



Acoustic Pollution in the Oceans: The Search for Legal Standards

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The introduction of noise into the marine environment may have significant impacts on marine species and ecosystems. This article examines how the existing international legal framework can be used to address this issue. After providing some background information on sound in the marine environment, the relevant global and regional instruments dealing with the protection of the marine environment, marine pollution, and the conservation of marine species and ecosystems are discussed. The analysis suggests that international law already requires states to address various aspects of this issue. A number of instruments and institutions provide an adequate framework to prescribe rules and standards regarding most sources of acoustic pollution.

Keywords noise, sound, marine pollution, acoustic pollution, marine animals

Introduction

Considerable evidence exists that human activities have significantly increased the overall level of sound in the oceans during the last 50 years.¹ Accordingly, concerns have arisen about the effects of this rise in humanmade sound on marine life. These concerns have generated greater interest in this issue from scientists and, more recently, from policy makers. The legal dimension of this topic has, however, remained largely outside the scope of discussions.

Although regulation at the national level in many cases will be sufficient to address acoustic pollution, public international law is still very relevant. International law provides general obligations for states to protect and preserve the marine environment and to treat specific sources of marine pollution. Various forms of marine pollution have been regulated in global and regional instruments, indicating that this might also be an appropriate solution for dealing with certain noise-creating activities. Since sound can impact on marine life, it can also be considered in the context of the conservation of marine species,

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ecosystems and habitats. Until now, the problem of noise has received most attention within the framework of regimes dealing with the conservation of marine mammals.

This article examines how the introduction of sound fits into the existing international legal framework for protecting the marine environment in general, and marine species and ecosystems in particular. Before looking at the relevant legal instruments, the study provides some background information on sound in the marine environment, appraising the sources involved, the effects of noise on marine species and ecosystems, and the potential mitigation measures. The discussion of the applicable international legal regime starts with the relevant general provisions of the 1982 United Nations Convention on the Law of the Sea (LOS Convention)² dealing with the protection and preservation of the marine environment. To assess how various sources of acoustic pollution might be regulated, it is necessary to look at both the LOS Convention and other relevant global and regional instruments. Attention is then given to the possibilities to address this issue within the context of the conservation of marine species, ecosystems, and habitats. The conclusions will assess to what extent the existing legal framework suffices to address acoustic pollution and suggest what future developments might be expected.

Sound in the Marine Environment

Sound is a form of energy that occurs naturally in the marine environment. It is also introduced intentionally and incidentally into the oceans through human activities. Sound is transported as waves through water, air, or any other elastic material by the motion or vibration of fluid particles.³ The resulting changes in pressure can be heard by humans and many species of animals through their ears and other sound-sensitive receptors. Sound waves can differ in frequency (the rate of oscillation or vibration of particles, measured in hertz (Hz) or in cycles per second), in wavelength (the distance the wave travels in one cycle of vibration), and in amplitude (the distance a vibrating particle is displaced from the other particles, generally measured in decibels (dB)). A higher frequency sound is perceived by humans as a higher pitched sound (which above a certain level can become undetectable for the human ear), while a sound with a higher amplitude is heard as a louder sound (which above a certain level can become painful to the human ear). Humans can generally hear sounds with a frequency between 20 Hz and 20,000 Hz, but many animals (e.g., dolphins) are capable of hearing sounds above these frequencies (ultrasonic sounds) and some (e.g., baleen whales) below them (infrasonic sounds).⁴

Unlike other forms of energy (such as heat and light), sound is transmitted very efficiently in water and can, especially at low frequencies, travel great distances from its source.⁵ These characteristics of underwater sound have beneficial, as well as detrimental, effects for marine life. Many marine species use sound to communicate and navigate, to avoid predators, and to search for food. On the other hand, sound is also capable of causing significant harm to marine life. At high levels and/or at frequencies where marine species have developed particular sensitivity, noise can lead to physical injuries, negatively affect species' ability to hear other sounds, disrupt their behavior, or increase their sensitivity.⁶

Sources of Noise

One way of classifying noise in the marine environment is to distinguish between ambient noise and humanmade noise. Both categories can be temporary or continuous and can vary strongly in frequency and intensity.

Ambient, or environmental background, noise is the noise for which no single source is identifiable. Ambient noise originates both from natural and anthropogenic sources.⁷ Wind and waves furnish the main sources of natural ambient noise on open waters. While noise created by surf on the shore is an important factor in coastal areas, other natural sources of ambient noise include earthquakes, volcanic activity, rain, movement or breaking of sea ice, sounds created by animal activity, and thermal noise.⁸ Humanmade noise is only considered ambient noise if no specific source can be distinguished, i.e., when it concerns a combination of noise-creating human activities heard from afar, such as the noise from shipping traffic rather than noise created by a single ship. Noise caused by distant shipping can be particularly dominant at lower frequencies.⁹

Ambient noise varies considerably depending on the weather, depth of the water, characteristics of the ocean floor, time of day or year, and other environmental conditions.¹⁰ The level of ambient noise can significantly influence the detection of sound and the effects of humanmade and other sources of noise on marine animals.¹¹

Humanmade noise originates from several sources, which can differ appreciably in frequency (Hz) and intensity levels (dB). Most noise is created incidentally to activities, but sometimes it is generated on purpose. Among the main types of activities are transportation, dredging and construction activities, exploration and exploitation of mineral resources, geophysical surveys, use of sonar, explosions, marine scientific research, and acoustic warning systems used to scare off marine mammals.¹²

Vessels and aircraft are the main sources of noise in the transportation category. Shipping is by far the most important source of underwater noise at low frequencies. The noise level produced by vessels depends mainly on the size of the ship, its load, speed, type of engine, and mode of operation. Generally speaking, noise levels increase with larger size, faster speed, and greater load of a vessel. Most of the noise is caused by the propellers. Noise created by vessels is normally transient, although on busy sea lanes it can be continuous and become (part of) ambient noise. Icebreakers can produce significant noise levels in polar regions. Noise created by aircraft is relevant mainly on the surface, although it can also be heard underwater. As with vessels, the level and type of noise created by the aircraft depends on its properties, as well as the altitude at which it is flying.¹³

Dredging can produce strong and continuous noise, mostly at low frequencies, which normally can be heard only at short distances. Tunnel-boring and construction of artificial islands cause varying levels of (mainly low-frequency) noise. These activities occur primarily in coastal areas, where such low-frequency sounds normally do not propagate well.¹⁴

Offshore operations from artificial islands, platforms, or ships can produce underwater noise that varies greatly. Seismic surveys carried out to study geological processes and to locate geological structures (e.g., oil and gas deposits) are conducted through airgun arrays and similar devices, which produce underwater noise pulses at high dB levels, albeit short in duration.¹⁵

Active sonars produce sounds that vary widely in intensity and frequency. They are used for a broad range of purposes, including depth measuring, bottom scanning, and detection of fish, submarines, or other objects. They are used mostly at moderate and high frequencies and can produce loud sound. Military sonars, in particular, can be very powerful. An example is the low-frequency active sonar being tested for submarine detection by the U.S. Navy and other North Atlantic Treaty Organization (NATO) member states.¹⁶

Underwater explosions are caused by the use of depth charges, torpedoes, mines,

bombs, and similar devices. The noise created by these explosions is of a high intensity and can often be detected at very long distances, up to thousands of miles from the site of detonation.¹⁷

Some noise sources (e.g., sonars, air guns, and explosives) are also used in pure marine scientific research.¹⁸ One such study, the Acoustic Thermometry of Ocean Climate (ATOC) study, involves the use of sound projectors (underwater speakers) that emit low-frequency sound of high intensity to gather information on global warming.¹⁹

Certain devices have been developed to frighten off selected species of marine mammals from fishing nets, aquaculture sites, seismic activities, and other places. Acoustic Deterrent Devices (ADDs) are used to prevent incidental by-catch of marine mammals in gillnets and similar fishing gear. Such acoustic alarms emit low-intensity sound at a low frequency to warn these species of the presence of the fishing gear.²⁰ Acoustic Harassment Devices (AHDs), on the other hand, are used to prevent marine mammals (in particular, pinnipeds) from feeding on fish in fishing nets, aquaculture sites, or at river entries where species gather in large numbers to migrate to or from their spawning grounds.²¹ AHDs generally emit sounds of high intensity.

In all likelihood, new sources of noise will arise in the future. Such a potential new source of noise is seen in underwater digital communication systems. Research is currently being conducted on an underwater acoustic communications system that permits the transmission of digital information through water with the aid of sound waves. These systems could replace the communication cables now used to transmit sound, images, and information and to control remotely operated underwater vehicles. They are expected to be useful for deep sea prospecting, maintenance of cables and pipelines, the exploration of mineral reserves, searching for shipwrecks, as well as military and other purposes.²²

Effects of Noise on Marine Species and Ecosystems

The effects of these various noises on marine species and ecosystems are difficult to ascertain and are still very much unknown.²³ Currently the issue is receiving considerable attention at the national level,²⁴ and by some international organizations (e.g., the International Council for the Exploration of the Sea (ICES)²⁵ and the Scientific Committee of the International Whaling Commission).²⁶ Several regional reports on the state of the marine environment (e.g., those prepared for the North Sea²⁷ and the Arctic²⁸) have identified potential effects of noise on marine species and ecosystems as a source of concern.

Generally, the introduction of noise into the marine environment can lead to changes in the conditions of the species habitat. Such changes can affect both directly or indirectly a wide variety of marine species with auditory capabilities. These species include not only marine mammals, but also fish, invertebrates, aquatic birds, and reptiles.

Marine mammals are the most obvious group affected, as all species can produce and hear a wide range of sounds and are very dependent on them for communication, navigation, and food location.²⁹ Marine mammals embrace all species of cetaceans (whales, dolphins, and porpoises), carnivores (seals, sea otters, and polar bears), and sirenians (manatees and the dugong).

The auditory capability of cetaceans and the sounds they produce differ from species to species.³⁰ In general, baleen whales produce intense, low-frequency sounds (lower than 1 kHz), but they can reach up to 25 kHz. Baleen whales seem to be most sensitive to noise at low and moderate frequencies. Toothed whales produce sounds mainly at

moderate to high frequencies between 1 and 20 kHz, but (unlike baleen whales) they also use very high frequency sounds (between 20 and 150 kHz) for echolocation, a technique analogous to sounds emitted by certain sonars.³¹ The latter species are most sensitive to noise at higher frequencies (above 10 kHz).³² Among other marine mammals, seals are known to produce sounds mostly at moderate to high frequencies. Their auditory sensitivity varies between species, though certain species of seals are known to be less sensitive as the frequency of sound decreases.³³

Sound is also significant for many species of fish. One survey lists over 50 families of fish species that produce sound.³⁴ Sounds produced by fish are predominantly of a low frequency, mainly below 3 kHz.³⁵ Most sounds produced by fish are used to communicate with individuals of the same species. Sound production can occur when an individual is disturbed by a predator or subjected to a noxious stimulus, as well as during reproductive activity.³⁶ It has been suggested, moreover, that sound might be important for maintaining the cohesion of schools of fish under poor visual conditions.³⁷ Experiments with cod and field observation of sharks have shown that they orientate themselves towards particular sources of sound.³⁸ Fish are sensitive to a rather restricted range of frequencies, as compared to marine mammals. Even fish with the best auditory capacity are relatively insensitive to sound at frequencies above 2 or 3 kHz.³⁹

Several invertebrates are susceptible to low-frequency sound, though at close range.⁴⁰ Invertebrates often have a limited action range, and especially activities on the sea-bed may be of particular concern in view of invertebrate acoustic sensitivity and ecological functioning.⁴¹ Acoustic communication and perception in invertebrates might be related to as many functions as in marine vertebrates.⁴²

The actual effect of noise on marine species depends not only on the species' auditory capabilities and sensitivity, but also on several other variables, including the environmental conditions of the area where the noise is introduced (which affect sound propagation), the distance between the species and the source, or the activities in which the species are engaged. In areas where ambient noise levels are high, noise from human-made sources often has fewer effects than in naturally quiet areas.

The direct effects of noise on marine species are best known for marine mammals.⁴³ Loud noise can have short-term and long-term negative effects on a species' physiology or behavior. Very loud or continuously high levels of noise can produce physical injury such as damage to ears, damage to body tissue, and even mortality. Elevated noise levels can also mask sounds made by these species to communicate with each other, or make it difficult to detect other important sounds, such as ambient noise that might alert them of the vicinity of the coast, or echolocation pulses used by toothed whales to seek prey and other objects.⁴⁴ In particular, species that need to communicate over large distances, such as sperm whales and many species of baleen whales, can be affected, since much of the noise introduced into the marine environment is of a low-frequency nature.

