INTERNATIONAL REGULATION OF UNDERSEA NOISE

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I. INTRODUCTION

In September 2002 seventeen whales were stranded off the coast of the Canary Islands at a time when NATO was testing its active sonar system designed to detect silent enemy submarines.[1] The suggestion has been made that the use of sonar caused these whales to strand. In fact, sonar is just one of a variety of anthropogenic undersea sounds which, scientific research increasingly suggests, impacts negatively on marine biodiversity. Pollution of an acoustic nature is currently omitted from traditional works on the protection of the marine environment and is as yet the subject of very little jurisprudential discussion.[2] However the topic, which has received scientific attention for over 30 years, has recently been identified as a cause for concern and consequently, for action, within the parameters of a number of global and regional environmental instruments.

A. Ocean Acoustics and Sources of Undersea Noise

Contrary to popular perception, the ocean constitutes a relatively high noise environment. In addition to the many anthropogenic origins of ocean noise, natural sources also make a significant contribution to the acoustic environment. Wind, waves, and eddies all contribute to a near constant source of ambient noise underwater.[3] Additionally, volcanic and tectonic activity and even precipitation contributes to transient ambient noise (particularly in the low frequencies), as does the break up of ice in polar waters.[4] Noise from

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[1] O Dyer 'Death Knell' *The Guardian*, 30 Oct 2002

[2] Notable exceptions include H Dotinga and A Elferink 'Acoustic Pollution in the Oceans: The Search for Legal Standards' (2000) 31 Ocean Development and International Law 151–82; E Gardner 'The Precautionary Principle as Applied to Marine Acoustic Activities' (1998) (31 Oct–1 Nov) Emerging Issues in National Ocean and Coastal Policy 9–14; E McCarthy 'International Regulation of Transboundary Pollutants: The Emerging Challenge of Ocean Noise' (2001) 6 Ocean and Coastal Law Journal 257–92.

[3] W Richardson, C Greene, C Malme, and D Thomson *Marine Mammals and Noise* (San Diego Academic Press 1995) ch 5.

[4] Ibid.

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biological sources such as cetaceans, as well as certain species of fish and shrimp also adds to the aquatic cacophony.[5] Water is a remarkably efficient conductor of sound.[6] However, the level of sound varies considerably in response to local transmission conditions as well as bottom and surface variables, and the presence of certain types of natural phenomena such as ice.[7] That part of the ocean which is most conducive to the transmission of sound is known as the deep sound channel, within which noise can travel for distances of many thousands of miles.[8] Unsurprisingly, sound (both in terms of its perception and its production) is vital to the survival of much marine life. Whilst acoustic research in relation to fish, crustaceans, and invertebrates is not extensive, marine mammals, particularly cetaceans, have received considerable scientific attention.[9] Cetaceans are believed to be highly sensitive to sound and are tremendously vocal.[10] Research has suggested that most cetaceans use sound for functions as diverse as communication, echolocation, and navigation.[11] Baleen whales (or mysticetes) are known to emit sound in order to communicate over many hundreds of miles.[12] The blue (*Balaenoptera musculus*) and fin (*Balaenoptera physalus*) whales in particular, are thought to use the deep sound channel for communication.[13]

Anthropogenic sources of noise in the oceans increased substantially during the nineteenth century as a result of industrialization. The most pervasive source of man-made noise in the oceans results from transportation, by both air and sea.[14] Noise of up to 205 decibels can be created by large tankers

[5] Ibid, 93.

[6] Sound velocity reaches speeds of 1600 m/s in seawater as compared with 350 m/s in air. See A Myrberg 'The Effect of Man-made Noise on the Behaviour of Marine Mammals' (1990) 16 Environment International 575–86, at 575.

[7] R Urick *Principles of Underwater Sound* (3rd edn California Peninsula Publishing 1983) chs 5 and 6.

[8] The depth of the deep sound channel (also known as the sofar channel) varies according to the temperature and salinity of the water. It can be found approximately 1 kilometre below the surface in the tropics and is a mere 100 metres or so below the surface in polar waters. See Urick, op cit, 159–64; R Shockley et al 'SOFAR Propagation paths from Australia to Bermuda: Comparison of Signal Speed Algorithms and Experiments' (1982) 71(1) J Acoust Soc Am 51–60.

[9] Marine mammals can be defined as including cetaceans, sirenians, and carnivores. On the impact of noise on fish see A Popper 'The Impacts of Anthopogenic Sounds on Fishes' (2001) 110(5) pt 2 J Acoust Soc Am 2750; A Scholik and H Yan, 'The Effects of Underwater Noise on Auditory Sensitivity of Fish' (2001) 23(4) Proc IOA 27–36.

[10] J Gordon and P Tyack 'Sound and Cetaceans' in Evans and Raga (eds) *Marine Mammals: Biology and Conservation* (New York Kluwer Academic 2001) 139–96, at 140.

[11] Echolocation is defined as the production of sound facilitating the location of objects by means of the returning sound waves or echoes. For a comprehensive study on marine mammalian hearing and use of sound see Richardson et al, n 3 chs 7 and 8.

[12] P Evans *The Natural History of Whales & Dolphins* (San Diego Academic Press 1987) 18.

[13] B Würsig and P Evans 'Cetaceans and Humans: Influences of Noise' in P Evans and J Raga (eds) *Marine Mammals: Biology and Conservation* (New York Kluwer Academic 2001) 565–87, 569.

[14] See Richardson et al, n 3, 102–23.

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and bulk carriers as a result of cavitation, engine roar, and outer hull vibration.[15] The seas of the northern hemisphere are particularly prone to high levels of vessel-source undersea noise owing to the multitude of shipping lanes,[16] and the presence of particularly noisy vessels such as hovercraft and ice-breakers.[17] Significant levels of noise may also result from marine dredging and construction activities, as well as from the oil and gas industry.[18] Likewise, sound pulses emitted from seismic surveys which are used in the context of oil and gas exploration as well as for the execution of marine geophysical surveys can be detected hundreds of kilometres from their source.[19] Whilst the development of renewable sources of energy such as offshore wind farms may lead to a reduction in air pollutants which result from the burning of fossil fuels, they may themselves provide a significant source of undersea noise, particularly within coastal regions.

One of the most controversial sources of anthropocentric noise results from the deployment of sonar for naval purposes. The development of so-called quiet submarines during the latter half of the Cold War led to the development of *active* sonar systems (known as Low-Frequency Active (LFA) Sonar) whereby sound is emitted in order to detect the presence of enemy submarines. A US version of the active sonar system (known as SURTASS-LFA) can generate intense low frequency noise of up to 230 decibels.[20] Water's exceptional ability to transmit sound over long distances has significant implications for ocean science as well as for military surveillance. Oceanographers have long used sound to map the contours of the deep-sea bed. More recently, the relationship between water temperature and the speed of sound transmission has formed the basis for a controversial experiment attempting to monitor the rate of global climate change. The Acoustic Thermometry of Ocean Climate (ATOC) experiment developed by the Scripps Institution of Oceanography in California in the early 1990s is designed to monitor the transmission time of sound between various points in the Pacific Ocean. Using the deep sound channel, low frequency sound of up to 180 decibels will be transmitted and monitored in order to determine whether the global climate is in fact changing.[21]

[15] M Jasny *Sounding the Depths: Supertankers, Sonar and the Rise of Undersea Noise*, report available online at <http://www.nrdc.org/wildlife/marine/sound/exec.asp>.

[16] Würsig and Evans, n 13, 569.

[17] C Erbe and D Farmer 'Zones of Impact Around Icebreakers affecting Beluga Whales in the Beaufort Sea' (2000) 103(3) Pt 1 J Acoust Soc Am 1332–40.

[18] Richardson et al, n 3, 123–35.

[19] Ibid 136–46.

[20] Ibid 146–8.

[21] I Anderson 'Global Hum Threatens to 'Deafen' Whales' (19 Jan 1991) New Scientist 19; J Cohen 'Was Underwater 'Shot' Harmful to the Whales?' (17 May 1991) 252 Science 912–14.

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B. Impact of Ocean Noise on Marine Mammals

Scientific data on the impact of ocean noise on marine biodiversity is still relatively incomplete. The first such study was conducted in 1971[22] and the most comprehensive review to date was published in 1995.[23] Recent detailed studies relate to the impacts of military sonar and the ATOC experiment on marine mammals[24] and, so far, has tended to focus on the short term as opposed to the long term impact of sound. Of all marine species, cetaceans are believed to be particularly vulnerable to undersea noise. Baleen whales for example, tend to feed and calve in coastal areas which are also the focus of much anthropogenic activity such as mineral extraction, dredging, and shipping.[25] Beaked and sperm whales, on the other hand, are particularly susceptible to noise generated by sonar and ocean science experiments since they are deep diving and have a tendency to strand.[26]

The impact of undersea noise has traditionally been categorized as either physical or behavioural. The ultimate physical impact is, of course, mortality. Whilst this is a relatively rare occurrence, a number of researchers have connected recent incidences of multiple (and often fatal) strandings to the testing of NATO and US military sonar. Multi-species strandings of between twelve and seventeen individuals (more often than not Curvier's beaked whales (*Ziphius cavirostris*)), took place off the coasts of the Canary Islands in 1985[27] and 2002,[28] Greece in 1996,[29] and the Bahamas in 2000.[30] All these incidences coincided with military active sonar operations. An investigation carried out by the NOAA, NMFS and the US Navy based on necropsies of the dead animals found in the Bahamas concluded that acoustic or impulse source trauma caused the strandings. The report also found that the use of tactical mid-range frequency sonar aboard US Navy ships was the most plausible source of the trauma although the mechanisms by which sonar caused both stranding and tissue damage are unknown.[31] In addition to causing cetaceans

[22] R Payne and D Webb 'Orientation by Means of Long Range Acoustic Signalling in Baleen Whales' (1971) Ann NY Acad Sci 188, 110–41.

[23] Richardson et al, op cit, n 3.

[24] *Joint Interim Report— Bahamas Marine Mammal Stranding Event of 15–16 March 2000* produced by the NOAA, NMFS, and US Navy available online at <http://www.nmfs.nooa.gov/prot_res/overview/Interim_Bahamas_Report.pdf>; NRC, *Marine Mammals and Low-Frequency Sound: Progress Since 1994* (2000) (Washington National Academy Press).

[25] C Clark and K Fristrup 'Baleen Whale Responses to Low-Frequency Human-Made Underwater Sounds' (2001) 110(5) pt 2 J Acoust Soc Am 2751.

[26] M Simmonds and S Doleman 'A Note on the Vulnerability of Cetacean to Acoustic Disturbance' IWC51/E15 (1999).

[27] M Simmonds and L Lopez-Jurado 'Whales and the Military' (1991) 351 Nature 448.

[28] O Dyer 'Death Knell' *The Guardian*, 30 Oct 2002

[29] A Frantzis 'Does Acoustic Testing Strand Whales?' (1998) 392 Nature 29.

[30] K Balcomb and D Claridge 'A Mass Stranding of Cetaceans Caused by Navel Sonar in the Bahamas' (2001) 2 Bahamas Journal of Science 1–12.

[31] *Joint Interim Report—Bahamas Marine Mammal Stranding Event of 15–16 March 2000* n 24. A recent study on beaked whales stranded off the Canary Islands in September 2002 found

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to strand, sonar and indeed other sources of undersea noise such as explosions can cause physical injury such as tissue damage (particularly within the cochlea) as well as permanent and temporary threshold shift.[32] A more insidious consequence of anthropogenic undersea noise lies in its potential to mask whale signals and calls as well as other natural sounds which are vital to cetacean communication, navigation, location of food and migration.[33]

Common behavioural responses of cetaceans to undersea noise which have been documented include the cessation of all vocalization during, and for a period following, the operation of LFA sonar,[34] and transmission of sound pursuant to the ATOC Heard Island experiment.[35] Deviation from course and temporary abandonment of an area by cetaceans has been recorded in response to not only the operation of sonar and the ATOC transmission,[36] but also as a reaction to ice-breakers[37] and shipping more generally[38] as well as to drilling and dredging.[39] Whilst deviation is not necessarily disadvantageous, as it can prevent further physical injury if it takes the animal beyond the zone of auditory damage, it may not always be possible. Cetaceans, particularly deep diving cetaceans, have finely tuned energy budgets and may not be able to deviate for long distances suddenly.[40] Pregnant or lactating females may be particularly vulnerable in this respect.[41] Moreover, permanent or even temporary abandonment of a noisy area may also impact negatively on the survival of a group of individuals or a vulnerable species. The ocean does not constitute a homogeneous habitat. Water salinity, depth, temperature, and other environmental conditions all vary. Species have their own requirements in relation to habitat and the abandonment of an area which is of importance for

evidence of acute and chronic tissue damage caused by the formation in vivo of gas bubbles which may have resulted from rapid decompression. See P Jepson et al 'Gas-Bubble Lesions in Stranded Cetaceans' (2003) 425 Nature 575.

