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OF WHALES AND SHIPS: IMPACTS ON THE
GREAT WHALES OF UNDERWATER NOISE
POLLUTION FROM COMMERCIAL SHIPPING AND
PROPOSALS FOR REGULATION UNDER
INTERNATIONAL LAW

Lora L. Nordtvedt Reeve^{*}

“Undersea noise pollution is like the death of a thousand cuts.”

-Dr. Sylvia Earle¹

In the aftermath the tragic events of September 11, 2001, the sea off the eastern coast of the United States nearly emptied of ships and, consequently, of the underwater noise pollution the ships generate, thus opening the opportunity for a unique scientific study of how marine mammals are affected by the noise. By comparing the stress on North Atlantic right whales caused by underwater noise pollution from commercial shipping before and after September 11, scientists were able to demonstrate the significant adverse impact of shipping noise on these critically endangered marine mammals. The findings add to a growing body of literature that provides the scientific basis for emerging global efforts to regulate underwater noise pollution and manage its impact on the great whales. The International Maritime Organization is the

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1. Dr. Sylvia Earle, Former Chief Scientist, National Oceanic and Atmospheric Administration (NOAA), quoted in MICHAEL JASNY, JOEL REYNOLDS, CARA HOROWITZ & ANDREW WETZLER, SOUNDING THE DEPTHS II: THE RISING TOLL OF SONAR, SHIPPING, AND INDUSTRIAL OCEAN NOISE ON MARINE LIFE, Natural Resources Def. Council i, iv (Nov. 2005), available at <http://www.nrdc.org/wildlife/marine/sound/contents.asp>.

primary global agency with the authority to regulate most other pollutants that are discharged from commercial vessels and could therefore regulate underwater noise as a new category of pollutant. Alternatively, other international treaties and regional agreements offer persuasive authority for a new convention dedicated to managing all types of underwater noise, including the noise from shipping activities. Whether through a new convention or revised regulations under the International Maritime Organization, the issue is urgent and requires action now by the international community.

I. INTRODUCTION

On September 11, 2001 (“September 11”), a tragedy unfolded on the eastern seaboard of the United States that caused the sea to nearly empty of ships.² This consequence of the terrible calamity in New York City opened an opportunity for a unique scientific study that may help to save the world’s whales.³ This rare experiment provides evidence that the undersea noise pollution generated by global commercial shipping slowly, chronically, and cumulatively cuts away at the lives of the great whales, including the critically endangered North Atlantic right whales,⁴ *Eubalaena glacialis* (“right whales”).⁵

The North Atlantic right whales are baleen whales⁶ that come each year to the productive waters of the Bay of Fundy, Canada to nurse their calves and forage for food.⁷ During the late summer of 2001, whale scientists from the New England Aquarium were studying the right

2. Rolland et al., *infra* note 7, at 2.

3. *See id.*

4. The North Atlantic right whale is listed as endangered under § 4 of the Endangered Species Act of 1973, 7 U.S.C. § 136, 16 U.S.C. §§ 1531 et seq. [hereinafter ESA]; *see* U.S. ATLANTIC AND GULF OF MEXICO MARINE MAMMAL STOCK ASSESSMENTS – 2010 (Gordon T. Waring, Elizabeth Josephson, Katherine Maze-Foley, & Patricia E. Rosel eds. 2010) NOAA Tech. Memo. NMFS-NE-219 [hereinafter STOCK ASSESSMENTS]; Phillip J. Clapham, Sharon B. Young, & Robert L. Brownell Jr., Baleen Whales: *Conservation Issues and the Status of the Most Endangered Populations*, 29 MAMMAL REVIEW 35, 40 (1999).

5. Rolland, et al., *infra* note 7, at 2.

6. For purposes of this paper, the terms “baleen whales,” “mysticetes,” and “great whales” are used interchangeably.

7. Rosalind M. Rolland, Susan E. Parks, Kathleen E. Hunt, Manuel Castellote, Peter J. Corkeron, Douglas P. Nowacek, Samuel K. Wasser, & Scott D. Kraus, *Evidence That Ship Noise Increases Stress in Right Whales*, PROCEEDINGS OF THE ROYAL SOC’Y B, Feb. 8, 2012, at 2, abstract, available at <http://rspb.royalsocietypublishing.org/content/early/2012/02/01/rspb.2011.2429.abstract>.

whales in the Right Whale Conservation Area (“RWCA”) of the Bay of Fundy.⁸ The researchers were tracking hormonal changes in the whales, chiefly the hormones associated with stress.⁹ The scientists were watching for signs that the whales suffer from the effects of chronic stress, which could offer key information as to why the species has not recovered from its depletion by commercial whaling, despite strong legal and policy protections.¹⁰ The number of individuals in the North Atlantic right whale population is critically low,¹¹ and the species remains endangered under both U.S. and international criteria.¹²

At the same time as the study above, other marine mammal scientists working on an unrelated project were also in the Bay of Fundy, monitoring the acoustic signals associated with the social behavior of the same right whales.¹³ This second group of researchers was looking for changes in the calls of the whales.¹⁴ Previous research had shown that high noise levels within the same low-frequency range that the great whales use to communicate causes the whales to raise the volume and frequency of their calls in order to be heard by others of their own species.¹⁵

The underlying scientific premise of both these studies is that underwater noise pollution significantly interferes with the whales’ natural communication and behavior, and therefore could be inhibiting the recovery of their species.¹⁶ The noise generated by the propulsion systems¹⁷ on commercial shipping vessels¹⁸ is of particular concern.¹⁹

8. *Id.* at Fig. 1.

9. *Id.* at 2.

10. *Id.* at 5. The primary legal protections are under the ESA, *supra* note 4; and the Marine Mammal Protection Act of 1972, 16 U.S.C. §§ 1361 et seq., 1401-1407, 1538, 4107. The primary policy protection is the Recovery Plan for the North Atlantic Right Whale, prepared by the Office of Protected Res. of the Nat’l Marine Fisheries Serv. (2004), available at http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rightwhale_northatlantic.htm.

11. STOCK ASSESSMENTS, *supra* note 4, at 8.

12. *Id.*; see also International Union for Conservation of Nature Red List of Threatened Species worldwide, <http://www.iucnredlist.org/apps/redlist/details/41712/0> (last visited Oct. 30, 2012).

13. STOCK ASSESSMENTS, *supra* note 4, at 2.

14. *Id.*

15. Susan E. Parks, Mark Johnson, Douglas Nowacek, & Peter Tyack, *Individual Right Whales Call Louder in Increased Environmental Noise*, 7 *BIOLOGY LETTERS* 33, 34 (2010).

16. Rolland et al., *supra* note 7, at 2.

17. John A. Hildebrand, *Anthropogenic and Natural Sources of Ambient Noise in the Ocean*, 395 *MARINE ECOLOGY PROGRESS SERIES* 5, 9 (2009).

The ships generate loud low-frequency background noise that may mask²⁰ communication among the whales,²¹ as well as hindering the whales' ability to navigate on their long migrations and to detect predators and prey.²²

As the world stood still after the tragic events of September 11, most shipping activities in U.S. waters were halted, causing the underwater noise level to drop dramatically.²³ The vessel management system for the Bay of Fundy recorded a substantial decrease in traffic in the shipping lanes that pass within sixteen kilometers of the RWCA.²⁴ On August 25, 2001, there were five vessels in the RWCA lanes and on August 29, four vessels.²⁵ Comparatively, only one ship passed through the Bay of Fundy on September 12 and two on September 13.²⁶

The unprecedented decrease in ship traffic gave scientists the extraordinary opportunity to compare the whales' stress hormone levels before and after September 11, and to correlate the findings with the intensity level of underwater noise from ships during the same time periods.²⁷ The investigators' conclusions were two-fold: 1) there was a "noticeable" decrease in the low-frequency background noise of the type that would mask communication among the right whales; and 2) this drop in the background noise level showed a statistically significant relationship to the reduction in the stress hormones in the whales.²⁸

This study demonstrated that the reduction in underwater noise pollution from the shipping activities was directly related to a significant decrease in the stress levels of the whales.²⁹ A large body of scientific

18. Peter L. Tyack, *Implications for Marine Mammals of Large-scale Changes in the Marine Acoustic Environment*, 89 J. OF MAMMALOGY 549, 553 (2008).

19. *See id.*

20. Clark et al., *infra* note 21, at 201 (defining "masking" as acoustic interference that "may impede one's ability to understand, recognize, or even detect sounds of interest [that] results in a reduction of a receiver's performance, as the sound of interest cannot be effectively perceived, recognized, or decoded.").

21. Christopher W. Clark, William T. Ellison, Brandon L. Southall, Leila Hatch, Sofie M. Can Paris, Adam Frankel, & Dimitri Ponirakis, *Acoustic Masking in Marine Ecosystems: Intuitions, Analysis and Implication*, 395 MARINE ECOLOGY PROGRESS SERIES 201, 217 (2009).

22. *Id.* at 203.

23. Rolland et al., *supra* note 7, at 2.

24. *Id.* at 3.

25. *Id.*

26. *Id.*

27. *Id.* at 2.

28. *Id.*

29. *Id.*

literature shows that chronic stress, as measured by high levels of stress hormones, can lead to detrimental effects on health and reproduction across a variety of vertebrate groups, including mammals.³⁰ If this is indeed the case with the North Atlantic right whales, reducing their stress hormone levels by reducing underwater noise pollution from shipping might lead to increased health and reproductive success, which could lead to the recovery of their species.³¹

Underwater sound from all sources, including shipping, is measured by the intensity of the source level in decibels.³² The standard source level reference for underwater sound is “re ___dB 1 μ Pa at 1 m,” with one micropascal (1 μ Pa) as the unit of intensity, the number of decibels (dB) as the unit of the sound level, and one meter (1 m) as the distance from the source,³³ where the blank is completed by adding the number of decibels. Underwater sound is also described by its frequency in hertz (Hz).³⁴

Underwater noise pollution from large ships is among the most pervasive of anthropogenic sounds in the ocean that falls within the low-frequency range of 5 to 500 Hz that may mask the sounds produced and heard by the great whales.³⁵ “Over the past few decades, the shipping contribution to ambient noise has increased by as much as 12 [decibels] coincident with a significant increase in the number and size of vessels comprising the world’s commercial shipping fleet.”³⁶ For comparison, a cargo vessel that is 173 meters long and sailing at 16 knots has a sound level of 192 dB, while a small boat outboard engine running at 20 knots has a sound level of 60 dB.³⁷

Underwater noise pollution affects the mysticetes in many ways, some so subtle that they become apparent only when whale populations do not thrive, as in the case of the stress on the right whales.³⁸ The adverse impacts are physical as demonstrated by the right whale study,

30. *Id.* at 4; see also R. M. Sapolsky, L. M. Romero, & A. U. Munck, *How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions*, 21 *ENDOCR. REV.* 55 (2000); M. L. Romero & L. K. Butler, 2007 *Endocrinology of stress*, 20 *INT’L. J. COMP. PSYCHOL.* 89 (2007).