Noise can also affect the behavior of a species. This can include interruption of resting, feeding, or mating, but, in the case of cetaceans, it can also lead to changes in respiration, surfacing, or diving. Disturbances caused by seismic testing have been reported to have caused such behavioral changes among certain species of cetaceans.⁴⁵ Similar disturbance reactions have also been detected in response to the use of military sonar and whale-watching activities, although in the latter case the proximity and movement of the vessels themselves have probably also influenced the species' reactions.⁴⁶ Actual effects of acoustic disturbance will largely depend on the species (or even the individual), the activities in which the species is involved when disturbed, the type of

habitat, other sources of ambient or humanmade noise in the area, the season, and many other variables.

Noise from stationary sources or in busy areas can disturb marine mammals continuously, even at great distances from the source. This may result in temporary or permanent displacement of the species, with significant effects if no suitable habitat is available elsewhere for the species. Such noise can also sensitize the species, that is, increase its responsiveness over time. On the other hand, species may become habituated to the noise and not be significantly affected. Certain species of marine mammals are known to be reasonably tolerant to noisy areas.⁴⁷

Although little is known about the impact of noise on species other than marine mammals, evidence suggests significant effects can occur. Scientific research on certain fish species indicates that fish hear sounds from seismic air guns at long distances and that adult fish will avoid the sound source.⁴⁸ Investigations have indicated catch reductions in locations where seismic shooting takes place, with reduced catch rates as far as 18 nautical miles from the seismic shooting area.⁴⁹

Impacts on one species may also have significant indirect effects on other species, e.g., by affecting prey availability.⁵⁰ Noise, therefore, is not only a potential threat to individual species, but also to the ecosystems of which they are a part.

Although single noise sources may have little or no significant effects on marine species, the presence of several sources of noise can potentially produce such effects. With additional noise sources, there are fewer places for especially sensitive species to seek refuge. A noisier environment may also exacerbate interference with a species' communication and navigation capability. Cumulative effects may also arise from other threats to the marine environment, such as pollution, loss of habitat, incidental takings through fisheries, and direct takings. Combined with these other threats, noise may therefore decrease the chances of survival of species populations that are depleted, threatened, or endangered, in particular, several species of whales and commercially exploited fish.

Mitigation of the Effects

Many marine species can respond naturally to the effects of humanmade noise. They are able to acclimate themselves, avoid, or move away from the noise source. Some species are also able to increase the sounds they produce for communication or navigation.⁵¹ Humanmade mitigation measures can also be taken to prevent or reduce negative effects of noise on marine species and ecosystems. Four types of mitigation measures have been suggested to reduce the effects of noise on marine mammals.⁵² In most cases these measures can be equally applied to reduce the effects of noise on other species. The suggested mitigation measures comprise: (1) construction, design, and equipment standards, e.g., use of equipment that produces less noise; (2) restrictions in or closure of areas, permanently or during particular periods of the year or day (e.g., in areas important for reproduction); (3) routing and positioning measures (e.g., establishment of areas to be avoided by ships or aircraft); and (4) operational measures (e.g., visual or acoustical monitoring before initiating a noise-creating activity to establish whether sensitive species are in the vicinity, speed restrictions, and possible need to reduce the duration and intensity of the noise, as well as gradual increase of sound signals, use of warning signals, and resort to several small charges, rather than one large charge).

The propriety of specific measures (or their combination) will depend largely on the species involved, the sound frequency and level, and conditions in the area where the activities are conducted. Each measure can be adopted voluntarily (through guidelines and codes of conduct) or mandatorily (through legislation).

The International Law Dimension

International law holds considerable relevance for the introduction of noise into the marine environment. The nature and location of the activities that produce noise, the nature of underwater noise, and the nature and distribution of the species affected by noise are all reasons substantiating the role of international law.

Many activities that generate noise in the marine environment are international or transboundary in nature, for instance, shipping. The competence of a state to adopt measures to protect marine species from noise caused by such activities is circumscribed by international law. A coastal state can only enact laws and regulations such that they do not unnecessarily restrict the internationally recognized rights of other states, e.g., innocent passage of foreign vessels in the territorial sea. Noise-creating activities are also conducted in areas outside national jurisdiction, or within the jurisdiction of more than one state. In those cases, international cooperation and agreements are needed to regulate these activities and coordinate national efforts. In this respect, noise is no different from any other human activity that negatively affects the marine environment.

Even when an activity is not of an international nature, noise emissions can have significant transboundary impacts. Sound is transmitted efficiently through water and quite often can be heard far from its source of origin. Thus, noise produced within one state's waters can have impacts beyond its boundaries, a situation that might require concerted action by states.

A third reason why international law is relevant relates to species that might be affected by noise. These species might only be temporarily within national jurisdiction (e.g., they can migrate between two or more states), or they could reside temporarily or entirely beyond national jurisdiction. Many potentially affected species migrate over large distances, and measures adopted by one state would be ineffective if similar measures were not also adopted by other states. For species that reside temporarily or entirely outside national jurisdiction, international regulation assumes particular relevance. Such species can only be protected from threats posed to them if all states involved cooperate and accept measures to reduce these threats.

International cooperation might also be needed to study the effects of noise on marine species and to compare results, to exchange experiences concerning national mitigation measures, to harmonize national laws and regulations, or to provide technical or financial support.

The 1982 United Nations Convention on the Law of the Sea

The point of departure for an analysis of the applicable international legal framework is the 1982 LOS Convention.⁵³ This agreement provides a comprehensive legal framework for nearly all uses of the oceans, and its provisions in many respects represent customary international law. The prominent position of the LOS Convention as regards protection of the marine environment and conservation and sustainable use of marine living resources has been confirmed by several instruments adopted since its conclusion.⁵⁴

The LOS Convention provides a balance between the rights and duties of coastal, flag, and other states based on the division of the oceans into jurisdictional zones. The instrument also provides a balance between legitimate use of the oceans and protection and preservation of the marine environment, including marine species and ecosystems. The Convention contains several provisions particularly relevant to humanmade noise in the oceans, namely, the definition of marine pollution in Part I; the general rules and principles relating to protection of the marine environment and the specific rules relating

to the prevention, reduction, and control of marine pollution, primarily contained in Part XII; and provisions relating to the conservation and management of marine living resources, mainly contained in Parts V and VII. In all these cases, states parties must fulfill their obligations arising from other (specialized) conventions and agreements concerning protection and preservation of the marine environment in a manner consistent with the general principles and objectives of the LOS Convention.⁵⁵

The Applicability of the LOS Convention to Noise

Before examining the relevant substantive provisions, it must be established whether noise falls within the scope of the LOS Convention. The first question to be addressed is whether noise can be qualified as pollution of the marine environment.⁵⁶ The classification of noise as a form of marine pollution is important, because it implies that provisions relating to the prevention, reduction, and control of marine pollution contained in the LOS Convention can also apply to noise. The LOS Convention defines "pollution of the marine environment" as: "the 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."⁵⁷

This definition is based on an earlier version prepared by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).⁵⁸ Initially, the definition of marine pollution discussed in GESAMP only referred to the introduction of substances. At a later stage the term "energy" was added, apparently to include thermal pollution, since there was evidence available to show that heat in seawater encouraged the development of certain undesirable organisms and interfered with the migration of fish in certain areas.⁵⁹ While the definition was, therefore, clearly not drafted with acoustic pollution in mind, the inclusion of "energy" implies that noise can be a form of marine pollution under the terms of the LOS Convention.⁶⁰ The reference to "energy" could in fact be read to cover all forms of energy, including noise, electricity, vibrations, heat, and radiation.⁶¹ Such an interpretation is in conformity with the general rule of interpretation contained in the 1969 Vienna Convention on the Law of Treaties that "a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to terms of the treaty in their context and in the light of its object and purpose."⁶²

As the definition indicates, only an "introduction by man" of energy which results or is likely to result in deleterious effects is considered as pollution. Noise that originates from natural sources therefore does not fall within the scope of this definition, even if it results in deleterious effects. Not relevant is the way in which noise is introduced by humans into the marine environment, i.e., whether it occurs directly (purposeful introduction of sound) or indirectly (resulting incidentally from other activities).

The definition of marine pollution in the 1982 LOS Convention refers only to the "introduction of substances or energy." In recent years, however, it has become commonplace to use the term "degradation" of the marine environment rather than "pollution." The use of "degradation" of the marine environment ensures that a much wider range of activities that result or are likely to result in deleterious effects than those involving the introduction of substances or energy fall within the scope of the obligations dealing with the protection and preservation of the marine environment (e.g.,

direct alteration of the physical, chemical or biological characteristics of the environment or the use of technology).⁶³ As acoustic pollution involves the introduction of energy into the environment, the need for use of the term “degradation” assumes less importance in the present context. It nevertheless affirms that the scope of the rights and duties of states in respect of environmental protection has widened considerably.

The introduction of noise also must result in “deleterious effects” to constitute marine pollution, i.e., an activity must have certain disruptive, harmful, or otherwise unwanted effects. The definition gives a list of such deleterious effects, viewed from both an anthropocentric and a broader environmental perspective. It includes harm not only to living resources useful to man, but also to marine life in general.⁶⁴ Although this list assists in interpreting the term “deleterious effects,” questions persist when “harm,” “hazards,” “hindrance,” “impairment,” or “reduction” occurs. It can be assumed that this would exclude an introduction of substances or energy which has only a minor impact in this respect.⁶⁵ To make an assessment it will be necessary to look at the circumstances of the particular case. The same level of energy may result in harm to marine life in one case, but not in another.

The reference to “results or is likely to result” in the definition of pollution indicates that the deleterious effects need not have manifested themselves yet, but can reasonably be expected to occur. The definition thus takes into account that full scientific certainty is often not available to establish if deleterious effects have occurred or are about to occur. It may also be read as a reference to the need to act with caution and not to delay preventive action where the circumstances require such.⁶⁶

The definition of marine pollution in the LOS Convention has been incorporated verbatim into many other international instruments dealing with the protection of the marine environment. These include the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention),⁶⁷ the 1974 (and its 1992 successor) Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention),⁶⁸ and most of the framework treaties adopted under the United Nations Environment Programme’s (UNEP) Regional Seas Programme and some of their Protocols dealing with specific sources of marine pollution.⁶⁹ The 1991 Arctic Environmental Strategy exemplifies an international instrument that explicitly mentions noise as a pollution issue requiring attention.⁷⁰

General Rules and Principles of Part XII of the LOS Convention

The 1982 LOS Convention contains several provisions relating to protection of the marine environment.⁷¹ The first four sections of Part XII of the LOS Convention provide rules and principles embracing certain general obligations for all states concerning the protection and preservation of the marine environment. More detailed rules regarding marine pollution from specific sources are set out in subsequent sections of Part XII.

States have a general obligation to protect and preserve the marine environment.⁷² This duty is unqualified and applies to all maritime zones of states, as well as to activities that are conducted under their control or jurisdiction in areas outside national jurisdiction. The provision does not stipulate what must be done to fulfil this obligation, but more specific requirements are set out in later articles. Thus, states are required to respect this duty when exercising their sovereign right to exploit their natural resources pursuant to their environmental policies.⁷³ This means that activities related to the exploitation of natural resources (e.g., mining or fishing) that result or may result in harm

to the marine environment (irrespective of whether they qualify as pollution) are subject to the obligation to protect and preserve the marine environment.⁷⁴ Although the precise implications of this general duty to protect and preserve the marine environment are unclear, it is evident that it is comprehensive in scope. The words “protection” and “preservation” imply that all states must take at least some form of positive action to maintain the current condition of the marine environment (including all forms of marine life), and probably also improve it where necessary.⁷⁵

This basic obligation is elaborated in more detail for activities that may result in marine pollution. States are required to take all necessary measures to prevent, reduce, and control pollution *from any source*, using “the best practicable means at their disposal and in accordance with their capabilities.”⁷⁶ They are required to “endeavor to harmonize their policies in this connection.”⁷⁷ States are also obliged to “take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other states and their environment,⁷⁸ and that pollution arising from incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights.”⁷⁹ Thus, states have a due diligence obligation to adopt the necessary measures to ensure that activities within their maritime zones or under their control (e.g., in respect of vessels flying their flag on the high seas) do not cause harm to the environment and interests of other states, as well as to the environment outside national jurisdiction.