[32] J Gordon and A Moscrop 'Underwater Noise Pollution and Its Significance for Whales and Dolphins' in Simmonds and Hutchinson (eds) *The Conservation of Whales and Dolphins: Science and Practice* (Chichester John Wiley & Sons 1996) 281–319, at 295–7; D Ketten 'Ageing, Injury, Disease and Noise in Marine Mammal Ears' (2001) 110(5) Pt 5 J Acoust Soc Am 2721; Myrberg op cit, n 6, 580; Richardson et al op cit n 3, 397–403.

[33] Richardson et al, op cit n 3, 226–36.

[34] W Watkins, K Moore, and P Tyack 'Sperm Whale Acoustic Behaviors in the Southeast Caribbean' (1985) 19 Cetology 1–15, at 6.

[35] A Bowles et al 'Relative Abundance and Behavior of Marine Mammals Exposed to Transmissions from the Heard Island Feasibility Test' (1994) 96(4) J Acoust Soc Am 2469–84, at 2481.

[36] See references cited ibid and n 34.

[37] Erbe and Farmer, op cit n 17; Myrberg, op cit n 6, 579.

[38] Richardson et al, op cit n 3, 252–72.

[39] J Goold 'Acoustic Assessment of Populations of Common Dolphin *Delphinus Delphis* in Conjunction With Seismic Surveying' (1996) 76 J Mar Biol Ass UK 811–20; W Richardson et al 'Reactions of Bowhead Whales, *Balaena Mysticetus*, to Drilling and Dredging Noise in the Canadian Beaufort Sea' (1990) 29 Marine Environmental Research 135–60.

[40] Simmonds and Doleman, op cit n 26.

[41] C Perry 'A Review of the Impact of Anthopogenic Noise on Cetaceans' IWC/SC/50/E9 (1998), 9.

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reproduction, as a nursery or even as a source of food is potentially damaging to the survival of a species.[42] Where individuals do not withdraw from noisy areas, noticeable changes in cycles of feeding and respiration have been documented. These, and indeed other factors, may potentially combine and cause the animal stress, which in turn may result in reduced resistance to disease and endocrine imbalances which may negatively impact on reproduction.[43] Finally, it should be noted that the negative impacts of noise when combined with factors such as hunting, pollution, by-catch and collision may cumulatively affect the survival of a vulnerable species.[44]

II. INTERNATIONAL REGULATION OF ACOUSTIC MARINE POLLUTION

Notwithstanding the increased scientific focus on the problem of ocean noise, marine acoustic pollution has received relatively little global regulatory attention. However, it should not be assumed that existing pollution and biodiversity instruments necessarily exclude noise from their remits, or that a general obligation to reduce marine pollution (broadly defined) should be inapplicable to noise. Moreover, ocean noise and its impact of marine biodiversity has recently appeared on the scientific and regulatory agendas of a number of instruments including the 1946 International Convention for the Regulation of Whaling, both ACCOBAMS and ASCOBANS which seek to protect cetaceans in the Mediterranean and Black Seas and the Baltic and North Seas respectively,[45] and, the 1991 Environmental Protocol to the 1959 Antarctic Treaty. The remainder of this article will explore the extent to which the global and regional network of selected pollution and biodiversity obligations currently regulate, or possess a mandate to regulate, acoustic marine pollution. An assessment of the appositeness of each instrument as a forum for ocean noise regulation will be attempted and preliminary conclusions will be drawn as to whether the issue should be ultimately addressed within the framework of pollution regulation or biodiversity conservation.

A. Global Obligations to Prevent and Minimise Pollution in the Marine Environment

At the global level, the fundamental obligation to protect and preserve the marine environment as reflected in customary international law is embodied in Part XII of the United Nations Convention on the Law of the Sea

[42] Simmonds and Doleman, op cit n. 35.
[43] Perry, op cit n 41, 10.
[44] Richardson et al, op cit n 3, 405–7.
[45] Agreement for the Conservation of Cetaceans of the Black Sea, Mediterranean Sea, and Contiguous Atlantic Areas (1996) (ACCOBAMS); Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (1992) (ASCOBANS).

(UNCLOS).[46] Article 194(1) obliges parties to take all measures that are 'necessary to prevent, reduce and control pollution of the marine environment *from any source*'.[47] Pollution is broadly defined in Article 1(4) as:

> '[t]he introduction by man, directly or indirectly, of substances *or energy* into the marine environment, including estuaries, which results or is *likely to result* in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.'[48]

It is suggested that the term 'energy' in Article 1(4), as interpreted in accordance with its ordinary meaning in the context of the objects and purposes of UNCLOS, should encompass noise within its remit.[49] As a matter of physics a sound wave is defined as a flow of acoustic *energy*. Essentially, 'sound waves transfer energy from one region of space to another'.[50] Therefore textually, the term 'energy' in UNCLOS should apply to sound as uncontroversially as it already applies to heat.[51] Moreover, a teleological approach to treaty interpretation lends further support to this conclusion. The protection and preservation of both the marine environment and marine biodiversity is a principal aim of the Convention and is articulated in both Part XII of UNCLOS and its preamble. To prevent the application of fundamental environmental obligations to sources of pollution primarily on the basis that they had not been identified as *pollution* in the 1970s represents an unduly restrictive approach to treaty interpretation, which would, it is suggested, frustrate the objects and purposes of UNCLOS itself. The paradigmatic nature of Article 1(4) means that this interpretation not only provides UNCLOS with a mandate to regulate ocean noise, but likewise endows every regional seas convention for which pollution is similarly defined. The judicious nature of this conclusion is illustrated by the fact that in one such regional seas convention, the 1992 Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea

[46] 21 ILM (1982) 1261. In force 1994. Hereinafter, UNCLOS. Whilst UNCLOS itself cannot be regarded as customary international law in its entirety, the International Court of Justice has taken the approach that individual provisions of UNCLOS may be assessed in order to conclude whether they themselves may nevertheless be regarded as customary. See the *Continental Shelf (Libya v Malta)* Case ICJ Rep (1985), 13, 30. It is notable that the opening paragraph of ch 17 of Agenda 21 (*Agenda 21: Programme of Action for Sustainable Development*, adopted at the 1992 United Nations Conference on Environment and Development (UNCED)) describes the customary international law obligations of protection and sustainable development of the marine and coastal environment as 'reflected in the provisions of' UNCLOS 1982.

[47] Emphasis added.

[48] Emphasis added.

[49] See Art 31(1) of the 1969 Vienna Convention on the Law of Treaties (8 ILM (1969) 679).

[50] H Young *University Physics* (Reading, Mass Addison-Wesley 1992), at 587.

[51] H Dotinga and A Elferink note that the term 'energy' was included in Art 1(4) of UNCLOS so as to apply its provisions to thermal pollution (heat). However, they and E McCarthy support the conclusion that the term energy should be likewise applied to sound. See Dotinga and Elferink op cit n 2, 158–9 and McCarthy op cit n 2, 276.

Area, where pollution is indeed defined in terms of substances or energy,[52] ocean noise is specifically identified as a topic in need of regulation in the body text of the instrument.[53]

In support of the posited general obligation to prevent pollution, UNCLOS develops a framework for the regulation of particular polluting activities. Its characterization as 'pollution' within the context of Article 1(4) demands the regulation of ocean noise within this framework. Of particular interest within the parameters of acoustic marine pollution are the provisions which relate to the regulation of scientific research, sea-bed activities under national jurisdiction and vessel-source pollution. Whilst all States have a right to conduct scientific research on (or in) the oceans under part XIII of UNCLOS,[54] such research must be conducted in conformity with its provisions, particularly those relating to the protection and conservation of the marine environment.[55] Consequently, research cannot be carried out with total disregard to its impact on marine biodiversity, particularly where (as in the case of the ATOC experiment) it may harm vulnerable species. Similarly, all activities relating to the exploration and exploitation of the sea-bed must be carried out with due regard to the protection of the marine environment and in particular, the prevention and control of pollution.[56] Accordingly, parties must take measures to prevent and control the emission of noise associated with seismic surveys, drilling and other associated activities. Little detail is provided for in Article 208, it being envisaged that international standards will be developed and applied to UNCLOS parties.[57] Global mandatory rules relating to the regulation of sea-bed activities have yet to be concluded,[58] but their remit should plainly include noise. It is notable that a number of States, including the UK and Australia, which have recently revised their guidelines in relation to the exploration and exploitation of offshore oil and gas, have addressed and attempted to mitigate the impact of noise.[59] Although of relevance to all activities likely to cause significant changes to the marine environment (such as coastal development), the requirements under UNCLOS to assess the potential impacts of such activities are of particular relevance to decisions to undertake major exercises in scientific experimentation and the developing of new oil and gas fields in the context of marine acoustic pollution.[60]

[52] Art 2(1).

[53] In Art 9 parties undertake to adopt measures dealing with air pollution, noise, and the hydrodynamic effects of pleasure craft in the Baltic sea area.

[54] Art 238.

[55] Art 240(d).

[56] Art 208(1) and (2).

[57] Art 208(3).

[58] But see the non-binding 1981 UNEP Conclusions of the Study of Legal Aspects Concerning the Environment Related to Offshore Mining and Drilling Within the Limits of National Jurisdiction (adopted in UN General Assembly Res 37/217 (20 Dec 1982) which recommend that Sates should take preventative measures to limit pollution and *other adverse effects on the environment* (emphasis added) resulting from offshore production (reproduced Hohmann (ed) *Basic Documents of International Law, Volume 1* (Dordrecht Graham & Trotman 1992) 121–9.

[59] See nn 217–18 and accompanying text.

[60] Art 206 stipulates that where States have reasonable grounds for believing that substantial

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As noted above, the most pervasive source of acoustic marine pollution is emitted from ocean going traffic. Article 211 of UNCLOS seeks to prevent, reduce and control the pollution of the marine environment from vessels. Again, there is nothing textually apparent in this Article which would prevent its application to vessel-source noise emissions. Moreover, Article 211(1) allows States to implement routing measures for the protection of the environment from pollution. States may therefore route traffic so as to avoid areas which are, for example, particularly important for breeding or migration. However, Article 211 (like Article 208) does not itself adopt specific standards in relation to vessel-source pollution. It is a framework provision which relies upon 'generally accepted rules and standards' for its operationalization. These rules and standards are generally considered to be those provided by the International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 relating thereto (or MARPOL 73/78 as it is more commonly known).[61] MARPOL 73/78 aims to 'achieve the complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimisation of accidental discharge of such substances'.[62] The use of the term 'substance' without the addition of 'energy' in place of the broader concept of pollution would appear to exclude the application of MARPOL to noise per se. Moreover, MARPOL provides for the detailed regulation of substances through a series of Annexes, none of which relate to noise.[63]

Nevertheless, in the context of vessel-source pollution, MARPOL remains an eminently suitable instrument for the regulation of noise, the control of which falls squarely within the regulatory mandate of the International Maritime Organization (IMO), and consequently, within the potential remit of MARPOL.[64] MARPOL has adopted three principal techniques for the control

pollution will result from planned activities they must, in so far as is practicable, assess the potential effects of such activities. The relatively high threshold required by Art 206 inevitably excludes much low level noise and even then, its terminology provides scope for considerable State discretion in subjecting activities to an environmental impact assessment.

[61] 12 ILM (1973) 1319, 17 ILM (1978) 456. In force 1983. The reliance on one instrument (such as MARPOL) to provide the details of obligations incurred under another (UNCLOS) raises an international conundrum of whether a State which is party to UNCLOS is bound by obligations incurred under MARPOL to which it is not a party. Whilst seemingly contrary to the consensual nature of international law, this mechanism, which has been adopted on a number of occasions in Part XII of UNCLOS, does not appear to be problematic in practice.

[62] Preamble, Art 1(1).

[63] MARPOL regulates the discharge of oil (Annex I), noxious substances (Annex II), the packaging of harmful substances (Annex III), sewage (Annex IV) and air pollution (Annex IV).

[64] Art 1(a) of the 1948 IMCO ((53) (1959) AJIL 516) provides that the purpose of the IMO is to provide the machinery for cooperation in the field of regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade. Although the IMO does not (as yet) deal with acoustic pollution (expressly) in an environmental context, noise falls unequivocally within its mandate. The regulation of noise is for example, incorporated into the standards relating to machinery installations under the International Convention for the Safety of Life At Sea 1974 (SOLAS). Moreover, the IMO has issued resolutions in relation to noise levels on board ships (Resolution A.468(XII) (1981), now incorporated into SOLAS 1974, see Chapter II-1, Regulation 36) and the methods of measuring noise levels at listening posts (Resolution A. 343 (IX) (1975)).

of pollution, namely: construction and design requirements, emission limits (which might vary according to time and location) and the designation of special areas where little or no discharge may take place. Measures to control and mitigate the impact of acoustic pollution will undoubtedly be drawn from these techniques. Vessels may be required to adopt noise reduction technology which, for example, already features in the design of military vessels and certain passenger ships, and/or limit the amount of noise in decibels they emit by the introduction of speed limits.[65] These measures may be applicable globally or apply in special areas where there are, for example, nursery grounds or migratory routes.