31. Clark et al., *supra* note 21, at 4.

32. Robert J. Urick, *PRINCIPLES OF UNDERWATER SOUND* 1 (3rd ed. 11, Peninsula Publishing 1983).

33. *Id.* at 14-15.

34. *Id.*

35. Hildebrand, *supra* note 17, at 5.

36. *Id.*; see also Urick, *supra* note 32, at 14-5.

37. Hildebrand, *supra* note 17, at Table 1.

38. Rolland et al., *supra* note 7, at 4.

and behavioral as documented extensively in the scientific literature.³⁹ Most worrying of all are the hidden deaths of the whales that end their lives at sea due to the adverse impacts of long-term chronic stress or the whales that are killed by predators they could not detect due to masking.⁴⁰ Those whales are never counted in the statistics of mysticete mortality from underwater noise pollution because no human eyes witness the causes of their deaths.⁴¹

This paper aims to contribute to the interdisciplinary field of marine policy, integrating marine mammal science and international ocean law to support policy to conserve the great whales. The paper explores underwater noise pollution from shipping as it affects the baleen whales and how the noise might be regulated to reduce the impacts. The first section discusses the use of sound by mysticetes, the impacts of underwater noise pollution from shipping, and the existing treaties and organizations with the authority for international regulation of marine pollution in general and underwater noise in particular. The second section examines the dual “shipping-conservation” mission of the International Maritime Organization⁴² (“IMO” or “Organization”) and whether the current global legal framework is effective for protecting the great whales. The third section offers some suggestions for improving international regulation of shipping noise with the objective of reducing its impact on mysticetes.

The analysis presented here addresses one small but important part of the wider group of issues regarding the intersection – and often, the conflict – between conservation of marine resources and the economically significant activities that may have adverse environmental impacts. The paper concludes that the IMO,⁴³ which regulates discharges of pollution from commercial vessels, has the competence under

39. See e.g., L. S. Weilgart, *The Impacts of Anthropogenic Noise on Cetaceans and Implications for Management*, 85 CANADIAN J. OF ZOOLOGY 1091, 1095 (2007); Christine Erbe, HEARING ABILITIES OF BALEEN WHALES, Defence R&D Canada, Contractor Rep. DRDC Atlantic CR 2002-065 (Oct. 2002); National Research Council of the National Academies, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, OCEAN NOISE & MARINE MAMMALS 94 (2003).

40. See generally Clark et al., *supra* note 21.

41. H. Peltier, W. Dabin, P. Daniel, O. Van Canneyt, G. Doremus, M. Huon, & V. Ridoux, *The Significance of Stranding Data As Indicators of Cetacean Populations at Sea: Modelling the Drift of Cetacean Carcasses*, 18 ECOLOGICAL INDICATORS 278 (2012) (finding that only 8% of small dolphins that died at sea landed ashore, the only such study on cetaceans).

42. See Convention on the Int'l Maritime Org., Mar. 6, 1948, 9 U.S.T. 621, 289 U.N.T.S. 3 [hereinafter IMO Convention].

43. See *id.*

international treaty law to regulate underwater noise pollution from shipping and could issue guidelines for controlling the sources of shipping noise that impact the whales. While IMO regulation is one solution, this paper also briefly presents the possibility of a new global treaty to comprehensively address the impacts of underwater noise pollution from all sources as it impacts not only the great whales but also other marine species and ecosystems.

II. BACKGROUND: GREAT WHALES, SCIENCE AND INTERNATIONAL LAW

The management of underwater noise pollution from shipping as it impacts the great whales is likely best addressed by an interdisciplinary approach. The first step is to demonstrate through rigorous scientific investigation that adverse impacts to the whales do indeed exist. The second step is to explore the available alternatives under international legal regimes. This section provides the background for understanding how the disparate disciplines of science and law might come together to formulate marine conservation policy to protect the whales from underwater noise pollution from commercial shipping.

A. The Great Whales Live in a World of Undersea Sound

The great whales live in a world of undersea sound.⁴⁴ Natural sources of sound in the ocean include earthquakes, wind-driven waves, rainfall, biologically produced sound, and the agitation of seawater related to temperature differences and changes.⁴⁵ The mysticetes have evolved to use hearing, instead of vision such as humans use, as the primary sensory system for their activities: to communicate with their potential mates and their young; to forage for summer prey in the cold, productive waters of the high latitudes; to navigate on their long migration routes through the open ocean; and to detect predators.⁴⁶ Scientific knowledge of the mysticetes is limited due to the difficulties of studying them at sea, but scientists do know that the ability of the whales to use sound effectively is vital to their survival.⁴⁷

44. Hildebrand, *supra* note 17, at 5.

45. *Id.*

46. *Id.*

47. Erbe, *supra* note 39, at 1.

The great whales belong to the taxonomic suborder of cetaceans Mysticeti or mysticetes.⁴⁸ All are large animals,⁴⁹ with North Atlantic right whales for example, ranging up to eighteen meters and ninety tons.⁵⁰ The mysticetes are very difficult to study,⁵¹ making the unplanned experiment in the Bay of Fundy all the more significant to the process of discovering why the right whales have not recovered from their near extinction at the hands of commercial whalers.⁵² Due to their size and feeding ecology, mysticetes cannot be held in captivity for even the short term.⁵³ Their habitat is also expensive and time consuming to approach, as most of the great whale species live far out to sea and spend much of their time deep underwater.⁵⁴ There have been no direct studies to measure baleen whale hearing, and scientists must infer the whales' hearing sensitivity from indirect evidence.⁵⁵

48. The defining characteristic of the mysticete group is the fringed baleen plates that hang from the upper jaw in place of the teeth of other mammals. When eating, the whales filter small fish and invertebrates through the baleen from the huge gulps of seawater they take into their mouths. Blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaenangliae*), bowhead whales (*Balaena mysticetus*), sei whales (*Balaenoptera borealis*), Bryde's whale (*Balaenoptera brydei*), and minke whales (*Balaenoptera acutorostrata*), in addition to the North Atlantic right whales, are the extant mysticete species. See THOMAS A. JEFFERSON, MARC A. WEBBER, & ROBERT L. PITMAN, *MARINE MAMMALS OF THE WORLD: A COMPREHENSIVE GUIDE TO THEIR IDENTIFICATION* 8, 17 (Elsevier 2008).

49. A blue whale approximately twenty-seven meters long and weighing over 136,000 kg is documented to be the heaviest animal ever weighed. See W. C. Winston, *The Largest Whale Ever Weighed*, 59 *NATUR. HIST.* 392 (1950).

50. JEFFERSON ET AL., *supra* note 48, at 28.

51. Erbe, *supra* note 39, at 1.

52. See R. R. Reeves, *Overview of Catch History, Historic Abundance and Distribution of Right Whales in the Western North Atlantic and in Cintra Bay, West Africa*, Special Issue 2 *J. OF CETACEAN RESEARCH & MGMT.* 231 (2001).

53. Erbe, *supra* note 39, at 1.

54. *Id.*

55. Several research efforts have attempted to confirm the range of mysticete hearing, and one Canadian scientist has suggested three possible indirect methods to verify the range of baleen whale hearing: 1) studies of vocalizations can indicate the most likely frequency range of best-hearing because often the frequency bandwidths of animals' vocalizations and best-hearing sensitivity ranges overlap; 2) the few dissections and anatomical studies of baleen whale ears taken from dead, stranded animals can be used to create a "relative" audiogram indicating the best-hearing frequency range, and 3) analysis of the vast scientific literature on observed reactions of baleen whales in the wild to biological and industrial sounds gives evidence of the top thresholds that the whales hear, the assumption being that as animals react to sounds they hear, they might not react to a sound that is barely audible but would only react to a sound that is a certain level louder. *Id.* "An audiogram is a function of auditory detection threshold versus frequency." *Id.*

If studying the lives and environments of the baleen whales in the wild is problematic, exploring the impact of acoustic disturbance on the whales is even more difficult.⁵⁶ One of the greatest challenges is finding the definitive link between a source of underwater noise pollution and its impacts to the great whales.⁵⁷ This is especially true when the impacts are subtle and cumulative like those from the stress demonstrated in the hormonal study of the North Atlantic right whales in the Bay of Fundy.⁵⁸ Scientists must rely on indirect methods to discover and measure the impacts to the hearing and communication of the mysticetes.⁵⁹

The potential for impacts from underwater noise pollution on the great whales is related to the fundamental properties of sound as it travels through the seawater.⁶⁰ Sound energy, especially at the low frequencies used by the baleen whales, spreads much faster and further through the water than light energy,⁶¹ leading to two important considerations for regulation of the sources of the noise pollution: 1) sound waves propagate in seawater comparatively readily, increasing the difficulty of linking the source of the noise, such as a specific vessel or vessels, with the impacts to the great whales;⁶² and 2) underwater noise is a pollutant that inevitably crosses national political boundaries.⁶³ It is clear that regulation of underwater noise pollution and successful control of its impacts will require the cooperation of the international community, especially coastal and maritime nations.

A large and growing body of scientific literature documents mysticete species that have changed their behavior in response to underwater noise pollution from different sources. For example, in 2007 a study demonstrated changes in the call production of the separate populations of North Atlantic and South Atlantic right whales due to the

Put simply, an audiogram measures and maps the auditory range and capabilities of a subject. See Andrew Tubelli, Aleks Zosuls, Darlene Ketten, & David C. Mountain, Prediction of a Mysticete Audiogram via Finite Element Analysis of the Middle Ear, in THE EFFECTS OF NOISE ON AQUATIC LIFE (Arthur N. Popper & Anthony Hawkins eds., 2011) (discussing mysticete audiograms).

56. Erbe, *supra* note 39, at 1.

57. *See id.*

58. Rolland et al., *supra* note 7, at 2.

59. Erbe, *supra* note 39, at 1.

60. Urick, *supra* note 32, at 1 (discussing sound as a form of energy that propagates in waves with very different characteristics traveling through the sea than traveling through the air).

61. *Id.*; see also Tyack, *supra* note 18, at 549.

62. NAT'L RES. COUNCIL, OCEAN NOISE & MARINE ANIMALS 6 (2003).

63. *See id.* at 7.

increase in low-frequency underwater noise pollution from shipping.⁶⁴ The results of an investigation published in January 2012 presented the first evidence of changes in the incidence of the songs of North Atlantic humpback whales wintering off the New England coast in Stellwagen Bank National Marine Sanctuary as the result of the anthropogenic acoustic transmissions of the Ocean Acoustic Waveguide Remote Sensing experiment located approximately 200 km away.⁶⁵ Yet another study showed that blue whales in the St. Lawrence Estuary increased their vocal behavior in the presence of seismic surveys that emitted intense sounds within the low-frequency range where the mysticetes most likely hear.⁶⁶ Underwater noise pollution from shipping falls within this same low-frequency range.⁶⁷

In the future, the problem of underwater noise pollution is expected to become even more significant. As the temperature of the earth rises due to climate change, scientists predict that the oceans will become increasingly transparent to low-frequency acoustic disturbance, allowing low-frequency sound to travel faster and farther from its sources, including underwater noise pollution from shipping that impacts the great whales.⁶⁸ Thus, human activities hundreds of kilometers away from the whales may have significant effects on the animals' behavior and physical health,⁶⁹ increasing the difficulty of establishing the link between the source of the sound and the impacts to the whales.