The measures that have to be taken by states to prevent, reduce, and control marine pollution (including acoustic pollution) from all sources can, in principle, involve an unlimited range of instruments (“all measures necessary”). The requirement for states to adopt such measures is somewhat qualified by the fact that only the “best practical means” have to be used, and that states with limited capabilities can take measures in accordance with their capabilities. The Convention gives a nonexhaustive list of the measures that must be taken to fulfil this obligation. These include measures designed to minimize to the fullest possible extent (certain forms of) pollution from land-based sources, atmospheric sources, dumping, vessels, installations, and devices.⁸⁰

The measures that can and have to be adopted by states on the basis of these provisions are conditioned by specific provisions contained in the Convention that address each of these sources of pollution separately. These provisions, in most cases, require states to adopt national laws and regulations that conform to or at least take into account international (minimum) standards, to harmonize national standards, and to work towards the development of international rules and standards through the competent international organizations. Regarding the adoption of such measures, whether in respect of these specific sources or any other activity that results in marine pollution, particular attention has to be given to the protection and preservation of “rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life.”⁸¹ This can also be of importance for noise-creating activities, since many of these may affect such ecosystems or species (e.g., cetaceans). The relevance of this provision is reflected in the growing number of global and regional conventions that are aimed at protecting marine species, ecosystems, and habitats from threats such as marine pollution.⁸² Measures have to be taken not only in respect of “activities” that may cause pollution, but also for “the use of technologies” under their jurisdiction and control that may result in pollution of the marine environment.⁸³

The measures that can be taken by states to prevent, reduce, or control pollution are qualified through the obligation of states to “refrain from unjustifiable interference with activities carried out by other States in the exercise of their rights and in pursuance of

their duties.⁸⁴ A state is, in principle, entitled to adopt measures in respect of activities by other states that are conducted within its jurisdiction. However, these measures are restricted by the legitimate rights of others states. Measures taken to prevent, reduce, or control acoustic pollution may therefore not unjustifiably interfere with legitimate uses of the ocean by other states as provided by the Convention, e.g., the navigational rights enjoyed by other states in the maritime zones of coastal states. The specific provisions dealing with each of the sources of pollution identified by the Convention provide greater detail on the rights and duties of states in this respect.⁸⁵

The general provisions outlined above not only require a state to adopt measures and take action when pollution has occurred. As posited before, states are required to *prevent*, reduce, and control pollution from occurring and take the necessary action to achieve this. This general duty, read together with the definition of pollution (which states that introduction of energy into the marine environment that results or is *likely to result* in deleterious effects constitutes pollution) and Chapter 17 of Agenda 21, requires states to take preventive action based on precautionary and anticipatory approaches.⁸⁶ These approaches can be applied equally in respect of the introduction of noise into the marine environment. States are required therefore, to take preventive measures based on existing knowledge to avoid pollution, rather than to take remedial measures once it has occurred, and to apply a precautionary approach when scientific certainty about the harmful effects is not (yet) available.

In its mildest form, the precautionary principle provides that “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”⁸⁷ More firmly put, the precautionary principle envisages preventive measures to be taken when there are reasonable grounds for concern that the introduction of substances or energy into the marine environment is likely to result in hazards to human health or harm to marine living resources and marine ecosystems, damage amenities, or interfere with other legitimate uses of the sea even when there is no conclusive evidence of a causal relationship between inputs and their alleged effects.⁸⁸ The precautionary principle does not specify how much evidence is needed to take action, nor does it specify what kind of preventive measures are to be taken.⁸⁹ However, it does require some form of positive action when there is sufficient evidence that environmental harm is likely to occur. It can also be read as putting the burden of proof upon the state conducting or allowing the activity, who will have to demonstrate that it is not likely to have such effects.

Aside from the general obligation to prevent pollution, prevention and precaution are reflected in particular in the duty for states to assess the risks related to activities conducted within their jurisdiction or control and the potential harm that may result from such activities. The LOS Convention requires states to assess the potential effects of planned activities within their jurisdiction or control (i.e., irrespective of where they occur), when there are reasonable grounds for believing that they may cause “substantial pollution of or significant and harmful changes to the marine environment.”⁹⁰ States are required to prepare assessment reports, which have to be communicated to the competent international organization, which is to make them available to all states.⁹¹ Although it is unclear when the threshold for such assessment will be reached and states are only required to fulfil this obligation “as far as practicable,” it is evident that this obligation can apply in the same way to activities that can result in acoustic pollution.⁹²

There are other general obligations that states must consider in respect of acoustic pollution. States have a duty to cooperate in good faith with each other on the appropriate

level and, if needed, through appropriate organizations to formulate international rules, standards, recommended practices, and procedures aimed at protecting and preserving the marine environment.⁹³ They are equally required to cooperate to promote studies, undertake programs of scientific research, and encourage the exchange of information and data acquired about pollution of the marine environment. Furthermore, they are required to endeavor to participate actively in regional and global programs to acquire knowledge for the assessment of the nature and extent of pollution, exposure to it, and its pathways, risks, and remedies.⁹⁴ On the basis of this information, states have to work towards the establishment of appropriate scientific criteria for the formulation and elaboration of rules, standards, recommended practices, and procedures to prevent, reduce, and control pollution.⁹⁵

States also have a duty to endeavor to observe, measure, evaluate, and analyze by recognized scientific methods the risks or effects of marine pollution directly or through the competent international organizations.⁹⁶ This duty is somewhat qualified, because states are only required to monitor pollution as far as practicable. States are not only obliged to look at the risks and effects of marine pollution itself but also have to monitor *activities* which they permit or in which they engage in order to determine whether they are *likely* to result in such pollution. As with the assessment obligation for planned activities, this provision implies a preventive and precautionary approach. The results of such monitoring activities have to be published in reports and made available (through the competent international organizations) to other states.⁹⁷

Specific Sources of Pollution

The LOS Convention contains specific provisions regarding marine pollution caused by vessels, dumping, sea-bed activities, land-based, and atmospheric sources. These sources of marine pollution are also addressed in sectoral and regional instruments. Dumping and land-based sources are less relevant in the present context. The former will normally only involve disposal of waste and similar matter.⁹⁸ Noise from land-based sources probably has only a limited impact on the marine environment.

Noise from Vessels

The provisions of the LOS Convention dealing with pollution from vessels cover both accidental and operational pollution from all types of vessels.⁹⁹ The LOS Convention provides a balance between the competence of flag, coastal, and port states over vessel-source pollution.¹⁰⁰ The relevant provisions distinguish between the competence of states to enact laws and regulations (prescriptive jurisdiction) and the competence of states to enforce legislation (enforcement jurisdiction) enacted in accordance with their prescriptive jurisdiction.¹⁰¹

With regard to standard-setting, the LOS Convention gives priority to international rules and standards.¹⁰² Flag, coastal, and port states are required to work together towards the establishment of international rules and standards, acting through the competent international organization or general diplomatic conference to prevent, reduce, and control pollution of the marine environment from vessels. States are also obliged to reexamine such international rules and standards on a regular basis as necessary.¹⁰³ With regard to acoustic pollution, no such international rules and standards have yet been established. The International Maritime Organization (IMO) is generally regarded as the competent organization for all issues related to vessel-source pollution.

The flag state has the primary responsibility to ensure that its vessels do not cause acoustic pollution. Flag states are obliged to adopt laws and regulations to prevent, reduce, and control pollution of the marine environment from vessels flying their flag or of their registry.¹⁰⁴ These laws and regulations need to be at least as effective as the generally accepted international rules and standards adopted within the auspices of the IMO.¹⁰⁵

While the exercise of jurisdiction by flag states is mandatory, port and coastal states have a discretionary power to exercise jurisdiction in respect of foreign vessels present in their ports or the coastal state's territorial sea or exclusive economic zone (EEZ) within the limits as set out by the provisions of the LOS Convention. This power, however, is only facultative to the extent that the measures go beyond what is required of states by the general provisions to protect and preserve the marine environment and to prevent, reduce, and control vessel-source pollution. The LOS Convention, therefore, establishes a maximum level for coastal and port state jurisdiction (as opposed to the minimum level required for flag states) in respect of vessel-source pollution.

States have full legislative jurisdiction over vessels in their ports and other internal waters.¹⁰⁶ In the exercise of their sovereignty in the territorial sea, coastal states can adopt laws and regulations to prevent, reduce, and control marine pollution from foreign vessels.¹⁰⁷ For the territorial sea, the coastal state may not adopt laws and regulations that hamper innocent passage of foreign vessels or that contain construction, design, manning, or equipment (CDEM) standards for foreign vessels unless the latter give effect to generally accepted rules and standards.¹⁰⁸ These provisions allow a coastal state to establish laws or regulations that require foreign vessels to reduce or eliminate their noise emissions in the territorial sea, e.g., by requiring them to reduce their speed in certain parts of the territorial sea to limit their noise emissions. It would also allow a coastal state to impose navigational standards (e.g., routing measures) to avoid areas important for marine species sensitive to underwater noise, provided that due consideration is given to shipping traffic and publicity is given to such measures.¹⁰⁹ In archipelagic waters the same regime of navigation applies as in the territorial sea.¹¹⁰ The legislative competence of the coastal state in its territorial sea and archipelagic waters is more limited in a strait used for international navigation or an archipelagic sea lane. In cases involving ships in transit passage or archipelagic sea lanes passage, a state may only adopt laws and regulations for the prevention, reduction, and control of pollution, by giving effect to applicable international regulations regarding the discharge of oil, oily waters, and other noxious substances.¹¹¹ This excludes the possibility to adopt laws and regulations to address sound emissions of ships in transit (or archipelagic sea lanes) passage.

The legislative competence of coastal states to prevent, reduce, and control vessel-source pollution in an EEZ is also more restricted than in their territorial sea. In their EEZ, coastal states have jurisdiction for the protection and the preservation of the marine environment.¹¹² They can, however, only adopt laws and regulations for the prevention, reduction, and control of pollution from vessels conforming and giving effect to generally accepted international rules and standards.¹¹³

Coastal states are entitled to adopt more stringent measures for special areas within their EEZ upon approval by the IMO.¹¹⁴ Coastal states can submit a request to the IMO to adopt special mandatory measures to prevent vessel-source pollution, when they have reasonable grounds for believing that the normal "generally accepted international rules and standards" are inadequate to meet the special circumstances of a particular, clearly defined area in their EEZ. The justification of such special pollution prevention measures

must be based on technical reasons in relation to its oceanographical and ecological conditions, as well as its utilization or the protection of its resources and the particular character of its traffic. Upon approval of the IMO, the coastal state can adopt laws and regulations to prevent, reduce, and control vessel-source pollution, which have to implement international rules and standards or navigational practices as are made applicable by the IMO for special areas. In principle, this can encompass a wide variety of measures, including standards to prevent, reduce or control acoustic pollution (e.g., special routing measures to avoid areas where noisy ships may affect marine species or ecosystems).¹¹⁵ The measures designed by IMO for special areas currently involve mainly discharge standards and some navigational measures.

In addition to measures adopted through the IMO procedure, coastal states are also allowed to adopt additional laws and regulations for such special areas.¹¹⁶ These measures are also subject to IMO approval and can only relate to discharge standards or navigational practices. It appears that little use has been made by coastal states of the powers granted to them to establish such special areas.¹¹⁷ There are, however, a number of regulatory conventions and other instruments adopted within the purview of the IMO that entail special measures for particularly defined sea areas.¹¹⁸

In certain ice-covered areas coastal states can adopt and enforce nondiscriminatory laws and regulations for the prevention, reduction, and control of marine pollution from vessels.¹¹⁹ Such laws and regulations must have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence. For these areas there is no requirement to conform to generally accepted rules and standards.¹²⁰

The IMO has not yet adopted instruments directly dealing with acoustic pollution from vessels. On occasion, the IMO has recognized noise as a hazard to the marine environment. The issue has come up in the particular context of the Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas (PSSA Guidelines), adopted in 1991.¹²¹ These Guidelines were primarily developed to “assist IMO and national Governments in identifying, managing and protecting sensitive sea areas.”¹²² They provide, *inter alia*, guidance on special measures that can be taken on the basis of IMO instruments for areas identified as PSSAs. These measures are intended to complement protective measures taken by coastal states for such areas in accordance with their sovereignty or jurisdiction, in particular for areas located beyond the territorial sea. The measures envisaged by the PSSA Guidelines include:¹²³

- Special discharge standards for vessels, e.g., through designation as a special area under the International Convention for the Prevention of Pollution from Ships of 1973, as amended by Protocol of 1978 (MARPOL 1973/78);¹²⁴
- Special routing measures to restrict shipping traffic under the International Convention for the Safety of Life at Sea of 1974 (SOLAS 74)¹²⁵ and the General Provisions on Ships’ Routing (e.g., areas to be avoided);¹²⁶ or
- Other special measures (e.g., compulsory pilotage or vessel traffic systems).¹²⁷

Under the first category it is currently not possible to adopt special discharge standards for sound emissions as MARPOL 1973/78 only applies to harmful substances and not energy.¹²⁸ The routing measures of the second category are mainly aimed at improving the safety of navigation but can also be used to protect the marine environment. The third category of special measures envisaged by the PSSA Guidelines can in theory involve a wide range of other protective measures. The PSSA Guidelines include a reference to measures such as special construction requirements and speed restrictions,¹²⁹

which in principle may also be directed towards preventing, reducing, or controlling acoustic pollution.¹³⁰

For the two areas that have thus far been identified as PSSAs, the Great Barrier Reef (Australia) and the Sabana-Camagüey Archipelago (Cuba),¹³¹ no measures aimed at preventing or reducing acoustic pollution are included.