New annexes may be adopted by the parties to MARPOL,[66] although without amendment to the text, this would require an interpretation of 'substance' which embraces noise. Notably, the IMO has recently appeared to include noise *within* a definition of 'substance'. Resolution A.927(22) (2001) which sets out guidelines in relation to Special Areas and PSSAs, appears to use the terms 'substance' and 'pollutant' interchangeably and expressly identifies noise as a type of pollutant. In accordance with Article 31(3)(b) of the 1969 Vienna Convention treaties may be interpreted with reference to subsequent State practice. However, whilst MARPOL and the PSSA Resolution are both IMO instruments, the latter is not in any way intended to be interpretative of the former,[67] and since MARPOL does not use the label 'pollutant,' it would be difficult to adopt such an expansive interpretation of the term 'substance.' In conclusion, to the extent that MARPOL does not regulate noise emissions from vessels, UNCLOS does not create obligations in relation thereto independently of it. Nevertheless, Article 211 does not *preclude* the topic of noise being addressed through the generation of relevant international standards if, for example, MARPOL was amended so as to facilitate such regulation.

In addition to these general obligations to regulate polluting activities, UNCLOS obliges parties to take special measures for the preservation of rare or fragile ecosystems, particularly those which provide the habitat for threatened or endangered species.[68] At a global level Article 194(5) is operationalized through IMO Resolution A.927(22) (2001) which establishes guidelines for the designation of Particularly Sensitive Sea Areas (PSSAs).[69] As noted above, these guidelines highlight noise as one of a variety of pollutants emitted by vessels which can harm the marine environment and the living resources of the sea.[70] A PSSA is defined as an area which needs special

[65] On noise mitigation measures see Richardson et al, op cit n 3, 417–23.

[66] New annexes enter into force upon acceptance by two-thirds of parties which constitute at least 50 per cent of world tonnage (Arts 16(5) and 16(2)(i) MARPOL).

[67] As noted by Simmonds in 'Ocean Noise and the Law' (SC/54/E8) (paper submitted to the Scientific Committee of the International Whaling Commission in 2002).

[68] Art 194(5).

[69] See also IMO Circular MEPC/Cir 298 (27 Mar 2003), *Guidance Document for Submission of PSSA Proposals to the IMO*.

[70] Para 2.2, Annex 2, Res A.927(22)(2001).

protection under the auspices of the IMO because of its significance for recognized ecological, socio-economic or scientific reasons and because it may be vulnerable to damage by international shipping.[71] PSSAs may include critical habitats such as breeding grounds and migratory routes.[72] Protective measures which may be adopted by the IMO and are relevant to the regulation of noise pollution include the designation of special discharge restrictions,[73] the adoption of vessel routing systems, the identification of areas which should be avoided altogether and the development of other measures aimed at protecting specific sea areas against environmental damage from ships.[74]

To date there have been six PSSAs designated: the Great Barrier Reef in Australia; the Sabana-Camagüey Archipelago in Cuba; Malpelo Island in Columbia; the Florida Keys in the United States, the Wadden Sea in the North Sea (as designated by Germany, Netherlands and Denmark) and the Paracas National Reserve in Peru.[75] Moreover, enthusiasm for the identification of PSSAs appears to be growing. In the wake of the Prestige oil disaster in 2002, the UK, Ireland, Spain, and Portugal sought the designation of a West European PSSA which will include stretches of the North East Atlantic, the English Channel, and zones around the Orkney and Shetland Islands. Approved in principal, the West European PSSA is due to be officially designated by the 2004 meeting of the MEPC.[76] Whilst areas already designated do not appear to be subject to express regulation in relation to noise, the above analysis has identified the capacity of the IMO to create standards minimizing the impact of acoustic pollution. Combined with the general obligation to reduce pollution under Part XII of UNCLOS, it is suggested that where noise has, or is likely to, harm marine mammals and other forms of biodiversity, states, together with the IMO, *must* designate PSSAs and regulate noise within those areas so as to minimize its impact.

This network of concatenated marine pollution prevention obligations form a global matrix from which the problem of undersea noise should ultimately be regulated. However, although the UNCLOS / IMO framework imposes a broad obligation on States to prevent and reduce all sources of pollution, including ocean noise, the tools required to effect relevant global action are not currently available. For example, in contrast to other sources of marine pollution such as dumping at sea or the emission of waste from vessels, there

[71] Para 1.2, Annex 2, ibid.

[72] Ibid.

[73] This type of measure may be adopted independently of MARPOL and there would appear to be no reason why *discharge* cannot apply to noise emissions bearing in mind the identification of noise as a substance/pollutant in the Resolution.

[74] See paras 6.1.1–6.1.3, Annex 2, Res A.927(22)(2001). The resolution identifies compulsory pilotage or traffic management schemes as examples of 'other measures' but it is strongly suggested that these measures are not *sui generis* and para 6.1.3 essentially provides a general mandate for further conservation measures.

[75] The dates of designation are 1990, 1997, 2002, 2002, 2002, and 2003 respectively.

[76] Source: IMO Press Release, 22 July 2003, available online at <http://www.imo.org/HOME.html>

is no multilateral convention on undersea noise which seeks to operationalize the obligations incurred under UNCLOS 1982. Moreover, instruments which may be regarded as pertinent in the regulation of acoustic marine pollution such as MARPOL 73/78 currently lack the necessary legislative mandate to adopt relevant measures. It is therefore necessary to investigate the extent to which an alternative regulatory context, that of biodiversity conservation, provides an appropriate framework within which the problem of marine acoustic pollution might be addressed.

B. Global Obligations to Protect and Conserve Biodiversity in the Marine Environment

UNCLOS recognizes the importance of biodiversity conservation in its preamble and, in particular, imposes an obligation on States to cooperate in the conservation of highly migratory species and marine mammals.[77] In the case of cetaceans, parties are encouraged to work through the appropriate international conservation organization, the International Whaling Commission (IWC) established under the 1946 International Convention for the Regulation of Whaling (ICRW).[78] The ICRW has as its purpose the establishment of a 'system of international regulation for the whale fisheries in order to ensure the proper and effective conservation and development of the whale stocks'.[79] In pursuit of this objective, the IWC may encourage, recommend and organize studies and investigations relating to whales and make recommendations to effect their conservation.[80] In recent years the Scientific Committee[81] has developed a relatively broad research mandate and has, in turn, formed sub-committees on topics such as environmental threats, pollution and whale-watching. This conservation mandate was formalized in a significant resolution adopted in June 2003 which establishes a formal Conservation Commission and confirmed the development of an extensive IWC conservation-oriented agenda.[82]

Notably the issue of acoustic marine pollution and its impact on cetaceans has, since 1998, provided a regular topic for discussion within both the Standing Working Group on Environmental Concerns and the sub-committee on Whale-Watching.[83] In 2002 a joint session on whale-watching activities

[77] Arts 64, 65, and 120.

[78] The IWC was established under Art III(1) of the Convention. 161 UNTS 143 (in force 1948, amended in 1956).

[79] Preamble.

[80] Arts IV(1) (a) and V(1).

[81] Established pursuant to Art III(4) of the Convention.

[82] Resolution 2003-1, *The Berlin Initiative on Strengthening the Conservation Agenda of the International Whaling Commission*.

[83] See the 1998 Report of the Scientific Committee, Annexes H and J, J Cetacean Res Manage 1 (Suppl) (1999) and Appendix 6; 1999 Report of the Scientific Committee, J Cetacean Res Manage 2 (Suppl) (2000), 64–5; 2001 Report of the Scientific Committee, J Cetacean Res Manage 4 (Suppl) (2002), 41. The Scientific Committee has also benefited from the submission of a

and noise impacts was held by the sub-committee on Whale-Watching and the Standing Working Group on Environmental Concerns. The report of the session noted that to date, the issue of noise pollution has received little attention from policy makers and acknowledged the difficulty in defining unacceptable noise levels which would need to be both species- and frequency-specific.[84] However, with one important exception, the IWC has yet to introduce conservation measures which directly mitigate the impact of noise on cetaceans. The exception relates to a set of General Principles for Whale-Watching adopted in 1996.[85] These (non-binding) principles identify good practices which seek to reduce the impact of noise on cetaceans relating to the design of vessels, engines, and other equipment so as to minimize noise, the regulation of vessel speed and direction and length of time spent with whales so as to minimize disturbance.

It is, however, debatable as to how much further the IWC can address the issue of undersea noise and whether the Commission in fact provides an appropriate forum for its regulation. Notwithstanding the adoption of over 100 conservation oriented resolutions[86] and the identification of noise as falling within the mandate of the new Conservation Commission,[87] the conservation measures contained in the Schedule to the Convention[88] currently relate only to direct capture of whales. Whilst theoretically measures which seek to close seasons, establish sanctuaries and provide for gear specification[89] may be applied to noise pollution, practicably this might not be possible. A number of States, including Japan, have traditionally not favoured an expanded interpretation of the Convention's mandate[90] and may therefore fail to support noise-related conservation measures notwithstanding the establishment of a Conservation Commission. Moreover, it should be noted that whilst the ICRW is undoubtedly a global instrument, in practice it is relatively narrow in scope. For example, it is currently applied only to the so-called great whales which

number of working papers on the impact of noise on cetaceans. See S Dolman et al 'Noise Sources in the Cetacean Environment' SC/54/E7 (2002); Simmonds, n 67; T Rowles et al 'Mass Stranding of Multiple Cetacean Species in the Bahamas on March 15–17 2000' SC/52/E28 (2000); Simmonds and Dolman op cit n 26; Perry op cit n 41.

[84] 2002 Report of the Scientific Committee, J Cetacean Res Manage 5 (Suppl) (2003), 73 and Annex L.

[85] Available online on the website of the IWC at <http://www.iwcoffice.org/>.

[86] The draft resolution on the Berlin Initiative helpfully compiles a list of these resolutions. See Document IWC/55/4/Rev (Agenda item 4) submitted to the 2003 IWC Meeting available online at <http://www.iwcoffice.org/>.

[87] See Annex II of the draft resolution on the Berlin Initiative. Ibid.

[88] Art I of the Convention provides that the Schedule forms and integral part thereof.

[89] Art V(1).

[90] The following statement has been made by Japan in relation to the status of whale-watching within the remit of the IWC: 'The Government of Japan believes that whale-watching is outside the competence of the IWC. Japan does not deny that studying the effects of whale-watching on whale stocks is beneficial in order to obtain better understanding of the stocks. However, because the IWC has a limited budget, the budget should be used for the primary objectives of the IWC, such as stock assessments.' See 2002 Report of the Scientific Committee, J Cetacean Res Manage 5 (Suppl) (2003) 72.

are listed in the Chart of Nomenclature of Whales annexed to the Final Act of the Convention. Whilst this issue is not insurmountable, as evidenced by the fact that the IWC established a sub-committee on Small Cetaceans in 1974 and has recently begun to adopt resolutions for the conservation of small cetaceans,[91] noise may impact on a whole variety of species including pinnipeds and fish which are undoubtedly beyond the remit of the Convention.[92] Furthermore, whilst measures might be applied to whaling vessels and possibly fishing vessels, the extent to which they might apply to other vessels such as oil tankers and cargo ships is unclear. Moreover, the Convention has relatively few State parties,[93] and the Commission is undoubtedly unable to regulate noise producing activities undertaken by vessels belonging to non-parties. Finally, it is doubtful that the Commission possesses the remit to adopt vessel standards which depart from the internationally recognised standards established by the IMO.

Nevertheless, it is suggested that the IWC can play an important role in raising the profile of noise as a source of environmental concern at an international level. It is well placed to co-ordinate and disseminate scientific research on the impact of noise on cetaceans according to its mandate under Article IV(1) of the Convention.[94] Most importantly, should the moratorium on commercial whaling be lifted, the IWC must take into consideration the impact of noise on the survival of individual species (or indeed populations) of whales when designating catch limits under the revised management procedure, which, it should be noted, endorses a precautionary approach.