64. Susan E. Parks, Christopher W. Clark, & Peter L. Tyack, *Short- and Long-term Changes in Right Whale Calling Behavior: The Potential Effects of Noise on Acoustic Communication*, 122 J. OF THE ACOUSTICAL SOC'Y OF AM. 3725, 3727 (2007).

65. Denise Risch, Peter J. Corkeron, William T. Ellison, & Sofie M. Van Parijs, *Changes in Humpback Whale Song Occurrence in Response to an Acoustic Source 200 km Away*, 7 PLOSONE e29741, available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256173/pdf/pone.0029741.pdf>.

66. Lucia Di Iorio & Christopher Clark, *Exposure to Seismic Survey Alters Blue Whale Acoustic Communication*, 6 BIOLOGY LETTERS 51, 52 (2010).

67. Hildebrand, *supra* note 17, at 5.

68. See Tatiana Ilyina, Richard E. Zeebe, & Peter G. Brewer, *Future Ocean Increasingly Transparent to Low-frequency Sound Owing to Carbon Dioxide Emissions*, 3 NATURE GEOSCIENCE 18 (2010).

69. See *id.* at 22.

B. Global Commercial Shipping and Underwater Noise Pollution

Commercial shipping is ubiquitous in all modern oceans and plays an indisputably essential role in the world's economy.⁷⁰ "Marine transportation is an integral, if sometimes less publicly visible, part of the global economy Maritime transportation is a necessary complement to . . . other modes of freight transportation. For many commodities and trade routes, there is no direct substitute for waterborne commerce."⁷¹ Coastal and island nations depend upon surface shipping for vital food, clean water, medicines, and fuel, and shipping companies often employ sailors from developing countries where jobs are scarce.⁷²

The world's merchant fleet has grown at a fast pace over the last few decades, both in the number and capacity of ships.⁷³ From 2005 to 2009, the global fleet of vessels with gross tonnage capacity of 10,000 metric tons (MT) or greater increased from 879.9 million deadweight (mill dwt) MT to 1144.4 mill dwt MT.⁷⁴ By the beginning of 2011, the gross tonnage of the world merchant fleet had grown to 1.3 *billion* dwt (bill dwt) MT, and the number of ships had increased to 47,833.⁷⁵ According to one shipping industry report, 2010 "was the biggest delivery year ever" for new merchant vessels.⁷⁶ Currently, the twenty-five nations with the top registry of vessels account for 20,050 ships and over 1.2 bill dwt MT.⁷⁷

70. See U.S. DEPT. OF TRANSP., MAR. ADMIN., TOP 25 FLAGS OF REGISTRY, http://www.marad.dot.gov/library_landing_page/data_and_statistics/Data_and_Statistics.htm (last visited Oct. 30, 2012) [hereinafter USDOT].

71. JAMES J. CORBETT & JAMES WINEBRAKE, ORG. FOR ECON. CO-OPERATION & DEV./INT'L TRANSP. FORUM, THE IMPACTS OF GLOBALIZATION ON INT'L MARINE TRANSPORT ACTIVITY 6 (2008).

72. See USDOT, *supra* note 70.

73. See UNITED NATIONS CONFERENCE ON TRADE & DEVELOPMENT, REVIEW OF MARITIME TRANSPORT 2011, 7-10 (2011). Vessel capacity is measured in deadweight (dwt), which is the total weight in metric tons (MT) of cargo, fuel, fresh water, stores and crew that a ship can carry when it is immersed to its load line. USDOT, *supra* note 70.

74. INST. OF SHIPPING ECON. & LOGISTICS, 55 SHIPPING STATISTICS & MARKET REVIEW, Jan.-Feb. 2009, at 3, available at http://www.infoline.isl.org/index.php?module=Downloads&func=prep_hand_out&lid=677.

75. *Id.* at 5 http://www.infoline.isl.org/index.php?module=Downloads&func=prep_hand_out&lid=677http://www.infoline.isl.org/index.php?module=Downloads&func=prep_hand_out&lid=677.

76. *Id.*

77. USDOT, *supra* note 70. The top five flags in terms of gross tonnage are Panama, Liberia, Marshall Islands, Hong Kong, and Singapore.

As noted above, the underwater noise pollution generated by these large commercial vessels overlaps with the low-frequency range that is the probable dominant acoustic range where the mysticetes hear and produce sounds.⁷⁸ Ship sounds can mask the whales' ability to hear and be heard,⁷⁹ much like the difficulty of having a human conversation at an earsplitting rock concert or while standing near a roaring jet engine.

Several main sources of noise on ships become underwater noise pollution when discharged into the ocean,⁸⁰ but the specific impacts on whales of these sources have not been studied due to the difficulties of research at sea.⁸¹ The analyses of shipboard noise to date have predictably focused on the impacts of ship noise to humans, although one technical paper mentions that the same sounds may impact whales as well.⁸²

C. Current Global Regulation of Ocean Pollution: The International Maritime Organization, the Marine Pollution Treaty, the U.N. Convention on the Law of the Sea, and the London Convention

Current global regulation of many types of pollution discharged from commercial vessels into the ocean is carried out under competent international organizations and conventions.⁸³ Three major implementing treaties underpin the international legal regime: the Convention on the International Maritime Organization, which established the International Maritime Organization; the International Convention for the Prevention of Pollution from Ships and its Protocol, also known as MARPOL; and the United Nations Convention on the Law of the Sea.⁸⁴ A fourth treaty, known as the London Convention, is included here as an example of an international agreement that addresses

78. Erbe, *supra* note 39, at 3-7.

79. Clark et al., *supra* note 21, at 217.

80. J.S. CARLTON & D. VLASIC, 1ST INT'L SHIP NOISE & VIBRATION CONFERENCE, SHIP VIBRATION AND NOISE: SOME TOPICAL ASPECTS, § 2 (2005) (bulleting omitted) (discussing vessel noise sources including 1) prime movers, typically diesel engines; 2) shaft-line dynamics; 3) propeller radiated pressures and bearing forces; 4) air conditioning systems; 5) maneuvering devices such as transverse propulsion units; 6) cargo handling and mooring machinery; 7) vortex shedding mechanisms; 8) intakes and exhausts; and 9) slamming phenomena).

81. *See* Erbe, *supra* note 39, at 1.

82. CARLTON & VLASIC, *supra* note 80, at § 4.

83. *See Oceans and Law of the Sea*, UNITED NATIONS, <http://www.un.org/en/globalissues/oceans/index.shtml> (last visited Oct. 30, 2012).

84. *See id.*

dumping of marine pollutants. Noise might be addressed under this convention if it was defined as being “dumped” into the ocean.⁸⁵

1. The International Maritime Organization

The International Maritime Organization (“IMO” or “Organization”), headquartered in London,⁸⁶ is a specialized agency of the United Nations (“U.N.”) created under the Convention of the Intergovernmental Maritime Consultative Organization.⁸⁷ The convention was concluded on March 6, 1948 and entered into force on March 17, 1958.⁸⁸ The original convention established the Intergovernmental Maritime Consultative Organization (“IMCO”), and the title of the body was officially changed to the International Maritime Organization in 1982.⁸⁹

One of the founding purposes of the IMCO was to “encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships.”⁹⁰ Initially, the IMCO was charged with facilitating cooperation among maritime nations to address the safety and technical issues of shipping,⁹¹ IMCO activities focused on human safety aboard ships at sea, with the body adopting a new version of the International Convention for the Safety of Life at Sea.⁹²

The mission of the IMO has expanded with the addition of responsibility for the prevention and control of marine pollution.⁹³ The IMO strategic plan for 2012 to 2017 affirms that one of the purposes of the Organization is “to promote safe, secure, *environmentally sound*,

85. *London Convention and Protocol*, INT’L MAR.ORG., <http://www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx> (last visited Oct. 30, 2012).

86. IMO Convention, *supra* note 42, art. 58.

87. IMO Convention, *supra* note 42.

88. *Convention on the International Maritime Organization*, U.N. TREATY SERIES DATABASE, http://treaties.un.org/pages/ShowMTDSGDetails.aspx?src=UNTSOnline&tabid=2&mtdsg_no=XII-1&chapter=12&lang=en#Participants (last visited Oct. 30, 2012).

89. *Brief History of IMO*, INTERNATIONAL MARITIME ORGANIZATION, <http://www.imo.org/About/HistoryOfIMO/Pages/Default.aspx> (last visited Sept. 29, 2012) [hereinafter *History of IMO*].

90. IMO Convention, *supra* note 42, art. I(a).

91. *History of IMO*, *supra* note 89.

92. Int’l Convention for the Safety of Life at Sea, Nov. 1, 1974, 32 U.S.T. 47, 1184 U.N.T.S. 278.

93. IMO Convention, *supra* note 42, art. I.

efficient and sustainable shipping through cooperation.”⁹⁴ The dual mission opens the potential for conflicts to arise between the priorities of marine conservation and those of commercial shipping activities.

The IMO is a legislative body with the competence to develop and maintain international treaties and other international legislation to address marine pollution from ships.⁹⁵ The IMO’s marine pollution regulatory authority derives from the International Convention for Prevention of Pollution from Ships⁹⁶ (“MARPOL Convention”) and the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships⁹⁷ (“MARPOL Protocol”), detailed below. The IMO Assembly is comprised of all state members⁹⁸ and is responsible for consideration “of any matters concerning shipping and the effect of shipping on the marine environment that may be referred to it by any organ or specialized agency of the United Nations.”⁹⁹ Decisions in the Assembly are taken by consensus,¹⁰⁰ the IMO adopts legislation, and the governments of member countries implement and enforce the legislation.¹⁰¹ The Council, composed of forty members elected by the Assembly,¹⁰² reviews committee reports and transmits the information to the Assembly.¹⁰³ All major maritime nations are members, including the U.S., the U.K., and the People’s Republic of China.¹⁰⁴

94. Int’l Mar.Org. Res. 27/1037, ¶ 1.1, U.N. Doc. A /RES//27/1037 , at 3 (Dec. 20, 2011) (emphasis added).

95. Frequently Asked Questions, INT’L MAR. ORG., <http://www.imo.org/About/Pages/FAQs.aspx> (last visited Apr. 18, 2012) [hereinafter IMO FAQs]; see also IMO Convention, *supra* note 42, art. I.

96. International Conference on Marine Pollution, London, U.K., Nov. 2, 1973, *Int’l Convention for the Prevention of Pollution from Ships*, Oct. 2, 1973, 34 U.S.T. 3407, 1340 U.N.T.S. 184 [hereinafter MARPOL Convention].