Noise from Sea-Bed Activities

States can, in principle, regulate sea-bed activities that might result in acoustic pollution subject to their jurisdiction unilaterally, as long as they adopt laws, regulations, and measures that are not less effective than international rules, standards, and recommended practices and procedures.¹³² Under the LOS Convention, states are required to endeavor to harmonize their policies concerning seabed activities at the appropriate regional level.¹³³ States are also obliged to cooperate to establish global and regional rules, standards, and recommended practices and procedures to prevent, reduce, and control pollution of the marine environment from this source. These rules, standards, and recommended practices and procedures must be reexamined periodically as necessary.¹³⁴

Aside from the 1981 Conclusions of the Study of Legal Aspects concerning the Environment Related to Offshore Mining and Drilling within the Limits of National Jurisdiction, which were endorsed in 1982 as guidelines for states by the UNEP Governing Council and the UN General Assembly, there is no global instrument that deals with pollution from seabed activities.¹³⁵ The 1981 Conclusions are of a very general character and do not explicitly address noise caused by sea-bed activities. The only other global instrument that covers pollution caused by sea-bed activities is the MARPOL 1973/78 Convention. However, this convention only covers pollution from offshore installations to a limited extent and, as stated before, currently only applies to harmful substances.¹³⁶

The OSPAR Convention, the (1974 and 1992) Helsinki Convention, and all regional seas conventions contain a basic provision requiring states parties to take measures to prevent (and in some cases eliminate) pollution from seabed activities.¹³⁷ More detailed provisions dealing with pollution from seabed activities are contained in the additional Protocols, Annexes, and related measures that have been developed under the OSPAR Convention, the Helsinki Convention, and the Kuwait and Mediterranean Conventions.¹³⁸ These additional instruments, however, only contain provisions dealing with pollution caused by oil and other harmful substances, and not noise. Since pollution caused by the introduction of energy is covered by all basic regional conventions, as well as some additional instruments adopted to deal specifically with pollution from seabed activities, they have the potential to deal with this issue.

Considerable action at the national level has been taken against acoustic pollution from seabed activities. Several states have adopted measures imposing restrictions on seismic surveys to prevent acoustic disturbance of marine mammals and other species. In Canada, for example, such restrictions include maintenance of distance between the survey and marine mammals and limitations on seismic surveys during the season that some of these species are present in Canadian waters.¹³⁹ Similar restrictions exist in the United States, where seismic surveys and similar operations are prohibited in certain areas at times of the year when endangered species are likely to be present.¹⁴⁰

Norway seems to have incorporated the recommendations of a study summarizing the knowledge about the effects of seismic airgun shooting on fish into its national regulations for the conduct of seismic surveys.¹⁴¹ This report concluded that air gun

shooting should be advised against in areas where fishing was taking place. Ordinary two-dimensional or three-dimensional surveys should be avoided at distances less than 50 kilometers from the outer edges of fishing areas. This restriction should apply at least one week before fishing is expected to start. In order to safeguard spawning and in accordance with the precautionary principle, spawning grounds and spawning migration routes must be protected for species whose spawning grounds and migration routes are concentrated, applying the same distance criterion as mentioned above for ordinary 2D or 3D surveys. Smaller airguns may be allowed at closer range, but in no case in the spawning ground itself.¹⁴² Conditions applicable to licensing conditions for seismic surveys in the United Kingdom also indicate limitations for such surveys regarding spatially concentrated spawning areas during spawning periods.¹⁴³

Noise from Atmospheric Sources

The LOS Convention requires states to adopt laws and regulations to address atmospheric pollution. In doing so, they have to take into account internationally agreed rules, standards, and recommended practices and procedures and the safety of air navigation.¹⁴⁴ States are also obliged to endeavor to establish global and regional rules, standards, and recommended practices and procedures to prevent, reduce and control such pollution.¹⁴⁵ Aircraft flying at low altitudes are probably the most important source of acoustic atmospheric pollution of the marine environment.

The state of registry of an aircraft can prescribe measures that are applicable in all maritime zones. The LOS Convention indicates that such states must take all measures that may be necessary to prevent, reduce, and control such pollution. Whether a coastal state can regulate atmospheric pollution caused by foreign aircraft (e.g., by indicating specific routes or altitudes, or prescribing the sound emission level of engines) depends on the maritime zones over which these aircraft fly and the activities in which they are involved.

A state has complete sovereignty over the air space of its territorial sea and archipelagic waters.¹⁴⁶ Over these waters no right exists for aircraft similar to that of innocent passage for ships. This gives a coastal state the authority to regulate noise from aircraft in these areas. Exceptions in this regard can be found in waters that form part of a strait used for international navigation or archipelagic sea lanes in which all aircraft enjoy the right of transit (or archipelagic sea lanes) passage.¹⁴⁷

Beyond the territorial sea, aircraft enjoy the freedom of overflight.¹⁴⁸ The coastal state is only allowed to subject foreign aircraft to regulation if these are involved in activities over which the coastal state has jurisdiction, such as those supplying offshore installations on the state's continental shelf.

Some states have adopted restrictions on aircraft to reduce disturbance of marine species by noise. For example, there is a requirement in leases for offshore oil exploration near Alaska that support helicopters must fly above an altitude of 1,000 to 1,500 feet.¹⁴⁹ Another national measure aimed at reducing acoustic pollution from aircraft is the denial of overflight for the Concorde over the Malacca Strait to prevent the sonic boom from disturbing spawning fish.¹⁵⁰

Conservation of Marine Species, Ecosystems, and Habitats

Thus far we have approached the issue of noise in the marine environment mainly from the perspective of marine pollution, and primarily from a source perspective. It is, however, also possible to examine it from the perspective of the species and ecosystems

affected, i.e., from the effect side. In this context, the LOS Convention also provides the relevant global framework, as it contains provisions dealing directly with the conservation of marine species.¹⁵¹ These provisions are mainly intended to deal with overexploitation of the ocean's living resources.¹⁵² However, they can also provide the basis for the adoption of conservation measures other than those intended to reduce overexploitation of the species involved.

According to the LOS Convention, coastal states can adopt laws and regulations to conserve the living resources in their territorial sea, so long as they do not prejudice the exercise of the right of innocent passage.¹⁵³ Coastal states also have, in respect of the living resources in their EEZ or on their continental shelf, the sovereign right to conserve and manage these resources.¹⁵⁴ In addition to measures aimed at reducing the direct taking of marine species, coastal states can take specific conservation measures that include, for instance, establishment of protected areas where noise-creating activities are strictly prohibited or similar measures are enacted to protect the species or ecosystems involved directly.¹⁵⁵ In adopting such conservation measures for marine species in the EEZ, coastal states are obliged to have due regard to the rights and duties of other states under the LOS Convention.¹⁵⁶ Such conservation measures can, therefore, only include restrictions on activities conducted by foreign nationals to the extent that these are compatible with the rights enjoyed by those states under the LOS Convention.

The LOS Convention also contains several provisions dealing with specific species. Those pertaining to specified commercially exploited fish require states to cooperate to establish conservation measures. On the other hand, the LOS Convention allows coastal states, as appropriate, to prohibit, limit, or regulate the exploitation of marine mammals more strictly than other marine living resources within their EEZ.¹⁵⁷ Several states have enacted very stringent legislation in accordance with this provision.¹⁵⁸ These laws and regulations in most cases not only prohibit the killing or injuring of the species involved, but also forbid disturbance of the species. Such prohibitive provisions have prompted states to conduct more research to establish whether such injury or disturbance can result from noise-creating activities. To be lawful, this research itself is often made subject to strict conditions.

Moreover, the LOS Convention requires all states to cooperate with a view to the conservation of marine mammals in the EEZ, as well as the high seas. Regarding cetaceans, the LOS Convention provides that states are required to work in particular through the appropriate international organizations for their conservation, management, and study.¹⁵⁹ Considerable disagreement has arisen over the meaning of the terms "work through" and "the appropriate international organizations."¹⁶⁰ Currently, there is no single organization dealing with all species of cetaceans. The International Whaling Commission (IWC) has an important responsibility for the conservation of (in particular large) species of whales. Nevertheless, other international organizations also play an important role in respect of the conservation of cetaceans, in particular with regard to smaller species and threats other than direct exploitation.¹⁶¹

Other Relevant Global and Regional Instruments

In addition to general provisions contained in the LOS Convention, several other global and regional agreements deal directly with the conservation of (specific) marine species, ecosystems, and habitats. These instruments include the 1992 UNEP Convention on Biological Diversity (CBD),¹⁶² the 1946 International Convention for the Regulation of Whaling (ICRW),¹⁶³ the 1979 Convention on the Conservation of Migratory Species of

Wild Animals (Bonn Convention) and agreements adopted under it,¹⁶⁴ the Protocols on Specially Protected Areas that have been established under the UNEP Regional Seas Programme,¹⁶⁵ and, the recently adopted Annex V on ecosystems and biological diversity to the OSPAR Convention.¹⁶⁶

The geographical and material scope of these instruments differs considerably. Some instruments require states parties to identify, regulate, and manage harmful processes or activities.¹⁶⁷ Others contain provisions requiring states to take measures to prohibit the taking, killing, or disturbance of (certain) species. Many also require states parties to adopt measures to protect ecosystems and (critical) habitats from disturbances or other harmful factors, mainly through the establishment of protected areas.

The relevant protocols adopted under the UNEP Regional Seas Agreements envisage the establishment of protected areas by states parties in areas within their national jurisdiction. These protocols generally require parties to take the necessary and appropriate measures to prohibit, restrict, or regulate activities that might have adverse effects on these areas and/or (particular) species. This could also include measures pertaining to noise-creating activities.

The regional protocols do not change the existing international legal framework. In establishing marine protected areas, coastal states can only adopt those measures permitted under international law. As discussed above, especially in the case of vessel-source pollution, this limits the possibilities for the coastal state to act unilaterally or even at a regional level.

The importance of marine protected areas is that they offer the opportunity to treat the issue of acoustic pollution in combination with other threats to marine species and ecosystems, instead of addressing it as a separate source of pollution.¹⁶⁸

International Whaling Convention

The ICRW was adopted in 1946 to provide for the “proper conservation of whale stocks” and the “orderly development of the whaling industry.”¹⁶⁹ While the Convention applies to “whales” without specifying which species are covered, its scope traditionally has been limited to large species of cetaceans. The IWC has nevertheless adopted some resolutions on smaller species of cetaceans.¹⁷⁰

The conservation measures adopted under the ICRW primarily concern restrictions on the exploitation of these species (mainly through amendment of the Schedule to the Convention), though in recent years the IWC has also considered threats not directly related to exploitation (mainly by promoting research on issues such as pollution and habitat alteration).¹⁷¹ All decisions adopted in this regard have inevitably been of a non-binding nature, as the IWC’s regulatory competence is restricted to measures dealing with the direct taking of whales.¹⁷² The Convention would have to be amended before mandatory measures could be adopted under it to deal with acoustic disturbance of whales.