Unlike the ICRW, the issue of acoustic marine pollution has not arisen on the agenda of either the 1992 United Nations Convention on Biodiversity[95] or the 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals.[96] However, both instruments are endowed with a much broader mandate for biodiversity conservation and, consequently, each may provide a more suitable forum from which acoustic marine pollution might be regulated. Both the Biodiversity and the Bonn Conventions provide for wide-ranging

[91] See, eg, Resolution 2000-9 on the Conservation of Freshwater Cetaceans. On the applicability of the IWC to small cetaceans see P Birnie 'Small Cetaceans and the International Whaling Commission' (1997) 10 Georgetown International Environmental Law Review 1–17; A Gillespie 'Small Cetaceans, International Law and the International Whaling Commission' (2001) 2 Melbourne Journal of International Law 257–303.

[92] It is conceded however, that any action to regulate noise in order to protect cetaceans is likely also to benefit other species indirectly.

[93] There are currently forty-nine parties to the Convention.

[94] A function which the IWC is already carrying out in the context of marine acoustic pollution. For example, a recent study on the status of cetaceans and their vulnerability to noise and other environmental threats in the Black Sea and Mediterranean regions completed under the auspices of ACCOBAMS 1996 was presented at the IWC Meeting in June 2003. See G Notarbartolo di Sciara (ed) *Cetaceans of the Mediterranean and Black Seas: State of Knowledge and Conservation Strategies, A Report to the ACCOBAMS Secretariat, Monaco, February 2002*. Available online at <http://www.accobams.mc>.

[95] 31 ILM (1992) 818. In force 1993. The Convention currently has 187 ratifications.

[96] 19 ILM (1980) 15. In force 1983. The Convention currently has eighty-four ratifications.

obligations in relation to the conservation of biodiversity.[97] Under the Biodiversity Convention conservation provisions apply to parties in respect of biodiversity within their jurisdiction, and in relation to activities under their control likely to impact on biodiversity wherever they may occur.[98] Similar jurisdictional scope is provided for under the Bonn Convention although its application is of course limited to migratory species.[99] Parties to the Biodiversity Convention must identify activities which have or *are likely to have* a significant adverse impact on biodiversity, and, regulate and manage those activities within protected areas which must be established for the purposes of biodiversity conservation.[100] The Biodiversity Convention consequently provides the framework for the creation of protected maritime areas within which activities which create substantial amounts of noise, such as the deployment of military sonar, seismic surveys and the operation of large ports, should be regulated. More generally, Article 14 of the Convention introduces a requirement that all activities likely to have a significant adverse impact on biodiversity be subject to an environmental impact assessment as far as possible and as appropriate.[101]

More detailed conservation requirements are provided for within the narrower context of the Bonn Convention. Range States must take action in order to avoid any migratory species becoming endangered and in particular, shall endeavour to provide immediate protection for migratory species included in Appendix I.[102] Appendix I currently lists eleven species of cetacean including the sei (*Balaenoptera borealis*), fin and blue whales as well as the Mediterranean monk seal (*Monachus monachus*). More specifically, parties must prevent and minimise as appropriate the adverse effects (including noise impacts) of activities which endanger Appendix I species or impede their migration.[103] Moreover, range States must prohibit the taking (which is defined as including harassment)[104] of all migratory species listed in Appendix I.[105] Exceptions may only be made when the taking is for a scientific purpose or where extraordinary circumstances so require.[106] Undoubtedly, the emission of loud sources of sound should be classified as harassment, particularly where this may result in the stranding or injury of individuals and as such, should be controlled or even prohibited. Whilst

[97] See Art 1 of the Biodiversity Convention and Arts II to IV of the Bonn Convention.
[98] Arts 4(a) and (b).
[99] See Art I(a), (f), and (h). It should be noted that the Convention applies to vessels flagged in party States wherever they may be within the range of a migratory species when they are engaged in the taking of that species (Art I(h)). 'Taking' is defined under the convention so as to include harassment (Art I(i)).
[100] Arts 7 and 8.
[101] The language of Art 14(1)(a) clearly qualifies the general obligation in relation to environmental impact assessment. It is foreseeable that a party may not regard an environmental impact assessment of sonar deployment as 'appropriate' in the context of military security.
[102] Art II(2) and (3)(b).
[103] Art III(4)(b) and (c).
[104] Art I(i).
[105] Art III(5).
[106] Art III(5)(a) and (d).

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exceptions to any such prohibition exist, it should be noted that such taking should not operate to the disadvantage of the species.[107] Notably, the Conference of the Parties in 2002 expressed concern over the impact of wind turbines on migratory species and highlighted noise and vibration emissions in particular, as possible negative consequences of increased reliance on renewable forms of energy. The Conference called upon parties to apply environmental impact assessment procedures to planned major developments of wind turbines and to evaluate their cumulative environmental impacts on migratory species taking full account of the precautionary principle.[108]

Notwithstanding the expansive mandate of the Biodiversity Convention, protection of marine and coastal areas emerged as an important agenda item in the mid-1990s with the conclusion of the Jakarta Mandate in 1995 and the adoption of a programme of works relating thereto in 1998.[109] Nevertheless, its conservation obligations are expressed at a level of considerable generality and practicably, this instrument is essentially framework in nature. In fact, the significance of the Convention in relation to the problem of undersea noise so far lies not in its express conservation obligations, but in its precipitation of the revision of a number of regional seas conventions in the light of its provisions and the Jakarta Mandate. In implementing these biodiversity obligations within the context of a regional seas instrument, States have not only sought to provide for express conservation of local biological diversity but, in some cases, have explicitly identified noise as a pollutant, the emission of which must be subject to regulation.[110] Although the Bonn Convention is likewise framework in nature,[111] its specific remit of application to migratory species and detailed conservation obligations make it a much more suitable forum for the global regulation of marine acoustic pollution. Moreover, the problem of undersea noise has already been identified as an issue in need of regulation by the parties to both ASCOBANS 1992 and ACCOBAMS 1996.[112] This regional regulatory experience is likely to prove beneficial in any attempt to legislate on a global scale. In the short term, it is therefore suggested that parties to the Bonn Convention extend their consideration of marine acoustic pollution beyond the problem of wind turbines with a view to adopting general measures for the purpose of its prevention and mitigation.

[107] Art III(6).

[108] Resolution 7.5 on *Wind Turbines and Migratory Species* adopted by the Conference of the Parties at its Seventh Meeting (Bonn, 18–24 Sept 2002). Environmental impact assessment, whilst not expressly provided for in the text of the Bonn Convention was endorsed as a tool for the conservation of migratory species by the Conference of the Parties following developments within the Biodiversity Convention in this area in Resolution 7.2 on *Impact Assessment and Migratory Species* adopted by the Conference of the Parties at its Seventh Meeting (Bonn, 18–24 Sept 2002).

[109] See Decisions II/10 and IV/5 on the Conservation and Sustainable Use of Marine and Coastal Biological Diversity.

[110] Below.

[111] Parties are encouraged to conclude agreements for the conservation of species listed in Appendix II of the Bonn Convention under Art IV. There are currently thirteen such agreements.

[112] On which see below.

III. NATIONAL AND REGIONAL CONTROL OF NOISE WITHIN THE GLOBAL FRAMEWORK

In the absence of detailed regulation of noise within the frameworks of global pollution and biodiversity instruments (although within the context of their general applicability to acoustic pollution), it is important to consider the extent to which a State or regional grouping of States may independently regulate the emission of noise within their own jurisdiction(s). The remainder of this article will explore the extent to which the global framework of UNCLOS facilitates an individual or regional response to the problem of undersea noise. Three distinct geographic and regulatory regions will be surveyed in order to provide an overview on how acoustic marine pollution is currently being, and indeed how it could be better addressed at the regional level. These three regions comprise the Mediterranean and Black Seas, the seas of Northern Europe and the Southern Ocean surrounding Antarctica. All regions provide the habitat for a substantial number of species of cetacean and pinniped.[113] The Mediterranean and Black seas are industrialized and important for tourism and maritime transport. Military manoeuvres are regularly conducted in the Mediterranean and it should be noted that in 1996 twelve cetaceans stranded off the coast of Greece at a time when NATO was testing a low-frequency active sonar system. The region is subject to regional seas agreements adopted under the auspices of the UNEP regional seas programme. As at the global level, measures preventing and mitigating acoustic marine pollution have been and may be further adopted pursuant to an integrated network of pollution prevention and biodiversity conservation obligations. The seas of Northern Europe support some of the busiest shipping lanes in the world as well as a thriving oil and gas industry. Although, as in the Mediterranean, pollution and biodiversity obligations are closely linked, the relevant regional seas conventions are distinct and independent from the UNEP regional seas programme. The Southern Ocean is a region subject to frequent seismic surveys in the pursuit of ocean science and it should be noted that Heard Island, from which the ATOC experiment was based, lies within the Antarctic Convergence.[114] Unlike the seas of Europe, the Antarctic marine (and terrestrial) ecosystem is subject to a unique regional regime which has as its focus the comprehensive protection of the Antarctic environment. Central to this regime is the 1991

[113] The Mediterranean and Black Seas provide the habitat for approximately twenty-one species of cetacean, many of which are vulnerable and known to strand. The seas of Northern Europe which for the purposes of this article comprise the North East Atlantic, English Channel, North Sea, Baltic Sea, and Arctic Ocean provide habitat for at least twenty-nine species of cetacean. The Southern Ocean provides habitat for approximately seventeen species of cetacean. For convenience, the term 'pinniped' will be used throughout this article although the scientific consensus now regards pinnipeds as belonging to three related families within the order Carnivora: *Otariidae* ('eared' seals), *Obdobenidae* (walrus), and *Phocidae* ('true' seals).

[114] The Antarctic Convergence lies between approximately 50° and 60° South Latitude. Heard Island is located at 53 06° South 72 31° East.

Environmental Protocol concluded under the auspices of the 1959 Antarctic Treaty.

Within a State's (or regional grouping of States') jurisdiction(s), considerable capacity exists for the adoption of measures designed to prevent and mitigate the problem of acoustic marine pollution. Within their territorial seas and exclusive economic zones (EEZ), States are able to adopt rules in order to prevent pollution, conserve living resources and regulate the conduct of scientific research.[115] Regulations may therefore be adopted in relation to the control of seismic activities, the exploitation of oil and gas as well as drilling and dredging activities. Generally speaking, a coastal State is more limited in its EEZ than in its territorial sea with respect to its legislative capacity. For example, a coastal State should not normally refuse to give its consent to a request by another State to conduct scientific research within its EEZ.[116] Nevertheless, it should be noted that such consent may be withheld if the research involves drilling onto the continental shelf or the use of explosives.[117] Additionally, consent may also be withheld if the research involves the introduction of harmful substances into the environment. However, as discussed above in the context of MARPOL 73/78, the term 'substance' cannot be convincingly applied to noise or sound.[118]

It should also be noted that whilst other States have a right to innocent passage through the territorial sea of a coastal State,[119] the definition of both innocent and passage[120] does not extend to the carrying out of research or survey activities,[121] and the right is lost on committing wilful and serious pollution.[122] Undoubtedly, the testing of ATOC and the conduct of other such scientific research is embraced by the former provision. Arguably, the *testing* of LFA sonar also falls within the remit of 'research' under Article 19(2)(j), which is not preceded by the term 'scientific' as it is in other provisions of UNCLOS. However, the *operation* of LFA sonar cannot really be regarded as research, and is presumably acceptable insofar as it does not present a threat to the coastal State, does not constitute an exercise in weapons testing and the passage of the vessel is continuous and expeditious.[123]

[115] Arts 21(1)(f), (d) and (g), 245, and 56(1)(b)(iii) of UNCLOS 1982. A State's territorial sea extends up to 12 nautical miles from its baseline (Art 3) and its EEZ extends up to 200 nautical miles from its baseline (Art 57).

[116] Art 246(3).

[117] Art 246(5)(b).

[118] Finally, it should be pointed out that where research relates to the exploitation of the continental shelf (which may or may not coincide with a State's EEZ), the coastal State has the exclusive right to authorize and regulate drilling (Art 81).

[119] Art 17 UNCLOS.

[120] Arts 18 and 19 UNCLOS.

[121] Art 19(2)(j).

[122] Art 19(2)(h).

[123] Arts 19(2)(a) and (b) and 18(2). The question as to whether military vessels in of themselves have a right to innocent passage has given rise to considerable controversy. The reference to the manner of submarine navigation through the territorial sea in Art 20 of UNCLOS implies that such a right exists, yet the practice of a number of States indicates that they regard there being no such right and stipulate that consent must be sought prior to navigation. See R Churchill and A Lowe *The Law of the Sea* (3rd edn Manchester MUP 1999) 88–92.