97. Protocol of 1978 Relating to the Int’l Convention for the Prevention of Pollution from Ships, Oct. 2, 1983, 1340 U.N.T.S. 61 [hereinafter MARPOL Protocol].

98. Major shipping nations that have acceded to the originating convention and are members of the IMO include the Russian Federation, the Republic of Korea, the People’s Republic of China (P.R.C.), the United Kingdom (U.K.), and the United States (U.S.). *Member States*, IMO, <http://www.imo.org/About/Membership/Pages/MemberStates.aspx> (last visited Apr. 4, 2012).

99. IMO Convention, *supra* note 42, art. 1(d).

100. IMO FAQs, *supra* note 95.

101. *Id.*

102. *Id.*

103. IMO Convention, *supra* note 42, art. 21.

104. See *Member States*, *supra* note 98.

In the 1970s, the IMO began to take on the responsibility of regulating the prevention and control of ocean pollution.¹⁰⁵ The need for regulation became alarmingly clear when, on March 18, 1967, the supertanker *Torrey Canyon* ran aground in the waters of the U.K. and began to discharge oil into the sea off the Cornish coast.¹⁰⁶ The crippled vessel eventually spilled 120,000 tonnes of oil into the ocean, causing a major environmental disaster.¹⁰⁷ As vessels increased in size, the shipping industry began to recognize the potential for disastrous accidents like the *Torrey Canyon*.¹⁰⁸ In 1973 under the aegis of the U.N., maritime nations agreed to the provisions of the MARPOL Convention, adding the MARPOL Protocol in 1978.¹⁰⁹

The IMO continues to be the authority for a number of treaties and agreements that regulate activities at sea and aboard ship¹¹⁰ and is the global body authorized to implement the provisions of MARPOL that regulate the discharge of the major types of pollution by commercial vessels into the ocean.¹¹¹ Underwater noise is not currently defined nor regulated as a pollutant by the IMO, nor is it among the listed pollutants in MARPOL.¹¹² The environmental work of the IMO is tackled in the Marine Environment Protection Committee (“MEPC” or “Committee”) consisting of all member states.¹¹³ The MEPC is concerned with the control and prevention of the discharge of marine pollution from ships into the marine environment,¹¹⁴ including recommendations for enforcement measures for violations, procurement of scientific and technical information, and “promo[tion] of cooperation with regional organizations concerned with the prevention and control of marine pollution”¹¹⁵ The Committee submits to the Assembly proposals for

105. See *History of IMO*, *supra* note 89.

106. 1967: *Supertanker Torrey Canyon Hits Rocks*, BBC ON THIS DAY, http://news.bbc.co.uk/onthisday/hi/dates/stories/march/18/newsid_4242000/4242709.stm (last visited Mar. 3, 2012).

107. IMO FAQs, *supra* note 95.

108. See *id.*

109. MARPOL Convention, *supra* note 96.

110. See *List of IMO Conventions*, IMO, <http://www.imo.org/About/Conventions/ListOfConventions/Pages/Default.aspx> (last visited Apr. 4, 2012).

111. *International Convention for the Prevention of Pollution from Ships (MARPOL)*, IMO, [http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-\(marpol\).aspx](http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx) (last visited Apr. 13, 2012).

112. *Id.*

113. IMO Convention, *supra* note 42, art. 37.

114. *Id.* art. 38.

115. *Id.*

new regulations and amendments to existing regulations, as well as recommendations and guidelines.¹¹⁶

The MEPC has addressed concerns about a wide variety of marine pollutants, most recently at the sixty-third session from February 27 to March 2, 2012, where the Committee discussed harmful aquatic organisms in ballast water,¹¹⁷ recycling of ships,¹¹⁸ and the adoption of mandatory vessel instrument requirements.¹¹⁹ The MEPC also adopted guidelines to support uniform implementation of mandatory measures to increase energy efficiency and reduce emissions of greenhouse gases from international shipping across all maritime states.¹²⁰ Most relevant to the conclusions of this paper, the MEPC noted that the subcommittee tasked with investigating noise from commercial shipping and its impact on marine life planned to report its conclusions to the Committee in October 2012.¹²¹

2. MARPOL: The International Convention for the Prevention of Pollution from Ships

The International Convention for the Prevention of Pollution from Ships,¹²² known as the MARPOL Convention, and the 1978 MARPOL Protocol¹²³ (“MARPOL”) together constitute the primary global agreement governing the discharge of pollution by ships into the marine environment through accidental or operational causes.¹²⁴ The MARPOL Protocol was adopted in response to a series of oil tanker accidents during 1976 and 1977.¹²⁵ By 1973 the Convention had not yet entered into force, and the 1978 Protocol absorbed the parent Convention.¹²⁶ The combined instrument, known simply as MARPOL, entered into force on October 2, 1983.¹²⁷

116. *Id.* art. 39.

117. *See* IMO Marine Environment Protection Comm., Rep. on its 63d Sess., Feb. 27-Mar. 2, 2012, § 2, U.N. Doc. A/63/23 (Mar. 14, 2012).

118. *Id.* at 8.

119. *Id.* at 17.

120. *Id.* at 34.

121. *Id.* at 60.

122. MARPOL Convention, *supra* note 96.

123. MARPOL Protocol, *supra* note 97.

124. *IMO and the MARPOL Convention*, [http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-\(marpol\).aspx](http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx) (last visited Mar. 3, 2012) [hereinafter IMO and MARPOL].

125. *Id.*

126. *Id.*

127. *Id.*

MARPOL has been amended through the years since its original adoption, and the added agreements continue to be administered through the IMO.¹²⁸ The annexes of the 1978 Protocol list and define the ship discharges that are controlled under MARPOL and the regulations pertaining to each pollutant,¹²⁹ including oil,¹³⁰ sewage,¹³¹ noxious liquid substances,¹³² harmful substances,¹³³ ballast water,¹³⁴ and garbage containing more than traces of heavy metals.¹³⁵ The Protocol also contains detailed procedures for pollution prevention and control.¹³⁶ As noted above, MARPOL does not currently regulate underwater noise from shipping as a pollutant.

In 2008, Annex VI of the Protocol was amended, adding extensive procedures for the prevention of air pollution from ships.¹³⁷ Ozone depleting substances and nitrogen oxides from diesel engines on ships are the focus of the new provisions.¹³⁸ The importance of the new amendments for efforts to regulate underwater noise pollution as it impacts the great whales is discussed in the analysis section.

128. *Id.* In 1997, a new Protocol was adopted to amend MARPOL, and Annex VI was added, entering into force on May 19, 2005. The 1997 Protocol (Annex VI) and several amendments have served to update MARPOL. *Id.*

129. *IMO and MARPOL*, *supra* note 124.

130. MARPOL Convention, *supra* note 96, at annex I.

131. *Id.* annex XIII.

132. *Id.* annex II.

133. *Id.* annex III.

134. *Id.*

135. *Id.* annex V.

136. Amendments to the Annex of the Protocol of 1979 Relating to the International Convention for the Prevention of Pollution from Ships, 1973, Regulation 10, Sept. 25, 1997, 2057 U.N.T.S. 69 (regulations for 1) ship structure to prevent, mitigate or manage accidents; 2) reporting of incidents of unsanctioned discharge, either intentionally or unintentionally; 3) avoidance of pollution accidents; 4) operational guidelines for avoiding pollution accidents; 5) survey and inspection of ships to check for seaworthiness; and 6) identification of “special areas” where extra precautions are required for discharge or discharge is not allowed under any circumstances).

137. MEPC Res., MEPC.176(58), Amendments to the Annex of the Protocol of 1997 to amend the International convention for the Prevention of Pollution from Ships 1973, as Modified by the Protocol of 1978 Relating thereto, Regulation 2, ¶ 16, 58/21/Add.1, U.N. Doc. MEPC/58/23/Add.1 (Oct. 10, 2008) [hereinafter MEPC.176(58)].

138. *Id.* Regulation 2(15) & (16).

3. The U.N. Convention on the Law of the Sea

The U.N. Convention on the Law of the Sea¹³⁹ (“UNCLOS”) provides the overall global framework for ocean uses and was designed to unify the existing fragmented international regulatory agreements.¹⁴⁰ The objectives of UNCLOS include promoting peaceful uses of the sea, equitable and efficient utilization of marine resources, *conservation of living marine resources*, and the *study, protection, and preservation of the marine environment*.¹⁴¹

UNCLOS includes clear protections for the marine environment. Article I defines marine pollution:

[P]ollution of the marine environment means 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.¹⁴²

At least twelve other UNCLOS articles also focus on marine pollution. Article 43 directs States that border straits and States that use straits for passage to cooperate to prevent, reduce, and control pollution from ships.¹⁴³ Under Article 194, States are to take measures, jointly and individually, to prevent, reduce, and control marine pollution.¹⁴⁴ Article 210 directs States to adopt laws and regulations to prevent marine dumping.¹⁴⁵ Articles 213 through 222 provide for enforcement of the environmental provisions in the other articles.¹⁴⁶

The most pertinent UNCLOS article for regulating underwater noise pollution already addresses other types of pollution from vessels.¹⁴⁷ Article 211 directs States to act through competent international

139. United Nations Convention on the Law of the Sea, art. 86, Dec. 10, 1982, 1833 U.N.T.S. 397, 21 I.L.M. 126 [hereinafter UNCLOS].

140. Lora L. Nordtvedt Reeve, Anna Rulska-Domino, & Kristina M. Gjerde, *The Future of High Seas Marine Protected Areas*, 26 OCEAN YEARBOOK 265 (2012).

141. *Id.*

142. UNCLOS, *supra* note 139, art I(1)(4).

143. *Id.* art. 43.

144. *Id.* art. 194.

145. *Id.* art. 210.

146. *Id.* arts. 213-22.

147. *Id.* art. 210.

organizations and to adopt national laws and regulations that serve to prevent, reduce, and control pollution in the marine environment, notably including “pollution of the marine environment from vessels flying their flags or of their registry.”¹⁴⁸ This article specifically applies to flag States¹⁴⁹ and port States,¹⁵⁰ placing upon them responsibility and authority to enforce the UNCLOS pollution provisions.¹⁵¹ The states’ duty to cooperate to manage marine pollution is a clear recognition that UNCLOS envisions the problem to be transboundary in nature, and that regulation requires the involvement of the international community. Article 211 provides authority for states alone and through competent international organizations to regulate underwater noise from commercial shipping as a marine pollutant.¹⁵²

148. *Id.* art. 211. The article provides in part:

1. States, acting through the competent international organization or general diplomatic conference, *shall* establish international rules and standards to prevent, reduce and control pollution of the marine environment from vessels and promote the adoption, in the same manner, wherever appropriate, of routing systems designed to minimize the threat of accidents which might cause pollution of the marine environment, including the coastline, and pollution damage to the related interests of coastal States
2. States *shall* adopt laws and regulations for the prevention, reduction and control of pollution of the marine environment from vessels flying their flag or of their registry. Such laws and regulations shall at least have the same effect as that of generally accepted international rules and standards established through the competent international organization or general diplomatic conference.
3. States which establish particular 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 *shall* give due publicity to such requirements and shall communicate them to the competent international organization. Whenever such requirements are established in identical form by two or more coastal States in an endeavor to harmonize policy, the communication shall indicate which States are participating in such cooperative arrangements. Every State *shall* require the master of a vessel flying its flag or of its registry, when navigating within the territorial sea of a State participating in such cooperative arrangements, to furnish, upon the request of that State, information as to whether it is proceeding to a State of the same region participating in such cooperative arrangements and, if so, to indicate whether it complies with the port entry requirements of that State
4. Coastal States *may*, in the exercise of their sovereignty within their territorial sea, adopt laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels, including vessels exercising the right of innocent passage. Such laws and regulations shall, in accordance with Part II, section 3, not hamper innocent passage of foreign vessels. *Id.* (emphasis added).