The issue of noise and its effects on whales has been addressed by the IWC’s Scientific Committee, especially through the Standing Working Group on Environmental Concerns (SWGEC).¹⁷³ Other subcommittees, in particular the Sub-Committee on Whale-Watching and the Sub-Committee on Small Cetaceans, have also dealt with aspects of this issue.¹⁷⁴

The SWGEC presented reports on noise to the Scientific Committee at IWC’s 50th and 51st meetings. In its 1999 Report, the Scientific Committee expressed “concern over potential adverse effects of anthropogenic noise on cetaceans.” It recognized the complexity of the issue and the difficulty in quantifying the risks associated with noise

exposure for most species, given the limited knowledge of cetaceans. The Scientific Committee also recognized that “mitigation and careful use of sounds are direct and effective mechanisms for reducing potential impact.” As an example of mitigation measures, the 1999 Report stated that noise-producing activities (such as seismic surveys or sonar operations) should not be conducted in critical habitats at certain times of the year, which could greatly reduce exposing mothers and calves or breeding animals to high sound levels. It supported measures to mitigate adverse effects of noise wherever possible and stressed the need for further research.¹⁷⁵

Disturbance of cetaceans by noise has also been discussed within the context of whale-watching. In 1996 the IWC adopted a resolution that endorsed a set of general principles for the management of whale-watching recommended by the Scientific Committee.¹⁷⁶ These principles provide, *inter alia*, that platforms should be designed, maintained, and operated to minimize the risk of adverse effects on cetaceans, including disturbance from noise. The IWC recommended that: (i) vessels, engines, and other equipment should be designed, maintained, and operated during whale-watching, to reduce as far as practicable adverse impacts on the target species and their environment; (ii) cetacean species may respond differently to low- and high-frequency sounds, relative sound intensity, or rapid changes in sound; vessel operators should be aware of the acoustic characteristics of the target species and of their vessel under operating conditions, particularly the need to reduce as far as possible production of potentially disturbing sound; (iii) vessel design and operation should minimize the risk of injury to cetaceans should contact occur; for example, shrouding of propellers can reduce both noise and risk of injury.¹⁷⁷ They also recommend operators to “avoid sudden changes in speed, direction, or noise.”¹⁷⁸

Several states have adopted regulations or guidelines to minimize acoustic disturbance to cetaceans from whale-watching activities. Such measures have been adopted in, e.g., Argentina, Australia, Canada, Japan, New Zealand, and the United Kingdom.¹⁷⁹

ASCOBANS

Acoustic disturbance of small cetaceans has received considerable attention under the regional Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) of 17 March 1992.¹⁸⁰ The Conservation and Management Plan contained in the Annex to ASCOBANS provides that the parties shall work towards, *inter alia*, “the prevention of other significant disturbance, especially of an acoustic nature” of the species involved.¹⁸¹ The Plan further provides that investigations shall be conducted to identify present and potential threats to different species.¹⁸² Such investigations should have special regard to the effects of pollution, disturbance, and interactions with fisheries, including work on methods to reduce such interactions.¹⁸³

ASCOBANS has addressed three potential sources of acoustic disturbance: seismic surveys, whale-watching, and high speed ferries. The Second Meeting of Parties to ASCOBANS, which convened 17–19 November 1997, addressed the disturbance caused by seismic activities in two of its resolutions.¹⁸⁴ The Meeting of Parties asked the ASCOBANS Advisory Committee to review various aspects of this issue. It also invited parties and non-party “Range States”¹⁸⁵ to submit to the Advisory Committee available information on the extent of seismic activities during 1997 and 1998, to provide details of any mitigation measures taken to reduce possible effects of such activities on small cetaceans,¹⁸⁶ and to introduce, where appropriate, guidelines and other measures to reduce disturbance to small cetaceans.

During the fifth Meeting of the Advisory Committee in April 1998, the United Kingdom presented a set of "Guidelines for Minimizing Acoustic Disturbance to Marine Mammals from Seismic Surveys."¹⁸⁷ These Guidelines, drawn up in 1994, are attached as mandatory conditions on all new licenses issued by the UK government.¹⁸⁸

During the sixth Meeting of the Advisory Committee in April 1999, it was noted that the UK Guidelines were frequently used by seismic contractors working in other areas. Nonetheless, the Committee recommended that other parties should apply similar guidelines. The Committee further noted that to provide guidance for the adoption of mitigation measures, the abundance, distribution, and behavior of cetaceans should be further investigated to review their seasonal and regional variation.¹⁸⁹

The UK Guidelines apply to all marine mammals, and all surveys using higher energy seismic sources should comply with these Guidelines. The Guidelines are intended to prevent direct physical harm to marine mammals and not any possible long-term effects. The Guidelines provide that beginning at least 30 minutes before the commencement of any use of seismic sources, checks should be made as to whether any marine mammals are within 500 meters. If marine mammals are present, the start of seismic sources should be delayed. Where equipment allows, power should be built up slowly to give adequate time for marine mammals to leave the vicinity. There should be a soft start every time airguns are used, even if no marine mammals have been sighted. Throughout the survey, the lowest practicable power levels should be used.¹⁹⁰

The United Kingdom has also presented to ASCOBANS Guidelines concerning disturbance of cetaceans from whale-watching operations and recreation at sea. These Guidelines contain precautionary measures to minimize disturbance of cetaceans.¹⁹¹ The measures request operators of whale-watching and recreational vessels, *inter alia*, to avoid making unnecessary noise which might interfere with the species' ability to use echolocation to detect prey and to communicate with each other. They also request maintaining a steady and slow speed to reduce noise disturbance and to maintain propellers and engines, and to use (where possible) boats with low engine noise (e.g., electric boats). At its sixth Meeting the Advisory Committee recommended that guidelines to minimize disturbance from these sources should be developed in other countries.¹⁹²

Another source of acoustic disturbance discussed within the framework of ASCOBANS are high-speed ferries.¹⁹³ Apart from the collection and review of information, no further action has been taken thus far.¹⁹⁴

Conclusions

This analysis suggests that international law is highly relevant for the issue of acoustic pollution. As a form of energy, sound falls under the definition of pollution of the marine environment contained in the LOS Convention and most relevant regional instruments. Moreover, several global and regional instruments for the conservation of marine species, ecosystems, and habitats also have the potential to deal with this issue, as some have already done.

The LOS Convention formulates several general duties for the protection and preservation of the marine environment, which must be taken into account for activities involving the introduction of sound into the oceans. These obligations include the duties to protect the marine environment from acoustic pollution; to prevent it from occurring; to act with precaution, and to carry out assessment procedures before starting new activities.

In fulfilling these obligations, states must take into account the requirements and limitations imposed upon them by international law. The LOS Convention prescribes to

what extent states have to take into account internationally agreed upon rules to regulate specific sources of marine pollution. Moreover, international law limits the possibilities of states to unilaterally regulate some sources of pollution, in particular, pollution from foreign vessels or aircraft in their maritime zones. As was indicated, this probably is less of a problem in respect of foreign aircraft than with regard to foreign vessels.

The IMO is the competent organization to address vessel-source pollution at the international level. Certain aspects of acoustic pollution from vessels can be regulated under a number of instruments adopted within the framework of the IMO. The PSSA concept offers a possibility to take these different instruments into account in an integrated manner. One important limitation in addressing vessel-source pollution, however, is that MARPOL 1973/78 only applies to pollution caused by substances, not by energy. This excludes the adoption of measures (e.g., CDEM standards) under MARPOL 1973/78 that would limit sound emissions from ships.

International agreements dealing with the conservation of marine species, ecosystems and habitats and the protection of the marine environment also offer opportunities to deal with acoustic pollution. Efforts under such instruments can be directed towards identifying which species, ecosystems, and habitats are most affected by noise, after which suggestions can be presented for mitigation measures. The example of ASCOBANS indicates that these instruments also provide an appropriate platform for adopting a holistic approach to various threats posed to these species and ecosystems.

One important strategy that can be used to treat acoustic pollution is the establishment of marine protected areas. The establishment of such areas should be based on an overall assessment of all threats to the species, habitats, or ecosystems concerned, and acoustic pollution could be one of the various issues to be taken into consideration in such an integrated approach. Such an approach is preferable over one that would only consider the impact of different pollutants on an individual basis. Regional agreements for the protection of the marine environment offer a suitable framework in which most measures could be adopted to effectively protect specific marine areas. In cases of vessel-source pollution, IMO's involvement would be required.¹⁹⁵

Up until now, most actions at the international level have been primarily directed towards incidental, rather than continuous, sources of noise. The relevant legislation and guidelines provide restrictions on the activities to prevent physiological harm or other direct disturbance of marine species, either in general or in designated (protected) areas. Actions now being regulated include whale-watching activities, seismic surveys, and, to some extent, shipping and the use of aircraft. To fully address the adverse effects of noise on the marine environment, it will also be necessary to look at the long-term impact on species, ecosystems, and habitats. Appreciating this, acoustic pollution in the marine environment is clearly an issue whose solution remains to be found in the coming decades.

Notes

1. *Proceedings of the Workshop on the Effects of Anthropogenic Noise in the Marine Environment*, 10–12 February 1998 (prepared by R. C. Gisiner, Marine Mammal Science Program, Office of Naval Research, USA), 3 (text available at http://www.onr.navy.mil/sci_tech/engineering/onrpgank.htm) (last accessed on 30 September 1999).

2. United Nations Convention on the Law of the Sea of 10 December 1982 (entered into force on 16 November 1994), *International Legal Materials* 21 (1982): 1261.

3. Sound can be defined as a “form of energy manifested by small pressure and/or particle velocity variations in a continuous medium.” W.J. Richardson *et al.*, *Marine Mammals and Noise* (San Diego: Academic Press, 1995): 544.

4. For more information on the principles of sound see Richardson et al., 15–32. See also A. D. Hawkins, “Underwater Sound and Fish Behaviour,” in T. J. Picher (ed.), *The Behaviour of Teleost Fishes* (London: Croom Helm, 1986): 114–151; and the United States National Marine Mammal Laboratory (NMML) and Pacific Marine Environmental Laboratory (PMEL), “An Introduction to Underwater Acoustics,” <http://newport.pmel.noaa.gov/whales/acoustics.html> (last accessed on 14 September 1999).

5. See Hawkins, “Underwater Sound and Fish Behaviour,” 116. The efficiency of sound propagation in water can, e.g., be seen in underwater explosions which can be detected halfway around the world; see *ibid.*, 118. Cf. also Richardson et al., *Marine Mammals and Noise*, 1. The distance of propagation of sound in water depends on the wavelength. For instance, in deep water sound with a wavelength of 15 meters propagates over a distance of thousands of kilometers, and sound with a wavelength of 15 centimeters, tens of kilometers. In shallow sea waters the distance of propagation is considerably less. For figures see C.C. ten Hallers, *Acoustic Disturbance of Sensory Perception and Behaviour of North Sea Animals* (Study prepared for the Netherlands Ministry of Transport, Public Works and Water Management, North Sea Directorate, September 1991): 9.

6. The term “noise” is often used as an equivalent of “sound.” Noise has been defined as “a sound, especially one that is loud, unpleasant, or disturbing” and in a technical sense as “irregular fluctuations accompanying and tending to obscure an electrical signal or other significant phenomenon,” *The Concise Oxford Dictionary* (Oxford: Oxford University Press, 1999): 966–967. In this article no distinction is made between the terms “noise” and “sound.”

7. Richardson et al., *Marine Mammals and Noise*, 30 and 87 et seq.

8. Thermal noise is created by the movement of molecules. It is particularly relevant at high frequencies (above 30 kHz). Cf. Richardson et al., *Marine Mammals and Noise*, 94.

9. *Ibid.*

10. See Ten Hallers, *Acoustic Disturbance*, 10–11; Richardson et al., *Marine Mammals and Noise*, 97.

11. Richardson et al., *Marine Mammals and Noise*, 97–98 and 427.

12. *Ibid.*, 101 et seq.

13. *Ibid.*, 102–123 and 430–431.

14. *Ibid.*, 123–126 and 431.

15. *Ibid.*, 127–146 and 431–433.

16. *Ibid.*, 146–148 and 433. See for more information on NATO’s activities in this area <http://www.saclantc.nato.int/> (last accessed on 21 September 1999).

17. Richardson et al., *Marine Mammals and Noise*, 148–154 and 433.

18. *Ibid.*, 154–155 and 433.

19. The ATOC project is a four-year study that is conducted by the Scripps Institution of Oceanography in the United States. The goals of ATOC are to gather information about temperatures in the ocean to verify existing climate models and to assess, through a marine mammal research program, the potential effects of these transmissions on marine mammals and sea turtles. More information on the ATOC study is available at <http://atoc.ucsd.edu/> (last accessed on 14 September 1999).