With respect to vessels registered to its own flag, a State may of course require the adoption of noise mitigating design and construction standards which go beyond those stipulated by the IMO.[124] However, within the territorial sea and particularly within the EEZ, there exists considerably less scope for the coastal State to enact legislation controlling vessel-source noise emissions from vessels registered to third States. Although Article 211(4) of UNCLOS permits States to introduce regulation controlling vessel-source pollution *beyond* the international standards required by MARPOL 73/78 within the territorial sea, no coastal State (or indeed regional grouping thereof) may adopt rules relating to the construction and design of vessels beyond the standards which are already required by international law.[125] Consequently, coastal States are restricted to enacting measures which designate sea lanes in order to avoid vulnerable areas such as breeding grounds or migratory routes and the introduction of speed limits for vessels.[126] Within its EEZ, a State is generally confined to legislation which reflects the provisions of MARPOL 73/78.[127] There are however, two important situations within which States may adopt legislation which introduces requirements in excess of MARPOL standards. First, where international standards are insufficiently able to protect specific areas due to particular oceanographical and ecological conditions, States may adopt, through the competent international organization (the IMO), laws and regulations which apply to discharges or navigational practices.[128] The designation of these areas currently takes place under the auspices of the IMO's rules on the creation of Special Areas and PSSAs.

The second instance in which a coastal State may regulate vessels in excess of international standards to prevent, reduce and control pollution of the marine environment from vessels, relates to ice-covered areas.[129] This provision is particularly significant because whilst all such laws and regulations must be non-discriminatory, coastal States appear to be free to regulate the construction, design, and equipment of vessels such as, for example, ice-breakers.[130] Although Article 234 explicitly relates to the EEZ it would appear to apply also to the territorial sea which for the purposes of the provision is simply subsumed within the EEZ. Otherwise known as the 'Canadian Provision,' Article 234

[124] Art 94(3)(a) UNCLOS.
[125] Art 21(2).
[126] A right to designate sea lanes where necessary for the safety of navigation is provided for in Art 22 of UNCLOS. It is now not uncommon for sea lanes to be designated for the protection of the environment. For example, in July 2003 new shipping lanes were put into effect in the Bay of Fundy by Canada in order to protect the North Atlantic Right Whale (*Eubalaena glacialis*) from ship strikes. See Press Release of Transport Canada No A007/03.
[127] Art 211(5) UNCLOS.
[128] Art 211(6). States may not however, attempt to regulate the construction and design of vessels (Art 211(6)(c)).
[129] Art 234.
[130] Churchill and Lowe op cit n 123, 348.

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applies to the Arctic[131] and clearly allows concerned States such as Canada to implement special measures to protect the environment from pollution, including acoustic marine pollution. Recently, the IMO has attempted to operationalize Article 234 through the conclusion of Guidelines for Ships Operating in Arctic Ice-Covered Waters.[132] However, these guidelines do not seek to regulate acoustic emissions from vessels and pollution is very narrowly defined, applying principally to those substances currently listed in the MARPOL 73/78 annexes.

A. Regional Obligations to Prevent and Minimise Acoustic Marine Pollution

Unlike the Southern Ocean, the seas of Europe are subject to distinct yet compatible regional seas regimes. The Mediterranean was the first sea to benefit under UNEP's regional seas programme which was initiated in 1974. The 1975 Action Plan was swiftly followed with the conclusion of the Barcelona Convention for the Protection of the Mediterranean Against Pollution in 1976.[133] The text of this Convention was revised in 1995 in the light of the conclusion of the 1992 Biodiversity Convention, the adoption of Agenda 21 and the entry into force of the UNCLOS 1982.[134] Almost 20 years after the approval of the Mediterranean Action Plan, the 1992 Bucharest Convention for the Protection of the Black Sea against Pollution was adopted and is expressed in very similar terms to the Barcelona Convention.[135] In contrast to the Southern European regimes, the 1992 Convention for the Protection of the

[131] It is highly unlikely that the provision could be applied to the Southern Ocean due to the absence of ice covering it for most of the year and the fact that the seas surrounding the Antarctic continent are currently classed as high seas. Arguably, Art IV of the Antarctic Treaty 1959 which essentially provides for a 'freezing' of Antarctic claims precludes the claim by a State to an EEZ within the Antarctic Treaty Area, although it should be noted that Australia has made such a claim. See S Kaye and D Rothwell 'Southern Ocean Boundaries and Maritime Claims: Another Antarctic Challenge for the Law of the Sea?' (2002) 33 Ocean Development and International Law 359–89.

[132] These voluntary guidelines were agreed upon in Dec 2002. See IMO. MSC/Cir.1046/MEPC/Circ 399 available online at <http://www.imo.org/HOME.html>. Originally known as the Polar Code, considerable debate has taken place as to whether they should apply to the Antarctic. A working paper on the topic was presented by the UK to the XXV Antarctic Treaty Consultative Meeting (ATCM) in Poland, 2002 and it was decided that the parties should wait until finalized guidelines were produced by the IMO before any decision as to applicability is taken (see *Final Report of the Twenty-Fifth Antarctic Treaty Consultative Meeting, Poland, 2002*, paras 97–9).

[133] 15 ILM (1976) 290. In force 1978.

[134] 1995 Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, text available online at <http://www.unep.ch/seas/hconlist.html>. The amended text is currently not in force. All references, unless otherwise stated, relate to the revised text of the Convention. It is notable that the number of parties to the Barcelona Convention represents almost complete geographic coverage of this region.

[135] 32 ILM (1993) 1110. In force 1994.

Marine Environment of the North-East Atlantic (OSPAR)[136] and the 1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM)[137] operate independently of the UNEP regional seas programme. The Arctic Ocean is not subject to a binding regional seas regime,[138] but marine pollution is expressly identified as comprising part of the remit of the 1991 Arctic Environmental Protection Strategy (AEPS).[139]

Acoustic marine pollution is expressly identified in only two of these instruments: HELCOM and the AEPS. Article 9 of HELCOM narrowly calls on parties to undertake special measures in order to abate the harmful effects of pleasure craft on the Baltic which include air pollution, *noise* and hydrodynamic effects. Much more generally, the AEPS identifies noise as one of six environmental concerns present within the Arctic ecosystem and notes that existing legal instruments do not currently address this issue.[140] Nevertheless, *all* of these instruments contain a wide-ranging commitment to reduce and mitigate the impact of pollution, which is defined, as in the context of UNCLOS, in terms broad enough to so as to be applicable to noise.[141] Both OSPAR and HELCOM operate a series of Annexes which address specific sources of pollution but none directly address undersea noise.[142] Nonetheless, Article 7 of OSPAR expressly stipulates that parties must prescribe measures to protect the environment against pollution *from other sources* to the extent that such pollution is not already the subject of effective measures prescribed by other international conventions.

Unlike the seas of Northern Europe, the Southern Ocean lacks a regional seas instrument and consequently, the articulation of broad obligations to prevent and minimise pollution are also absent. Instead, the 1991 Environmental

[136] 32 ILM (1993), 1072. In force 1998. Replaces the 1972 Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo) and the 1974 Convention for the Prevention of Marine Pollution from Land-Based Sources (Paris). OSPAR applies to those parts of the Atlantic and Arctic Oceans and their dependent seas which lie north of 36° north latitude and between 42° west longitude and 51° east longitude (Art 1(a)(i)). The Baltic and Mediterranean Seas are excluded from its remit (Art 1(a)(i)(1) and (2)).

[137] BNA 35:0401. In force 2000. Replaces 1974 Convention on the Protection of the Marine Environment of the Baltic Sea Area.

[138] Although as noted above, 1992 OSPAR has jurisdiction over limited parts of the Arctic.

[139] Text available on the website of the Arctic Council at <http://www.arctic-council.org/index.html>.

[140] *Arctic Environmental Protection Strategy*, paras 3.4 and 4.4.

[141] Arts 4(1) and 2(a) of the Barcelona Convention; Arts II(1) and V(2) of the Bucharest Convention; Arts 2(1) and 1(d) of OSPAR 1992; Arts 3(1) and 2(1) of HELCOM 1992. With few firm conservation obligations, it should be noted that the fifth objective of the AEPS is the elimination of pollution which is undefined in the Strategy.

[142] It should be noted that under HELCOM, obligations in respect of the offshore exploration and exploitation are broad enough to apply to noise. Regulation 2 of Annex VI stipulates that parties must use best available technology and best environmental practice to prevent and eliminate pollution from offshore activities. Pollution is defined in terms of substances or energy (Art 2(1)) and as argued above, these obligations are consequently of application to noise. Annex III of OSPAR, which also relates to the regulation of pollution from offshore sources, is expressed much more narrowly. Art 4 of the Annex seeks to restrict the discharge of *substances* in the maritime area.

Protocol[143] ambitiously commits parties to 'the comprehensive protection of the Antarctic environment and dependent and associated ecosystems' and designates Antarctica as a natural reserve, devoted to peace and science.[144] Notwithstanding the reference in Article 2 to dependent and associated ecosystems, the Protocol essentially applies to activities taking place within the Antarctic Treaty Area which is defined in Article VI of the 1959 Antarctic Treaty as the area south of 60° South Latitude including all ice shelves.[145] Consequently, whilst the Environmental Protocol is of unambiguous maritime application, its remit does not appear to extend to the Antarctic Convergence nor to a number of sub-Antarctic Islands such as Heard Island. Nevertheless, within its geographical remit it is clear that the issue of undersea noise is subject to regulation within the framework of the Protocol, a conclusion supported by the fact that marine acoustic pollution reached the scientific agenda of the Committee on Environmental Protection (CEP) in 2000, 2002 and 2003.[146] Furthermore, it should be noted that any measures of a military nature, including military manoeuvres, such as, it is suggested, the testing and/or use of active military sonar, are prohibited by Article I of the 1959 Antarctic Treaty within the Antarctic Treaty Area.

Within the Southern Ocean, measures taken to prevent and mitigate acoustic marine pollution take place within the framework of environmental impact assessment, which is of fundamental importance to the operation of the Protocol. *All* proposed activities (including tourism and scientific research) likely to have more than a minor or transitory impact on the Antarctic ecosystem are subject to an environmental impact assessment in accordance with the regulations set out in Annex I of the Protocol.[147] Minor and transitory are

[143] 30 ILM (1991) 1461. In force 1998.
[144] Art 2.
[145] Art 1(b) of the Environmental Protocol.
[146] The CEP was established under Art 11 of the 1991 Environmental Protocol. See *Report of the Committee for Environmental Protection's Third Meeting (CEP III), The Hague, Netherlands, 2000*, at paras 42–3; *Report of the Committee for Environmental Protection's Fifth Meeting (CEP V), Warsaw, Poland, 2002*, paras 25–8; *Report of the Committee for Environmental Protection's Sixth Meeting (CEP VI), Madrid, 2003*, at paras 56–8. An information and working paper submitted by the Scientific Committee on Antarctic Research (SCAR) to the 2002 CEP Meeting noted that although disturbance of cetaceans has been documented on occasion, acoustic scientific investigation is vital to the understanding of the Antarctic environment. Consequently, the organization regarded a ban on seismic surveys or scientific echo-sounders in Antarctic waters as unjustifiable. However, SCAR recommended that all surveys should be examined on a case by case basis and that in all instances, mitigation strategies such as the use of minimum source levels, soft starts and special measures in biologically sensitive areas should be implemented. See further SCAR 'Marine Acoustic Technology and the Environment' WP-023; SCAR *Impacts of Marine Acoustic Technology on the Antarctic Environment* (July 2002), 25IP024/E both presented at the XXV ATCM (2002); Spain 'Anthropogenic Acoustic Noises and Discharges and their Impact on Marine Mammal Populations' WP-034-E; SCAR 'Acoustic Technology and the Marine Ecosystem' IP-077-SCAR and; ASOC 'Marine Acoustic Technology and the Antarctic Environment' IP-073-ASOC all presented at the XXVI ATCM (2003).
[147] Art 8.

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nowhere defined in the Protocol[148] and it has been noted that parties are not always consistent in their approach to noise within the context of an environmental impact assessment. In the past, a number of States have regarded noise emissions as resulting in less than minor or transitory impact, whereas others have submitted similar activities to a comprehensive environmental evaluation.[149] All draft assessments are considered by the Antarctic Treaty Consultative Meeting,[150] which must make a decision on whether the proposed activity may proceed on the basis of the report as well as other relevant considerations.[151]

The process of environmental impact assessment, by means of which the impacts of undersea noise may be mitigated or even prevented, is not of course restricted to the Southern Ocean. Within the Mediterranean all activities which are likely to cause a significant adverse impact on the marine environment and which are subject to authorization by competent national authorities require an environmental impact assessment under Article 4(3)(c) of the Barcelona Convention.[152] Similar requirements are provided for in respect of the Baltic under HELCOM, although in contrast to the Barcelona Convention, the assessment must be required by international law or supra-national regulations rather than by national law.[153] Moreover, in all these instruments and the AEPS, there is a strong endorsement of the precautionary principle whereby the absence of full scientific certainty should not be used as a reason to postpone measures preventing environmental degradation.[154] Consequently, in

[148] But see the *Guidelines for Environmental Impact Assessment in Antarctica* available on the CEP website at <http://www.cep.aq/>.