149. *Id.* art. 211(2).

150. *Id.* art. 211(3).

151. *Id.* art. 211.

152. *Id.*

4. The London Convention

The International Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter¹⁵³ (“London Convention”) was concluded on December 29, 1972 and entered into force on August 30, 1975.¹⁵⁴ Subsequently, the London Convention was replaced by the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter¹⁵⁵ (“London Protocol”).

Under the London Protocol, the contracting Parties have a duty to protect and preserve the marine environment from the dumping of wastes.¹⁵⁶ Parties are to take effective measures individually and collectively, according to their scientific, technical and economic capabilities, to prevent marine pollution caused by dumping, and are to coordinate their policies and cooperate to accomplish these goals.¹⁵⁷ The London Protocol also provides that the “[c]ontracting Parties *shall* prohibit the dumping of any wastes or other matter with the exception of those listed in Annex 1,”¹⁵⁸ including sewage, dredged material, organic materials, and inert inorganic materials.¹⁵⁹

Notably under the London Protocol, “[d]umping does not include the disposal at sea of wastes or other matter incidental to, or derived from the normal operations of vessels”¹⁶⁰ Although underwater noise pollution likely does not fall under the London Protocol’s definition of dumping wastes into the ocean, the treaty provides an example of an enforceable global agreement that regulates marine pollution from ships.

The next section begins with a discussion of binding international agreements on marine pollution and the precautionary principle as a basis for regulation of underwater noise pollution, either through the IMO or under a new international convention.

153. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29, 1972, 26 U.S.T. 2403, 1046 U.N.T.S. 120, 11 I.L.M. 1294 [hereinafter London Convention].

154. *Id.*

155. 1996 Protocol to the London Convention of 1972, Nov. 7, 1996, 36 I.L.M. 1 [hereinafter London Protocol].

156. *Id.* art. 2.

157. *Id.*

158. *Id.* art. 4 (emphasis added).

159. *Id.* annex 1.

160. *Id.* art. I(4.2).

III. ANALYSIS

Underwater noise pollution as it impacts the great whales is not currently regulated under international legal agreements or by international organizations.¹⁶¹ There is no global instrument or agency with the mandate to oversee all – or indeed any – sources of anthropogenic noise in the ocean.¹⁶² This section analyzes the existing tools under international treaties as well as an emerging rule of customary international law, the precautionary principle,¹⁶³ that might serve to guide the process for such a treaty and organization. Several existing regional and global instruments might also inform the framework for a new international convention, and three are discussed here.

Alternatively, the IMO could regulate underwater noise from shipping as a pollutant with binding regulations as it does for other categories of marine pollution listed under MARPOL. A third alternative would be for the IMO to manage the noise pollution under non-binding guidelines, as in the Organization's current voluntary regulations for Particularly Sensitive Sea Areas ("PSSAs").¹⁶⁴

To support any regulatory development, the analysis includes two important considerations. First, the precautionary principle as a foundation for regulation could offer a margin of safety for the inevitable scientific uncertainty as to the extent of the impacts on the mysticetes. As scientists will never know everything about how underwater noise pollution from commercial shipping affects the great whales, the precautionary principle is a way to assure that scientific uncertainty does not prevent action to conserve the whales nor allow the impacts of commercial shipping activities to push the whales toward extinction.

Second, there could be an acknowledgement by international policymakers that underwater noise from commercial shipping is a transboundary pollutant requiring international cooperation to address its impacts on the great whales. As discussed above, low-frequency

161. ELENA MCCARTHY, INT'L REGULATION OF UNDERWATER SOUND: ESTABLISHING RULES AND STANDARDS TO ADDRESS OCEAN NOISE POLLUTION 131 (2004) [hereinafter MCCARTHY 2004]; see also Elena M. McCarthy, *Int'l Regulation of Transboundary Pollutants: The Emerging Challenge of Ocean Noise*, 6 OCEAN & COASTAL L.J. 257, 276 (2001) [hereinafter McCarthy 2001].

162. *Id.*

163. *Id.*

164. IMO, *Revised Guidelines for Identification and Designation of Particularly Sensitive Sea Areas*, Assembly Res. 24/982/A24/RES982 (Feb. 6, 2006) [hereinafter PSSA Guidelines].

underwater noise travels rapidly and far from its source, and with complete indifference to national political and jurisdictional boundaries. The baleen whales also travel, undertaking long seasonal migrations throughout ocean basins. These conditions oblige the community of nations, State parties to UNCLOS, and parties to other international marine pollution agreements to cooperate to formulate and enforce regulations on underwater noise pollution from commercial shipping.

A. Beginning with the Principle: How Might Precaution Be Used as the Basis for International Regulation of Underwater Noise Pollution from Shipping As It Impacts the Great Whales?

The precautionary principle is evolving into a tenet of customary international law that is useful in the decision making process about natural resource issues and that might be applied to international regulation of underwater noise pollution from shipping as it impacts the great whales. In 2004, Jon M. Van Dyke observed that the precautionary principle “has evolved from being a ‘soft law’ ‘aspirational’ goal to its present status as an authoritative norm recognized by governments and international organizations as a firm guide to activities affecting the environment.”¹⁶⁵ Christopher D. Stone has characterized the precautionary principle as a “seminal moral commitment.”¹⁶⁶ At its heart, the precautionary principle is a method for managing, in the face of scientific uncertainty, the risk of harm that a given activity may cause to a valued resource.¹⁶⁷

The precautionary principle shifts the burden of risk in the policymaking process from the proponents of resource conservation to the proponents of the action that might adversely impact the resource.¹⁶⁸ The traditional view is that an activity is presumed to be safe until proven otherwise,¹⁶⁹ while the precautionary principle requires the proponent of an activity to show that there will be no significant impact *before* the project can go forward.¹⁷⁰ The U.N. Environment Programme

165. Jon M. Van Dyke, *The Evolution and International Acceptance of the Precautionary Principle*, in BRINGING NEW LAW TO OCEAN WATERS 357 (D. D. Caron & H. N. Scheiber eds., 2004).

166. Christopher D. Stone, *Is There a Precautionary Principle?* 31 ENVTL. L. REP. 10790, 10791 (2001).

167. Jacqueline Peel, *Precaution: A Matter of Principle, Approach, or Process?* 5 MELB. J. INT'L L. 483, 484 (2004).

168. Van Dyke, *supra* note 165, at 359.

169. Reeve et al., *supra* note 140, at 281.

170. Van Dyke, *supra* note 165, at 359.

succinctly defines the precautionary principle in a Regional Seas Programmes publication: “[W]hen scientific knowledge is incomplete, regulators should err on the side of caution (that is, act in the least risky manner) within reasonable economic and social limits.”¹⁷¹

Prompted by the continued degradation of the marine environment and over-exploitation of marine resources, at the U.N. Conference on Environment and Development (“UNCED”) in June 1992 states called for marine and coastal management actions “that are integrated in content and are precautionary and anticipatory in ambit.”¹⁷² States affirmed their commitment to the conservation and sustainable use of high seas living resources, and recognized the need to protect and restore endangered marine species and preserve habitats.¹⁷³ UNCED Principle No. 15 distills the use of precaution in making conservation decisions: “In order to protect the environment, the precautionary approach *shall be* widely applied by States according to their capabilities. 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.”¹⁷⁴ Since UNCED, the precautionary principle as a foundation for decisions affecting the conservation of marine resources has been employed in an increasing number of international agreements and conventions, including CCAMLR¹⁷⁵ in the Southern Ocean¹⁷⁶ and OSPAR¹⁷⁷ in the Northeast Atlantic Ocean.¹⁷⁸ In general, marine protected areas and reserves such as CCAMLR and OSPAR provide “[s]patial protection [that] is a

171. TUNDI AGARDY, J. DAVIS, K. SHERWOOD, & O. VESTERGAARD, UNEP REGIONAL SEAS REPORTS AND STUDIES NO. 189, TAKING STEPS TOWARD MARINE AND COASTAL ECOSYSTEM-BASED MANAGEMENT: AN INTRODUCTORY GUIDE 16 (2011).

172. United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3-14, 1992, *Agenda 21*, U.N. DOC. A/CONF.151/26/REV.1 (Vol. 1), Annex II (Aug. 12, 1992).

173. *Id.* at 252-53.

174. United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3-14, 1992, *Rio Declaration on Environment and Development*, 6, U.N. DOC. A/CONF.151/26/REV.1 (Vol. 1), Annex I (Aug. 12, 1992) (emphasis added).

175. Convention on the Conservation of Antarctic Marine Living Resources, May 20, 1980, 33 U.S.T. 3476, 1329 U.N.T.S. 48, 19 I.L.M. 841 [hereinafter CCAMLR]; *see also* CCAMLR management principles of the CCAMLR Commission, *available at* <http://www.ccamlr.org/pu/e/cc/intro.htm> [hereinafter CCAMLR management principles].

176. *See id.*

177. Convention for the Protection of the Marine Environment of the NorthEast Atlantic, art. II, Sept. 22, 1992, 2354 U.N.T.S. 67, 132 I.L.M. 1069 [hereinafter OSPAR Convention]; *see also id.* at arts. 2(2) & 3(1)(b)(ii).

178. *Id.* at arts. 2(2) & 3(1)(b)(ii).

precautionary approach consistent with habitat and ecosystem management”¹⁷⁹

The precautionary principle is particularly applicable to the regulation of underwater noise pollution as it impacts the baleen whales. Given the difficulty of studying the whales in the wild and the absence of direct knowledge regarding their hearing capabilities, the precautionary principle could be employed to ensure a margin of error in restricting shipping activities that cause underwater noise pollution. This circumstance, where the scientific knowledge about the whales and potential impacts of noise to their health is so scarce, provides the perfect opportunity to “err on the side of caution” by acting in “the least risky manner”¹⁸⁰ to protect the whales from the impacts of shipping noise pollution.