20. See, e.g., the reports cited *infra* in note 174 (Report of the Scientific Committee of the International Whaling Commission, IWC/51/4, in particular paragraph 12.3) and note 189 (ASCOBANS, Report of the 6th Advisory Committee Meeting, in particular Document ASCOBANS/ADV.COM/6/DOC.34). See also R. R. Reeves et al. (eds.), *Acoustic Deterrence of Harmful Marine Mammal-Fishery Interactions: Proceedings of a Workshop held in Seattle, Washington*, 20–22 March 1996, (NMFS-OPR-10), available at http://www.nmfs.gov/prot_res/publicat.html (last accessed on 21 September 1999).

21. Richardson et al., *Marine Mammals and Noise*, 311 et seq.

22. For more information on the development of these systems see <http://merz.ncl.ac.uk/dspgp01.html> (last accessed on 14 September 1999).

23. For a recent summary of the state of knowledge on the effects of humanmade noise on

marine organisms see *Proceedings of the Workshop on the Effects of Anthropogenic Noise in the Marine Environment*, supra note 1.

24. See, e.g., supra note 19.

25. The potential effects of acoustic disturbance on marine mammals have been discussed in ICES's Working Group on Marine Mammal Habitats. See the *Report of the Working Group on Marine Mammal Habitats*; ICES Headquarters, Copenhagen, 18–20 March 1998 (ICES CM 1998/E:6) (permission to cite the report has been granted by the General Secretary of ICES). In this report the Working Group expressed concerns about the continuing increase in noise levels and the possible effects of noise on marine mammals. The Working Group recommended that high priority be given to this topic for review at a future meeting. See *ibid.*, 6–17.

26. See *infra* note 173 and accompanying text.

27. ICES has also had an important task with regard to the scientific input for the International North Sea Ministerial Conferences, a political forum established to enhance the environmental protection of the North Sea. The 1993 Quality Status Report, which was prepared by the North Sea Task Force (established by ICES and the Oslo and Paris Commission (OSPARCOM) in 1988) identifies noise from offshore installations, shipping, and military activities as sources of acoustical disturbance of marine habitats. The report draws no conclusions as to the effects of these disturbances on ecosystems, but it does state that seismic surveys and airgun explosions can have lethal effects on fish eggs and larvae close to the energy source. It also states that this is one of the reasons for prohibiting seismic surveys during certain periods of the year in the spawning areas of fish such as herring. *Ibid.*, 95 and 100. Although the report recommends that pollution reduction should, in the context of species and habitat protection, receive high priority, no specific recommendations were made with respect to acoustic pollution. *Ibid.*, 129–131. A recent report issued in the framework of the International North Sea Ministerial Conferences summarizes the studies of the effects of seismic air gun surveys on fish and catching efforts. *Assessment Report on Fisheries and Fisheries related Species and Habitat Issues* (Report of the Committee of North Sea Senior Officials to the Intermediate Ministerial Meeting of 13–14 March 1997; available at <http://odin.dep.no/hsc/meeting1997/report/> (last accessed on 22 June 1999), para. 7.5.

28. *State of the Arctic Environment, Report on Underwater Noise*, November 9, 1990 (Finnish Initiative on the Protection of the Arctic Environment, prepared by R. A. Davis, W. J. Richardson, L. Thiele, R. Dietz, and P. Johanson). This report concluded that the effects of underwater noise on marine mammals are potentially very important. The effects of noise on other species were not addressed in the report.

29. See Richardson et al., *Marine Mammals and Noise*, 2–4 and 159–240.

30. Cetaceans are generally divided into two groups: the Odontocetes or toothed whales and the Mysticetes or baleen whales. The group of toothed whales (approximately 68 species) includes species such as the sperm whale, killer whale, dolphins, and porpoises. Baleen whales (about 11 species) include the blue, fin, and humpback whales. *Ibid.*, 2–3.

31. *Ibid.*

32. *Ibid.*, 239.

33. *Ibid.*, 240.

34. A. A. Myrberg, "Sound Communication and Interception in Fishes," in W. Tavolga, A. N. Popper, and R. R. Fay (eds.), *Hearing and Sound Communication in Fishes* (New York: Springer-Verlag, 1981), quoted in Hawkins, "Underwater Sound," 121. For more detailed information on the auditory capacities of fish see also R. R. Fay and A. N. Popper (eds.), *Comparative Hearing: Fish and Amphibians* (New York: Springer-Verlag, 1999).

35. Hawkins, "Underwater Sound," 121; Ten Hallers, *Acoustic Disturbance*, 3.

36. Hawkins, "Underwater Sound," 125–126.

37. *Ibid.*, 127.

38. *Ibid.*, 134.

39. *Ibid.*, 129.

40. Ten Hallers, *Acoustic Disturbance*, 3.

41. *Ibid.*

42. *Ibid.*, 21.

43. See for detailed information on disturbance reactions of marine mammals to underwater noise and related issues Richardson et al., *Marine Mammals and Noise*, 241–417. See also M. P. Simmonds and S. Dolman, “A Note on the Vulnerability of Cetaceans to Acoustic Disturbance,” 1999 (paper submitted to the Scientific Committee of the International Whaling Commission at its 51st meeting, IWC/SC/51/E15).

44. A stranding of 12 Cuvier’s beaked whales on the Greek coast in May 1996 has been connected to the introduction of high levels of low frequency sound by a NATO vessel for military tests of a submarine detection system. See *Time*, July 27, 1998, p. 12 and *Nature* 392 (March 5, 1998), 29.

45. See Simmonds and Dolman, “Vulnerability of Cetaceans,” 2.

46. Richardson et al., *Marine Mammals and Noise*, 392–397.

47. *Ibid.*, 319–321 and 400–414.

48. J. Dalen, E. Ona, A. Vold Soldal, and R. Sætre, *Seismiske Undersøkelser til Havs: En Vurdering av Konsekvenser for Fisk og Fiskerier* (Fisken og Havet No. 9 - 1996): 4. See also S. Løkkeborg and A. Vold Soldal, “The Influence of Seismic Exploration with Airguns on Cod (*Gadus Morhua*) Behaviour and Catch Rates,” *ICES Marine Science Symposium* 196 (1993): 62–67; A. Engås, S. Løkkeborg, E. Ona, and A. Vold Soldal, “Effects of Seismic Shooting on Local Abundance and Catch Rates of Cod (*Gadus Morhua*) and Haddock (*Melanogrammus Aeglefinus*),” *Canadian Journal of Fisheries and Aquatic Sciences* 53 (1996): 2238–2249.

49. *Ibid.*. See also infra note 141 and accompanying text on the regulatory response to this issue.

50. See Simmonds and Dolman, “Vulnerability of Cetaceans,” 3.

51. Richardson et al., *Marine Mammals and Noise*, 415.

52. *Ibid.*, 417–423.

53. Widespread participation in the LOS Convention was delayed by the opposition of the developed states to the deep seabed regime (Part XI). The 1994 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (UN General Assembly Resolution 48/263 of 28 July 1994), reprinted in *International Legal Materials* 33 (1992):1309 and *Law of the Sea Bulletin* (special issue IV, 1994): 8, made the LOS Convention acceptable for these states. As of 1 November 1999, 131 states and the European Community were Parties to the Convention (<http://www.un.org/Depts/los/los94st.htm>).

54. See, e.g., Article 4 of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks of 4 August 1995 (not yet entered into force), *International Legal Materials* 34 (1995):1542 and *Law of the Sea Bulletin* 29(1996): 25; Article 22(2) of the United Nations Environment Programme Convention on Biological Diversity (CBD) of 5 June 1992 (entered into force on 29 December 1993), reprinted in *International Legal Materials* 31 (1992):841. See also Chapter 17 of Agenda 21, entitled “Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi-Enclosed Seas, and Coastal Areas and the Protection, Rational Use and Development of their Living Resources,” adopted in Rio de Janeiro, 3–14 June 1992, A/CONF.151/26 (Vol. II), 13 August 1992. The introductory paragraph of the Ocean’s Chapter of Agenda 21 states that: “International law, as reflected in the United Nations Convention on the Law of the Sea . . . sets forth rights and obligations of States and provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources.”

55. LOS Convention, Article 237.

56. Noise is sometimes approached from the perspective of physical alteration of marine habitats or ecosystems, rather than marine pollution. See, e.g., E. A. Norse (ed.), *Global Marine Biodiversity. A Strategy for Building Conservation into Decision Making* (Washington, D.C.: Island Press, 1993): 88, 106, 113, and 117. Together with overexploitation, introduction of alien species and global atmospheric change, physical alteration of marine ecosystems and marine pollution are considered to be the most serious direct threats to marine biological diversity.

57. LOS Convention, Article 1(1)(4).

58. The name of GESAMP was changed in 1994. Originally the acronym stood for the Joint Group of Experts on the Scientific Aspects of Marine Pollution.

59. Doc. GESAMP I/11 of 17 July 1969, p. 14, para. 35; see also Doc. GESAMP II/11, Annex V, pp. 16–17; J. Barros and D. M. Johnston, *The International Law of Pollution* (New York: The Free Press and London: Collier Macmillan Publishers, 1974): 6; and M. Nordquist (ed.), *United Nations Convention on the Law of the Sea 1982; A Commentary, Vol. II* (Dordrecht: Martinus Nijhoff Publishers, 1993): 41. The term “energy” does not seem to have attracted much attention at the Third United Nations Conference on the Law of the Sea.

60. In some cases the LOS Convention only refers to substances and not energy. Under article 246(5)(b) of the LOS Convention, e.g., the coastal state may withhold its consent for marine scientific research projects in its exclusive economic zone or on its continental shelf if it involves the introduction of harmful substances into the marine environment.

61. See in this sense also A. Kiss and D. Shelton, *International Environmental Law* (Ardsey-on-Hudson: Transnational Publishers, 1991): 117 and E. J. Molenaar, *Coastal State Jurisdiction over Vessel-Source Pollution* (The Hague: Kluwer Law International, 1998): 17. But see contra K. M. Gjerde and D. Ong, “Protection of Particularly Sensitive Sea Areas Under International Marine Environmental Law,” *Marine Pollution Bulletin* 26 (1993): 9–13. The definition of pollution is sometimes interpreted to include other human activities such as anchoring, based on the presumption that it involves the introduction of a combination of substances and energy. See in this respect W. T. Burke, “Changes Made in the Rules of Navigation and Maritime Trade by the 1982 Convention on the Law of the Sea,” in R. B. Krueger and S. A. Riesenfeld (eds), *The Developing Order of the Oceans* (San Francisco: LSI, 1984): 671.

62. Vienna Convention on the Law of Treaties of 23 May 1969, Article 31(1), reprinted in *International Legal Materials* 8 (1969): 679.

63. The term “degradation of the marine environment” was introduced by Chapter 17 of Agenda 21 (see in particular paragraphs 18 and 19). See also Report of the Secretary-General for the 49th Session of the United Nations General Assembly (UN Doc. A/49/631 of 16 November 1994, paras. 74–76) according to which the term is used, inter alia, to ensure that “control of harmful fishing practices and prevention of overfishing are part of the obligation to protect and preserve the marine environment.” Reference is also made to the addition and removal of sediments and land-based activities.

64. Not included in the definition is harm to “marine ecosystems” or “biological diversity.” The term “marine life” can, however, be seen as broad enough to encompass biological diversity, as well as the living components of marine ecosystems.

65. See also P. Birnie and A. Boyle, *International Law and the Environment* (Oxford: Clarendon Press, 1992): 101–102; Kiss and Shelton, *International Environmental Law*, 117; K. Hakapää, *Marine Pollution in International Law* (Helsinki: Suomalainen Tiedeakatemia, 1981): 39–40.

66. See infra note 86 and accompanying text.

67. See Article 1(d) of the Convention for the Protection of the Marine Environment of the North-East Atlantic of 22 September 1992 (entered into force on 25 March 1998), 23 *Law of the Sea Bulletin* (1993), p. 32; *The Law of the Sea; Current Developments in State Practice; No. IV* (1995), p. 254.

68. See Article 2(1) of the Convention on the Protection of the Marine Environment of the Baltic Sea Area of 9 April 1992 (not yet entered into force), 22 *Law of the Sea Bulletin* (1993), p. 54; *The Law of the Sea; Current Developments in State Practice; No. IV* (1995), p. 200.