[149] As noted by SCAR in WP-023 (2002).

[150] After being made publicly available and passed to the CEP. See Arts 3(3) and (4) of Annex I.

[151] Art 4, Annex I. It should be noted that although subject to a 50-year moratorium under Art 7 of the Environmental Protocol, the commercial exploitation of oil and gas in and off Antarctica remains a possibility (see Art 25(2) of the Protocol). Conscious of the potential negative impact of such a development, the parties to the Protocol agreed that the conclusion of a binding minerals regime must precede any such exploitation (Art 25(5)(a)). Plainly, any such instrument must address the discharge of undersea noise as well as the discharge of other substances. It is notable that the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA) ((1988) 27 ILM 868, not in force) is drafted in terms broad enough to embrace noise (see Arts 4 and 13).

[152] In common with most regional seas conventions, the Barcelona Convention incorporates a sovereign immunity provision (Art 3(5)) which arguably might prevent its provisions from applying to the deployment of military sonar.

[153] Art 7(1). Where the impact of noise is transboundary in nature such an assessment will in fact be required by the 1991 Espoo Convention on Environmental Impact Assessment in a Transboundary Context (30 ILM (1991) 802, in force 1997) which applies to maritime as well as terrestrial areas (see Art 1(Viii)) and has been ratified by all HELCOM parties save Russia. In particular, Appendix I activities, which include the construction of ports and the development of offshore activities, must be assessed under the Convention. Moreover, those parties which are also Member States of the EU are subject to European EIA regulation (see Council Directive 85/337/EC as amended by Council Directive 97/11/EC of 3 Mar 1997). It should be noted that both the Espoo Convention and EU regulations are of course applicable to the seas of Europe beyond the Baltic.

[154] Art 4(3)(a) Barcelona Convention 1995; Art 2(2)(a) OSPAR 1992; Art 3(2) HELCOM 1992.

applying a precautionary approach it is arguable that many activities which create substantial amounts of noise such as drilling, dredging, ocean science experimentation, and even the exercise of military sonar (subject to sovereign immunity provisions), should be subject to an environmental impact assessment with a view to mitigating and, if appropriate, preventing the adverse impact of undersea noise on the maritime ecosystem within these diverse regions.

In conclusion, whilst undersea noise is not generally *directly* regulated within the context of regional seas conventions, all instruments are clearly facilitative of such regulation. Moreover, the planning of noisy activities such as extending a port or permitting the execution of marine scientific research should be, within all the above regions, subject to some form of environmental impact assessment which must include an assessment of the acoustic effects in the maritime environment. As a (albeit recently identified) pollutant, undersea noise should ultimately be regulated within the framework of regional pollution prevention obligations. However, regionally (as well as internationally) the problem of undersea noise is not currently perceived as a priority for regulation within the pollution prevention framework. Consequently, as at the international level, it is necessary to examine the extent to which regional biodiversity instruments provide a forum for the regulation of undersea noise.

B. Regional Obligations to Conserve Marine Biodiversity and their Applicability to Undersea Noise

As noted above, unlike other forms of pollution, noise does not damage the marine environment per se. Rather, its harm lies in the injury caused to marine life, particularly marine mammals, and the consequent damage caused to a marine ecosystem through the loss or displacement of a species. In all three regions a network of discrete yet consonant obligations relating to the conservation of marine biodiversity are incurred within a variety of fora which include regional seas conventions, treaties for the protection of biodiversity within a particular geographic region and instruments for the conservation of a specific species. In all regions surveyed, three principal mechanisms are used in order to effect the conservation of marine biodiversity: the general regulation of activities within the maritime environment, the designation of specially protected areas and the special protection of endemic vulnerable species. All three regulatory tools may be utilised in order to protect marine biodiversity from the negative impacts of undersea noise. Taking the first of

Since 1997 the parties to the AEPS 1991 have regarded the principles of precaution and EIA as central to the protection of biodiversity and prevention of pollution in the Arctic (see the *Co-operative Strategy for the Conservation of Biological Diversity in the Arctic Region* (1997) text available online at <http://www.arctic-council.org/index.html>). Although lacking an express endorsement in the manner of the regional seas conventions, the nature of the 1991 Environmental Protocol is clearly precautionary and this is best illustrated by Art 3(2) of the Protocol.

these regulatory tools it is notable that the adoption of the UN Biodiversity Convention in 1992 led to the consequent inclusion of direct obligations designed to conserve maritime biodiversity within the text of the many regional seas regimes which were revised during the early 1990s.[155] In the Mediterranean for example, parties to the Barcelona Convention concluded, in 1995, a Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean.[156] Article 3(1)(b) of this Protocol stipulates that each party shall take the necessary measures to protect, preserve and manage threatened or endangered species of fauna and flora, and in particular, they must identify activities that have or are likely to have a significant impact on the conservation of biodiversity.[157] Similar provision for the adoption of general conservation measures is provided for under Annex V of OSPAR and Article 15 of HELCOM with respect to the North East Atlantic and Baltic respectively.

These largely hortatory provisions may be contrasted with the detailed conservation obligations in respect of Antarctic flora and fauna incurred pursuant to Annex II of the 1991 Environmental Protocol.[158] Within the Antarctic Treaty area, the taking of, or harmful interference with, native species of fauna is prohibited except in accordance with a permit.[159] 'Take' is defined so as to include the killing of, injury to and molestation of, native mammals and birds, all of which can result from significant noise emissions.[160] 'Harmful interference' directly addresses the issue of noise pollution and is defined as the flying or landing of aircraft, and the use of vehicles, vessels, explosives or firearms in a manner which disturbs concentrations of birds and seals.[161] The focus of this provision appears to be narrowly confined to birds and seals and it is evident that the drafters had in mind terrestrial or coastal disturbance rather than undersea noise. However, a set of proposed guidelines for the operation of aircraft near concentrations of birds presented to the 2002 CEP meeting noted that in the longer term, consideration should be given to extension of the guidelines to concentrations of marine mammals, which suggests 'harmful interference' may well be given a broader definition

[155] Art 10 of the Barcelona Convention; Art XIII of the 1992 Bucharest Convention; Annex V of 1992 OSPAR; Art 15 of 1992 HELCOM.

[156] (1995) 6 Yearbook of International Environmental Law 887. In force 1999. Hereinafter cited as the SPA Protocol. This protocol replaces the 1982 Protocol Concerning Mediterranean Specially Protected Areas. Again geographic coverage of the region is comprehensive although the current omission of Greece, Libya, and Turkey from among its parties results in diminished protection for the Eastern Mediterranean.

[157] Art 3(5).

[158] Annex II of the Environmental Protocol incorporates and updates the 1964 Agreed Measures for the Conservation of Antarctic Flora and Fauna.

[159] Art 3(1), Annex II. Authorization may be given in order to provide for unavoidable consequences of scientific activities or for the construction and operation of scientific support facilities (Art 3(2)(c), Annex II).

[160] Art 1(g), Annex II.

[161] Art 1(h), Annex II.

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in the future and become more directly applicable to sources of undersea noise.[162]

As noted above, the Environmental Protocol has a relatively restricted geographical mandate. By contrast, the jurisdictional scope of the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) is more expansive and extends to the marine living resources found south of the Antarctic Convergence.[163] However, the Convention's principal aim is the regulation of harvesting and associated activities.[164] The extent to which CCAMLR may regulate noise producing activities consequently depends on whether they may be classified as 'associated activities'. It is highly likely that the execution of seismic surveys, ocean science experimentation and the deployment of military sonar cannot be so regarded. However, there appears to be no reason why fishing vessel noise cannot be managed, (provided requirements do not relate to their construction or design) and the use of sonar to deter prey species by fisherman regulated, under CCAMLR.[165] Moreover, CCAMLR explicitly endorses an ecosystem approach whereby the direct and *indirect* effects of harvesting activities on dependent and related populations of living resources should be taken into account when implementing conservation measures.[166] Consequently, the impact of undersea noise caused by fishing and associated activities on all Antarctic marine biodiversity, including cetaceans and pinnipeds, should be addressed by the CCAMLR Commission when adopting conservation measures and setting catch limits. Nevertheless, whilst CCAMLR may have a minor role to play in the mitigation and prevention of undersea noise, as a forum for the adoption of more general measures within the Southern Ocean, it is inevitably concluded that CCAMLR is considerably less apposite than the 1991 Environmental Protocol.

An increasingly popular mechanism used for the preservation of both terrestrial and maritime ecosystems in all the regions surveyed is the designation of specially protected areas. Within such areas it may be possible to regulate particularly noisy activities much more stringently or even prohibit them

[162] See WP-026 presented at the V CEP Meeting in Poland in 2002.

[163] 19 ILM (1980) 837. In force 1982. Arts 1(1), II(1) and I(2). Art VI provides that nothing in CCAMLR shall derogate from the rights and obligations of contracting parties under the ICRW 1946 and the Antarctic Seals Convention 1972. This provision does not however, necessarily exclude seals and whales from the remit of CCAMLR which, it is suggested, may adopt conservation measures in respect of those species to the extent that they are not provided for under the above instruments.

[164] Art II(3).

[165] The types of conservation measures which may be implemented by the Commission (established under Art VII of CCAMLR) are relatively broadly defined under Art IX.

[166] Art II(3)(b). Recently the CCAMLR Commission has promulgated conservation measures relating to harvesting equipment with the aim of reducing the by-catch of seabirds and marine mammals. See Conservation Measures 25-02 (2002): Minimization of the Incidental Mortality of Seabirds in the Course of Longline Fishing or Longline Fishing Research in the Convention Area and Conservation Measure 25-03 (1999): Minimization of the Incidental Mortality of Seabirds and Marine Mammals in the Course of Trawl Fishing in the Convention Area.

altogether and, in co-operation with the IMO, regulate shipping so as to minimize their impact on vulnerable species. Within the Southern Ocean, Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMAs) may be designated under Annex V of the Environmental Protocol.[167] Within these areas (which may include maritime regions) activities may be prohibited, restricted or managed in accordance with management plans developed pursuant to the Annex.[168] There is no reason why noisy activities such as seismic surveys and so forth cannot be restricted or even prohibited within ASPAs and ASMAs. In respect of a maritime protected area, it should be noted that the CEP should take into account advice afforded by the CCAMLR Commission. Likewise, within the seas of Europe, considerable scope exists for the designation of specially protected areas under a number of different regional seas and regional biodiversity instruments. Both OSPAR 1992 and HELCOM 1992 seek to incorporate the international PSSA scheme implemented by the IMO into their regional conservation strategy.[169] Furthermore, both HELCOM and the Barcelona SPA Protocol establish regional networks of protected areas within the Baltic and Mediterranean respectively.[170] For example, there are currently forty-seven Specially Protected Areas of Mediterranean Importance (or SPAMIs) which comprise important habitat for endangered or endemic species within the Mediterranean region.[171] Within SPAMIs, parties must adopt conservation measures which include, inter alia, the regulation of navigation, scientific research, sub-soil exploration and exploitation and, most significantly, the regulation (and if necessary, prohibition), of any activity likely to harm or *disturb* species.[172]

Much more generally, the seas of Europe also benefit from a network of protected areas created pursuant to two other regional biodiversity instruments, namely the 1979 Bern Convention on the Conservation of European Wildlife and Natural Habitats[173] and the 1992 EC Council Directive on the Conservation of

[167] Annex V was incorporated into the Protocol through Recommendation XVI-10 of 1991. See the *Final Report of the Sixteenth Antarctic Treaty Consultative Meeting, Bonn, Germany, 1991*. In force May 2002.

[168] Art II, Annex V.

[169] Art 4(2), Annex V, OSPAR 1992, stipulates that the OSPAR Commission must bring issues which relate to the management of maritime traffic to the IMO with a view to their being dealt with in the context of PSSA designation. HELCOM Recommendation 15/5 (as updated by HELCOM HOD 11/2003) notes that it is intended that the IMO PSSA guidelines will ultimately be incorporated into the Baltic Sea Protected Areas (BSPAs) guidelines.

[170] Art 5 Mediterranean SPA Protocol; HELCOM Recommendation 15/5 as updated by HELCOM HOD 11/2003 which establishes a system of Baltic Sea Protected Areas (BSPAs). It should also be noted that a network of protected areas (known as Protected Areas Network or PAN) within the Arctic is in the process of being created, although currently only 2 per cent of the Arctic maritime environment is protected. A Strategy and Action Plan for the creation of a Protected Areas Network was endorsed in 1996. See <http://www.arctic-council.org/index.html>).

[171] Arts 5, 8 and Annex I of the SPA Protocol.

[172] Arts 6(c), (f), (e) and (h). Emphasis added.

[173] UKTS 56 (1982), Cmnd 8738. In force 1982.