An exhaustive discussion of the precautionary principle is beyond the scope of this paper, however it is important to note briefly that there are dissenting voices regarding its application to natural resource management. Although the precautionary principle is increasingly used as the basis for decision-making about marine conservation issues, reservations remain. Some scholars parse the concept into the “precautionary principle” and the “precautionary approach.”¹⁸¹ Jacqueline Peel suggests that the divergence between the two views arises from sharp differences in the “appreciation of the ‘seriousness’ of potential health or environmental risks in the face of imperfect scientific knowledge.”¹⁸² Nations with different views of the “seriousness” of the risks in an issue may become involved in conflicts about the use of precaution in the management of a resource.¹⁸³ Cass R. Sunstein commented that the precautionary principle “leads in the wrong directions, but that if it is taken for all that it is worth, it leads in no direction at all.”¹⁸⁴ Sunstein argues that because of the risks both

179. J.A. Bohnsack, *Incorporating No-Take Marine Reserves into Precautionary Management and Stock Assessment Proceedings*, in PROCEEDINGS OF THE FIFTH NATIONAL NMFS STOCK ASSESSMENT WORKSHOP: PROVIDING SCIENTIFIC ADVICE TO IMPLEMENT THE PRECAUTIONARY APPROACH UNDER THE MAGNUSON-STEVENS FISHERY CONSERVATION ACT 9 (V.R. Restrepo ed., 1999) available at https://www.st.nmfs.noaa.gov/StockAssessment/workshop_documents/nsaw5/bohnsack.pdf.

180. Agardy ET AL., *supra* note 171, at 16.

181. Peel, *supra* note 167, at 485.

182. *Id.*

183. *Id.* at 491-92.

184. Cass R. Sunstein, *The Paralyzing Principle*, 25 REGULATION 32, 37 (2002-03).

alternatives pose — to regulate or not to regulate — it is impossible to avoid violating the precautionary principle.¹⁸⁵

For the purposes of this paper, the precautionary principle is discussed in relation to its use as the basis for the management of marine protected areas and as a precept that could guide new IMO regulations or a new international convention to regulate underwater noise pollution from shipping as it impacts the great whales.

B. Underwater Noise from Commercial Shipping as a Transboundary Pollutant Under Any Regulatory Scheme

Underwater noise could be categorized as a transboundary pollutant under any regulatory scheme because it propagates readily through seawater and will inevitably cross national and jurisdictional boundaries.¹⁸⁶ Recall that sound travels far and fast in the ocean, depending upon its intensity and frequency,¹⁸⁷ and that the great whales communicate and probably hear within the low frequency range where underwater noise pollution from shipping falls.¹⁸⁸ Underwater noise pollution from shipping at frequencies that mask communication among the mysticetes affects the whales within national waters and on the high seas, and no state acting alone can successfully regulate to reduce its impacts.

Categories of pollutants that are currently regulated across national boundaries include thermal ocean pollution, nuclear radiation, and air pollution.¹⁸⁹ In addition to shared characteristics as transboundary pollutants, thermal ocean pollution and nuclear radiation are similar to noise as they are all forms of energy.¹⁹⁰ Nuclear radiation has historically been treated as a substance rather than as energy emissions.¹⁹¹ The nuclear source is defined as a substance that emits radioactive materials, and the emissions are defined as the hazardous wastes from the source.¹⁹² “No laws expressly prohibit the *emission* of radiation at sea; instead, the laws control the *source*, e.g., nuclear

185. *Id.*

186. *See* Urlick, *supra* note 32, at 1 (describing of the properties of underwater sound).

187. *See id.*

188. *See* Tyack, *supra* note 18, at 551-2; *see also* Parks et al., *supra* note 15, at 33; Hildebrand, *supra* note 17, at 5.

189. McCarthy 2001, *supra* note 161, at 258, 276.

190. *Id.* at 276-78.

191. MCCARTHY 2004, *supra* note 161, at 135.

192. *Id.*

reactors on ships.”¹⁹³ Thus, the sources of radioactive materials are regulated, not the emissions.¹⁹⁴ This method of regulation may inform efforts to manage the sources of noise pollution, including commercial shipping vessels, rather than the noise emissions.

Unlike underwater noise pollution from shipping, radiation pollution from dumping nuclear waste into the ocean has been addressed under international law.¹⁹⁵ By 1996, concerns about the efficacy of a voluntary moratorium on dumping of nuclear waste resulted in the promulgation of the London Protocol,¹⁹⁶ which replaced the outmoded London Convention.¹⁹⁷ The new London Protocol made the moratorium on dumping of all radioactive materials *binding on all parties*.¹⁹⁸ The mandatory provisions for dumping radioactive materials into the ocean from ships could be used as guidance for binding regulations to address underwater noise pollution from ships as it impacts the great whales, including provisions for monitoring and enforcement.

Although underwater noise pollution from shipping might be regulated as either a source or as emissions, there are challenges to its treatment as a source.¹⁹⁹ First, there are many sources of noise in the ocean, increasing the difficulty of determining which noise is attributable to each shipping activity.²⁰⁰ Second, as some operational activities rely on sound, the shipping industry could be expected to oppose regulation of decibel levels from machinery and sonar on individual vessels.²⁰¹

One argument in favor of regulating underwater noise pollution from shipping as a source rather than as emissions is the unique competence of the IMO as the international organization that oversees all international shipping activities.²⁰² An exploration of the differences in regulating the source of pollution, as in radiation pollution, as opposed to the emissions, as in air pollution, might inform efforts to regulate underwater noise. These differences and similarities in the experience of regulating

193. *Id.* (emphasis added).

194. *Id.*

195. McCarthy 2001, *supra* note 161, at 277; *see also* E. D. Brown, *International Law and Marine Pollution: Radioactive Waste and “Other Hazardous Substances,”* 11 NAT. RES. J. 221, 228-35 (1971).

196. London Protocol, *supra* note 155, at art. IV § 1.

197. Sen. Rep. No. 110-21, at 1 (2008).

198. MCCARTHY 2004, *supra* note 161, at 134.

199. *Id.*

200. *Id.*

201. *Id.*

202. IMO Convention, *supra* note 42, at art. 1(c)-(d).

transboundary pollutants might offer some guidance for establishing a framework to regulate underwater noise pollution.²⁰³

As discussed above, air pollution from transboundary greenhouse gas emissions from ships was addressed in the new amendments to MARPOL, focusing on ozone depleting substances and nitrogen oxides from diesel engines.²⁰⁴ The additional regulations establish a new category of pollutants and could provide a framework for adding other new sources, such as underwater noise pollution.

Whether the regulatory regime is binding or voluntary, underwater noise pollution can be defined as a transboundary pollutant because it impacts whales across different national jurisdictions, as well as in areas beyond national jurisdiction. International cooperation, such as under an international convention and its implementing organization, will be vital in the process of negotiating the restrictions on shipping interests and gaining the state support required for successful enforcement.

C. Are Legal Instruments Available To Regulate Underwater Noise Pollution Generated by Ships?

Underwater noise pollution from commercial shipping as it impacts the great whales is not currently regulated under any global agreement, however existing instruments may offer guidance for at least two avenues for action: 1) amending the existing legal framework; or 2) negotiating a new international convention dedicated to controlling underwater noise pollution from all sources. This section compares the aspects of both opportunities but is not intended to exclude other possibilities.

In addition to the global legal instruments that regulate marine pollution, several regional agreements addressing underwater noise pollution and employing the precautionary principle may offer guidance for a new convention. This section also analyzes the possible contributions of agreements in the Northeast Atlantic Ocean, the Mediterranean Sea, and the Southern Ocean.

203. See e.g., MCCARTHY 2004, *supra* note 161, at 132-34. (Thermal ocean pollution is created by the emissions from heated water dumped into the sea and although the adverse effects are potentially transboundary in nature, they are usually localized. The legal controls have historically also been local not international and may be of limited use as guidance for regulating the impact to the great whales of underwater noise pollution from international commercial shipping).

204. MEPC.176(58), *supra* note 137.

1. Legal Instruments under the IMO and MARPOL

The IMO has potential legal instruments at its disposal to manage underwater noise pollution from commercial shipping activities. Noise pollution from shipping as it impacts the great whales is not currently regulated under the IMO, but two possible options for potential regulation are analyzed here.

First, the IMO could manage the impacts of underwater noise pollution on the great whales with voluntary guidelines.²⁰⁵ The IMO has the authority to designate Particularly Sensitive Sea Areas (PSSAs), which are non-binding guidelines for areas defined as needing “special protection through action by [the] IMO because of [their] significance for recognized ecological, socio-economic or scientific attributes where such attributes may be vulnerable to damage by international shipping activities.”²⁰⁶ PSSAs have been designated in nations and oceans worldwide.²⁰⁷

In 2005, the IMO adopted Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas²⁰⁸ (“PSSA Guidelines”). Designation of a PSSA has two requirements: 1) the area must fall into at least one of three IMO categories of criteria as an environmentally or ecologically sensitive area (ecological; social, cultural, and economic; scientific and educational criteria) laid out in the PSSA Guidelines;²⁰⁹ and 2) the integrity of the area must be at risk from commercial shipping activities.²¹⁰

The ecological criteria are representative of scientific findings regarding areas that make significant contributions to healthy

205. PSSA Guidelines, *supra* note 164.

206. *Id.* at 3.

207. IMO, *Particularly Sensitive Sea Areas*, <http://www.imo.org/OurWork/Environment/PollutionPrevention/PSSAs/Pages/Default.aspx> (last visited Apr. 18, 2012) PSSAs include the Great Barrier Reef, Australia (1990), the Sabana-Camagüey Archipelago, Cuba (1997), Malpelo Island, Colombia (2002), the sea around the Florida Keys, United States (2002), the Wadden Sea, Denmark, Germany, Netherlands (2002), Paracas National Reserve, Peru (2003), Western European Waters (2004), Extension of the existing Great Barrier Reef PSSA to include the Torres Strait, Australia and Papua New Guinea (2005), Canary Islands, Spain (2005), the Galapagos Archipelago, Ecuador (2005), the Baltic Sea area, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden (2005), the Papahānaumokuākea Marine National Monument, United States (2007), and the Strait of Bonifacio, France and Italy (2011). *Id.*

208. PSSA Guidelines, *supra* note 164, at 3.

209. *Id.* at 5.

210. *Id.* at 7.

ecosystems.²¹¹ The social, cultural, and economic factors focus on human connections to the area and include measurements of human interactions with the ecosystem.²¹² The scientific and educational criteria focus on human exploration of the ocean.²¹³ A candidate PSSA must meet the additional requirement of being at risk of impact from international shipping activities, as demonstrated by meeting at least one of the criteria under section five of the PSSA Guidelines.²¹⁴ These criteria include vessel traffic characteristics²¹⁵ and natural factors.²¹⁶

The designation of a PSSA to protect the great whales from the impacts of underwater noise pollution from commercial shipping thus has the underlying prerequisite of a demonstrated link between the risk of harm to the whales and shipping activities that cause the noise.²¹⁷ In offshore areas and the high seas, establishing this nexus between the impacts to the mysticetes, such as changes in behaviour and communication levels, and the sounds discharged into the ocean as a result of vessel noise, may be a challenge that is nearly impossible to meet.²¹⁸ The application of the precautionary principle would be one method for taking into consideration this lack of scientific certainty. A generous margin for error could be added to the designation of PSSAs by relaxing the requirement for demonstrating the connection between the source and the impacts. Conservation measures could then be instituted where the link was shown to be highly probable or probable.

