- Tyack, P., Madsen, P., Johnson, M., Aguilar de Soto, N. 2005a. Presentations on: Diving, Sound production, Acoustic foraging behaviour, Social diving behaviour. ECS Workshop : Research priorities to reduce risk to beaked whales from military sonar. 19th annual conference of the European Cetacean Society. La Rochelle 3 April 2005.
- Tyack, P., Johnson, M., Madsen, P. 2005b. Extreme diving behaviour of beaked whale species known to strand in conjunction with use of military sonars. 19th annual conference of the European Cetacean Society. La Rochelle 2nd-7th April 2005.
- Weilgart, L. and Whitehead, H. 2004. The threat of Underwater Noise on Whales: Management in Light of Scientific Limitation. *Polarforschung*, 72 (2/3), 99 – 101.
- Weir, C., Dolman, S. J. and Simmonds, M. P. 2006. Marine mammal mitigation during seismic surveys and recommendations for worldwide standard mitigation guidance. Paper presented to IWC Scientific Committee, SC/58/E12.
- Van Dyke *et al.*, 2004. Whales, Submarines and Active Sonar, 18 *Ocean Yearbook* 330 – 363.
- Widolf, H. E. 2002. Animal Rights and the Antarctic Treaty System. *Human Ecology Forum*, 9 (2), 59 – 67.