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Natural Habitats and of Wild Fauna and Flora.[174] Both instruments have very similar aims and use proximate techniques in their attempt to protect both biodiversity and habitats within marine as well as terrestrial ecosystems.[175] In particular, both the Bern Convention and the Habitats Directive provide for the designation of sites which constitute habitat for endangered species.[176] Under the Bern Convention, parties must have regard to the conservation of species within these sites in the formation of planning and development policies and pay special attention to sites which are of importance to migratory species such as cetaceans.[177] Greater detail is provided for in relation to special areas of conservation under the EC Habitats Directive. Member States must establish necessary conservation measures and if appropriate, develop management plans for these areas.[178] Such measures may include taking steps to avoid disturbance, in so far as such disturbance could be significant (which is undefined) in relation to the objectives of the Directive.[179] The principal objective of the Directive is to maintain fauna and flora at, or restore it to, a favourable conservation status.[180] The implication of Article 6(2) is such that the obligation to take steps to avoid the disturbance of species occurs when that disturbance has *or is likely* to have an impact on the conservation status of that species. This relatively high threshold for action is however, mitigated by a clear reference to the precautionary principle.[181] The Emerald Network of areas of special conservation interest established under the auspices of the Bern Convention is closely coordinated with Natura 2000, an ecological network of special areas designated in pursuance of the EC Habitats Directive. To date, the focus of both instruments has been on its implementation within terrestrial regions. For example, under the EC Habitats Directive, only Belgium, Denmark, Greece, the Netherlands, and the UK had identified marine special areas of conservation by 1998. However the importance of protecting marine areas under the Directive has recently been emphasized and it is likely that more sites will be so designated in the future.[182]

[174] Council Directive 92/43/EEC [1992] OJ L206/7.

[175] Art 1 of the Bern Convention; Art 2(1) of the Habitats Directive. On their conservation obligations in respect of individual species see below.

[176] Under Art 4(1) of the Bern Convention parties must take appropriate measures to protect the habitats of species listed in Appendix II (which includes all species of cetacean not listed in Appendix I, below). See also Arts 3–5 of the EC Habitats Directive where parties must protect inter alia the habitats of species listed in Annex II, which include two species of cetacean and five species of pinniped.

[177] Arts 4(2) and 4(3). [178] Art 6(1). [179] Art 6(2).

[180] Art 2(2) Conservation status is defined in Art 1(i) as the 'sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2'.

[181] For further detail on Art 6 of the Habitats Directive see *Managing Natura 2000 Sites: The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* available online at <http://europa.eu.int/comm/environment/nature/art6_en.pdf>.

[182] See C Coffey (ed) *Implementing the Habitats Directive in Marine and Coastal Areas: Proceedings of a Seminar Held at Morecambe Bay, England, 22–24 June 1997* available online at <http://europa.eu.int/comm/dg11/nature/home.htm>.

The final mechanism which may be employed for the protection of marine biodiversity against the impact of acoustic marine pollution is the adoption of conservation measures in respect of a vulnerable species, in particular the cetacean. A number of regional seas instruments, the Bern Convention, EC Habitats Directive and the 1991 Environmental Protocol all provide for the adoption of such conservation measures. Within the Mediterranean for example, the parties to the SPA Protocol undertake to identify endangered species of fauna (and flora) within their jurisdiction and accord those species protected status.[183] Article 11(2) of the Protocol imposes a general obligation to regulate and, where appropriate, prohibit activities having adverse effects on those species. Furthermore, States must also control and, where appropriate, prohibit the killing, including to the extent possible the *incidental killing*, of protected species.[184] Significantly, in the context of acoustic marine pollution, Article 11(3)(b) obliges parties to control and, where appropriate, prohibit to the extent possible the *disturbance* of wild fauna, particularly during periods of breeding or migration as well as other periods of biological stress. Arguably, this provision (which is not limited in its application to endangered species or to Specially Protected Areas), obliges parties to control shipping, seismic surveys and other noisy activities in areas which are important to cetaceans. Finally, it should be noted that maximum protection must be afforded in respect of endangered or threatened species listed in Annex II of the Protocol.[185] Twelve species of whales are currently listed in Annex II (of which several are deep diving and at least two are relatively common stranders) in addition to five species of dolphin, the Harbour Porpoise (*Phocoena phocoena*) and the Mediterranean Monk Seal.

Beyond the Mediterranean (although of application to that region), both the Bern Convention and the EC Habitats Directive provide for wide-ranging conservation obligations in respect of individual species throughout Europe. Pursuant to Article 6 of the Bern Convention parties must for example, take appropriate measures to protect those species listed in Appendix II from a number of threats including their deliberate disturbance (particularly during breeding and migration) insofar as disturbance would be significant in relation to the objects of the Convention.[186] There are currently thirty species of cetacean listed in Appendix II. Since the objects of the Bern Convention are broadly defined as the conservation of wild fauna and flora in their natural habitats,[187] it is suggested that disturbance resulting from seismic surveys or ocean science experimentation within the habitat of a vulnerable species would be significant in relation to the objects of the Bern Convention. 'Disturbance' as expressed in Article 6(c) would appear to have to be deliberate. A narrow interpretation of this provision might exclude a number of activities whereby the emission of noise is a pure by-product of that activity, from

[183] Art 11(2).
[184] Art 11(3)(a).
[185] Art 12(2).
[186] Art 6(c).
[187] Art 1(1).

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its remit. More broadly, it could be argued that where the by-product of an activity (such as noise from a high speed vessel) is known to cause, or is highly likely to cause, the disturbance of an Appendix II species, such disturbance may be regarded as deliberate.[188] Under the 1992 Habitats Directive, likewise protected species listed in Annex IV (which includes all species of cetacean and a number of species of pinniped) are equally protected from deliberate disturbance.[189]

Similarly, in the Southern Ocean further protection is afforded to Antarctic Specially Protected Species (ASPS) listed in Appendix A of Annex II of the 1991 Environmental Protocol. Permits for taking and harassment will not be issued in respect of an ASPS unless they are for a compelling scientific purpose, will not jeopardize the survival or recovery of that species or local population, and use non-lethal techniques where appropriate.[190] However, these provisions are currently of limited impact in the context of marine acoustic pollution as, to date, Appendix A lists only certain pinniped species.[191] Nevertheless, recently concern has been expressed over the narrow parameters of Appendix A, and, in 2002, the ATCM endorsed a CEP proposal that the designation of ASPSs be based on the IUCN Red List categorization.[192] Those species listed at least as 'vulnerable' based on IUCN criteria (which includes both the blue and fin whales in the Antarctic) will be designated ASPSs. Moreover, SCAR has been requested by the ATCM to conduct a review in conjunction with the IUCN of those species designated as 'data deficient' on the Red List, which currently include a further six species of Antarctic cetacean.[193]

The final layer of conservation obligations which are significant in the context of marine acoustic pollution are provided for by three instruments which seek to protect cetaceans within the seas of Europe, namely the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1992 (ASCOBANS);[194] the Agreement on the Conservation of

[188] It should be noted that in Resolution No 1 adopted by the Standing Committee in 1989 'deliberate damage to or destruction of breeding or nesting sites' in Art 6(b) has been interpreted so as to include 'any act committed without the intention to cause damage or destruction but in the knowledge that such would probably be the consequences of the act'. A broader interpretation of Art 6(c) is therefore consistent with this interpretation of Art 6(b). Moreover, under Art 8 parties must also prevent the *serious disturbance* of populations of all species listed in Appendix III, which includes all species of cetacean not listed in Appendix II.

[189] Art 12(1)(b).

[190] Art 3(5), Annex II. Art 3(4), Annex II stipulates that *any* species of native mammals, birds, and plants may be listed in Appendix A.

[191] Appendix A lists all species of fur seals (*Arctocephalus)* and the Ross Seal (*Ommatopoca rossi*)

[192] ATCM Resolution 1 (2002) reproduced in *Final Report of the Twenty-Fifth Antarctic Treaty Consultative Meeting, Warsaw, Poland, 2002*.

[193] Ibid. It should also be noted that a UK proposal to give special consideration to the inclusion of marine biodiversity within the list of ASPSs was acceded to. See *Final Report of the Twenty-Fifth Antarctic Treaty Consultative Meeting, Warsaw, Poland, 2002*, para. 64.

[194] (1995) UKTS No 52. In force 1994.

Cetaceans of the Black Sea and Mediterranean Sea 1996 (ACCOBAMS)[195] and; the Ligurian Sea Cetacean Sanctuary Agreement concluded in 1999 by France, Italy, and Monaco.[196] As noted above, research suggests that cetaceans in particular suffer negative impact from the presence of undersea noise. It is therefore not surprising that all three of these instruments specifically identify noise as a threat to cetaceans and are beginning the process of adopting measures for its prevention and mitigation. Both ASCOBANS and ACCOBAMS were concluded under the auspices of the 1979 Bonn Convention on Migratory Species. Since neither France nor Italy are yet party to ACCOBAMS, the agreement to create a cetacean sanctuary in the Ligurian Sea, which comprises biologically the richest part of the Mediterranean, forms an important link in this network of conservation instruments.

All three instruments contain a wide-ranging commitment to the conservation of cetaceans, although in the case of ASCOBANS, its remit is limited to small cetaceans.[197] Despite the hereditary connection between ACCOBAMS and ASCOBANS, their obligations are in fact, dissimilarly expressed when analysed in the context of their applicability to acoustic marine pollution. Unlike ACCOBAMS, ASCOBANS expressly recognizes in its preamble that disturbance may adversely affect populations of small cetaceans and accordingly, parties undertake to apply those conservation measures outlined in the Annex attached to the Convention.[198] These measures include those taken to prevent disturbance, *especially of an acoustic nature*.[199] Since entry into force, the issue of undersea noise has been a prominent ASCOBANS agenda item. The potential negative impact of seismic surveys on small cetaceans was identified in 1997 and parties were invited to submit information to the Advisory Committee[200] on the location and extent of seismic activities within the ASCOBANS and neighbouring areas, and any mitigating measures implemented to reduce possible effects on small cetaceans.[201] This led directly to the conclusion of resolutions on disturbance at both the third and fourth Meetings of the Parties in 2000 and 2003.[202] Recognizing the difficulty of proving the detrimental effects of acoustic disturbance on cetaceans, the

[195] 36 ILM (1997) 777. In force 2001.

[196] 1999 Agreement Relative to the Creation of a Mediterranean Sanctuary for Marine Mammals. Text available online at the Tethys Research Institute at <http://www.tethys.org/sanctuary_text.htm>.

[197] ACCOBAMS, Art II(1), the Ligurian Sanctuary Agreement, Art 2(2) and ASCOBANS, Art 2(1). Small cetaceans under ASCOBANS are defined as any species, subspecies or population of toothed whales *Odontoceti*, except the sperm whale (*Physeter macrocepalus*) (Art 1.2(a) ASCOBANS).

[198] Arts 2(1) and 2(2).

[199] Annex, Art 1(d). Emphasis added.

[200] Established under Art 5 of ASCOBANS.

[201] MOP2: Resolution on Further Implementation of ASCOBANS (Bonn 1997).

[202] The ASCOBANS MOP is established under Art 6 of the Convention. MOP3: Resolution No 4 on Disturbance (Bristol 2000) was repealed by MOP4: Resolution No 5 on Effects of Noise and of Vessels (Esbjerg 2003).

parties endorsed the application of a precautionary approach in dealing with this issue. The 2003 Resolution addressed, in particular, seismic surveys and requested parties to introduce guidelines in relation to the timing of surveys, the imposition of noise limits, the avoidance of areas where cetaceans are known to be in the vicinity and the development of monitoring and management systems. However, the Resolution also (albeit to a lesser extent) addressed other sources of marine acoustic pollution. Although sensitive to the demands of the military, the Resolution invited parties and range States to work with military authorities in order to develop effective mitigation measures including environmental impact assessments and relevant standing orders to minimize disturbance of small cetaceans and to report these measures to the 2005 Advisory Committee meeting. Furthermore, the Resolution also called for further research addressing the impact of shipping (particularly high speed ferries) and acoustic deterrence devices (used in the fishing industry) on small cetaceans.[203]

Although ACCOBAMS has not yet addressed the issue of undersea noise as directly as ASCOBANS, this should not suggest that the Convention cannot provide an equally promising forum for its regulation within the Mediterranean and Black Seas region. Under the Convention, parties must develop conservation measures which address the management of human-cetacean interactions as well as the assessment and subsequent regulation of activities such as offshore oil and gas exploration, nautical sports and whale-watching.[204] The work of the Scientific Committee[205] has recently identified noise as a source of concern in relation to all species of whales and of primary importance in respect of the Curvier's beaked whale.[206] Furthermore, at the first meeting of the parties held in Monaco in 2002 the parties concluded a set of recommendatory guidelines for commercial whale-watching activities in the ACCOBAMS area.[207] Additionally, within the north-western Mediterranean, ACCOBAMS is complemented by the 1999 Ligurian Sanctuary Agreement which prohibits the deliberate taking (defined so as to include harassment) or intentional *disturbance* of marine mammals.[208] The Agreement specifically identifies two sources of noise and disturbance inducing activities which must be regulated within the region, namely, whale-

[203] MOP4: Resolution No 5 on Effects of Noise and of Vessels (Esbjerg 2003).
[204] Art II(3)(b) and Annex II.
[205] Established under Art VII of the Convention with the function of providing advice to the Meeting of the Parties (established under Art III) and conducting scientific research.
[206] Notarbartolo di Sciara et al 'Overview of Known or Presumed Impacts on Different Species of Cetaceans in the Mediterranean and Black Seas' in id (ed) n 94, s 17 at 4. In this report four chapters are devoted to the impact of noise in the Mediterranean and Black Seas. Particular attention is paid to noise resulting from vessel traffic and whale-watching activities.
[207] MOP 1, Resolution 1.11. As would be expected these guidelines seek to minimize acoustic and other forms of disturbance to cetaceans.
[208] Arts 1(c) and 7(a) of the Agreement. The analysis of 'deliberate disturbance' in the context of the Bern Convention is equally applicable in the interpretation of 'intentional disturbance' under the Ligurian Sanctuary Agreement. See n 187 and accompanying text.

watching and high-speed motorboat competitions. The importance of noise as a principal focus of the agreement is evidenced by the attached Declaration which calls for an assessment of the consequences of seismic and acoustic detection techniques and vessel-source noise on marine mammals within the region.