The other defining characteristic of a PSSA is that it is a non-binding measure.²¹⁹ The IMO “encourages” and “calls upon” its parties to protect vulnerable areas of the ocean from “damage or degradation, including from shipping activities.”²²⁰ For a PSSA to offer effective

211. *See id.* at 8-9 (considering uniqueness or rarity, critical habitat, dependency, representativeness, diversity, productivity, spawning or breeding grounds, naturalness, integrity, fragility, and bio-geographic importance).

212. *See id.* at 9 (considering social or economic dependency, human dependency, and cultural heritage).

213. *See id.* at 10 (considering high scientific interest for research, baselines for monitoring studies, and educational opportunities).

214. *See id.*

215. *See id.* (considering operational factors, vessel types, traffic characteristics, and harmful substances carried on the ship).

216. *See id.* at 10-11 (considering hydrological, meteorological, and oceanographic factors, such as water depth and bottom topography, prevailing weather and wind, and ocean currents and ice).

217. *See id.* at 8.

218. Reeve et al., *supra* note 140, at 9.

219. *See* PSSA Guidelines, *supra* note 166, at 3.

220. *Id.*

protection for the great whales, the IMO would need to take into account the large ecological area required to sustain a population of mysticetes, as well as the large area required to buffer against the low frequency underwater noise pollution from shipping as it travels rapidly and for long distances across the ocean.²²¹ Even voluntary restrictions in such large areas could be controversial, and shipping interests might organize in opposition and allow noncompliance.

The protections offered under the PSSA designation are also limited to those measures approved or adopted by the IMO:²²² application of special discharge restrictions of pollutants regulated under MARPO; adoption of ship reporting or routing systems while the ship is in or near the PSSA; and “development and adoption of other measures aimed at protecting specific sea areas against environmental damage from ships, provided that they have an identified legal basis.”²²³ Such measures might be more helpful in protecting great whales from some of the impacts of underwater noise pollution from shipping if noise pollution was defined and regulated as a pollutant under MARPOL, including discharge restrictions.

The second alternative for the IMO to address underwater noise pollution involves amending MARPOL, the primary international convention regulating the discharge of pollutants from ships into the marine environment.²²⁴ Although MARPOL does not currently define nor regulate underwater noise from shipping as a pollutant, there is precedent for amending the agreement to add a new category.²²⁵ The 2008 amendment to the MARPOL Protocol to address air pollution discharged from vessels could be used to guide the process for a new amendment to address noise pollution discharged into the ocean from vessels.²²⁶ Underwater noise pollution could be defined as a marine pollutant and added to the list of other pollutants regulated under MARPOL according to strict protocols such as those for oil,²²⁷

221. *See generally* Risch et al., *supra* note 65.

222. PSSA Guidelines, *supra* note 164, at 8.

223. *Id.* at 8.

224. *See* International Convention for the Prevention of Pollution from Ships (MARPOL), INTERNATIONAL MARITIME ORGANIZATION, [http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-\(marpol\).aspx](http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx) (last visited Apr. 13, 2012).

225. MEPC.176(58), *supra* note 137.

226. *Id.*

227. Int'l Convention for the Prevention of Pollution from Ships, Oct. 2, 1973, *Regulations for the Prevention of Pollution by Oil*, 34 U.S.T. 3407, 1340 U.N.T.S. 184, Annex I (Oct. 31, 1973).

sewage,²²⁸ noxious liquid substances,²²⁹ harmful substances,²³⁰ ballast water,²³¹ and garbage containing more than traces of heavy metals.²³² MARPOL already regulates vessel design and maintenance as related to possible and actual discharges of pollutants into the ocean from ships.²³³ The IMO could phase in requirements for quieter engines, as well as other changes in ship design to reduce other sources of noise pollution. An effort is currently underway in the MEPC to explore the possibility of requiring quieter engines and propellers to reduce the amount of noise pollution discharged into the water.²³⁴

The IMO clearly has the competence to regulate underwater noise from shipping as it impacts the great whales. However, one concern is the IMO's dual authority of conserving marine resources and facilitating the shipping industry. This double mission opens the way for conflicts between the two priorities of the Organization, as well as opportunities for decision-making on conservation of marine resources to be corrupted by pressure from international shipping interests and powerful maritime nations. One approach for the IMO to transparently regulate underwater noise pollution from commercial shipping could be to separate its conservation actions from those that support its mission to facilitate maritime activities.

228. Int'l Convention for the Prevention of Pollution from Ships, Oct. 2, 1973, *Regulations for the Prevention of Pollution by Sewage from Ships*, 34 U.S.T. 3407, 1340 U.N.T.S. 184, Annex IV (Oct. 31, 1973).

229. Int'l Convention for the Prevention of Pollution from Ships, Oct. 2, 1973, *Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk*, 34 U.S.T. 3407, 1340 U.N.T.S. 184, Annex II (Oct. 31, 1973).

230. Int'l Convention for the Prevention of Pollution from Ships, Oct. 2, 1973, *Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Forms, or in Freight Containers, Portable Tanks or Road and Rail Wagons*, 34 U.S.T. 3407, 1340 U.N.T.S. 184, Annex III (Oct. 31, 1973).

231. *See id.*

232. Int'l Convention for the Prevention of Pollution from Ships, Oct. 2, 1973, *Regulations for the Prevention of Pollution by Garbage from Ships*, 34 U.S.T. 3407, 1340 U.N.T.S. 184, Annex V (Oct. 31, 1973).

233. *Id.*

234. *See* Minimizing The Introduction of Incidental Noise from Commercial Shipping Operations into the Marine Environment to Reduce Potential Adverse Impacts on Marine Life, IMO, NOAA, http://www.gc.noaa.gov/documents/MEPC_58-19%5B1%5D.pdf (last visited Oct. 31, 2012).

2. Legal Instruments under UNCLOS and the London Protocol

UNCLOS and the London Protocol offer potential instruments for the regulation of underwater noise pollution under international treaty law.

a. UNCLOS

This year, 2012, marks the thirtieth anniversary of the conclusion of the U.N. Convention on the Law of the Sea, whose environmental and conservation duties have been described as rigorous but outdated.²³⁵ Unlike more modern instruments, UNCLOS does not explicitly include principles such as ecosystem-based management and the precautionary principle, or tools such as representative networks of MPAs and strategic environmental assessments.²³⁶ UNCLOS also does not reflect modern governance norms such as transparency, accountability, and inclusiveness.²³⁷

Nevertheless, UNCLOS does have several substantive provisions that support international regulation of underwater noise pollution from commercial shipping as it impacts the great whales. Articles 194 and 211 are particularly applicable. Article 194 creates an affirmative duty for states to take measures to prevent, reduce, and control marine pollution:

1. States *shall* take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection.
2. States *shall* 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, and that pollution arising from incidents or activities under their jurisdiction or control does not spread

235. See David Freestone, *Modern Principles of High Seas Governance: The Legal Underpinnings*, 39 INT'L ENVTL. POL'Y & L. 44 (2009).

236. *Id.* at 45-48.

237. *See id.*

beyond the areas where they exercise sovereign rights in accordance with this Convention.²³⁸

Article 211 creates two affirmative duties for states to control, prevent, and reduce pollution in the marine environment.²³⁹ First, Article 211 requires states to work through international organizations “to establish international rules and standards to prevent, reduce and control pollution in the marine environment from vessels”²⁴⁰ Second, states are required to “adopt [national] laws and regulations for the prevention, reduction and control of pollution of the marine environment from vessels flying their flag or of their registry.”²⁴¹ These obligations under UNCLOS demonstrate that the global community has historically agreed to binding provisions under international law for marine environmental protection.

Importantly, the duties under Article 211 require states to act on the obligatory provisions, as opposed to the voluntary protections for PSSAs under the IMO Revised Guidelines.²⁴² Underwater noise from shipping could be defined and regulated under the provisions of Articles 194 and 211 of UNCLOS as part of the charge for states to individually and jointly take measures to prevent, control and reduce marine pollution of all types.²⁴³

b. The London Protocol

Five affirmative duties for parties under the London Convention provide precedent for *binding* regulation on the discharge of wastes into the ocean from ships that could be applied to the regulation of underwater noise pollution as it impacts the great whales. Regulations like those under the London Protocol might be applied to the discharge of noise from ships.

Article 2 provides the first and second obligations:

Contracting Parties *shall* individually and collectively protect and preserve the marine environment from all sources of pollution and take effective measures, according to their scientific, technical and economic capabilities, to prevent, reduce

238. UNCLOS, *supra* note 139, art. 194 (emphasis added).

239. *Id.* art. 211.

240. *Id.* art. 211(1).

241. *Id.* art. 211(2).

242. PSSA Guidelines, *supra* note 164.

243. UNCLOS, *supra* note 139, arts. 194, 211.

and where practicable eliminate pollution caused by dumping or incineration at sea of wastes or other matter. Where appropriate, they *shall* harmonize their policies in this regard.²⁴⁴

Article 3 provides the three additional obligations. Third, “[p]arties *shall* apply the precautionary approach to environmental protection when dumping wastes into the ocean from ships.”²⁴⁵ Fourth, parties *shall* promote practices where the polluter is required to pay the costs associated with dumping the regulated wastes.²⁴⁶ Fifth, in implementing the London Protocol, “[p]arties *shall* act so as not to transfer, directly or indirectly, damage or likelihood of damage from one part of the environment to another or transform one type of pollution into another.”²⁴⁷

These provisions of the London Protocol are examples of the use of binding regulation for the discharge of pollution into the marine environment. They might be employed as a suggested framework or process for developing similar restrictions on the discharge of underwater noise pollution from ships that impacts the great whales.

3. Might Legal Instruments under Current Regional Agreements Offer Guidance for a New International Convention?

Regional agreements to conserve marine resources might offer guidance for international cooperation to regulate the discharge of noise pollution under a new global legal instrument. Of the three regional marine protected areas (“MPAs”) discussed below, two address anthropogenic energy or noise pollution discharged into the ocean.²⁴⁸ One of the MPAs also employs the precautionary principle as the basis for its resource management, and the third MPA uses the precautionary approach. As areas that have heightened protections for marine resources, MPAs offer an approach for protecting the great whales from the impacts of underwater noise pollution from commercial shipping.²⁴⁹ MPAs often restrict the activities that take place in ecologically

244. London Protocol, *supra* note 155, art. 2 (emphasis added).

245. *Id.* art. 3(1) (emphasis added).

246. *Id.* art. 3(2) (emphasis added).

247. *Id.* art. 3(3) (emphasis added).