69. See, e.g., Article 2(1) of the Convention on the Protection of the Black Sea against Pollution of 21 April 1992 (entered into force 15 January 1994), 22 *Law of the Sea Bulletin* (1993), p. 31; *The Law of the Sea; Current Developments in State Practice; No. IV* (1995), p. 233; Article 2(b) of the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region of 21 June 1985 (entered into force 30 May 1996), *Official Journal of the European Communities* (1986) C253, p. 10; Article I(3) of the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environ-

ment of 14 February 1982 (entered into force on 20 August 1985) (<http://www.tufts.edu/fletcher/multi/texts/BH811.txt> (last accessed on 19 July 1999)). An exception is the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region of 24 March 1983 (entered into force on 11 October 1986), *The Law of the Sea; Current Developments in State Practice* (1987), p. 149, which does not contain a definition of pollution.

70. Arctic Environmental Protection Strategy of 14 June 1991, 30 *International Legal Materials* 1624 (1991), para. 3, which lists six specific pollution issues. The action plan defined in the Strategy required the evaluation of the effects of noise as part of project planning and approval processes, and if significant adverse noise effects on the specific components of the Arctic ecosystems were predicted, then measures should be implemented to avoid or mitigate the impact. Moreover, it called upon states to carry out further research into the impact of noise on marine mammals (*ibid.*, para. 5.4). The introduction of sound into the marine environment has received little further attention in the framework of regional cooperation in the Arctic.

71. See for a general analysis of the environmental provisions of the LOS Convention, *inter alia*, J. I. Charney, "The Marine Environment and the 1982 United Nations Convention on the Law of the Sea," *International Lawyer* 28 (1994): 879–901. See also IUCN, *The Law of the Sea: Priorities and Responsibilities in Implementing the Convention* (Gland: IUCN, 1995).

72. LOS Convention, Article 192.

73. *Ibid.*, Article 193. Cf. Charney, "The Marine Environment," 886.

74. See for the relationship between Principle 21 of the Stockholm Declaration and Article 192 and 193, *inter alia*, Birnie and Boyle, *International Law and the Environment*, 91–92 and 254–255; Kiss and Shelton, *International Environmental Law*, 129–130 and 144–147.

75. See M. H. Nordquist (ed.), *United Nations Convention on the Law of the Sea 1982. A Commentary Vol. IV* (Dordrecht/Boston/London: Martinus Nijhoff Publishers, 1991): 35–43.

76. Some more recent regional conventions require states to "prevent and *eliminate* (emphasis added)," rather than to "prevent, reduce and control" marine pollution. See, e.g., OSPAR Convention, Article 2(1)(a).

77. LOS Convention, Article 194(1).

78. The term "damage" is not defined in the LOS Convention. Such damage would seem to include the "deleterious effects" as described in the definition of marine pollution contained in article 1(1)(4) of the LOS Convention, but may involve a broader range of negative effects that are not explicitly mentioned in this definition, e.g., harm to marine ecosystems or biological diversity. See *supra* note 65 and accompanying text. If such damage would occur, the state responsible could be held liable to pay compensation under general international law. Cf. Articles 232, 235, and 304 of the LOS Convention.

79. *Ibid.*, Article 194(2) (footnote added).

80. Article 194(3) of the LOS Convention provides that the measures taken pursuant to Part XII shall deal with all sources of pollution of the marine environment. This provision contains an extensive list of possible measures.

81. *Ibid.*, Article 194(5).

82. See in particular the instruments mentioned *infra* note 162 and following.

83. This obligation is contained in Article 196(1) of the LOS Convention, which provides that "States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto." It appears that this provision was intended mainly to deal with pollution resulting from biotechnology. Some authors are, however, of the opinion that "the use of technologies" can be read to include "biotechnology or any polluting technology." D. Freestone, "The Conservation of Marine Ecosystems under International Law," in M. Bowman and C. Redgwell (eds.), *International Law and the Conservation of Biological Diversity* (The Hague: Kluwer Law International, 1995): 91–107, at 103.

84. LOS Convention, Article 194(4).

85. See further *infra* note 98 et seq. and accompanying text.

86. Cf. paragraphs 17.21 and 17.22 of Agenda 21. Agenda 21 refers to the need for “new approaches to marine and coastal area management and development, at the national, subregional, regional and global levels, approaches that are integrated in content, and precautionary and anticipatory in ambit” (Introductory paragraph to the Ocean’s Chapter).

87. Principle 15 of the Rio Declaration on Environment and Development. This Principle also provides that “in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities.”

88. See, e.g., Article 2(2)(a) of the 1992 OSPAR Convention and Article 3(2) of the 1992 Helsinki Convention. See on the precautionary principle, D. Freestone and E. Hey (eds.), *The Precautionary Principle and International Law* (The Hague/London/Boston: Kluwer Law International, 1996) and H. Hohmann, *Precautionary Legal Duties and Principles of Modern International Environmental Law: the Precautionary Principle. International Environmental Law between Exploitation and Protection* (London/Dordrecht/Boston: Graham & Trotman/Martinus Nijhoff, 1994).

89. Cf. D. Bodansky, “Scientific Uncertainty and the Precautionary Principle,” *Environment* 33 (1991): 4–5 and 43–44.

90. LOS Convention, Article 206.

91. *Ibid.*

92. Requirements for prior impact assessment of planned activities are also contained in regional agreements and many other international instruments. See, e.g., Article 14(1)(a) of the Convention on Biological Diversity.

93. LOS Convention, Article 197.

94. *Ibid.*, Article 200.

95. *Ibid.*, Article 201.

96. *Ibid.*, Article 204.

97. *Ibid.*, Article 205.

98. See *ibid.*, Articles 1(1)(5), 210, and 216.

99. Warships and other Government ships operated for noncommercial purposes enjoy sovereign immunity from enforcement jurisdiction by states other than the flag state. See *ibid.*, Articles 31 and 32. See also *ibid.*, Article 236.

100. For a detailed analysis of the provisions dealing with vessel-source pollution see Molenaar, *supra* note 61; Nordquist, *UNCLOS Commentary Vol IV*, 176–206, 240–314, and 320–398.

101. Since the emphasis of this article is on standard-setting, the complex enforcement provisions contained in the LOS Convention are not discussed here.

102. LOS Convention, Article 211(1).

103. *Ibid.*

104. *Ibid.*, Article 211(2).

105. On the interpretation of “generally accepted,” see, e.g., Molenaar, *Coastal State Jurisdiction*, pp. 148–167; B.H. Oxman, “The Duty to Respect Generally Accepted International Standards,” *New York University Journal of International Law and Politics* 24 (1991): 109–159.

106. LOS Convention, Article 211(3). Port states can establish special requirements for the prevention, reduction, and control of pollution of the marine environment as a condition for the entry of foreign vessels into their ports or internal waters or for a call at their off-shore terminals.

107. *Ibid.*, Article 211(4); see also *ibid.*, Articles 21 and 22. Article 21(1) provides that a coastal state can adopt laws and regulations relating to innocent passage through the territorial sea, *inter alia*, in respect of the safety of navigation and the regulation of maritime traffic; the conservation of living resources of the sea; the preservation of the environment of the coastal state, and the prevention, reduction, and control of pollution thereof.

108. *Ibid.*, Article 21(2) and 24.

109. *Ibid.*, Article 22(3) and (4).

110. *Ibid.*, Article 52(1).

111. *Ibid.*, Article 42(1)(b) and 54.

112. *Ibid.*, Article 56(1)(b)(iii).

113. *Ibid.*, Article 211(5). This provision primarily relates to the competence of coastal states to prevent, control, and reduce illegal discharges by foreign vessels. The authority of a coastal state to establish navigational measures would have to be based on a coastal state's general authority to protect and preserve the marine environment (Article 56) or on the authority to adopt measures for special areas within its EEZ (Article 211(6)).

114. *Ibid.*, Article 211(6).

115. The measures for such special areas could in theory include any type of discharge standards, CDEM standards, or navigational measures. Cf. Molenaar, *Coastal State Jurisdiction*, 405.

116. LOS Convention, Article 211(6)(c).

117. See Molenaar, *Coastal State Jurisdiction*, 418.

118. See *infra* notes 122–124.

119. This concerns ice-covered areas within the limits of the EEZ, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. See LOS Convention, Article 234.

120. *Ibid.*

121. Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas, IMO Doc. A17/Res.720, 9 January 1992. See in particular paras. 1.2.1–2, 1.2.11, and 1.4. The Guidelines are currently in a process of revision. On the PSSA concept see further K. Gjerde and D. Freestone, "Particularly Sensitive Sea Areas—An Important Environmental Concept at a Turning-Point," *International Journal of Marine and Coastal Law* 9 (1994): 431–578.

122. PSSA Guidelines, Preface. A PSSA has been defined as "an area which needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to environmental damage by maritime activities" (see *ibid.*, para. 3.1.2). PSSAs are considered as a useful mechanism to implement the special areas provision of Article 211(6) of the LOS Convention, as well as the Convention on Biological Diversity and the regional protocols on specially protected areas. See *Relationship between the 1982 United Nations Convention and the Law of the Sea and the IMO Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas* (document submitted by the Office of Legal Affairs of the United Nations Division on Ocean Affairs and the Law of the Sea to IMO's Marine Environment Protection Committee; MEPC 43/6/2, 31 March 1999).

123. See PSSA Guidelines, paras. 3.1.3–3.1.5.

124. International Convention for the Prevention of Pollution from Ships of 1973, as amended by Protocol of 1978 (entered into force on 2 October 1983), reprinted in *International Legal Materials* 17 (1978): 546.

125. International Convention for the Safety of Life at Sea of 1 November 1974 (entered into force on 25 May 1980), *United Kingdom Treaty Series* 46 (1980).

126. General Provisions on Ships' Routing (A.572(14)) of 20 November 1985. See PSSA Guidelines, paras. 3.4–3.7.

127. PSSA Guidelines, para. 3.8.

128. See MARPOL 1973/78, Article 2(2) and 2(3).

129. PSSA Guidelines, para. 3.8.3.

130. IMO's Subcommittee on Safety of Navigation recently approved two mandatory ship reporting systems to protect Right whales off the U.S. east coast. These measures were, however, intended to reduce ship strikes, rather than disturbance of the species by noise. See IMO Doc. NAV 44/3/1 of 24 April 1998. A substantial minority in the Subcommittee could not agree with the proposal and expressed preference for a recommendatory reporting system. The Subcommittee expressed serious concerns over the potential for the proliferation of proposals for mandatory

ship reporting systems focused on a single species. See IMO Doc. NAV 44/14 of 4 September 1998, paras. 3.26 and 3.27.

131. See IMO Res. MEPC.44(30) of 16 November 1990 and MEPC.74(40) of 25 September 1997.

132. LOS Convention, Article 208(3).

133. *Ibid.*, Article 208(4).

134. *Ibid.*, Article 208(5).

135. UNEP Doc. 10/14 (VI) of 31 May 1982 and UNGA Res. 37/217 of 20 December 1982.

136. See *supra* note 124 and accompanying text.

137. See, e.g., Article 5 of the OSPAR Convention; Article 12 of the 1992 Helsinki Convention; and Article 7 of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean of 19 June 1995 (which will replace the original Barcelona Convention of 16 February 1976). T. Scovazzi, *Marine Specially Protected Areas* (The Hague: Kluwer Law International, 1999): 129.

138. See, *inter alia*, Annex III to the OSPAR Convention; Annex VI to the 1992 Helsinki Convention; Protocol for the Protection of the Mediterranean Sea Against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and Its Subsoil of 14 October 1994 (not yet entered into force), Scovazzi, *Marine Specially Protected Areas*, 179; Protocol concerning Marine Pollution resulting from the Exploration and Exploitation of the Continental Shelf of the Gulf of 29 March 1989 (entered into force 17 February 1990).

139. Richardson et al., *Marine Mammals and Noise*, 11.

140. *Ibid.*, 10.

141. E-mail of 11 June 1999 of Mr. Jon Dalen of the Institute of Marine Research, Bergen, Norway, to one of the authors. The text of the relevant regulation was not available to the authors.

142. J. Dalen, E. Ona, A. Vold Soldal, and R. Sætre, *Seismiske Undersokelser til Havs*, 6.

143. See *infra* for similar guidelines with regard to marine mammals.

144. LOS Convention, Article 212(1). Article 212(2) provides that states also have to take other measures as may be necessary to prevent, reduce, and control such pollution.