In the short to medium term it is likely that these regional biodiversity instruments will provide the principal fora for the regulation of particular sources of undersea noise such as the exploration of oil and gas and the execution of scientific and commercial seismic surveys. The development of acoustic marine pollution regulation within Europe in particular, is likely to benefit from the synergy which is being pursued between the institutions established pursuant to these regional biodiversity instruments. For example, in the Mediterranean the ACCOBAMS administration and secretariat to the Barcelona Convention have developed an Action Plan for the Conservation of Cetaceans in the Mediterranean Sea.[209] To date, the Action Plan has focused on monitoring cetacean strandings within the Mediterranean region and in 2001 a decision was taken to establish a database to record such occurrences.[210] However, it has been suggested that ultimately, the management plan and measures taken under the auspices of the Ligurian Sanctuary Agreement may provide the basis of the Cetacean Action Plan. Such a development would be particularly welcome should the Ligurian Sea Sanctuary be designated a SPAMI under the 1995 Special Areas Protocol.[211] Moreover, it is likely that further cooperation will be called for between ASCOBANS and ACCOBAMS when the geographical jurisdiction of the former instrument is expanded so as to include the coastal area of western parts of the UK, Ireland and the Atlantic coasts of France, Spain, and Portugal as agreed at the fourth Meeting of the Parties in August 2003.[212]

Of particular promise in the short term is the Bern Convention. As noted above it provides for obligations in respect of the conservation and protection of particular species of cetacean and their habitats from threats including disturbance. However, in contrast to other instruments surveyed, this convention benefits from an innovative implementation procedure. On receipt of a complaint from a State, NGO or even an individual that a party is in breach of its obligations under the Convention, the Standing Committee may open a file

[209] See the *Report of the Fifth Meeting of National Focal Points for SPAs (Valencia, 23–26 April 2001)* UNEP(DEC)/MED WG.177/9 (29 May 2001) 11–12. See also Raga *Project of the Establishment of a Mediterranean and Black Sea Regional Cetacean Stranding Network* MOP 1/inf.7 rev 1 submitted to the First Meeting of the Parties, ACCOBAMS, Monaco, 28/02/2002–2/03/2002.

[210] Ibid.

[211] Art 16 of the Ligurian Sea Sanctuary Agreement obliges the parties to prepare a proposal for inclusion within the SPAMI list as soon as the SPA Protocol enters into force.

[212] MOP4: Resolution No 4 on Extension of the ASCOBANS Agreement Area (Esbjerg 2003).

for the purpose of monitoring the problem and the adoption of necessary conservation recommendations.[213] These recommendations may be of a general nature or alternatively may request the adoption of specific, detailed measures for the conservation of an endangered species. The longest running file, which has recently been closed, concerned the protection of Laganas Bay, Zakynthos in Greece, a breeding site for the threatened sea turtle (*Caretta caretta*) which is under threat from coastal development.[214] Recommendations adopted pursuant to Article 14 of the Convention varied from broad exhortations to provide adequate legal protection for nesting beaches to demands that thirteen illegal buildings surrounding the Dafni beach be demolished.[215] The fact that relatively few, if any parties to the Bern Convention have taken sufficient measures to protect listed cetaceans from undersea noise and disturbance suggests that these States may be in breach of their obligations under this Convention. It is consequently suggested that the swiftest way of addressing marine acoustic pollution in the short term within European waters is through the opening of such a file on the problem and the adoption of recommendations providing for noise prevention and mitigation measures by the Standing Committee.

IV. CONCLUSIONS AND RECOMMENDATIONS

The presence of undersea noise has only recently been identified as a potential source of serious harm. In general, acoustic marine pollution is not yet prioritised by environmentalists, policy makers or regulators. However, public concern over recent multi-species cetacean strandings has led to the consideration of anthropogenic sources of ocean noise by a variety of regional and global regulatory forums. Moreover, recent developments at the national level illustrate the rising profile of acoustic marine pollution. In the UK for example, it has recently become an offence to intentionally or recklessly disturb any species of cetacean.[216] Furthermore, all seismic surveys connected with the offshore oil and gas industry must be conducted in accordance with guidelines designed to minimize the disturbance of marine mammals.[217] Likewise,

[213] This mechanism was first adopted in 1984 and procedures for its implementation were provisionally adopted in 1993. See Secretariat Memorandum, *Opening and Closing of Files and Follow Up to Recommendations*, Document T-PVS (93) 48. The Standing Committee is authorized to adopt conservation recommendations under Art 14 of the Bern Convention.

[214] See the *Report on Specific Sites, Caretta caretta in Laganas Bay, Zakynthos (Greece)*, 1998 T-PVS (98) 43.

[215] Ibid.

[216] Section 4, A Wildlife and Countryside Act 1981 (as inserted by the 2000 Countryside and Rights of Way Act). This provision also applies to basking sharks (*Cetorhinus maximus*).

[217] See the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (SI 2001 No 1754). JNCC Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Surveys are available online at <http://www.jncc.gov.uk/marine/seismic_survey> and include recommendations on the planning and implementation stage, the need for marine mammal observers, the use of soft starts and the operation of surveys with lowest practicable noise levels.

Australia has also developed measures to mitigate the impact of seismic surveys on marine mammals and where such activity is likely to interfere with or threaten a cetacean, an operator must apply for a permit authorizing such interference.[218] In the US, the deployment of naval sonar has not gone unchallenged. The decision of the National Marine Fisheries Service (NMFS) to authorize an incidental take of cetaceans under the Marine Mammals Protection Act 1972[219] by the US Navy was successfully challenged in 2003 resulting in the grant of a tailored permanent injunction to prevent the deployment of peace-time SURTASS-LFA in biologically rich areas of the oceans until defects in the environmental impact assessment on the deployment of sonar are remedied.[220] Finally, many States provide for detailed regulation of the whale-watching industry, in particular, in relation to the impact of noise on cetaceans.

With the identification of a new source of pollution there is often temptation to suggest that only the conclusion of a multilateral convention will provide a solution to the problem. However, the difficulty of amalgamating all sources of undersea noise within the one instrument and obtaining sufficient State support in respect thereof, combined with the general perception that current environmental regulation already exists within a treaty-congested context,[221] militates against this solution. Rather, it is submitted that the current network of pollution and biodiversity instruments already provides an ideal matrix for the future regulation of marine acoustic pollution. As noted above, at the global and more particularly at the regional level, it is within the biodiversity conservation framework that measures to prevent acoustic marine pollution are likely to be adopted, at least in the short term. Nevertheless, whilst these instruments provide a suitable forum for the regulation of certain types of activities such as the exploration of oil and gas, ocean science experimentation and coastal development, they are unable to address all sources of undersea noise. For example, effective measures to mitigate vessel-source pollution generally fall beyond the mandate of all of these conventions. Moreover, these instruments tend to be narrowly focused on the conservation of cetaceans or the protection of listed species. However, undersea noise may well impact negatively on a whole variety of fish and invertebrates which do

[218] See s 238 Environment Protection and Biodiversity Conservation Act 1999 and the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999 (Statutory Rules 1999 No 228) made under the Petroleum (Submerged Lands) Act 1967.

[219] §105(5)(A) MMPA 1972, 16 USC § 1731(101(5)(S)). The decision of the NMFS is reported in 67 Fed Reg 46712.

[220] *Natural Resources Defense Council et al v Donald L. Evans et al* (2003) 279 F Supp 2d 1129. See also *Natural Resources Defense Council et al v Donald L. Evans et al* (2002) 232 F Supp 2d 1003. It should also be noted that a petition demanding a moratorium on the use of NATO high-intensity active sonar was presented to NATO in Oct 2003 by members of the European Parliament acting together with a number of non-governmental organizations (text of petition on file with author).

[221] See E Weiss 'International Environmental Law: Contemporary Issues and the Emergence of a New World Order' (1993) 81 Georgetown Law Journal 675–710, at 697–702.

not fall within the mandate of any of these instruments. Consequently, it is suggested that the broader pollution prevention framework provides a more suitable forum for its regulation in the long term. Moreover, it should be noted that the adoption of effective measures for the prevention and mitigation of acoustic marine pollution will require the employment of regulatory tools which are most commonly located within the pollution prevention framework. Such measures might include the assessment of noise impacts resulting from activities, the adoption of noise emission limits and the use of technology and techniques to as to minimize undersea noise.

All pollution prevention obligations incurred under global instruments such as UNCLOS 1982 and the many regional seas conventions should be applied to anthropogenic sources of undersea noise. Both a textual and teleological analysis of these instruments is clearly facilitative of such an approach and an application of the precautionary principle, an emerging norm of international law,[222] positively mandates such an interpretation. However, it is acknowledged that the pollution prevention framework as applied to undersea noise is currently incomplete. For example, notwithstanding the text of Article 208(5) of UNLCOS 1982, no mandatory guidelines regulate the exploration and exploitation of offshore oil and gas.[223] However, in occluding this lacuna, parties to UNCLOS might simultaneously adopt global measures for the prevention and mitigation of acoustic marine pollution which results from the development of offshore industry. National regulations adopted by Australia and the UK are particularly comprehensive in this respect and might serve as examples of good environmental practice.[224] A further significant omission in the current regulatory framework relates to measures stipulating design and equipment requirements for the reduction of vessel-source noise emissions. Realistically, such measures can only be adopted globally by the IMO. In the long term it is suggested that the text of MARPOL 73/78 be amended so as to apply to pollution (broadly defined) rather than substances, and a further Annex on noise emissions be added to the Convention. A more limited, but shorter term solution, can be found in the designation by States, in conjunction with the IMO, of PSSAs and the adoption of noise mitigation measures within those areas.

Anthropogenic sources of undersea noise combined with other forms of maritime pollution and over-exploitation of marine biodiversity comprise humankind's ecological footprint[225] on the world's oceans. A paradigm shift

[222] See the dissent of Judge Weeramantry in the *Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgment of 20 December 1974 in the Nuclear Tests Case (New Zealand v France)* (1995) ICJ Reports 288, 342–4.

[223] Above n 57 and accompanying text.

[224] The UK regulatory guidelines were recently commended by the ASCOBANS Meeting of the Parties in 2003 and it was noted that Belgium had also adopted legislation providing for similar guidelines. (See MOP 4: Resolution No 5 on Effects of Noise and of Vessels (Esbjerg 2003).)

[225] The concept of the ecological footprint was developed by William E Rees. See Rees 'Ecological Footprint, Concept of' in *Encyclopaedia of Biodiversity, Volume 2* (San Diego California Academic Press 2001) 229–44.

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in attitudes towards use and most importantly misuse of the seas during the closing decades of the twentieth century has led to the adoption of extensive international and regional measures designed to reduce the size and severity of this anthropogenic ecological footprint. Nevertheless, acoustic marine pollution has been hitherto neglected as compared with its corporeal cousins comprising oil, noxious substances, sewage, and so forth. This notwithstanding, it is suggested that the international framework of pollution prevention obligations has achieved sufficient maturity to be of application to new and unusual forms of pollution such as undersea noise. Moreover, as anthropogenic sources of sound escalate in the oceans as a result of larger ships, increased commercial and scientific seismic surveys and of course the deployment of military sonar by a greater number of States, its control and regulation will, within a very few years, become exigent.

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