248. See OSPAR Convention, *supra* note 177; CCAMLR, *supra* note 175; SPA/BD Protocol, *infra* note 262.

249. OSPAR Convention, *supra* note 177.

important or sensitive areas.²⁵⁰ The IMO could revamp the protections for PSSAs to reflect more stringent restrictions on the discharge of underwater noise pollution from shipping. The Organization could also revise the current protections PSSAs offer to be enforced as binding.

a. The Northeast Atlantic Ocean

One of the foremost marine conservation organizations in the Northeast Atlantic Ocean is the OSPAR Commission, which was created pursuant to the Convention for the Protection of the Marine Environment of the North-East Atlantic²⁵¹ (“OSPAR”). The OSPAR Commission promotes regional action to protect marine areas from the adverse impacts of human activities, including the impacts of underwater noise pollution.²⁵² In 1998, the OSPAR Commission committed to creating an ecologically coherent network of MPAs by 2012²⁵³ and set an international precedent in 2010 with the designation of the first network of MPAs with areas in the high seas beyond national jurisdiction.²⁵⁴

OSPAR addresses many issues of pollution in the marine environment.²⁵⁵ Article 1(d) of OSPAR defines pollution as “the introduction by man, directly or indirectly, of substances or *energy* into the maritime area which results, or is likely to result, in hazards to human health, *harm to living resources and marine ecosystems*, damage to amenities or interference with other legitimate uses of the sea.”²⁵⁶ The OSPAR Commission specifically interprets the mention of “energy” to include noise as a form of pollution.²⁵⁷

250. See *generally* J. ARDRON ET AL., INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES, ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS IN THE PELAGIC REALM: EXAMPLES & GUIDELINES (2011); J. DAY ET AL., INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES, GUIDELINES FOR APPLYING THE IUCN PROTECTED AREA MANAGEMENT CATEGORIES TO MARINE PROTECTED AREAS (2012).

251. OSPAR Convention, *supra* note 177.

252. OSPAR, *About OSPAR*, http://www.ospar.org/content/content.asp?menu=00010100000000_000000_000000 (last visited Sept. 30, 2012).

253. See OSPAR Convention, *supra* note 177, Annex V (discussing “the protection and conservation of the ecosystems and biological diversity of the Maritime Area”).

254. Reeve et al., *supra* note 140, at 383.

255. OSPAR Convention, *supra* note 177.

256. *Id.* art. 1(d) (emphasis added).

257. OSPAR Commission, The North-East Atlantic Environment Strategy: Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010–2020 (OSPAR Agreement No. 2010-3) 7 (2010).

The OSPAR Commission has established the OSPAR maritime area to manage the marine resources under its jurisdiction.²⁵⁸ OSPAR's management of the maritime area under the Commission is based upon the precautionary principle.²⁵⁹ This application of the precautionary principle to management of the issues of marine pollution, which includes underwater noise pollution from shipping that would impact the great whales, sets an example that the IMO could follow when implementing provisions to regulate underwater noise as a pollutant.

In 2010, the OSPAR Commission published a ten-year plan that includes a section addressing energy and noise pollution.²⁶⁰ “[T]he OSPAR Commission will . . . endeavor to keep the introduction of energy, including underwater noise, at levels that do not adversely affect the marine environment in the OSPAR maritime area”²⁶¹ The OSPAR approach could inform a new international convention to address all sources of anthropogenic noise in the ocean or revisions of the PSSA guidelines under the IMO.

b. The Mediterranean Sea

The region of the Mediterranean Sea is home to several marine conservation cooperative multi-state agreements, including the Barcelona Convention for the Protection of the Mediterranean Sea from Pollution (“Barcelona Convention”) and its Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean (“SPA/BD Protocol”).²⁶²

Article 2 of the Barcelona Convention defines pollution as “the introduction by man, directly or indirectly, of substances or *energy* into the marine environment resulting in such deleterious effects as harm to living resources”²⁶³ This reference could include underwater noise

258. See OSPAR Commission, *The North-East Atlantic*, http://www.ospar.org/content/regions.asp?menu=00020200000000_000000_000000 (last visited Oct. 1, 2012).

259. OSPAR, *About OSPAR*, *supra* note 252.

260. OSPAR, *The North-East Atlantic Environment Strategy: Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2010–2020*, http://www.ospar.org/content/content.asp?menu=01491300000000_000000_000000 (last visited Oct. 31, 2012).

261. *Id.* at 7.

262. The Convention for the Protection of the Mediterranean Sea against Pollution, Dec. 2, 1978, 1102 U.N.T.S. 27 [hereinafter Barcelona Convention]; Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean, art. 8.3, 12 Dec. 1999, 2102 U.N.T.S. 203, 161, Art. 8.3 [hereinafter SPA/BD Protocol].

263. Barcelona Convention, *supra* note 262, art. 2(a) (emphasis added).

as a form of energy and therefore lend support for the inclusion of a similar provision in a new convention to address the impacts of underwater noise pollution from shipping as it impacts the great whales.

The Pelagos Sanctuary for Mediterranean Marine Mammals (“Pelagos Sanctuary”), a marine protected area established in 2002, is also located in the region.²⁶⁴ The Pelagos Sanctuary was adopted as a Specially Protected Area of Mediterranean Interest (“SPAMI”) under the SPA/BD Protocol.²⁶⁵ The SPA/BD Protocol is designed to secure regional cooperation for the protection of SPAMIs.²⁶⁶ Parties to the SPA/BD Protocol commit “to recognize the particular importance of these areas . . . to comply with the measures applicable to the SPAMI, and not to authorize nor undertake any activities contrary to [its conservation] objectives”²⁶⁷ The SPA/BD Protocol could be used as a guide for cooperation among states to support the aims of a new convention to address the impacts of underwater noise on the great whales.

c. The Southern Ocean

The Convention on the Conservation of Antarctic Marine Living Resources²⁶⁸ (“CCAMLR”) aims to conserve the marine living resources of the Southern Ocean that surrounds Antarctica.²⁶⁹ CCAMLR has established a Commission that implements the precautionary approach in its management measures.²⁷⁰ CCAMLR possesses the governance mechanisms to establish MPAs in the high seas and deep seabed,²⁷¹ and has committed to the establishment of a representative network of MPAs as a priority.²⁷²

264. Case Study: Pelagos Sanctuary for Mediterranean Marine Mammals, CETACEANHABITAT.ORG, <http://www.cetaceanhabitat.org/pelagos.php> (last visited Oct. 30, 2012).

265. See Agreement Concerning the Creation of a Marine Mammal Sanctuary in the Mediterranean (with declaration), Nov. 25, 1999, 2176 U.N.T.S. 38306.

266. SPA/BD Protocol, *supra* note 262..

267. *Id.*

268. CCAMLR, *supra* note 175.

269. CCAMLR, *General Introduction*, <http://www.ccamlr.org/pu/e/gen-intro.htm> (last visited Oct. 30, 2012).

270. See UNDERSTANDING CCAMLR’S APPROACH TO MANAGEMENT (K.H. Kock, ed., 2000).

271. CCAMLR, *supra* note 175, at art. IX, 2(g).

272. CCAMLR, Report of the 23d Meeting of the Commission for Environmental Protection, ¶ 4.13 (2004); Report of the Committee for Environmental Protection ¶¶ 94-101 (2006).

CCAMLR is another example that could inform changes for PSSAs under the IMO. The framework for this high level of protection of the marine resource in the Antarctic could be used as guidance for increasing the protection through similar binding measures under the IMO.

IV. CONCLUSIONS AND PROPOSALS

Current international and regional efforts do not adequately manage the impacts of underwater noise pollution from commercial shipping; it impacts the great whales. Underwater noise pollution is present in the commons of the high seas, crosses national coastal and offshore jurisdictions, and affects marine resources without regard to political boundaries. The noise and its impacts are thus best regulated by cooperation among nations through international law, whether as amendments to the existing IMO-MARPOL marine pollution regime or under a new global treaty negotiated specifically to balance the competing interests of marine conservation and ocean noise producing industries.

The regulation of transboundary pollution also requires international cooperation through global agreements and organizations because shipping and its regulation are international activities. Any changes in regulations that affect the shipping industry, such as adding provisions to control underwater noise pollution that may require costly restrictions on engine or propeller design only will be enforceable if they are the product of negotiations that ensure acceptance by the international community.

The IMO has the authority to define and regulate shipping noise as a pollutant with discharge restrictions under MARPOL as evidenced by its recent addition of air pollutants to the list of discharges to be regulated.²⁷³ The process and framework already established for air pollution could be applied to similar work on noise pollution. Importantly, the IMO is currently in the process of considering legislation for member States to make alterations to ship design and shift traffic lanes to protect whales from underwater noise pollution.²⁷⁴

The IMO also has the authority to create Particularly Sensitive Sea Areas.²⁷⁵ Designation may not be the best solution for addressing underwater noise pollution from commercial shipping as it impacts the

273. MEPC.176(58), *supra* note 137.

274. MEPC, MEPC 61/19, Noise from Commercial Shipping and Its Adverse Impacts on Marine Life, Rep. of the Correspondence Group 1 (2010).

275. See PSSA Guidelines, *supra* note 164.

great whales, however, for at least two reasons related to the non-binding nature of PSSAs. First, by definition PSSAs measures lack enforcement provisions and are therefore voluntary.²⁷⁶ If there are no sanctions for violating the special restrictions in a protected area, such as for the discharge of regulated pollutants, compliance may be inconsistent. Second, although the protections for PSSAs are non-binding, the fact of their existence maintains the *appearance* that safeguards are in place, thereby undermining other efforts to enact other enforceable provisions.

One alternative to regulation by the IMO of underwater noise pollution from commercial shipping as it impacts the great whales, as well as all other sources of underwater noise pollution, could be to negotiate a new global convention. Such a comprehensive instrument has the advantage of dedication to a specific pollutant resulting from human activities: noise. The convention could regulate all anthropogenic underwater noise from all sources, not only shipping, and thereby coordinate protections on an ecosystem level.

While a new convention may seem at first consideration to be the broadest solution, the main opposing argument is simple and powerful. Based on the length of time often required to shepherd a new convention through the negotiation stages until it enters into force, as demonstrated by UNCLOS for example, the process may take years. This issue is urgent. Underwater noise pollution from shipping is adversely impacting the great whales, and mysticete species may be lost to extinction if a new convention is viewed as the only viable solution.

This paper opened with the characterization of impacts from underwater noise pollution portrayed in Dr. Earle's Comment, followed by the story of a rare experiment in the aftermath of the tragedy of September 11. The study of the North Atlantic right whales in the Bay of Fundy and many other studies provide extensive scientific support for Dr. Earle's contention. Mysticetes are especially affected by underwater noise pollution from commercial shipping activities, but because the impacts may take place in small increments over time and far out to sea, it is difficult to link the discharge of noise pollution from ships to the changes in behavior, vocalizations, and stress levels that the whales are experiencing.

International treaty law and the IMO, sustained by the precautionary principle and informed by existing regional agreements, provide strong legal support for regulating underwater noise pollution from commercial

276. *Id.* (finding no stipulations for the enforcement of special provisions in PSSAs).

shipping. The time for action is now to prevent the loss of even one mysticete species by "the death of a thousand cuts."²⁷⁷

277. Earle, *supra* note 1.