145. *Ibid.*, Article 212(3).

146. *Ibid.*, Articles 2 and 49.

147. *Ibid.*, Articles 38 and 53.

148. *Ibid.*, Articles 56(1)(a), 78(1), and 87 (1)(a).

149. Richardson et al., *Marine Mammals and Noise*, 10.

150. See M. J. Valencia and J. B. Marsh, "Access to Straits and Sea Lanes in Southeast Asian Seas: Legal, Economic, and Strategic Considerations," *Journal of Maritime Law and Commerce* 16 (1985): 513–551, at p. 528.

151. The general rules and principles of the LOS Convention concerning the protection and preservation of the marine environment and the specific rules relating to marine pollution are, of course, directly relevant for the conservation of marine species, ecosystems, and habitats. The LOS Convention's definition of pollution not only includes a direct reference to living resources and marine life, but its Part XII specifically requires states to adopt measures to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened, or endangered species and other forms of marine life. See note 81 *supra*.

152. For a review of the fisheries regime of the LOS Convention and subsequent practice in this regard see, e.g., W. T. Burke, *The New International Law of Fisheries; UNCLOS 1982 and Beyond* (Oxford: Clarendon Press, 1994).

153. The right to conserve marine living resources in the internal waters and territorial sea is based on the sovereignty states enjoy in these maritime zones (LOS Convention, Articles 2 and 21(1)(d)). See also note 107 *supra*.

154. *Ibid.*, Articles 56(1)(a) and 77.

155. According to Article 61(2) of the LOS Convention the coastal state is only obliged to take proper conservation and management measures for the living resources in its EEZ to prevent

“overexploitation.” The Convention does provide that such measures have to be designed to “maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield, *as qualified by relevant environmental and economic factors*” (emphasis added) and “taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether subregional, regional or global.” *Ibid.*, Article 61(3). Theoretically, this might be read to allow coastal states to take into account the effects of acoustic pollution on such species, when determining the allowable catch. Similar observations can be made in respect of the conservation measures for marine living resources on the high seas. Cf. LOS Convention, Articles 118 and 119. Article 61(3) has been broadly interpreted by some authors. See, e.g., Burke, *New International Law of Fisheries*, 54–55.

156. LOS Convention, Article 56(2).

157. *Ibid.*, Article 65.

158. This includes, e.g., Australia (the Whale Protection Act, No. 92, of 6 June 1980); New Zealand (Marine Mammal Protection Act, No. 80, of 20 October 1978) and the United States (Marine Mammal Protection Act of 21 October 1972, 16 *United States Code* 1361–1421h).

159. LOS Convention, Articles 65 and 120.

160. Burke, *New International Law of Fisheries*, 286–287.

161. See *infra* note 180 and accompanying text.

162. See *supra* note 54.

163. International Convention for the Regulation of Whaling of 2 December 1946 (entered into force on 10 November 1948), 161 *United Nations Treaty Series* 72. See further *infra* note 169 and accompanying text.

164. Convention on the Conservation of Migratory Species of Wild Animals of 23 June 1979 (entered into force on 1 November 1983), *International Legal Materials* 19 (1980): 15. For the Agreements adopted under the Bonn Convention, see *infra* note 180 and accompanying text.

165. Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region of 21 June 1985 (entered into force on 30 May 1996), *The Marine Mammal Commission Compendium of Selected Treaties, International Agreements and Other Relevant Documents on Marine Resources, Wildlife and the Environment* (Washington, DC: U.S. Government Printing Office, 1994): 2364; Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the South-East Pacific of 21 September 1989 (not yet entered into force). *Ibid.*, 2248; Protocol concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region of 18 January 1990 (not yet entered into force), *International Journal of Estuarine and Coastal Law* 5 (1990): 369; Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean Sea of 10 June 1995 (not yet entered into force). T. Scovazzi, *Marine Specially Protected Areas*, 163. Some regional conventions on the protection of the marine environment, which do not have a protocol on marine protected areas, address this issue (in more general terms) in an article of the Convention. See, e.g., Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region of 23 March 1981 (entered into force 5 August 1984) (<http://www.tufts.edu/fletcher/multi/texts/BH800.txt>) (last accessed on 1 October 1999), Article 11.

166. OSPAR Convention, Annex V on the Protection and Conservation of the Ecosystems and the Biological Diversity of the Maritime Area of 23 July 1998.

167. See, e.g., Article 7(c) of the Convention on Biological Diversity which requires states parties to “identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques.” Article 8(1) of the Convention on Biological Diversity requires states to regulate or manage such processes and categories of activities that have been identified to have significant adverse effects. See further C. de Klemm, “The Regulation and Management of Destructive Processes: A New Type of Instrument for the Conservation of Biological Diversity,” *Environmental Policy and Law* 27 (1997): 350–354. Annex V of OSPAR contains similar requirements for states parties.

168. Cf. D. Freestone, *The Road from Rio: International Environmental Law after the Earth Summit* (Hull: The University of Hull Press, 1993): 19–20.

169. See supra note 163. See for more information on the ICRW <http://ourworld.comuserve.com/homepages/iwcoffice/>. See also P. Birnie, *International Regulation of Whaling*, 2 Vols. (Dobbs Ferry, NY: Oceana Publications, 1985); M. Maffei, “The International Convention for Regulation of Whaling,” *International Journal of Marine and Coastal Law* 12 (1997): 287–305; S. Wettestad, “The International Whaling Regime: Order at the Turn of the Century?,” in D. Vidas and W. Østreng, *Order for the Oceans at the Turn of the Century* (The Hague/London/Boston: Kluwer Law International, 1999): 215–228.

170. See, e.g., IWC Resolution 1999-9 (IWC/51/54), which concerns Dall’s porpoise. The Scientific Committee established under the ICRW has a Standing Sub-Committee on Small Cetaceans.

171. The Schedule is an integral part of the ICRW, which is binding on all states parties.

172. According to Article V of the ICRW, the IWC can indicate (a) protected and unprotected species; (b) open and closed seasons; (c) open and closed waters, including the designation of sanctuary areas; (d) size limits for each species; (e) time, methods, and intensity of whaling (including the maximum catch of whales to be taken in any one season); (f) types and specifications of gear and apparatus and appliances which may be used; (g) methods of measurement; and (h) catch returns and other statistical and biological records.

173. See in particular the Report of the Standing Working Group on Environmental Concerns, presented to the Scientific Committee at the 51st Meeting of the IWC, IWC/51/4, Annex H. See also “A note on the vulnerability of cetaceans to acoustic disturbance,” prepared by M.P. Simmonds and S. Dolman, IWC/SC/51/E15.

174. See Report of the Scientific Committee, IWC/51/4, paragraph 12.3 (dealing with by-catch mitigation through acoustic deterrent devices) and paragraphs 13.3 and 13.4 (dealing with reactions of cetaceans to whale-watching activities).

175. IWC/51/4, paragraph 11.4.1 and Annex H, paragraph 7.1.

176. Whale-Watching Guidelines, IWC Resolution 1996-1, IWC Chairman’s Report of the 48th Annual Meeting, 24–28 June 1996, Appendix 2.

177. Principle 2 Whale-Watching Guidelines.

178. Principle 3 Whale-Watching Guidelines.

179. See, e.g., the *Report of the Workshop on the Scientific Aspects of Managing Whale Watching*, Montecastello di Vibio, Italy, 30th March–4th April 1995, pp. 24–25 and C. Carlson, “A Review of Whale-watching Guidelines and Regulations around the World” (Working Paper MWW/95/1 presented at this workshop). See for the guidelines adopted by the United Kingdom *infra* note 191 and accompanying text.

180. The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas of 17 March 1992 (entered into force on 29 March 1994) was adopted as an Agreement under Article IV(4) of the Bonn Convention. Apart from ASCOBANS, two other agreements have been concluded in respect of marine mammals under Article IV(4) of the Bonn Convention, i.e. the Agreement on the Conservation of Seals in the Wadden Sea of 16 October 1990 (entered into force on 1 October 1991) and the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea, and Contiguous Atlantic Area (ACCOBAMS) of 24 November 1996 (not yet entered into force). Of these three Agreements, only ASCOBANS has addressed the issue of acoustic disturbance. ACCOBAMS may have a similar significance as ASCOBANS in addressing this issue. The Agreement on the Conservation of Seals in the Wadden Sea seems mostly intended to address the adverse impact of hazardous substances on seals. The texts of the agreements are available at <http://www.wcmc.org.uk/cms/>. For an analysis of ASCOBANS see H. Nijkamp and A. Nollkaemper, “The Protection of Small Cetaceans in the Face of Uncertainty: An Analysis of the ASCOBANS Agreement,” *The Georgetown International Environmental Law Review* 9 (1997): 281–302.

181. ASCOBANS, Annex, para. 1.

182. *Ibid.*, Annex, para. 2. The protection of one of the species covered by ASCOBANS, the harbor porpoise, has also been addressed by HELCOM Recommendation 17/2 of 12 March

1996 (The Helsinki Committee (HELCOM) is established under the Helsinki Convention). Recommendation 17/2 recommends governments of the parties to the Helsinki Convention to take action, in close cooperation with ICES, for the collection and analysis of additional data on disturbance of porpoise by shipping (e.g., underwater noise). As of July 1999, the Recommendation had not yet been implemented.

183. ASCOBANS, Annex, para. 2. Sound is generally considered to be only a minor threat to the species covered by ASCOBANS. Incidental catches in fisheries are considered as the most important threat. During the Sixth Meeting of the Advisory Committee the IWC/ASCOBANS Working Group on Harbor Porpoises advised ASCOBANS that its interim objective (maintaining or restoring population size to 80% of carrying capacity) was unlikely to be met by reducing annual by-catch to the levels set by ASCOBANS. ASCOBANS, *Report of the 6th Advisory Committee Meeting*, 8.

184. See *Report of the Second Meeting of Parties to ASCOBANS, 17–19 November 1997, Bonn, Germany*, Annexes M and N.

185. Article I(1h) of the Bonn Convention defines “Range States” as “any state . . . that exercises jurisdiction over any part of the range of a migratory species, or a state, flag vessels of which are engaged outside national jurisdictional limits in taking that migratory species.”

186. During its Sixth Meeting the Advisory Committee asked the parties to submit such information to the Secretariat by the end of 1999, to be included in the Agenda for the next Advisory Committee Meeting. ASCOBANS, *Report of the 6th Advisory Committee Meeting*, 12.

187. See Document ASCOBANS/ADV.COM/5/DOC.9.

188. See *Marine Mammals and Seismic: The London Workshop* (submitted by Mark Tasker) (ASCOBANS, 6th Advisory Committee Meeting, Doc. 39). In June 1998 the UK oil and seismic industries organized a workshop on seismic activities and marine mammals. The workshop suggested that in addition to existing mitigation measures (seasonal and geographic limitations on surveys; soft start procedures; safety zones around noise sources and use of minimal source power compatible with imaging subsurface targets), industry should strive to design sources that minimize the output of sound outside the usable bandwidth; the effectiveness of soft-start should be reviewed; safety zones should be better defined; more transparent administrative procedures would reassure third parties; and strategic environmental impact assessment would help guide activities at a regional level. *Ibid.*

189. ASCOBANS, *Report of the 6th Advisory Committee Meeting*, 12.

190. Similar guidelines are in force in the United States. In the United States safety zones are established on the basis of the distance at which sound is above a specific level. See *Marine Mammals and Seismic: The London Workshop*.

191. See ASCOBANS/ADV.COM/2/DOC.8 and 9.

192. ASCOBANS, *Report of the 6th Advisory Committee Meeting*, 12.

193. These ferries also pose a threat to cetaceans, because of their high cruising speeds (up to over 70 km/h). This makes it difficult for cetaceans to avoid them, and there have been several reports of fatal collisions (see <http://www.ascobans.org/page12.html> (last accessed on 17 June 1999)).

194. ASCOBANS, *Report of the 6th Advisory Committee Meeting*, 12; see also *Report on the potential impact of high speed ferries on small cetaceans in the ASCOBANS Area and adjacent waters* (Submitted by the Secretariat) ASCOBANS, 6th Advisory Committee Meeting, Doc. 17. This report suggests that there is little evidence that noise from high-speed ferries leads to greater disturbance of marine mammals than that of conventional ferries.

195. A recent discussion in IMO in connection with the designation of two mandatory ship reporting systems indicates that support for such measures may be difficult to obtain in certain instances. See note 131 *supra*.